THE CHANGING
OF
AUSTRALIAN MANUFACTURING

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The views expressed in this paper do not necessarily reflect those of the Industry Commission

Forming the Productivity Commission

The Industry Commission, the former Bureau of Industry Economics and the Economic Planning Advisory Commission have amalgamated on an administrative basis to prepare for the formation of the Productivity Commission. Legislation formally establishing the new Commission is before Parliament. This paper has been prepared by officers of the former Bureau of Industry Economics.

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Foreword

In light of the widespread changes in recent years to the environment in which Australia's manufacturers operate — resulting from specific government policies as well as a number of other factors — it is timely to review key changes in the Australian manufacturing sector. In addition to providing an overview of the present structure and role of manufacturing in Australia, this paper attempts to gauge the extent to which Australian manufacturers have changed their business practices in response to the increasingly open and competitive economic environment in which they operate.

Clearly, given the scope of this study it is impossible to provide an in-depth treatment of the full range of issues raised. Nevertheless, it is hoped that this paper will stimulate discussion on a range of issues relating to Australia's manufacturing industries and in so doing improve community understanding of these issues.

The paper was researched and written principally by Colin Clark and Timothy Geer. 'Manufacturing and the open economy' — chapter 4 of the paper — was written by Barry Underhill. Geraldine Martisius assisted in formatting the report to publication standard. Garth Pitkethly and Ralph Lattimore of the Industry Commission and Professor Peter Forsyth, Department Head, Department of Economics, University of New England provided numerous helpful comments and suggestions. Gerd Hollander was responsible for overseeing the early stages of research, while Ian Monday supervised the latter stages of the project and contributed significantly to the drafting of several key sections of the paper.

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Abbreviations

ABS	Australian Bureau of Statistics
AMC	Australian Manufacturing Council
ANZSIC	Australian and New Zealand Standard Industrial Classification
APEC	Asia-Pacific Economic Cooperation
ASIC	Australian Standard Industrial Classification
BIE	Bureau of Industry Economics
CAD	Current account deficit
DAEs	Dynamic Asian economies — China, Hong Kong, Indonesia, South Korea, Malaysia, Philippines, Singapore and Thailand (Taiwan has been omitted due to lack of suitable data)
DFAT	Department of Foreign Affairs and Trade
DIST	Department of Industry, Science and Tourism
EPAC	Economic Planning and Advisory Commission
ERA	Effective rate of assistance
ETMs	Elaborately transformed manufactures
FDI	Foreign direct investment
G7	United States, Japan, Germany, France, Italy, United Kingdom and Canada
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
IAC	Industry Assistance Commission
IC	Industry Commission
IGP	Industry gross product
IMF	International Monetary Fund
ISIC	International Standard Industrial Classification
NICs	Newly Industrialising Countries
NIEs	Newly Industrialising Economies
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
RBA	Reserve Bank of Australia
SCI	Structural change index
SITC	Standard International Trade Classification
STMs	Simply transformed manufactures
TFP	Total factor productivity
TREC	Trade Exports Classification
UN	United Nations
WTO	World Trade Organisation

Summary

In 1994-95, Australia's manufacturing sector produced around one seventh of the nation's gross domestic product (GDP) and employed over one million people. This paper examines major developments in the sector over the last two decades. Specifically, it comments on the extent of structural change in manufacturing, its productivity performance, its trade orientation and factors bearing on its contribution to the economy.

Manufacturing and the rest of the economy

Manufacturing is a highly diverse sector. At one end of the spectrum it encompasses activities involving relatively little processing — such as the production of some food and mineral products. But many activities involve more complex transformation processes (eg. the manufacture of paper, plastics, sheet metal products and motor vehicles).

Manufacturers are typically closely integrated with other parts of the Australian economy (including other parts of the manufacturing sector). For example, to produce $100 of output in 1992-93, manufacturers on average required $55 worth of intermediate inputs from other Australian industries — $7 from agriculture, $5 from mining, $25 from other manufacturing industries and $18 from services. Manufacturers also provide significant inputs to other sectors, with agriculture in particular drawing heavily on the output of manufacturing (using $16 on average of manufactured inputs to produce $100 of agricultural output).

Manufacturers rely more on imported inputs than other Australian producers, on average requiring $13 of imported goods to produce $100 of output in 1992-93. This compares with between $4 and $5 for producers in the agricultural, mining and service sectors.

Structural change

Substantial and ongoing changes to the structure of Australian industry have been a feature of Australia's economic development. In recent decades manufacturing's share of economy-wide output and employment has fallen steadily. But although the *share* has fallen steadily, actual manufacturing employment *levels* have not fallen by nearly as much. For example, in the three decades between 1966 and 1995, manufacturing's share of total employment fell from 26 to 14 per cent. However, employment in manufacturing fell by less than 120 000 (down from 1.23 million to 1.12 million people). An increase in total Australian employment from 4.8 million to 8.1 million was the major factor underlying the decline in manufacturing's share. The overwhelming majority of these new jobs were created within the services sector.

Production data tell a similar story. Although annual manufacturing output is more than twice as large (in real terms) as it was three decades ago, the share of GDP accounted for by manufacturing has fallen by around 11 percentage points over the period.

The decline in the share of total Australian output and employment accounted for by manufacturing reflects a combination of factors. Technological changes and rising incomes resulting in an increased demand for services such as health, education, transport, communication and entertainment have been major contributing factors.

The declining share of both production and employment accounted for by manufacturing is a common feature of many industrialised nations. For instance, the current-price share of GDP accounted for by manufacturing for the OECD countries examined fell on average by 8 percentage points between 1970 and 1993. In contrast, manufacturing's share of GDP in a group of rapidly growing newly industrialising Asian economies rose on average by over 4 percentage points in the same period.

The make-up of industries within Australia's manufacturing sector has also been changing steadily, with structural change accelerating over the 1980s compared with the 1970s. Over the last decade, the Metal products, Petroleum, coal and chemical products and Food, beverage and tobacco manufacturing industries recorded the highest trend rates of growth in value-added. Conversely, the output of the Textiles, clothing and footwear industry actually declined in real terms over the past decade, while the Wood and paper products industry registered a weak trend rate of growth.

Productivity performance

Anecdotal evidence suggests that Australian manufacturers have improved their productivity over the last decade or so. For example, all firms interviewed as part of this study raised their productivity — in particular labour productivity — through new investment, the introduction of better work training and operating arrangements and improved management practices.

Higher productivity in manufacturing is confirmed by evidence at the sector level. Between 1973 and 1993 Australian manufacturers' total factor productivity (TFP) increased on average by 1.5 per cent a year. With TFP growth of 1.7 per cent a year between 1983 and 1993, Australian manufacturing's performance was somewhat stronger than in the period 1973-83 (1.4 per cent a year). Over the past two decades manufacturers' labour productivity has also increased steadily, rising by 2.3 per cent a year on average. However, while labour productivity growth has picked up slightly since the late 1980s, the rate of growth remains below that achieved in a number of earlier years, and has fallen slightly over the past year.

Nevertheless, Australia's overall manufacturing productivity performance was still below that of a group of OECD countries examined — which recorded a trend annual rate of TFP growth of 1.8 per cent a year between 1973 and 1993.

Moreover, although Australian manufacturing TFP growth picked up somewhat in recent years, stronger rates of improvement have been achieved over selected years since the mid 1970s. Consequently, it is too early to make definitive judgements about whether Australian manufacturers as a group have significantly improved their productivity performance in recent years, including whether they have improved their performance relative to other OECD countries.

But this does not mean that the reform process has been unsuccessful. In historical terms, most of the reforms have been under way for a relatively short time and many are still taking place. Thus, many of the benefits have not as yet been fully realised.

Trade orientation

In the ten years to 1994-95, annual manufactured exports (measured on an industry basis) grew in real terms at a trend rate of 8.7 per cent. The export propensity of Australia's manufacturing sector as a whole rose from 16 to 25 per cent over the period. In other words, by 1994-95, some 25 cents in every dollar of sales from our manufacturing firms was earned overseas. Imports of manufactured goods increased at an annual rate of 6.8 per cent between 1984-85 and 1994-95. Over the period, imports' share of sales of manufacturing goods increased from 26 to 35 per cent.

There has been a shift in the trade orientation of Australia's manufacturing exporters towards Asia. This is reflected in manufactured export sales to Asia totalling about $23 billion in 1994-95, compared with $5 billion in 1984-85. As a result Asia's share of our manufactured exports rose from 38 per cent to around 56 per cent.

Perspectives on the role of manufacturing

The relative decline in the importance of manufacturing to the Australian economy in recent decades is sometimes viewed as a cause for concern. However, much of this concern is based on misperceptions about the role of manufacturing in the Australian economy.

Many in the community support government initiatives aimed at increasing the share of GDP accounted for by the manufacturing sector because of perceived benefits to the Australian community. Underlying these views are notions that a larger manufacturing sector is necessary to: create high-wage jobs; generate additional exports to eliminate Australia's large trade deficit on manufactured goods; improve the overall level of productivity growth in the economy; promote higher R&D and hence economic growth; and increase overall incomes via the production of higher value-added goods.

Although there is a grain of truth in some of the arguments associated with these views, when examined from an economy-wide perspective they are far less appealing (see chapter 5). Indeed, a focus of this paper has been to highlight the importance of *all* of Australia's industries. With this in mind, the notion that manufacturing ought

to account for some specific share of total GDP, employment or exports is not particularly helpful. Given the dynamic nature of Australian and global economic activity, government policies directed at advancing the manufacturing sector or firms/industries within the sector simply because they are manufacturing entities are unlikely to be compatible with government objectives to improve efficiency and increase community welfare. Past experience demonstrates that such policies are unlikely to enhance Australians' living standards due to the negative impact they can have on the rest of the economy.

This is not to deny the possibility that manufacturing will become a more important part of the Australian economy — in particular in terms of its contribution to exports. But ultimately, a vibrant manufacturing sector is more likely to emerge in an environment where firms are encouraged to adapt to changes in their operating environment. This does not, however, preclude a real role for government. But manufacturers, other businesses and the community at large, are likely to derive greater benefits from government initiatives which effectively address market and institutional impediments to the wealth creation process.

1 Introduction

1.1 Background

Since the Industrial Revolution, a country's state of industrialisation has been a commonly used benchmark or proxy for its level of development. Popular notions of what constitutes an 'advanced' economy typically include the requirement that either a large share of national output be produced by manufacturers, or that a high proportion of the labour force work in factories. Even in Australia — where manufacturing at its peak of influence in the late 1950s only accounted for between 25 and 30 per cent of total output and employment — some continue to hold this view.

One reason that manufacturing generates so much interest is that it forms a link between the resource sectors and the service sector. Manufacturers use raw materials as inputs, as well as services like energy, construction, finance, legal, accounting, communication, and transportation. The goods which manufacturers produce are then stored, moved, packaged, advertised, marketed and sold by a range of service industries. So clearly, any changes which affect manufacturing can impact, either directly or indirectly, on many other areas of the economy.

Moreover, the fact that manufacturing is a highly tradeable sector means that it can provide an insight — a window if you like — into the health of the overall economy. For instance, the ability of Australian manufacturers to make products which can compete successfully in international markets also reflects, to varying degrees, on Australia's physical, financial, educational and scientific infrastructure.

Manufacturing also receives much attention for the purely pragmatic reason that there is so much information available on it relative to most other parts of the economy. The Australian Bureau of Statistics (ABS) and a range of private sector organisations regularly release data on a wide range of manufacturing indicators including investment, output, stocks, sales, employment, productivity, exports and imports, business confidence and capacity utilisation.

In light of this it could be expected that our understanding of the state of manufacturing in Australia would be good. But this is not necessarily the case. Witness the recent debate about whether manufactured exports have been performing well or poorly. Or more broadly, whether manufacturing is growing or whether it is in decline. With so much information available it is possible to lose sight of the broader picture. This is compounded by many economic

journalists' concern with contemporary events — often with a view to what the financial markets will make of them. For example, much analysis of manufacturing is focussed on the ups and downs of short-term indicators such as quarterly or monthly seasonally adjusted data. These data are often extremely volatile and can sometimes mask, or indeed exaggerate, overall trends. Of course, there is a role for short-term analysis, but it can limit our perspective to the very recent past, and many issues can only be fully understood in their proper historical context.

1.2 Objectives of the study

The objectives of this study are relatively modest. We aim to provide a short overview of the changing role of manufacturing in the Australian economy, with a particular focus on events over the past two decades. In so doing we hope to shed light on basic issues like: the nature and scope of Australia's manufacturing sector; how Australian manufacturing has developed; and the importance of manufacturing to the Australian economy and how this is changing over time.

In addressing these issues we have used information from a range of different sources. The major data sources used for this paper include a number of published and unpublished ABS data sets, as well as a variety of international sources including databases maintained by the Organisation for Economic Co-operation and Development (OECD) and the United Nations (UN). We have attempted, wherever possible, to put these data into their proper context. This task in itself may well be the most fruitful part of the exercise. Many of the difficulties people have in understanding the manufacturing sector are due to relatively simple misunderstandings of data issues. Nowhere is this problem more obvious than with respect to manufacturing export statistics — there are currently around half a dozen different ways by which manufacturing exports are measured.

A range of more complex issues are also canvassed in the paper including: the major forces impacting on Australian manufacturing that cause different industries to grow at different rates over time; the extent of structural change within manufacturing; and changes in the trade intensity of manufacturing — in particular the nature and extent to which Australian manufacturers are engaged in exporting — and the role of manufacturing in driving the creation of high wage jobs, exports, productivity, and research and development (R&D). It is not our intention to provide a comprehensive treatment of these issues. That would require a considerably larger document than this. But our work aims to at least identify areas which could benefit from further examination.

A number of these issues have already been addressed in earlier work, particularly the issue of structural change. For example, in 1977 the then IAC produced a series of papers which examined the extent of structural change in the Australian economy and the possible implications of these changes (IAC 1977a, b). These issues were again canvassed in 1986 in a paper which examined the evidence on structural change up to the mid-1980s (IAC 1986). However, since that time there have been extensive and widespread changes to the Australian economy generally and the manufacturing sector in particular. There have also been significant changes in the way the ABS collects data on Australian industries. Consequently, it is hoped that aspects of this paper will complement earlier work through its focus on Australia's manufacturing sector in particular and through its examination of more recent data.

Ten company profiles have been included in the analysis. Their purpose is twofold: firstly, to provide concrete examples of the diverse range of manufacturing activities undertaken in this country and, secondly, to illustrate the impact of broader economy and industry-wide structural changes on particular firms.

We wish to thank the following people for their time and assistance in compiling these profiles: Mr Anthony Phillips, General Manager of Finance, Bonlac Foods Ltd; Mr Andrew Edgar, Managing Director of Yakka Pty Ltd; Mr Peter Cairns, General Manager Corporate Affairs, Amcor Ltd; Mr Patrick Gallagher, Managing Director of Allen & Unwin Pty Ltd; Ms Susan James, Account Executive of National Capital Printing; Mr Graeme Pearson, Executive Director of BTR Nylex Ltd; Mr Andrew Miedler, Personnel Manager, Windscreens O'Brien; Mr Paul Locke, Manager Corporate Services, BHP Building and Industrial Products Division; Mr Russell Scoular, Government Liaison Manager and Mr Will Angove, Government Affairs Manager, Ford Motor Company of Australia Ltd; and, Mr Stephen Docherty, Group Accountant, Dream Haven Bedding and Furniture Ltd.

1.3 Structure of the paper

The paper comprises four core chapters. Chapter 2 provides background information about what manufacturing is, how it developed in Australia and its direct and indirect contributions to the Australian economy. In chapter 3 we analyse a range of published and unpublished ABS data to highlight changes in the structure and performance of manufacturing in the Australian economy. The final section of the chapter assesses the productivity performance of Australian manufacturing over the past two decades. Chapter 4 is devoted to an examination

of developments in manufactured trade, with a particular focus on the growth in exports since the early 1980s. The chapter aims to clarify some of the misconceptions about the definition of Australia's manufactured exports, as well as identifying some of the reasons for the growth in these exports over the recent past. We also look at the sources of the rising international demand for Australia's manufactured goods.

In the final chapter we explore a number of common misperceptions about manufacturing and its role in the Australian economy. These relate to the manufacturing sector's capacity to generate growth in high-wage jobs, exports, productivity, R&D and value-added.

Finally, appendices A to E supplement the information presented in the main body of the paper by providing further detail on structural change in Australian manufacturing at the industry and firm level. The appendices also clarify a number of data-related issues.

2 Definition and role

This chapter provides background on Australia's manufacturing sector. It is structured to supply answers to three basic questions — What is manufacturing? How did Australia develop a manufacturing sector? How important is manufacturing to the Australian economy?

The first section explains how manufacturing is defined by statisticians around the world and then outlines the diverse range of activities which fall under the banner of manufacturing in Australia. We then provide a brief overview of some of the key developments in Australian manufacturing this century. The final section pinpoints the importance of the manufacturing sector, as measured by its direct and indirect contributions to economic activity.

2.1 Manufacturing defined

The United Nations International Standard Industrial Classification of All Economic Activities (ISIC) forms the basis upon which most countries collect data on their economies. According to the ISIC, manufacturing is:

> ... the physical or chemical transformation of materials or components into new products, whether the work is performed by power-driven machines or by hand, whether it done in a factory or in the worker's home, and whether the products are sold at wholesale or retail (UN 1990, p. 76).

So manufacturing entails *transforming* things — it can involve stitching, weaving, casting, bending, joining, heating, freezing and a host of other activities. Manufacturing is defined here as a set of activities (or industries), not a set of goods or products. The Australian cousin of the ISIC, the Australian and New Zealand Standard Industrial Classification (ANZSIC), is also an industry-based classification and employs a similar definition. The ANZSIC contains seventeen major divisions of the Australian economy, of which manufacturing is only one. Other divisions include mining, agriculture and a range of other activities such as transport, finance, retail, health and education — usually grouped together to form the 'service' sector. [1]

[1] In this paper the service sector is defined as all ANZSIC divisions except manufacturing and the resource sectors. Other definitions of the service sector often exclude the Construction and Electricity, gas and water divisions. The large number (and extreme diversity) of the ANZSIC divisions contained within the 'service' sector means that the term has limited usefulness. Nevertheless, it is used throughout this paper for convenience — but where

As the ANZSIC is a hierarchical system, the manufacturing division is broken down into nine sub-divisions (table 2.1). The ABS divides the nine sub-divisions into a further 46 manufacturing 'groups', which are in turn, split into 153 manufacturing 'classes'. However, timely data at the 'group' and 'class' levels of disaggregation are relatively scarce. Consequently, the bulk of the analysis in this paper is based on data for the nine manufacturing sub-divisions — referred to in the remainder of this report as manufacturing 'industries' (table 2.1).

An examination of table 2.1 reveals that manufacturing is a highly diverse sector, with industries varying greatly in the types of activities they engage in. Activities include the manufacture of fibres, clothes and shoes, paper, books and magazines, videos and computer disks, petroleum and plastics, chemicals and pharmaceuticals, structural and sheet metal products, motor vehicles, toys, prefabricated buildings and furniture. Table 2.1 also lists some of the larger firms which operate within each industry. [2] Short summaries of the activities of a sample of firms within the nine major manufacturing industries are contained in appendix A, along with a brief profile of some of the key characteristics of each industry.

At one end of the spectrum, manufacturing entails processing the output of the agricultural and mining sectors, such as freezing and packaging meat, wood chipping, making dairy products such as cheese and milk and iron and steel making. The nature of these activities means that it is often not readily apparent where agriculture and mining end and manufacturing begins. The distinction between services and manufacturing can also be unclear. For example, if timber is transformed into furniture it is deemed to be manufacturing. But if it is transformed into a house it is labelled construction. The key difference is that when manufacturing takes place 'on site' it is not called manufacturing.

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appropriate, data for the divisional break-up of the service sector are presented alongside data for the manufacturing division.

[2] Clearly many of the larger firms such as CSR, BTR Nylex and Pacific Dunlop produce across a range of manufacturing and non-manufacturing industries. For example, Pacific Dunlop produces such diverse products as tyres, clothing and footwear, latex products and car batteries. If each company was treated as a single entity by the ABS for the purposes of statistical collection this would result in aggregated data which were highly misleading. Consequently, the ABS collects data at the establishment level (with some companies having a large number of different establishments) and groups these establishments into 'classes' which represent recognisable segments of Australian industry and are relatively homogenous as well as being economically significant (for more detail see ABS 1993).

Table 2.1 Australia's manufacturing industries

Manufacturing industry	*Major products/activities*	*Selected firms*
Food, beverage and tobacco	Meat packing and freezing, grading and filtering of dairy products, drying and preserving of fruit and vegetables, milling and baking of cereals, alcohol bottling and blending and cigarette making.	CSR, Fosters, National Foods, Bonlac
Textile, clothing, footwear and leather manufacturing	Fibres — wool preparation and synthetic fibres, dyeing and printing of fabrics, men's and women's clothing and footwear, leather tanning and suitcases.	Yakka, Pacific Dunlop, BTR Nylex, JGL Investments,
Wood and paper product manufacturing	Wood chipping, sawmilling and dressing, production of plywood, particle boards, frames, furniture, wood pulping — paper products, tissues, wallpaper, corrugated and solid cardboard containers.	BTR Nylex, Amcor, Wesfarmers, Boral
Printing, publishing and recorded media	Stationery — calendars, greeting cards, printing of books, newspapers and magazines, recorded media — compact disks, videos and computer disks.	Newscorp, Amcor, Pacific Dunlop, CPR, Allen & Unwin, National Capital Printing
Petroleum, coal, chemical & associated product manufacturing	Petroleum and coal products, bitumen, industrial chemicals, fertiliser, explosives, paint, pharmaceuticals, soaps and cosmetics, tyres, mattresses, plastic and fibreglass products.	Shell, ICI, Mobil, Pacific Dunlop, BP, BTR Nylex
Non-metallic mineral products	Glass — windows, bottles, mirrors, ceramics, bricks, tiles, china, ready mixed concrete and concrete pipes.	O'Brien Glass, BTR Nylex, Pilkington, CSR, Boral
Metal product manufacturing	Iron and steel — galvanising, casting, forging — aluminium, copper and lead products — girders, frames, garage doors, cans, wire, firearms and locks.	BHP, SCI Holdings, Alcoa, Comalco, Boral
Machinery and equipment manufacturing	Motor vehicles, engines, parts, ships, trains, aircraft, computers, televisions, telecommunications, refrigerators, batteries, machinery — tractors, mining machinery, cranes and air conditioners.	Pacific Dunlop, BTR Nylex, MIM, Ford, Email, General Motors Holden
Other manufacturing	Prefabricated metal buildings — sheds, furniture — beds, chairs, desks, jewellery, coins, gem cutting, toys and sporting goods and musical instruments.	Pacific Dunlop, Boral, James Hardie, Dream Haven

Sources: IBIS Business Information database and ABS (1993).

Another problem with the ANZSIC, or indeed any industry classification, is that the distinction between industries and the goods they produce exists in theory only. It is an industry's output of goods or services that is of interest to most people — not the activity per se. Clearly then, much of the economy — manufacturing in particular — does not fit neatly into discrete homogeneous sectors. Indeed, an understanding of manufacturing which is based on the notion of some clearly defined sector engaged in similar activities and producing similar products can lead to serious error. So given that any splitting up of an economy is somewhat arbitrary, why do economists do it? To answer this we need to take account of the sheer size and complexity of the Australian economy.

In 1995-96 around $500 billion worth of goods and services was produced by over eight million people working in more than 900 000 businesses. Activities ranged from mineral extraction and crop growing, through basic mineral processing, to high technology manufacturing and the provision of a range of general and specialised services. Although some economic analysis can be performed without any need to break down the economy into the components of production (using demand aggregates such as consumption and investment for example) any analysis beyond the macro level would be impossible without data broken down in some way.

Further, although the industry classification involves simplification and abstraction it does serve a useful purpose. The ANZSIC forms a kind of 'map' of the Australian economy and, like any other map, it is its simplicity that makes it useful (try finding your way around using a 1:1 road map). Data collected and organised according to the logical framework of an industry classification allows us to observe how the structure of Australian production and employment changes over time. The information provided assists governments in forward planning and in making decisions across a range of areas including education and training, trade related initiatives and infrastructure provision.

2.2 Stages of development

This section provides a quick overview of the historical development of Australian manufacturing capacity since federation. This is not meant to be a comprehensive treatment — rather, it is designed to show how a range of factors have shaped the way manufacturing has developed in our country. Clearly, given the close links between the manufacturing sector and Australian governments throughout the course of this century, any comprehensive discussion of the development of manufacturing in Australia would include an extensive examination of the role of government. However, the role governments have

played in the development of Australian manufacturing has been examined at length in a number of works — see, for example, Stubbs (1972), Crawford et al (1979), Rattigan (1986) and Boehm (1993).

1901 to 1940 — Federation to depression

During the first four decades of this century three important factors — federation, the First World War and the worldwide economic depression — influenced the development of manufacturing in Australia. Federation in 1901 provided an enlarged 'common market' which aided the development of Australian manufacturing. This was one of the key aims of federation, and resulted in more rapid growth in manufacturing, particularly within the two larger states of New South Wales and Victoria (Boehm 1993).

The First World War provided some stimulus to Australian manufacturing, notably the steel industry. An important development during the war was the opening of the BHP steelworks at Newcastle in June 1915. Although Australia already had a blast furnace at Lithgow, the site at Newcastle had greater potential. It was chosen because of the high quality of the iron deposits nearby, the closeness of coal supplies, the tidewater site and the fact that it was close to Sydney and the other major east coast markets. A range of other products were developed during the war including aspirin — supplies of which had previously come from Germany — and chlorine. The latter was needed for use as a bleaching agent in the paper, textile and soap industries and for making hydrochloric acid and caustic soda (Carroll 1987, p. 5).

But Australian manufacturing was generally insufficiently developed and too remote from the war arena to play much of a role in meeting the war's needs. Consequently the importance of the First World War for the development of Australian manufacturing was more indirect than direct. The war emphasised the strategic weakness in Australia's heavy reliance on imports of manufactures. This provided arguments for protection on defence grounds. Industries which had developed during the war were given protection from imports via the 'Greene tariff' in 1921.

An important development in manufacturing occurred in the mid 1920s, with the two large American car manufacturers General Motors and Ford 'jumping' the tariff barrier by setting up subsidiaries in some Australian states to assemble their products using imported components. Although there was a tariff on imported components, the differential between tariff rates on assembled chassis and components was substantial (Stubbs 1972). Ford established plants in Brisbane, Adelaide, Fremantle and Sydney during the 1920s and 1930s (see appendix A). Although the 1920s were a time of strong growth and diversification in

Australian manufacturing, these advances were checked by the onset of a worldwide economic depression at the end of the decade. But this, in turn, led to further increases in protective tariffs.

The 1930s saw continued expansion of Australian metal works and machinery industries. In 1935, BHP took over the Port Kembla steelworks of Australian Iron and Steel Ltd. Two years later GMH built Australia's first all-steel welded car body at its new plant at Fishermens Bend in Melbourne. Other notable developments in manufacturing in the mid-1930s included; the construction of the Ajax Pump works at Tottenham (Vic), Patience and Nicholson commenced drill manufacture at Maryborough (Vic), Australian Pulp and Paper Mills Ltd started making writing and printing papers at Burnie (Tas) using Australian hardwoods and Rheem commenced making water heaters (Carroll 1987, p. 64). Consequently, when the Second World War began in 1939 Australian manufacturing was sufficiently developed and diversified to play a much greater role than it had during the First World War.

1941 to 1970 — Golden years?

The Second World War provided stimulus to Australian manufacturing in three ways: the interruption to imports meant a switch in demand to domestically-produced goods; rising expenditure associated with the war increased real income and demand as unemployed resources were absorbed; and Australia became an important source of supply for a number of British countries east of Suez (Boehm 1993, p. 187 and Commonwealth Bureau of Census and Statistics 1965, pp. 143-144). Through a combination of existing industries expanding and diversifying their production and the rapid development of new industries, Australia was able to produce a huge range of products including many types of munitions, ball bearings, machine tools, ships, aircraft, chemicals, textiles and optics.

After 1945 Australian manufacturing continued to grow steadily for the duration of postwar reconstruction in the northern hemisphere. The re-emergence of competition from manufactured imports in the late 1940s was effectively eliminated by the introduction of increased protection by the federal government. This time quantitative restrictions were used, remaining in force throughout the 1950s and, for some products, a considerably longer period of time. The demand for manufactures created by rising living standards — in the context of a closed market — meant that manufacturing production grew strongly. Australian manufacturing also benefited from the influx of migrants from all parts of Europe following the end of the Second World War. From 1951 migrants were selected for their skills to suit vacancies in Australia, and many brought with them essential skills which greatly benefited Australian manufacturing industries.

The general prosperity generated an increased demand for a range of household goods such as kitchen appliances, radios and washing machines. Emmco Pty Ltd (later Email) made use of the high-precision engineering techniques employed in the small arms factory at Orange to make sealed units for refrigerators. Australia's automotive industry came of age on 29 November 1948 when the first wholly Australian built car was made (the Holden 48/125). Australia's electronics industry also prospered in the decade following the war, with a number of companies producing radios and record-players for the domestic market. Local manufacture of television receivers began in the mid-1950s and grew strongly over the second half of the decade, with over 400 000 sets made in 1959–60. Companies involved included Admiral, AWA, EMI, A.G. Healing, A.W. Jackson, GE-Kirby, Kriesler, Philips, Pye, STC, Stromberg-Carlson and Thorn (Carroll 1987, p. 77).

But while Australian manufacturing made steady advances in the decades following World War Two, these were nothing like the industrial changes taking place overseas. Many Australian manufacturers had become predominantly inward looking. This was to be expected given their operating environment. But it meant that they were ill-prepared to adapt to changes resulting from structural shifts occurring offshore, as newly industrialising countries (NICs), led by Japan, began to flex their muscles.

Further, as Australia's trade links with Britain weakened during the 1950s and 1960s, Australian producers looked to Asia for new markets. Trade growth with Japan increased steadily and, by the mid-1960s, Japan was Australia's biggest customer for a wide range of primary products. A substantial trade deficit with Australia developed which Japan sought to address by exporting more manufactured goods to Australia. Other Asian NICs followed Japan's lead. Initially they exported predominantly labour-intensive manufactures such as clothing and footwear. But as their economies developed and their capital and skill bases deepened they started to produce more technically advanced goods, including cars, stereos and televisions. By the end of the 1960s, the pressures Japanese imports (and to a lesser extent imports from other NICs) were placing on Australian manufacturers were already beginning to be felt — pressures which were to strengthen in the decades ahead.

1971 to 1995 — Competitiveness and internationalisation

The 1970s was a decade of turbulence for Australian manufacturing. In addition to the strengthening in import competition across a range of manufactures from the Asian NICs, other factors had profound effects on Australia's manufacturing sector. For example, Australia's rush to mineral riches which began in the 1960s

also compounded the pressure on manufacturing, with vast reserves of mineral wealth discovered, including iron ore in the Pilbara region of Western Australia, oil and natural gas in the Bass Strait, bauxite at Weipa and uranium in the Northern Territory.

The resulting mining boom led to a rapid increase in Australia's exports (and in the case of oil a fall in imports) which, combined with the associated inflow of foreign development capital, resulted in upward pressure on the exchange rate. This meant that the competitiveness of tradeable industries, including manufacturing, was necessarily reduced — other factors held constant — the so-called 'Gregory effect' (Gregory 1976, see also Maddock and McLean 1987, p. 172). In other words, imports (the bulk of which were manufactures) became cheaper relative to domestically produced manufactures, while Australian manufactured exports became less competitive on world markets.

The early 1970s also saw large wage increases, as well as strong pushes for equal pay for women in the context of high rates of inflation. In 1974, award wage rates increased in real terms by over 20 per cent. This, combined with the significant compression of skill differentials over the early 1970s, resulted in further reductions in the competitiveness of Australia's more labour-intensive tradeable industries (Maddock and McLean 1987, p. 172). It was these industries which generally faced the strongest competitive pressures from the NICs. The 25 per cent across-the-board cut in tariffs in July 1973 added to the pressures on manufacturing.

The combined effects of these influences was substantial, with manufacturing employment and real output actually declining in 1974-75 and 1975-76. And even when manufacturing did increase output it was at a considerably slower rate than other sectors of the economy. As a consequence, manufacturing declined in terms of both its share of GDP and total employment. Nevertheless, some milestones in manufacturing were achieved during the 1970s. These included the installation of the first numerically controlled machine by Diecraft in 1971, the production of the three-millionth Holden in 1973, the formation of Australian Precision Optics in 1974, and, in 1977 Ericsson was awarded the contract to domestically produce exchange equipment for Telecom (Carroll 1987).

The openness of the Australian economy accelerated during the 1980s. Following its float in December 1983, the Australian dollar depreciated by over 30 per cent over 1985 and 1986, increasing the competitiveness of Australian manufactures. Manufactured exports began to pick-up significantly with strong performers including Holden, Comalco, Hawker de Havilland and BHP, which earned from one-eighth to one-third of their sales revenue from exports in 1986 (this growth in manufactured exports is discussed in more detail in chapter 4).

The move to a more open economy was further facilitated by trade liberalising initiatives included in the Commonwealth Government's *Economic Statement* (Keating 1988) and the March 1991 *Building a Competitive Australia* statement (Department of Prime Minister and Cabinet 1991). In the *Working Nation* statement of 1994, the government confirmed that the tariff reduction program announced in 1991 would remain on track (Keating 1994). Recognising the importance of trade with our near neighbours and the potential for future growth, the Australian government also pursued continuing liberalisation of trade through the GATT's Uruguay Round and the APEC forum (BIE 1995a, 1996a).

2.3 The importance of manufacturing

The most direct and well known measures of economic activity are output and employment. In 1994-95, 1.1 million Australians were employed in the manufacturing sector, compared with total employment for the economy as a whole of 8.1 million people (table 2.2). This meant that one in seven (13.8 per cent) worked for manufacturers (figure 2.1).

Table 2.2 Sector contributions to Australian economic activity – 1994-95[a]

Sector	*Value-added*	*Employment*	*Investment*	*Capital stock*	*R&D*
	($m)	*(`000 persons)*	*($m)*	*($m)*	*($m)*
Agriculture	13 131	404	na	31 338	na
Mining	17 994	86	6 665	55 155	242
Manufacturing	60 532	1 116	9 856	81 561	1 929
Services	278 202	6 452	17 815	230 528	1 213
Total	**408 099**	**8 058**	**34 336**	**398 582**	**3 383**

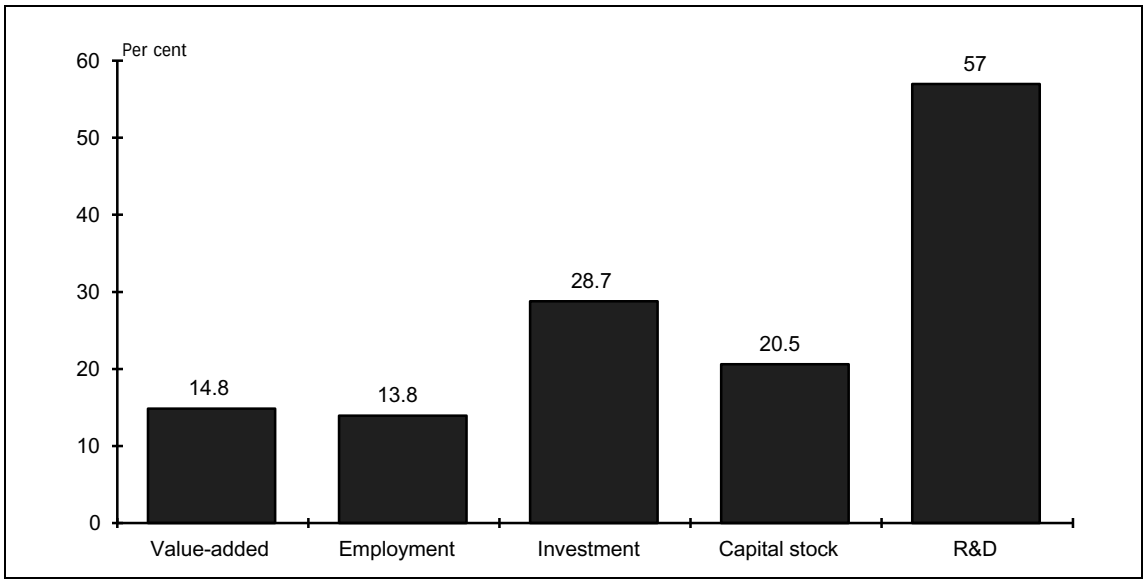
a Value-added data are in constant 1989-90 prices — subtotals do not add to total due to omission of ownership of dwellings and import duties less imputed bank service charges. Investment data relate to private new capital expenditure — survey excludes agriculture. Capital stock data relate to 1994-95 year end net capital stock (non-dwelling construction plus equipment) for private enterprises only. The ABS advises that the R&D survey excludes agriculture due to collection difficulties — also because such enterprises are believed to have very low R&D activity (agricultural R&D activity is generally carried out by specialised research institutes).
na Not available.

Sources: ABS Cats 5206.0, 5221.0, 5625.0, 6203.0 and 8104.0.

This workforce produced $60.5 billion worth of output (1989-90 prices), which was 14.8 per cent of the total value-added produced by Australians in 1994-95. [3] This means that manufacturing is about twice the size of mining and agriculture combined. But manufacturing is dwarfed by the service sector, which is more than four times its size. The fact that manufacturing's share of employment is broadly comparable to its value-added share suggests that manufacturing labour productivity (defined here as output per employee) is in line with other parts of the economy. But as we will see later this has not always been the case.

Clearly, labour is not the only input used by manufacturers. They also use large quantities of capital equipment in their production activities, such as lathes, foundries, furnaces, computers, lasers, transport equipment and other sophisticated measuring and sensing equipment. Manufacturers spent $9.9 billion on capital equipment in 1994-95 — $8.8 billion on equipment, plant and machinery and $1.1 billion on buildings and structures. This was 28.7 per cent of the total private new capital equipment expenditure in Australia (figure 2.1), with mining and services accounting for 19.4 and 51.8 per cent of the total respectively.

Figure 2.1 Different measures of the contribution of manufacturing to Australian economic activity — 1994-95[a]



a See notes for table 2.2.

Sources: ABS Cats 5206.0, 5221.0, 5625.0, 6203.0 and 8104.0.

In addition to measuring the flow of investment in Australia, the ABS also provides updated annual estimates of the stock of capital in Australia. Latest data

[3] In this paper the terms 'output' and 'production' are used interchangeably with the term 'value-added'. Value-added is made up of wages earned by labour, rent for land, returns to capital and other payments to value-adding factors of production.

indicate that the manufacturing sector's share of the total capital stock of Australian private enterprises in 1994-95 was 20.5 per cent. Manufacturers also contribute significantly to other areas of economic activity including R&D and exports. ABS data reveal that manufacturing is a particularly R&D-intensive sector. Of the $3.4 billion spent on R&D by Australian firms in 1994-95, 57 per cent (or $1.9 billion) was by manufacturers.

Finally, manufacturing plays an important role in generating Australian export revenue. However, as this topic is of considerable interest at present — combined with the fact that data issues mean that it is difficult to deal with the topic briefly without the danger of misrepresentation — we have devoted the bulk of chapter 4 to an examination of manufactured exports.

Indirect contribution

The measures discussed above do not provide the complete picture of the role each sector plays in the Australian economy. This is because they measure only direct activities — as if the sectors existed in isolation. But we all know that the Australian economy is highly interlinked, with the outputs of one industry making up many of the inputs of other industries. Manufacturing is a good case in point. Manufacturing firms make use of raw materials from the agricultural and mining sectors as well as services like power, water and transportation to produce goods which are then distributed, advertised, marketed and sold either for final consumption or for use as intermediate inputs in other sectors.

These complex relationships are quantified by the ABS using input-output tables. At the most detailed level, input-output tables reveal the interdependence of more than one hundred industries making up the Australian economy. A fairly straightforward manipulation of these tables allows the calculation of inputs as a percentage of output for an industry. The percentages calculated can then be used to estimate the input requirements for any given level of output of that industry. The latest ABS data (covering 1992-93) have been aggregated into four broad sectors — agriculture, mining, manufacturing and services. These are included in table 2.3.

Table 2.3 Sector by sector direct requirement coefficients — 1992-93

	These sectors provide inputs ...						
	Ag	Mining	**Mfg**	Services	Total domestic intermediate inputs	Imports	Total

... to the	Agriculture	7.8	0.1	**15.6**	20.0	43.4	4.3	100.0
production	Mining	0.2	6.6	**8.1**	19.7	34.6	5.2	100.0
of these	**Manufacturing**	**7.3**	**4.8**	**25.1**	**17.9**	**55.1**	**13.2**	**100.0**
sectors.	Services	0.3	0.6	**8.6**	26.0	35.4	3.6	100.0

Source: ABS Cat 5209.

Reading *across* table 2.3, we see that to produce $100 of output in 1992-93, manufacturers on average required $55.10 worth of inputs from industries making up the Australian economy ($7.30 from agriculture, $4.80 from mining, $25.10 from other manufacturers and $17.90 from services). These data clearly show that manufacturers are more integrated with other parts of the Australian economy than are mining, services and agriculture.[4] The data also show that manufacturing is more dependent on imported inputs than any other sector. To produce $100 of output in 1992-93, the manufacturing sector required $13.20 worth of imports. By contrast, mining, agriculture and services only required about $4-5 worth of imports to produce the same level of output.

Reading *down* table 2.3 we see that manufacturers also provided significant inputs to other sectors, with agriculture in particular drawing heavily on their output (using $15.60 of manufactured inputs to produce $100 worth of agricultural output). Of particular note is the importance of the service sector as a provider of inputs to all other sectors of the Australian economy. Manufacturing, mining and agriculture use between $18 and $20 worth of services per $100 of output.

However, the data in table 2.3 disguise the fact that the use of intermediate inputs from other sectors varies greatly in terms of both type and quantity across the different manufacturing industries. Direct requirement coefficients for individual manufacturing industries[5] reveal that Food, beverage and tobacco manufacturers require the greatest proportion of inputs from other industries — with Meat and dairy products, Other food products and Beverages and tobacco products manufacturers requiring $77, $66 and $59 respectively of inputs from Australian

[4] The nature of manufacturing activity means that in addition to the strong links with other sectors of the economy, Australia's manufacturing industries are also heavily interlinked *with each other*. For example, the manufacturing firm BTR Nylex Ltd uses inputs from the mining and service industries to produce goods that will, in turn, be used as intermediate inputs by other manufactures (discussed further in appendix A).

[5] To more clearly illustrate the differences between the various manufacturing industries, table 2.4 presents data at a slightly more disaggregated level than the 2-digit ANZSIC aggregation generally employed in this paper. These industry groups are in accordance with those used in table 4 of ABS Cat. No. 5209.

industries for every $100 worth of output. Other above-average users of domestically produced intermediate products were Textiles, Wood products, Basic metals, Non-metallic minerals and Fabricated metal products (table 2.4).

As would be expected, the Food, beverages and tobacco and Textiles industries also use the most agricultural products of all the manufacturing industries, while the largest users of the output of the mining sector are the Petroleum and coal products, Non-metallic minerals and Basic metals products industries — requiring between $10 and $38 of mineral products per $100 of output. Finally, the data reveal that while all manufacturing industries draw on inputs from other parts of the manufacturing sector, the Fabricated metal products industry is easily the greatest user of the output of other manufacturing industries ($41 per $100 of output).

Table 2.4 Manufacturing industry direct requirement coefficients –1992-93

		These sectors provide inputs ...						
		Ag	Mining	Mfg	Services	Total domestic intermediate inputs	Imports	Total
	Meat and dairy	49.8	0.4	11.4	15.7	**77.3**	1.3	100.0
	Other food	16.5	0.3	28.2	20.6	**65.5**	5.5	100.0
	Beverages and tobacco	8.4	0.2	31.6	18.8	**59.0**	5.5	100.0
	Textiles	22.9	0.2	17.4	17.7	**58.2**	13.4	100.0
	Clothing and footwear	0.8	0.0	32.0	12.8	**45.6**	21.2	100.0
	Wood products	5.4	0.1	32.4	19.2	**57.1**	9.0	100.0
	Paper, printing and publishing	1.4	0.4	18.4	21.6	**41.7**	13.4	100.0
	Petroleum and coal products	0.0	38.4	4.7	10.1	**53.2**	35.6	100.0
	Chemicals	0.5	1.2	29.6	19.6	**50.8**	18.3	100.0
... to the	Rubber and plastics	0.8	0.1	29.3	16.9	**47.1**	16.0	100.0
production	Non-metallic minerals	0.2	10.2	20.9	24.9	**56.2**	6.3	100.0
of these	Basic metals	0.1	14.9	21.9	20.0	**56.9**	11.1	100.0
industries	Fabricated metal products	0.0	0.7	41.3	13.8	**55.8**	8.0	100.0
	Transport equipment	0.0	0.1	33.2	19.9	**53.3**	20.3	100.0
	Other machinery and equipment	0.1	0.2	27.8	15.1	**43.2**	17.5	100.0
	Miscellaneous mfg	0.9	3.1	34.4	16.4	**54.9**	12.6	100.0

Total manufacturing	**7.3**	**4.8**	**25.1**	**17.9**	**55.1**	**13.2**	**100.0**

Source: ABS Cat 5209.

These data reinforce the point made at the start of the chapter that manufacturing is a highly diverse sector. Furthermore, this diversity has meant that individual manufacturing industries have responded in different ways to the development of the more open and competitive business environment discussed earlier. In the following chapter we look at what the data reveal about how Australian manufacturers are adapting to this new environment — in aggregate as well as at the industry level.

3 Structural change and industry performance

This chapter examines the major changes in the structure of Australian manufacturing over the course of this century with a focus on developments over the past two decades. Structural change refers to:

> ...the larger and more lasting changes which occur in the structure of production in the economy — such as changes in the relative size and basic characteristics of industries (IAC 1977b, p. 1).

Clearly, structural change is not a recent phenomenon. It has been integral to the process of Australian economic development. Key factors driving change in Australian industry have been: shifts in demand patterns due to changes in tastes and social attitudes — for example, growth in demand for labour-saving devices such as motor vehicles, and household appliances and the growth in demand for services such as childcare, health and education; developments in innovation/technology leading to pressures on labour markets and industrial structure; changes in population/demography — such as the impact of immigration flows on the skills profile of labour markets; and changes in the direction and composition of trade flows.

Structural change can be analysed from different perspectives depending on what information is being sought. Analysis at the broadest level can reveal movements in the relative importance of the various sectors of an economy — for example, the declining share of Australian output and employment accounted for by the rural sector. Structural change can also be viewed at an industry level — the compositional changes which occur within sectors. Finally, structural change can be analysed at the firm level. This type of analysis can, for example, reveal why some firms increase their market share while others within the same industry contract. Firm-level analysis can be invaluable to both government and industry when performed properly. It is, however, beyond the scope of this paper. Consequently we address structural change at the sector and industry level only.

The following section outlines the changes in the share of GDP and employment accounted for by Australian manufacturing. Industry-level data are then analysed to determine the extent and nature of structural change occurring within manufacturing. The chapter concludes with an examination of the productivity performance of manufacturing across time and across countries.

3.1 Changes in the contribution of manufacturing

Data on manufacturing employment and production reveal a clear pattern over the course of this century. In 1903, manufacturing employment, at under 200 000, accounted for 17 per cent of total Australian employment (Boehm 1993, p. 180). This increased steadily to a peak of roughly 27 per cent around 1950, remaining high throughout the 1960s (figure 3.1).

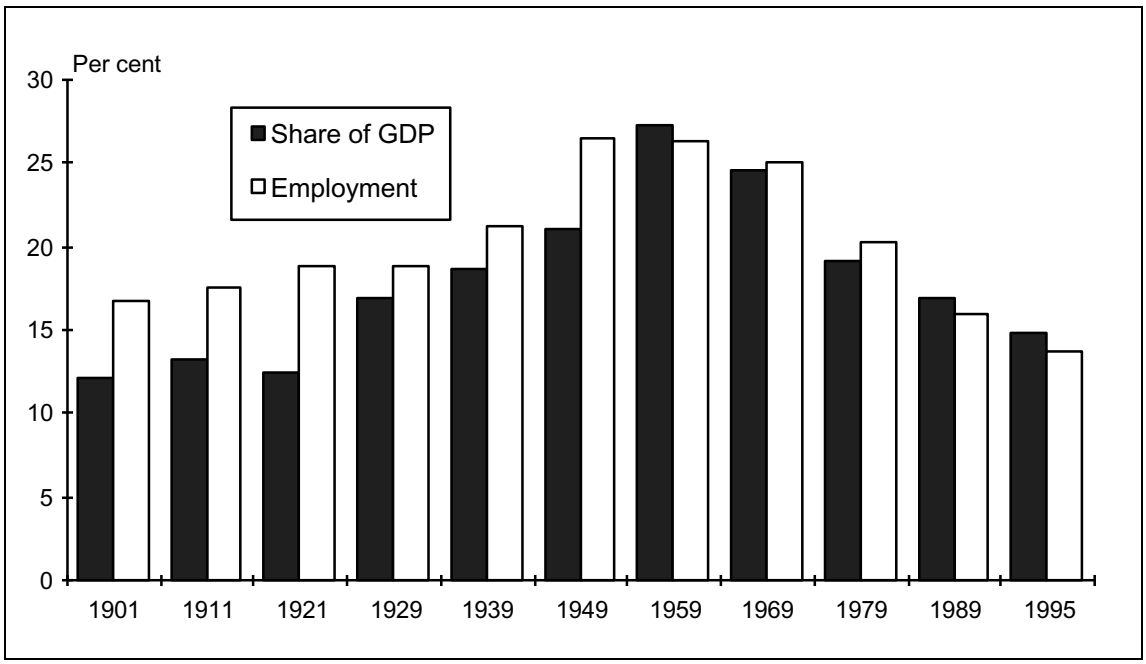
Since then it has fallen, to 20 per cent in 1979, and then to its present share of 14 per cent. But although the share has fallen steadily in recent decades, actual manufacturing employment levels have not fallen by nearly as much. For example, in the three decades between 1966 (when manufacturing accounted for 26 per cent of total employment) and 1995, the number of people employed in manufacturing has fallen by less than 120 000 — down from 1.23 million to 1.12 million people. The major reason for the decline in share is that total Australian employment increased from 4.8 million to 8.1 million between 1966 and 1995, with the overwhelming majority of these new jobs being created within the service sector.

Production data tell a similar story. The share of GDP accounted for by manufacturing rose steadily until around 1960 and then fell steadily — from 26 per cent in 1962-63 to 15 per cent in 1994-95. Of course, this does not mean that manufacturing *output* fell over the period — far from it. In real terms, manufacturing output in 1994-95 was more than twice as large as it was in 1962-63. Changes in industry shares are caused by differences in growth rates . Consequently the reason that the manufacturing sector's share of total production fell despite growing in real terms, is that other parts of the economy were growing faster. These strong-growth industries were all, with the exception of mining, within the service sector. Real services output was over three times greater in 1994-95 than in 1962-63, resulting in an 11 percentage point increase in the service sector's share of total output (up from 57 per cent to 68 per cent).

Figure 3.1 also reveals a noticeable shift in the way Australian manufacturers organise their production. In the first half of this century it is clear that the manufacturing sector absorbed a greater proportion of the Australian workforce than the proportion of GDP it produced. In 1921 the share of total employment accounted for by manufacturing exceeded its GDP share by slightly more than 50 per cent. But this was not the case for industrial countries as a group, suggesting that the labour intensity of Australia's manufacturing sector was above that of other industrial countries (Maddock and McLean 1987, p. 167). But Australian manufacturing has become progressively less labour-intensive, with its labour productivity moving up towards the average for the economy as a whole around 1960. This trend has continued over the past few decades to the present situation

where manufacturers use slightly fewer employees on average, to produce a given amount of output than is the case with respect to the economy as a whole. [1]

Figure 3.1 Share of manufacturing in total employment and GDP — 1901 to 1995[a]



a Due to fact that this figure deals with a long time-series, there are inevitably a number of definitional problems as well as other changes in the way data are collected over the period. Consequently, it should be viewed as an indicative measure of changes in the relative importance of manufacturing this century. But regardless of the sources used, the broad movements in the indicators remain the same.

Sources: ABS Cat. Nos. 5204 and 5206, Butlin (1962) — table 2, Keating (1973) — tables 19.20 and 19.21, Maddock and McLean (1987), Reserve Bank of Australia (1991) — tables 4.10c and 5.9 and Boehm (1993) — table 6.1.

This general trend identified in the aggregate data was also evident in our discussions with a number of the larger Australian manufacturing firms — including BHP, BTR Nylex, Amcor, Ford and Bonlac Foods. These firms have all undergone some form of rationalisation through amalgamation, mergers and/or centralising of manufacturing activities over the past decade (see appendix A). A recurrent rationale for these adjustments was the desire to reap increased economies of scale.

Is Australia atypical?

Although we have seen that manufacturing has been undergoing changes for more than a century, until the 1960s these changes had all resulted in

[1] The fact that the employment data do not distinguish between differences in average working hours within industries means that this is quite a crude measure of labour productivity.

manufacturing becoming more — not less — important. This raises the issue of whether the relative decline in Australian manufacturing over the past three decades should be a cause for concern. An examination of the experiences of other industrialised economies sheds some light on this question. Ideally we should only select countries that have similar resource endowments, economic and social institutions and are at a comparable stage of development to Australia. As the number of countries possessing these characteristics is limited we have used a broad cross section of industrialised and industrialising countries. [2]

The international data indicate that the declining share of economic activity accounted for by manufacturing is not unique to Australia among industrialised nations. Current-price shares of manufacturing output have fallen in most industrialised countries (appendix B). The OECD average share fell from 28.3 per cent of GDP in 1970 to 20.6 per cent in 1993, with the UK and Austria experiencing the largest falls (appendix B). As with Australia, the other resource-based economies of Canada and New Zealand saw their GDP-shares accounted for by manufacturing fall below the OECD average (to 16.8 per cent and 17.5 per cent respectively in 1993).

In contrast to the industrialised economies, the dynamic Asian economies (DAEs) of Hong Kong, Indonesia, South Korea, Malaysia, Philippines, Singapore, China and Thailand (Taiwan omitted due to lack of suitable data) in general experienced strong rises in the relative importance of their manufacturing sectors. Manufacturing accounted for 20.3 per cent of total DAE GDP in 1970, but had increased its share to 24.7 per cent in 1993, with Thailand and Indonesia industrialising the fastest.

In general, the change in the relative importance of a country's manufacturing sector over the period was inversely related to its starting share. In other words, those economies with the greatest proportion of their output or employment accounted for by manufacturing experienced the largest falls in manufacturing share. Conversely, those economies with the smallest manufacturing sectors experienced the greatest increases in manufacturing share (see figure B1 in appendix B).

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[2] But clearly Australia has a great deal more in common with industrialised countries than it does with industrialising economies, such as the dynamic Asian economies — in terms of relative income levels, degree of economic and industrial development, industry structure and manufacturing wage rates. In any case, international data should be used as a guide only. Australia's industry structure also reflects our extensive natural resource endowments and hence, it is to be expected that our intersectoral composition of economic activity will diverge to some degree from other countries.

International per capita income data also help to explain the shifts in relative importance of manufacturing across countries. When levels of per capita income for various countries are compared with the change in manufacturing's share of GDP a fairly clear inverse relationship is apparent (figure B2, appendix B). In general, manufacturing declined as a share of GDP in high-income countries and increased its share in the lower-income countries examined. Therefore it is clear that rapid industrialisation was an integral part of the development process for lower-income countries. Furthermore, the DAEs generally increased their incomes at much faster rates than the industrialised countries (including Japan). With the exception of the Philippines and China, all the other DAEs saw their per capita incomes more than double over the period, relative to the US. [3]

The foregoing discussion suggest that the use of international comparisons as a means of indicating the appropriate role of manufacturing in any given country must take account of each country's stage of development and resource endowments. In the following subsection we briefly overview the factors most likely to have underpinned the broad trends in Australia's industry structure identified earlier.

Reasons for relative decline

The high levels of protection afforded some manufacturing activities in Australia in the three decades following the Second World War probably meant that the shares of total employment and GDP accounted for by some parts of manufacturing were higher in the mid-70s than they would otherwise have been. Reductions in border protection since the early 1970s would have reversed this stimulus to assisted activities within manufacturing. Thus, some of the decline in the relative share of Australia's GDP and employment accounted for by a range of manufacturing industries is likely to be due to changes in industry policy.

But the question of how much of this relative decline can be attributed to changes in government policy becomes more complicated when dynamic factors are considered. Indeed, the increased competition arising from trade liberalisation encouraged a new dynamism in Australian manufacturing — showing up in the development of new export markets (discussed in the following chapter) and upgrading of technological capabilities across a range of manufacturing industries. So when a longer-term perspective is taken the overall impact of changes in government policies on the decline in relative importance of manufacturing in Australia is less clear-cut. The fact that manufacturing has

[3] This tendency for incomes to 'converge' is a phenomenon well recognised by development economists — technological 'catch up' is one reason given for its occurrence.

declined as a share of GDP in almost all other industrial countries — often with quite different policy settings to Australia — suggests that there were additional factors at work.

Some of the decline in the share of manufacturing observed for Australia (and other industrialised countries) is likely to be overstated due to the increasing specialisation of economic activities. A range of activities including legal and accounting services as well as cleaning and maintenance — previously performed in-house by manufacturing firms — are increasingly being contracted out. This means that these activities which had previously been recorded as manufacturing output are now being registered as output by the service sector. Indeed, business services have been an important element of the growth in the service sector as a whole over the past three decades.

But increasing specialisation is likely to be only part of the reason for the relative decline in manufacturing. Over time, sectors experience differential growth rates linked to changing patterns of demand. For example, we saw in the previous subsection that higher-income countries tended to see the share of their GDP produced by manufacturing decline. This suggests, among other things, that the income elasticity of demand for the products made by manufacturers is often lower than that of services. In other words, as incomes rise (beyond some threshold level) the share of additional income spent on manufactured products falls, while the share spent on services increases.

Differing rates of productivity growth may also be a factor. Productivity growth rates for different sectors can vary greatly over time. In past decades most countries have achieved high rates of productivity growth in many of the 'goods' sectors of the economy — mining, agriculture and manufacturing. Although part of the difference in productivity growth rates across sectors can be explained by measurement problems with regard to services, it is also likely that many of the activities of manufacturing (and the resource sectors) have been more amenable to productivity rises through new technologies and new production techniques than has been the case for some service industries.

This phenomenon can lead to a 'productivity-price paradox' whereby the relative prices of the outputs of industries which have experienced higher productivity growth tends to fall (OECD 1994). This means that it is possible for the share of GDP accounted for by manufacturing to fall in current prices while the share in constant prices remains unchanged. A study which examined the performance of manufacturing in 13 OECD countries found that although all countries had experienced a decline in the share of GDP accounted for by manufacturing in current prices, a number of countries maintained a level share in constant prices

(including Japan, Denmark, Italy and the US — OECD 1994). [4] In Australia's case, manufacturing has been in relative decline in both current and constant price terms, but the fall in share is noticeably smaller when constant prices are used. [5]

It is not difficult to see these combined factors at work in Australia, initially in the case of agriculture and then later with respect to manufacturing. Over the course of this century we have seen the impact of new technologies and more efficient production techniques leading to a fall in the relative importance of agriculture in terms of both current-price output and employment. At the same time people's incomes have risen, resulting in a falling proportion of income spent on food. The case with respect to manufacturing is much the same, with labour-saving technologies freeing up labour to move into other fields. Further, as incomes have risen the demand for services has risen. Services such as health, education, transport, communication, entertainment, childcare and takeaway foods have all become more important in terms of both employment and output.

Attempting to separate the impact of changes in productivity and changes in social preferences on the prices of goods and services at an aggregated sector level is a difficult exercise. The case of productivity, for example, is complicated by the fact that growth rates vary greatly both over time and among different industries within the various sectors of the economy. This is compounded by measurement difficulties which mean that intersectoral productivity comparisons must be treated with care. These and related issues are taken up in appendix B — which contains a brief discussion of the merits of using current versus constant prices in analysing structural change — and appendix C.

3.2 Manufacturing's shifting industry profile

We have seen how manufacturing as a whole has changed — relative to the rest of the economy — over time. To gain further insight into the factors driving these changes we now examine how the make-up of industries within manufacturing has changed. Unfortunately our analysis is constrained by the fact that data at an

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[4] But even for those countries in which the share of GDP accounted for by manufacturing has not fallen in constant prices, the employment share of manufacturing has been falling steadily. For example, the G7 average employment share of manufacturing fell from 28 to 22 per cent between 1970 and 1990, with the average share of employment accounted for by manufacturing in Japan, the US and Italy falling by 3, 9 and 5 percentage points respectively (OECD 1994).

[5] ABS data indicate that in constant 1989-90 prices, the share of GDP accounted for by manufacturing fell by 5 percentage points, from 20 per cent in 1968-69 to 15 per cent in 1989-90. This compares with a fall of around 9 percentage points in current prices over the same period (down from 24 to 15 per cent).

industry level are only available back to the mid-1980s for manufacturing employment on an ANZSIC basis.

The industry structure of Australian manufacturing reflects Australia's strengths as a resource-based economy. In 1994-95, almost half of the total output of Australian manufacturers (48.7 per cent measured on a value-added basis) was produced by the resource-based industries of Food, beverage and tobacco, Metal products and Petroleum, coal and chemical products (table 3.1). Combined, these industries employed 467 500 people or 42 per cent of the total manufacturing workforce. The largest individual manufacturing industry was Machinery and equipment, producing almost $14 billion worth of output and employing 227 700 people.

Table 3.1 Structural change within Australian manufacturing — 1984-85 to 1994-95[a]

	Value-added[b]			Employment[c]		
Industry	*Level 1994-95*	*Share of total*	*Trend annual growth rate 1984-85 to 1994-95*	*Level 1994-95*	*Share of total*	*Trend annual growth rate 1984-85 to 1994-95*
	($m)	*(%)*	*(%)*	*(`000)*	*(%)*	*(%)*
Food, beverage and tobacco	12 603	20.8	2.3	181.3	16.3	0.7
Textiles, clothing, footwear and leather	2 643	4.4	-2.4	102.6	9.2	-2.2
Wood and paper products	3 269	5.4	0.3	72.5	6.5	-0.5
Printing, publishing and recorded media	5 361	8.9	1.9	110.2	9.9	1.0
Petroleum, coal and chemical products	6 702	11.1	2.7	106.2	9.5	0.3
Non-metallic mineral products	3 024	5.0	1.4	52.3	4.7	-0.2
Metal products	10 182	16.8	2.7	180.0	16.1	-0.7
Machinery and equipment	13 941	23.0	1.8	227.7	20.4	-2.0
Other manufacturing	2 807	4.6	1.1	82.7	7.4	1.9
Total manufacturing	**60 532**	**100.0**	**1.8**	**1 115.5**	**100.0**	**-0.4**

a The trend growth rates reported in this table and elsewhere in this paper were calculated by regressing the log of the variables against a time trend. **b** Constant 1989-90 prices. **c** 1984-85 employment data are calculated by averaging the employment levels for the December quarter 1984 and the March and June

quarters of 1985. This was necessitated by the unavailability of employment data for the September quarter 1984 or earlier as a result of the switch by the ABS from ASIC to ANZSIC.

Sources: ABS Cats 5206.0 and 6203.0.

The industries which grew the fastest (in value-added terms) between 1984-85 and 1994-95 were Metal products, Petroleum, coal and chemical products and Food, beverage and tobacco manufacturing. Conversely, the output of the Textiles, clothing, footwear and leather industry actually declined in real terms over the period, while the Wood and paper products industry registered weak trend rates of growth (0.3 per cent a year). Although overall manufacturing production grew at an annual trend rate of 1.8 per cent manufacturing employment actually declined slightly, with five of the nine industry groups recording negative trend rates of employment growth over the period. For more information on all these industries see appendix A.

Rate of structural change within manufacturing

To measure the rate of structural change within manufacturing we have constructed structural change indexes (SCIs). These are calculated by taking half the sum of the absolute value of the change in each industry's share of value-added or employment over a given period (see appendix B for more information). So, for example, significant movements in the shares of a large number of manufacturing industries (either up or down) would result in a large number for the index. Conversely, where changes in shares are minor the resulting index number would be small. These indexes can be used to compare rates of compositional change in a country's manufacturing sector for different periods. They can also be used to compare rates of compositional structural change between different countries.

As the SCI is highly sensitive to the level of aggregation used, we have chosen to use 3-digit ASIC data (ANZSIC data were not available). With a breakdown of 41 manufacturing industries, this is the most disaggregated set of manufacturing data available to us. Although the data series covering the period 1968-69 to 1991-92 contains some gaps, the five-year moving SCIs plotted in figure 3.2 suggest that structural change within manufacturing accelerated over the past decade.

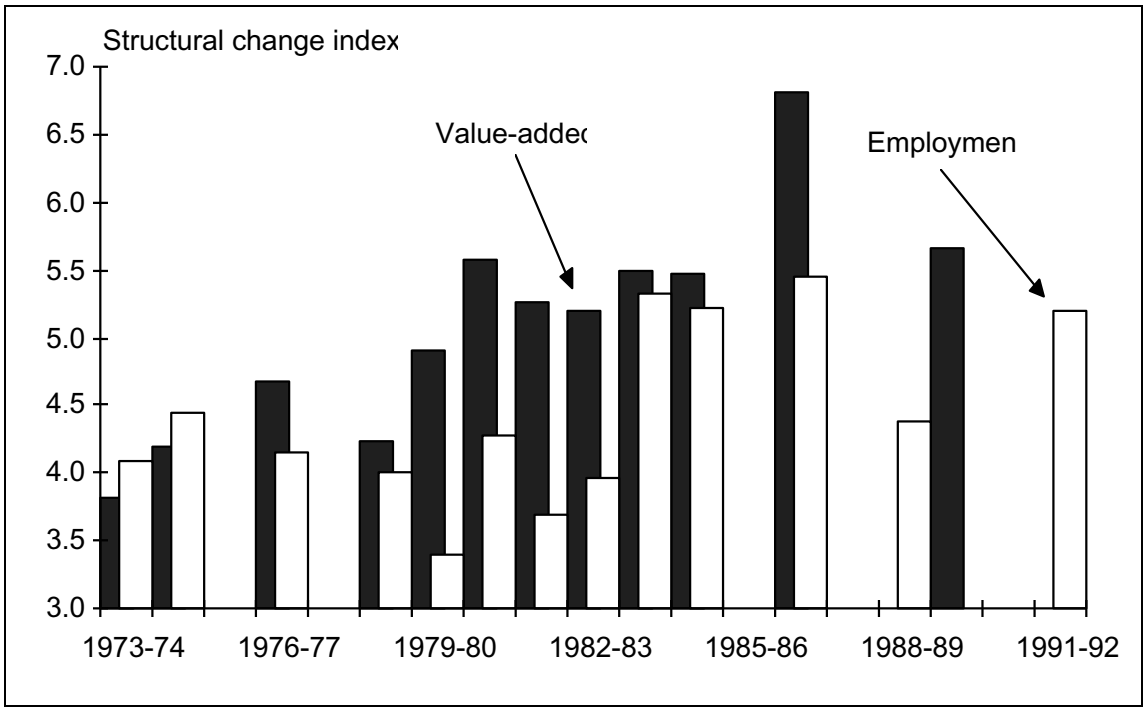
This view is reinforced by the employment SCI calculated for the decade to 1991-92, which was almost 50 per cent greater than the comparable number for the decade to 1981-82.[6] This pick-up is to be expected in light of the acceleration in

[6] The value-added SCI for the decade to 1989-90 (latest available data) was also somewhat higher (around 20 per cent) than the comparable number for the decade to 1979-80.

the move towards internationalisation during the 1980s driven by significant reductions in barriers to imports.

SCIs constructed for a group of industrialised and industrialising countries using the most disaggregated internationally comparable data available (ISIC 3 digit (28 industries) manufacturing data) indicated that Australia recorded the slowest rate of structural change within manufacturing between 1972 and 1992 when measured on a value-added basis. However, when measured on an employment basis, Australia's rate of structural change was relatively high in comparison with other industrialised countries. For example, of the industrialised countries examined, only Germany and Japan registered higher indexes of employment structural change over the period.

Figure 3.2 Five year moving structural change indexes for manufacturing employment and value-added — 1968-69 to 1991-92[a]



a The yearly columns in figure 3.2 represent the degree of structural change which had taken place in the previous five years measured in terms of either employment or value-added. Estimates for some years could not be made due to breaks in the data series as a result of classification and data definition changes.

Source: Calculations based on IC (1995a).

The high degree of employment structural change in Australian manufacturing was caused by the large falls in employment shares experienced by the textiles, clothing, rubber products, iron, steel, electrical machinery and transport equipment industries, which typically experienced falls in their absolute levels of employment of between 40 and 50 per cent over the period. This resulted in their

combined share of manufacturing employment dropping by 10 percentage points (from 37 to 27 per cent). Over the same period, these industries saw their collective value-added share decline also, but by only 6 percentage points (from 31 to 25 per cent), suggesting improvements in labour productivity were a part of the restructuring process.[7]

Clearly, these simple measures of rates of structural change are quite limited due to the difficulties in obtaining highly disaggregated panel data for Australia, let alone on a comparable basis with other countries. Consequently it is difficult to draw too much of value from them beyond the inference that structural change within manufacturing appears to have accelerated during the 1980s. Furthermore, SCIs reveal nothing about why some industries grow faster than others.

Reasons for disparate performance

As we saw in the last chapter, the development of manufacturing capacity in Asia, first in Japan then in the DAEs, at a time when the Australian economy was becoming increasingly open, is likely to have been an important factor driving structural change in Australian manufacturing. An examination of labour costs per unit of output[8] provides some insight into which Australian manufacturing industries would be expected to experience the strongest pressures from the development of manufacturing capacity in Asia.

ISIC data at the two-digit level (available for the period 1970 to 1990) suggest that the more labour-intensive industries in Australia generally performed poorly, relative to those industries in which labour costs per unit of output were lower. One of the most labour-intensive of Australia's manufacturing industries is the Textiles, clothing and footwear industry, and as expected it experienced the sharpest decline in its share of manufacturing output over the past two decades. Not surprisingly, resource-based activities such as the Food, beverage and tobacco industry were found to be the least labour-intensive of Australia's manufacturing industries. Moreover, data on wage rates per employee reveal that the more labour-intensive industries tended to exhibit the lowest wage rates. For example, the labour-intensive Textiles, clothing and footwear industry had average wages per worker around 22 per cent lower than the average for Australian manufacturing in 1990.[9] Further discussion of industry-specific

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7 For further information see BIE (1996c).

8 We have used the wages' share of value-added as a proxy — although it is an imperfect measure as wages do not represent the full costs of employment to an industry.

9 A number of relationships between different structural indicators were also examined including investment, effective rates of assistance (ERAs), growth in employment and turnover, labour intensity and export orientation for three-digit ASIC data for the period

characteristics of Australia's nine major manufacturing industries using ABS data is contained in appendix A.

Clearly, international competitiveness cannot be attributed to a single factor such as labour costs. There are a range of economy-wide, industry, and firm-specific factors which determine the success of particular firms including natural endowments, breadth of industrial base, management quality, innovativeness, work practices and R&D. The nature of available data make it very difficult to take account of these factors. Consequently, the avenue of research which is most likely to yield meaningful results is to use micro-or firm-level data or to conduct separate analyses of individual manufacturing plants. For an example of the latter see BIE (1990 and 1991).

3.3 Productivity performance

We have devoted a considerable part of this chapter to an examination of the extent to which structural change has been taking place in Australian manufacturing. But it is important to remember that structural change is not an end in itself. Rather, it is the improved economic performance — productivity growth in particular — which usually accompanies structural change, that is of interest to policy makers via its impact on material living standards. [10]

Anecdotal evidence suggests an improvement in the efficiency with which manufacturers in Australia use inputs in recent years. For example, the manufacturing firms interviewed during the course of preparing this paper employed a number of techniques to improve their productivity — in particular labour productivity — including investment in new plant and equipment, the introduction of better training and operating arrangements and improved management practices. About half of the firms interviewed had also become more focussed on their core competencies, divesting themselves of peripheral activities over the past decade (see appendix A).

Given this evidence, a question that needs to be resolved is whether productivity in the Australian manufacturing sector has shifted onto a sustainably higher growth path in recent years. In this section we examine both labour productivity

1968-69 to 1992-93. Analysis of these data indicated several possible relationships, but most of the results were quite weak. The strongest finding backed up the analysis at the 2-digit level in revealing that those manufacturing industries with the highest labour intensity at the beginning of the 1970s were the ones which reduced their labour costs the most.

[10] For a further discussion of the relationship between structural change and economic performance see Dao, Ross and Campbell (1993).

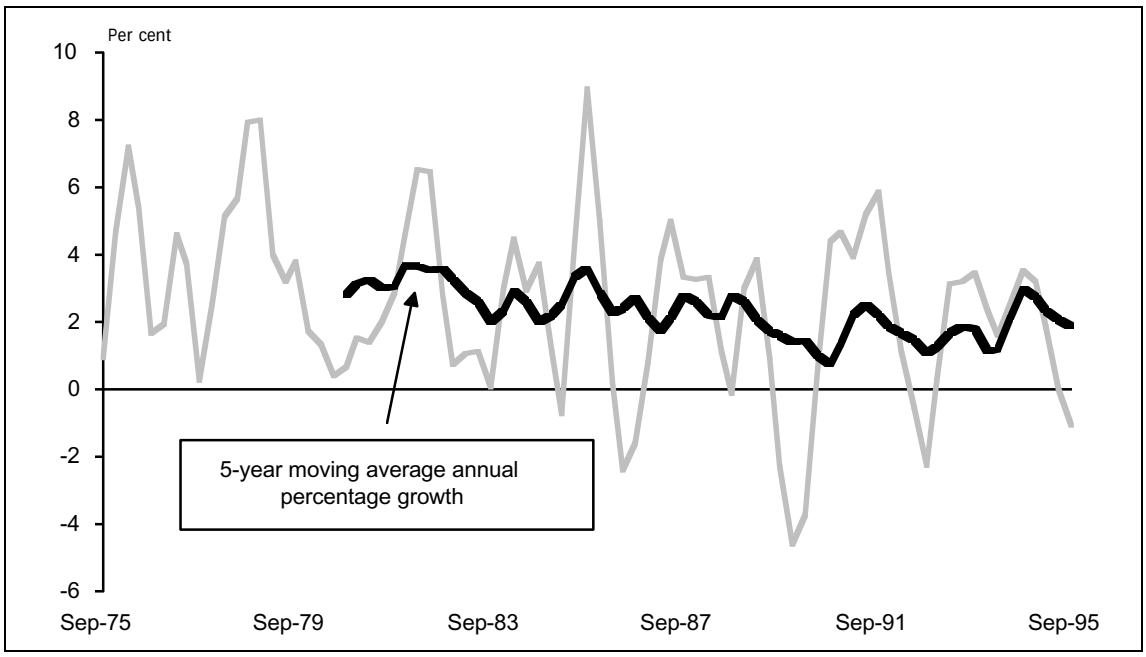
data and total factor productivity (TFP) data for Australia and selected OECD countries in an attempt to answer this question. Information on comparative rates of TFP growth for the different sectors/industries making up the Australian economy together with comparative productivity levels is presented in appendix C.

Before we begin a word of caution is appropriate. International comparisons of productivity performance can be quite problematic, even at the economy-wide level, due to a number of differences between countries including: factor endowments, economic structure, statistical collection conventions (notably the way output is measured and the techniques used to estimate capital stock levels), state of the business cycle (and hence capacity utilisation rates) and government policies. Another problem is that productivity growth rates on their own provide an incomplete picture of relative productivity levels as they do not take into account relative starting levels.

These difficulties notwithstanding, the OECD has recently compared the TFP performance of the manufacturing sectors of fourteen OECD countries (including Australia) for the period 1973 to 1993. Before we look at these comparisons we examine data on labour productivity trends — defined here as real output per hour worked.[11] These data confirm that Australia's manufacturers have collectively improved their labour productivity over the past two decades. Between 1975 and 1995, labour productivity within Australia's manufacturing sector increased by almost 60 per cent, with a trend annual increase of 2.3 per cent a year (figure 3.3).

[11] This concept of productivity is often used in making international comparisons of productivity performance. It is also used as a benchmark in comparing performance across industries.

Figure 3.3 Growth in Australian manufacturing sector labour productivity — 1975 to 1995[a]



a Raw quarterly data were smoothed using a five-term Henderson trend.

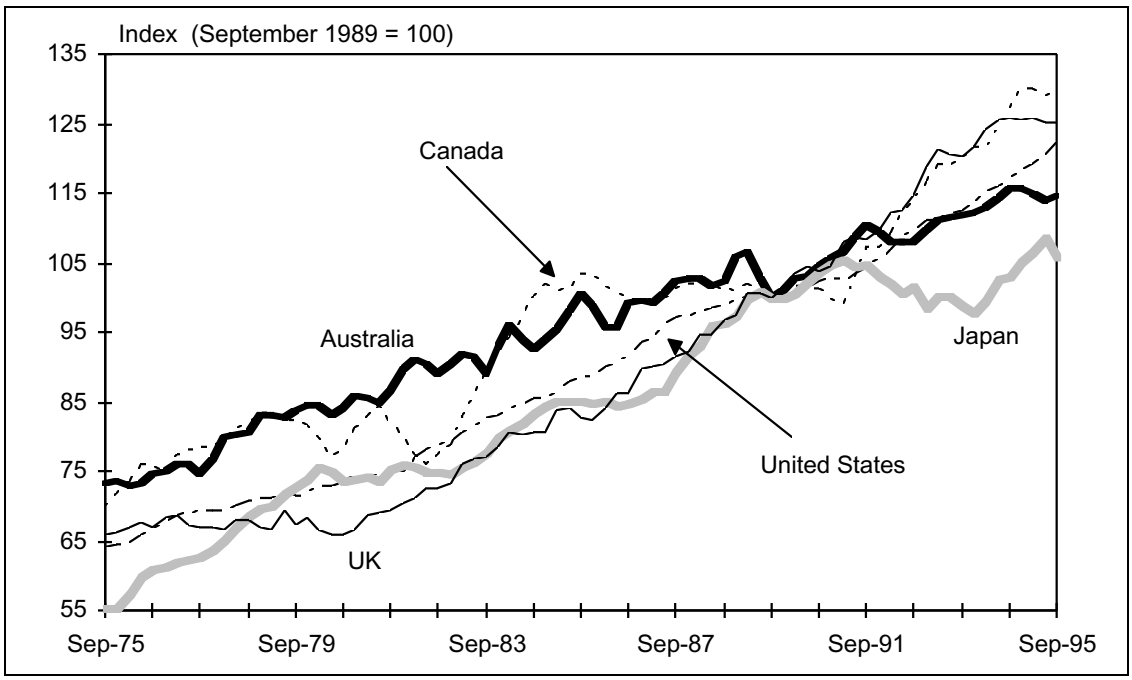
Sources: ABS Cats 5206.0, 6203.0 and OECD (1995a).

Over the same period, labour productivity for Australia's non-farm market sector[12] improved by around one-half of a percentage point a year less than that for manufacturing. Nevertheless, although the five-year moving average productivity growth series presented in figure 3.3 has picked up slightly since the late-1980s, the growth rates remain below those achieved in a number of previous years and have levelled off over the past year. Hence, the data provide no indication of any acceleration in the rate of labour productivity growth achieved by Australia's manufacturing sector over the period under examination.

Moreover, the manufacturing sectors of other OECD countries have also improved their labour productivity over the period. When compared with labour productivity growth in the manufacturing sectors of selected OECD countries, the performance of Australian manufacturing does not measure up well. Of the countries examined, the UK recorded the highest trend rate of productivity growth in the twenty years to 1995, with an annual rate of growth of 3.6 per cent (figure 3.4).

[12] The non-farm market sector excludes the agricultural sector (which is subject to relatively high inter-year variability due to changing seasonal conditions) and the Government administration and defence industry. Furthermore, due to problems in estimating output for some services, the Finance and insurance, Property and business services, Education, Health and community services, and Personal and other services industries are also omitted (ABS 1995d).

Figure 3.4 Growth in manufacturing sector labour productivity, Australia and selected OECD countries — 1975 to 1995[a]



a Raw quarterly data were smoothed using a five-term Henderson trend.

Source: OECD (1995a).

Despite the marked slowdown in Japan's productivity growth in the early 1990s it still registered average growth for the period of 3.2 per cent a year. The US recorded the same trend rate of growth in labour productivity as Japan, while the trend growth rate achieved by Canada — 2.7 per cent per year — was also superior to Australia's.

However, although the measurement is called 'labour productivity' it must be remembered that other factors, such as capital investment and changes in technology, also influence changes in this indicator. Thus labour productivity measures on their own can present a misleading picture of overall productivity changes. Hence, to gain a more complete picture of the relative productivity performance of Australia's manufacturing sector we turn to an examination of TFP data.

OECD estimates of manufacturing TFP growth for Australia and a number of industrialised countries suggest that TFP grew considerably slower than labour productivity. Australian manufacturing achieved an annual trend rate of TFP growth of 1.5 per cent between 1973 and 1993 (table 3.2) — 0.8 of a percentage point a year slower than the rate of labour productivity growth achieved over the past two decades (discussed earlier). Australia's TFP growth rate was also clearly

below the weighted average manufacturing TFP growth rate of 1.8 per cent achieved by the fourteen OECD countries examined.

These data suggest that Australia's TFP performance was somewhat stronger in the second half of the period, with Australia's trend annual rate of TFP growth in the ten years to 1993 coming in at 1.7 per cent — table 3.2. But TFP growth rates for a number of other countries' manufacturing sectors also picked up in the second half of the period. The OECD weighted average increased from 1.1 per cent a year in the period 1973-83 to 2.1 per cent a year in the period 1983-93, due in part to the strong influence of the US improvement in the latter period.

Figure 3.5, which contains more up to date TFP estimates for Australia only, reveals considerable year-to-year volatility, with annual TFP growth rates for Australia's manufacturing sector moving between positive and negative values. [13] In an attempt to remove some of this year-to-year volatility we have calculated a five year moving-average TFP growth series for Australia. However, it is clear from these data that although Australian manufacturing TFP growth has picked up in recent years, stronger rates of improvement have been achieved over selected years since 1974-75. Consequently it is too early to make definitive judgements about whether Australian manufacturers as a group have significantly improved their productivity performance in recent years, including whether they have improved their performance relative to other OECD countries. [14]

Table 3.2 A comparison of manufacturing TFP growth in fourteen OECD countries — 1973-1993[a]

	Trend annual growth		
Country	*1973 to 1983 (%)*	*1983 to 1993 (%)*	*1973 to 1993 (%)*
Australia	**1.4**	**1.7**	**1.5**
United States	-0.2	2.1	1.3
Canada	-0.5	0.8	0.8
Japan	3.3	2.5	3.0
Germany (West)	1.3	1.2	1.2
France	1.9	1.6	1.6

[13] These data were estimated using the same methodology as the OECD (1995c). The resulting TFP growth rates are very similar to those estimated by the OECD (except that the OECD data refer to calendar years instead of financial years).

[14] The importance of exercising caution in the interpretation of trends in productivity measures (either TFP or labour productivity) is reinforced by the recent large revisions to ABS data which reduced the growth in manufacturing value-added (constant 1989-90 prices) between 1991-92 and 1994-95 by $3.7 billion (ABS 1996e).

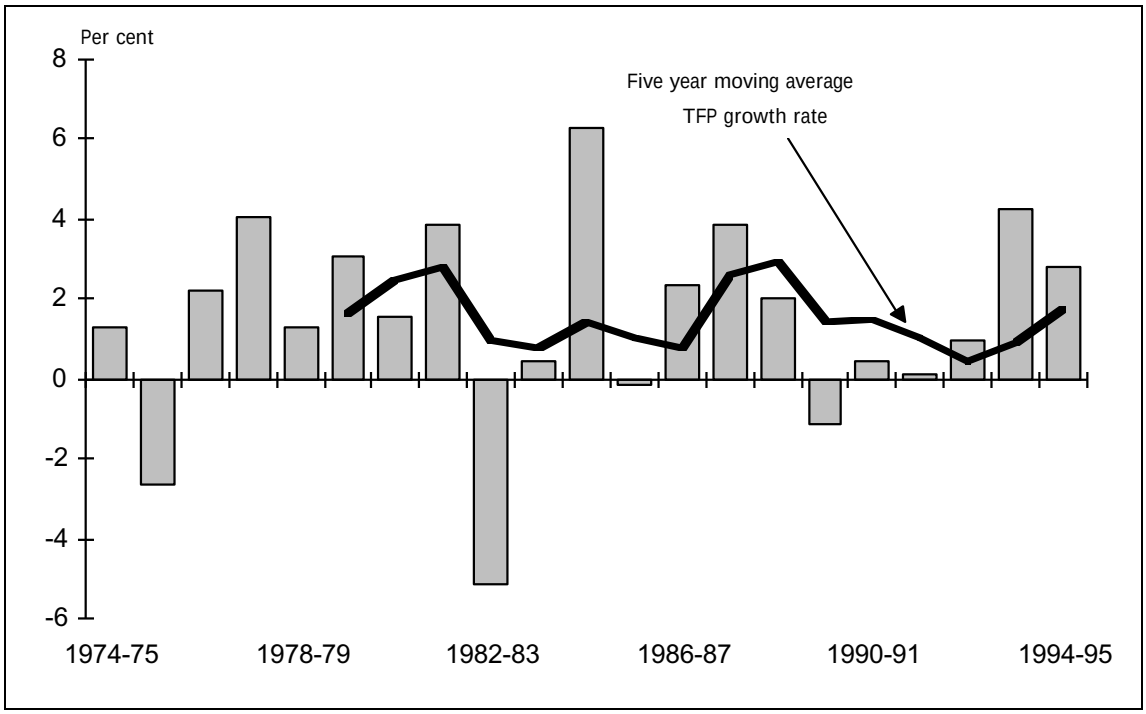
Italy	3.2	3.2	3.2
Great Britain	-0.1	3.6	1.9
Netherlands	2.2	0.9	1.9
Belgium	4.1	2.4	3.6
Denmark	2.2	-0.6	0.8
Norway	-0.8	0.5	0.3
Sweden	0.4	1.5	1.5
Finland	2.3	3.1	3.0
OECD average [b]	**1.1**	**2.1**	**1.8**

a Data for Germany and France refer to the period 1973-92. Data for Italy, the Netherlands and Norway refer to the period 1973-91. Data for Great Britain and Belgium refer to the period 1973-90. **b** Weighted average — listed countries constitute approximately 90 per cent of OECD output. As the US accounts for over 35 per cent of OECD output, the OECD average is heavily influenced by movements in the US rates of manufacturing TFP growth.

Source: OECD (1995c).

The fact that we do not as yet have clear evidence of manufacturing productivity shifting onto a higher growth plane does not mean that the reform process has been unsuccessful. Given that most of the reforms have been under way for a relatively short time — in historical terms — and many are still taking place, it is reasonable to assume many of the benefits has not as yet been fully realised.

Figure 3.5 Growth in Australian manufacturing sector total factor productivity — 1974-75 to 1994-95



Sources: ABS Cats 5206.0 and 6203.0.

In the following chapter we continue our examination of structural change in manufacturing at the broad sector level as well as within individual industries. We do this through a focus on trade in manufactures. Trade is the key mechanism through which many of the pressures and opportunities for Australian manufacturing (discussed earlier) manifest themselves. Further, an examination of trade issues — export performance in particular — also provides considerable insight into how Australian manufacturing industries are coping with the transition to a more open economy.

4 Manufacturing and the open economy

The increasing trade orientation of Australian manufacturing is discussed in this chapter, with a particular focus on the growth in manufactured exports. This topic is of interest because it is both an outcome of, and a driving force behind, the structural changes discussed in chapter 3. The focus is on developments over the past decade, in the main due to data limitations. After presenting some key facts on the rising trade orientation of manufacturing in Australia we examine the data in more detail — at an industry level — to explain the aggregate or sectoral changes. The chapter begins with a discussion of some of the issues surrounding the definition and measurement of manufactured exports in an attempt to dispel some common misconceptions about what the term 'manufactured exports' actually means.

4.1 Defining manufactured exports

Most of the export data in this chapter refer to 'Australian-produce' exports. These data exclude re-exports — goods which were originally imported and then subsequently exported. The most common examples of re-exports are large capital items like passenger aircraft and ships. But Australian-produce data are not always appropriate, for example when calculating sectoral shares of exports (as in table 4.1) or when comparing exports and imports. In these cases total export data are used and identified as such.

The first task in examining the export performance of any sector in the economy is to determine which of the nation's large basket of exports are actually produced by it. In this paper the term 'manufactured exports' is used to refer to the overseas sale of products from those industries classified to the manufacturing sector under the ANZSIC — see appendix D for more information. According to these data, Australia's total manufactured exports were valued at $43.7 billion (in current prices, including re-exports) in 1994-95. This means that manufactured exports represented about half of Australia's total exports of goods and services in the same year (table 4.1).

But this is not the whole story. Taken in isolation the data in table 4.1 provide a somewhat misleading picture of how much each sector of the economy is actually contributing to total Australian exports. The service sector provides many of the inputs used to produce other sector's exports — services like transportation, power and communications for example. So the data in table 4.1 underestimate

the actual (or indirect) contribution of the service sector, while overestimating the actual contribution of the manufacturing sector, to the level of value-added embodied in total exports. This is because the entire value of an export, which may involve inputs from a range of sectors is credited to the industry which was last associated with the item.

Table 4.1 Total exports of goods and services by sector — 1994-95[a,b]

	Value ($b)	*Share* (%)
Total	**87.4**	**100.0**
Agriculture	6.9	8.4
Mining	14.9	18.5
Manufacturing	43.7	51.0
Services	20.4	20.2

a The sum of the components does not add to the total due to the exclusion of some confidential items. **b** Data are for total exports, and therefore include re-exports.

Sources: DFAT (1995), ABS Cat 5302.0 and unpublished ABS data.

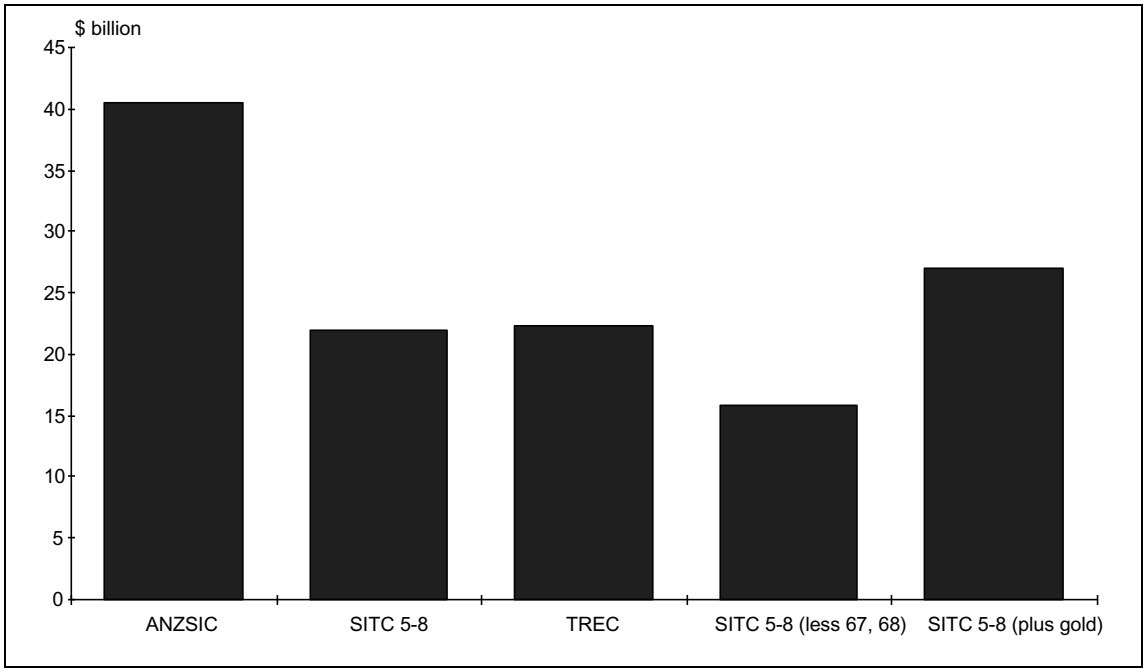
A systematic analysis of this question using ABS input-output tables was reported in Ho, Van Thiep (1994). This analysis estimated that the manufacturing sector supplies only about 55 per cent of the value-added embodied in its exports. This varied greatly across the various manufacturing industries, with the exports of the Food, beverages and tobacco and Metal products industries containing higher shares of non-manufacturing value-added than the Machinery and equipment industry. By contrast, the service sector supplies 93 per cent of its own embodied value-added. The 'bottom line' from this analysis was that in 1989-90 the manufacturing sector contributed 25 per cent of the total value-added embodied in Australia's exports (Ho, Van Thiep 1994, table 9, p. 14). [1]

This problem has resulted in a range of different measures of 'manufactured exports' being used which better reflect the overall contribution of manufacturing to total exports. These estimates are usually derived by summing up a subset of the commodities produced by Australia's manufacturing industries. This set generally includes only the more elaborately transformed items like transport equipment, machinery and equipment, and some extensively processed metal products like aluminium window frames. As illustrated in figure 4.1, these

[1] The mining and agricultural sectors contributed a further 22 and 12 per cent respectively, while service industries supplied the remaining 41 per cent of embodied value-added. Clearly embodied services are a very important constituent of our exports, and their competitive supply is therefore important to Australia's export performance.

commodity-based estimates (SITC and TREC — see appendix D) vary significantly, ranging from between one-third and one-half lower than the ANZSIC industry-based measure of manufactured exports.

Figure 4.1 The different measures of manufactured exports — 1994-95[a]



a For more detail on some of these definitions see appendix D.

Sources: ABS Cat 5422.0, DFAT (1995) and CSIRO (1995).

More simply transformed goods produced by the Food, beverage and tobacco, Metal products, Textiles, clothing, footwear and leather, Wood and paper product manufacturing and Petroleum, coal, chemical and associated product manufacturing industries are not included in the commodity-based measures of manufacturing exports. The exclusion of these products is to some degree understandable. The ANZSIC (or industry-based) measure of manufactured exports claims 'credit' for many products often regarded as predominantly the output of the agricultural or extractive sectors (eg frozen meat, woodchips etc).

But while the commodity-based measures provide a better approximation of the *total* contribution made by manufacturing to Australia's exports, they are generally of limited usefulness. This is because they are based on commodity data, and hence cannot be used in any empirical work which is based on industry classifications.

Clearly, any useful analysis of the manufacturing sector requires a consistent measure of the different variables. That is, manufactured exports should be

directly comparable with say, value-added, employment, investment, R&D, assistance and wages data. Comparable data allow us, for example, to estimate import penetration and export propensity ratios and track changes in them over time. As Australia (and virtually all other countries) use an industry-based system to measure domestic variables at the sector level, we have adopted the same system for manufactured exports in this paper. [2]

4.2 Manufacturing's rising trade orientation

Increased internationalism — the extent to which Australian firms are developing global outlooks and strategies, and are sourcing out of or selling into various overseas locations — is a key driver of much of the structural changes we examined in chapter 3. But it is also a partial indicator of the success or otherwise of the reforms introduced by Australian governments since the early 1980s.

The most tangible outcome of this new international exposure and changing attitudes is increased trade. Australia's total exports of goods and services grew at a trend rate of 6.9 per cent (in constant prices, balance of payments basis) in the ten years to 1994-95, much faster than the trend growth in the previous ten years (3.7 per cent a year). By far the largest contribution to the export growth in the past ten years came from manufactured exports, which accounted for almost two-thirds (constant prices, industry basis) of the total export growth over the period.

However, the strong export growth has not occurred in isolation. Australia's imports of goods and services have also risen, increasing at a real yearly trend rate of 5.8 per cent in the ten years to 1994-95, up from 3.7 per cent in the previous ten years. Once again, manufactured products comprised the largest proportion of the growth in imports over the period (81.6 per cent, constant prices, industry basis). Manufactured imports grew in real terms at an annual trend rate of 6.8 per cent between 1984-85 and 1994-95 to reach $70.7 billion (in current prices). The major contributors to this growth were imports of machinery and equipment and petroleum, coal, chemicals and associated products, amounting to $50 billion worth of imports in 1994-95 (table 4.2).

Other data confirm the increasing trade orientation of the manufacturing sector. In 1984-85 approximately 16 per cent of the sales from Australia's manufacturing firms were sold overseas (figure 4.2). A decade later, in 1994-95, this ratio had risen to 25 per cent. That is, on average, 25 cents in every dollar of sales from our manufacturing firms was earned overseas. The import penetration of our domestic

[2] As outlined in chapter 2, the United Nations International Standard Industrial Classification of All Economic Activities (ISIC) forms the basis upon which most countries collect data on their economies. Our own ANZSIC system is based on revision 3 of the ISIC.

market for manufactured products (share of imports in total sales to the domestic market) also rose over the period. In 1984-85 imports accounted for about 26 per cent of all sales of manufactured goods in Australia. By 1994-95 this ratio had risen to 35 per cent.

Table 4.2 Australia's manufactured imports — 1984-85 to 1994-95

	Level in 1994-95	*Trend annual growth 1984-85 to1994-95*
	($m)	*(%)* [a]
Food, beverage and tobacco	3 103	6.4
Textiles, clothing, footwear and leather	5 232	5.0
Wood and paper products	2 807	1.6
Printing, publishing and recorded media	1 663	6.3
Petroleum, coal, chemical and associated products	11 379	7.0
Non-metallic mineral products	1 059	3.3
Metal products	5 102	8.2
Machinery and equipment	38 486	7.6
Other manufacturing	1 914	6.0
Total manufacturing	**70 745**	**6.8**

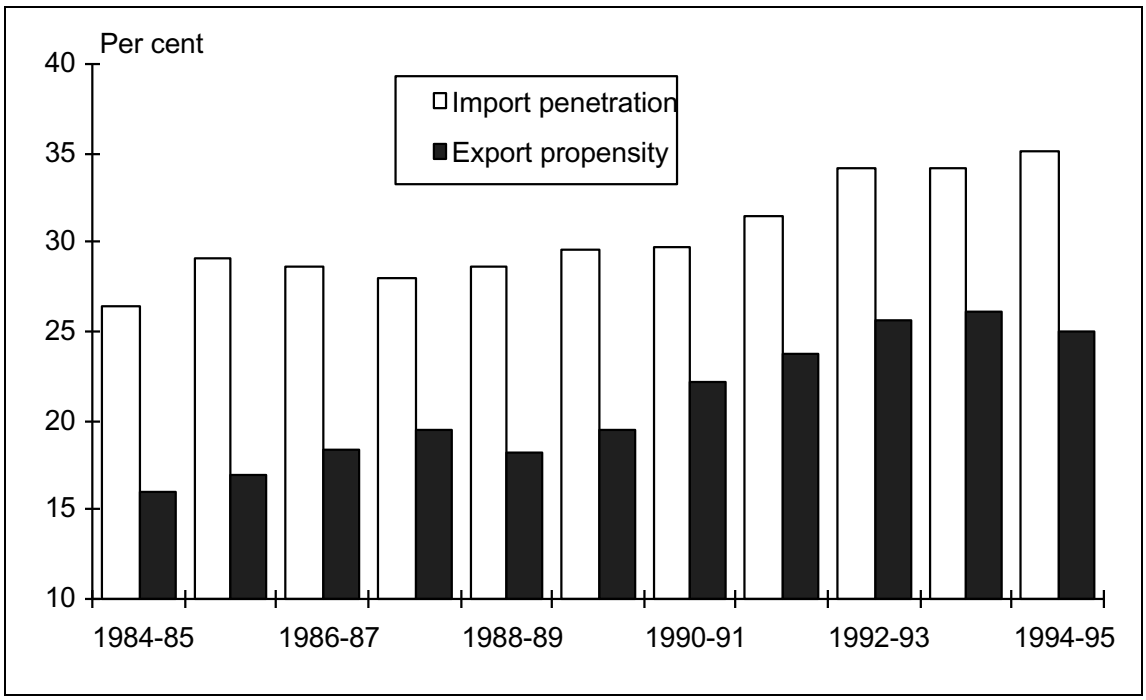
a Constant 1989-90 prices.

Sources: DFAT (1995) and unpublished ABS data.

Although rising imports are often viewed with alarm, especially in periods of strong cyclical upswings in the domestic economy, the long-term growth in imports is part of the transition towards a more open economy. As firms concentrate on new opportunities in export markets, that is, by specialising in the things they do well, they may choose to pull out of some domestic market segments where they are uncompetitive with imported products. The supply vacuum is then taken up by importers — implying further import growth. The relationship between manufacturing and Australia's overall trade position is discussed further in the following chapter.

The increasing openness of the economy has not been restricted to trade flows. Increasing levels of both inward and outward foreign investment by business enterprises have also been a distinctive feature of the growing globalisation of economic activity in Australia over the last decade. This process has been accelerated by the deregulation of capital and foreign exchange markets and the relaxation of restrictions on the foreign ownership of assets.

Figure 4.2 Export propensity and import penetration of Australia's manufacturing sector (current prices)



Sources: DFAT (1995) and ABS Cat 5629.0.

In 1994-95, the stock of Australian investment abroad totalled $141 billion (current prices). Much of this consisted of investment in companies registered overseas, and to a lesser extent, investment in overseas branches by Australian enterprises. This was $41 billion higher than the level four years ago. Despite this increase, the stock of Australian investment abroad continues to be overshadowed by the stock of foreign investment into Australia — which stood at $401 billion in 1994-95 — due in part to the large differences in the starting magnitudes.

Firms in the manufacturing sector played a significant role in the recent growth in the stock of both inward and outward foreign investment. According to ABS estimates, Australia hosted an additional $27 billion of inward foreign investment in manufacturing in the four years to 1994-95 (ABS 1996a). This represented almost one-quarter of the total growth in inward foreign investment over the same period. Comparable data on stocks of outward foreign investment are not readily available. However, ABS data on stocks of outward foreign *direct* investment (FDI) are available at the sector level [3] (ABS 1996b). These data suggest that the manufacturing sector accounted for about 38 per cent of Australia's total outward

[3] The concept of direct investment is broadly one of capital invested in an overseas enterprise where the investing firm is in a position to significantly influence decisions in the overseas enterprise. In compiling statistics the ABS regards the ownership of 10 per cent or more of the ordinary shares or voting stock of an enterprise as indicative of significant influence by the investor (ABS 1996a).

FDI stocks in 1994-95, and contributed around half of the growth in the stock of outward FDI in manufacturing over the past four years.

4.3 Recent trends in manufactured exports

Measured on an Australian produce basis, Australian manufactured exports grew at a trend rate of 8.7 per cent a year between 1984-85 and 1994-95 (constant prices)[4] — faster than the 6.9 per cent growth in total Australian exports (all sectors) over the same period. This resulted in the value of manufactured exports tripling over the period, increasing from $13.5 billion in 1984-85 to $40.8 billion in 1994-95 (in current prices). Consequently, manufacturing's share of total goods and service exports rose from 37 per cent in 1984-85 to about 50 per cent in 1994-95. Growth accelerated to an annual trend rate of 9.2 per cent (Australian produce, constant prices) in the second half of the period.

There are a number of factors to consider when examining why the growth in Australia's exports of manufactured products over the last decade has been so strong. These can be broadly divided into supply and demand influences.

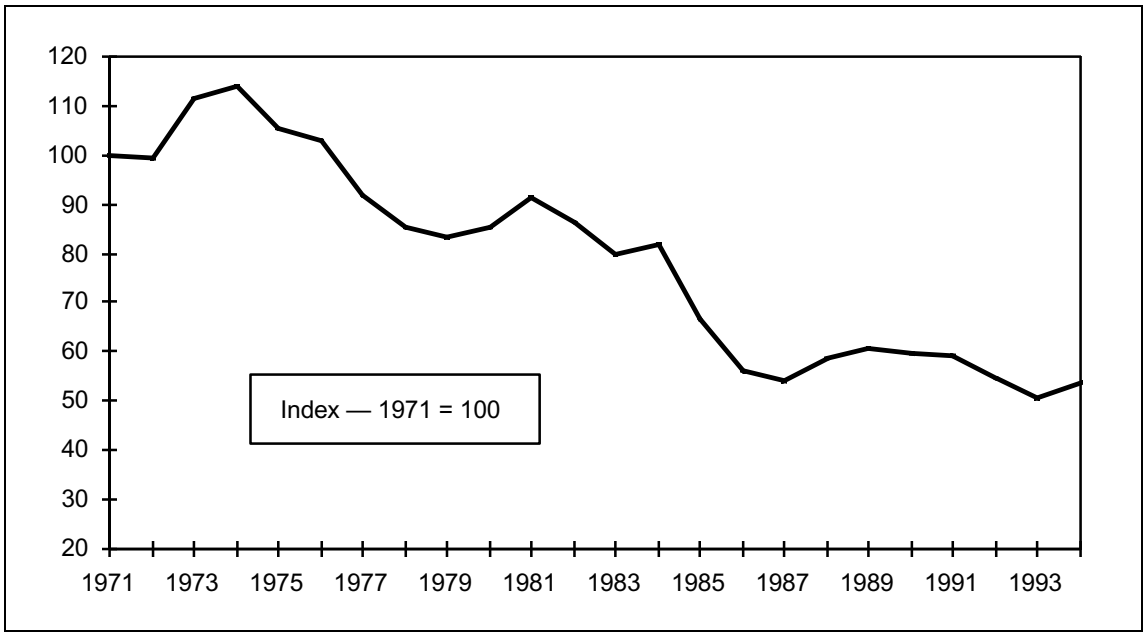
On the supply side, there has been a noticeable improvement in the price competitiveness of Australian-produced manufactured goods over the last decade. Cyclical factors like favourable exchange rate movements and relatively lower growth in Australian wage rates played an important role in this development. The trade-weighted index of the Australian exchange rate (weighted against our trading partners) fell about 30 percentage points between 1984 and 1994, representing a significant boost to the competitiveness of Australia's traded sector (figure 4.3). Moreover average nominal wages in the manufacturing sector rose by about 21 per cent in the five years to the September quarter 1995 (seasonally adjusted data). This was significantly slower than the 42 per cent growth posted in the previous five years.

Government policies designed to improve the operating environment and incentive structure faced by Australian firms also provided significant impetus to stronger export performance. These measures are generally grouped under the micro-economic reform banner. Key elements of Australia's microeconomic reform agenda since the mid-1980s include: trade liberalisation and other rationalisations of government assistance, infrastructure reform, industrial relations and workplace reform and regulatory reform, including reforms to competition policy. Over recent years many organisations have attempted to

[4] This translates to an annual trend rate of growth of 11.2 per cent in current price terms (that is, including the impact of price movements) over the period.

calculate the economy-wide impact of the microeconomic reform initiatives, including their impact on export growth. The BIE recently examined many of these studies (BIE 1996a). A key finding from this work was the positive impact of microeconomic reform measures on aggregate export growth.

Figure 4.3 The trade weighted index of Australia's exchange rate



Source: Reserve Bank of Australia (1996).

Although the impacts are difficult to quantify, a number of government industry policies designed to directly increase the export orientation of some of Australia's manufacturing industries helped shift the focus of many manufacturers offshore.

On the demand side, there have been a number of developments which have made overseas markets a more attractive proposition to Australian manufacturers since the mid-1980s. Some of these include the strong economic growth and rising incomes in Asia. As an industrialised nation on the edge of the fastest growing region of the world, Australia is uniquely situated to benefit from the rising demand for more complex goods and services from increasingly wealthier Asians. This issue is examined further towards the end of this chapter.

Nevertheless the domestic recession in the early 1990s also contributed to Australia's export growth. A contracting local market forced many manufacturers to shift some of their surplus production to more buoyant economies offshore. Industry evidence suggests that most of these firms have maintained a presence in these export markets, even after the recovery of the domestic market. A recent research discussion paper by the Reserve Bank of Australia (RBA 1993b) provides an explanation for this phenomenon. The RBA argues that exporters

incur 'sunk costs', such as the establishment of distributional and storage facilities in foreign markets when they commence exporting. Sunk costs effectively create a hurdle which any would-be exporter must overcome. Thus exporters may not immediately respond to changing trading conditions, such as exchange rate movements or demand fluctuations, until a threshold level is reached. Similarly, if the shock is reversed, they are unlikely to immediately abandon their new markets.

Moves towards a more open world trading environment in recent years through forums like the General Agreement on Tariffs and Trade (GATT) and the Asia-Pacific Economic Cooperation (APEC) initiative have raised the awareness of the economic benefits of trade and increased specialisation, not only in Australia, but throughout the world. These, combined with better communications technology and the increasing role played by multi-national corporations in cross-country flows of goods, have also facilitated increased international trade links over the past decade. For a discussion of these developments see Porter (1990), Snape (1994) and BIE (1995d).

4.3.1 Exports at the industry level

We now turn to an examination of the recent export performance of the nine ANZSIC manufacturing industries which make up Australia's manufacturing sector.

A quick glance at table 4.3 and figure 4.4 shows that almost 80 per cent of the growth in Australia's manufactured exports in the decade to 1994-95 was sourced from three industries: Food, beverage and tobacco, Metal products manufacturing and Machinery and equipment manufacturing. These industries are very large exporters — combined they accounted for about three-quarters of Australia's manufactured exports in 1994-95. So even though the first two industries did not achieve the spectacular double-digit-plus growth rates of some other manufacturing industries their sheer size meant that they still contributed significantly.

The strong export performance from the Food, beverage and tobacco and Metal product manufacturing industries over the last ten years is not surprising. These industries add value to, or transform, Australia's abundant mineral and agricultural resources (as discussed in chapter 2). These industries produce a range of cast, rolled and extruded ferrous and non-ferrous metal products as well as fabricated and structural metal products like tubes, aluminium window frames and springs, frozen meat, wine, canned vegetables, cheese and powdered milk. A good example of a dairy food exporter is Bonlac Foods, which now exports

around $450 million of dairy products a year — around 45 per cent of its sales (see appendix A for a profile of this firm as well as a brief overview of the Food, beverage and tobacco industry).

Table 4.3 Manufactured export growth by industry (Australian produce data)

	Level 1994-95	*Share of manufactured exports 1994-95*	*Trend annual growth 1984-85 to 1994-95*	*Contribution to growth1984-95 to1994-95*
	($m)	*(%)*	*(%)* **a**	*(%)* **a**
Food, beverage and tobacco	10 560	25.9	6.1	21.4
Textiles, clothing, footwear and leather	2 604	6.3	8.9	7.5
Wood and paper products	978	2.4	6.8	1.9
Printing, publishing and recorded media	305	0.8	9.7	0.7
Petroleum, coal, chemical and associated products	6 350	15.6	5.7	8.5
Non-metallic mineral products	289	0.7	14.8	0.9
Metal products	12 283	30.1	9.9	31.6
Machinery and equipment	6 951	17.1	15.9	26.3
Other manufacturing	427	1.0	13.2	1.2
Total manufacturing	**40 746**	**100.0**	**8.7**	**100.0**

a Measured in constant 1989-90 prices.

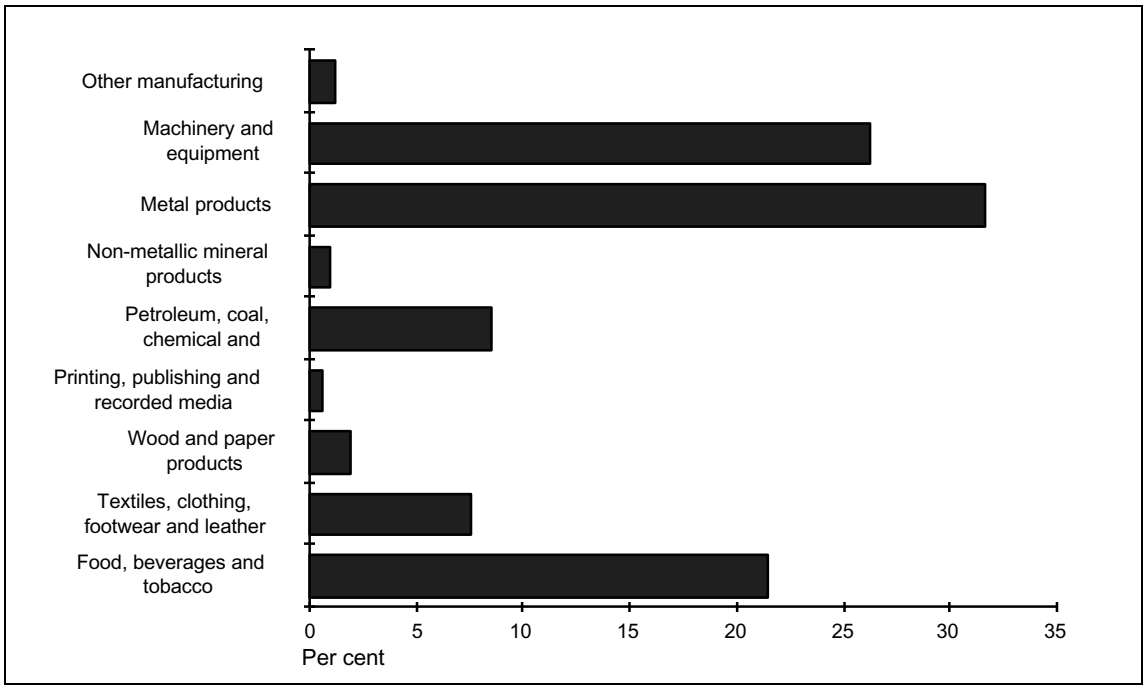
Sources: DFAT (1995) and unpublished ABS data.

Other data confirm the strong export orientation of these industries. Food, beverage and tobacco and Metal product manufacturing are also characterised by both a relatively high export propensity and relatively low import penetration. Moreover, exports by these two industries exceeded imports by $15 billion in 1994-95 (current prices). These data provide further evidence of the high degree of competitiveness of many firms in these industries.

Nevertheless, these industries did not completely dominate manufactured exports. Combined, exports from the Food, beverage and tobacco and Metal product manufacturing industries grew at an annual trend rate of 8.2 per cent (constant prices) over the last decade. This was slightly slower than the growth in total manufacturing exports over the same period. This relatively slower growth meant that their share of total exports fell from 57.2 per cent to 56.1 per cent over the period. Underpinning this result was the relatively weaker performance of the Food, beverage and tobacco industry. In 1984-85, exports from this industry accounted for 28.8 per cent of total manufactured exports — the largest of any industry. A decade later, this share had fallen to 25.9 per cent and the Metal

products industry had overtaken it as Australia's largest export earner in the manufacturing sector.

Figure 4.4 Industry contribution to total manufactured export growth — 1984-85 to 1994-95 (constant prices)



Sources: DFAT (1995) and unpublished ABS data.

The strong contribution to overall export growth from the third member of the top three exporting industries, Machinery and equipment, warrants further attention. Increased foreign sales from this industry accounted for about one-quarter of the overall rise in manufactured exports in the last decade. Exports from this industry also recorded the fastest growth of the nine major manufacturing industries over the period. In many ways this performance is surprising. Exports from this industry include sophisticated products like computers, motor vehicles and parts, aircraft components and industrial machinery. Many of these products are commonly referred to as elaborately transformed manufactures (ETMs — see appendix E for more information). Although the Australian manufacturing sector does not have a strong track record in the export of these products these data suggest this may be changing.

Other data confirm the increasing orientation by firms operating in the Machinery and equipment industry towards export markets. In 1984-85 approximately 10 cents of every $1 of sales from this industry was earned overseas. By 1994-95 this figure had risen to about 27 cents (table 4.4). Much of the export success of this industry has been attributed to the increasing ability of many Australian firms to compete in smaller specialised or niche markets. Firms are increasingly

focussing on things that they do well, emphasising quality and design rather than price as their major competitive tool. A survey by the Australian Manufacturing Council (AMC 1994) provides some evidence of this. The survey of 1400 manufacturing sites in Australia and New Zealand found that 65 per cent of Australian respondents and 75 per cent of respondents from New Zealand were making efforts to adopt 'world best practice' business techniques.

Table 4.4 Trade orientation of Australia's manufacturing sector

	Export propensity 1994-95 (%)	*Percentage point change in export propensity 1984-85 to 1994-95*	*Import penetration 1994-95 (%)*	*Percentage point change in import penetration 1984-85 to 1994-95*
Food, beverage and tobacco	25.2	5.9	9.0	1.4
Textiles, clothing, footwear and leather	32.9	21.7	48.4	18.4
Wood and paper products	9.0	4.1	21.9	2.9
Printing, publishing and recorded media	3.9	1.0	15.9	-2.7
Petroleum, coal, chemical and associated products	25.9	-0.2	37.5	3.4
Non-metallic mineral products	2.8	1.8	9.0	0
Metal products	42.6	18.0	23.2	11.7
Machinery and equipment	27.3	16.7	61.5	15.6
Other manufacturing	9.9	4.9	29.7	2.4
Total manufacturing	**25.0**	**9.0**	**35.1**	**8.7**

Sources: ABS Cat. 5629.0 and DFAT (1995).

The strong export growth from the Machinery and equipment manufacturing industry has also been accompanied by strong rises in imports. Machinery and equipment imports accounted for over half of all manufactured imports in 1994-95 (table 4.2). In fact imports of machinery and equipment exceeded exports by more than $29 billion in that year. This compares to the total trade deficit in manufacturing of $27 billion in 1994-95. The fact that imports exceed exports in this industry is not surprising. As noted earlier, the strong growth in exports from this industry is largely due to the ability of exporting firms to produce specialised goods for relatively small niche markets. Much of Australia's imports of these products, on the other hand, consist of standardised consumer products.

The only other industries to make a non-trivial contribution to Australia's manufactured export growth over the last decade were the Textiles, clothing, footwear and leather and Petroleum, coal, chemical and associated product manufacturing industries. Combined, these industries accounted for about 16 per cent of the overall rise in exports over the ten years to 1994-95. A key feature of

these industries is that they engage in a substantial amount of intra -industry trade (ie. trade within the industry group involving the exchange of similar goods). Although intra-industry trade features in all of the nine manufacturing industries, it is noticeably higher in the Textile, clothing and footwear and Petroleum, coal and chemical products industries.

The significant share of manufactured exports (and imports) held by the Textiles, clothing and footwear and Petroleum, coal, chemical and associated product manufacturing industries provides evidence that many firms in these industries have also successfully participated in the growing specialisation that has occurred in Australia's manufacturing sector over the last decade. This is especially the case in the Textiles, clothing and footwear industry. Many firms have moved their later-stage processing plants offshore to take advantage of lower input costs.

The increased internationalisation of the Australian economy is, to a large degree, inevitable. Better (and cheaper) transportation and communications services together with reduced barriers to trade are certainly making trading more attractive for an increased number of firms and an increased number of products. This is no more evident than in the recent export performance of the remaining four manufacturing industries. Combined, exports from the Wood and paper products, Printing, publishing and recorded media, Non-metallic mineral products and Other manufacturing industries grew at an annual trend rate of 9.6 per cent (constant prices) between 1984-85 and 1994-95. This was faster than the growth rate for total manufactured exports, although from a very small base. Together, these industries only accounted for about 5 per cent of Australia's overseas sales of manufactured products in 1994-95.

Low import penetration and low export propensity are features of both the Non-metallic minerals and Printing, publishing and recorded media industries. Although export propensities are also quite low in the Other manufacturing and Wood and paper products industries, import penetration levels are somewhat higher at about 30 and 22 per cent respectively (compared with the manufacturing average of 35 per cent in 1994-95). Essentially, these results indicate that these industries are primarily geared towards the domestic market. This domestic orientation is due in some degree to natural protection of these industries resulting from factors like the difficulty or cost of transporting many products from these industries over long distances and the need for customer and supplier to be co-located.

4.3.2 Changing markets

The previous section established that Australia's manufactured exports posted very strong growth over the last decade. This section examines the sources of the increased demand for Australia's manufactured goods. Australia's top fifteen markets for manufactured exports in 1994-95 are listed in table 4.5.

Clearly Japan is our dominant overseas market for manufactured products, accounting for 17.9 per cent of Australia's manufactured exports in 1994-95. New Zealand, Singapore, the Republic of Korea and the United States constitute the remaining top five markets (although these markets are far less significant than Japan). Combined, the top five absorbed about 47 per cent of our manufactured exports in 1994-95, up from a 44 per cent share a decade ago. [5] These data indicate that a sizeable proportion of Australia's overseas sales of manufactured products are concentrated amongst a relatively small number of markets.

Table 4.5 Australia's major markets for manufactured exports — 1994-95[a]

	Sales	*Share of manufactured exports*	*Trend annual growth 1984-85 to 1994-95*
	($m)	*(%)*	*(current prices, %)*
Japan	7 338	17.9	10.8
New Zealand	3 316	8.1	11.7
Singapore	3 063	7.5	24.9
Republic of Korea	2 885	7.0	25.1
USA	2 672	6.5	7.5
Hong Kong	1 919	4.7	12.7
Taiwan	1 752	4.3	17.6
Malaysia	1 412	3.4	18.3
Thailand	1 365	3.3	24.6
Indonesia	1 192	2.9	21.2
United Kingdom	1 124	2.7	8.1
China	798	1.9	5.4
Philippines	696	1.7	21.3
Papua New Guinea	587	1.4	4.8
Italy	465	1.1	7.9
Total manufactured exports	**41 087**	**100.0**	**11.6**

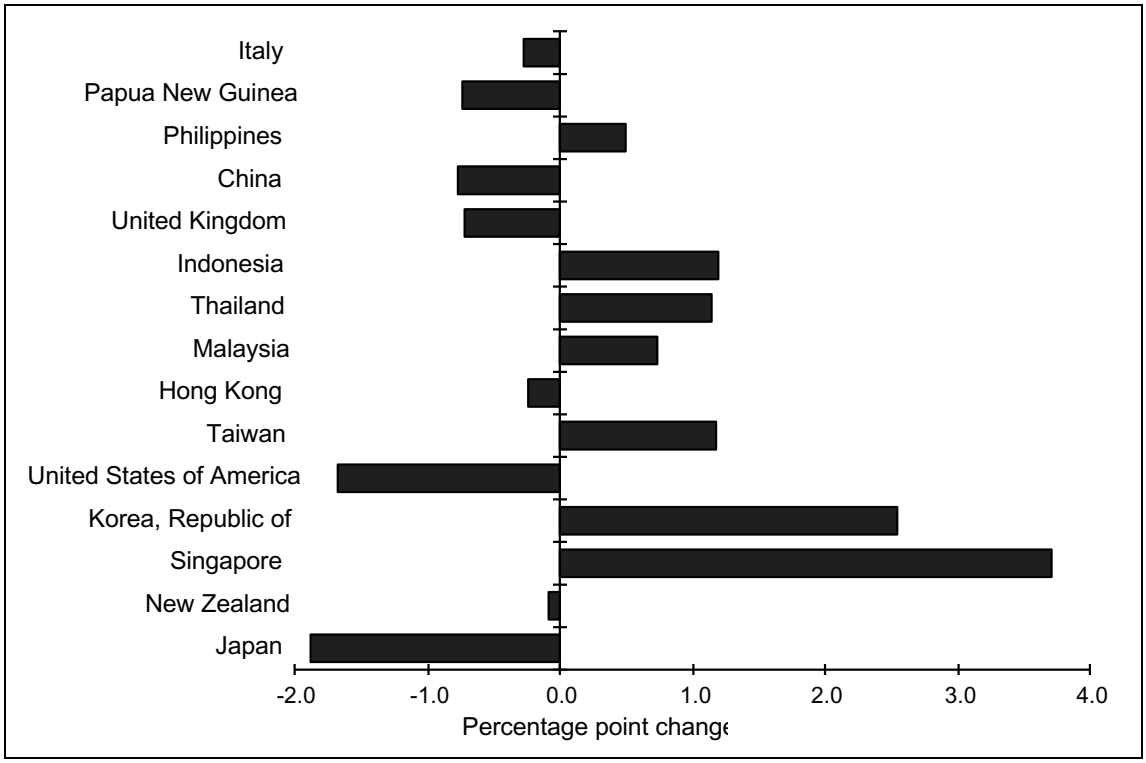
[5] The membership of the top five group changed over the period. The top five markets in 1984-85 comprised Japan, the US, New Zealand, Hong Kong and the UK.

a The discrepancy between total manufactured exports in this table and earlier tables in this chapter is mainly due to the differences between the ASIC and ANZSIC systems.

Source: DFAT (1995).

However the composition of our largest markets is changing. Figure 4.5 shows the percentage point change in the average market share of our largest fifteen markets for manufactured products between the five years to the end of 1989-90 and the five years to the end of 1994-95. Clearly, with the exception of Japan and to a lesser extent China and Hong Kong, Asian markets are becoming more important to Australian manufacturers.

Figure 4.5 The changing relative importance of Australia's top 15 markets for manufactured exports[a]



a This measure indicates the *changing* importance of overseas markets to Australia. It does not provide an indication of the *relative* importance of these markets to Australian exporters. A positive value indicates an increase in the share of total Australian manufactured exports sold to that market between the period 1984-85 to 1989-90 and the period 1989-90 to 1994-95. A negative value indicates that a market is accounting for a smaller proportion of total Australian manufactured exports.

Source: DFAT (1995).

This growth has been at the expense of Australia's traditional markets like the United Kingdom, the United States, New Zealand, and Japan. Of course, this is not to say that our sales of manufactures to traditional markets declined over the period. Quite the contrary. The data in table 4.5 show that the declining share is simply an outcome of the relatively faster export growth to various Asian destinations.

We are able to analyse Australian manufacturing's shift towards Asian markets by dividing the world into Asian and non-Asian regions. Asia is now the most common destination for our manufactured exports. Australia exported almost $5 billion (current prices) of manufactures to Asia in 1984-85. A decade later, in 1994-95, this figure was about $23 billion. This translates to a trend annual rate of growth of 15.4 per cent over the period. Moreover, the average growth in sales to Asia outstripped the rise in exports to non-Asian markets by a ratio of almost two to one over the decade. Consequently Asia's share of our manufactured export market rose from 38 per cent in 1984-85 to about 56 per cent in 1994-95.

Further analysis of the different country groups within Asia reveals some interesting trends. Over three-quarters of the growth in our exports to Asia in the decade to 1994-95 was accounted for by increased demand from two groups of countries — the Newly Industrialised Economies (NIEs) of Singapore, Taiwan, Hong Kong and the Republic of Korea, and the North Asian countries of China, Mongolia, Macau and Japan. Of the two groups, the NIEs made the larger contribution, absorbing about 44 per cent of the increased value of exports to Asia over the period. Interestingly, the NIEs made a much larger contribution in the latter half of the decade, accounting for almost two-thirds of the growth to Asia over the five years to 1994-95. Conversely the relative contribution of North Asia slowed over the second half of the decade. This was mainly the result of the declining share experienced by the Japanese market.

The increasing dominance of Asian markets as destinations for our manufactured exports is not surprising. Apart from its geographical proximity, the region has also been enjoying the fastest rates of economic growth in the world. However, the reason for Australia's export growth in Asia goes beyond these simple facts. As an industrialising rather than industrialised region, Asian economies are currently geared more towards production than consumption. Moreover, Asia's manufacturing strengths, currently at least, lie mainly with the high-volume production of standardised consumer goods. As a result, economic growth in Asia has generated a substantial increase in the world demand for inputs to the manufacturing process due to Asia's lack of resources. These inputs include unprocessed mineral products as well as a range of resource-based manufactured products. Australia, as a resource-rich country with a strong comparative advantage in the production of inputs to the manufacturing process, has benefited from this.

Australia's input-producing manufacturing industries have been major beneficiaries of the push towards Asia. For example, Asian markets absorbed 89, 86 and 79 per cent, respectively, of the growth in the exports of the Wood, wood

products and furniture,[6] Basic metals, and Textiles industries over the last ten years. Moreover Asian markets also accounted for a majority of the export growth from the Food, beverage and tobacco, Other machinery and equipment and Chemical, petroleum and coal products industries over the last decade.

Many readers will be surprised to find that Asian markets accounted for a slight majority of the export growth from the Other machinery and equipment industry over the period. In part this is a reflection of the broad nature of the industry-based classification. The Other machinery and equipment industry produces both consumer and capital goods. It is likely that the capital goods component accounted for most of the Asian export drive from this industry over the decade. Interestingly, for those industries more oriented towards the production of consumer goods, such as the Clothing and footwear, Transport equipment and Miscellaneous manufacturing industries, a majority of their export growth over the last decade went to non-Asian markets.

The rise in trade with Asia has also been evident during our discussions with a range of manufacturing firms around Australia. BHP, Amcor, Bonlac Foods and Allen & Unwin already export to Asia or have operations in Asia while Yakka, BTR Nylex and Dream Haven are considering moving into Asian markets, either as an exporter or an off-shore producer (see appendix A).

It is also worth noting that, although Australian manufacturing firms have increased the value of their exports to Asia, they have not been maintaining their share of Asian imports of manufactured products. According to work undertaken by the BIE, Australia supplied 2.8 per cent of all imports of manufactures to Asia in 1982. By 1992 this share had fallen to 1.7 per cent (see BIE 1995b). The BIE study found that much of the fall in Australia's share of Asia's manufactured imports could be explained by the dramatic increase in intra-Asian trade in manufactured products over the period. In the ten years to 1992, the share of total Asian imports of manufactures supplied from *other* Asian countries rose from 47.1 per cent to 56.7 per cent.

A more recent study by Drysdale and Lu (1996) considered these questions using data on Australia's total exports of goods to East Asia, with a focus on the period 1985 to 1994. They found that the commodity structure of import growth in East Asian markets had disadvantaged Australian exporters of agricultural commodities and minerals and fuels — which included many of Australia's resource-based manufactures. Interestingly, they also found that non-resource-

[6] The older ASIC system is used in this section of the report because, at the time of publishing, a comprehensive time series of ANZSIC export destination data was unavailable.

based Australian manufactured exports had basically retained their market share over the period — registering strong growth as a consequence.

In explaining this growth, Drysdale and Lu concluded that the evidence that industry specific policies were decisive in the turnaround of performance in manufacturing exports was not persuasive. Indeed, through their analysis of the relationship between export performance and government assistance to industry, the authors came to the preliminary conclusion that reductions in industry assistance stimulated export performance, while high levels of assistance actually inhibited exports (Drysdale and Lu 1996, p. 33).

In summary then, data presented in this chapter have clearly highlighted the rising trade orientation of Australian manufacturing, in particular the strong growth in manufactured exports. The strong export growth rates achieved by Australian manufacturers are of interest, not primarily for their own sake, but because of what they represent — tangible evidence of a fundamental change in the way the Australian manufacturing sector operates. In the course of this chapter several issues have been raised which warrant further discussion — notably the relationship between the manufacturing sector and Australia's overall trade position. The following chapter canvasses differing views on this and a range of other issues which have arisen in previous chapters.

5 Perspectives on the role of manufacturing

The previous two chapters have highlighted the significant changes to the structure and trade orientation of Australian manufacturing in recent decades. In this chapter we explore a number of common misperceptions about manufacturing and its role in the Australian economy. A range of issues stemming from the information presented in earlier chapters are canvassed, including the role of manufacturing in driving the creation of high-wage jobs, exports, productivity, R&D and value-added.

5.1 Manufacturing as the 'engine of growth'

Chapter 3 showed that a decline in the share of GDP accounted for by manufacturing is common to most developed economies. Nevertheless, the fact remains that Australian manufacturing accounts for a smaller proportion of GDP than most other OECD countries (appendix B). However, it does not necessarily follow that Australia has a structural weakness. Inter-country differences in industry structure reflect a myriad of factors, including natural resource endowments, divergent historical experiences, proximity to markets, differing impacts of technological advances and some cultural and social factors. Moreover, as we have seen in earlier chapters, Australia's industry structure is constantly shifting to meet changes in incomes and tastes as well as movements in the global pattern of production. Consequently, a particular industry structure should not be seen as an end in itself — it is its capacity to deliver high and rising living standards that is important. It is unrealistic to expect that all countries will achieve this aim in identical ways.

But that is not to say that industry structure in unimportant. Industries grow at different rates over time and some industries have a greater potential for growth than others. So clearly, a country with a high proportion of its output and workforce employed in industries with strong growth prospects will perform better than a country with a higher proportion of slow-growth industries.

In the past, some have advocated preferential treatment for the manufacturing sector to support various national goals such as population growth, defence, self sufficiency, employment creation and fair and reasonable wages. [1] More recently a

[1] For a discussion of these views, see for example, Rattigan (1986) and Maddock and McLean (1987).

number of different views have been expressed in support of preferential treatment, including:

- A strong manufacturing sector is needed to create high-wage jobs — jobs created in the service sector are generally part-time or low-skill occupations;
- Australia's external trading position would benefit from a larger manufacturing sector because of its capacity to improve our living standards by halting the long-run decline in Australia's terms of trade, reduce Australia's reliance on imports of manufactures and generate the necessary growth in exports to eliminate Australia's large trade deficit on manufactured goods;
- Productivity grows faster in manufacturing than in other se ctors — hence, a larger manufacturing sector is needed to generate the level of productivity growth required for an acceptable rate of increase in GDP per capita;
- Manufacturing is R&D intensive and R&D underpins growth in modern economies. Accordingly, if the manufacturing sector was boosted, this would lead to higher long-term growth rates for the Australian economy;
- Manufacturing is a high value-added activity. This means that it contributes more to the wealth generation process than other sectors do; and
- Manufacturing is a mainspring of economic activity. [2]

Although there is a grain of truth in some of the arguments associated with these views, when viewed from an economy-wide perspective they are far less appealing. We examine each issue in turn below.

5.2 High-wage jobs

It cannot be disputed that, although services industries have accounted for virtually all of the employment growth in Australia over the past few decades, many of the new jobs created were part-time. Data for 1994-95 reveal that an employee in the service sector is three times more likely to be part-time than is a manufacturing employee (28 per cent of services employment is part-time

[2] Elements of these views can be found in AMC (1995 and 1986), BIS Shrapnel (1995), Stewart (1994), Phipps, Sheen and Wilkins (1992), Hart (1992), Pappas, Carter, Evans and Koop/Telesis (1990) and Senate Standing Committee on Industry Science and Technology (1988). For an international (and historical) perspective see: Ansari (1992), Maddison (1991), Cohen and Zysman (1987), Singh (1987), Bluestone and Harrison (1982), Folsom and Lubar (1980) and Kaldor (1966).

compared with only 10 per cent for manufacturing, table 5.1). Services which made the greatest use of part-timers were the Accommodation, cafes and restaurants and Retail trade industries (46 and 42 per cent respectively). Although it is to be expected that these industries would make extensive use of part-time workers, it is also notable that around one-fifth of employees in the Finance and insurance industry and around one-quarter of those within the Property and business services industry are part-time.

Table 5.1 Australian full-time wages and employment mix by industry — 1994-95[a]

Sector/industry	*Percentage of employees working part-time*	*Share of full-time economy-wide employment*	*Full-time wage index*[b]
Mining	**2.6**	**1.5**	**152.3**
Manufacturing	**9.6**	**17.0**	**95.7**
Services	**27.6**	**81.5**	**100.0**
Electricity, gas and water	3.1	1.4	109.0
Construction	15.1	8.7	99.4
Wholesale trade	14.6	7.5	97.7
Retail trade	41.6	11.9	78.7
Accommodation, cafes and restaurants	45.6	3.6	80.8
Transport and storage	12.4	5.7	107.8
Communication services	12.3	2.3	106.7
Finance and insurance	18.8	4.4	109.9
Property and business services	24.4	10.2	106.6
Government admin and defence	11.4	5.6	103.3
Education	31.1	6.8	115.3
Health and community services	38.0	7.9	103.7
Cultural and recreational services	39.3	2.0	101.5
Personal and other services	28.0	3.6	101.2
Total	**24.8**	**100.0**	**100.0**

a Agricultural sector data are not directly comparable and have therefore been excluded from this analysis. **b** Data in this column represent the average full-time wage in 1994-95 for each industry expressed as a percentage of the Australian average full-time wage.

Sources: Estimates based on ABS Cats 6203.0 and 6302.0.

But to some extent these results reflect the changing employment preferences of people towards less onerous and more flexible working arrangements as incomes rise — and away from production-line work. For example, a survey of manufacturing employees in Britain indicated that production-line workers expressed the lowest level of job satisfaction of any occupation (quoted in Brown and Julius 1993). Further, many of these new jobs meet the employment needs of people on the fringes of the workforce, like students, women returning to part-time work after having children and the recently unemployed. The great diversity within the service sector provides opportunities for people who would find it

difficult to fit in with the more rigid production processes in manufacturing (BIE 1994a). Moreover, it would be a mistake to conclude that services create part-time jobs only. In 1994-95, more than four-fifths of all full-time non-agricultural employees worked within the service sector (table 5.1) — almost five times as many as the number of full-time manufacturing employees.

The charge that services jobs are typically low-wage or low-skill is also very much a quarter-truth. Although ABS full-time average weekly earnings data reveal that employees within the Retail trade and Accommodation, cafes and restaurants industries earned only around 80 per cent of the average weekly wage, these industries accounted for less than one-fifth of all full-time services employment in 1994-95. Bankers, accountants, brain surgeons, designers, teachers, research scientists, and most managers also work in services industries. Indeed, 12 of the 14 service industries recorded higher average weekly wages than did manufacturing in 1994-95 (table 5.1). The most highly paid were the Education, Finance and insurance and Electricity, gas and water industries, with wages 19, 14 and 13 per cent above manufacturing. Overall, earnings for full-time service employees were exactly equal to the national average for 1994-95, and more than 4 per cent higher than the average for full-time manufacturing employees (which came in at 95.7 per cent of the national average).

5.3 Trade and exports

A number of trade-related issues are sometimes used as arguments in support of a larger manufacturing sector in Australia. For example, some contend that the long-run decline in Australia's terms of trade (the price we receive for our exports divided by the price we pay for our imports), jeopardises continued growth in Australians' living standards. With manufacturing constituting the largest component of world trade, some commentators claim that it is the only sector capable of generating the export growth needed to pay for Australia's increasing import requirements (see, for example, BIS Shrapnel 1995, pp. 56-62).

Moreover, the existence of large deficits on Australia's trade in manufactures (and the consequent flow-on to the current account of the balance of payments) has led some commentators to question the wisdom of continuing to reduce barrier protection and the generally non-interventionist approach to industry policy (see for example BIS Shrapnel 1995 and Hart 1992).

While, the strong growth in Australia's manufactured exports in recent years is noted as encouraging, it is seen as being insufficient to overcome Australia's persistent current account deficit (CAD). Thus, some argue that Australia's manufacturing sector cannot achieve the necessary rate of export growth without

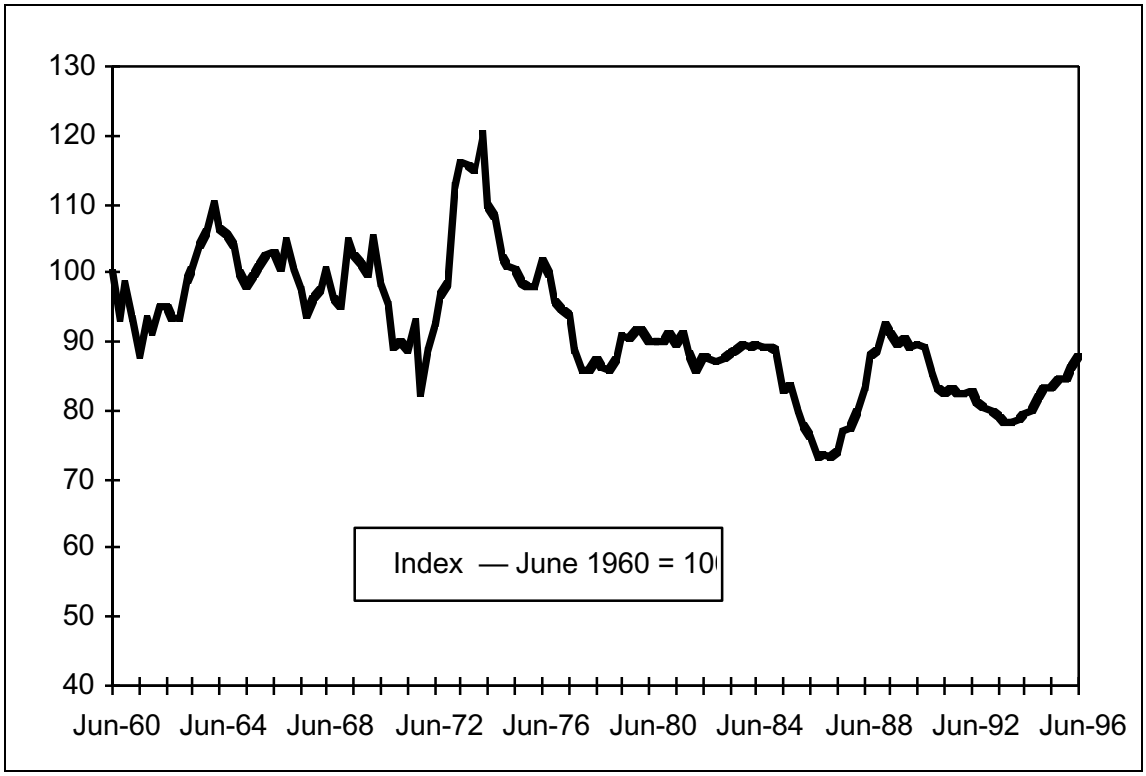
some form of direct assistance, in part to help level the global playing field (Stewart 1994). Some commentators propose 'managed' industry policy (BIS Shrapnel 1995) or 'rewarding winners' (Stewart 1994). Many attribute the rapid industrialisation of a number of dynamic Asian economies, to strategic trade interventions by their governments.

The arguments in favour of government efforts to selectively promote a range of Australian manufacturing industries draw on an interpretation of two key facts relating to Australia's trade position, namely that Australia's terms of trade have been in decline for the past few decades and that Australia's deficit on manufactured trade has been rising over the past decade. These two facts provide a useful starting point for a discussion of the issues raised above.

Terms of trade

It is certainly true that Australia's terms of trade have been falling — figure 5.1 reveals that Australia's terms of trade for goods and services have declined by a total of 12 per cent over the past three and a half decades (June 1960 to June 1996).

Figure 5.1 Australia's terms of trade (goods and services) — 1960 to 1996



Source: ABS Cat 5302.

But although Australia's terms of trade have been in gradual decline, this does not mean that the real incomes of Australians have also declined. In a recent report on the performance of Australian industry, the IC measured the impact of the terms of trade on Australian incomes. Using data for the period 1968-69 to 1993-94 the IC found that, although the gradual decline in the terms of trade has reduced the purchasing power of Australians (real incomes), this was more than offset by improvements in productivity. The study found that over the period 1968-69 to 1993-94 purchasing power grew at an average annual rate of 1.4 per cent. This was due to productivity improvements boosting purchasing power at an annual rate of 1.5 per cent, with the terms of trade reducing purchasing power by -0.1 per cent a year (IC 1995c, p. 37).

Deficit on manufactured trade

It is also the case that Australia's deficit on manufactured trade is rising due to faster increases in the value of manufactured imports relative to the value of exports. Before we examine this issue in detail the point needs to be made at the outset that there is nothing inherently wrong with imports — manufactured or otherwise. As we saw from our examination of input-output tables earlier, imports provide key inputs to every sector of the economy. Much of the machinery, plant and equipment used to boost the production and productivity of firms across Australia can only be obtained from specialist offshore suppliers — and this means imports.[3] Indeed, given the diversity of modern global manufacturing, it is inconceivable that all the different types of manufactured products domestic businesses and consumers demand could be efficiently produced in Australia.

Be that as it may, the fact remains that the total value of Australia's manufactured imports has been increasing steadily over the past decade, with imports of machinery and equipment contributing much of this growth (see chapter 4). Overall, between 1984-85 and 1994-95 the deficit on manufactured trade increased from $12.5 billion to $27 billion (figure 5.2).[4]

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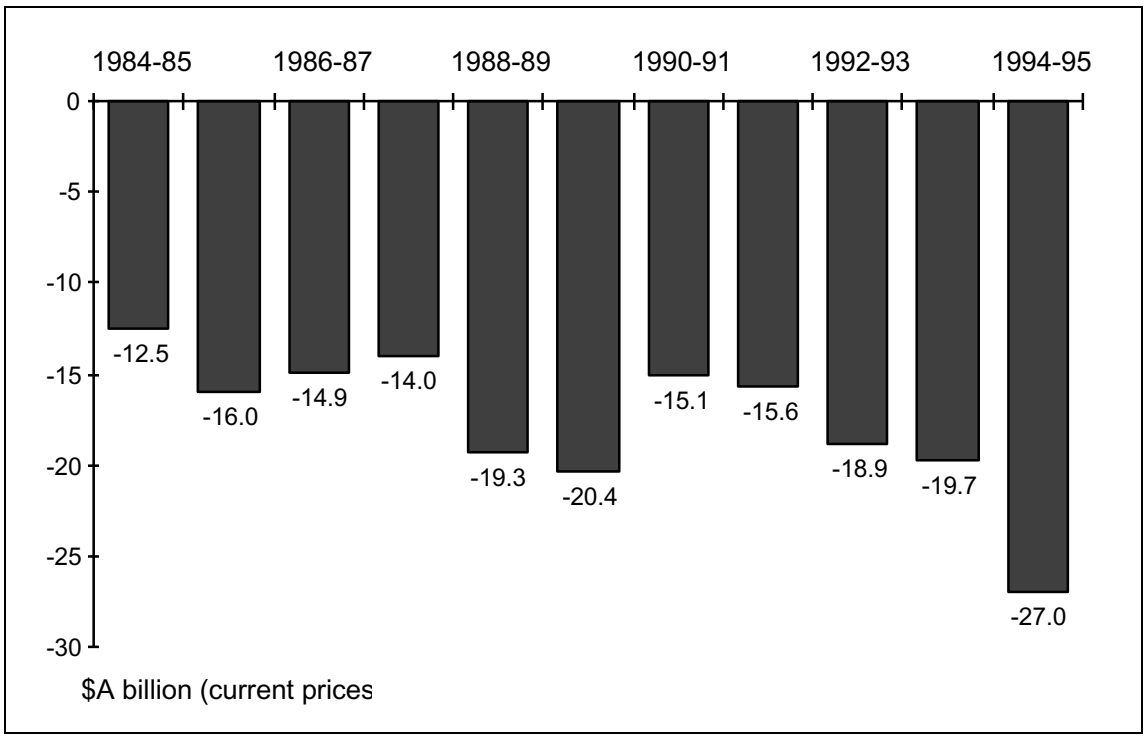
[3] We noted in chapter 2 that for every $100 of output, manufacturers required $13 worth of imports. In other words, you have got to import — to export.

[4] The discussion contained in this section of the paper does not specifically address the question of what impact a boost in manufacturing exports or a reduction in manufactured imports is likely to have on Australia's overall CAD — assuming policies which specifically targeted the manufacturing sector were actually successful in boosting manufactured exports or reducing imports of manufactures. According to a number of commentators it is by no means clear what the impact on the CAD would be. In essence, what these commentators have concluded is that efforts to boost exports from one sector of the economy (or reduce imports) with the aim of lowering Australia's overall CAD are fundamentally flawed as they do not take into account the opportunity costs of such initiatives nor the dynamics of

Figure 5.2 Australia's annual deficits on manufactured trade — 1984-85 to 1994-95



Source: Estimates based on unpublished ABS data.

However, these figures can give the misleading impression that imports of manufactures are growing at a faster rate than exports of manufactures. This is not the case. The growth rate for manufactured exports has outperformed that for imports over the past decade. The deficit continues to rise because of the significant difference in the starting magnitudes of the value of exports relative to imports.[5] For example, if total manufactured exports and imports continue to grow at their respective real trend rates of growth achieved over the past decade (9.0 per cent a year for total exports and 6.8 per cent a year for imports), the deficit on manufactures will continue to rise for a further decade, peaking at $33.5 billion (in today's prices) in 2006. Thereafter the deficit would fall. Consequently, the growth in the manufactured trade deficit does not present a complete picture of the performance of manufactured exports. [6]

Australia's trade position in the context of floating exchange rates (for a discussion of these issues see Forsyth 1990 and IC 1995b).

5 This line of analysis is drawn from Sheehan, Pappas and Cheng (1994, p.19) which presented an illustrative example based on projections of the ETM trade deficit.

6 Another reason that changes in the deficit can be misleading when examined on their own, is because the data take no account of growth in the domestic economy. Deflating the data to take account of changes in prices does not solve this problem as deficits measured in constant prices are meaningless. The way this problem can be overcome it to measure the

Moreover, it would make no sense for Australia to aim for balanced trade in each sector (or indeed each industry) of the economy. This would imply massive reductions in the output of our agricultural and mineral sectors, both of which run large trade surpluses.[7] It would effectively undermine the very basis of international trade — the gains realised when countries specialise in activities where they have a comparative and competitive advantage. Moreover, the use of higher import barriers, as proposed by some advocates of balanced trade, ignores the impact protection has on exports. Extensive research has revealed that protection adds to the costs of exporters, both directly and indirectly (see, for example, Cordon 1978).

Notions that manufacturing is the only sector capable of generating significant export growth are based on limited perceptions of the nature of global trade. While it is true that manufacturing is the largest segment of world trade, it is also the case that services are the fastest growing area of world trade. Australia's service export growth in the decade to 1993-94 was more rapid than the global average (IC 1995b, p. 191).[8] The IMF (1995) estimated that trade in services accounted for one-quarter of total trade among industrial countries in 1994. The strong growth has come about despite significant impediments to trade in services (Brown and Julius 1993, p. 13).

The importance of services trade was acknowledged with the signing of the General Agreement on Trade in Services (GATS) in 1994, which brought services trade under the coverage of GATT trading rules for the first time. This was the first multilateral and legally enforceable agreement covering trade and investment in the service sector. It provides the prospect of lower barriers to trade in services and higher growth rates. The key outcome of the GATS is that member countries will not be able to discriminate between service exports from other member countries. With an estimated coverage of around $A2 000 billion per year, the GATS is expected to ultimately provide Australian service exporters

deficit as a percentage of GDP each year. Using this method the growth in the manufactured trade deficit is not nearly as strong.

7 Even within manufacturing there is considerable variation in the trade position of the various industries. A number of industries run large surpluses, such as the Food, beverages and tobacco and Metal products industries. There are also industries which run large deficits, such as the Machinery and equipment and Petroleum, coal, chemical and associated products industries.

8 Nonetheless, Australian exports of services are currently only about 5 per cent of total domestic service production with Travel being the country's largest contributor (IC 1995b). For a discussion of some of the issues related to trade in services see LEK Partnership (1994) and BIE (1994a, pp. 81-85).

with significant export and investment opportunities in the telecommunications, banking, insurance, professional and business service sectors. [9]

Furthermore, there is no guarantee that a larger manufacturing sector would actually generate more exports. The link between the importance of a sector as measured by its contribution to the domestic economy in terms of the usual measures — such as employment and output — and its contribution to exports, is not strong. For example, mining and agriculture combined only accounted for 8 per cent and 6 per cent respectively of Australia's GDP and employment in 1994-95 — a small fraction of their contribution to Australia's total exports (see table 4.1 in chapter 4).

Finally, the use of strong-growth East Asian economies as evidence of the feasibility of attempting strategic government interventions for Australia has been questioned on a number of grounds. Recent work suggests that the East Asian growth superiority can be explained primarily by faster growth in labour and capital inputs, while higher rates of TFP growth are primarily due to 'catch-up' or convergence (see Krugman 1994 and Dowrick 1995). A summary of the recent work on these issues (MTIA 1995) noted that the majority of the high growth rates of the Asian Tigers resulted from rapid accumulation of factor inputs, leaving only a relatively small proportion of growth unexplained by these factors.[10]

The IC (1990) noted that the success of the Hong Kong, Japan, Korea, Singapore and Taiwan economies could not be explained in terms of government targeting of key sectors — such targeting was not present at all in the success of Hong Kong, and where targeting was present there were also notable failures. In Japan and Korea, targeted and non-targeted industries both recorded outstanding output growth. The IC found a number of additional factors had contributed to strong growth in the Asian economies examined including: high savings and investment rates; a plentiful and flexible labour supply; a general resistance by government to the claims of special interest groups; and a strong social consensus in favour of growth.

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[9] Despite the potential for growth in global markets for services and for manufactures we should not overlook the growth prospects for Australia's traditional commodity exports. Despite the fact that the share of world trade accounted for by primary products is small in comparison with manufacturing and services, it is still a huge market. Moreover, it is a market in which Australian producers have proven themselves to be highly competitive with good prospects for further growth (see, for example, ABARE 1996, pp. 56-62).

[10] According to Dowrick (1995, p. 19), 'the estimated unique component of East-Asian miracle growth is less than one percentage point of annual growth'.

5.4 Productivity growth

The belief that a larger manufacturing sector would support a higher productivity outcome for the nation as a whole is based on the view that manufacturing generally exhibits faster rates of productivity growth than do other parts of the economy. Consequently, if manufacturing accounted for a larger share of the economy, some contend that Australians would experience higher living standards.

In examining this notion two main questions arise. First, is the productivity performance of the manufacturing sector superior to that of other sectors/industries? Second, does superior productivity performance by an industry/sector justify government intervention to boost activity levels beyond what they would otherwise be?

Information on comparative productivity growth rates and levels for Australia's manufacturing sector relative to other sectors/industries is presented in appendix C. Overall, the results suggest that the manufacturing sector and most industries within it have not exhibited a particularly outstanding productivity performance. The manufacturing sector has, however exhibited above average productivity growth over the past twenty years and also recorded above average productivity levels. Moreover, there are sizeable variations in productivity growth rates at an industry level within sectors.

In examining the second question, it is certainly the case that the ability of the Australian economy to generate wealth in support of higher living standards is affected by the productivity performance or technical efficiency of its industries/sectors. However, allocative efficiency within and between industries/sectors is also important.

Lets have a quick look at these two concepts of efficiency. In the process we will discover why the notion of seeking to boost the size of an industry/sector simply because it is highly productive (ie. technically efficient) is misplaced.

From a firm's perspective, technical efficiency is clearly important for a number of reasons. For example, the capacity of firms/industries to compete for resources, retain or improve their share in product markets and generate a return on their activities are critically influenced by their cost competitiveness and the effectiveness with which they improve their production processes and products over time (see appendix A).

From the community viewpoint, technical efficiency plays an important role in shaping living standards. It does this by affecting the overall quantity of goods and services produced from the community's productive resources and the

effectiveness with which consumer demands for goods and services are satisfied. However, merely because a firm (or industry or sector) displays technical efficiency (or has the potential to perform well in this area) does not necessarily mean that it is efficient to use or expand resources in that firm (or industry or sector) from the community's perspective. Why?

Seeking an answer to this question leads us to the concept of allocative efficiency. Allocative efficiency refers to the extent to which the allocation of resources in producing and consuming different goods and services reflect their value in use. The resource requirements of different activities and the success with which firms/industries can ultimately compete for these resources is also dependent on the strength of consumer demand for different products/services. The demand patterns of consumers interact with the supply conditions of different industries to determine the prices of products/services. Variations in these prices signal different values in use for different products/services. An efficient allocative outcome occurs where resources are matched to their highest value uses.

Drawing these concepts of efficiency together, it is apparent that there is not a one to one correspondence between the technical efficiency of an industry and the value attaching to the products/services which it produces. If there was, then the economy would only comprise firms and industries with relatively high levels of technical efficiency and correspondingly, consumers would have access to a much narrower range of locally produced products/services. Production of some products/services by firms/industries with relatively low levels of technical efficiency is both feasible and appropriate (particularly when it is not economic to import) because users are prepared to attach a value to them which makes their production profitable.

As the earlier discussion of structural change and industry performance in chapter 3 demonstrated, supply and demand factors combine to shape trends in industry/sector shares of output and employment over time. The relative decline of manufacturing over time (in the sense of experiencing a declining share of the economy's output and employment) reflects the joint impact of, amongst other things, slower growth in demand for its products on average than that of other parts of the economy combined with a capacity to improve its productive efficiency. Similar factors have contributed to the relative decline of the agricultural sector.

The experiences of both these sectors point to what has been termed a 'productivity paradox'. This occurs where productivity improvements in certain industries/sectors free up resources to service demand growth in other industries/sectors producing products which are in greater demand (ie. thereby

signalling higher value uses). Hence, intervention by governments to arrest or reverse these resource flows would reduce rather than augment the real wealth of the community by forcing resources to remain in or relocate to lower value uses.

In summary, the granting of preferential treatment to particular industries/sectors simply because they have relatively high levels of productivity and/or productivity growth rates ignores the importance of allocative efficiency in shaping community welfare. In this context, the appropriate focus for government will, in general, be to address market and/or institutional weaknesses in incentive systems affecting the technical and/or allocative efficiency of the economy. Experience has shown that the appropriate policy responses are likely to involve reforms to regulatory structures and institutional arrangements which impede opportunities for improving productivity and/or give rise to inappropriate price signals to producers and consumers alike. Initiatives focussing on particular industries/sectors will only be appropriate where market and/or institutional failures are specific to particular industries/sectors. [11]

5.5 R&D intensity

The notion that a larger manufacturing sector would benefit Australians by boosting the long-term growth rate of the economy is partially based on two ideas — that manufacturing is R&D-intensive, and that R&D underpins growth in modern economies. Before we examine what the ABS data reveal about the sectoral distribution of R&D, we discuss briefly the linkages between growth and R&D.

R&D and long-term growth

The slowdown in growth in most developed countries over the past two decades has led to a renewed focus by economists on the determinants of economic growth — resulting in the evolution of a set of 'new growth theories'. A major contribution of these new theories has been their attempts to formalise the links between advances in knowledge (or technological progress) and long-run growth. One of the factors identified by these theories as an important determinant of technological progress, and hence productivity and long-run growth, is R&D. Research activities lead to new knowledge which can raise the productivity of

[11] For a discussion of areas of the Australian economy where microeconomic reforms have the potential to yield productivity and pricing (allocative) improvements see Productivity Commission (1996).

people and organisations across the economy — benefits which extend beyond those who conduct the R&D (BIE 1993). [12]

But R&D is not the only determinant of long-run growth identified by these theories. The quantity and quality of resources devoted to education and training is widely recognised as just as important to growth, both through its capacity to directly raise the productivity of workers and to allow industries to invest in new technology. Another factor recognised as fundamental to growth is investment in machinery, plant and equipment, as well as infrastructure investment more generally. Investment in capital that embodies new technologies, it is argued, stimulates growth through spillovers in knowledge from the new technology (BIE 1993).

In summary, R&D is one of a number of key activities identified by new growth theories as important to economic growth. Although these new theories have provided a reminder of the importance of these factors in establishing the preconditions for growth, they are not as yet sufficiently refined or empirically supported to provide specific policy guidance for government action. For example, the theories do not provide firm conclusions about where education and training spending should be focussed, or whether R&D spending should be aimed at 'pure' or more applied research (IC 1993a). That said, R&D is clearly important for growth. Hence, the following subsection examines the sectoral distribution of Australia's business R&D expenditure.

Sectoral distribution of R&D

Table 5.2 presents a breakdown of the ABS data on R&D spending by business enterprises for 1994-95 that were presented in chapter 2. These confirm that the manufacturing sector is R&D-intensive (by Australian standards), accounting for 57 per cent of Australia's total business R&D expenditure. This share of R&D expenditure is almost four times greater than its share of value-added produced in the same year (final column of table 5.2).

The data also reveal that the mining sector spends relatively heavily on R&D — $242 million or 7.1 per cent of the total compared with a value-added share of around 4 per cent. By contrast, service sector expenditure on R&D is relatively low, with the exception of the Property and business services and Scientific research industries, which combined accounted for around one-fifth of business R&D spending (table 5.2). But, these data probably understate the innovativeness

[12] The public-good characteristics of knowledge and R&D and the existence of spillovers and positive externalities were widely accepted by economists well before the advent of 'new growth theories' (BIE 1992).

of some services, due to the definition applied to R&D. [13] This definition excludes some expenditures by services firms on 'human' R&D through worker training.

Table 5.2 Business R&D in Australia by sector — 1994-95[a]

	Total expenditure *($m)*	*Share of total* *(%)*	*Value-added share*[b] *(%)*
Mining	**241.6**	**7.1**	**4.4**
Food, beverage and tobacco	141.6	4.2	3.1
Textile, clothing, footwear and leather	26.9	0.8	0.6
Wood and paper products	76.5	2.3	0.8
Printing, publishing and recorded media	15.1	0.4	1.3
Petroleum, coal, chemical and associated products	309.8	9.2	1.6
Non-metallic mineral products	45.3	1.3	0.7
Metal product manufacturing	309.5	9.1	2.5
Machinery and equipment	985.6	29.1	3.4
Motor vehicles, parts and other transport equip	*338.1*	*10.0*	*1.3*
Photographic and scientific equipment	*123.0*	*3.6*	*0.2*
Electronic/electrical equipment and appliances	*451.0*	*13.3*	*1.2*
Industrial machinery and equipment	*73.5*	*2.2*	*0.7*
Other manufacturing	18.3	0.5	0.7
Total manufacturing	**1 928.6**	**57.0**	**14.8**
Wholesale and retail trade	196.4	5.8	17.3
Finance and insurance	103.4	3.1	4.1
Property and business services	545.9	16.1	8.3
Scientific research	114.1	3.4	na
Other nec[c]	253.0	7.5	38.5
Services	**1 212.8**	**35.8**	**68.2**[d]
Total	**3 383.1**	**100.0**	**87.4**[e]

a Agricultural sector data are not directly comparable and have therefore been excluded from this analysis. **b** From ABS National Accounts (5206.0). Value-added shares for Motor vehicles, parts and other transport equipment, Photographic and scientific equipment, Electronic and electrical equipment and appliances and Industrial machinery and equipment industries are estimated using shares from ABS Manufacturing census (Cat. No. 8221.0). **c** ANZSIC divisions Electricity, gas and water, Construction, Accommodation, cafes and restaurants, Transport and storage, Communication, Government administration and defence, Education, Health and community services, Cultural and recreational services and Personal and other services. **d** This figure is somewhat misleading as it includes all service activities, including a range of government activities — whereas the R&D data, by definition, do not include government R&D spending. **e** Data do not sum to 100 due to the omission of agriculture, ownership of dwellings and import duties less imputed bank service charges.

Sources: ABS Cat. No. 8104.0, 5206.0 and 8221.0.

[13] The ABS applies the OECD definition of R&D, namely: '... creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications' (ABS 1995e). For a discussion of some of the issues associated with the measurement of services R&D spending (in the US context) see Alic (1994).

Moreover, although manufacturers as a group conduct a high proportion of Australia's business R&D, within manufacturing there is considerable diversity. Indeed, more than half of the manufacturing sector's R&D is carried out by firms within only one of the nine ANZSIC manufacturing industries — the Machinery and equipment industry (table 5.2).

In addition to being concentrated in a relatively few industries, manufacturing R&D is also concentrated amongst a relatively small number of firms within these industries. For example, the BIE (1993) observed that the number of R&D performing firms which claimed the R&D tax concession (1200) pales into insignificance relative to the almost 50 000 manufacturing firms in Australia. [14] These results suggest that a policy aimed at boosting Australia's R&D spending by granting preferences to the manufacturing sector as a whole, would be an indirect and inefficient way of increasing total R&D.

But as noted earlier, the existence of positive spillovers from R&D means that in the absence of government intervention there may be a lower level of investment in R&D in Australia than is socially optimal. This is because information — the output of R&D — possesses special qualities (it is both non-excludable and non-rivalrous). Consequently, producers of information have difficulty appropriating all the benefits which stem from research. In these circumstances, government action to correct this 'market failure' may be warranted.

However, government policies which address market failures directly are generally more transparent, easier to administer and less likely to result in negative side-effects on other parts of the economy than more indirect approaches. This is why government activity is normally directed at promoting the desirable activity — R&D — irrespective of the industry (or the sector) in which it is undertaken. [15]

5.6 Value-added

The manufacturing/value-added argument is based on the notion that high value-added activities in an economy are more important than low value-added activities because of their capacity to sustain a higher standard of living. Drawing on this, it is sometimes contended that since manufacturing is likely to have a

[14] For an international perspective see Alic (1994), who notes that most of the 350 000 manufacturing firms in the US conduct no R&D at all.

[15] Like most other countries, the Australian government provides a mix of measures in support of R&D activity — from intellectual property protection via patents and direct funding of research in the public and higher education sectors (CSIRO and the universities) to a variety of grant and tax concession measures for business R&D (IC 1995d).

larger proportion of high value-added activities than other parts of the economy, then overall incomes could be boosted if the manufacturing sector were larger. Before we examine the logic of this argument, we first look at whether the claim that manufacturing is 'high value-added' is backed up by the data.

Value-added consists of wages earned by labour, rent for land and returns to capital and other payments to value-adding factors of production. In other words, value-added provides a measure of the contribution of an activity to national wealth — with GDP representing the sum of total value-added in an economy. So, from one perspective, a high value-added sector is one that accounts for a large share of Australia's total value-added (or GDP).

But value-added can also be viewed as essentially the difference between the turnover of an establishment and the purchases of intermediate inputs of various kinds (after taking into account changes in stocks). The concept of a sector being 'high value-added' is usually related to this second definition. That is, the ratio of value-added to turnover (or sales) is relatively high. Although ABS data for these indicators are available for the manufacturing sector they are not available on a consistent basis for the economy overall. Nevertheless, comprehensive and consistent industry gross product (IGP) and sales data are regularly published in ABS (1996d). As IGP is conceptually similar to value-added (see notes to table 5.3) IGP/sales ratios are presented in table 5.3.

Overall, IGP represented 28.6 per cent of total sales for the Australian economy in 1994-95, with a slight variation between large and small/medium sized businesses (table 5.3). The ratio for the manufacturing sector, at 30.4 per cent, was somewhat higher than both the national average and the average for the service sector (26.3 per cent), but below the ratios calculated for the agricultural and mining sectors.

As published data are only available at the ANZSIC division level, detail of the variation within manufacturing are not available from this source. However, data from other sources indicate that the Printing, publishing and recorded media, Other manufacturing and Machinery and equipment industries recorded the highest value-added to sales ratios (ABS 1996e). Conversely, the manufacturing industries with the lowest ratios were Petroleum, coal, chemical and associated products and Non-metallic mineral product manufacturing.

There was also considerable diversity within the various divisions of the service sector. The lowest IGP/sales ratios were registered by the Wholesale and Retail trade divisions — with ratios around half the national average. The service divisions with the highest ratios were Private community services, Communication services, Property and business services and Electricity, gas and

water supply (with IGP/sales ratios of between 45 and 74 per cent, table 5.3). Overall of the eleven ANZSIC service divisions for which data were available, seven registered higher IGP/sales ratios than the manufacturing division.

Table 5.3 Industry gross product to sales ratios for Australian industry — 1994-95[a]

ANZSIC division	*Small and medium businesses*	*Large businesses*	*All businesses*
Agriculture	**na**	**na**	**34.9**
Mining	**45.3**	**53.0**	**51.4**
Manufacturing	**31.1**	**30.1**	**30.4**
Services[b]	**26.0**	**27.8**	**26.3**
Electricity, gas and water supply	52.8	44.1	45.5
Construction	26.8	17.9	24.7
Wholesale trade	14.2	12.5	13.6
Retail trade	16.0	15.8	15.9
Accommodation, cafes and restaurants	37.4	44.1	38.8
Transport and storage	37.8	44.8	42.1
Communication services	41.6	65.2	64.0
Property and business services	50.7	48.1	50.0
Private community services	71.1	82.6	74.4
Cultural and recreational services	33.3	24.1	27.5
Personal and other services	40.7	47.2	42.2
Total all industries	**27.1**	**30.2**	**28.6**

a These ratios were estimated by dividing the industry gross product by the total sales of goods and services data published in the ABS *Business Operations and Industry Performance* survey for 1994-95. Industry gross product is defined as, 'a measure of the unduplicated gross product of a business defined as gross output minus intermediate inputs'. Although not identical to value-added, the measure of industry gross product provides a close proxy, with the key difference between the two concepts being that insurance premiums (other than workers' compensation premiums) are deducted in calculating value-added, whereas no such adjustment is made in calculating industry gross product. For a further discussion of the relationship between IGP and the national accounts see ABS Cat. No. 8140.0. **b** Although as noted in chapter 2, 'services' is not an official category of the ANZSIC, it has been included here for purposes of comparison with the goods sectors of the economy. In this table it represents an aggregation of all the ANZSIC divisions except the agriculture, mining, manufacturing and government administration and defence divisions. **na** Not available.

Source: ABS Cat 8140.0.

Although, these data do not suggest that manufacturing is particularly 'high value-added', it should be noted that the measures above will result generally in lower values for downstream industries than will be the case for industries involved in processing raw materials. Hence, the ratios contain an implicit bias towards industries such as agriculture and mining.[16] But even if the

[16] This is because of the impact that cumulative value-adding (to the inputs of latter stage production activities) has on the ratios calculated for downstream processing industries. To

manufacturing sector had recorded a value-added to sales ratio as high as mining or agriculture, this would not necessarily mean that Australians would be better off if manufacturing accounted for a larger share of GDP. This is because the extent to which value-adding takes place in firms across the economy is driven largely by firms' perceptions of the returns to each value-adding stage relative to its costs. These factors determine the relative profitability of each activity and hence govern the point beyond which it is not commercially attractive to add value.

In its report titled *Adding further value to Australia's forest products,* the IC (1993b) noted that attempts by governments to coerce forest products suppliers into producing higher value products could be counter-productive. The report argued that higher value-added does not necessarily equate with greater efficiency or higher profitability — that it is quite conceivable that initiatives to promote production of higher value products will erode profitability and the economies capacity for future new investment. [17] The same logic holds with respect to adding value within any sector or industry. For example, in the context of mining, the IC (1991, p. 108) concluded:

> Thus, because gross domestic product (equal to national income) is merely the sum of value added in each Australian industry, calls to add further value to our mineral resources represent no more than an unfulfilled desire to be richer than we are, unless we are prepared to ensure that, in the process of adding value to our natural resources, we do not price the resulting products out of the market.

The foregoing discussion suggests that instead of focussing on value-adding per se, a more appropriate role for government is to focus on removing or lessening factors which impede local manufacturers' capacity to produce higher value-added goods. These impediments can include trade barriers, unnecessarily restrictive regulatory practices as well as a range of factors which increase processing costs, such as inefficient power, transportation and communication services.

take an extreme example, the inputs to the bauxite mining industry are a smaller proportion of the value-added than is the case for a manufacturing industry such as alumina production — which requires the input of bauxite (the output of the mining industry) on top of other inputs like energy, transportation etc.

[17] For a simple numerical demonstration of this point see IC (1993b, pp. 217-18).

5.7 Mainspring of economic activity?

Related to the previous point — but from a different perspective is the notion that a country's manufacturing sector is the mainspring that drives the rest of the economy. This line of thinking does not draw specifically on technical or statistical definitions such as the relationship between an industry's value-added and sales discussed earlier. Instead, it is based on something more fundamental — the importance of material goods, specifically manufactures, to all economic activity.

Nevertheless, it is clear from ABS input-output tables that the linkages between sectors work in many directions (refer to chapter 2 of this paper). Manufacturers — along with the rest of the economy — could not exist without a range of key infrastructure services like power, water, construction, transportation and communication. Moreover, the activities of services industries like transport, retailing and wholesaling should not be seen as inferior relative to those of the goods sectors. Assisting the flow of goods between producers and consumers by providing transportation, storage and information on markets and prices lowers transaction costs and therefore raises the distributional efficiency of the economy. Moreover, as observed by the OECD (1992, p. 110):

> Misconceptions about the service sector abound. It is still widely considered to be dominated by fast-food restaurants and barber shops when in reality in countries like the US the fastest growing segments of the economy are sophisticated transactional services like communications, business services, finance and insurance. Taken together, these transactional services alone account for more value-added than all of manufacturing in the US: 24 per cent in 1985.

In the case of R&D (discussed earlier), although a large percentage of business R&D is conducted by manufacturers, much of it is services-driven. The growing interdependence of advanced economies means that services such as the communication industry create the markets for products like cellular phones and fax machines, the transport industry drives aerospace development and much of the research of pharmaceutical companies is also shaped by the health industry (Brown and Julius 1993). Hence:

> ... large corporations are contracting out important activities such as marketing and computing to the service sector, and are buying high-technology intermediate inputs such as just-in-time distribution systems and computer-aided design (hence the rapid growth of business services). The growth of services is a natural and necessary concomitant to increased economic specialisation and sophistication. Thus during the coming decades breakthroughs in productivity and wealth creation are equally likely to spring from the service sector (Brown and Julius 1993, p. 14).

Consequently, the notion that one sector is the only truly 'productive' part of the economy is not a particularly helpful one. [18] Indeed, all sectors of the economy could put forward claims of similar validity. For example, without the security of property rights provided by law, or a healthy and educated workforce resulting from medical and education services, any economic activity would be significantly curtailed. Clearly, any developed economy is made up of a complex mix of industries which all meet different — but nonetheless important — requirements.

5.8 Concluding comments

The foregoing discussion is not designed to down-play the importance of manufacturing, or the role of exports, to the economic welfare of all Australians. Indeed, earlier chapters of this paper have confirmed the significant role played by manufacturers in the increasingly interconnected Australian economy. Moreover, improvements in the productivity and performance of Australia's export and import-replacement activities are an important aspect of the wealth generation process. Growth in exports raises national income and allows us to sustain higher levels of imports which support continued rises in our living standards.

However, a focus of this paper has been to highlight the importance of *all* of Australia's industries. With this in mind, the notion that manufacturing ought to account for some specific share of total GDP, employment or exports is not particularly helpful. Given the dynamic nature of Australian and global economic activity, government policies directed at advancing the manufacturing sector or firms/industries within the sector simply because they are manufacturing entities are unlikely to be compatible with government objectives to improve efficiency and increase community welfare. Past experience demonstrates that such policies are unlikely to enhance Australians' living standards due to the negative impact they can have on the rest of the economy. Indeed, as recognised in the 1994 *Working Nation* statement (Keating 1994, p. 56):

> Australian and international experience makes it clear that protectionism, resistance to structural change and avoidance of competition are inimical to growth ... An open economy leaves no room for subsidies that prop up uncompetitive firms, nor for detailed prescriptions for industry where government directs the flow of resources.

[18] For example, in Adam Smith's time there existed an influential school of thought (the 'Physiocrats') which argued that agriculture was the only truly 'productive' sector of the economy.

Ultimately, a vibrant manufacturing sector is more likely to emerge in an environment where firms are encouraged to adapt to changes in their operating environment. This does not, however, preclude a real role for government. But manufacturers, other businesses and the community at large, are likely to derive greater benefits from government initiatives which effectively address market and institutional impediments to the wealth creation process.

Appendix A Industry and firm profiles

This appendix presents short profiles of each of the nine ANZSIC manufacturing industries. Each industry profile contains a brief summary of the major activities undertaken by firms within the industry, an examination of some of the key characteristics of the industry, and a profile of a prominent firm operating in the industry.

The individual firm profiles were included to provide concrete examples of the diverse range of manufacturing activities undertaken in Australia and to help illustrate the impact of structural changes on particular firms. The information contained in each firm profile was obtained through discussions with individuals within each firm in July and August 1996. As will become apparent, the industries examined contain a diverse range of manufacturing processes. Consequently, the activities of individual firms presented below should not be taken as representative of all the activities of the industry in which they operate.

With the exception of the effective rate of assistance (ERA), the key industry characteristics charted in each section are relatively straightforward. The ERA estimates the *net* impact of government assistance — taking into account the effects of such assistance on the prices of an industry's inputs as well as its outputs. It provides an estimate of the extent to which the value-added produced by an industry is affected by the existence of assistance.

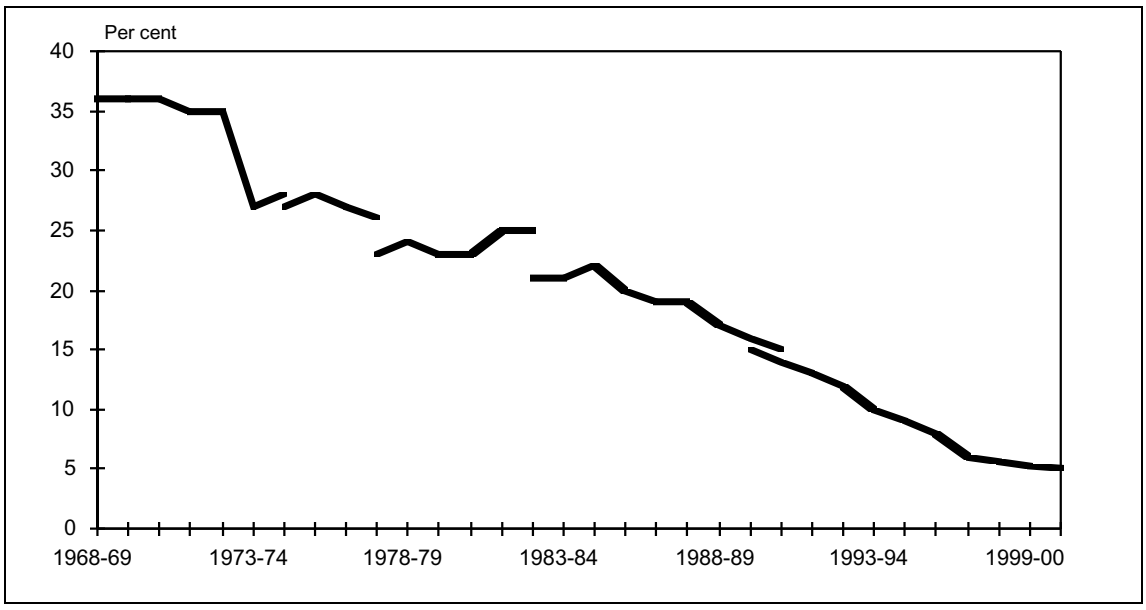
The average ERA for manufacturing has dropped from over 35 per cent in 1968-69 to around 8 per cent in 1995-96, with levels expected to drop to 5 per cent by 2000-01 (figure A1). However, not all manufacturing industries have had their protection levels earmarked to be 5 per cent by the year 2000-01. The Textiles, clothing, footwear and leather manufacturing industry and the Passenger motor vehicles industry will continue to operate under a higher level of assistance than the manufacturing average.

The production share measure refers to the percentage of total manufacturing value-added (measured in constant 1989-90 prices) contributed by each manufacturing industry. The level of import penetration is simply the percentage of total sales in the domestic market accounted for by imports. Likewise, export propensity is the ratio of exports to total sales by an industry.

Finally, labour intensity refers to the ratio of wages, salaries and supplements to value-added. The higher the ratio the more labour-intensive the industry. Of

course this measure may also reflect high wage payments in an industry (due to a higher proportion of skilled workers) relative to other manufacturing industries.

Figure A1 Average effective rates of assistance for Australian manufacturing — 1968-69 to 2000-01[a]



a Series discontinuity is due to periodic revisions to the fixed production bases to reflect changes in the internal structure of the manufacturing sector over time.

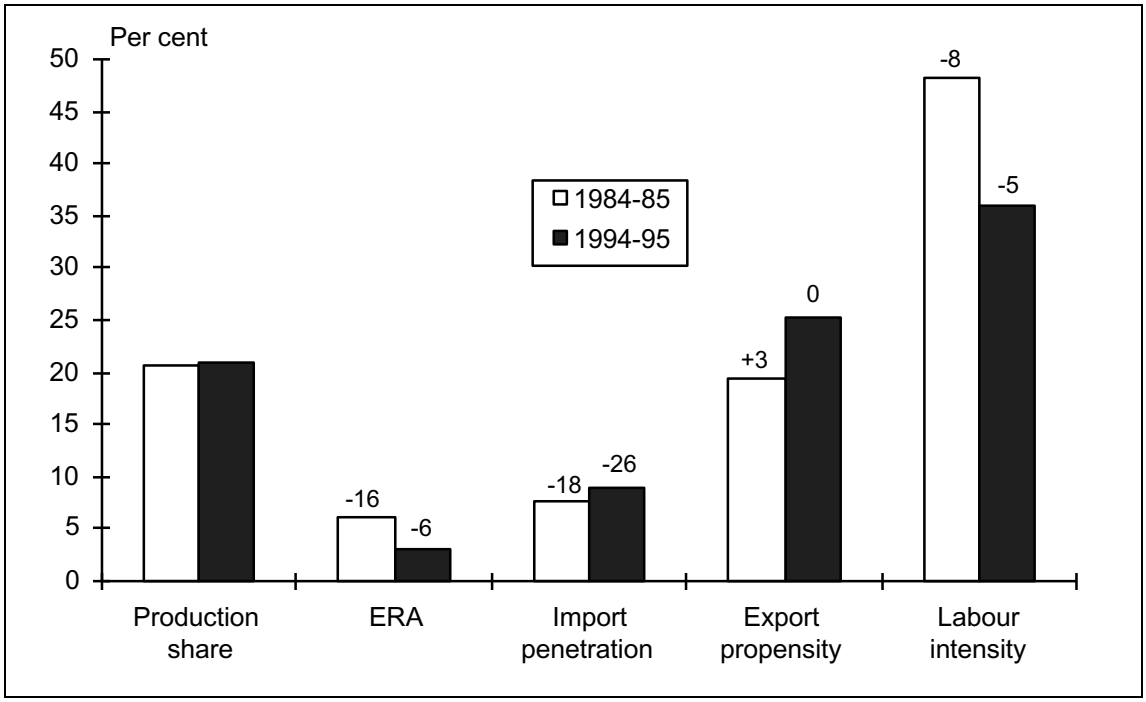
Source: IC annual reports (various issues).

A.1 Food, beverage and tobacco manufacturing

When international comparisons are made between Australia's manufacturing sector and manufacturing in other developed countries the most noticeable difference is the size of Australia's Food, beverage and tobacco industry. In 1990 this industry accounted for around 50 per cent more of total manufacturing output in Australia than for the G7 countries (United States, Japan, Germany, France, Italy, United Kingdom and Canada — BIE 1995b pp. 81-82). It is Australia's second largest manufacturing industry, accounting for about one-fifth of all production from the sector in 1994-95 (figure A2). This clearly reflects Australia's relatively large and highly efficient agricultural sector. Activities undertaken by firms within the Food, beverage and tobacco industry include the processing (including slaughtering), freezing and canning of meat and poultry products, grading and filtering of milk and cream and processing of other dairy products (including cheese and milk powder), beer and wine making, sugar refining, flour milling and cigarette manufacture.

The industry operates with very low effective rates of assistance and experiences low import penetration relative to manufacturing as a whole. Partly because of its large size, the Food, beverage and tobacco industry contributed about one-fifth of manufacturing export growth in the decade to 1994-95. Nonetheless, the industry currently has an export propensity the same as the manufacturing average although it exported a greater percentage of its sales than the manufacturing average a decade ago.

Figure A2 Selected characteristics of the Food, beverage and tobacco manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

As Australia's premier dairy products producer, Bonlac Foods provides an example of the changes experienced by the food industry in recent years.

Bonlac Foods Ltd

Bonlac Foods, based in Victoria, is equal largest of Australia's dairy manufacturers. It accounts for around a quarter of Australia's milk production. As well as its 'upstream' production of bulk dairy products, Bonlac Foods is brand leader in the Australian retail market for butter, natural cheddar, mozzarella, hard grating and ricotta cheeses and number two in the processed cheese and dairy blend markets.

Although formed in 1986 from the amalgamation of three dairy co-operatives and a dairy marketing company, Bonlac Foods has a heritage going back more than a century. Over this time the local and regional cooperatives which grew into Bonlac Foods have always had a major export focus. It and its predecessor companies have been active in markets in South East and North Asia for almost fifty years.

In 1995-96 Bonlac Foods received some 2 billion litres of milk from its 3116 dairy farming suppliers. This milk was converted into dairy products and sold on local and export markets, giving the company a turnover of $1.06 billion for the year.

There have been a number of changes in Bonlac's manufacturing process in recent years. Between 1994 and 1997 it expects to invest $250 million in improvements to its operational infrastructure and technology. A central element in this redevelopment is the leading edge milk powder plant being built at Darnum Park. This $150 million plant will be one of the most advanced in the world, in terms of both processing technology and environmental impact. The plant is virtually self sufficient in water usage – purifying and re-using the water evaporated from the milk. The water will also be supplied to neighbouring farms for use by stock. Effluent is contained and treated on site and then used to irrigate crops and pastures. Noise and airborne emissions are also being minimised.

Darnum Park is also the subject of a path breaking enterprise agreement developed with the National Union of Workers. This agreement provides for a single classification covering all production and associated activities and a single annualised rate of pay covering all time worked.

The company, along with the dairy industry, generally has seen industry marketing and assistance arrangements change significantly over the last decade or so. Until 1986 the industry operated with regulated prices for major dairy products sold on the domestic market and pooling of returns between the domestic and export markets. Under the 'Kerin plan' pooling was abolished and replaced with market support payments which were phased down over time. These payments had the effect of raising prices on the domestic market. In 1992 this scheme was broadly continued but with further phasing down under the 'Crean plan'. In 1995-96 the scheme was replaced with one more consistent with Australia's obligations under the GATT Uruguay Round outcome. This scheme requires all dairy product manufacturers to pay a levy on milk fat and protein. The levy funds are paid to dairy farmers in proportion to their production of manufacturing milk.

Currently exports represent about 45 per cent of Bonlac's sales – amounting to around $450 million a year. These exports consist of skim milk powder, whole milk powder and cheese, going to countries in South East Asia, North East Asia, the Middle East and South America.

Bonlac Foods' biggest challenge for the future is to remain internationally, as well as domestically competitive. Imports from New Zealand have increased as a share of Australian sales over the past decade. Furthermore, European and American producers are heavily subsidised which means Bonlac Foods has to continually improve its efficiency to compete. However, the company believes that over the longer term the GATT Uruguay Round agreement will help in this regard.

A.2 Textile, clothing, footwear and leather manufacturing

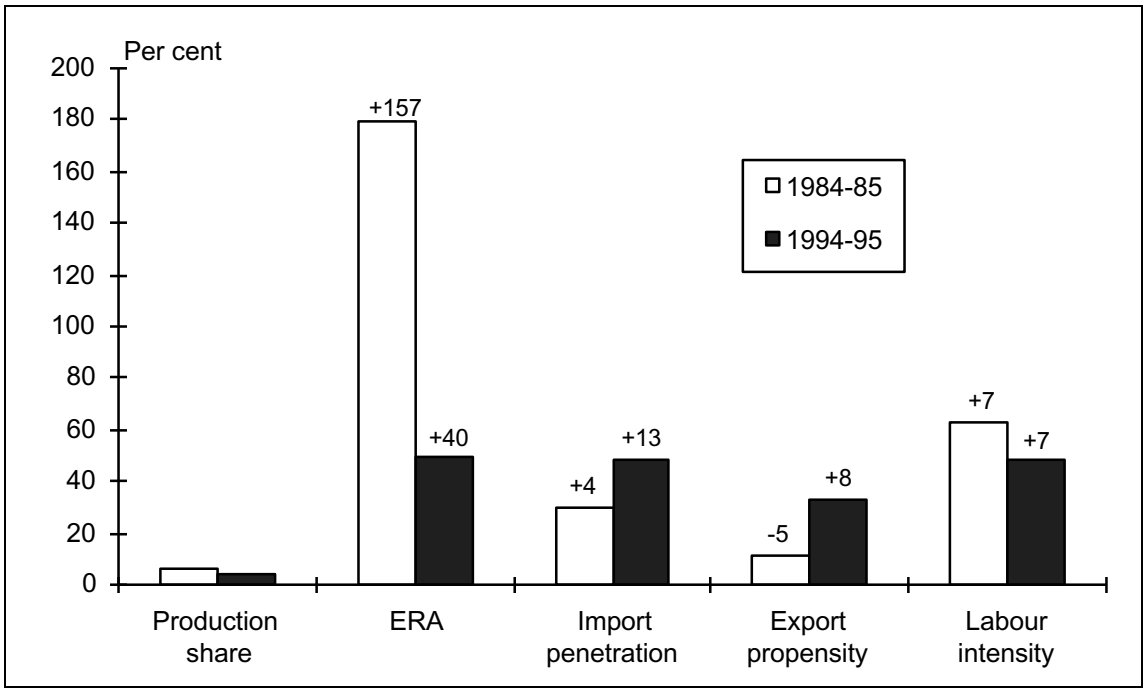
Australia's increased openness to trade in recent decades has resulted in competitive pressures on most Australian industries. The labour-intensive nature of the Textile, clothing, footwear and leather industry has meant that it has been vulnerable to international competition from low-wage producers in Asia in particular. In consequence it has been the only Australian manufacturing industry to see its production actually fall in real terms over the past decade. The industry involves a range of activities at the earlier stage of processing including wool scouring, leather tanning and fur dressing, weaving of natural and synthetic fibres and the manufacture of cotton and wool textiles. The industry also includes firms which manufacture various goods from these inputs such as rope, blinds, tents, carpets and rugs, a wide range of clothing goods, knitted items such as cardigans and pullovers, shoes, boots and other footwear and other leather goods such as handbags, saddles, wallets and suitcases.

The Textile, clothing, footwear and leather industry in Australia has experienced an increase in international trade over the decade to 1994-95 (figure A3). Imports, as a share of domestic sales, increased by 60 per cent over the period.

Interestingly, exports increased proportionally three times more than imports over the decade. However, the industry is still characterised by an extremely high ERA despite experiencing significant falls in protection in the ten years since 1984-85. In this time the industry has seen its share of total manufacturing output decline to the point where, in 1994-95, it was the smallest of Australia's nine major manufacturing industries. The industry remains a predominantly labour-intensive industry relative to the other industries in the manufacturing sector. Its labour-

intensive nature is, however, in decline, falling by about one-quarter in the ten year period. This fall is in line with recent trends recorded in the manufacturing sector as a whole.

Figure A3 Selected characteristics of the Textile, clothing, footwear and leather manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

An examination of one of Australia's more prominent clothing manufacturing firms — Yakka Pty Ltd — provides further insight into the experiences of the clothing industry over the past decade.

Yakka Pty Ltd

Yakka Pty Ltd is a private company owned by the Laidlaw family manufacturing industrial and corporate clothing. The company's origins date back to 1922 when overalls were manufactured in the back room of the family home in Brunswick, Melbourne. Today Yakka has factories in Brunswick, Shepparton, Wangaratta, Wodonga and Broadmeadows, and a turnover of more than $200 million per year. This represents about 6 per cent of the turnover of the Australian clothing manufacture industry. Yakka and the other major producer, King Gee, share about 80 to 85 per cent of the industrial clothing market in Australia.

The company has undergone a number of changes in response to the microeconomic reforms of the 1980s and 1990s. Ten years ago clothing

manufacturing was a lot more labour-intensive. The company employed over 2000 people a decade ago but now employs 1200 people which is about 3.5 per cent of clothing industry employment. In this period productivity has greatly increased as has the quality of Yakka's products. Productivity improvements are attributed to a variety of factors including the utilisation of new technologies, employee productivity linked incentives and a change in the manufacturing process. The manufacturing process has gone from a piece-work assembly line process to a just-in-time (JIT) process. This means garments are made to fulfil orders as they come in, thus reducing the need to hold large inventories.

The JIT process has been facilitated by technological advances at the distribution stage of the manufacturing process. Yakka now has state-of-the-art warehousing and distribution technology including an electronic system for customer ordering, bar-coding, carousel picking, garment management systems and a portable data entry system. This has increased Yakka's ability to deliver their products faster with greater emphasis on customer needs. The company can now distribute 25 000 garments a day with only 14 employees within 48 hours of the garments being ordered. Yakka uses computer aided design, computerised pattern making systems and computer aided cutting machines in the early stages of its manufacturing process to help improve productivity.

The sewing process has also changed over the last decade. Sewers, working in teams, now work on more than one stage of garment production using more than one machine. This minimises time losses caused by machine breakdown, as well as increasing employee satisfaction. Each team has a daily target to reach and incentives include the possibility of an early finish once the targets are achieved. The company is also looking to improve labour efficiency as part of its enterprise agreements.

Yakka has also changed its marketing and production arrangements. For example, the company ended a 15 year marketing relationship with Faberge USA jeans in 1995 but continued to market Lee jeans which are now made in China (having shifted from Wodonga).

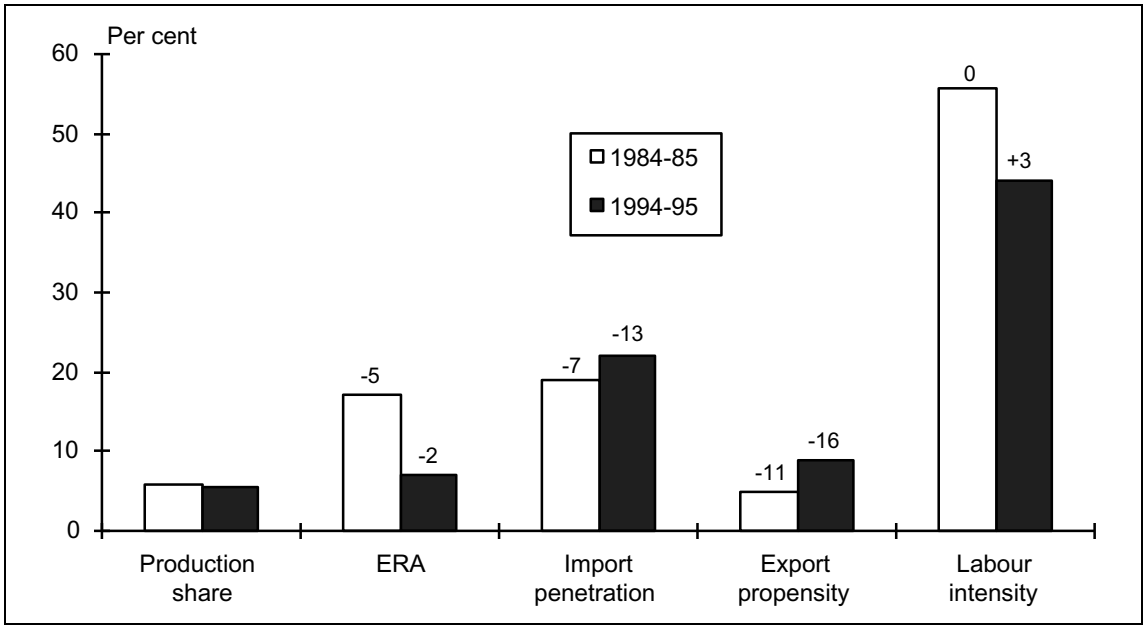
The management sees the company's future in the industrial clothing market, complemented by producing corporate apparel. Large companies increasingly want 'image' work wear with their corporate logo displayed. This market is growing at double-digit rates in Australia, whereas the traditional industrial wear market is growing at single-digit rates. Yakka's first corporate apparel customer was Telstra in 1991. Other customers are now Australia Post, Kentucky Fried Chicken, Pizza Hut and the NSW Health Department. The company also sees this market as an opportunity to increase exports. Currently exports only make up $1-1.5 million of its $200 million turnover.

A.3 Wood and paper products manufacturing

In chapter 2 we saw that the distinctions made between different parts of the economy for statistical purposes can sometimes be somewhat arbitrary. This is evident when we examine the Wood and paper products industry. This industry includes firms which engage in sawmilling to produce rough sawn timber, sleepers, wood chips, resawn and dressed timber — activities that are closely linked to the agricultural sector. But the industry also includes the manufacture of more highly transformed items such as plywood and veneers, particle and chip boards, wooden structural fittings (for prefabricated wooden buildings), wooden containers and pallets, turned wood products, picture frames and cork and bamboo products. These activities account for around 55 per cent of the activity of the industry. The remainder of the output consists of wood pulp (including pulp made from recycled paper), paper products including newsprint, cardboard and paper packaging products.

As a result of the stagnant output performance of the Wood and paper products industry (it recorded a trend rate of annual growth of 0.3 per cent in the decade to 1994-95), its share of manufacturing output declined over the period (figure A4). International trade (especially exports) in goods produced by this capital-intensive industry is very low relative to the manufacturing average.

Figure A4 Selected characteristics of the Wood and paper products manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

Still, both imports (as a proportion of domestic sales) and exports (as a percentage of total sales by domestic producers) have increased over the last ten years. The bulky, low-value nature of many of the products produced by the industry means that this industry enjoys considerable natural protection from imports. However, this feature also makes it relatively difficult for local producers to enter export markets.

An example of a large paper manufacturer is Amcor Ltd, a leading Australian producer.

Amcor Ltd

Amcor manufactures metal, plastic and paper packaging and a range of paper products including stationery and printing and business papers. Its history dates back to 1868 when a paper mill began in Melbourne, which later (in 1926) became part of an amalgamation of paper makers called Australian Paper Manufacturers (APM). APM Ltd changed its name to Amcor Ltd in 1986. Companies involved in the Amcor group include Australian Paper (formed by a merger of APM and APPM) and Kimberly-Clark Australia (50 per cent owned). Amcor is now one of Australia's largest companies — operating in 25 countries with an annual turnover of $6.4 billion (1995-96). The Amcor paper group contributed $1.4 billion of this. Amcor also manufactures packaging products in its containers and fibre packaging operations from paper made by the paper group. Approximately half of the company's sales occur overseas. In Australia, Amcor is the sole producer of white paper and holds 50 per cent of the cardboard box market and about a third of the total packaging market.

Plant and capital investments of about $3.5 billion have been made by the company in the past four years (about 50 per cent of this was spent in Australia). It has allocated a further $380 million to expand its white paper production at Maryvale Mill in Victoria and in northern Tasmania. The company currently produces about 350 000 tonnes of white paper per year and the new Victorian plant will have an expected capacity of 160 000 tonnes per year. Waste paper treatment plants are being expanded at the Maryvale, Fairfield and Botany Mills. R&D has also increased in recent times. In 1995-96 the company spent $44 million on R&D. The company does its own research in packaging and paper manufacturing but conducts joint projects with foreign firms in other areas.

The last decade for Amcor has been highlighted by corporate acquisitions. As a result, from 1985 to 1996 turnover has increased from $1.8 billion to $6.4 billion, and employment has risen to 25 300 from 9000 (worldwide). Rationalisation in the industry over the past decade has seen the number of box makers in Australia

fall from more than ten to two. Amcor also sold businesses which were not considered to be a part of its core operations. These businesses undertook operations such as manufacturing of automotive parts, security printing and greeting card manufacturing (John Sands). Although total employment in Amcor has increased as a result of corporate acquisitions, the workforce in individual plants is decreasing. Ten years ago the Maryvale Mill employed 1200 people but now employs about 900. A decade ago the Botany Mill in Sydney produced about 500 tonnes of paper per person per year but that figure has since more than doubled.

Increased productivity is due to many factors. Amcor has changed its corporate culture by breaking down manager/worker barriers by giving employees greater responsibilities and introducing an employee share purchase scheme (97 per cent of eligible employees are in the scheme). Multi-skilling and job sharing are also encouraged by the company.

Changes have also come to Amcor as a result of market opportunities arising from increased community awareness of the environment. As a consequence, Amcor has become Australia's largest paper recycler. Chlorine is no longer used in the manufacture of disposable nappies and less paper is being used in cardboard boxes without reducing the quality of the product.

Amcor has also moved into China (adding to the plants the company has in Europe and the UK) where it has five plants manufacturing cigarette packaging, boxes and flexible packaging, predominantly to meet domestic demand. The company has done this because it is not viable to export these products from other countries such as Australia. In 1996 off-shore operations accounted for 47 per cent of sales and 27 per cent of the company's profits. Ten years ago these figures were below ten per cent. However, because of the nature of Amcor's product — exports are generally unprofitable due to transportation costs — exports are low.

The company is confident about its future. After all, cardboard boxes are still the most common packaging material worldwide. However, there are some challenges to overcome and Amcor is conscious of the need to improve. The company continuously benchmarks itself against world best practice and is now achieving prices closer to the world's best than has been possible at any time in the past. Amcor will continue to look for opportunities outside of the Australian market, concentrating in the foreseeable future on Europe, including eastern Europe, as well as North America and Asia.

A.4 Printing, publishing and recorded media manufacturing

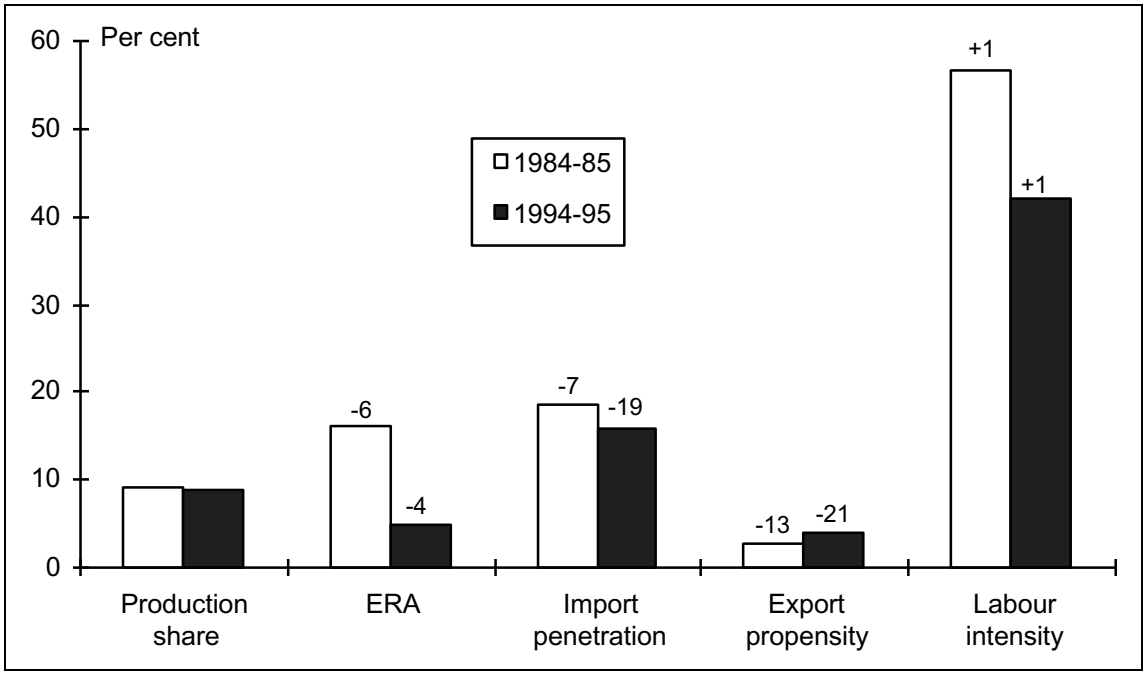
The bulk of the output of the Printing, publishing and recorded media manufacturing industry is shared between the printing and publishing sub-industries. The printing sub-industry includes the manufacture of a range of stationary products such as albums, calendars, games, greeting and playing cards, books, periodicals and screen prints. Also included are services to printing — activities such as preparation of artwork, bookbinding and typesetting. Newspaper printing is included within the publishing sub-industry, which also includes book and periodical publishing as well as sheet music, maps and other printed articles such as art prints. The third sub-industry — recorded media manufacturing and publishing — includes the manufacturing or publishing of audio and video tapes, compact disks and computer tapes or disks. [1] Although rising in recent years, these activities still play a small role in the industry relative to traditional printing and publishing.

The Printing, publishing and recorded media is the only manufacturing industry to enjoy a fall in competition from imports over the ten years to 1994-95 (figure A5). This occurred over a period when the ERA to the industry fell by about two-thirds. However, the goods produced by the industry are not highly traded. In 1994-95 the industry's import penetration and export propensity were 19 and 21 percentage points respectively below the manufacturing sector average. Furthermore, the industry's output growth did not keep pace with the average growth in manufacturing production over the past decade.

In terms of the manufacturing process, publishing and printing complement each other and should be viewed as interlinked. We can gain an insight into publishing by looking at Allen & Unwin — one of Australia's best known publishers. National Capital Printing is also examined below. It provides an example of how the printing industry has changed in recent times.

[1] The actual business of filming videos and recording music is not counted as manufacturing. The production and employment resulting from these activities is credited to the service sector.

Figure A5 Selected characteristics of the Printing, publishing and recorded media manufacturing industry — 1984-85 – 1994-95[a,b]



a Data for 1984-85 do not include recorded media. **b** Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0, 5629.0, 8112.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

Allen & Unwin Pty Ltd

Allen & Unwin (UK) began in 1914 as a family publishing company in England. Over sixty years later (in 1976) an Australian branch of the company was opened in Sydney. It became an independent company in 1990 with 50 employees and a turnover of $10 million. The company has since expanded to about 100 employees and annual revenue of $28 million.

Although the company does not actually transform materials, publishers like Allen & Unwin service the printing industry (where the actual manufacturing takes place) through their publishing activities. Consequently, they effectively drive the printing industry. It is for this reason that Allen & Unwin is classified as a manufacturer. The publishing process involves commissioning an author, editing the author's work, sub-contracting a typesetter and then sub-contracting a printer. Some activities that were originally performed in-house, such as editing, are now generally outsourced. Allen & Unwin also distributes foreign books from UK publishers in Australia from publishers such as Orion, Blackwell and Bloomsbury.

Since becoming an independent company Allen & Unwin has increased its exports steadily. The company's current exports are about $1.5 million (which is about 15 per cent of turnover from *Australian* books) to countries such as the USA, New Zealand, UK, Canada, Japan, South Africa, Hong Kong and some South East Asian nations.

The role of the publisher has not changed greatly over the years; nevertheless technology has had an impact on the industry. Perhaps the most notable change is the prevalence of word-processors used by authors. Publishers such as Allen & Unwin now receive manuscripts on computer disks whereas once they were on paper. This has made the editing, typesetting and indeed the printing of the work more efficient and easier. Other changes have included the increased use of computer design and improvements to the quality of colour printing which has helped improve book jackets.

Although improved technology has helped the publishing process, rapid technological advancement has also posed serious problems to the industry — particularly in rendering some regulation obsolete. Authors can place their work on the internet, bypassing publishers and going directly to readers. Works can also be reproduced without permission on the internet, violating Australian copyright laws. Additionally, works can be photocopied in large quantities under statutory licence, which particularly affects educational and academic book sales.

Allen & Unwin is also concerned about regulation regarding publishing rights of foreign books. After bidding successfully for exclusive rights to the Australian distribution of a foreign book, Australian publishers have 30 days in which to publish that book or else the exclusive distributing rights are forfeited. If this happens, books may be brought in ahead of Australian publication by local retailers or wholesalers which may adversely affect the Australian distributor's sales.

National Capital Printing

National Capital Printing is a printing company based in Canberra. It started as a family business before being incorporated in 1991. The company specialises in printing high-quality five colour reports, booklets, brochures, posters, handbills and general stationery. Approximately 60 per cent of the company's work comes from the Commonwealth government. However, National Capital is trying to enter into new markets, particularly interstate, and has already won printing contracts from the NSW state government and other Sydney-based clients. Currently the company employs about 100 employees, a level that has grown steadily in recent years.

One of the ways National Capital receives a job to be printed (the 'pre-press') is on computer disk. The work is then typeset and, if need be, edited to the appropriate fonts and sizes. Any photos or pictures that are to be printed are scanned using a high definition colour scanner or a black and white flat-bed scanner, outputting the image to film. The negative of the images and text are exposed onto a printing plate. The scanned plate image is transferred onto an image card recording the colours of the image so when the image card is loaded into the press the correct percentage of colours are printed. The printing plates as well as the ink and paper are manually placed into the printing machines. National Capital's printing machines can print in five colours, on one side of the page at a time, or two colours on two sides at a time. For a book-sized publication, National Capital can bind up to 650 copies per hour perfect bound or 10 000 saddle stitched.

The printed product is loaded onto a guillotine by hand and cut to the appropriate size. Depending on the binding operation the sections are folded in 4, 8, 16 or 32 page sections and sent to the binders for finishing. In some cases the covers are die cut. Here a wooden base with metal creasing rulers is placed into a chase and die cut on a cylinder press. The sheets are then ready to be finished on a guillotine or hot-glued. The folding, stapling and gluing are performed by machine using a conveyor belt process. However, the publications have to be loaded onto, and unloaded from, the machine manually. The stapled or glued publication is trimmed on three sides, completing the process.

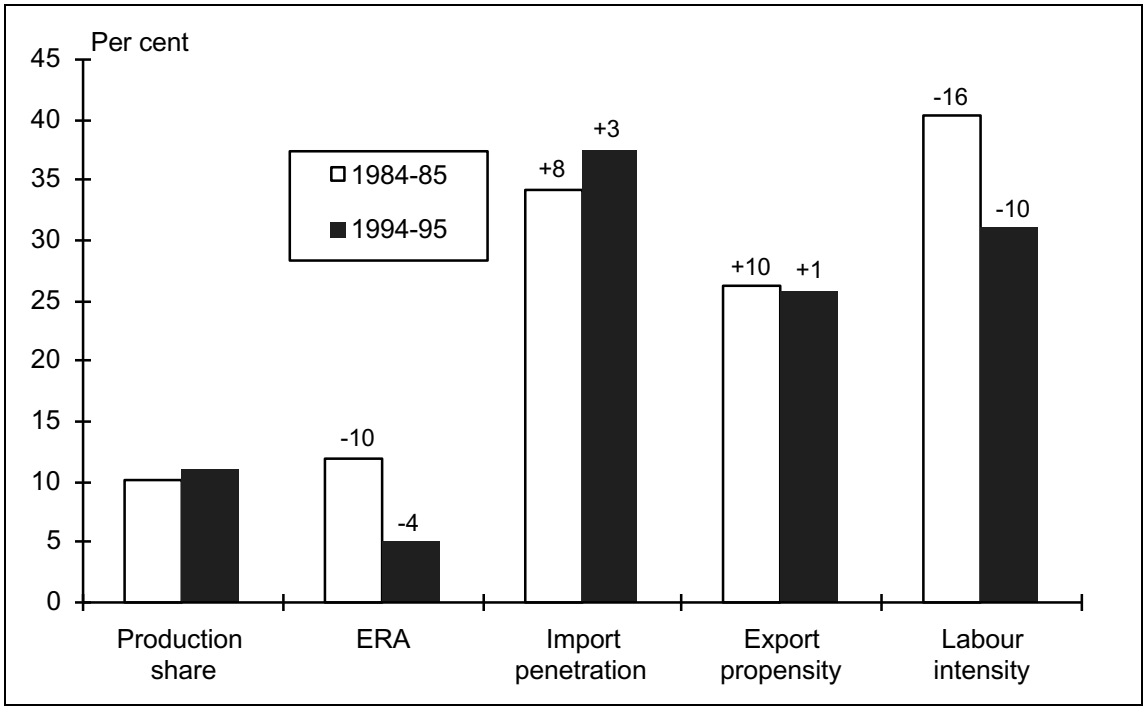
The biggest change in National Capital's printing process is in the way the company receives the pre-press. Besides receiving work on computer disk, images and photographs are now able to be scanned and recorded on an image card. Previously the company would require the images on film or to be 'camera-ready'. Camera-ready refers to a black and white hard copy of a photo or image that has to be photographed by the printer before it can be printed. This technique only works well for images in one colour. It was only recently that the company commenced its own colour scanning. Previously National Capital outsourced this function because it did not have the appropriate equipment. The printing industry is highly competitive with price discounting being commonplace. As part of its efforts to increase productivity National Capital Printing has invested heavily in capital equipment in recent years — notably two high-speed automated printing presses.

A.5 Petroleum, coal, chemical and associated products manufacturing

The most capital-intensive of the manufacturing industries is the Petroleum, coal, chemical and associated products industry (figure A6). This is to be expected given the nature of the industry. Around one-half of the output of the industry consists of chemical manufacturing — this includes products like ammonium nitrate and phosphate fertilisers, industrial gases such as hydrogen, oxygen and acetylene, synthetic resins, organic and inorganic chemicals, explosives, paint, pharmaceuticals, pesticides, detergent, ink and cosmetics. Petroleum refining accounts for a further quarter of the output of the industry and yields products like petrol, fuel and lubricating oils and petroleum gases. Rubber and plastic products such as mattresses, rubber gloves, plastic pipes and injection moulded products (eg kitchenware and automotive components) make up the remainder of the industry.

The industry has increased its share of manufacturing production by one percentage point over the decade from 1984-85. The level of imports as a share of domestic sales was relatively high in 1994-95 in comparison to the manufacturing sector overall. The level of exports, however, was almost on a par with the manufacturing average in 1994-95 despite being much higher than the average ten years earlier. Because of the capital-intensive nature of the industry, R&D expenditure is also high. In fact, the industry accounted for 16 per cent of total manufacturing R&D expenditure in 1994-95, a share that was about 50 per cent more than the industry's share of manufacturing production and employment.

Figure A6 Selected characteristics of the Petroleum, coal, chemical and associated products manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

Although not exclusively devoted to the manufacture of chemical products, BTR Nylex does give us an insight into the industry through its plastics and rubber manufacturing activities.

BTR Nylex Ltd

BTR Nylex Ltd manufactures a range of plastic and rubber products including conveyer belting, polyvinyl chloride (PVC) hosing, plastic bottles, foam trays, car door seals and panels, bumper bars, fuel tanks, watering products, coolers and storage units for kitchens and bathrooms.

The company started out as Hopkins Odlum Holdings Ltd in 1952, becoming BTR Hopkins Ltd in 1980 before settling on its present title after acquiring Nylex Ltd in 1985. BTR Nylex's annual turnover in 1994 was $6.7 billion with Australian sales making up about $3.4 billion of this total.

BTR's main rubber producers are Apex Belting (belting) and Empire Rubber (rubber moulding and extrusions). These divisions manufacture rubber and rubber-coated belting as well as a range of products manufactured by a process of moulding and extrusion. The main plastic producers are Nylex and ACI Plastics.

In recent years, the manufacturing processes for several of BTR's products have been changed in response to environmental concerns. For example, plastic bottles are now made with up to five layers which include recycled plastic using leading edge technology. Recycled PVC is used when making PVC hosing. These processes have required BTR to invest in recycling equipment. The manufacture of blow-moulded foam trays has also changed as a result of environmental concerns. These are now manufactured using air as a blowing agent instead of fluoro-carbons. A further example is BTR's watering systems. As consumers have had to pay increasingly more for their water, the watering systems have been designed to help conserve water through timers and drips. Again, this introduces changes to the manufacturing process.

BTR's manufacturing processes have also been modified due to changes in the products which use BTR components as inputs. An example of this is the amount of plastics, particularly moulded plastics, that are now in cars. BTR is the sole supplier of many plastic components to the Australian car industry. Interior door panels, for example, are produced as one moulded piece whereas they were previously made in parts. Another example is the company's recent contract to supply General Motors Holden with plastic moulded, multi-layered fuel tanks to replace the older style metal tanks. Consequently, BTR's plastics operations have both increased and changed in nature over the past decade.

As tariffs have declined BTR has considerably improved its plastics manufacture productivity. Over the past five years sales have increased by 25 per cent with little change in employment. Such productivity gains have easily surpassed labour cost increases. The company estimates plastics production productivity has improved significantly in the past five years. These gains have been due to an increased focus on management and worker training programs, changes made in response to customer satisfaction surveys, increased employee input into the manufacturing processes and the introduction of strategic plans incorporating the results of benchmarking to strive for international best practice.

Productivity gains have also been due to the company continuing to improve its manufacturing process through new equipment and better technologies. BTR spent $12 million on capital equipment and $31 million for R&D in 1995. This is consistent with trends over the past five years which have seen R&D expenditure at BTR double.

Another important aspect of BTR's improved productivity is the influence of corporate acquisitions and amalgamations. A key acquisition was the plastic manufacturing company, Nylex, in 1985. Other plastics companies, Acmil Plastics and ACI International were also purchased in the 1980s. Such mergers and acquisitions have given BTR greater access to new markets and the

accompanying economies of scale which play a big part in being internationally competitive. For example, BTR now supplies over half of the Australian plastic bottles market and is a major supplier of rubber and plastic products to the Australian car industry which enables BTR to stage large production runs.

As many of BTR's products are used as inputs into other products, BTR itself is not a big direct exporter of these products. However, these products may be exported as components of another product. For example, plastic interior car door panels will be used in Australia as inputs for cars and then the car may be exported. In this way some of BTR's products are indirectly exported. Other products such as plastic bottles have a low value to volume or weight ratio making them unprofitable for export due to the transportation costs involved. Nonetheless, higher value products such as conveyer belts and PVC filming are exported.

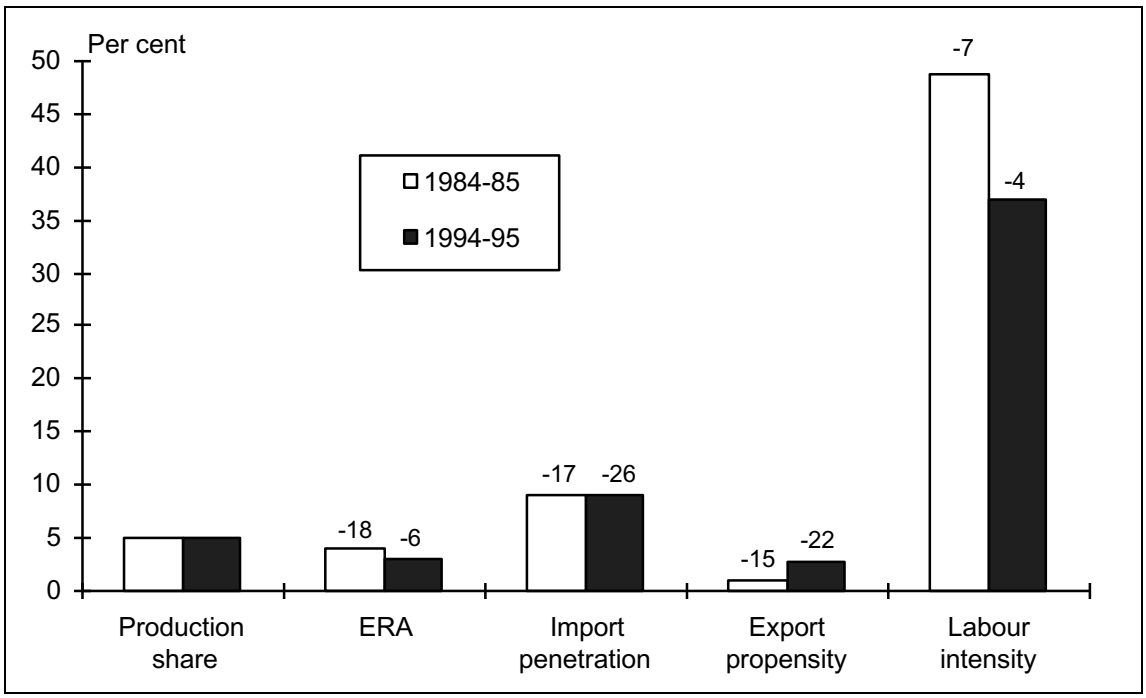
The fortunes of BTR's products which are used as inputs largely rest with the fortunes of the final product (eg motor vehicles). Nonetheless, the company is optimistic about its future despite identifying several challenges to overcome. Inputs in the manufacture of plastic products are often dumped in overseas markets hence reducing the price for them. This flows on as a lower price for the final product by these foreign producers. BTR sees tightening of international anti-dumping laws as one challenge for the industry.

The company also recognises the benefits of economies of scale and concedes the Australian market is too small to gain maximum benefits from scale economies. Therefore the company will seek to move into new markets, possibly in Asia. BTR acknowledges, however, that Australia has a well educated labour force and good infrastructure, together with lower wages and land costs when compared to Japan, Taiwan and Singapore.

A.6 Non-metallic mineral product manufacturing

The Non-metallic mineral product industry is relatively small, currently accounting for about 5 per cent of total manufacturing production (figure A7). Around 45 per cent of the output of this industry comes from firms which produce cement, concrete slurry ready for pouring, concrete pipes, box culverts, railway sleepers, pre-fabricated building products, cisterns and plaster products.

Figure A7 Selected characteristics of the Non-metallic mineral product manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT Stars (1995) and IC (1995a).

A further 40 per cent of the industry consists of glass and ceramic product manufacturing — resulting in products such as automotive windscreens, bottles, kitchenware, scientific glassware, clay bricks, crucibles, ceramic tiles and crockery. The remainder of the industry is made up of a diverse mix of products including abrasives, acoustic tiles, headstones, mortar and ground talc.

This industry is strongly domestically oriented. Imports' share of domestic sales and the share of total sales by domestic producers sold overseas is the lowest in the manufacturing sector. The level of protection to the industry was also the lowest of the nine manufacturing industries in 1984-85 and remains so a decade later. However, the Non-metallic mineral product industry is the most capital-intensive manufacturing industry after Petroleum, coal, chemical and associated products. Yet, partly because of its small size, the industry was responsible for little more than 2 per cent of total manufacturing R&D expenditure in 1994-95.

A key theme of this paper has been the extent of interlinkages between different firms and industries of the Australian economy. A good example of this is provided by the firm Windscreens O'Brien which draws on the output of glass manufacturers to produce automobile windscreens — which in turn, become the key input to their windscreen replacement service.

Windscreens O'Brien

Windscreens O'Brien started in Alexandria, Sydney in 1927, as Frank G. O'Brien Ltd. The company manufactured automobile mirrors from reprocessed glass as well as acting as glass merchants, replacing building glass. By the 1960s O'Brien was the largest building glass replacements company in the eastern states of Australia. In 1972 an additional company was formed for the manufacture of automobile windscreens. The company's emphasis has been on windscreen manufacture ever since, now producing 450 000 windscreens per year for cars, trucks and buses, some of which are exported to New Zealand.

Windscreens O'Brien has gone through several changes in recent times, driven by changes in technology, car design and the company's competitive position. In 1988 the company stopped manufacturing mirrors in order to concentrate on windscreens — its core business activity. This impacted on the company's employment levels, which had been rising to 1988. The company now employs about 700 people of which 100 are involved in manufacturing. Nonetheless, total employment has risen by 30 per cent over the past twelve months as windscreen production has increased by 50 per cent in that time.

The manufacturing process, while becoming more automated, is still quite labour-intensive. This conflicts with the nature of the Non-metallic mineral product manufacturing industry as a whole. An example of an automation to the company's manufacturing process is the automated silk screening of the black UV bands on windscreens. This was previously done manually. Advances in air-conditioning technology have also improved the quality of the product by keeping the glass dust-free — a critical precondition to the bonding stage (where a piece of vinyl interlayer is sandwiched between two pieces of glass and heat-bonded). Windscreens O'Brien also plans to automate the glass cutting stage through the use of numerically controlled machines.

Changes to the company's manufacturing philosophy and timing have been more dramatic. O'Brien is now moving to a short run, just-in-time manufacturing philosophy which enables the company to hold less stock. The improvements in its distribution technology (the distributions section is becoming more computerised) and improvements in warehousing have helped make this possible.

The increasing use of team-based management practices has assisted in productivity improvements. One such example is a competency-based skills program. Employees are now rewarded for their skills learnt and used. Many employees now have the skills to work in any area of the manufacturing process as the need arises.

As a result of concentrating on its core competence of windscreen manufacture and moving to a more automated manufacturing process, Windscreens O'Brien is confident about its future. There are concerns and obstacles to overcome, nonetheless. The company continues to improve its management practices as it firmly believes that better employee relations increase productivity. Although current levels of imports are negligible, increased windscreen production in some other nations concerns the company.

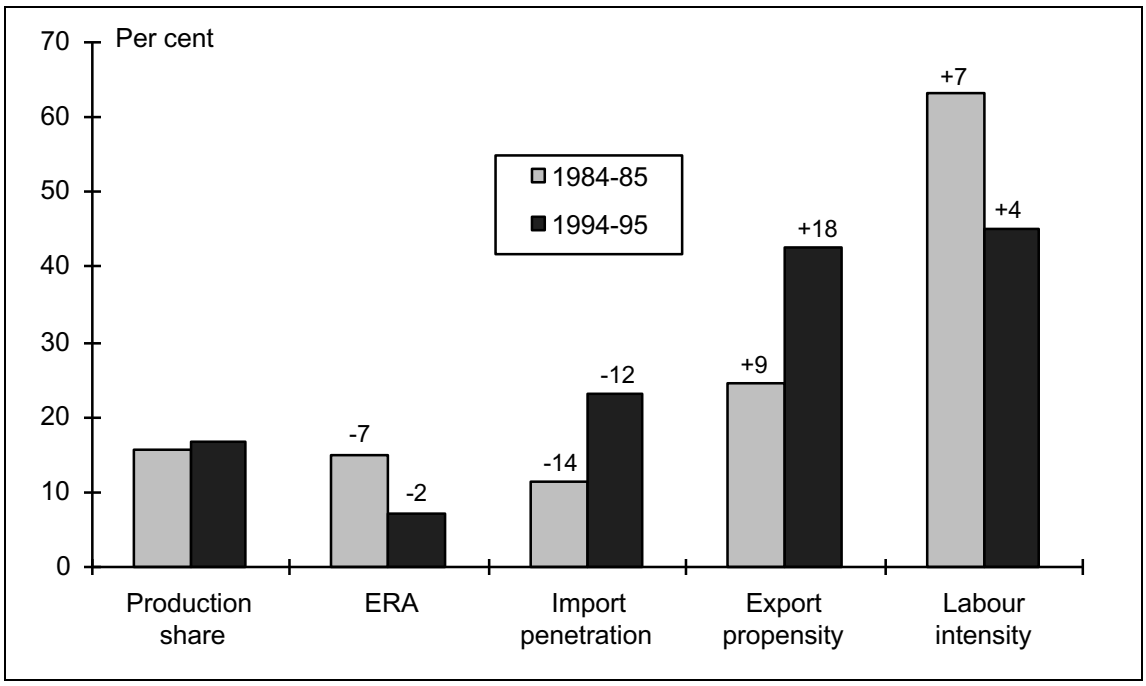
A.7 Metal product manufacturing

One of the key distinguishing features of Australia's manufacturing sector is the relative importance of Australia's Metal product industry — a consequence of Australia's strong resource base. In 1990 the Metal products industry was almost twice as important to Australian manufacturing (measured as the share of total manufacturing output accounted for by metal products) as it was to manufacturing in the G7 countries (BIE 1995b, pp.81-82).

Non-ferrous metal manufacturing (alumina, aluminium, copper, lead and zinc) as well as rolling, drawing, extruding and casting of these metals accounts for over 40 per cent of the industry's output. Another quarter of the output of the industry consists of basic iron and steel manufacturing, casting, forging and steel pipe and tube manufacturing. The remaining firms within the industry produce structural, sheet and fabricated metal products including steel girders, prefabricated building parts such as rafters, scaffolding, aluminium door and window frames, railings, aerosol containers, kegs, hand tools, springs and wires, nuts, bolts, metal coatings and sprockets.

The most salient feature of the recent performance of the Metal products industry is the large increase in exports as a share of total sales in the ten years from 1984-85 (figure A8). In fact, in 1994-95 the industry was the most export oriented in the manufacturing sector with 43 per cent of total sales by domestic producers sold overseas. Import penetration also grew in the period, but remained well below the manufacturing average. The amount of labour used to produce a fixed value of output was very high in 1984-85 but dropped back closer to the manufacturing average by 1994-95, suggesting improvements in labour productivity over the period. In 1994-95 the industry accounted for about one-sixth of total manufacturing R&D expenditure, the second largest R&D contributor amongst the nine manufacturing industries. With stimulus being provided by new foreign markets, the ten year period to 1994-95 also witnessed a one percentage point rise in the Metal products' share of manufacturing production.

Figure A8 Selected characteristics of the Metal product manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

Australia's largest company, BHP, operates in the Metal products manufacturing industry. A business group of BHP Steel's Building and Industrial Products Division, BHP Structural and Pipeline Products division is a prominent example of a Metal products manufacturer.

BHP Structural and Pipeline Products division

Formerly a division of Tubemakers of Australia Ltd (a company in which BHP held a 49 per cent shareholding), the business began in 1901 as Stewarts and Lloyds Ltd (Aust), a subsidiary of a UK company, distributing steel products. In 1934 the company started manufacturing steel tubes at Newcastle. In 1946 Tubemakers was incorporated in order to bring together the interests of Stewarts and Lloyds, BHP and British Tube Mills.

Today the business manufactures a range of steel pipes and tubes for purposes as diverse as oil and gas pipelines, fence posts, structural beams for light constructions, steel tubes for automotive vehicles and pressure pipes. In 1995 Tubemakers had a turnover of $1.7 billion, capital expenditure of $46 million and R&D expenditure of $11 million. BHP acquired the remaining 51 per cent of shares in Tubemakers (to take its shareholding to 100 per cent) in April 1996.

Structural Products has made a number of changes to its manufacturing process over the years in an effort to improve productivity. A key process-innovation has been in the manufacture of galvanised products. Previously, galvanised products were first manufactured and then individually hot-dipped at the end of the process. The galvanising process, which was developed internally about three years ago, now takes place in-line without interrupting the running speed of the weld mill, producing a tube with the galvanising on the external surface only.

Structural Products has also improved its dispatch facilities. Two years ago the business computerised its finished goods storage area in order to have a 'paperless warehouse'. Computers and high-speed magnet cranes, controlled by one person in the warehouse office, store and collect stock items which are bar-coded. The cranes have a laser scanner which reads the bar codes which subsequently allows the computer to allocate storage space for the item. The computer also directs the cranes to pick up items in the correct order when it is time to load them onto a truck. This allows the company to load and retrieve stock much more efficiently (no space is required for fork-lift arms), quickly and accurately, reducing the amount of stock carried. In short, the business is moving to a just-in-time manufacturing process. The new facility has also virtually eliminated product damage.

Employment levels have declined steadily, from 2130 employees in 1980 to 620 by August 1996. Over the same period, production has substantially increased. Investment in new machinery and technology has been a vital part of Structural Products' improved productivity. The establishment of a new plant in Melbourne is a recent example of this commitment to investment.

Improved employee relations have also helped to increase productivity. For example, in order to improve employee relations the then Tubemakers set up an employee share scheme in 1989. More recent initiatives include greater employee involvement in managing work teams and improving the manufacturing process. Specific employee training is now encouraged for the management level and below. Finally, enterprise agreements are now well entrenched within the company.

The Structural and Pipeline Products business has been significantly affected by declining tariffs. To remain internationally competitive in an environment of falling tariffs the business undertook a program of international benchmarking in the 1980s. Such competitive forces will see the business continue to pursue new business opportunities overseas as well as continuing to automate and improve domestic operations. Exports are currently a small part of BHP Structural and Pipeline Products' sales, although some larger steel pipes and tubes are exported

to Asia and New Zealand. This is an area in which the business hopes to improve in the years ahead.

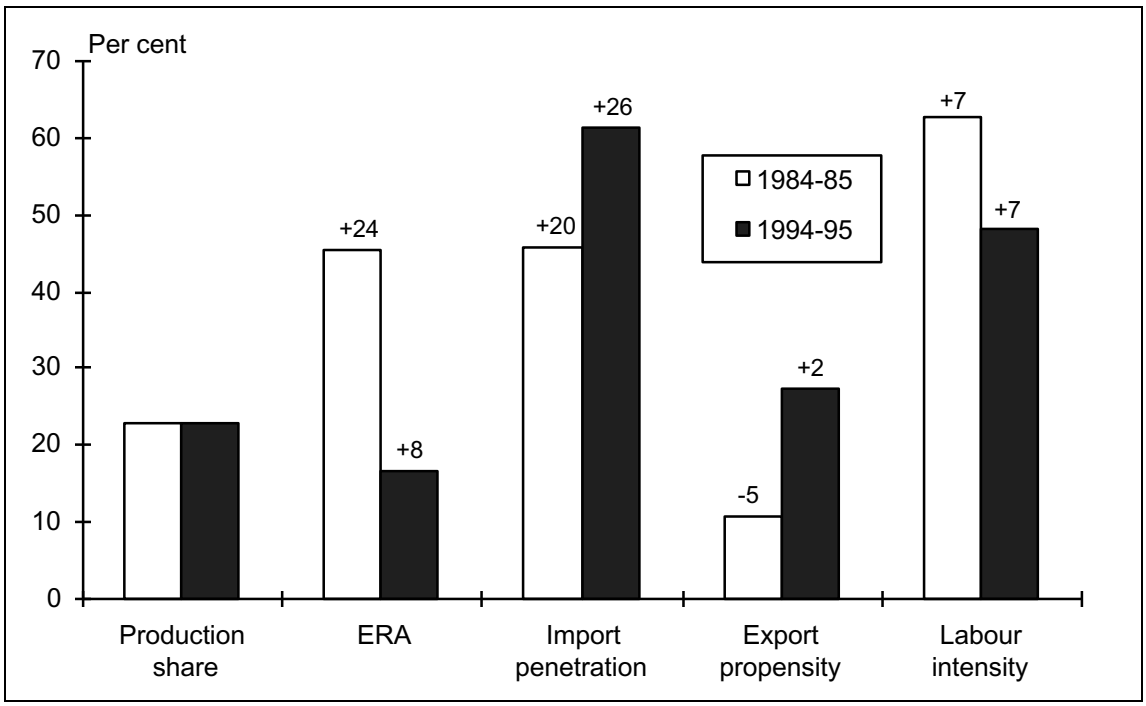
A.8 Machinery and equipment manufacturing

Machinery and equipment is the largest industry in the manufacturing sector, accounting for 23 per cent of total manufacturing production in 1994-95 (figure A9). It contains most of the industries people generally associate with manufacturing. Motor vehicles, engines and parts account for around 30 per cent of the production of this industry, while another 15 per cent is produced by the shipbuilding, boatbuilding, rail and aircraft industries. Electrical, electronic and scientific products account for a further 40 per cent of the industry. These include contact lenses, glasses, cameras, respirators, surgical equipment, watches, computers, televisions, stereos, alarm systems, lights, batteries, electric motors, telephones, fridges, washing machines and water coolers.

The remainder of the industry consists of industrial machinery and equipment — items such as pumps, compressors, tractors and bulldozers, lawn mowers, canning and bottling machinery and parts, saws, machine dies, lathes, pneumatic tools, forging machinery, cranes, forklift trucks, furnaces, vending machines and mechanical presses.

Output growth in the Machinery and equipment industry kept pace with manufacturing output growth over the last decade, maintaining the industry's share over the period (figure A9). ERAs remained twice as high as the average for the manufacturing sector over the decade, despite falling from 46 per cent to 17 per cent. Import penetration in the industry was the highest of any manufacturing industry in 1994-95. The industry also remains one of manufacturing's most labour-intensive, although the level of labour-intensity has fallen since 1984-85, mirroring the general manufacturing trend. Nonetheless, in 1994-95 more than half of manufacturing R&D expenditure was accounted for by the Machinery and equipment industry — a consequence of the industry's large size and the technical sophistication of many of the goods it produces.

Figure A9 Selected characteristics of the Machinery and equipment manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

We saw earlier that the automotive sector accounts for a large proportion of the output of the Machinery and equipment manufacturing industry. Consequently we can gain further insight into the nature of this industry by reviewing the recent experiences of one of Australia's oldest and largest car makers — Ford Australia.

Ford Motor Company of Australia Ltd

The Ford Motor Company of Australia was formed in 1925 in Geelong as a subsidiary of the Ford Motor Company of Canada, becoming one of the first major car manufacturers in Australia. Throughout the next decade assembly plants were opened in Brisbane, Adelaide, Fremantle and Sydney while the Broadmeadows plant in Melbourne was opened in 1959. The company assembled imported and local components until 1960 when it commenced local manufacture of the Falcon.

In the 1960s Australian design and development of the Falcon began. The 1980s and 1990s saw Ford undertake major restructuring including the closure of some plants, including Homebush (Sydney) in 1994. In 1989 an export program to the USA for the Capri was started, concluding in 1994.

Today Ford has plants in Broadmeadows, Geelong and Brisbane and in 1995 revenue of $3.3 billion or about 30 per cent of the total motor vehicle and parts market in Australia. In 1995 the company held 24 per cent of the Australian passenger car market and 22 per cent of the total vehicle market.

Ford has invested heavily in new technologies and capital equipment in recent years in an effort to increase the efficiency of its manufacturing processes. For example, the use of robots in the welding process was introduced in the mid-1980s. Computer aided design, computer aided engineering and computer aided manufacturing are also employed. Other technologies and capital equipment that the company has invested in include new stamping presses and an automatic mould line in the casting plant. Furthermore, one billion dollars has been allocated over the next five years for development of a new Falcon, including $85 million for a new enamel paint facility at Broadmeadows. Ford believes that to get the most out of its capital equipment there must be feedback and input from the people on the plant floor. Employees have also been given more responsibility and input into management decisions.

Ford has experienced many other changes in recent times. The company's employment has fallen from about 13 800 in 1990 to the current level of about 6500, although the number of cars produced (about 105 000 per year) is much the same as six years ago. Investments in new capital equipment and better technologies have contributed to this improvement, as have better work practices and a greater commitment to training and education. Ford currently spends 8 per cent of its wages bill on employee training and education. This includes training in English and numeracy skills, a Vehicle Industry Certificate which is TAFE accredited as well as trade progression courses, supervisory programs and degree courses. The company recognises this training, as well as acquired on-the-job knowledge, in its pay scales.

While exports (consisting of cars, aluminium transmissions and engine blocks) declined from $346 million in 1990 to $176 million in 1995 (reflecting the cessation of the Capri program), Ford nevertheless posted a $202 million profit in 1995 (the highest on record).

The forces behind these recent changes are varied. Increased competition from imports stimulated in part by reductions in tariffs have placed cost pressures on Australian producers. These pressures have encouraged plant and model rationalisations. High volume sales are particularly important in motor vehicle manufacturing due to the large capital outlays involved. It was partly because of cost penalties associated with somewhat limited production runs that Ford stopped the assembly of Lasers in its Sydney plant in 1994 (Lasers are now imported from Japan).

Another cost pressure over the past decade has come from the Japanese and, more recently, the Koreans. These producers have reduced the life cycle of their models forcing their competitors to do likewise. Contracting life cycles add to the cost of manufacturing and shorten the time frame over which costs can be recovered. Securing large model production runs is crucial to profitable operations. As the Australian market has become more open, local producers like Ford have felt competitive pressures more strongly, with imports taking an increasing share of the domestic passenger car market.

The company is optimistic about its future citing the quality of its cars and the strong growth in labour productivity achieved over the past decade. Ford has recognised the production of the Falcon as its core competence and will concentrate on this to maintain a strong domestic base, without which it believes an export program is not possible. Nonetheless, Ford can see challenges ahead. Declining industry assistance and continuing competition from imports add to the cost pressures of the local producers. Australia currently produces less than 1 per cent of total world vehicle output. Sales limited to the domestic market are insufficient to reap the benefits of economies of scale required to be at the forefront of international best practice. For this reason Ford sees its export program as increasingly important to its future success.

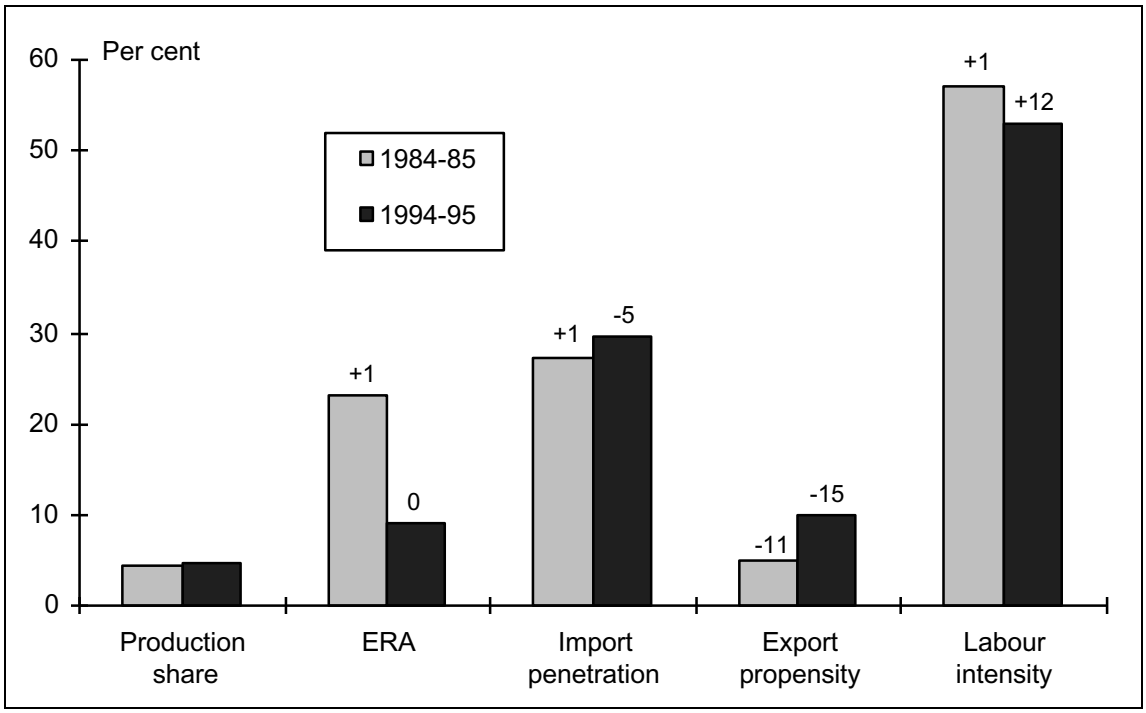
A.9 Other manufacturing

Manufacturing activities that fall into the unhelpfully named 'Other' category consist of a very small (albeit rising) share of total manufacturing activity. Furniture manufacturers represent the largest sub-group within this industry, accounting for around two-thirds of the total output of the industry — with products like wooden and metal chairs, tables, lounge suites, office furniture, filing cabinets, desks, mattresses and water beds. The remainder of the industry includes the manufacture of prefabricated metal sheds, carports, bus shelters, jewellery, silverware, sporting goods, brushes, musical instruments, pens, umbrellas and toupees.

Overall import penetration for this industry was 5 percentage points below the manufacturing average in 1994-95 (figure A10). The ERA for this industry was on a par with the manufacturing sector in 1994-95, as it had been over the previous ten years. Firms in this industry mainly focus on domestic markets as exports are relatively small. Labour-intensity for the manufacturing activities in this industry was very high in 1994-95. Manufacturing as a whole experienced productivity gains in the ten year period from 1984-85 with the level of labour-intensity falling by about 27 per cent. Yet firms in this industry have not had

labour productivity gains of the same magnitude, experiencing only a 7 per cent decline in the amount of labour required for a fixed value of output.

Figure A10 Selected characteristics of the Other manufacturing industry — 1984-85 and 1994-95[a]



a Numbers on the bars show the percentage point difference from the manufacturing average.

Sources: ABS Cats 5206.0 and 8221.0, unpublished ABS data, DFAT (1995) and IC (1995a).

As furniture manufacturers represent the largest sub-group in this classification, to better understand this industry it is instructive to look at the experiences of one of Australia's nation-wide furniture companies, Dream Haven.

Dream Haven Bedding and Furniture Ltd

Dream Haven began in 1978 in Melbourne as a manufacturer of mattresses and bedding products for the Melbourne market. In 1983 the company expanded into the manufacture of bedroom furniture and in 1989 expanded further into producing lounge furniture, focusing on sofa beds and lounge suites. Today the company has a national distribution network (for furniture) and an annual turnover of $16 million (1995).

As a result of emerging capacity constraints, Dream Haven has moved to a purpose-built factory at Epping, Melbourne. The company has also recently invested in new machinery including a computer guided four-headed parallel router which has significantly increased the speed of the production line.

Automations in gluing, polishing, lacquering and drying are other examples of changes in the company's manufacturing process in recent times. This has enabled the company to achieve greater productivity from its 150 employees. Dream Haven has also improved the distribution side of its operations. Now the company can produce bedding products in two to four days from when the order is placed. However, lounge suites still take longer — about two to four weeks.

When Dream Haven started in 1978 it produced only bedding mattresses and bases. Now 50 per cent of the company's operations involve making bedroom furniture and 20 per cent is making lounge suites. Dream Haven believes that these products can be successfully exported to South East Asia and Japan, by marketing the unique Australian wood that the company uses. This in turn introduces new challenges to the company including cultural challenges. For example, the lack of space in Japanese apartments means that many Japanese sleep on bedding rolled out on the floor rather than on traditional western beds.

Dream Haven also see their future in the domestic and foreign commercial market. It is currently the preferred supplier to Flag Hotels throughout Australia and has supplied bedroom furniture to a hotel at Mount Bulla in Victoria. The benefits of this are not only new markets but also greater economies of scale in the manufacturing process — enabling the company to produce its products at lower cost.

Appendix B Structural change data

This appendix provides some of the background data on the industry structures of a selection of industrialised and industrialising countries discussed in chapter 3. A brief description of the structural change indexes used in chapter 3 is also provided along with a discussion of a number of pricing and productivity measurement issues.

B.1 Structural change index

The structural change index (SCI) is half the sum of the absolute value of the differences in value added shares over time (note: employment or turnover can also be used). The calculation is given by the formula:

$$SCI = 0.5 * \_ \text{ abs } [a_{i(t)} - a_{i(t-1)}]$$

where $a_{i(t)}$ is the percentage share of sector i in total value added at time t. The SCI is bounded between zero and 100, with zero representing no structural change while 100 indicates a complete reversal of structure (OECD 1994). Clearly the resulting numbers are influenced by the industrial classification chosen. A more disaggregated industrial classification results in the observation of a greater degree of structural change.

B.2 Current versus constant prices

The choice of whether to use current or constant prices when examining the changing share of GDP accounted for by manufacturing (or indeed any other sector) is not straightforward. Constant prices remove the impact of changes in relative prices and measure only the changes in volumes of output produced. An additional advantage of using constant prices is that adjustments are usually made for changes in the quality of products.

Current prices, on the other hand, incorporate a number of variables. They reflect the relative price changes across various industries, for example, falling prices in computers due to technological advances. Current prices also reflect differences in the productivity of one industry relative to another. For international comparisons we have used current price data because the availability of international constant price data for manufacturing *as a whole* is strictly limited, let alone at any level of disaggregation. Furthermore, current prices possess the strong intuitive appeal of being the prices in which the transactions actually take

place and changes in relative prices are an important determinant of structural change (OECD 1994).

As mentioned earlier, the share of GDP accounted for by manufacturing generally falls faster when current prices are used instead of constant prices. It is interesting to note that the share of Australia's GDP accounted for by manufacturing in constant prices varies greatly depending on *which year's* constant prices are used. In 1989-90 manufacturing accounted for 15 per cent of GDP in 1989-90 prices. But manufacturing accounted for approximately 21 per cent of GDP in 1989-90 *measured in 1968-69 prices*. This reflects the impact of re-basing the series to take into account the falls in the relative price of manufactured goods. This phenomenon is even more apparent with respect to the agricultural sector due to the large falls in the relative price of food over the course of this century. The share of total Australian output accounted for by agriculture in 1989-90 doubles when measured in constant 1968-69 prices.

Pricing issues also underlie the discussion of productivity growth rates versus productivity levels contained in appendix C. Productivity growth, by definition, must be measured in terms of constant prices — in other words, the impact of price changes are removed to allow the measurement of changes in 'real' output. While this is essential in measuring productivity growth, it means that movements in relative prices are ignored. But as noted above, changes in relative prices are important. The way that shifts in demand for various goods and services are signalled is via prices.

Moreover, as alluded to in appendix C, there are also a number of specific problems related to the measurement of productivity growth within the service sector. The effective measurement of productivity requires accurate data on both inputs and outputs. While the measurement of the output of the goods sectors is relatively straightforward, this is not necessarily the case with respect to some service industries — notably the Finance and insurance, Property and business services, Government administration and defence, Education, Health and community services and Personal and other services industries. Indeed, for the purposes of constructing the national accounts, the ABS derives estimates of output for these six industries either wholly or primarily from either deflated input cost data or hours worked. The ABS (1996e) notes:

> As such, the estimates cannot adequately reflect changes in productivity. For the purpose of measuring changes in productivity, it is therefore preferable that these industries be excluded.

Another difficulty with measuring changes in productivity in the service sector is the question of how to account for changes in the quality of service output.

Although the ABS usually makes allowance for improvements in the quality of goods, it generally does not do so in the case of services (Lowe 1995, p. 99). Lowe (1995) also observes that while deregulation of retailing during the 1980s resulted in increases in opening hours and employment, it is unlikely to have led to significant increases in the total volume of goods sold. Given the definition of productivity (the level of output per unit of input), despite improvements in technology as well as rationalisations in the industry, labour productivity is recorded as falling during the latter half of the 1980s. However, this result ignores the significant increase in the level of convenience provided by the industry, and hence, to many people's living standards (Lowe 1995, p. 94).

B.3 Structural change and per capita incomes

This section presents the industry structure data for a number of industrialised and industrialising countries discussed in chapter 3. Contained in table B1 are current price shares of GDP accounted for by the rural, manufacturing and service sectors of each economy for 1970 and 1993. The table also presents levels of GDP per capita relative to the US in 1970 and 1992. Figures B1 and B2 provide an indication of the relationships between the relative growth or decline in a country's manufacturing sector (measured as a share of GDP) and the degree of industrialisation and/or development of each country at the start of the period.

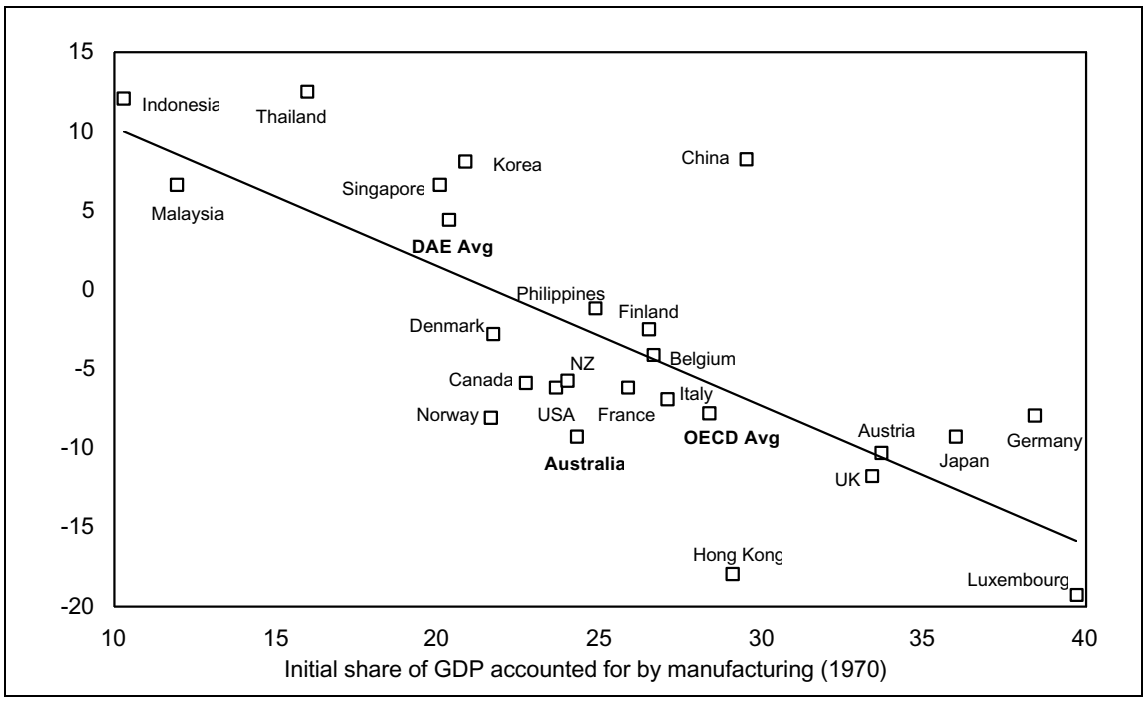
Table B1 Structural change and per capita incomes — selected countries, 1970 and 1993 (current prices)

	Share of GDP[a]						*GDP per capita relative to US*	
	Rural		*Manufacturing*		*Services*			
Country	*1970*	*1993*	*1970*	*1993*	*1970*	*1993*	*1970*	*1992*
Australia	**5.8**	**4.4**	**24.3**	**15.1**	**55.2**	**66.9**	**82.4**	**79.7**
Austria	6.9	2.3	33.7	23.4	47.8	63.6	57.3	73.2
Belgium	2.8	1.9	26.6	22.5	60.1	68.0	65.1	77.9
Canada	4.4	2.4	22.7	16.8	59.3	67.8	74.9	90.3
Denmark	6.5	3.5	21.7	18.9	58.9	69.3	76.6	80.7
Finland	12.3	5.2	26.5	24.0	47.8	63.2	61.9	67.3
France	4.8	2.3	25.9	19.8	59.8	69.8	71.3	78.5
West Germany	3.2	1.5	38.4	30.5	47.4	59.8	72.8	87.0
Italy	7.8	2.9	27.1	20.2	50.9	65.6	58.3	72.0
Japan	6.1	2.1	36.0	26.8	47.2	57.6	57.5	85.8
Luxembourg	3.5	1.2	39.7	20.5	47.4	70.3	81.5	91.1
New Zealand	11.8	7.4	23.6	17.5	55.3	66.6	72.2	66.8
Norway	5.6	2.9	21.6	13.5	62.4	62.4	60.4	73.6
United Kingdom	2.8	1.9	33.4	21.7	53.0	66.3	64.5	70.2
United States	2.8	2.0	24.0	18.3	62.8	71.1	100	100
OECD member average[b, c]	**5.8**	**2.9**	**28.3**	**20.6**	**54.4**	**65.9**	**70.4**	**79.6**
China	34.1	19.5	29.6	37.8	27.5	32.9	5.1	7.9
Hong Kong	1.8	0.2	29.1	11.2	62.2	81.6	32.6	90.6
Indonesia	44.9	17.9	10.3	22.3	36.4	42.4	4.8	11.2
South Korea[d]	26.0	7.1	20.8	28.9	44.8	49.5	12.8	42.1
Malaysia	28.5	19.4	11.9	18.5	46.2	45.1	15.8	31.0
Philippines	29.5	21.6	24.9	23.7	38.8	45.7	10.8	9.4
Singapore	2.3	0.2	20.0	26.7	67.9	64.1	24.2	72.1
Thailand	25.9	10.2	15.9	28.5	48.8	50.5	11.9	21.6
DAE average[c, e]	**24.1**	**12.0**	**20.3**	**24.7**	**46.6**	**51.5**	**14.8**	**35.7**

a The activities not listed here are mining, electricity, gas and water and construction. Data are for the years 1970 and 1993 except for the following countries. Belgium (1975 & 1990); Canada, Luxembourg, Norway and USA (1970 & 1991); France (1977 & 1993); West Germany (1970 & 1990); and New Zealand (1971 & 1993). **b** This is the average for the OECD members presented in this table. It is not a total OECD average as the member nations Greece, Ireland, Iceland, the Netherlands, Portugal, Spain, Sweden, Switzerland and Turkey are not included. **c** Unweighted average. **d** GDP per capita is for 1970 & 1991. **e** DAE average includes China but excludes Taiwan due to the lack of suitable data.

Sources: EconData Pty Ltd (1996) — World Bank World Tables and Penn World Tables.

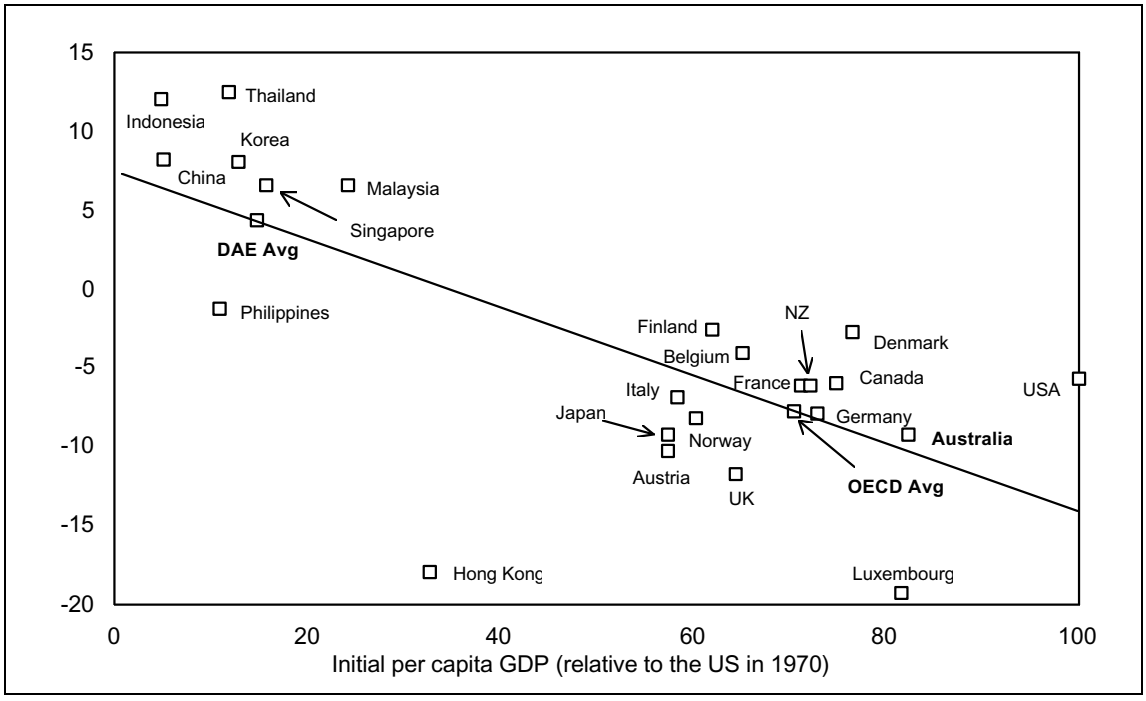
Figure B1 Changes in manufacturing share of GDP compared with initial shares[a]



a See notes for table B1.

Sources: EconData Pty Ltd (1996) — World Bank World Tables and Penn World Tables.

Figure B2 Changes in manufacturing share of GDP compared with income[a]



a See notes for table B1.

Sources: EconData Pty Ltd (1996) — World Bank World Tables and Penn World Tables.

Appendix C Comparative productivity measures for Australian sectors/industries

This appendix provides background information on a number of productivity measures for a selection of Australian sectors/industries which are dealt with elsewhere in the paper.

A comparison of total factor productivity (TFP) growth rates for Australian sectors and industries based on an OECD (1995c) study is presented in section C.1. The comparison covers the years 1973 to 1993 and two sub-periods. Estimates of relative productivity *levels* for various sectors/industries, based on ABS data, are reported in section C.2. Finally, a comparison of labour and capital productivity levels of a number of Australian sectors/industries relative to their OECD counterparts, drawing on a study by Dao et al (1993), is reported in section C.3.

C.1 Total factor productivity growth rates for Australian sectors/industries

The OECD TFP data set examined in chapter 3 provide estimates of TFP growth rates for a number of sectors/industries making up the Australian economy for the period 1973 to 1993. The data reported in table C1 cover aggregate outcomes for a number of ANZSIC divisions of the Australian economy, including agriculture, mining, manufacturing and a number of different service divisions. An estimate of aggregate service sector TFP growth is also provided for comparison (see notes to table C1).

Over the entire period, the agricultural and manufacturing sectors achieved TFP *growth* rates above the average for the economy as a whole. In contrast, the mining and service sectors recorded TFP growth rates below the economy-wide average. The results reported for the two sub-periods — 1973-83 and 1983-93 — indicate that the TFP growth rates recorded by the agricultural and mining sectors display sizeable variations over time relative to the other two sectors.

Within the service sector, there are marked variations in the TFP performance of different industries. The Transport, storage and communication and Electricity, gas and water industry groups recorded TFP growth rates well above the service

sector average and in excess of the average for manufacturing industries as a whole. In contrast, the other service industries recorded relatively low (and even negative) rates of TFP growth.

Table C1 A comparison of TFP growth rates for Australian sectors/industries — 1973 to 1993

Sector/industry	*Trend annual growth*		
	1973-83	*1983-93*	*1973-93*
Agriculture	0.8	1.8	1.6
Mining	-3.6	1.8	-0.4
Manufacturing	1.4	1.7	1.5
Services[a]	0.4	0.2	0.4
Electricity, gas and water	1.0	4.1	2.5
Construction	1.1	-1.6	-0.2
Wholesale and retail trade	0.5	-0.8	0.3
Transport, storage and communication	2.5	4.2	3.1
Finance, insurance and business services	-0.7	-0.5	-0.5
Community, social and personal services	0.0	-0.3	-0.3
Total industries[b]	**0.8**	**0.6**	**0.8**

a These figures are estimates based on a weighted average of the TFP growth estimates for the different industries making up the service sector for which data were available. **b** Consistent with OECD (1995c), the services' industry group 'Producers of government services' is excluded from these totals.

Source: OECD (1995c).

While industry level data for the manufacturing sector were not available from the database used to generate the growth rates reported in table C1, an analysis by Lattimore (1990) found sizeable variations in productivity performances also existed in manufacturing industries over a broadly similar time frame. The study found that overall productivity for the manufacturing sector grew by 1.6 per cent per annum over the period 1968-69 to 1988-89. Over the same period, three manufacturing industry groups — Textiles, Chemicals, petroleum and coal products and Clothing and footwear — recorded annual growth rates of 3 per cent or better, while three industry groups — Food, beverages and tobacco, Transport equipment and Wood, wood products and furniture — recorded growth rates of less than 1 per cent a year.

These results provide some indication of broad trends in longer-term productivity growth across sectors and industries. However, they need to be interpreted with some care as there are many sources of differences in productivity performance.

In addition, growth rates do not necessarily provide a good guide to future productivity gains. For example, the scope for technological advances varies across industries. For some industries, technical advances offer scope to achieve sizeable productivity improvements. For others, production techniques are more settled and/or less amenable to technological advances. In some industries, there may be scope to improve productivity relatively rapidly by closing sizeable gaps in the application of best practice production systems. [1]

Simply because an industry, or group of industries, has greater scope to achieve higher rates of productivity growth does not, of itself, make these industries superior to those with limited opportunities to raise productivity. In this context, it is important to recognise a distinction between productivity *growth rates* and productivity *levels*.

The OECD data used above relates to growth *rates* of TFP only. This means that a sector/industry which has recorded higher TFP growth over the period may not actually be more productive in terms of levels of productivity. For example, the sector/industry could have been highly unproductive at the start of the period and, hence, had greater scope for productivity gains than was possible in an already highly productive sector/industry. Hence, it is also desirable to examine changes in productivity levels over time.

C.2 Estimates of relative productivity levels for Australian sectors/industries

Drawing on data available from the ABS, estimates of relative productivity levels for the main sectors and some industries comprising the Australian economy are presented in table C2. The data, which are based on ASIC and ANZSIC divisions, cover averages for two five year time periods to lessen the impact of fluctuations between years. The productivity levels shown in the table are expressed as proportions of the average productivity level of all industries. As evident from

[1] There are a number of practical difficulties in measuring productivity performance, particularly in relation to service industries. These include difficulties in measuring outputs for some industries (notably services), accounting for changes in product quality, measuring capital inputs and distinguishing between apparent and real increases in productivity. These difficulties should condition inferences drawn about the significance of observed differences in productivity growth rates across industries/sectors. A number of studies provide a general treatment of these issues, see for example, Lattimore (1990) and Dao et al (1993). Specific difficulties in measuring outputs for the manufacturing and service sectors, and changes in the underlying quality of output for particular industries, are discussed in, for example, Lowe (1995) and ABS (1990b).

table C2, there are sizeable variations in the productivity levels between sectors/industries.

Table C2 Comparative productivity levels between Australian industries — 1970-71 to 1974-75 and 1990-91 to 1994-95[a]

	Overall relative productivity levels[b]	
ASIC/ANZSIC division	*1970-71 to 1974-75*	*1990-91 to 1994-95*
Agriculture	0.88	0.85
Mining	1.19	1.44
Manufacturing	1.02	1.10
Electricity, gas and water	0.88	1.00
Construction	1.98	1.62
Wholesale and retail trade	1.41	1.48
Wholesale trade	na	1.77
Retail trade	na	1.12
Transport, storage and communication	1.10	0.93
Finance, property and business services	1.39	0.99
Finance and insurance	na	0.95
Property and business services	na	1.01

a Data limitations precluded reporting results for a number of divisions including the Accommodation, cafes and restaurants, Government administration and defence, Education, Health and community services, Cultural and recreational services and Personal and other services divisions. The data presented for the period 1970-71 to 1974-75 are classified according to the ASIC, whereas the data for the period 1990-91 to 1994-95 are presented according to the ANZSIC. However, to assist comparisons, the data for the latter period have been aggregated where appropriate to provide broadly comparable estimates to the ASIC data for the earlier period. **b** These data represent estimates of the relative two-factor productivity levels for each ASIC/ANZSIC division. The data are weighted averages of the estimated relative labour and capital productivity levels for each division. The weights used in the calculation were derived from divisional average factor income shares for the periods 1970-71 to 1974-75 and 1990-91 to 1994-95. Values greater than one suggest that the productivity levels of the division are high relative to the level of productivity for the economy overall. **na** Not available.

Sources: ABS Cat. Nos 5206.0, 5204.0, 5221.0, 6203.0 and RBA (1991) .

Over the 1970-71 to 1974-75 period, the Mining, Manufacturing, Construction, Wholesale and retail trade, Transport, storage and communication and Finance, property and business services divisions recorded relatively high weighted average two-factor productivity levels. In contrast, the Agriculture and Electricity, gas and water divisions recorded relatively low levels of overall productivity. In the latter period, the Mining, Manufacturing, Construction, Wholesale and retail trade and Property and business services ANZSIC divisions registered productivity levels above the average for the economy overall.

Drawing on the information presented in tables C1 and C2, it is apparent that manufacturing has not been an outstanding performer. Nevertheless, it has exhibited above average overall productivity growth over the past two decades

and has also registered above average overall productivity levels in the two periods examined.

C.3 Australian labour and capital productivity levels relative to the OECD

The estimates presented in table C3 compare the labour and capital productivity levels of a number of Australian sectors/industries with those of other OECD countries for the periods 1970-73 and 1984-87. It is apparent that although Australia's business sector as a whole recorded lower levels of labour and capital productivity than the OECD average, Australia's rural sector generally recorded above average relative productivity levels (table C3). Mining recorded an above average performance in terms of its capital productivity in the latter period.

Table C3 Productivity levels in Australian sectors/industries compared with the OECD average[a]

	1970-73	*1984-87*
Labour productivity		
Rural	1.17	1.19
Mining	0.60	0.84
Manufacturing	0.88	0.79
Electricity, gas and water	0.42	0.48
Construction	0.80	1.12
Wholesale and retail trade	0.90	0.83
Transport, storage and communication	0.60	0.73
Finance	0.84	0.82
Business sector	**0.89**	**0.90**
Capital productivity		
Rural	0.85	1.20
Mining	0.77	1.07
Manufacturing	0.82	0.75
Electricity, gas and water	0.36	0.53
Construction	0.76	0.79
Wholesale and retail trade	0.81	0.74
Transport, storage and communication	0.53	0.82
Finance	0.66	0.58
Business sector	**0.82**	**0.83**

a Comparative productivity levels were calculated by dividing the productivity level of each Australian sector/industry by the sector/industry weighted average productivity level of selected OECD countries. Values greater than one indicate that the productivity level of the Australian sector/industry is greater than the weighted average OECD sector/industry productivity level.

Source: Dao *et al* (1993), table 10.

The data also reveal that in the latter period, Australia's business sector labour and capital productivity levels were 90 and 83 per cent of the OECD average respectively — little changed from the comparable estimates for the early 1970s. For the 1984-87 period, manufacturing registered labour and capital productivity levels of 79 and 75 per cent respectively of the average for manufacturing in OECD countries. These results suggest that there is considerable scope for Australia's manufacturing industries to further improve their productivity performance.

Appendix D Measuring manufactured exports

The existence of different statistical systems for reporting domestic and external variables makes it difficult to present compatible and consistent data for say, production and trade. A recent paper by the Institute of Industrial Technologies in the Commonwealth Scientific and Industrial Research Organisation (CSIRO 1995) recently looked at the implications of these different systems for the measurement of manufactured exports. This appendix draws heavily on that paper.

The ANZSIC system

Data on most domestic indicators (production, employment and investment etc) for the manufacturing sector are published by the ABS according to the Australian and New Zealand Standard Industrial Classification (ANZSIC). ANZSIC was introduced in 1993 to replace the earlier ASIC (Australian Standard Industry Classification) and its New Zealand equivalent. ANSZIC (and the older ASIC) are aligned with the International Standard Classification of all Economic Activities (ISIC), Revision 3, thus allowing comparability between Australian and international data. As discussed in chapter 2, the ANZSIC is a hierarchical system with seventeen major divisions. The manufacturing division involves nine sub-divisions, forty-six groups and one hundred and fifty-three classes. It is designed to classify businesses according to their predominant activity.

Other systems

Australian trade data on the other hand are generally reported by the ABS according to the United Nation's Standard International Trade Classification (SITC — third revision). SITC is commodity-based, not business-based like the ANZSIC. It is also a hierarchical system but with a much finer level of detail than is available under ANZSIC. For example, at the finest level (five digit) the SITC has many thousands of specified commodities.

The single-digit level SITC system is reproduced in figure D1. By convention, the manufacturing sector is generally defined as SITC 5 to 8 inclusive. Nonetheless different organisations tend to use variants of the SITC 5 to 8 rule. For example Treasury publications remove SITC codes 67 and 68 (iron and steel and non-ferrous metals) from their definition of manufactured exports. The

OECD adds gold exports to SITC 5 to 8 for its measure of manufactured exports (OECD 1996).

Figure D1 Manufactured exports under the Standard International Trade Classification (SITC)

SITC code	Description	
0	Food and live animals	
1	Beverages and tobacco	
2	Crude materials, inedible, except fuels	
3	Mineral fuels, lubricants and related materials	
4	Animal and vegetable oils, fats and waxes	
5	Chemical and related products	
6	Manufactured goods classified chiefly by material	
7	Machinery and transport equipment	**= Manufacturing**
8	Miscellaneous manufactured articles	
9	Commodities and transactions not elsewhere classified in SITC	

Source: CSIRO (1995)

Another commonly cited source of manufactured trade data is the Trade Exports Classification (TREC) system maintained by the Department of Foreign Affairs and Trade (DFAT). These data are derived from SITC (revision three) data through a concordance developed by DFAT. This concordance essentially regroups SITC 5 to 8 into simply transformed and elaborately transformed manufactures (DFAT 1995). Further analysis of these data is contained in appendix E.

Reconciling the different systems

Although ANZSIC is primarily a domestic-based system, it can be used for reporting manufactured trade data. ANZSIC-based trade data are compiled by a concordance that links SITC data on exports of commodities to establishments in the manufacturing sector at the 5-digit SITC and 4-digit ANZSIC level. These concorded ANZSIC-based manufacturing trade data have been extensively used in the past by the former BIE for its regular analysis of manufactured exports. [1] These data allow the user to directly compare manufacturing exports data with domestic variables without the compatibility problems that arise through the use of the two different statistical classifications.

[1] For example, see BIE (1996a).

Appendix E Recent trends in Australia's exports of ETMs

The recent very strong growth in exports of elaborately transformed manufactures (ETMs) is often said to be one of Australia's economic success stories of the past decade. But in many ways our ETM exports remain a mystery. It is now well known that they are growing rapidly, but beyond this very little work has been undertaken on this sub-set of Australia's trade in manufactures. This appendix addresses at least part of that problem by examining some of the features of the recent growth in ETM exports. As outlined in appendix D, the ETM classification was developed by DFAT as part of their efforts to monitor trends in Australia's trade. ETMs are defined by DFAT as those products with unique features which permit their identification as differentiated products in world markets. In more simple terms they can be considered as complex products where a higher proportion of their value is derived from transformation by the manufacturing sector.

Nevertheless ETMs are not always final or finished products at the end of the transformation process such as computers and motor vehicles. Like the much wider set of manufactured exports, ETMs comprise a whole range of products across the transformation spectrum (table E1).

Table E1 Australia's exports of ETMs (Australian-produce, current prices)

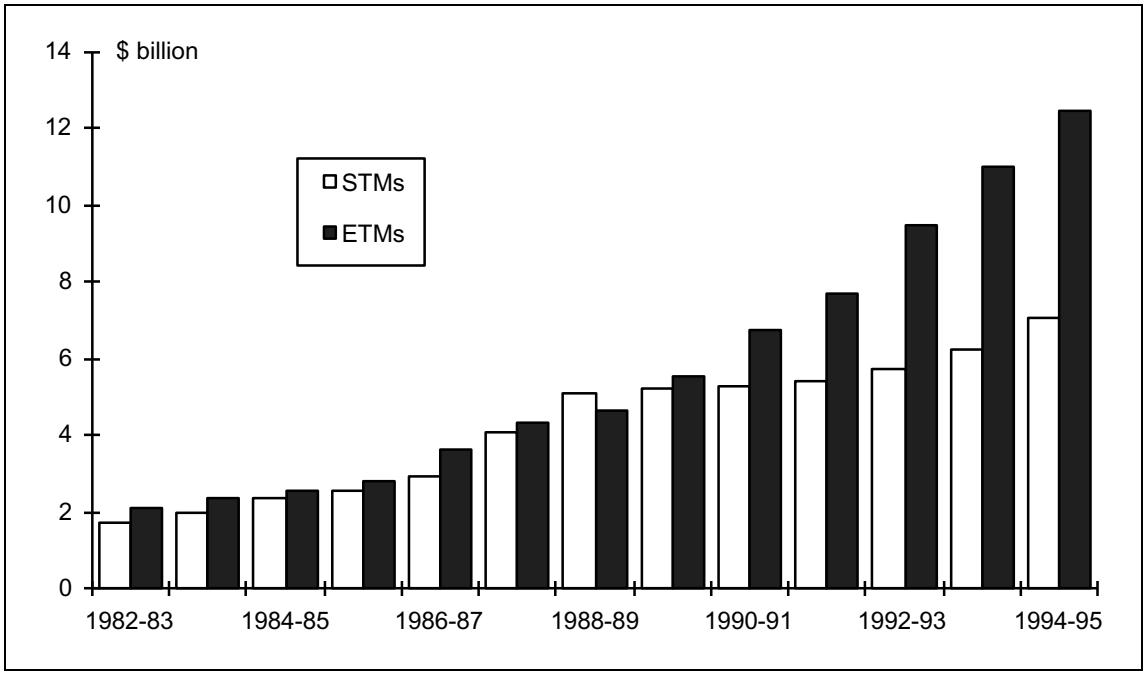
Category	*Value 1994-95 ($m)*	*Share 1994-95 (%)*	*Trend annual growth 1984-85 to 1994-95 (%)*	*Contribution to growth 1984-85 to1994-95 (%)*
Non-metallic mineral manufactures	136	1.1	18.5	1.2
Iron and steel	775	6.2	10.0	5.1
Non-ferrous metal manufactures	790	6.3	13.1	5.7
Chemicals and chemical preparations	1 639	13.1	17.6	13.4
Other semi-manufactures	267	2.1	21.5	2.4
Machinery for specialised industries	1 597	12.8	17.3	13.2
Office and telecommunications equipment	1 399	11.2	28.6	13.1
Road motor vehicles and parts	915	7.3	14.9	6.7
Other machinery and transport equipment	2 974	23.8	16.2	23.9
Household equipment	554	4.4	9.7	3.6
Textile fabrics and made-up articles	336	2.7	16.3	2.8
Clothing and footwear	276	2.2	26.3	2.6
Miscellaneous manufactured articles	835	6.7	13.5	6.3
Total ETMs	**12 494**	**100.0**	**16.2**	**100.0**

Source: DFAT (1995).

For example, many intermediate or unfinished goods such as fabricated steel products like wire rods, iron and steel castings and paints and varnishes are also classified as ETMs. In fact, about one-third of our ETM exports in 1994-95 can be said to be unfinished goods at the lower end of the ETM spectrum.

Australia exported $2.6 billion (current price, Australian produce data) of ETMs in 1984-85, but a decade latter, in 1994-95, this figure was $12.5 billion (figure E1). This translates to an impressive trend rate of growth of 16.2 per cent a year over the decade. This is much faster than the trend annual growth of 10.7 per cent in STMs over the same period. Despite this recent strong growth, we shouldn't expect to see exports of ETMs overtake our imports of ETMs in the near future. In 1994-95 Australia's total imports of ETMs exceeded our total exports of ETMs by about $41 billion.

Figure E1 Australia's ETM and STM exports — 1982-83 to 1994-95



Source: DFAT (1995).

More detailed data on the thirteen different ETM categories reported in table E1 shed additional light on those products which have been driving the recent growth in Australia's ETM exports. Approximately one-quarter of the ETM export growth over the last decade was accounted for by the Other machinery and transport equipment category (table E1). This includes products like internal combustion engines, industrial machinery, passenger motor vehicle parts and components for aircraft parts. A further 40 per cent of the overall growth was contributed by the Chemicals and chemical preparations (products like paints, varnishes, vitamins, soaps and explosives), Machinery for specialised industries

(products like agricultural machinery, food processing machines, metal working equipment and pumps and compressors) and the Office and telecommunications equipment and parts (products like computers, telephones and televisions) categories. The Office and telecommunications category posted the fastest trend annual growth (28.6 per cent) over the period.

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