TRADE LIBERALISATION AND EARNINGS DISTRIBUTION IN AUSTRALIA

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PREFACE

The paper was researched and written by Greg Murtough, Kate Pearson and Peter Wreford. Dr John Salerian, Assistant Commissioner of the Economic Projects Branch of the Commission, supervised the project. Comments from Professor Richard Snape of the Industry Commission and Dr Jeff Borland of the Centre for Economic Policy Research, Australian National University are gratefully acknowledged. The authors also wish to thank Dr Patrick Jomini of the Industry Commission and Professor Brian Parmenter of the Centre of Policy Studies for their assistance with the interpretation of the Monash model results in chapter 4.

ABBREVIATIONS AND EXPLANATIONS

Abbreviations

ABS	Australian Bureau of Statistics
ANZSIC	Australia New Zealand Standard Industrial Classification
ASCO	Australian Standard Classification of Occupations
ASIC	Australian Standard Industrial Classification
FBT	Food, beverages and tobacco
fob	Free on board
GBEs	Government business enterprises
GDP	Gross domestic product
GNE	Gross national expenditure
IC	Industry Commission
OECD	Organisation for Economic Cooperation and Development
TCF	Textiles, clothing and footwear

Explanations

Billion	The convention used for a billion is a thousand million (10^9).

SUMMARY

Is there a link between trade liberalisation and earnings inequality and/or unemployment in Australia?

This paper investigates whether trade liberalisation by Australia has reduced the wages and/or employment of low skill workers relative to other employees. The reduction in trade barriers since the mid 1980s coincided with a period of growing inequality in the distribution of earnings from employment. However, such a coincidence of events does not prove causation.

Import prices of manufactures have declined since 1984-85 but indexes of prices of import competing goods made in Australia have been stable, possibly reflecting measurement problems.

Increased import competition from low skill labour intensive goods may be expected to reduce the relative prices of such goods in Australia. It was found that between 1984-85 and 1995-96, the prices of imported manufactured goods fell. However, the relative producer prices of import competing goods made in Australia were stable. This result needs to be heavily qualified because it may reflect measurement problems with the price indexes.

While wage relativities between skill groups have been stable, trade effects could have emerged via employment changes.

Earnings data suggest that wage relativities between full-time employees in different skill groups have been stable since the mid 1980s, even in those industries for which protection has been reduced significantly. This result also needs to be qualified because of measurement problems. Labour market conditions may have caused trade effects to emerge via changes in employment rather than wages.

Calculations based on labour-output ratios suggest that low wage imports have had a small impact on total manufacturing employment.

The employment effects of increased imports between 1986-87 and 1993-94 were estimated using labour-output ratios. The results suggest that the fall in employment associated with increased low wage imports was outweighed by the increase in jobs associated with greater exports. However, low wage imports were associated with large employment falls in the Textiles, clothing and footwear industries. The results of this analysis should be

interpreted with caution because they are purely accounting calculations based on fixed labour-output ratios and do not incorporate the effects of changed prices, wages, and producer and consumer responses. In addition, they provide little guidance on the extent to which increased imports and import related employment changes were caused by Australia's reduction in trade barriers.

Estimates from the Monash model of the Australian economy indicate that changes in assistance had a negligible impact on aggregate employment.

Some of the above problems were overcome by using the Monash model of the Australian economy (in 'historical mode'). The results indicate that between 1986-87 and 1993-94, the number of hours worked in manufacturing would have fallen by 12.7 per cent if total Australian labour supply and employment had not grown over that period. Only about one-tenth (or 1.4 per cent) of this fall in manufacturing hours worked was estimated to have been caused by changes in industry assistance (which includes tariffs). About a quarter (or 3.2 per cent) was attributed to changes in technology across the economy which reduced the use of manufactured inputs and labour per unit of output. Around one-third (or 4.4 per cent) of the estimated employment decline was linked to shifts in preferences between imports and domestic products not attributable to changes in relative prices. It is possible that some of this change was associated with the removal of quantitative import restrictions.

The results imply that trade barrier reductions had little effect on the employment of low skill workers at an economy-wide level.

The estimated changes in the distribution of employment between industries would have reduced the number of hours worked in some occupations if total Australian labour supply and employment had not grown between 1986-87 and 1993-94. There would have been a decline in hours worked by tradespersons (of 3.6 per cent), plant and machine operators and drivers (of 8.8 per cent) and labourers and related workers (of 1.8 per cent). No more than one-twentieth of these occupational changes were attributed to reduced assistance. Among the major factors contributing to the changes in employment

were shifts in international trading conditions for primary commodities and technical change which favoured greater use of high skill labour. The extent to which the technical change is attributable to import competition is unclear.

Reductions in assistance for the Textiles, clothing and footwear, and Motor vehicles and parts industries had little impact on the economy-wide distribution of employment between occupations.

The relatively large reductions in assistance for the Textiles, clothing and footwear, and Motor vehicles and parts industries had little impact on the economy-wide distribution of employment between occupations. Those industries account for only a small part of total Australian employment and so changes in their levels of assistance tend to have little impact at an economy-wide level. Between 1986-87 and 1993-94, the greatest employment shifts were associated with changes in service industries.

In summary, none of the analytical approaches used in this paper provides strong support for the claim that trade liberalisation has increased earnings inequality or unemployment in Australia. Other factors appear to be more significant.

In summary, none of the analytical approaches used in this paper provides strong support for the claim that reduced trade barriers have increased Australia's earnings inequality or unemployment. What the results do suggest is that the employment effects of lower trade barriers have been overshadowed by other developments. The industries for which protection has fallen significantly since the early 1980s account for only a small share of total Australian employment. Where large protection reductions did occur, such as for the Textiles, clothing and footwear industries, they were only one of a number of (often larger) forces affecting employment. It therefore appears that the reasons for Australia's growing earnings inequality and its unemployment are not significantly attributable to the reduction in trade barriers by Australia.

A policy implication is that industry assistance is

A policy implication of this paper is that there is no clear indication that reductions in assistance have

of little use in preventing unemployment in particular income groups or occupations and even, in the longer term, in particular industries.

been more than a minor element in changes in employment or earnings in Australia. If one of the objectives of previous industry assistance programs was to increase aggregate employment or reduce earnings inequality then it is unlikely that they have been of much value. Even at the industry level, substantial increases in assistance in the decade up to the mid 1980s failed to reverse a long term decline in employment in the Textiles, clothing and footwear industries. The impotence of even very high levels of assistance as a means of maintaining employment in particular occupations or industries highlights the significance of the structural changes occurring in the Australian economy which are not directly related to industry assistance.

1 INTRODUCTION

This paper tests the hypothesis that trade liberalisation by Australia has suppressed the wages and/or employment of its low skill workers relative to other employees. Various studies have found that the distribution of earnings from employment has become more unequal in Australia over the past decade and a half (see for example Gregory 1993; IC 1995c; Borland and Wilkins 1996; Harding 1996). However, researchers have yet to identify clearly the economic forces driving this change. One hypothesis is that there is a causative link between the fall in trade barriers for low skill labour intensive products and the declining relative wages and/or employment of workers earning low incomes.

Identifying whether trade liberalisation has caused an increase in earnings inequality is important for three reasons. First, it is important to know the consequences of reducing trade barriers. Second, uncertainty about the effects of reducing trade barriers creates resistance to further policy reform even if such reform benefits Australia as a whole. Knowledge about the incidence of the benefits of reform may help to devise strategies, if they are judged appropriate, for alleviating adverse effects on particular groups. Third, and related to the second point, understanding how the Australian labour market has adjusted to reductions in tariffs may provide guidance to policy makers about how best to manage future changes in industry protection and labour market regulation.

This chapter examines relevant developments in Australian economic policy and earnings distribution and specifies the conceptual framework used in this paper. The following chapter examines whether Australian wage, employment and trade data provide prima facie evidence that trade liberalisation is increasing earnings inequality. The results of this analysis are investigated further in chapters 3 and 4 using an input–output structural decomposition and a computable general equilibrium model. This enables the distributional effects of trade to be estimated relative to the impacts of other factors, such as technical change. The final chapter discusses the main findings of this paper and their policy implications.

1.1 The evolution of Australian trade and labour market policy

The hypothesis that trade barriers can raise wages was an important influence on the formulation of Australian trade policy from the early years of Federation

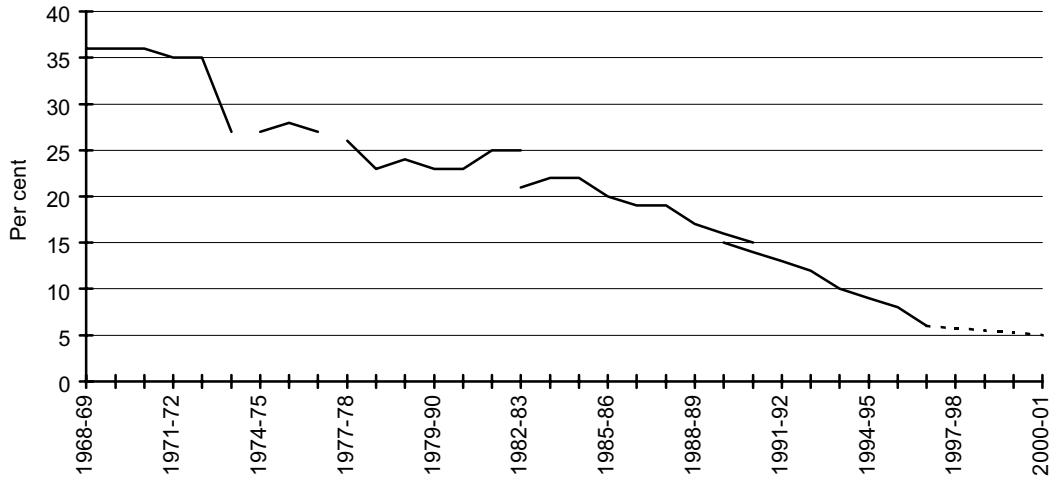
until the 1970s (Pincus 1995). During that period there was a widespread belief that Australia needed to attract more migrants and that this could be achieved by using protection to raise wages in the manufacturing sector. This logic was evident in the Brigden Report of 1929, an inquiry into tariff policy commissioned by the Australian government. It argued that protection supported the maintenance of a larger population than would otherwise be possible. It was recognised by the Brigden Report and others that protection imposed certain costs on the economy but it was argued that these were outweighed by the benefits of a larger population and more diverse economy. Nevertheless, the Brigden Report argued against increasing tariffs above their 1929 level.

In essence, Australia's economic strategy prior to the 1980s was to redistribute income earned by its prosperous export industries (agriculture and mining), which were generally land and capital intensive operations, to the more labour intensive manufacturing sector. A feature of the economic strategy was a system of centralised wage fixation which was supposed to ensure that the gains to domestic manufacturers from protection were shared with their employees.

By the early 1970s, Australia had one of the most highly protected economies in the OECD and there was growing evidence about the costs this imposed on the country as a whole. Policy makers increasingly questioned whether the combination of protection and a highly regulated labour market sustained high real wages and employment. A turning point came in 1973, when the government reduced tariffs by 25 per cent in order to alleviate inflationary pressures (BIE 1996). While this reduction in trade barriers was reversed the following year for some industries, the average rate of effective assistance for manufacturing never returned to its level of the late 1960s (figure 1.1).

A further impetus for change came in the 1980s when it appeared that primary commodity prices were generally in long term decline in international markets. This meant that Australia's de facto policy of taxing its agriculture and mining exports to support its import competing manufacturing sector had become less sustainable. The government responded by announcing a program of general tariff reductions in its May 1988 Economic Statement and announced further falls in protection in its March 1991 Industry Policy Statement (IC 1995a). As a result, the average rate of effective assistance for manufacturing will decline to 5 per cent by 2000-01. Nevertheless, relatively high rates of assistance will remain for passenger motor vehicle and textiles, clothing and footwear (TCF) manufacturing. These industries, particularly TCF, tend to be intensive users of relatively low skill labour.

Figure 1.1 **Average effective rate of assistance to Australian manufacturing**[a]



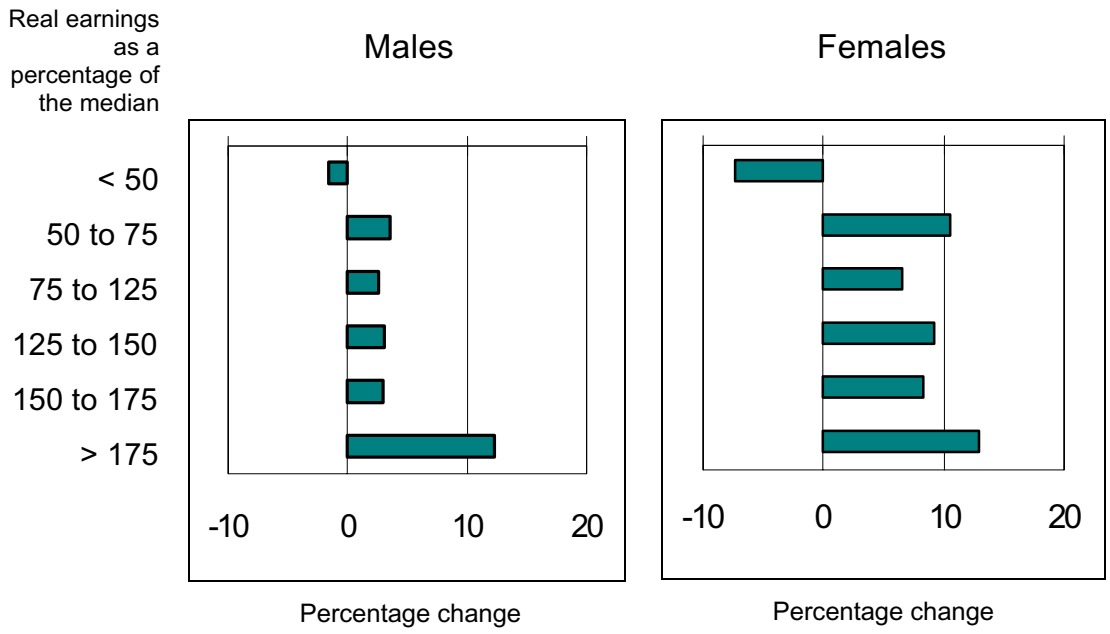
[a] The effective rate of assistance is the percentage increase in returns to an industry's value added per unit of output relative to the hypothetical situation of no government assistance. This takes account of the subsidy effect of assistance on an industry's output and the tax effect of assistance on its inputs. The term assistance covers measures such as tariffs, import quotas, tax concessions and export incentives. Breaks in the series are due to changes in the method of calculation.
Data source: IC (1995a).

1.2 Changes in the distribution of earnings from employment

Various studies have analysed changes in the distribution of earnings from employment in Australia (see for example Gregory 1993; Harding 1996; Borland and Wilkins 1996; and IC 1995c). Specific results differ between studies because different data and time periods were analysed. Nevertheless, the general consensus of recent research is that the distribution of earnings from full-time employment has become more unequal and that this trend is most evident for male workers.

Harding (1996) provides some of the most recent evidence on the trends in earnings inequality among employed persons in Australia. That study found that between 1981-82 and 1993-94 there was a decrease in the real earnings of full-time employees who earned less than 25 per cent of the real full-time median earnings for their gender. In contrast, real earnings increased for most full-time employees and by the greatest amount at the upper end of the earnings distribution (figure 1.2).

Figure 1.2 **Change in real earnings of full-time employees at various percentages of median earnings, 1981-82 to 1993-94**

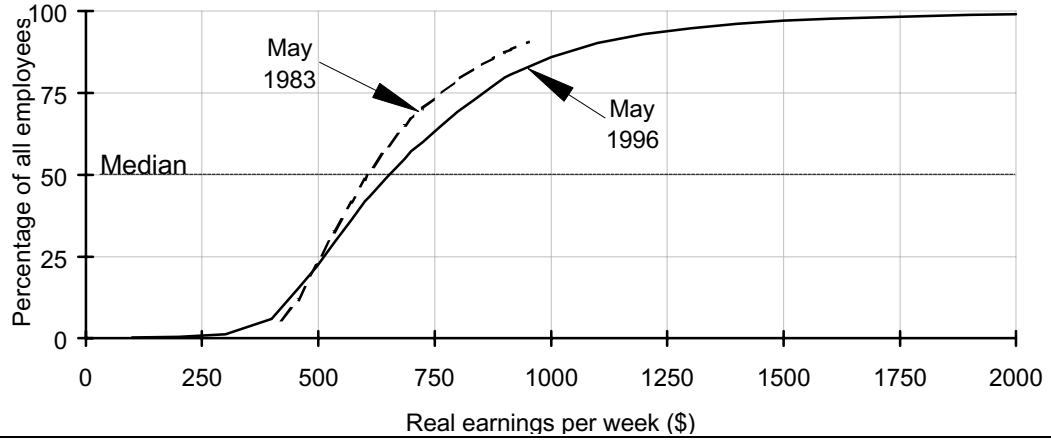


Source: Harding (1996).

A longer term analysis by Borland and Wilkins (1996) found that earnings inequality has not grown at a uniform rate over time. That study found that between 1975 and 1982, there was an increase in earnings dispersion for full-time male employees because real earnings fell in the bottom half of the distribution. In contrast, between 1990 and 1994, earnings inequality increased because real earnings grew by the greatest rate for those on very high incomes. For full-time female employees, earnings dispersion increased between 1975 and 1982 because real earnings growth tended to be less for those on low incomes. Between 1982 and 1994, the earnings distribution became more equal for full-time female employees because earnings grew relatively rapidly at the bottom end of the distribution.

Gregory (1993) found that job growth has been biased against full-time male employees and the growth that did occur between 1976 and 1990 occurred at the top and bottom of the earnings distribution. Harding found that there was a 'hollowing out' of the middle of the earnings distribution. For all wage and salary earners (including part-time workers) she found that there was a decline in the proportion of employees whose real earnings were close to the median between 1981-82 and 1993-94. More recent data suggests that this trend continued after 1993-94 (figure 1.3).

Figure 1.3 **Cumulative distribution of real total weekly earnings for full-time employees, 1983 and 1996**[a]



[a] Earnings for 1983 are converted to 1996 dollars using the consumer price index for the June quarter.
Data source: ABS (*Distribution and Composition of Employee Earnings and Hours*, Cat. no. 6306.0); ABS (*Consumer Price Index,* Cat. no. 6401.0).

Growth in the relative importance of part-time employees makes it desirable to examine changes in the earnings distribution of such workers. Harding (1996) found that inequality among part-time workers increased for females between 1981-82 and 1993-94 but decreased for males. This result needs to be qualified because it is difficult to distinguish between shifts in hours worked and hourly wage rates for part-time employees on the basis of available statistics (Borland and Wilkins 1996). Nevertheless, Harding found that earnings inequality for all male employees (full and part-time combined) increased between 1981-82 and 1993-94 despite the decline in earnings inequality for part-time males.

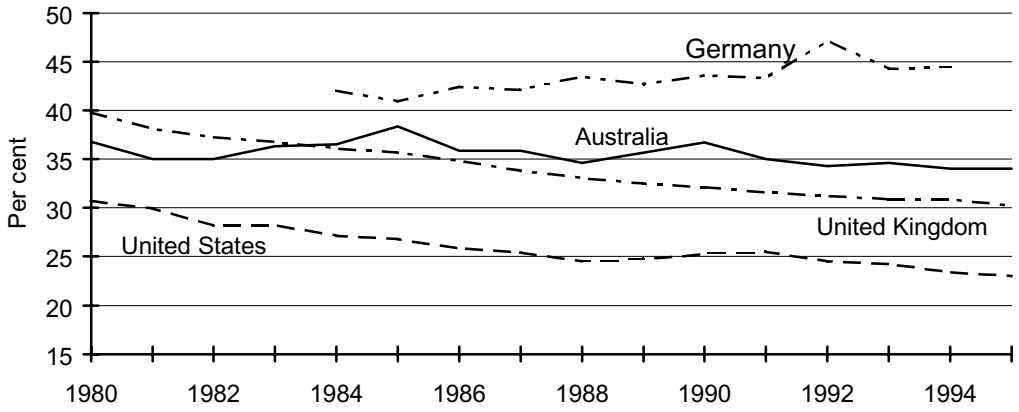
The rise in Australia's earnings inequality appears to be less significant than that experienced by the United Kingdom and the United States but it is larger than the changes experienced by some other OECD economies (figure 1.4). In particular, earnings inequality appears to have decreased in Canada, Finland and Germany since the mid 1980s (OECD 1996).

Earnings structure and the composition of employment

The increase in Australian earnings inequality could reflect shifts in earnings relativities between different categories of workers (the structure of earnings) and the relative importance of those worker categories in total employment. However, past research suggests that changes in earnings relativities and labour force composition between workers categorised exclusively by their education,

experience or occupation do not explain the growth in Australian earnings inequality.

Figure 1.4 **Earnings of low income males as a proportion of earnings for high income males**[a]



[a] Ratio of the upper bound of earnings for the first decile to the upper bound of earnings for ninth decile. The deciles are ranked from the lowest 10 per cent of all earnings (decile 1) to the highest 10 per cent (decile 10). The earnings data are for full-time male employees.
Data source: Commission estimates based on data in OECD (1996).

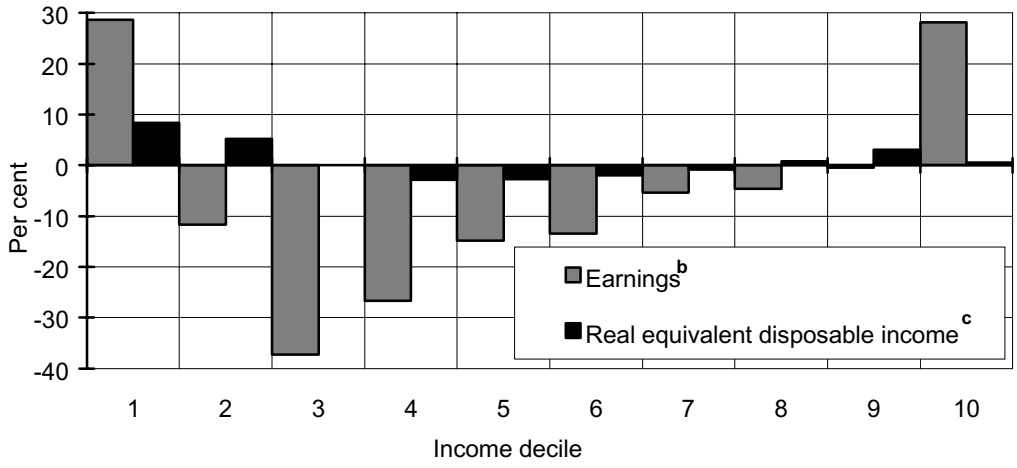
Borland and Wilkins (1996) found that changes related to education and experience reduced earnings inequality in Australia between 1982 and 1990. Using the technique of variance decomposition, they estimated that changes in earnings relativities between full-time employees with different levels of experience and education had the effect of reducing earnings dispersion and that this outweighed a slight increase in earnings inequality caused by the relative decline in the number of less educated workers. This led Borland and Wilkins to conclude that much of the observed increase in Australia's earnings inequality was due to factors other than education and experience.

An alternative categorisation based solely on occupations also appears to be less than satisfactory in explaining Australia's growth in earnings inequality. In an analysis of full-time male workers, Gregory (1993) found that the employment-population ratio for low and middle pay occupations declined between 1976 and 1990. This led Gregory to conclude that employment growth at low weekly earnings could not be explained by employment growth in low pay occupations and as a result employment declines at middle level earnings could not be explained by employment declines in middle pay occupations. Gregory argued that most of the change in earnings inequality must have occurred within rather than between occupations between 1976 and 1990.

Earnings distribution and welfare

This paper focuses on the distribution of earnings of employees because the hypothesis being examined is that imports have had a disproportionate effect on the wages and/or employment of low skill workers. Nevertheless, it is important to note that increases in earnings inequality may not lead to corresponding changes in the well-being of individuals. For the purpose of welfare analysis, it is more appropriate to study the distribution of individual earnings from all sources adjusted for the combined income of the relevant individual's household, the number of adults and children it contains, and the net government benefits it receives. These adjustments produce a measure known as *equivalent disposable income*, which enables meaningful comparisons between individuals in different types of households. Harding (1996) found that differences in the growth of equivalent disposable income within the income distribution have been less pronounced than that for earnings (figure 1.5). She argued that changes in the tax transfer system (particularly income tax) played a significant role in this outcome.

Figure 1.5 **Change in the real income of Australians from 1981-82 to 1993-94, by income decile**[a]



[a] A decile represents 10 per cent of all individuals. The deciles are ranked from the least affluent 10 per cent of all individuals (decile 1) on the basis of their equivalent disposable income to the most affluent 10 per cent (decile 10). [b] Earnings from employment. Excludes self employed workers. [c] Equivalent disposable income is calculated for individuals by adjusting the combined disposable income of their household by its number of children and adults and the net government benefits it receives. This adjustment is made using the simplified Henderson equivalence scales.

Source: Harding (1996).

1.3 Conceptual framework

The above discussion indicates that the reduction in import barriers in Australia since the mid 1980s coincided with a period of increasing earnings inequality. However, such a coincidence of events does not prove causation.

Formal empirical studies are useful in establishing whether there is a probable link between trade liberalisation and earnings inequality. However, there is disagreement among economists about the appropriate conceptual framework and quantitative technique to use (Burtless 1995; Freeman 1995). The options can be broadly divided into three groups. These are regression analysis, techniques which focus on changes in quantities and composition of trade, and those which are based on general equilibrium analysis. There are strengths and weaknesses in all approaches. Their use in past studies, most notably for the United States, has tended to support the same conclusion that trade has not been the primary cause of increased earnings inequality (Freeman 1995). This section reviews the different approaches and the results they have produced.

Quantity based approaches

One method of analysis is to examine the labour-output ratios of exports and import competing goods and through this the extent to which changing imports and exports have altered the net 'demand' for labour. The estimated net impact on the demand for each type of labour can then be used to infer how trade affects relative wages (Burtless 1995). This approach is commonly referred to as factor content analysis because it uses estimates of the factors (low and high skill labour) embodied in trade to calculate changes in labour 'demands'. A more comprehensive variant of the quantity approach, known as input–output analysis, calculates changes in labour 'demands' associated with changes in trade, domestic final demand, intermediate input use and labour productivity. Results from previous research using both factor content and input–output techniques are briefly reviewed below. Most of this research has been for the United States.

Factor content analysis

For the United States, the majority of factor content analyses have found that trade has had only a minor effect on the demand for unskilled labour. For example, Borjas, Freeman and Katz (1992), Sachs and Schatz (1994) and Cooper (1994) all concluded that the effect of trade on the demand for unskilled workers was minor. Most factor content studies indicate that trade accounted for less than 20 per cent of the drop in demand for unskilled workers (Freeman 1995). Using factor content analysis, trade is found to have only a small effect

on the demand for unskilled workers because only a small share of total employment is in commodities that are being exported or are import competing.

Sachs and Schatz (1994) analysed US trade with less developed countries between 1978 and 1990 and found that increased import penetration could account for only a modest amount of reduced manufacturing employment. The increase in net imports from developing countries between 1978 and 1990 was associated with a 6 per cent decline in this trade related manufacturing employment. This decline was more sharply felt in production manufacturing jobs than non-production manufacturing jobs (declines of 6 per cent and 4 per cent respectively). The authors noted that since production jobs, overall, are less highly skilled than non-production jobs, this is likely to have an adverse impact on unskilled workers.

Wood (1994) argued that standard factor content analyses understate the effect of trade on unskilled labour for three reasons. First, unskilled labour may be used more intensively in the domestic replacement of imports than in the domestic production of different goods in the same sector. Second, labour shedding may be due to productivity increases in response to import competition. Third, most studies ignore the impact of trade in services on incomes and employment. Wood undertook a factor content analysis of US data for 1990 with adjustments to overcome the deficiencies he identified in past studies. He concluded that trade was chiefly responsible for the drop in demand for unskilled labour in the United States. However, Wood's adjustments are controversial. Many economists argue that his estimates of the effect of trade on unskilled labour demand are overstated (Flanders and Wolf 1995).

Input output studies

Most economies publish input–output tables which document how each industry's production is utilised as an input into other industries and consumed in final demand and exports. They also document how imports are used as inputs and in domestic final consumption. National accounting identities can be used to manipulate this information in order to calculate how trade and other factors interact with employment (OECD 1992). The concept is broadly similar to factor content analysis because the quantity of exports and imports is used to estimate the net impact of trade on labour used in the production of traded goods. In fact, factor content studies typically use input–output methods to estimate the labour embodied in traded goods (Lawrence 1996). The key difference is that input–output studies can be used to estimate the significance of trade on labour utilisation relative to other factors such as labour productivity growth. In addition, it takes account of indirect as well as direct effects on labour.

Numerous input–output studies have been undertaken in Australia and elsewhere but typically they do not divide labour into different skill groups (see for example OECD 1992; de Laine, Lee and Woodbridge 1997; Gregory and Greenhalgh 1996). Nevertheless, the results of such studies typically indicate that trade is not the primary source of changes in labour utilisation over time. For example, Fahrer and Pease (1994) used input–output analysis to examine the 25 per cent decline in Australian manufacturing employment from 1981-82 to 1992-93. They concluded that labour productivity improvements were the principal cause of the decline in manufacturing employment. Trade was found to have a relatively minor impact on Australian manufacturing employment because import growth was generally matched by increased exports for the manufacturing sector as a whole. However, Fahrer and Pease found that this did not apply to the Clothing and footwear industry, where increased net imports were estimated to have accounted for about one third of the 28 000 jobs lost from 1981-82 to 1992-93. While this result may appear to be linked to the substantial fall in assistance for Clothing and footwear in recent years it should be noted that employment in the industry has been in long term decline since at least the late 1960s (IC 1997a). This is despite extended periods during which assistance was increased substantially.

Criticisms of quantity based analyses

Quantity based analyses have been criticised because they are essentially 'accounting exercises' with fixed labour content or input–output coefficients and do not incorporate the effects of changing prices and wages, producer and consumer responses, and economy-wide adjustments. In addition, quantity based calculations can be sensitive to the choice of a base year and the level of industry aggregation (Fahrer and Pease 1994; Borland and Foo 1996).

Freeman (1995) sets out three criticisms of quantity based analyses. First, the technique ignores any adjustment of wages in response to import competition. If firms lower their wages in response to import competition, then the volume of imports may be lower than otherwise. Hence, quantity analyses can understate the pressure of trade on earnings distribution. This would be less likely for countries where wages are inflexible downwards, which may include Australia. Second, the possibility that imported goods would be more expensive if they were produced domestically (with protection) is ignored. If domestic demand is sensitive to changes in price then without trade consumers will reduce their consumption of the good. Hence, quantity analyses can in this respect overstate the impact of trade on the number of unskilled workers employed domestically. Third, it is not possible to conclude that the estimated net impact of trade was due solely to reduced trade barriers. For example, imports might increase because of an increase in per capita income.

Approaches based on general equilibrium analysis

General equilibrium analysis treats the economy as a set of interconnected and mutually dependent markets where prices and factor rewards (including wages) are jointly determined. In general equilibrium models, trade influences wages through its effect on the product prices received by domestic producers rather than the quantity of trade, as in the quantity approaches discussed above. In other words, wages do not depend on labour supply independently of goods prices.

General equilibrium analyses of trade and earnings generally start with the Heckscher Ohlin model of international trade. This emphasises the different factor endowments of countries as a basis for relative cost differences and hence for international trade (box 1.1). It yields the result that countries will tend to export products which use intensively the factors of production with which the countries are relatively well endowed. Trade increases the demand for these factors and their price. On the other hand, countries tend to import products which use intensively factors of production with which countries are not well endowed. Trade reduces the demand for these factors and their price.

Two theorems stemming from the Heckscher Ohlin model describe how international trade can affect wages. The Stolper Samuelson Theorem states that a fall in the domestic price of a product caused by reduced protection will lower the real return of the factor of production that is used relatively intensively in making the product. The Factor Price Equalisation Theorem states that free international trade between two countries will cause the prices of the factors of production to equalise, respectively, between the two countries. These theorems are based on various restrictive assumptions which limit their applicability. In particular, the prerequisites for factor price equalisation are that countries have broadly similar resource endowments and use identical technologies. There are also restrictions in terms of the relative numbers of products and factors. In practice the conditions for full factor price equalisation are unlikely to be met.

Box 1.1 The factor endowments theory of trade

The factor endowments theory of trade was initially developed by the Swedish economists Eli Heckscher and Bertil Ohlin and has since become an important part of modern trade theory. It asserts that a determinant of comparative advantage is differing endowments of factors of production and that not all products employ those factors in the same proportions. Without international trade, product prices would differ between economies because of the different factor endowments. The relative price of factors will tend to be greater in economies where it is relatively scarce while goods which use relatively large amounts of a nation's plentiful resources as inputs will be relatively

cheap to produce. In contrast, products that rely heavily on relatively scarce factors will be expensive.

Opening an economy to trade encourages it to specialise in the production of products which use relatively more of the factors of production with which it is well endowed. This tends to raise the prices of those products and the factors used intensively in their production.

The broad message of the Stolper Samuelson Theorem is more robust than the Factor Price Equalisation Theorem and could potentially apply to Australia and its developing country trading partners. On the basis of its factor endowments vis a vis low income countries, it could be argued that Australia does not have a comparative advantage in those goods that use unskilled labour intensively. If tariffs typically protect industries where Australia does not have a comparative advantage, then its general program of tariff reductions could be expected to place downward pressure on the price of low skill intensive goods. In line with the Stolper Samuelson Theorem, this will cause the wages of unskilled workers at least to decline relative to other workers (and possibly even decrease in real terms) and so increase earnings inequality.

Analyses of output price changes

The general equilibrium approach outlined above predicts that trade will reduce the relative wage of unskilled workers when there is a fall in the relative price of low skill labour intensive goods. Indeed, in a very wide range of analytical frameworks one would expect that increased import competition from low skill labour intensive goods would reduce the domestic prices of such goods relative to those of other goods and services. Price effects studies examine whether such a change in relative prices has occurred.

The typical result of price effects studies is that the price of goods that use low skill labour intensively have, if anything, risen relative to the price of goods that utilise more highly skilled workers over recent periods in which trade has been liberalised. This was the result obtained by Lawrence and Slaughter (1993) and Bhagwati (1991) in separate studies of US price data. Lawrence (1996) found similar results in a study of the price behaviour of German and Japanese imports and producer prices. Leamer (1996) found evidence that the relative price of labour intensive goods declined in the 1970s in the United States, but not in the 1980s.

Fahrer and Pease (1994) analysed Australian price data for four industries (clothing, footwear, motor vehicles and household appliances) from 1981-82 to 1992-93. For Clothing and footwear, they found a trend for the ratio of the

consumer price to the CPI to decline but not the ratio of producer price to the GDP deflator. Because consumer prices are an average of producer and import prices, they concluded that import prices had declined relative to the price of domestic products. For motor vehicles, they found that consumer and producer prices had increased. In the case of household appliances, both the consumer and producer price ratios fell but the consumer price ratio fell at a greater rate. Fahrer and Pease argued that this started well before any cuts in tariffs on imported appliances and so is unlikely to have been due to changes in assistance.

There is some criticism of the techniques used in price effects studies. Freeman (1995) sets out three main problems. First, there can be measurement problems. For example, import price data typically exist for only a limited subset of industries and adjustments are rarely made for changes in product quality over time. Second, the method of determining whether a sector is skill intensive is usually determined on a rough basis by using the proportion of production workers in the industry. Third, it is not possible to attribute changes in output prices solely to trade: increased productivity would enable producers to reduce their output prices.

Pattern of employment changes

The standard version of the Stolper Samuelson Theorem is based on the assumption that factor rewards will adjust so as to ensure unchanged total employment. For example, if the protection of low skill labour intensive industries were reduced then this would encourage the relative expansion of high skill industries and hence the employment of high skill workers. In order to maintain the employment of low skill workers there has to be a decline in their real wage so as to encourage a substitution towards low skill workers in all industries. In other words, the between industry shift towards high skill industries caused by reduced protection has to be accompanied by a within industry substitution to low skill workers across all industries in the economy.

A modified version of the Stolper Samuelson Theorem where wage relativities between different skill groups are inflexible would yield a different result. Reduced protection of low skill labour intensive industries would be expected to result in the above mentioned between industry shift towards high skill industries without any within industry substitution to low skill workers. The net result would be an increase in unemployment for low skill workers due solely to between industry effects.

Borland and Foo (1996) tested whether the pattern of labour market adjustment predicted by the Stolper Samuelson Theorem occurred in the Australian manufacturing sector between 1952 and 1987. Their results do not provide

support for the hypothesis that trade has had an adverse effect on low skill workers and hence Australia's earnings distribution. Borland and Foo estimated that there was a fall in the share of production (low skill) workers in total manufacturing employment and that this was due to shifts both between and within manufacturing industries. Most of the relative decline of production workers in total manufacturing employment was estimated to be due to substitutions towards non-production (high skill) workers within manufacturing industries. This conflicts with the prediction of the standard version of the Stolper Samuelson Theorem that substitution toward low skill labour should occur within industries. It also appears to conflict with the Stolper Samuelson Theorem where relative wages are assumed to be inflexible because most of the fall in low skill employment was estimated to be due to within industry effects.

Computable general equilibrium models

Some of the weaknesses of input–output analysis discussed previously can be addressed by developing the input–output framework to include empirical estimates and assumptions about how consumers and producers respond to changes in incentives. A computable general equilibrium (CGE) model can then be developed to simulate the effects of trade on different types of workers. But like all models, CGE models have their limitations. For example, the level of industry detail is often insufficient to analyse industries that are known to be intensive users of unskilled labour and the specification of labour markets tends to be rudimentary.

Tyers and Yang (1996) conducted a global general equilibrium analysis using the GTAP (Global Trade Analysis Project) model. This is a multi-country multi-commodity general equilibrium model which captures not only the interactions between markets within an economy but also between economies. Tyers and Yang divided labour into three occupational groups in GTAP — professionals, production workers and farm workers — between which firms and households could substitute. Tyers and Yang simulated the effect of changes in factor use, openness to imports and productivity growth since 1970 in rapidly developing economies. They found that in the period 1970 to 1990, shifts in demand from unskilled to skilled labour were mainly responsible for increased wage dispersion in developed countries. The authors noted that trade caused an unknown proportion of this effect, but the direct influence of trade on wage dispersion was comparatively small. Simulations comparing the effects of restricted with unrestricted trade in the future indicated that continuing with trade liberalisation would be beneficial to all workers except European farm workers, who currently benefit from very high levels of protection. Tyers and Yang noted that one of the problems with their analysis was that the

aggregation of industries concealed some of the industry specific effects on different occupations.

Francois (1996) used a 15 sector general equilibrium model to estimate the impact of projected non-OECD labour force growth on wages and employment in OECD economies. He found that increases in the labour supply of non-OECD countries ranging from 18 to 35 per cent would change real wages in OECD economies by less than 1 per cent at an economy-wide level. This result was evident using various alternative specifications of technology, investment behaviour and import demand. This led Francois to conclude that the direct transmission of non-OECD labour market pressures through trade is relatively limited.

The Industry Commission (IC 1996) used the Monash general equilibrium model of the Australian economy in combination with the Monash Income Distribution model to investigate the effects of selected microeconomic reforms on household incomes. The reduction in Australian tariffs scheduled between 1996 and 2000 was estimated to reduce employment in manufacturing by 0.3 per cent but result in little change in wage dispersion across income deciles. The study assumed that wages were flexible and that aggregate employment did not change. The outcome was that employment rises in other industries offset reductions in manufacturing employment resulting in no effect on total employment. It was assumed that real wage changes in percentage terms were the same for all occupations. Changes in the distribution of wages arose through changes in employment within occupations.

Regression analysis

Numerous studies in other countries have used econometric techniques to test whether there is a statistically significant relationship between trade and earnings inequality. However, many of those studies are subject to the same criticisms as quantity based approaches because they link labour market outcomes with trade volumes rather than prices (OECD 1997).

One regression analysis which was based on prices rather than quantities was that by Leamer (1996). He estimated a regression model using the assumption that the only way that trade would affect the labour market is via relative output price changes that induce Stolper Samuelson wage responses. Using the assumption of zero pure profits he derived an expression which defined changes in output prices as a function of changes in factor rewards (including wages) and total factor productivity growth. He estimated the coefficients of that equation using US data on output prices, productivity growth, and the shares of inputs in the value of output for 450 industries between 1961 and 1991. He

interpreted the coefficients as indicating the changes in factor rewards necessary to maintain the assumption of zero pure profits given known changes in technology and output prices.

Leamer assumed that only a certain proportion of total factor productivity growth was passed on to consumers in the form of lower prices. The residual price variability was attributed to 'globalisation' on the assumption that the prices of traded goods are determined in the international marketplace. He then applied this approach to his data for the three decades 1961-71, 1971-81 and 1981-91. He estimated that output price changes increased inequality during the 1971-81 period but that such an effect was not as evident in the 1980s. His specific results for the 1981-91 period were sensitive to his assumptions about the share of productivity improvements passed through to consumers as lower prices and the criteria for categorising workers.

Revenga (1992) also undertook a regression analysis where trade was assumed to affect the labour market through prices. Her model used data on import prices and the employment and earnings of production workers for 38 US manufacturing industries between 1977 and 1987. She estimated that a 10 per cent fall in the price of the relevant competing import good was associated with, on average, a drop of about 2.5 to 4.0 per cent in employment and about 0.5 to 1.0 per cent in wages. She argued that the relative size of the wage and employment elasticities suggested that labour is quite mobile across industries in the United States and so the impact on wages of an adverse trade shock is small, with most of the adjustment occurring through employment.

Grossman (1987) also estimated wage and employment equations which had import prices as an explanatory variable. He estimated his model using monthly data for 9 manufacturing industries from January 1969 to December 1979, comprising a total of 132 monthly observations. His results indicated that US wages were generally not very sensitive to import competition. The estimated sensitivity of employment to import prices varied significantly across industries but in the majority of cases was smaller than the average estimated by Revenga (1992).

1.4 Research strategy

The material presented in sections 1.1 and 1.2 indicates that Australia's phased tariff reductions occurred during a period of growing inequality in the distribution of earnings from employment. However, such a coincidence of events does not establish causation. The following chapters formally test the hypothesis that there is a link between trade liberalisation and earnings inequality in Australia. It was decided not to rely solely on one of the

quantitative techniques discussed in section 1.3. Instead, three techniques are used. The following chapter investigates whether the prices of the relevant products have fallen as compared with the prices of other goods and services. Chapter 3 uses the quantity based approach of input–output analysis and chapter 4 reports the results of a computable general equilibrium model.

Regression analysis, such as that by Leamer (1996) for the United States, was also considered but it was decided not to proceed with this approach because of limitations with Australian data. Specifically, it was felt that regression results were unlikely to be robust because highly disaggregated industry level data on variables such as capital stocks, productivity and wages are either unavailable or are survey estimates based on small sample sizes and hence subject to large standard errors.

Much of the focus in following chapters is on the manufacturing sector because that is generally where trade barriers have fallen most dramatically and where import competition from low wage developing economies is most intense. However, attention is also given to the services sector as it employs the majority of Australian workers.

2 TRENDS IN TRADE, PRICES, WAGES AND EMPLOYMENT

As discussed in chapter 1, reducing tariffs on low skill intensive products could be expected to place downward pressure on the price of low skill intensive goods and, through Stolper Samuelson effects, on the wages and/or employment of low skill labour. The conditions required under the Stolper Samuelson Theorem for a decline in real wages are stringent. This chapter examines whether wages, and in particular the wages of low skilled workers, have declined in relative, rather than real terms. Thus, in examining whether there is any evidence of a link between trade liberalisation and income distribution in Australia, this chapter focuses on two questions:

- has the relative price of import competing manufacturing goods fallen? and
- has the return to low skill labour fallen in relative terms?

On the second question, if wages are not flexible downwards and the price of low skill labour intensive goods decline, then under the Stolper Samuelson Theorem increased unemployment of low skill employees would result. Consequently, this chapter also examines changes in the level of employment.

The chapter focuses on the 1980s and 1990s experience. Appendix A provides a supporting detailed analysis of trends in trade, employment and earnings.

2.1 Trade

Manufacturing industries that are import competing and use low skill labour relatively intensively are likely to be influenced by imports produced with low cost labour. Most manufacturing industries are import competing in terms of net trade. The exceptions are Food, beverages and tobacco and Basic metals. Available evidence suggests that there is a tendency for the import competing group to be more labour intensive than the export industries (see appendix A for a more detailed discussion).

To determine which manufacturing industries use low skill labour relatively intensively (and are therefore vulnerable to increases in imports of low skill labour intensive goods), employment by industry needs to be divided into categories based on skill level. The ABS collects information on employment by occupation rather than the skill of particular employees. Therefore, it is necessary to use occupation as a proxy for skill level. In this paper, three skill

groups are defined (high, middle and low) using the first edition of the Australian Standard Classification of Occupations (ASCO). High skill occupations are defined as Managers and administrators, Professionals, Para-professionals and Investment, insurance and real estate salespersons (ASCO first edition minor groups 11 to 39 and 61). Middle skill occupations are Tradespersons (groups 41 to 49). Low skill occupations are Clerks, Salespersons and personal service workers (excluding Investment, insurance and real estate salespersons), Plant and machine operators and drivers, and Labourers and related workers (groups 51 to 59 and 62 to 89) (see box A.2 in appendix A).

The skill groups used here are fairly broad. However, the employment and earnings data used from the ABS are estimates, so as the data are disaggregated, the less reliable the estimates become. Therefore, to be able to obtain industry estimates by occupation group, it was necessary to group a number of major occupations together.

Table 2.1 presents the share of employment in each of the skill groups in 1996 by manufacturing industry (see appendix A for more detail). Industries where employment is relatively low skill intensive include Textiles, Food, beverages and tobacco and Clothing and footwear industries (with 75, 72 and 68 per cent of employment, respectively, in low skill occupations).

The source of import competition also provides an indication of those manufacturing industries most likely to experience competition from low cost labour. In this study, countries have been divided into high income and low income groups (see box A.1 in appendix A for a description of the groups).

There has been a notable increase in the proportion of Australia's manufactured imports that come from low income countries. The share of manufactured imports from low wage countries increased from 13 per cent in 1981-82 to 24 per cent in 1995-96. This trend is evident to varying degrees for all the industries within manufacturing.

An industry that stands out as being particularly affected by imports from low income countries is Clothing and footwear. Its share of imports from low income countries in total imports increased from 57 per cent in 1981-82 to 76 per cent in 1995-96.

Table 2.1 **Share of employment in occupation group by manufacturing industry,[a,b] 1996**

Industry	*High skill occupations*	*Middle skill occupations*	*Low skill occupations*	*Total*
	%	%	%	%
Food, beverages & tobacco manufacturing	12.7	15.3	72.0	100.0
Textiles	11.5[c]	13.5[c]	74.9	100.0
Clothing and footwear	11.1	20.8	68.0	100.0
Wood, wood products and furniture	8.0	47.1	44.9	100.0
Paper, paper products and publishing	25.3	27.0	47.8	100.0
Chemical, petroleum and coal products	34.7	7.9	57.4	100.0
Non-metallic mineral products	15.5	23.4	61.1	100.0
Basic metal products	21.7	26.9	51.4	100.0
Fabricated metal products	15.0	41.2	43.8	100.0
Motor vehicle and parts	14.2	26.7	59.1	100.0
Other machinery and equipment	27.6	28.0	44.4	100.0
Miscellaneous manufacturing	15.3	21.4	63.2	100.0
Total manufacturing	**17.9**	**27.1**	**55.0**	**100.0**

a Based on 2 digit ASIC industry data (with the exception of 3 digit class Motor vehicle and parts – ASIC 323). Note manufacturing total includes Other transport equipment (ASIC 324). **b** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 in Appendix A for definitions. **c** These shares are statistically unreliable are they are based on employment estimates below 4000, which are considered statistically unreliable by the ABS.

Source: IC estimates adapted from ABS (*Labour Force Australia*, unpublished data, 1987 to 1996, Cat. no. 6203.0).

2.2 Producer and import prices

As noted in chapter 1, if greater imports from low wage economies have increased earnings inequality, then there should be evidence of downward pressure on domestic prices via declining import prices. There should have been a decline in the relative price of low skill labour intensive imports and it would be expected that this would have been reflected in the output prices of competing domestic industries. This section investigates whether such evidence exists for Australia's manufacturing industries between the mid 1980s and mid 1990s.

If imports and import competing goods were perfect substitutes then import and producer prices would be equal, and hence the relativity between them would not change. But if the goods represented in the import and producer price baskets are not perfect substitutes then the relativity may change.

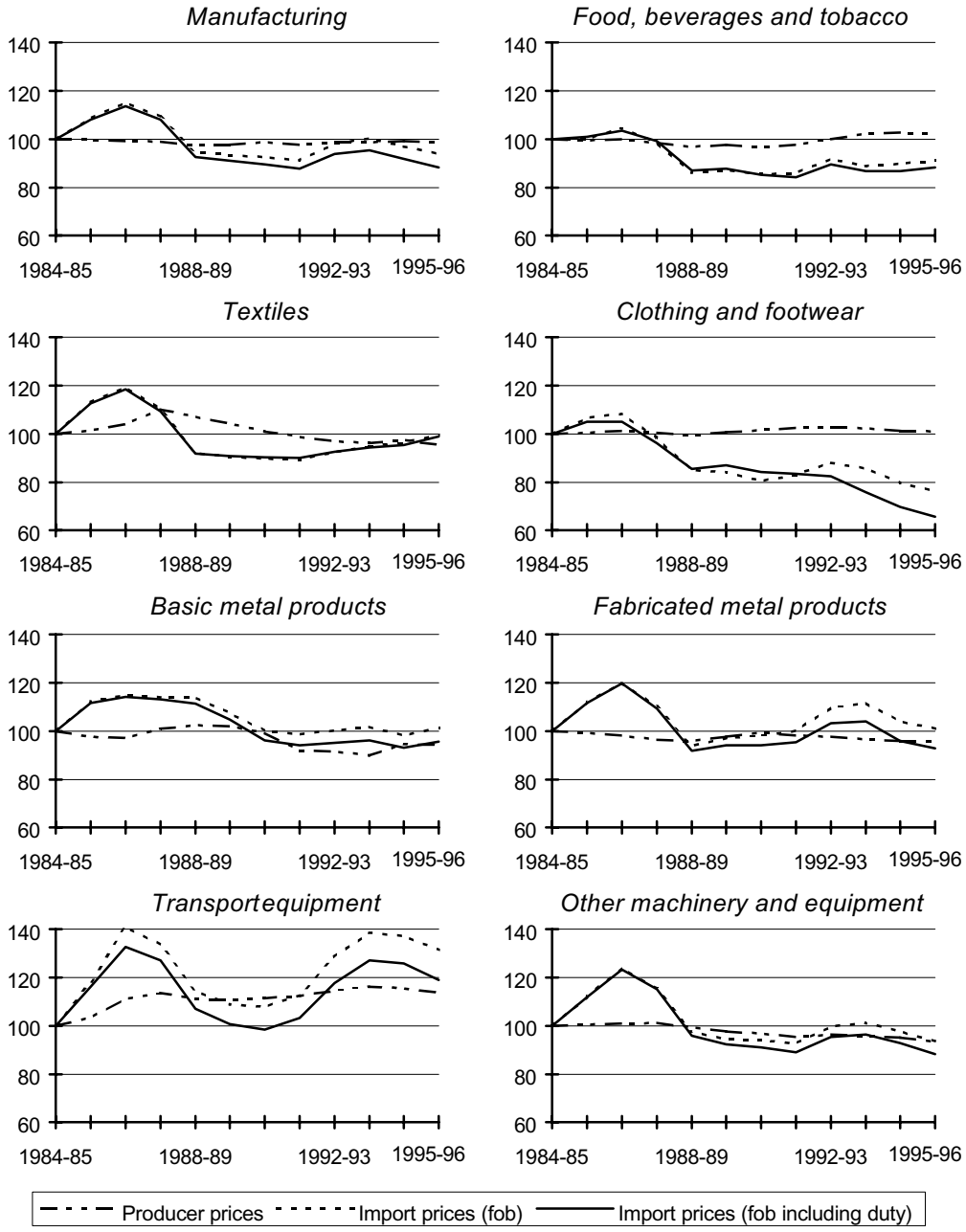
In this section there are two areas of interest. First, has there been downward pressure on both import and producer prices for importable low skill manufactures relative to the economy as a whole? Second, has there been any change in the relativity between import and domestic producer prices of low skill manufactures within industry classifications over that period?

To address the first question, import prices and producer prices are deflated by an economy-wide price index. As the import and producer price series are 'fixed weight' indexes, the GDP(E) fixed weight deflator is used as the economy-wide price index. Two import price indexes are used here. The first is calculated on a 'free on board' (fob) country of origin basis. Australian import duties and freight and insurance charges involved in shipping goods from foreign to Australian ports are therefore excluded from the index. The second import price index is based on fob values, but also incorporates the average import duty that was paid on the relevant categories of imports. The difference between the two import price indexes can be interpreted as the impact on import prices of changes in the average rate of duty paid on imports in the relevant industrial category.

Note that the average rate of duty paid is not necessarily a reflection of all the assistance to domestic industry. First, there are forms of assistance to industry other than tariffs, such as production bounties and import quotas. Second, there is an issue with composition. For example, assume a particular industry produces two goods, good 1 with a prohibitively high tariff, and good 2 with a very low tariff. If good 1 was predominantly produced locally, and good 2 was mainly supplied by imports, the industry average duty paid would be low (reflecting the tariff imposed on good 2), while the nominal rate of assistance to the domestic industry would be very high (reflecting the tariff imposed on good 1). Finally, there are a number of exemptions from paying duty.

Between 1984-85 and 1995-96 relative producer prices (producer prices deflated by the economy-wide price index) in manufacturing remained relatively stable (figure 2.1). Import prices in all manufacturing industries rose between 1984-85 and 1986-87, driven in part by the depreciation of the Australian dollar. Relative import prices in manufacturing were marginally lower in 1995-96, compared to the level in 1984-85, but were much more

Figure 2.1 **Relative import[a] and producer prices for manufacturing and selected manufacturing industries[b], 1984-85 to 1995-96**



[a] Import prices (fob) relates to the free on board price of imports. Import prices (fob including duty) relates to the free on board price of imports taking into account the average duty paid on imports. [b] Ratio of either import or producer prices as specified, to the GDP(E) fixed weight deflator.

Source: IC estimates adapted from ABS (*Australian National Accounts: National Income, Expenditure and Product*, Cat. no. 5206.0; *Price Indexes of Articles Produced by Manufacturing Industry, Australia*, Cat. no. 6412.0; *Import Price Index, Australia,* Cat. no. 6414.0; *International Trade, Australia: Magnetic Tape Service*, Cat. no. 5464.0); IC (1995b).

volatile than producer prices over the period. During the same period, the average rate of duty paid for manufacturing imports fell from around 11 per cent to 5 per cent. Consequently, relative import prices taking into account declines in import duty paid fell by around 12 per cent between 1984-85 and 1995-96, about twice the fall in fob terms.

It should be noted that a complicating factor in this analysis is that the compositions of the import and producer price series are different. The indexes relate to manufacturing goods that Australia imports, and goods the manufacturing industry produces, respectively, and there are compositional differences between imports and domestic production. For example, at the broad level, Australia's FBT industry only accounts for 4 per cent of manufacturing imports, but contributes around 20 per cent of manufacturing value added.

Figure 2.1 also presents the results for those manufacturing industries for which large changes in relative prices occurred. The impact on import prices of reductions in the average rate of duty was most significant in Clothing and footwear and Transport equipment. Furthermore, over that period quantitative import restrictions were removed on motor vehicles and textiles, clothing and footwear.

While Chemicals, petroleum and coal products experienced the largest decline in relative import and producer prices between 1984-85 and 1995-96 it is not shown in figure 2.1. This industry has been excluded because price changes primarily reflect movements in oil prices, and it is relatively capital intensive and so it is unlikely to exert any notable influence on low skill wages.

Import prices for Transport equipment fluctuated more than other manufacturing industries over the period. The main decline in the average rate of duty paid occurred between 1984-85 and 1986-87, when it fell from 20 per cent to 12 per cent. (The average duty paid in 1995-96 was 8 per cent.) Producer prices in the Transport equipment industry rose 12 per cent between 1984-85 and 1987-88, stimulated in part by the decline in the exchange rate (IC 1997c). Since then, producer prices have been relatively stable.

Import prices for Clothing and footwear have declined significantly since 1986-87, suggesting that the industry is under pressure from these imports (figure 2.1). Since the average rate of duty paid on Clothing and footwear imports fell from 42 per cent in 1984-85 to around 23 per cent 1995-96, import prices (fob including duty) have fallen further than the import prices (fob). But despite these two sources of pressure, and the removal of quantitative restrictions on imports, producer prices have remained relatively stable since 1984-85.

A possible explanation for the divergence in the two price indexes is that while both series refer to prices of 'Clothing and footwear' goods, the compositions of the indexes are different. In clothing, the items predominantly supplied by imports include jumpers, woven trousers and coats, while the three main categories mostly supplied locally are male work clothing, hosiery and female outerwear such as dresses and skirts (IC 1997b).

Importantly, the weights used in the price indexes relate to the composition of imports and local production in the late 1980s, and this has changed markedly over the last decade. For example, estimates of production quantities for seven major clothing and footwear items show that while the volume of production has declined in all groups, it has been at differing rates (ABS 1997b). Since 1989-90 there have been strong declines in the volume of production of sports footwear, men's shirts, and jeans (down by 81, 41 and 32 per cent respectively) but less strong declines in other footwear (excluding sports footwear), female long trousers, male long trousers and female shirts and blouses. On the import side there has been a decline in the importance of knitting mills and footwear, with a corresponding increase in the importance of clothing (particularly sleepwear, underwear and infant's clothing and male clothing).

If all clothing and footwear prices were changing at similar rates, the composition issue may not matter too much. However, some of the component price indexes are showing different trends. For example, between 1991-92 and 1994-95 footwear import prices (fob) fell around 9 per cent, while import prices (fob) for female blouses and shirts rose 12 per cent.

Overall, the Clothing and footwear industries have been under pressure from increasing, and cheaper, imports, particularly from low wage countries and from declining assistance. The apparently relatively stable producer prices appears to be an artefact of the composition of the price indexes. Some segments of the local industry are better placed to compete with imports in areas other than just price. In its recent report on the Textiles, clothing and footwear industries, the Industry Commission noted that strategies that companies have pursued to cope with their increased exposure to international competition include 'greater emphasis on product quality and customer service (including quick response supply); [and] reorientation of production and marketing towards niche markets or internationally competitive products' (IC 1997d, pp. xxv). In particular, the report noted:

> The relative success of local production of female outerwear is partly due to the high fashion component, which tends to lead to short-run and constantly changing production runs. Local manufacturers are close to the market and are in a better position to respond to changing consumer demand. (IC 1997d, pp. 62)

As mentioned in chapter 1, Fahrer and Pease (1994) also observed that import prices for Clothing and footwear have fallen relative to the price of domestic goods. Their study suggested that domestic and foreign products may not be close substitutes.

The experience for the Textiles industry has been somewhat different. Import prices (fob) declined between 1986-87 and 1989-90, and then remained relatively stable. Import prices (fob including duty) have tracked import prices (fob) fairly closely. The average duty paid on Textiles imports has remained fairly stable (only fluctuating between 6 and 8 per cent) despite the declines in nominal assistance over the period. Producer prices on the other hand increased by about 9 per cent between 1985-86 and 1987-88, and then declined until around 1993-94. Again, compositional effects are likely to be a factor in the differential trends.

In summary, for most manufacturing industries relative import prices rose between 1984-85 and 1986-87, and then declined, while relative producer prices tended to remain stable. The change in relativity between import and producer prices suggests that imports and import competing goods at the industry level are not perfectly substitutable. The differing trends may reflect compositional differences.

In most industries the impact on import prices (fob including duty) of changes in the average rate of duty paid has been overshadowed by other factors. Two industries where the average rate of duty paid has significantly influenced import prices (fob including duty) were Clothing and footwear and Transport equipment.

Over the period, the largest fall in relative import prices (fob) occurred in the Clothing and footwear industry. This was compounded by falling average rates of duty paid on imports and by the removal of quantitative restrictions on imports. However, the decline in import prices has not been reflected in domestic producer prices.

2.3 Changes in earnings relativities

If increased trade, particularly with low wage countries, has affected the earnings (and/or employment) of workers in low skill occupations, then it would be expected to result in reduced earnings (and/or employment) for employees in low skill occupations, relative to employees in high skill occupations.

This section uses ABS data from its survey of employee earnings and hours. Unless specifically mentioned, earnings refer to average weekly total earnings

(ordinary time earnings plus overtime, see ABS 1997a for definitions) of full-time workers. This allows an analysis of earnings that is not influenced by shifts between full and part-time employment. However, if full-time workers in low skill occupations shift into part-time employment, their earnings will tend to decline, but this will not be picked up in an analysis of full-time earnings. The impact on average earnings of the shift in employment towards part-time work is discussed later.

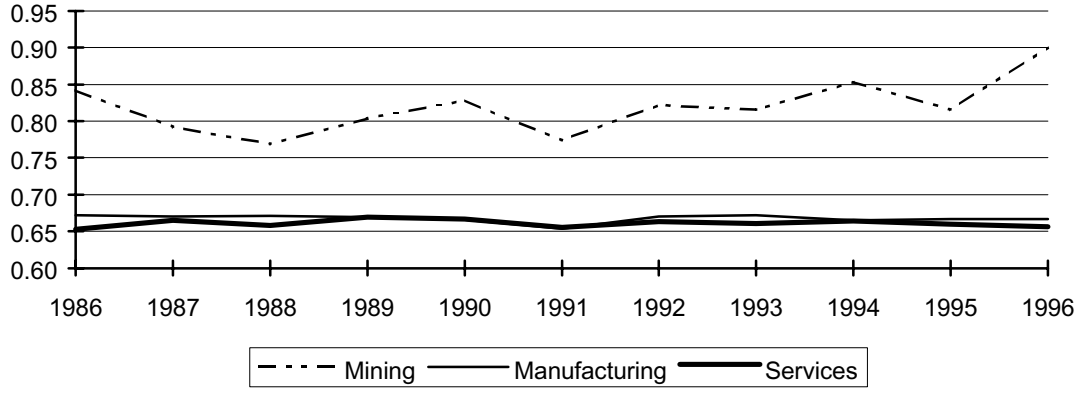
The earnings analysis here relates to weekly earnings, which may be influenced by changes in weekly hours of work. However, at the aggregation used here there has not been significant changes in full-time non-managerial adult workers average hours paid for, over the period of analysis.

Sector results

The ratio of low skill earnings to high skill earnings was relatively stable for employees in manufacturing and services overall, with employees in low skill occupations earning about 66 per cent of the earnings of employees in high skill occupations (figure 2.2). In the mining sector, the ratio varied over the decade. Employee earnings in low skill occupations ranged from 77 per cent of high skill occupations' earnings in 1988, to 90 per cent higher in 1996. The broad skill groupings used in this study may mask divergences between some occupations' earnings.

Published data are available on total earnings for adult full-time non-managerial employees for the one digit major occupation groups. These data suggest that full-time earnings of Labourers and related workers' have declined marginally over the last decade relative to Professionals' earnings. Average total earnings for Labourers and related workers fell from 71 per cent of that of Professionals in 1987 to 67 per cent in 1996. Relative earnings for Clerks, Para-Professionals and Tradespersons also decreased (by 4, 3 and 1 percentage points respectively). Relative earnings for Salespersons and personal service workers remained stable, while relative earnings for Plant and machine operators and drivers increased from 82 per cent of that of Professionals in 1987 to 86 per cent in 1996.

Figure 2.2 **Ratio of low skill occupations' earnings to high skill occupations' earnings[a] by sector, 1986–96**



[a] Ratio of respective full-time employees average weekly total earnings (ordinary time plus overtime). Earnings are divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 in appendix A for definitions.

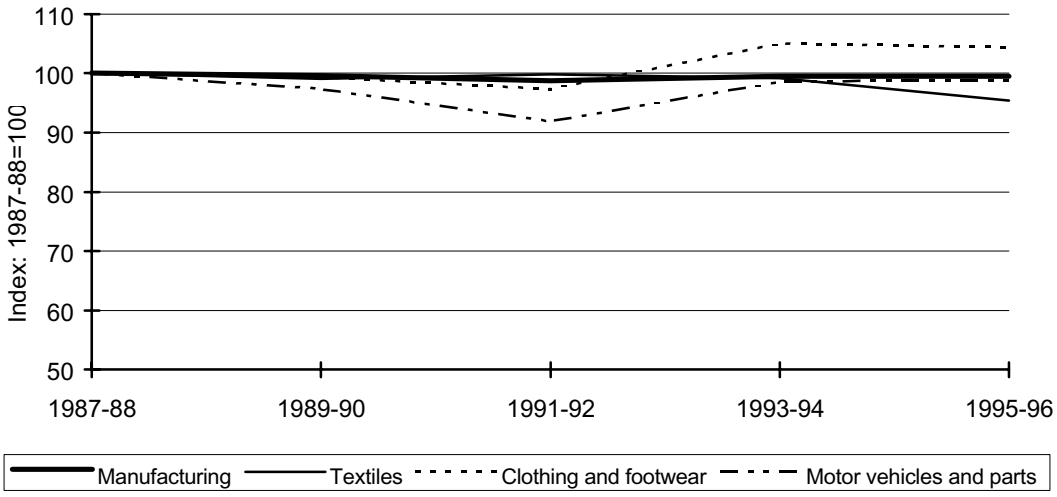
Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1996, Cat.no. 6306.0; *Consumer Price Index*, Cat. no. 6401.0).

Industry results

For most manufacturing industries, the ratio of earnings for full-time employees in low skill occupations to the earnings of *all* manufacturing full-time employees in high skill occupations suggests a relatively stable relationship. That is, there is no evidence of significant downward pressure on the earnings of full-time employees in low skill occupations since the mid-1980s. Even for those industries in which protection has been significantly reduced over the period, the full-time earnings of employees in low skill occupations relative to the overall manufacturing high skill occupations' average has not changed significantly (figure 2.3).

It is possible that the above comparison of industry level low skill earnings to the manufacturing average for high skill earnings conceals significant changes in the ratio of low to high skill earnings at an industry level. However, the small sample size used by the ABS for high skill workers in 2 digit ASIC manufacturing industries raises doubts about the accuracy of high skill earnings data by manufacturing industry. Nevertheless, the only industry in which there appears to be some evidence of a decline in low skill occupations' earnings, relative to high skill occupations' earnings is Food, beverages and tobacco. The decline in the ratio is due to stronger growth in high skill occupations' earnings (low skill occupations' earnings grew in line with the manufacturing average).

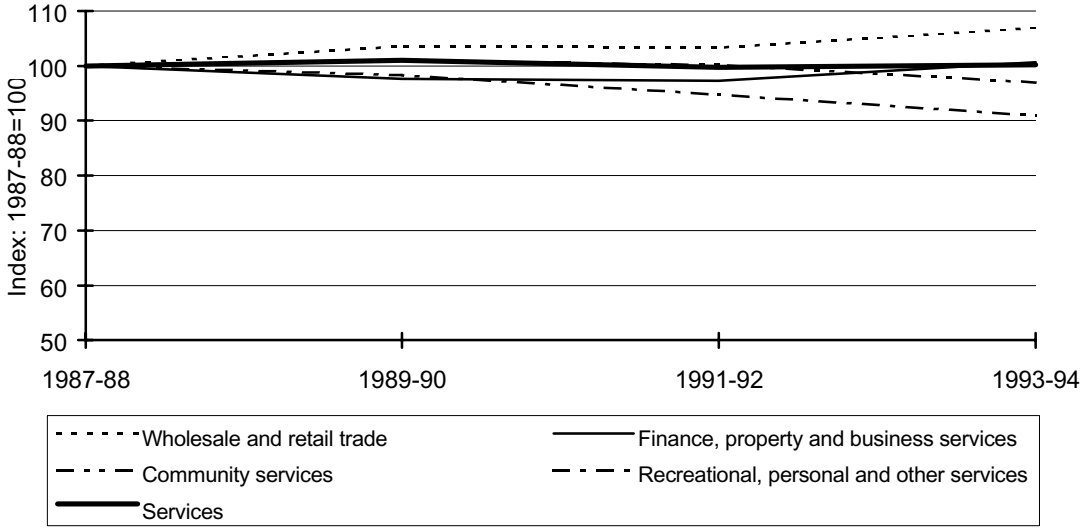
Figure 2.3 **Manufacturing low skill occupations' earnings relative to high skill occupations' earnings[a], 1987-88 to 1995-96**



a Ratio of selected industries low skill occupations' earnings to average manufacturing high skill occupations' earnings. Relates to full-time employees' average weekly total earnings. Data is averaged over two year periods, using real earnings (nominal earnings deflated by the consumer price index) in 1996 dollars. See box A.2 in appendix A for definitions of high- and low skill occupations.
Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1996, Cat.no. 6306.0; *Consumer Price Index*, Cat. no. 6401.0).

Figure 2.4 presents the relevant ratios of low skill occupations' earnings to high skill occupations' earnings for selected services industries. While there is no evidence that there has been a relative decline at the sectoral level, the data suggests that employees in low skill occupations in the Recreational, personal and other services industry may have experienced a modest decline in their earnings relative to earnings of high skill workers in that industry. Conversely, low skill occupations' earnings in Wholesale and retail trade have increased relative to high skill occupations' earnings. In both cases, the shift has not been particularly significant, and the standard errors in the data need to be kept in mind.

Figure 2.4 **Services low skill occupations' earnings relative to high skill occupations' earnings[a], 1987-88 to 1993-94**



[a] Ratio of selected industry's low skill occupations' earnings to high skill occupations' earnings. Relates to full-time employees' average weekly total earnings. Data is averaged over two year periods, using real earnings (nominal earnings deflated by the consumer price index) in 1996 dollars. See box A.2 in appendix A for definitions of high- and low skill occupations.

Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1996, Cat.no. 6306.0; *Consumer Price Index*, Cat. no. 6401.0).

Employment effects

The above analysis suggests since the mid-1980s there has not been downward pressure on the earnings of employees in low skill occupations, but it only relates to full-time employees' earnings. Wage rigidities may mean Stolper Samuelson effects are emerging through unemployment and/or a shift to part-time employment, rather than the earnings of full-time employees.

Over the last decade there have been significant changes in the composition of employment. These include:

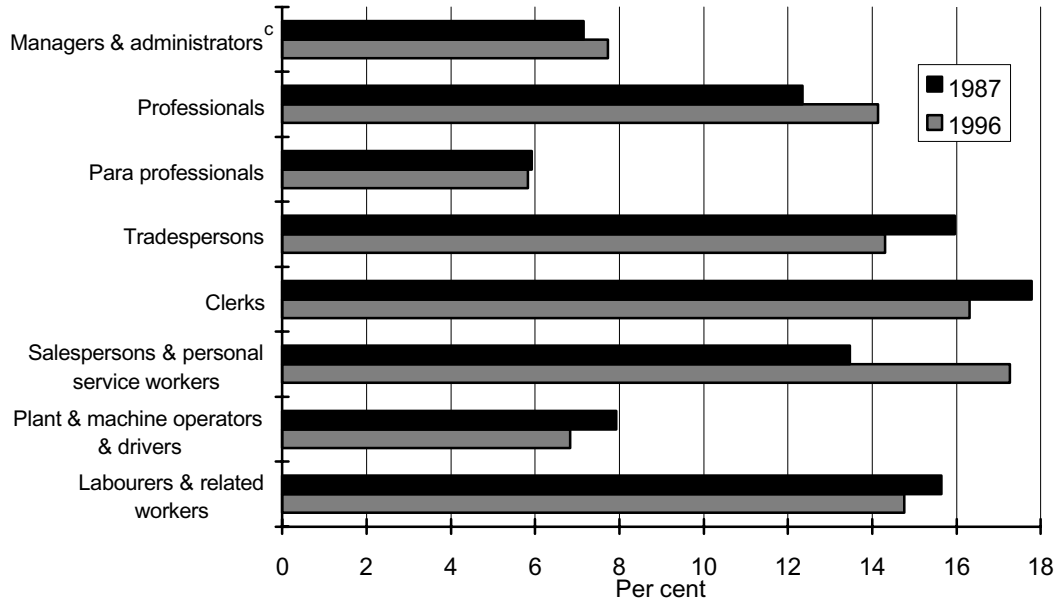
- a shift in employment away from blue collar occupations to white collar occupations;
- at the sectoral level, a shift towards employment in the services sector; and
- a shift towards part-time work.

Between 1987 and 1996 the number of employees in each of the major occupation groups has increased, but there has tended to be a shift in the

employed workforce away from blue collar occupations to white collar occupations (figure 2.5). The exception is Clerks, a (relatively low skill) white collar occupation, which has declined in importance as an occupation. Tradespersons experienced the largest decrease in share of total employment, falling by nearly 2 percentage points to 14 per cent in 1996. On the other hand, Salespersons and personal service workers increased their share by almost 4 percentage points to 17 per cent over the period. Professionals was another occupation with relatively strong growth (accounting for 14 per cent of employees in 1996, up from 12 per cent in 1987). The decline in importance of Tradespersons, Plant and machine operators and drivers and Labourers and related workers is similar to the trend observed between 1971 and 1986 by Aungles et al. (1993). In contrast, their study found that Clerks increased as a share of total employment in the fifteen years to 1986.

In terms of the skill groups discussed earlier, between 1987 and 1996 the share of employment in low skill occupations has remained fairly stable, while there has been a relative shift in employment from middle skill occupations to high skill occupations (see appendix A for more detail).

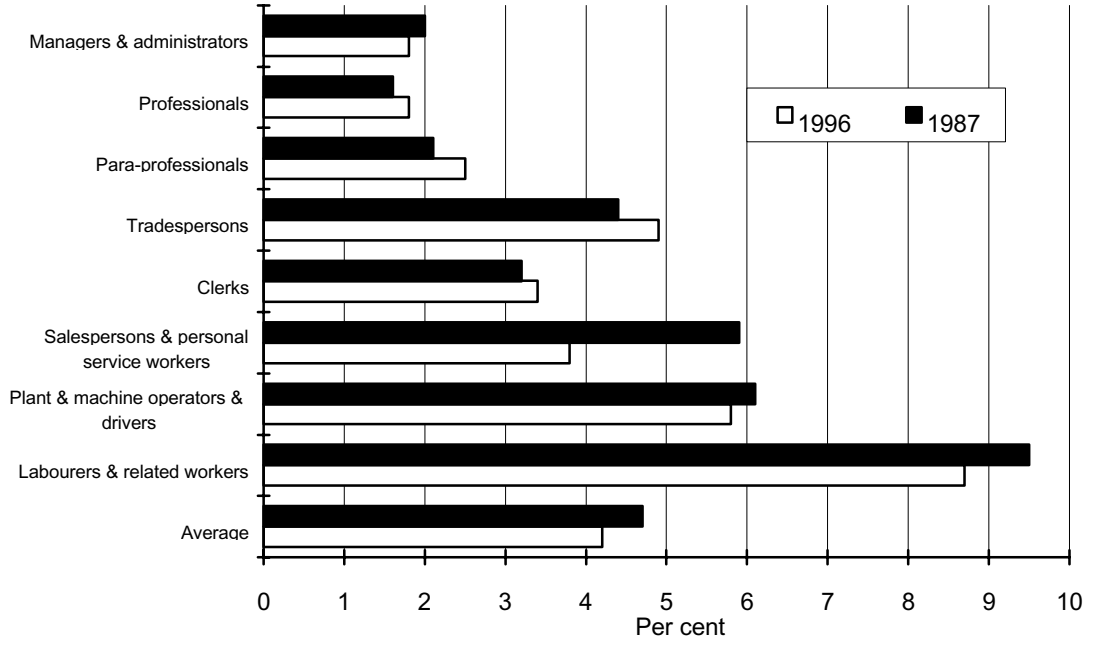
Figure 2.5 **Share of employment[a] by occupation, 1987 and 1996[b]**



a Note the data relates to employees, rather than employed, so excludes self-employed persons. **b** Labour force data for May 1987 and May 1996. **c** Managers and administrators excludes Farmers and farm managers (ASCO 14).

Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1996, Cat. no. 6203.0).

Figure 2.6 **Unemployment rates by occupation,[a] 1987 and 1996[b]**



a Unemployment rates by occupation relate to unemployed persons who had worked full-time for two weeks or more in the last two years, classified according to the occupation of their most recent full-time job. The unemployment rate for all unemployed persons was 8.2per cent in May 1987 and 8.3per cent in May 1996. **b** Data relates to May 1987 and May 1996.
Data source: ABS (*Labour Force Australia,* Cat. no. 6203.0).

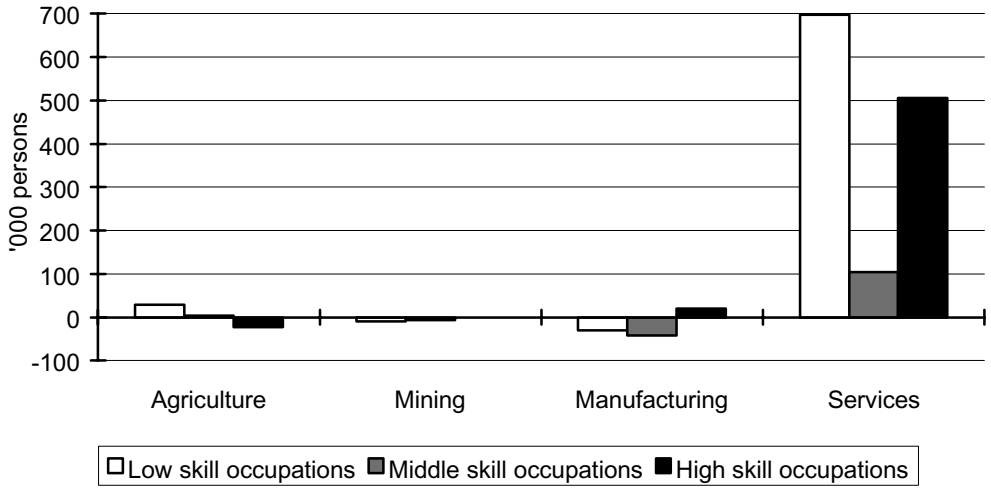
For unemployed persons who had worked within the last two years, generally those with previous occupations that required higher skills had lower unemployment rates than people with lower skill levels (figure 2.6). Between 1987 and 1996 unemployment rates by occupation have remained remarkably stable, with the only significant change occurring for Salespersons and personal service workers, where the unemployment rate declined from 6 per cent in 1987 to 4 per cent in 1996.

Growth in employment varies by sector. The significant contribution of the services sector to the growth in employment from 1987 to 1996 is apparent from figure 2.7. The number of employees in the economy increased by 1.2 million persons over the period, with 1.3 million new jobs in the services sector, an increase of around 8 900 in agriculture, a decline of 16 000 in mining, and a fall of about 55 300 in manufacturing (see appendix A for detail).

Between 1987 and 1996, the strongest decline in employment in the manufacturing industries in absolute terms occurred in the Other machinery and equipment industry, where employment declined by 15 900 persons. This corresponded to an average annual decline of 1.2 per cent. The strongest declines in employment in percentage terms occurred in the Textiles, clothing

and footwear industries. Employment fell at an average annual rate of 3.7 per cent in Textiles (11 100 persons), and 2.1 per cent in Clothing and footwear (13 400 persons) (see appendix A).

Figure 2.7 **Growth in employment[a] by sector and occupation,[b] 1987 to 1996[c]**



[a] Note the data relates to employees, rather than employed, so excludes self-employed persons. [b] Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 in appendix A for definitions. [c] Labour force data for May 1987 and May 1996.
Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1996, Cat. no. 6203.0).

Between 1987 and 1996 the majority of the new jobs in the services sector were in low skill occupations, although the share of jobs in low skill occupations in 1996 remained at around the same level as in 1987. The job growth in low skill occupations in the services sector has tended to be in Wholesale and retail trade, Recreational, personal and other services and Community services (see appendix A). Employment in high skill occupations in services grew at the strongest growth rate of any of the industry skill groups (at an average annual rate of 3 per cent).

There has been a shift in employment towards part-time work, but this has primarily occurred in the services sector. In this sector, the proportion of part-time workers increased from 22 per cent in 1987 to 28 per cent in 1996. On the other hand, the share of part-time employees in the manufacturing sector grew only marginally from 8 per cent in 1987 to 10 per cent in 1996. The shift towards more part-time work has implications for full-time job creation. For the service sector, where the job growth has been, just over half of the new jobs created between 1987 and 1996 were part-time. For jobs in low skill

occupations around three-quarters of the new jobs were part-time. The shares for middle and high skill occupations were lower at 15 per cent and 28 per cent respectively.

Analysing total hours worked, rather than the number of employees, would take into account the shift in composition between full-time and part-time work. The growth in total hours worked by occupation group is similar to the discussion above on the number of employees. However, the increase in the absolute number of hours worked in low skill occupations in the services sector was closer to the growth in hours worked in high skill occupations. (Compared to being around a third higher in figure 2.7). This reflects the fact that average hours worked for all employees tends to be lower in the low skill occupations, where part-time work is more concentrated. At the sectoral level, the growth rates were broadly similar in employment and hours worked for the skill groups.

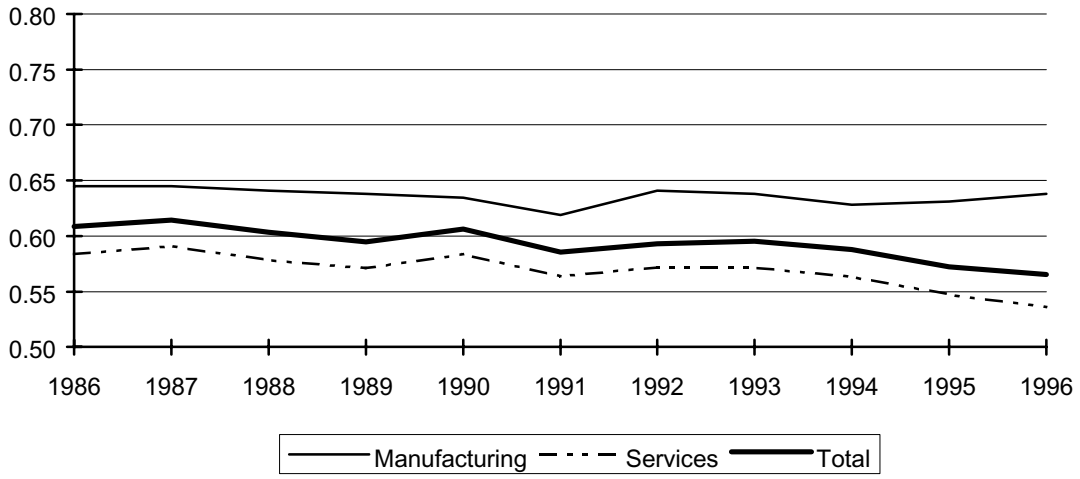
As mentioned, the earlier analysis of earnings relates to full-time employees. If earnings for all employees were used instead, it would be influenced by compositional shifts between full and part-time work. Nevertheless, such a comparison would provide an insight into how the growing significance of part-time work has affected average earnings for the entire workforce.

Between 1987 and 1996 most of the growth in low skill employment has been in the services sector and in part-time rather than full-time jobs. Consequently, the average earnings for low skill workers could be expected to decline in relative terms for a number of reasons:

- part-time workers are paid less on average than full-time workers;
- employees in the services sector tend to be lower paid than employees in manufacturing (see appendix A); and
- the services industries where low skill employment growth has been are the relatively lower paid service industries (Wholesale and retail trade, Recreational, personal and other services and Community services).

While the economy-wide ratio of low skill earnings to high skill earnings for full-time workers remained relatively stable between 1987 and 1996, the average ratio for all employees (full and part-time) has decreased. Earnings of low skill workers fell from 61 per cent of high skill workers earnings in 1986 to 57 per cent in 1996 (figure 2.8). This was driven by a decline in the ratio for the services sector.

Figure 2.8 **Ratio of low skill occupations' earnings relative to high skill occupations' earnings by sector[a], for all employees 1986–96**



[a] Ratio of low skill occupations' earnings to high skill occupations' earnings. See box A.2 in appendix A for definitions of high- and low skill occupations.
Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1996, Cat.no. 6306.0).

2.4 Concluding comments

If trade liberalisation since the mid 1980s in Australia had resulted in Stolper Samuelson effects, then there should be evidence of downward pressure on the price of low skill labour intensive goods, and on the wages or employment of low skilled labour over that period. The data presented in this chapter do not provide firm evidence to support the hypothesis that increased trade has been a significant contributor to increased earnings inequality.

Price evidence suggests that while relative import prices have declined across most industries, relative producer prices have remained more stable. However, there is an issue of composition with the price indexes. The largest relative decline in import prices occurred in Clothing and footwear and yet this decline has not been reflected in available data on producer prices in Australia. Nonetheless, the Clothing and footwear industries have experienced declines in domestic output and employment. This seems to be the clearest example in Australia of effects arising from import competition.

The material presented in this chapter indicates that there has not been a widespread increase in earnings inequality among full-time employees on the basis of occupation. By industry there is no evidence of significant downward

pressure on the earnings of full-time employees in low skill occupations over the last decade, relative to the average earnings of full-time employees in high skill occupations.

At the aggregate level, there is evidence that full-time earnings of Labourers and related workers and Clerks have declined marginally relative to Professionals' earnings, although the other occupations that are included in the low skill occupation group, Salespersons and personal services workers and Plant and machine operators and drivers, experienced stable and increasing relative full-time earnings respectively.

While there does not appear to have been any significant pressure on full-time wages, there are a number of qualifications. For some of the detailed industry data, small sample sizes mean that the earnings estimates may not be reliable. Total employment has not grown in the manufacturing sector over the period covered. It may be the case that institutional arrangements in the labour market are causing Stolper Samuelson effects to emerge via unemployment and/or a shift to part-time work, rather than through employees' full-time earnings. The shift in the composition of the workforce towards part-time work and services sector employment has put downward pressure on the average earnings for the total workforce. This is particularly the case in low skill occupations, where part-time work is more concentrated.

3 INPUT–OUTPUT ANALYSIS

The analysis presented in previous chapters indicates that wage inequality among employed persons in Australia has increased only marginally since the early 1980s. However, there have been notable changes in the composition of employment. The extent to which employment changes may be linked, in an 'accounting' or employment/output sense, to increased trade is investigated in this chapter using input–output analysis.

3.1 Methodology

As discussed in chapter 1, input–output analysis uses labour–output ratios to calculate changes in the use of labour attributable to growth in a country's exports and imports. The difference between changes in labour use due to exports and imports is interpreted as the net impact of trade on employment. Input–output analysis can also be used to calculate changes in employment attributable to domestic final demand, technical change and labour productivity movements (box 3.1).

Input–output analyses of Australian employment changes have been undertaken in the past by Fahrer and Pease (1994) and de Laine, Lee and Woodbridge (1997). However, those studies did not differentiate between different types of labour. Furthermore, de Laine et al. only reported results for the manufacturing sector as a whole and did not distinguish between the effect of imports from low and high income countries.

This chapter uses input–output techniques to estimate how manufactured imports from low and high income countries have been associated with employment changes in the Australian manufacturing sector between 1986-87 and 1993-94. This is the longest interval over which the detailed data required are available and broadly corresponds to the significant reduction in protection which began in the mid 1980s. The effects of changes in labour productivity for both low and high skill labour (using the definitions adopted in chapter 2) are also calculated. Percentage changes in employment for low and high skill labour were the same for the other sources of change (see appendix B). The manufacturing sector is divided into 12 separate industries so that industry specific effects can be identified. Technical details of the approach and data used are provided in appendix B.

Box 3.1 Input–output analysis

Input–output analysis is used to calculate changes in an economy's employment over time attributable to movements in six factors:

- domestic final demand;
- import substitution in intermediate (input) demand;
- import substitution in domestic final demand;
- exports;
- use of intermediate inputs; and
- labour productivity growth.

Taken together, these factors account for observed employment changes. To calculate the individual influence of each factor, the change in employment is calculated, holding all other factors constant. Each factor except labour productivity growth has both a direct and an indirect effect on employment. An increase in demand for the output of an industry increases output directly in that industry. It also results in increased demand by that industry for the outputs of other industries as intermediate inputs, raising their outputs indirectly.

The basis for the calculations is a comparison of an economy's input–output tables for two different years. Input–output tables document how the output of each industry in an economy is used in one of three possible ways:

- an input into the production process of domestic industries (intermediate demand);
- goods for domestic final demand (including investment); and
- goods for export.

Input–output tables also document the extent to which imports are used in intermediate and final demand.

3.2 Results

The impacts of each of the sources of employment change discussed in box 3.1 are presented in table 3.1. The key results are discussed for each source of change in turn. The effects of labour productivity are presented separately for high and low skill labour in table 3.2. Percentage changes are only different between high and low skill labour for labour productivity. The reason for this is explained in appendix B.

Domestic final demand

The first column of table 3.1 reports how increases in final demands across the economy would have affected employment if labour-output ratios had remained

at their 1986-87 levels. On this basis there would have been an increase in total manufacturing employment of 14.7 per cent between 1986-87 and 1993-94. Within manufacturing, the largest changes were in the Wood, wood products and furniture (18.5 per cent), Motor vehicles and parts (31.6 per cent) and Other machinery and equipment industries (25.8 per cent). Growth in Other machinery and equipment could reflect the greater use of computers since the late 1980s.

International trade

Columns 2 to 5 of table 3.1 report how increases in imports would have reduced labour demand if labour-output ratios had remained at their 1986-87 levels. Column 6 reports the equivalent results for exports. On this basis the net impact of trade on total manufacturing employment would have been a decline of 1.7 per cent (the sum of columns 2 to 6 in table 3.1). There was substantial variation at a more disaggregated level. The net impact of trade was most positive for the export oriented Food, beverages and tobacco industry (7.0 per cent) and Basic metal products (16.2 per cent). The largest negative net impacts of trade were found in the import competing industries of Clothing and footwear (-17.9 per cent) and Motor vehicles and parts (-17.4 per cent). These industries were subject to some of the largest falls in protection over the period.

Changes in import penetration were mostly associated with reduced employment, reflecting the widespread growth in Australian imports since the late 1980s. However, import substitution of intermediate demand from low income countries had a relatively minor effect in all industries except Textiles. Thus, reduced protection of the Textile industry coincided with increased import substitution from low income countries. Textiles are used as an intermediate input in the Clothing and footwear industry, which explains why the effect of import substitution is largest for intermediate demand.

Import substitution in final demand had large negative effects on employment in Clothing and footwear (-19.5 per cent) and Motor vehicles and parts (-20.4 per cent). These industries were subject to some of the largest falls in protection from 1986-87 to 1993-94. However, import substitution of final demand from low income countries was largely confined to Clothing and footwear. High income countries were the principal source of trade related employment changes for Motor vehicles and parts, reflecting their dominance of the industry.

Table 3.1 **Sources of change in employment growth, 1986-87 to 1993-94**

		Import substitution							
		Intermediate demand		*Final demand*					
Industry	*Domestic final demand*	*Low income sources*	*High income sources*	*Low income sources*	*High income sources*	*Exports*	*Labour productivity*	*Inter-mediate input use*	*Total change*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
	%	%	%	%	%	%	%	%	%
Food, beverages & tobacco	11.1	-0.5	-0.7	-1.2	-1.6	11.0	-19.9	-3.9	-5.7
Textiles	4.7	-11.0	-0.4	-5.0	0.6	16.5	-26.3	1.4	-19.5
Clothing & footwear	0.8	-2.8	-0.1	-19.0	-0.5	4.5	7.6	1.5	-8.1
Wood, wood products & furniture	18.5	-1.8	-2.5	0.0	0.4	4.9	12.3	-10.1	21.7
Paper, paper prods, printing & publishing	15.3	-2.6	-6.5	-0.9	0.2	7.5	-17.1	4.6	0.5
Chemical, petroleum & coal products	14.4	-5.1	-11.0	-1.8	-3.6	12.8	5.6	-1.6	9.8
Non-metallic mineral products	17.3	-3.7	0.3	-1.0	0.1	9.4	-19.9	-7.7	-5.1
Basic metal products	8.8	-5.2	-2.0	-1.3	-1.4	26.1	-25.8	-5.1	-5.9
Fabricated metal products	4.3	-3.2	-2.9	-1.1	-1.1	9.6	-2.3	9.1	12.5
Motor vehicles & parts	31.6	-1.6	-0.4	-3.5	-16.9	5.0	-24.5	-2.6	-13.0
Other machinery & equipment	25.8	-6.2	-2.6	-8.6	-7.0	17.9	-31.4	6.9	-5.2
Miscellaneous manufacturing	17.5	-5.0	-1.0	-4.7	-3.1	9.1	0.8	-12.2	1.3
Total manufacturing[a]	**14.7**	**-3.5**	**-2.5**	**-3.8**	**-3.0**	**11.1**	**-13.2**	**-0.7**	**-0.8**
Other industries	**18.3**	**-1.0**	**-0.9**	**-0.5**	**-0.3**	**6.8**	**-15.2**	**5.1**	**12.4**

a Excludes Other transport equipment

Source: Industry Commission estimates.

Labour productivity

The estimates in column 7 of table 3.1 report how labour productivity changes between 1986-87 and 1993-94 would have changed the number of workers required to produce the level of output recorded in 1993-94. They are calculated as the change in the labour-output ratio between 1986-87 and 1993-94 multiplied by employment in the relevant industry in 1993-94. Increases in labour productivity reduce the amount of labour required to produce a given level of output and so result in a negative employment growth rate in table 3.1. Labour productivity fell in some industries and so the amount of labour required to produce 1993-94 output increased.

Labour productivity of low skill workers grew by more than that of high skill workers in the same industry between 1986-87 and 1993-94. As a result, the disaggregated results in table 3.2 indicate that labour productivity had the greatest adverse impact on low skill employment. This is consistent with the economy-wide shift from low skill labour to high skill labour observed in chapter 2. The industries in which low skill labour productivity increased the most were Basic metal products and Other machinery and equipment. This had the effect of reducing the employment of low skill workers in the Basic metal products and Other machinery and equipment industries by 27.9 and 34.2 per cent respectively.

There were large percentage declines in high skill labour productivity (and hence increases in employment) in half of the manufacturing industries listed in table 3.2. However these percentage changes are somewhat misleading because high skill employment grew from a low base. For example, Clothing and footwear output was similar in 1986-87 and 1993-94 but high skill employment grew from around 8 000 to around 13 000. This accounts for the increase in high skill employment of 76.5 per cent reported in the last column of table 3.2. Low skill employment in the Clothing and footwear industry only declined by 10.3 per cent due to labour productivity changes but this represented a much larger change in the number of employees. Low skill employment was around 59 000 in 1986-87 and dropped to around 43 000 in 1993-94. Similar substitutions from low skill to high skill labour occurred in other industries. A notable exception was Wood, wood products and furniture, which experienced a decline in both low and high skill labour productivity.

The estimates in tables 3.1 and 3.2 may overstate the extent to which improvements in labour productivity reduced employment. This is because the economy was at different stages in the business cycle in 1986-87 and 1993-94. In 1986-87, growth of the Australian economy (as measured by annual changes in GDP(A) in figure 3.1) slowed to 2.3 per cent from more than 4.0 per cent in the previous year. Unemployment had risen slightly to 8.3 per cent in 1986-87

and monetary policy had become more restrictive with real interest rates at high levels in the preceding 2 years. In contrast, 1993-94 was the third year of recovery from a recession (in 1990-91) with growth in GDP(A) of 4.4 per cent and falling real interest rates. However, unemployment in 1993-94 was 10.5 per cent, which was much higher than in 1986-87. Given the tendency of some employers to hoard workers in periods of slack demand, it is likely that labour productivity in 1986-87 was lower than it would have been if there had not been a slowdown in economic growth in that year. In 1993-94, it is possible that labour productivity was higher than it would otherwise have been because employers were apprehensive about hiring new staff. These cyclical effects may exaggerate the labour productivity estimates in tables 3.1 and 3.2.

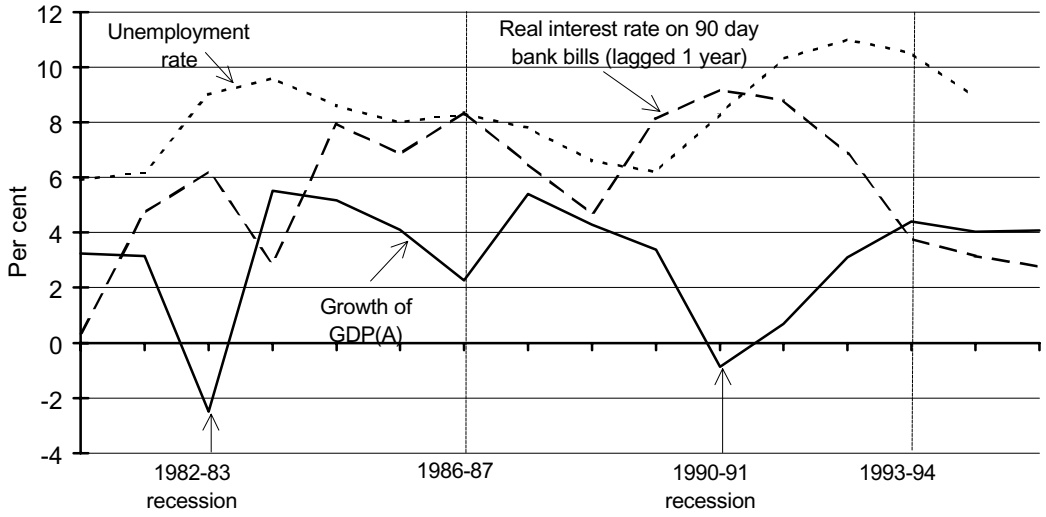
Table 3.2 Labour productivity effects on employment by skill group, 1986-87 to 1993-94

Industry	*Low skill labour productivity*	*High skill labour productivity*
	%	%
Food, beverages & tobacco	-20.4	-3.4
Textiles	-21.1	-4.0
Clothing & footwear	-10.3	76.5
Wood, wood products & furniture	19.4	28.2
Paper, paper prods, printing & publishing	-9.9	-9.4
Chemical, petroleum & coal products	-9.7	49.8
Non-metallic mineral products	-21.8	23.1
Basic metal products	-27.9	-23.8
Fabricated metal products	-6.3	1.4
Motor vehicles & parts	-17.2	29.9
Other machinery & equipment	-34.2	-19.0
Miscellaneous manufacturing	-17.1	39.7
Total manufacturing[a]	-8.9	1.1
Other industries	-15.2	-11.7

a Excludes Other transport equipment

Source: Industry Commission Estimates

Figure 3.1 **Australian unemployment, real interest rates and GDP growth, 1980-81 to 1995-96**



Sources: Unemployment rate and growth in GDP(A): ABS (*Labour Force Australia,* Cat. no. 6202.0; *Australian National Accounts: National Income, Expenditure and Product,* Cat. no. 5206.0). Real interest rate: IC estimates based on data in Reserve Bank of Australia *Bulletin* and ABS (*Consumer Price Index*, Cat. no. 6401.0).

Intermediate input use

Some industries recorded increases in employment due to changes in the use of intermediate inputs across the economy (table 3.1). This result may be misleading because of greater outsourcing. In particular, a part of intermediate input demand may not have been recorded in the past because firms produced such inputs in-house, such as accounting services (Gregory and Greenhalgh 1996). Industries in which employment decreased by the largest amounts due to changes in intermediate input use were Wood, wood products and furniture (-10.1 per cent), Non-metallic mineral products (-7.7 per cent), and Miscellaneous manufacturing (-12.2 per cent).

In summary, it appears that changes in imports from low wage economies were associated with relatively minor changes in total manufacturing employment between 1986-87 and 1993-94. This was also found in Fahrer and Pease (1994) for the period between 1981–82 and 1991–92. The effect of imports from low wage economies was not found separately in de Laine, Lee and Woodbridge (1997). Of greater significance than imports from low wage economies were employment decreases due to labour productivity improvements and employment increases due to growth in exports and domestic final demand. These three factors were also found to be the largest influences on

manufacturing employment in Fahrer and Pease (1994) and de Laine, Lee and Woodbridge (1997) over similar periods.

Changes in intermediate input use were generally of lesser significance than domestic final demand, exports and labour productivity. The result that trade was not significantly associated with changes in total manufacturing employment suggests that falling protection and increased trade were not major influences on income distribution. This was also found in the other two Australian studies. However, this must be qualified by the fact that the low skill intensive industries of Textiles, clothing and footwear experienced significant adverse employment effects from low wage imports also found in Fahrer and Pease (1994). Furthermore, it is possible that increased import competition contributed to labour productivity improvements which were associated with the greatest adverse impact on low skill labour.

All these results for total manufacturing were found to be insensitive to a change in the level of aggregation used. There were only minor changes in the results when total manufacturing was used instead of 2 and 3 digit ASIC manufacturing industries.

4 GENERAL EQUILIBRIUM ANALYSIS

A common criticism of input–output analysis is that it is based on national accounting identities rather than on a model of the underlying behaviour of domestic producers and consumers. In particular, the technique merely translates observed changes in the components of national income and expenditure into employment effects on the basis of observed and fixed domestic labour–output ratios. This provides little guidance on how reduced trade barriers contributed to changes in employment. A general equilibrium model overcomes this problem by incorporating empirical estimates and assumptions of how consumers and producers respond to changes in policies and other variables into the input–output framework.

This chapter uses results from the Monash general equilibrium model of the Australian economy to analyse how changes in assistance and technological progress between 1986-87 and 1993-94 altered the distribution of employment among occupations. The results are derived from an historical analysis undertaken for the Commission's recent inquiry into the Textiles, clothing and footwear industries (IC 1997d). The methodology used is specified in Dixon, Parmenter and Rimmer (1997) and briefly outlined in box 4.1. Further details about the Monash model are provided in appendix C.

In summary, it was assumed that observed changes in employment (measured as total hours worked) between 1986-87 and 1993-94 were the net result of changes in eight separate factors. The contribution of each of these sources of employment change was estimated in isolation from the others. For example, the contribution of changes in assistance was estimated by holding constant other sources of employment change such as growth in aggregate employment, the balance of trade as a proportion of GDP, and the shares of consumption and investment in GDP. As a result, all sources except 'growth in employment' measure how a fixed level of total employment was redistributed between industries. Such distributional effects are of greatest relevance to this paper.

Box 4.1 Sources of employment changes

The Monash model results analysed here attribute employment changes between 1986-87 and 1993-94 to eight sources:

1. **Shifts in international trading conditions** are a combination of movements in foreign demands for Australian exports and changes in the foreign currency prices of Australian imports. It is assumed that Australia can affect the price of its exports but not its imports.
2. **Changes in assistance** are alterations to import quotas, tariffs and other forms of industry assistance.
3. **Technical change** is the shift in input use per unit of output due to changes in production functions. Substitutions between labour and capital which are accounted for in the model by changes in relative input prices are not considered to be a part of technical change.
4. **Changes in import/domestic preferences** are the observed substitutions between imported and domestic products not accounted for in the model by changes in relative prices.
5. **Changes in consumer preferences** are the observed substitutions between different products not accounted for in the model by changes in relative prices.
6. **Growth in employment** is the change in employment (measured by hours worked) and the number of households.
7. **Changes in macro composition of GDP** are movements in the balance of trade and the ratio of consumption to investment.
8. **Apparent changes in required rates of return** are those which would bring industry specific rates of return to capital closer to what is considered to be their long run average.

Movements in some of these variables are not recorded in official statistics. As a result, it was necessary to adopt a two stage modelling process. The Monash model was first used to solve for parameters associated with the eight sources of employment change which cannot be observed directly. This was done in a way that is consistent with observable statistics such as assistance, output and employment. Separate Monash simulations were then run to estimate the impact of the eight observed/estimated sources of employment change in isolation.

Sources: Dixon and McDonald (1993) and Dixon, Parmenter and Rimmer (1997).

4.1 Industry results

Table 4.1 summarises the industry level results produced by the Monash model. It is apparent from the last column of the table (on page 49) that the majority of employment growth occurred in the services sector between 1986-87 and 1993-94. While total employment in manufacturing is estimated to have fallen by 2.61 per cent over that period, there was significant variation at a disaggregated level. Employment growth of more than 10 per cent occurred for Wood, wood products and furniture, Chemical, petroleum and coal products, and Miscellaneous manufacturing. In contrast, measured employment in the Textiles, clothing and footwear industries fell by more than 30 per cent. Employment in the Motor vehicles and parts industry fell by 17.5 per cent.

Assistance

The estimates in table 4.1 indicate that changes in assistance between 1986-87 and 1993-94 in isolation would have caused a redistribution of employment from manufacturing to other industries. This result reflects the fact that government assistance to manufacturers in 1986-87 was generally higher than that for other industries and so fell by a greater amount as the government sought to reduce assistance disparities between industries. Within manufacturing, the highly protected Textiles, clothing and footwear, and Motor vehicles and parts industries are estimated to have experienced the greatest employment falls associated with changes in assistance. Nevertheless, reduced assistance was only one out of a number of (often larger) forces acting to redistribute employment away from manufacturing to other industries (figure 4.1). This was the case even for the most highly protected industries within manufacturing (figure 4.2).

International trading conditions

Shifts in international trading conditions had a more significant impact on employment for the majority of manufacturing industries than did changes in assistance.

The large fall in relative import prices for Clothing and footwear observed in chapter 2 appears to have reduced employment in that industry. Most of the decline in employment in Textiles occurred in synthetics and cotton yarn production. These were the largest employers of Textile industry workers

Table 4.1 Estimated sources of change in the composition of industry employment between 1986-87 and 1993-94[a]

Industry	*Shifts in internationa l trading conditions*	*Changes in assistance*	*Technical change*	*Changes in import/ domestic preferences*	*Changes in consumer preferences*
	%	%	%	%	%
Agriculture & mining	**-19.98**	**0.96**	**-5.53**	**3.99**	**0.73**
Food, beverages & tobacco	1.92	-0.04	3.91	0.54	-2.06
Textiles	-4.35	-7.85	-21.00	1.21	-6.56
Clothing & footwear	-7.93	-9.44	-6.59	-8.63	-10.90
Wood, wood products & furniture	5.13	-0.87	13.47	-8.21	-1.71
Paper, paper products, printing & publishing	-0.06	-0.48	-8.16	-1.43	0.12
Chemical, petroleum & coal products	-1.13	-0.69	1.88	-3.34	1.13
Non-metallic mineral products	0.94	-0.41	-4.80	-3.19	0.05
Basic metal products	-9.39	0.78	8.53	-8.66	0.14
Fabricated metal products	7.20	-0.96	3.01	-4.01	-0.33
Motor vehicles & parts	5.55	-4.60	-17.19	-8.69	3.24
Other machinery & equipment	2.83	-0.58	-9.48	-5.51	-0.46
Miscellaneous manufacturing	0.79	-2.40	11.28	-7.45	-0.17
Total manufacturing	**0.66**	**-1.41**	**-3.22**	**-4.39**	**-1.05**
Electricity, gas & water	-3.48	-0.40	-42.52	0.09	0.10
Construction	1.72	0.20	16.40	0.11	-0.18
Wholesale & retail trade	2.47	0.45	1.51	0.09	-2.05
Transport & storage	-4.29	0.56	-10.58	2.52	-1.39
Communication	0.79	-0.34	-16.91	0.30	0.18
Finance, property & business services	0.63	0.02	11.84	1.25	1.42
Public administration & defence	1.99	0.32	-8.13	0.12	-0.52
Community services	2.26	0.12	0.14	0.00	2.66
Recreation, personal & other services	8.55	-0.02	11.00	1.15	-3.89
Total services	**1.46**	**0.20**	**1.42**	**0.53**	**0.09**
Total employment[b]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

(continued on next page)

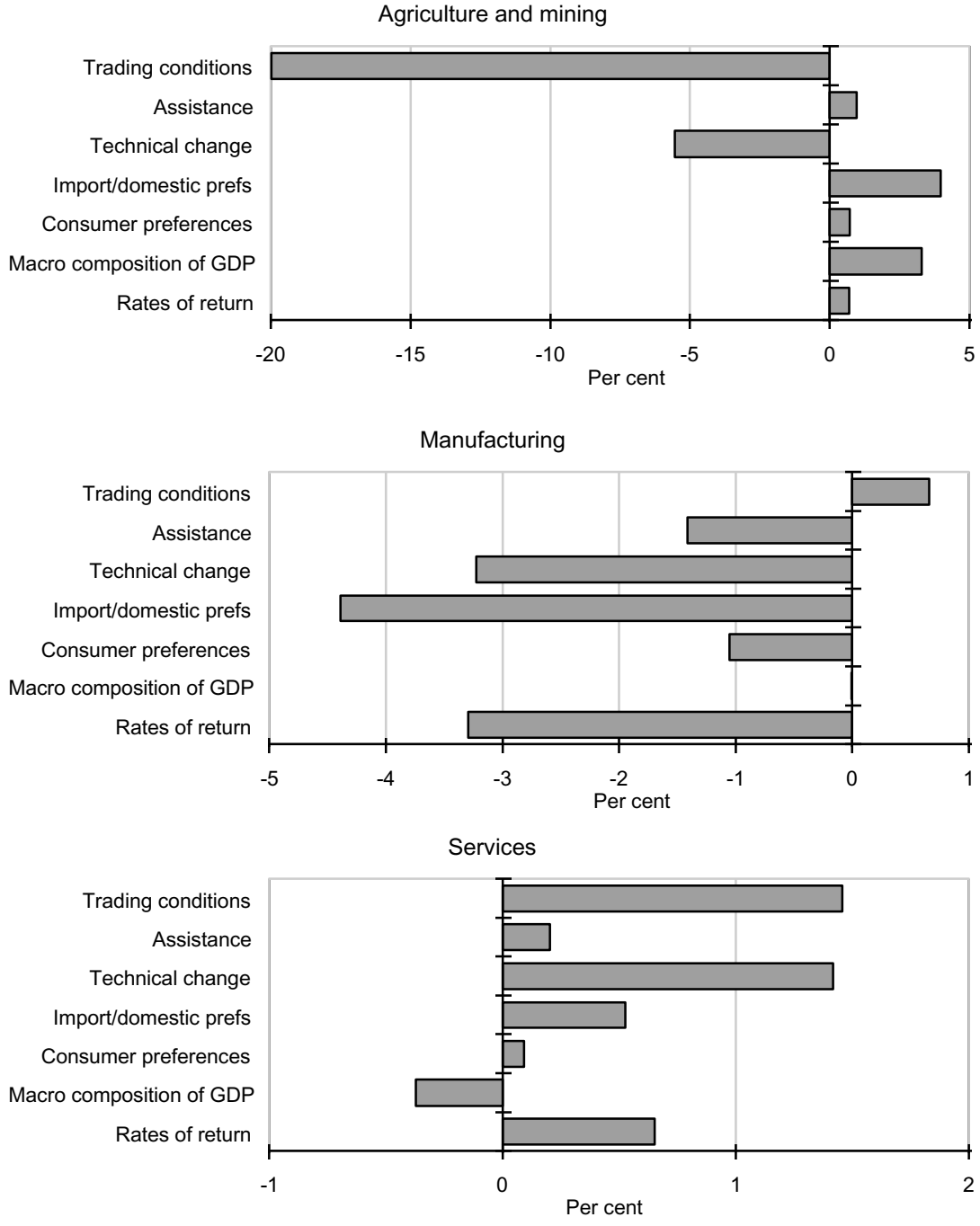
Table 4.1 **Estimated sources of change in the composition of industry employment between 1986-87 and 1993-94[a]** (continued)

Industry	*Growth in employment*	*Changes in macro composition of GDP*	*Apparent changes in required rates of return*	***Total change***
	%	**%**	**%**	**%**
Agriculture & mining	**9.84**	**3.30**	**0.69**	**-6.00**
Food, beverages & tobacco	9.72	1.59	-9.44	**6.12**
Textiles	9.21	3.18	-5.88	**-32.04**
Clothing & footwear	9.06	3.87	-6.81	**-37.37**
Wood, wood products & furniture	10.65	2.63	-3.32	**17.77**
Paper, paper products, printing & publishing	9.84	1.91	-3.49	**-1.75**
Chemical, petroleum & coal products	10.82	3.09	-0.11	**11.64**
Non-metallic mineral products	9.82	-1.13	-0.75	**0.53**
Basic metal products	11.71	0.09	-2.96	**0.23**
Fabricated metal products	10.27	-7.51	-1.49	**6.19**
Motor vehicles & parts	10.34	-3.21	-2.93	**-17.50**
Other machinery & equipment	9.77	-2.27	-0.12	**-5.82**
Miscellaneous manufacturing	10.92	2.02	-1.40	**13.59**
Total manufacturing	**10.11**	**-0.01**	**-3.29**	**-2.61**
Electricity, gas & water	8.96	0.64	9.94	**-26.66**
Construction	10.02	-12.62	-1.40	**14.24**
Wholesale & retail trade	10.04	-0.01	1.53	**14.02**
Transport & storage	10.18	2.03	3.85	**2.88**
Communication	9.48	-1.33	1.47	**-6.37**
Finance, property & business services	10.71	-1.73	-2.09	**22.05**
Public administration & defence	9.62	1.21	0.89	**5.50**
Community services	10.36	4.58	0.42	**20.53**
Recreation, personal & other services	10.83	2.68	-0.51	**29.78**
Total services	**10.19**	**-0.37**	**0.65**	**14.16**
Total employment[b]	**10.16**	**0.00**	**0.00**	**10.16**

a Employment is measured as hours worked. **b** All sources of change except 'growth in employment' are estimated by holding total employment fixed.

Source: Industry Commission estimates based on results of the Monash model.

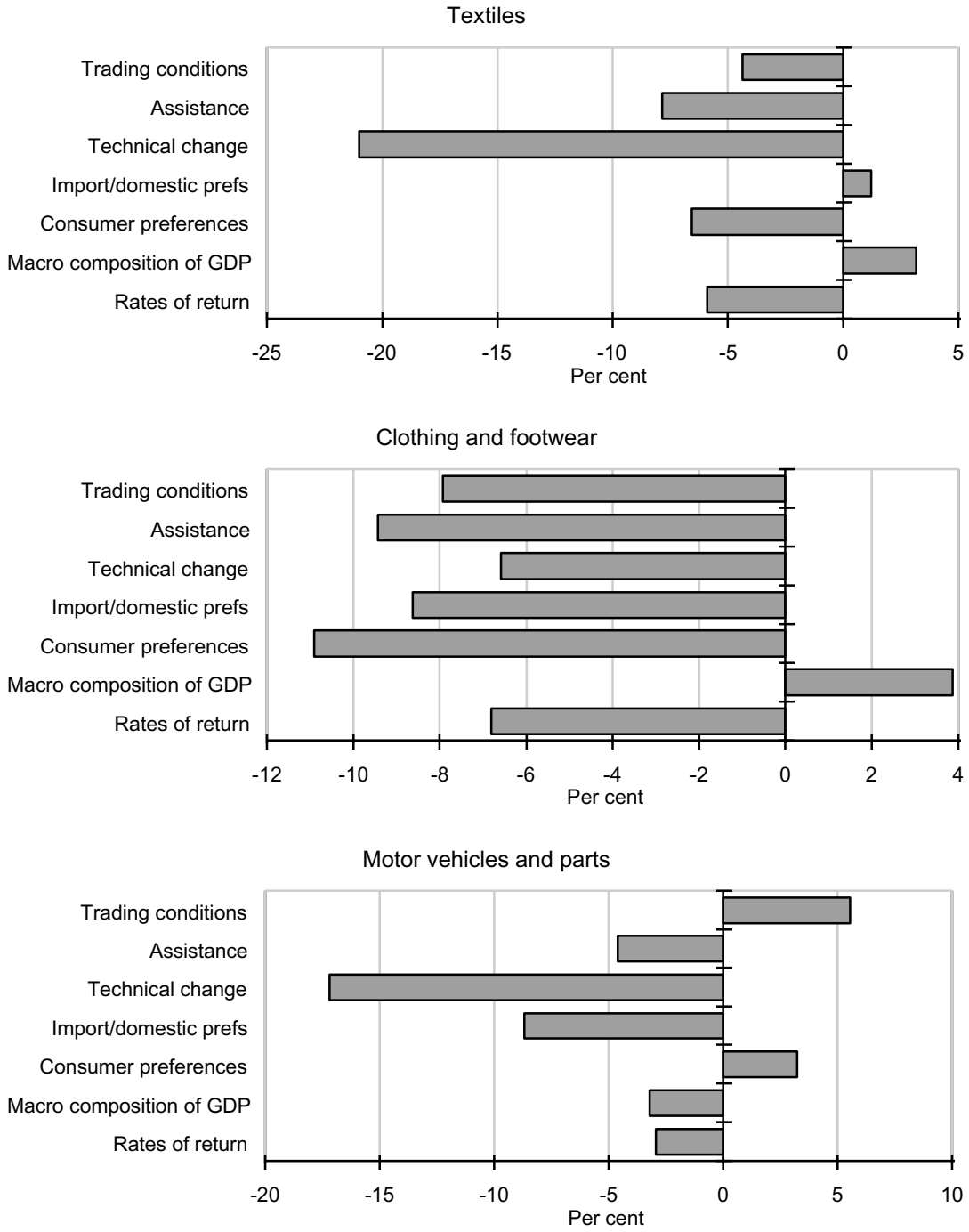
Figure 4.1 **Estimated sources of change in employment for selected industries, 1986-87 to 1993-94**[a]



[a] Excludes the impact of growth in employment and the number of households.

Source: Industry Commission estimates based on results of the Monash model.

Figure 4.2 **Estimated sources of change in employment for selected manufacturing industries, 1986-87 to 1993-94[a]**



a Excludes the impact of growth in employment and the number of households.
Source: Industry Commission estimates based on results of the Monash model.

in 1986-87 and had high import penetrations. Clothing was by far the largest employer in Clothing and footwear in 1986-87 and was responsible for most of the decline in employment in the industry. Import prices declined significantly relative to the CPI for all commodities produced by the industry. This would have been the cause of the decline in employment considering that it is an import competing industry. Basic metal products also had a significant decline in employment associated with falling international prices.

Motor vehicles and parts experienced a rise in employment, reflecting higher import prices following the appreciation of the Japanese Yen between 1986-87 and 1993-94. Wood, wood products and furniture and Fabricated metal products also experienced employment rises associated with favourable international trading conditions.

Movements in international trading conditions resulted in an improvement in Australia's terms of trade with associated real appreciation of the Australian dollar and growth in wages and GNE (Dixon, Parmenter and Rimmer 1997). This had a beneficial impact on employment in most service industries.

The terms of trade improved because import prices fell faster than export prices. Export price falls were greatest for agricultural and mining products. As a result, Agriculture, forestry and fishing would have experienced a 4.5 per cent fall in employment. The decline in employment in Agriculture, forestry and fishing was due primarily to a fall in the export demand for wool and to a lesser extent the export demand for wheat.

Changes in international trading conditions in isolation would have reduced mining industry employment by 44.7 per cent. The main source of the large drop in employment in Mining was a decline in the export demand for black coal. Export demands for iron ore and non ferrous metal ores also declined. Domestic production of Non ferrous metal ores fell because of a decline in import prices and decreased demand as an input into the domestic Non ferrous metal products manufacturing industry.

In order to maintain the fixed balance of trade assumption, so as to abstract from any change in capital and other financial flows, the falls in primary commodity exports were matched by rapid growth in manufacturing and other exports and changes in imports.

Technical change

Technological progress had a greater impact on employment than changed assistance in all manufacturing industries except Clothing and footwear. Most notably, it was estimated that technical change would, in isolation, have

reduced Textile industry employment by 21 per cent. This was due to a large fall in the amount of labour used per unit of textile production (partly caused by a substitution away from labour to capital) and shifts in technology in other industries which reduced their use of textiles per unit of output. A similar, but less dramatic, pattern of adjustment occurred in Clothing and footwear, and Paper, paper products, printing and publishing.

In some industries the adverse effect on employment of labour productivity improvements was partly offset by shifts in technology in other industries. This was the case for employment in Motor vehicles and parts, which was adversely affected by a large fall in the use of labour per unit of output but benefited from greater use of motor vehicles per unit of output in other industries. A similar pattern of labour productivity improvements which outweighed favourable economy–wide shifts in technology occurred in the Communications and Other machinery and equipment industries. The reverse was true for Basic metal products and Finance, property and business services. Those industries experienced favourable shifts in the technologies of other industries which outweighed the adverse employment effects of labour productivity improvements.

Miscellaneous manufacturing was estimated to increase employment by 11.28 per cent. This was the net result of an increase in the use of labour per unit of output (due in part to a substitution of labour for capital) which outweighed the effect of shifts in the technologies of other industries which reduced their use of miscellaneous manufactures per unit of output.

The Wood, wood products and furniture, Construction, and Recreation, personal and other services industries were also estimated to experience an increase in employment associated with technical change. This was due to greater use of labour per unit of output in those industries and greater demand for their output by other industries.

Government policy changes led to significant technical change in some industries. In particular, the reform of government business enterprises (GBEs) and the deregulation of what were previously highly regulated industries led to significant reductions in the number of employees per unit of capital and output. This is reflected in estimates from the Monash model, which indicate that technical change would, in isolation, have reduced employment by more than 30 per cent in the Electricity, gas and water, Rail transport and Air transport industries between 1986-87 and 1993-94 (the latter two industries are included in the Transport and storage classification in table 4.1). Similarly, employment in Public administration and defence would have declined by 8.13 per cent.

Technical change led to increases in both exports and imports. Primary commodity exports increased at a rapid rate because agriculture and mining experienced among the largest labour productivity increases between 1986-87 and 1993-94 (Dixon, Parmenter and Rimmer 1997). These productivity improvements were reflected in a 5.53 per cent fall in the use of labour by agriculture and mining.

It is possible that Australia's reductions in trade barriers forced domestic producers in traded industries to increase their efficiency. If this is the case, then part of the employment changes attributed here to technical change should be viewed as being caused by reduced assistance. However, detailed occupational results discussed later in this chapter suggest that that the size of this effect is not large at an economy–wide level because the employment effects of technical change were concentrated in Australia's largely non-traded service industries.

Preferences

Shifts in import/domestic preferences tended to favour imports and so worked against employment in the majority of manufacturing industries. Again, this factor appears to have been more significant to most manufacturers than changes in assistance.

Changes in consumer preferences were estimated to have a minor impact on employment at the sectoral level. However, within the manufacturing sector there were noticeable shifts for the more highly protected industries. In particular, changes in consumer preferences reduced employment in Textiles and Clothing and footwear by 6.56 and 10.90 per cent respectively. In contrast, consumer preferences raised employment in the Motor vehicles and parts industry by 3.24 per cent.

It is possible that some of the shifts in import/domestic and consumer preferences were linked to the removal of quantitative restrictions, a change in assistance that may not be captured fully by the 'change in assistance' variable. For example, reductions in assistance for motor vehicle production appear to have caused the domestic industry to specialise mainly in large six cylinder cars. Demand for smaller four cylinder vehicles is now met primarily by imports. Import quotas prior to 1993-94 may have encouraged importers to concentrate on higher margin luxury items so as to maximise their profit from a fixed number of sales. The abolition of quotas would have led to greater variety in imports and this could have been reflected in the 'preferences' variable.

Macro composition of GDP

Between 1986-87 and 1993-94 the macro composition of GDP changed with consumption growing faster than investment. This had a negative effect on employment in industries whose output was used more in investment than consumption. For example, employment in Motor vehicles and parts and Construction declined because of the shift in the composition of GNE towards consumption. In contrast, industries which sold their production mostly to final consumers experienced increases in employment. Industries in this category included Food, beverages and tobacco, Clothing and footwear, Community services, and Recreation, personal and other services.

Rates of return

It was assumed that if an industry's rate of return on capital was low in 1986-87 relative to what was considered to be the long run average for that industry then the required rate of return would increase. This in turn would encourage both a substitution away from capital and a decrease in output. The former would tend to increase employment but the latter would reduce it.

The Monash model results indicate that apparent changes in required rates of return had an adverse impact on employment in most manufacturing industries. This reflects the relatively low rates of return recorded by manufacturers in 1986-87. Manufacturing employment falls associated with apparent changes in required rates of return were greatest in Food, beverages and tobacco, Textiles, clothing and footwear. In contrast, agriculture and mining was estimated to increase employment because it had a relatively high rate of return in 1986-87.

Overall impact

In summary, the Monash estimates indicate that between 1986-87 and 1993-94 the number of hours worked in manufacturing would have fallen by 12.7 per cent if total Australian labour supply and employment had not grown over that period. Only about one-tenth (or 1.4 per cent) of this fall in manufacturing hours worked was estimated to have been caused by changes in industry assistance (which includes tariffs). About a quarter (or 3.2 per cent) was attributed to changes in technology across the economy which reduced the use of manufactured inputs and labour per unit of output. Around one-third (or 4.4 per cent) of the estimated employment decline was linked to shifts in preferences between imports and domestic products not attributable to changes in relative prices. It is possible that some of this change was associated with the removal of quantitative import restrictions. The following section combines the

Monash results with other data in order to quantify the impact of changes in assistance on different occupations.

4.2 Occupational results

Changes in the share of each occupation in aggregate employment can be attributed to two forces. First, there are industries which grow faster than average and so benefit those occupations which are used most intensively in that industry. This is known as the **industry share effect**. Second, there are substitutions within industries towards certain occupations. This is called the **occupational share effect**. These two effects can be estimated using the formulae specified in box 4.2. This was done for the period between 1986-87 and 1993-94 by combining the previously discussed industry level results from the Monash model with ABS data on the distribution of occupations within industries.

The resulting estimates indicate that there was a large occupational share effect between 1986-87 and 1993-94 towards the two highest skill occupations (Managers and administrators and Professionals) and the occupation which is most highly concentrated in the services sector (Salespersons and personal service workers) (table 4.2). Farmers and farm managers (ASCO group 14) were excluded from the Managers and administrators group in this analysis because they experienced unusually large negative industry and occupational share effects (-16.08 and -6.88 per cent respectively) which mask changes experienced by other occupations in the Managers and administrators group. The only other occupation estimated to have had a positive, albeit relatively small, occupational share effect was Plant and machine operators and drivers. The greatest within industry substitutions away from an occupation occurred for Clerks (-6.14 per cent) and Tradespersons (-6.10 per cent).

Industry share effects reinforced the occupational share effects in favour of Managers and administrators, Professionals, and Salespersons and personal service workers. This is different from the United States and Europe, where the shift in employment to higher skill occupations has primarily occurred via occupational share effects (Machin, Ryan and Van Reenen 1996). Positive industry share effects were also estimated for Para professionals and Clerks but these were outweighed by adverse occupational share effects. The greatest decline attributable to industry share effects was for Plant and machine operators and drivers (-8.76 per cent). This far outweighed the small positive occupational share effect for that occupation.

Box 4.2 Decomposition of employment growth by occupation

The share of each occupation in aggregate employment will change over time if the employment of some occupations grow by less or more than the economy–wide average. Differences in growth rates at the aggregate and occupational level can be attributed to some industries growing faster than others (the **industry share effect**) and substitutions within industries towards certain occupations (the **occupational share effect**). This decomposition can be expressed in mathematical terms using the following formula:

$$g_i - g^A = g_i^I + g_i^O$$

where g_i is the rate of growth in employment of occupation i, g^A is the rate of growth in aggregate employment, g_i^I is the industry share effect for occupation i, and g_i^O is the occupational share effect for occupation i. The industry share effect can be calculated using the following formula:

$$g_i^I = \sum_{j=1}^{n} S_{ij} g_j - g^A$$

where S_{ij} is the share of occupation i employed in industry j and g_j is the rate of growth of total employment in industry j. The occupational share effect can then be calculated by substituting known values for g_i, g^A and g_i^I into the first formula.

Source: Adapted from Meagher (1995).

The industry share effects in table 4.2 can be attributed to the eight sources of employment growth discussed in box 4.1 by using the industry level results from the Monash model. The resulting estimates indicate that changes in assistance between 1986-87 and 1993-94 had a relatively minor impact on each occupation (table 4.3). Of far greater significance were shifts in international trading conditions and technical change. These were among the biggest sources of employment change for all occupations and appear to have led to a redistribution of employment away from the two lowest skill occupations to other workers (figure 4.3). Note, however, that the third lowest skill occupation (Salespersons and personal service workers) was estimated to benefit substantially from changed international trading conditions and technological progress. The result for each occupation depends on its distribution between growing and shrinking industries.

Table 4.2 **Estimated composition of employment changes between 1986-87 and 1993-94**

Occupation	*Industry share effect*[a]	*Occupational share effect*[b]	*Aggregate employment growth*	*Total change*[c]
	%	%	%	%
Managers and administrators[d]	2.24	15.74	10.16	28.15
Professionals	5.89	6.11	10.16	22.16
Para professionals	3.03	-4.39	10.16	8.81
Tradespersons	-3.56	-6.10	10.16	0.49
Clerks	1.78	-6.14	10.16	5.80
Salespersons and personal service workers	5.89	11.84	10.16	27.89
Plant and machine operators and drivers	-8.76	0.85	10.16	2.25
Labourers and related workers	-1.84	-3.88	10.16	4.43
Total employment	**0.00**	**0.00**	**10.16**	**10.16**

a Employment changes due to shifts in the distribution of output between industries. **b** Employment changes due to movements in the distribution of occupations within industries. **c** Equals the sum of the first three columns. **d** Excludes Farmers and farm managers, which had an industry share effect of -16.08 per cent and an occupational share effect of -6.88 per cent.

Source: Industry Commission estimates based on unpublished ABS data and Monash model simulations.

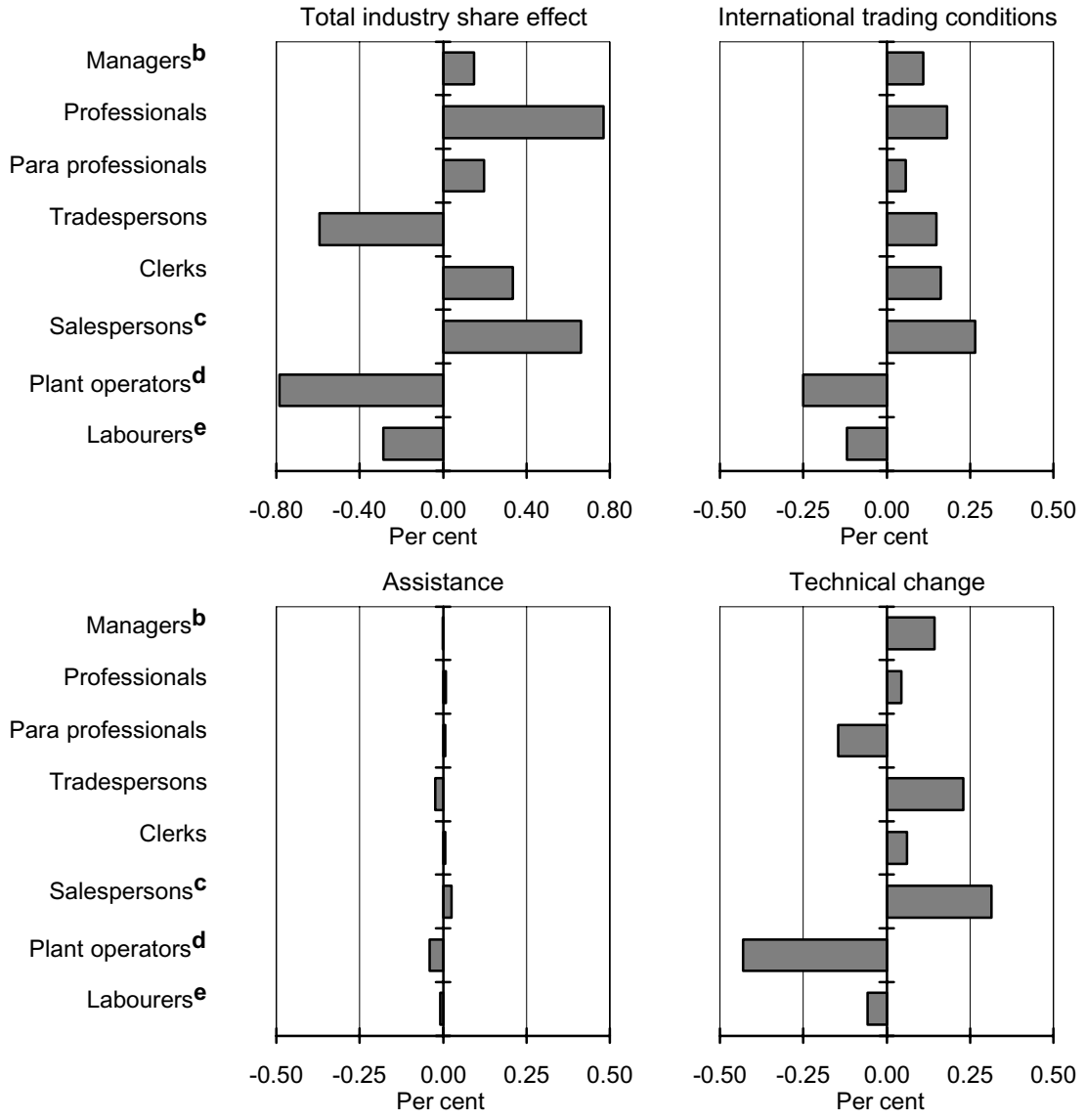
Assistance

Changes in assistance were of most significance to Plant and machine operators and drivers. The fall in Textiles, clothing and footwear employment of 7.85 and 9.44 per cent respectively adversely affected that occupation because it had a greater concentration in those industries. Similarly, Tradespersons were adversely affected by the 4.6 per cent fall in Motor vehicles and parts employment because it had a greater presence in that industry.

International trading conditions

International trading conditions had an adverse impact on the two lowest skill occupations (Plant and machine operators and drivers and Labourers and related workers) because they had a greater proportion of workers employed in agriculture and mining. The fall in primary commodity exports associated with adverse trading conditions led to reduced use of rail and water transport. This in

Figure 4.3 **Estimated industry share effects by selected sources of employment change, 1986-87 to 1993–94**[a]



[a] Changes are measured as percentages of total Australian hours worked in 1986-87. Other things being equal, this means that occupations with more employees will tend to record larger changes. [b] Managers and administrators, excluding Farmers and farm managers. [c] Salespersons and personal service workers. [d] Plant and machine operators and drivers. [e] Labourers and related workers

Source: Industry Commission estimates based on results of the Monash model.

turn further reduced the employment of Plant and machine operators and drivers. The decline in Textiles, clothing and footwear employment had a much smaller, but still negative, effect on the employment of Plant and machine operators and drivers and Labourers and related workers. Changes in the Textiles, clothing and footwear industries had a relatively minor impact because those industries only account for about 1 per cent of total Australian employment.

The growth in all other occupations was primarily the result of increased employment in service industries. This was particularly the case for Salespersons and personal service workers because almost all such workers are employed in the services sector. The gain for this occupation was primarily the result of a 2.47 per cent increase in employment in Wholesale and retail trade. Changes in manufacturing played a (positive) secondary role for Tradespersons (because employment in Fabricated metal products and Motor vehicles and parts rose by 7.20 and 5.55 per cent respectively) but otherwise had a comparatively minor effect on occupations.

Technical change

The industry share effects caused by technical change had a significant impact for a range of reasons but again it was developments in service industries rather than manufacturing that provided most of the explanation. The large fall in Electricity, gas and water employment associated with the reform of government business enterprises had a disproportionately negative impact on Para professionals and the two lowest skill occupations. Tradespersons was also adversely affected but this was outweighed by increases in employment in Construction and Recreation, personal and other services. Salespersons and personal service workers benefited from large increases in employment in Finance, property and business services, Recreation, personal and other services, and Wholesale and retail trade. Managers and administrators also benefited from employment growth in those industries as well as Construction.

Technical change was estimated to have reduced total employment in the Textiles, clothing and footwear industries by 21.00 and 6.59 per cent respectively between 1986-87 and 1993-94. While these changes appear large, they had a relatively minor impact on each occupation because the Textiles, clothing and footwear industries only account for about 1 per cent of total Australian employment. The occupations most adversely affected by changes in Textiles, clothing and footwear were Plant and machine operators and drivers and Labourers and related workers. However, those occupations experienced far greater employment effects from the service industry changes noted above.

As discussed in the industry results section, it is possible that Australia's reductions in trade barriers forced domestic producers in traded industries to increase their efficiency. If this is the case, then part of the employment changes attributed here to technical change should be viewed as being caused by reduced assistance. However, it appears that the size of this effect is not large at an economy–wide level. This is because the employment effects of technical change were concentrated in Australia's largely non-traded service industries. For example, the largest employment effect of technical change was a 4.59 per cent fall for Plant and machine operators and drivers. Most of this change was due to big increases in labour productivity in the Electricity, gas and water and Transport and storage industries. As discussed previously, those industries recorded large reductions in the use of labour per unit of output because of the reform of GBEs and the deregulation of what were previously highly regulated industries.

Preferences

Tradespersons and Plant and machine operators and drivers are estimated to have experienced the greatest declines due to the combined effects of changes in import/domestic and consumer preferences. For Tradespersons, this reflects falls in total employment in most manufacturing industries. For Plant and machine operators and drivers, the decline is mostly due to a 19.53 per cent fall in total Clothing and footwear employment. This accounted for about two thirds of the 1.41 per cent fall (-0.18 plus -1.23) in the employment of Plant and machine operators and drivers. As discussed previously, falls in employment associated with changes in preferences may to some extent be the result of reductions in protection.

Changes in consumer preferences had a positive effect on Professionals and Para professionals because they increased total employment in Community services by 2.66 per cent. Employment of Salespersons and personal service workers declined by 1.00 per cent because total employment in Wholesale and retail trade fell.

Macro composition of GDP

Changes in the macro composition of GDP was the other notable source of shifts in the distribution of occupations. Growth of 4.58 per cent in total Community services employment had a positive impact on Professionals, Para professionals and Salespersons and personal service workers. The 12.62 per cent fall in total Construction employment led to a 3.71 per cent decline in the employment of Tradespersons. Plant and machine operators and drivers also

experienced the adverse effects of reduced Construction employment but this was slightly outweighed by greater employment in Transport and storage.

Overall impact

In summary, the estimated changes in the distribution of employment between industries would have reduced the number of hours worked in some occupations if total Australian labour supply and employment had not grown between
1986-87 and 1993-94. There would have been a decline in hours worked by Tradespersons (of 3.6 per cent), Plant and machine operators and drivers (of 8.8 per cent) and Labourers and related workers (of 1.8 per cent). No more than one-twentieth of these occupational changes were attributed to reduced assistance. Among the major factors contributing to the changes in employment were shifts in international trading conditions for primary commodities and technical change which favoured greater use of high skill labour. The extent to which the technical change is attributable to import competition is unclear.

Table 4.3 **Estimated sources of change in the composition of occupational employment between 1986-87 and 1993-94[a]**

	Industry share effect									
Occupation	*Shifts in international trading conditions*	*Changes in assistance*	*Technical change*	*Changes in import/ domestic preferences*	*Changes in consumer preferences*	*Growth in employment*	*Changes in macro composition of GDP*	*Apparent changes in required rates of return*	*Occupational share effect*	***Total change[b]***
Managers and administrators[c]	1.56	-0.02	2.40	-0.26	-0.80	0.04	-0.58	-0.09	15.74	**28.15**
Professionals	1.27	0.06	0.56	0.08	1.48	0.14	2.25	0.04	6.11	**22.16**
Para professionals	0.78	0.11	-2.03	0.14	1.29	0.02	2.08	0.66	-4.39	**8.81**
Tradespersons	0.79	-0.15	1.60	-1.01	-0.58	-0.13	-3.71	-0.38	-6.10	**0.49**
Clerks	0.76	0.03	0.54	0.21	0.31	0.03	-0.12	0.02	-6.14	**5.80**
Salespersons and personal service workers	2.26	0.23	3.01	0.34	-1.00	0.09	0.51	0.45	11.84	**27.89**
Plant and machine operators and drivers	-2.90	-0.46	-4.59	-0.18	-1.23	-0.11	0.36	0.35	0.85	**2.25**
Labourers and related workers	-0.88	-0.06	-0.15	-0.17	-0.20	-0.04	-0.01	-0.34	-3.88	**4.43**
Total employment[d]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**10.16**

[a] Employment is measured as hours worked. It is assumed that none of the sources of change except the occupational share effect causes a change in the distribution of occupations within industries. This would tend to overstate the adverse effect of each source of change on lower skill workers if their wages fell relative to other employees from 1986-87 to 1993-94. [b] The sum of growth in aggregate employment (10.16 per cent) and the industry and occupational share effects for the relevant occupation. [c] Excludes Farmers and farm managers. [d] All sources of change are estimated by holding total employment fixed.

Source: Industry Commission estimates based on results of the Monash model.

5 CONCLUDING COMMENTS

This paper has tested the hypothesis that trade liberalisation by Australia has suppressed the wages and/or employment of its low skill workers relative to other employees. Three separate approaches were applied to test this hypothesis. These were an examination of changes in prices of traded products, an input–output analysis, and a computable general equilibrium analysis. None of the three tests provided strong support for the claim that reduced trade barriers for low skill labour intensive products has substantially increased Australia's earnings inequality. What the results do suggest is that the wage and employment effects of changes in trade barriers have been overshadowed by other developments.

To some extent the results of this study are understandable because the industries where protection has fallen by a large amount since the early 1980s account for only a small share of total Australian employment, although the size of the sector is not relevant in the basic Stolper Samuelson Theorem. Where large protection reductions did occur they may have had an adverse effect on employment in the relevant industry but not relative wages between occupations, though employment in the major protected sectors was falling well before protection fell. Indeed, it was falling when protection was increasing. The results are consistent with past research which suggest that the growth in Australian earnings inequality is not due to changes in the structure of earnings between employees categorised on the basis of education, experience or occupation (Borland and Wilkins 1996; Gregory 1993). It appears that the reasons for Australia's growing earnings inequality are complex and so not easily attributable to one factor, such as trade.

The remainder of this chapter summarises the key results from the three empirical tests undertaken in this paper and discusses the policy implications.

5.1 Key results

The theory outlined in chapter 1 implies that if imports from low wage economies have increased earnings inequality, then there should be evidence of downward pressure on domestic prices via declining import prices. In particular, there should have been a decline in the relative price of low skill labour intensive imports and it would be expected that this should have been reflected in the output prices of competing domestic industries.

Movements in Australian import prices for manufactures relative to the GDP(E) fixed weight deflator were analysed in chapter 2 on an fob (free on board) basis, which excludes import duties, freight and insurance. The import duty inclusive fob prices were also examined. It was found that the relative import price index for total manufacturing taking into account import duties fell by around 12 per cent between 1984-85 and 1995-96, about twice the fall in fob terms. In most industries the impact on import prices of changes in the average rate of duty paid was overshadowed by other factors, such as exchange rate movements.

The biggest fall in fob (plus duties) import prices occurred in the low skill labour intensive Clothing and footwear industry, suggesting that it has been under pressure from imports. Since the average rate of duty paid on Clothing and footwear imports fell from 42 per cent in 1984-85 to around 23 per cent in 1995-96, fob import prices including duty have fallen further than fob import prices alone. In addition, quantitative import restrictions were removed during that period.

Producer prices for the Clothing and footwear industry remained relatively stable between 1984-85 and 1995-96. This suggests that imports and domestic products are not perfect substitutes and hence changes in import prices have a less than proportionate effect on domestic prices. Nevertheless, the Clothing and footwear industry has been under pressure from increasing, and cheaper, imports, particularly from low wage countries, and has experienced large declines in domestic output and employment. The strongest declines in manufacturing employment in percentage terms between 1987 and 1996 occurred in the Textiles, clothing and footwear industries. Employment fell at an average annual rate of 3.7 per cent in Textiles (11 100 persons), and 2.1 per cent in Clothing and footwear (13 400 persons)

The input–output estimates presented in chapter 3 suggest that import substitution from low wage economies were associated with a fall in total manufacturing employment of 7.3 per cent between 1986-87 and 1993-94. However, this was smaller than the employment effects of changes in exports (plus 11.1 per cent), domestic final demand (plus 14.7 per cent) and labour productivity (minus 13.2 per cent). The industries where low wage imports were significantly associated with reduced employment were Textiles and Clothing and footwear (minus 21.8 and minus 16.0 per cent respectively).

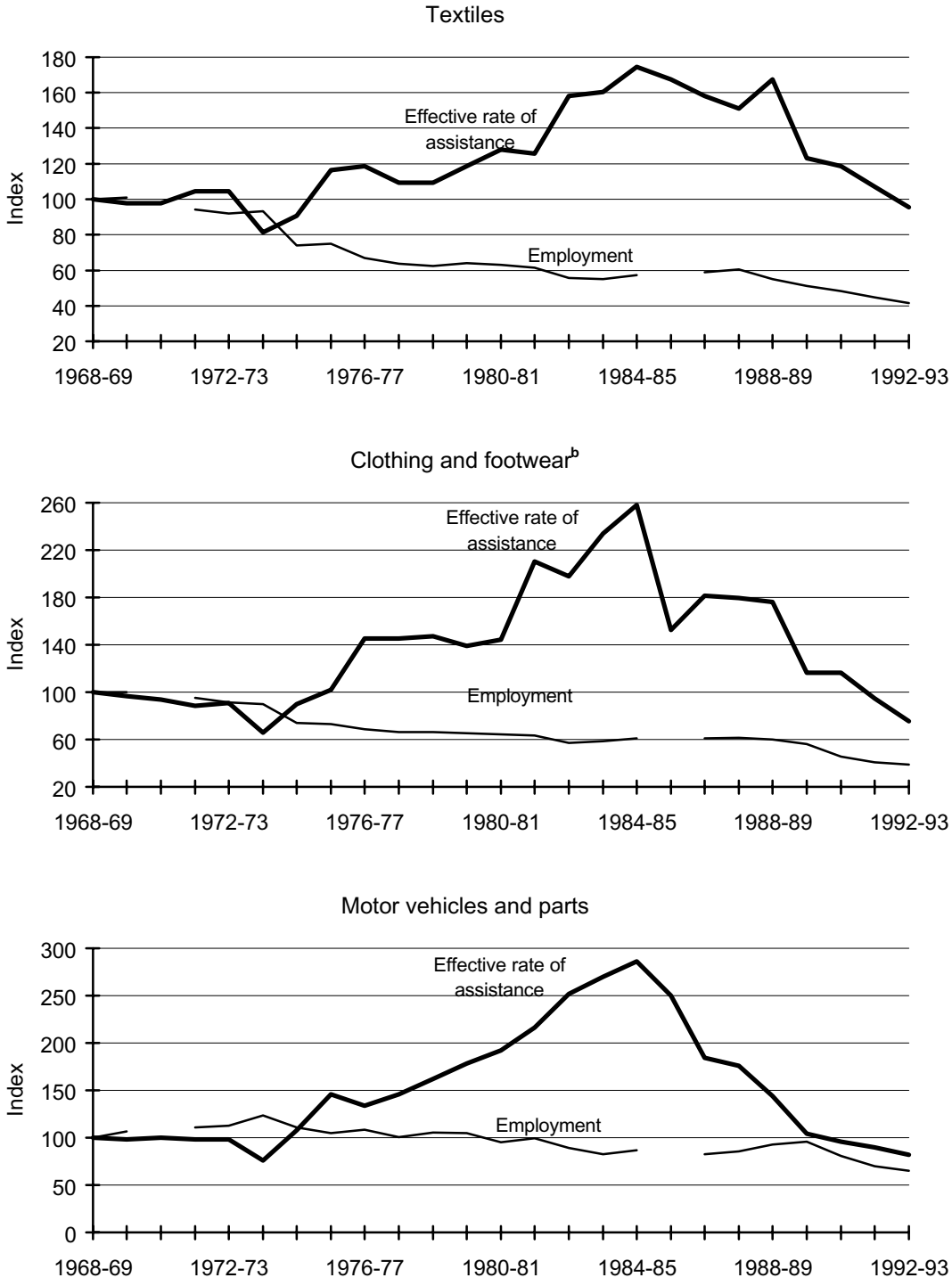
The analysis in chapter 4 using a computable general equilibrium model suggests that reduced protection in Australia did cause a shift in the composition of employment away from the two lowest skill occupations and Tradespersons. However, the size of this effect between 1986-87 and 1993-94 was small at an economy–wide level compared to other factors affecting employment. Of far greater significance were the effects of adverse trading

conditions in export markets for primary commodities, 'skill biased' technical change, shifts in the macro composition of GDP, and technological change. Furthermore, the results in chapter 4 indicate that reduced assistance for manufacturers increased employment of the most numerous low skill occupation (Salespersons and personal service workers). Nevertheless, the low skill labour intensive Clothing and footwear industry was estimated to have been among the most adversely affected by changes in assistance between 1986-87 and 1993-94.

5.2 Policy implications

A policy implication of this paper is that as there is no clear indication that reductions in assistance have been more than a minor element in changes in employment or earnings, industry assistance as a policy weapon directed at employment or income distribution is likely to be of little use. Another illustration of this apparent ineffectiveness is the failure of substantial increases in assistance up to the mid 1980s to reverse a long term decline in employment in the Textiles, clothing and footwear industries (figure 5.1). The evidence presented in chapter 4 indicates that subsequent reductions in assistance since the mid 1980s also had little impact on Australia's earnings distribution. The impotence of even very high levels of assistance as a means of maintaining employment in particular industries or occupations highlights the significance of the structural changes occurring in the Australian economy which are not directly related to assistance.

Figure 5.1 **Employment[a] and assistance, 1968-69 to 1992-93**



a Note employment data is from the manufacturing census, whereas other employment data in this paper is from the labour force survey.**b** In 1984-85 protection in Clothing and footwear was greater than 250 per cent.
Source: IC (1995b) and ABS (*Manufacturing Industry, Australia*, Cat. no. 8221.0).

APPENDIX A

DETAILED INFORMATION ON TRADE, EMPLOYMENT AND WAGES

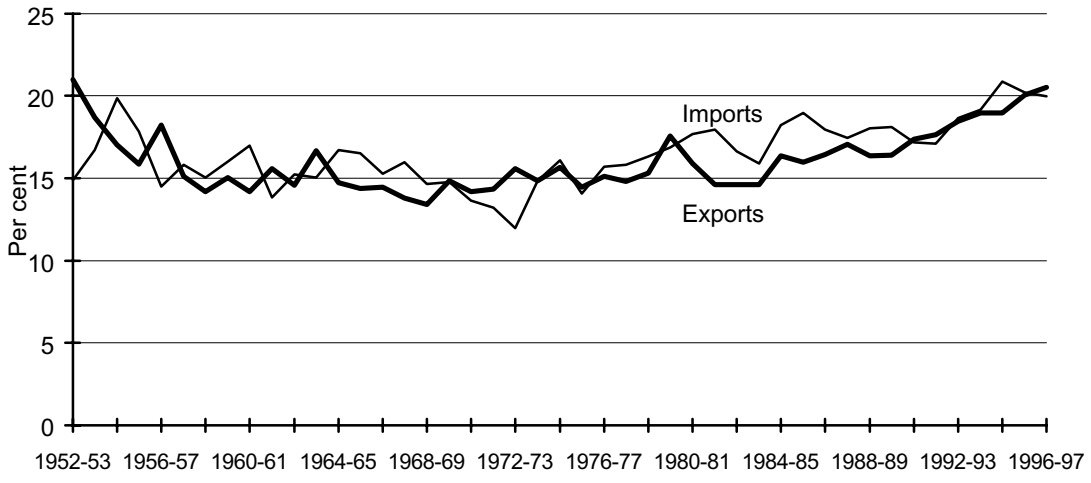
This appendix provides a detailed discussion of trends in trade, employment and earnings levels. It should be read in conjunction with chapter 2.

A.1 Composition and direction of Australian trade

The relative importance of international trade to the Australian economy has increased significantly since the early 1980s (figure A.1), bringing it back to the percentage of GDP reached early in the century. Imports of goods and services rose from around 16 per cent of GDP in 1981-82 to about 24 per cent in 1996-97. Exports of goods and services increased to about 24 per cent of GDP in 1996-97 from around 13 per cent in 1981-82.

The direction of Australian trade at a broad sectoral level suggests that import competition is likely to be greatest for manufacturing. Using the broad industry

Figure A.1 **Australian exports and imports of goods and services as a share of GDP[a]**

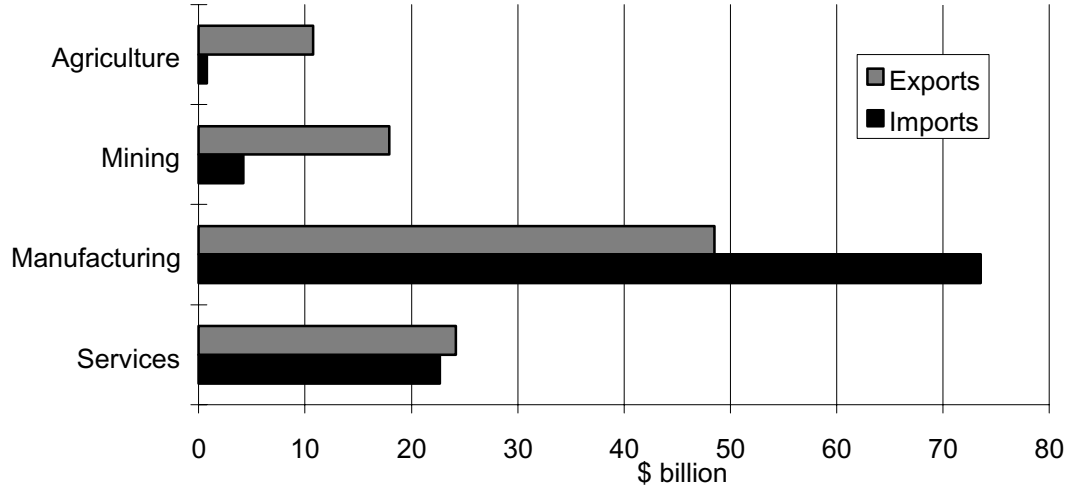


[a] Based on current price data (nominal terms).

Data source: ABS (*Australian National Accounts: National Income, Expenditure and Product,* Cat. no. 5206.0) and RBA (1996).

aggregation shown in figure A.2, manufacturing is the only sector where Australia is a net importer. In 1996-97, about three-quarters of all Australian imports were manufactured goods. Manufactured imports were $74 billion, compared to exports of $48 billion. In contrast, Australia is a net exporter of primary commodities. In 1996-97 agricultural and mining exports were $11 billion and $18 billion respectively, with imports of only $1 billion and $4 billion. Trade in services is small, relative to its size in the economy.

Figure A.2 **Australian exports and imports by sector, 1996-97**



Data source: ABS (*International Trade in Goods and Services*, Cat. no. 5368.0; *International Trade, Australia: Magnetic Tape Service*, Cat. no. 5464.0).

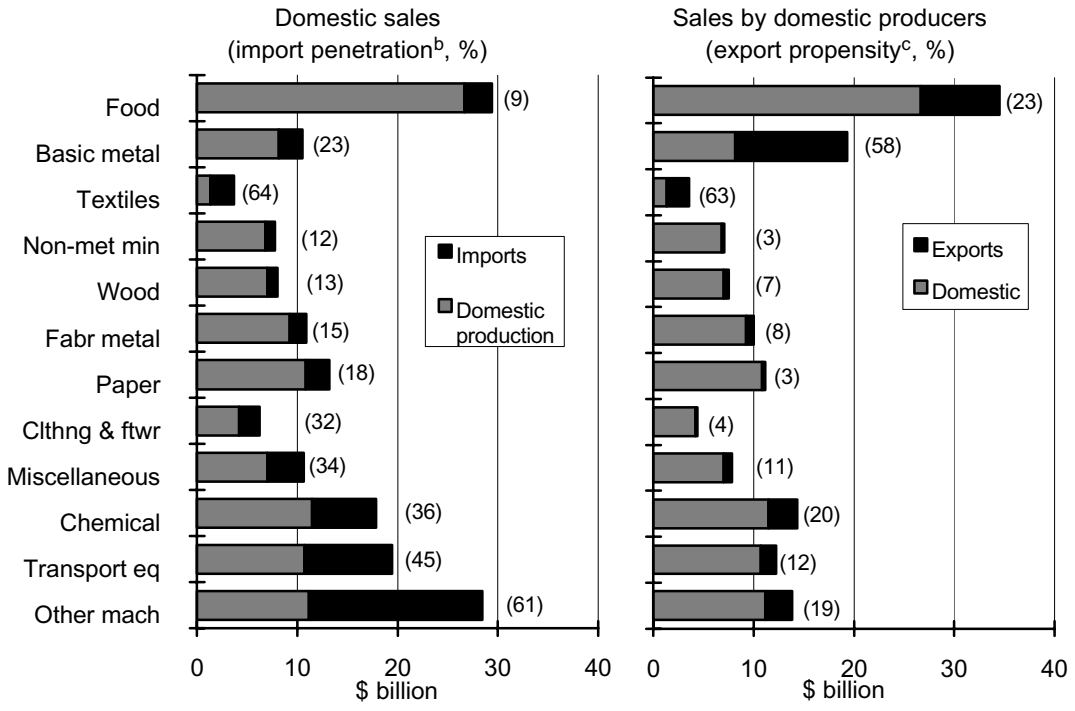
Manufacturing trade

There are significant differences in the relative importance of imports between manufacturing industries, even though Australia is a net importer of manufactured products at the aggregate level. This is illustrated by dividing manufacturing industries according to their trade orientation based on net exports. Three categories are chosen, net exports, net imports and balanced trade.

Figure A.3 shows how industries are divided according to trade orientation. The first two industries, Food beverages and tobacco and Basic metal products are classified as export industries. Their export propensity is high relative to their import penetration. Textiles is classified in the intra-industry trade group, due to the level of aggregation being used. Textiles is made up of both export and import competing industries. Almost half of its imports are synthetics and its exports are mostly from the Wool scouring industry. Exports and imports are

almost the same in this industry. The remaining industries are on balance import competing.

Figure A.3 **Trade orientation of Australian manufacturing industries,[a] 1991-92**



[a] Industry titles are abbreviated. Full titles and ASIC codes are: Food (ASIC 21, Food, beverages and tobacco), Textiles (23, Textiles), Clthng & ftwr (24, Clothing and footwear), Wood (25, Wood, wood products and furniture), Paper (26, Paper, paper products, printing and publishing), Chemicals (27, Chemical, petroleum and coal products), Non-met min (28, Non-metallic mineral products), Basic metal (29, Basic metal products), Fabr metal (31, Fabricated metal products), Transport eq (32, Transport equipment), Other mach (33, Other machinery and equipment), Miscellaneous (34, Miscellaneous manufacturing).[b] Import penetration (in brackets) refers to the share of imports in the value of domestic sales of commodities produced by that industry.[c] Export propensity (in brackets) refers to the share of exports in the value of sales by domestic producers.

Data source: IC (1995b).

Available evidence suggests that there is a tendency for the import competing group to be more labour intensive than the export industries. In 1996, the Textiles, clothing, footwear and leather industry contributed 4 per cent of manufacturing output (measured as value added), yet accounted for 9 per cent of employment, reflecting the relatively labour intensive nature of the industry. On the other hand, the export oriented Food, beverages and tobacco (FBT) industry appears to be a much less labour intensive industry. FBT employed 16 per cent of manufacturing employees to produce 20 per cent of manufacturing output in 1996.

The ratio of the capital stock to the level of employment provides a further guide to the capital (and labour) intensity of an industry. Gretton and Fisher (1997) calculated capital stock estimates as part of their analysis of productivity growth in Australian manufacturing industries. The manufacturing industry classifications used by Gretton and Fisher are not identical to those used here, but they are broadly similar. Using their capital stock estimates, Textiles, clothing and footwear appears to be the most labour intensive manufacturing industry, with a capital to labour ratio around 45 per cent of the manufacturing average. Both members of the export group (Basic metals and Food, beverages and tobacco) have above average capital intensity. Other capital intensive industries are Petroleum, coal, chemicals and associated products and Transport equipment.

The source of import competition provides a further indication of those manufacturing industries most likely to experience competition from low cost labour. In this study countries have been divided into high income and low income groups (see box A.1 for a description of the groups).

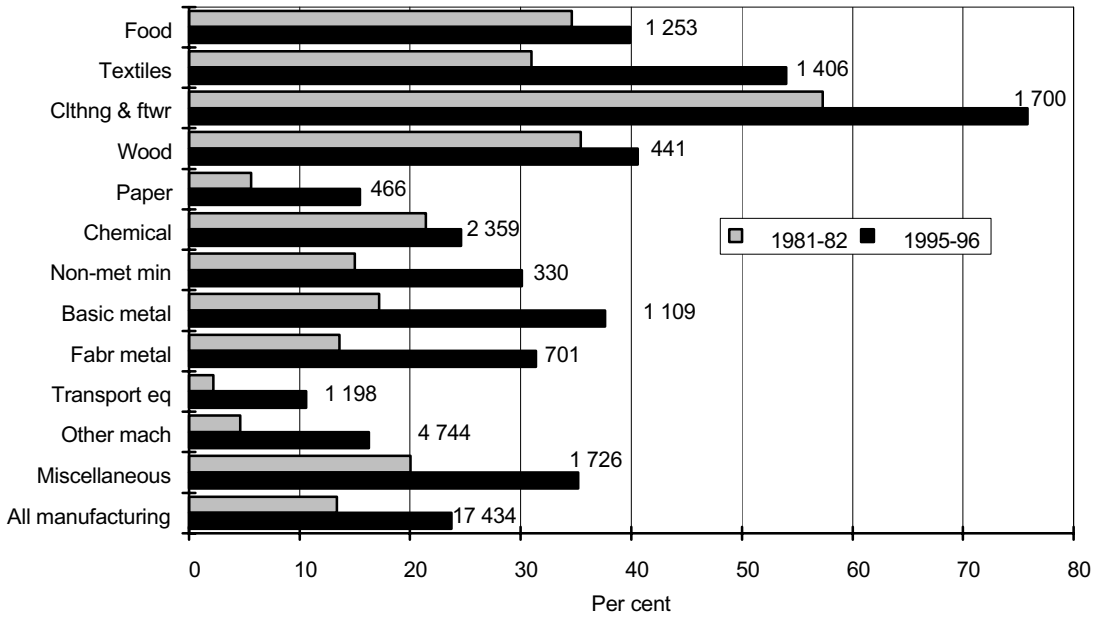
Box A.1 Classification of countries into hi gh and low income groups

The classification used in this paper is essentially the same as that used in the World Bank *World Development Report 1996*. Countries are classified according to their gross national product per capita in US dollars using prevailing exchange rates. High income countries include all OECD countries as well as several other countries. In Asia these countries are Brunei, French Polynesia, Hong Kong, Macau and Singapore. In Europe they are Andorra, Channel Islands, Cyprus, Faeroe Islands, Greenland, Liechtenstein and Monaco. In the Middle East they are Israel, Kuwait, Qatar and United Arab Emirates. In the Americas they are Aruba, The Bahamas, Bermuda, Cayman Islands, Netherlands Antilles and Virgin Islands (US). All other countries are classified as low income countries for the purposes of this paper. The only economy classified differently to the World Bank report is Taiwan (the World Bank classifies Taiwan as a high income economy). Taiwan is classified as a low income economy as real GDP per worker is significantly lower than in Australia.

Source: World Bank (1996).

There has been a notable increase in the proportion of Australia's manufactured imports which come from low income countries. Figure A.4 shows that the share of manufactured imports from low wage countries increased from 13 per cent in 1981-82 to 24 per cent in 1995-96. This trend is evident to varying degrees for all the industries within manufacturing.

Figure A.4 **Shares of low wage country imports in total imports by industry and low wage country import levels[a] by industry[b]**



a Levels of imports from low income countries in 1995-96 in $A million are given in the text to the right of the bars for each industry. **b** Industry titles are abbreviated, see note c in figure A.3 for full titles.
Data source: STARS (Statistical Analysis and Retrieval System database), Statistical Services Section, Department of Foreign Affairs and Trade (accessed April and June 1997).

Since 1981-82, the growth in Australia's imports has differed markedly between low income countries. Over the last 14 years, imports from China have grown the strongest. In 1981-82, China accounted for 1.4 per cent of Australia's manufactured imports. By 1995-96, China was the most important low income country source for Australia's imports, accounting for 5.3 per cent of manufactured imports. Next in importance were Taiwan and the Republic of Korea, which also showed strong growth in their supply of goods to the Australian market. Taiwan increased its share of Australian manufactured imports from 3.1 per cent in 1981-82 to 3.4 per cent in 1995-96 (although this was below a peak of 4.6 per cent in 1987-88). The share of manufactured imports from the Republic of Korea increased from 1.5 per cent to 3.0 per cent over the same period.

An industry which stands out as being particularly susceptible to imports from low income countries is Clothing and footwear. Its share of imports from low income countries in total imports increased from 57 per cent in 1981-82 to 76 per cent in 1995-96. There was also a change in the composition in

international supply, with imports from China as a share of total imports increasing from 12 per cent to 53 per cent over the same period. In all years the share of Clothing and footwear imports from low income countries in total imports was the highest. These data are not surprising when the nature of the industry is considered. Clothing and footwear is a low skill labour intensive manufacturing industry, which tends to be supplied from low income countries.

Services trade

While relatively few services are traded, service industries can be divided according to trade orientation on the basis of the trade that does occur. Data were available for a breakdown of the sector into four industries. In 1996-97, Travel was a net exporting industry and Shipment was a net import competing industry. Exports and imports in Other transportation and Other services were relatively balanced.

Exports from the Service sector grew faster than imports over the period between 1981-82 and 1996-97. As a result, Australia went from being a net importer to a net exporter of services. In current dollars, services exports grew by a factor of 6 between 1981-82 and 1996-97, while imports grew by a factor of 3. Exports grew fastest in Travel and Other services. Exports grew by a factor of 10 in Travel and by 5 in Other services. Import growth was also strongest in Travel and Other services. Imports grew by a factor of 4 in both.

A.2 Employment by skill group and sector

The labour force can be divided into categories based on skill level using data collected in the ABS Labour Force Survey (ABS 1996b). The ABS collect information on employment by occupation rather than the skill of particular employees. Therefore, it is necessary to use occupation as a proxy for skill level. In this paper, three skill groups are defined (high, middle and low) using the first edition of the Australian Standard Classification of Occupations (ASCO). High skill occupations are defined as Managers and administrators, Professionals, Para professionals and Investment, insurance and real estate salespersons. Middle skill occupations are Tradespersons. Low skill occupations are Clerks, Salespersons and personal service workers (excluding Investment, insurance and real estate salespersons), Plant and machine operators and drivers, and Labourers and related workers (see box A.2).

Box A.2 Skill groups

In this paper, occupation is used as a proxy for skill level. The Australian Standard Classification of Occupations (ASCO) is a skill based classification of occupations. The most recent edition of the classification, ASCO second edition, has nine major groups of occupations, corresponding to five skill levels (ABS 1996a). In this study the five skill levels are divided into three skill groups:

- high skill is skill levels one and two;
- middle skill group is skill level three; and
- low skill is skill levels four and five.

However, historical occupational data are only available in ASCO first edition, so the relevant classifications in these three skill groups were concorded back to ASCO first edition. The following groups resulted.

High skill is ASCO codes 11 to 39 (Managers and administrators, Professionals and Para Professionals) and 61 (Investment, insurance and real estate salespersons).

Middle skill is ASCO codes 41 to 49 (Tradespersons).

Low skill is ASCO codes 51 to 59 (Clerks) and 62 to 89 (Salespersons and personal service workers, excluding ASCO 61, Plant and machine operators and drivers, and Labourers and related workers).

Looking at the economy as a whole, 30 per cent of employees were in high skill occupations in 1987, and around half of employees were in low skill occupations (table A.1). Between 1987 and 1996 employment in low and high skill occupations increased strongly, by 685 000 and 502 000 persons respectively (corresponding to average annual rates of growth of 1.8 per cent for low skill occupations and 2.4 per cent for high skill). Growth in middle skill occupations (tradespersons) was more subdued, increasing by 60 000 persons or an average annual rate of 0.6 per cent.

By 1996, the share of high skill occupations in total employment had increased slightly to 32 per cent, while the share of low skill occupations remained stable. The modest growth in employment in middle skill occupations translated into a fall in its share of total employment from 16 per cent in 1987 to 14 per cent in 1996.

Table A.1 **Employment by sector and skill level,[a,b] 1987 and 1996[c]**

	Level				*Share of total*			
	High skill	*Middle skill*	*Low skill*	*Total*	*High skill*	*Middle skill*	*Low skill*	*Total*
	'000	'000	'000	'000	%	%	%	%
1987								
Agriculture	272.4	13.4	129.3	415.1	65.6	3.2	31.1	100.0
Mining	21.0	23.3	59.1	103.5	20.3	22.5	57.1	100.0
Manufacturing	176.6	338.2	633.2	1 150.5	15.3	29.4	55.0	100.0
Services	1 664.2	758.1	3 001.0	5 428.7	30.7	14.0	55.3	100.0
Total	**2 134.2**	**1 133.0**	**3 822.6**	**7 097.8**	**30.1**	**16.0**	**53.9**	**100.0**
1996								
Agriculture	249.1	16.9	158.0	424.0	58.8	4.0	37.3	100.0
Mining	20.9	17.2	49.5	87.5	23.9	19.7	56.6	100.0
Manufacturing	196.1	296.5	602.7	1 095.2	17.9	27.1	55.0	100.0
Services	2 170.1	862.6	3 699.0	6 730.5	32.2	12.8	55.0	100.0
Total	**2 635.9**	**1 193.1**	**4 507.7**	**8 337.1**	**31.6**	**14.3**	**54.1**	**100.0**

a Note the data relates to employees, rather than employed, so excludes self employed persons. Numbers may not add due to rounding. **b** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See boxA.2 for definitions. **c** Labour force data for May 1987 and May 1996.
Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1996, Cat. no. 6203.0).

By sector, the story varies. The significant contribution of the services sector to the growth in employment over the decade to 1996 is apparent from figure 2.7. While over the decade the majority of the new jobs were in low skill occupations, employment in high skill occupations in services grew at an average annual rate of 3.0 per cent, the strongest growth rate of any of the industry skill groups.

Agriculture has a very high proportion of employees in high skill occupations (59 per cent), reflecting the inclusion of Farmers and farm managers in this group. Over the decade, high skill employment fell, which was more than offset by increases in employment in low and middle skill occupations. In the mining sector there were declines in employment across all occupation groups.

The manufacturing sector has a relatively low share of employees in high skill occupations (18 per cent in 1996) and proportionally more employment in middle skill occupations (27 per cent). The proportion of jobs that are in low skill occupations (55 per cent) is around the Australian average.

While the share of jobs that are in high skill occupations is lower in manufacturing than for other sectors, the share of employment in high skill occupations increased by 3 percentage points over the decade to 1996 (primarily at the expense of employment in middle skill occupations). Between 1987 and 1996 manufacturing employment in high skill occupations increased by 19 500 persons (an average annual increase of 1.2 per cent). Employment falls were recorded in middle skill manufacturing occupations (down by 41 700 persons, or an average annual decline of 1.5 per cent) and in low skill occupations (a fall of 30 500 persons or 0.5 per cent per year).

Part-time employees are more concentrated in low skill occupations. Around 40 per cent of employment in low skill services occupations were part-time in 1996, compared with 9 and 17 per cent for middle and high skill occupation groups. For manufacturing, the share of part-time employees in low skill occupations was somewhat lower than for services at around 15 per cent (middle and high skill shares were 5 and 4 per cent).

The shift towards more part-time work has implications for full-time job creation. For the service sector, where the job growth has been, just over half of the new jobs created between 1987 and 1996 were part-time. For jobs in low skill occupations around three-quarters of the new jobs were part-time. The shares for middle and high skill occupations were lower at 15 per cent and 28 per cent respectively.

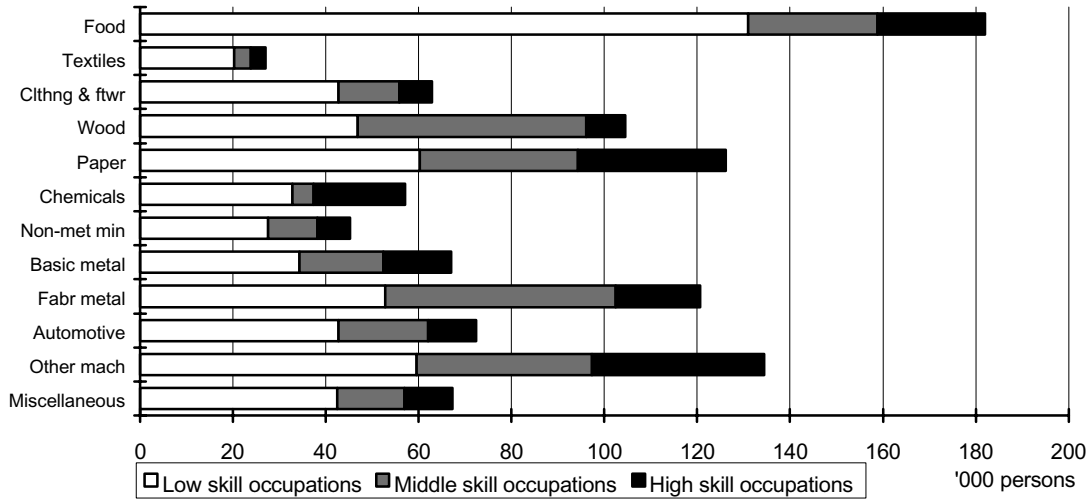
Manufacturing employment by skill group

Employment by occupation groups for eleven main manufacturing industries and the Motor vehicles and parts industry is presented in figure A.5. The manufacturing industries are based on the ASIC classification.

The Textiles, Food, beverages and tobacco and Clothing and footwear industries are relatively low skill labour intensive industries (with 74, 72 and 68 per cent of employment, respectively, in low skill occupations in 1996).

Relatively higher skill intensive manufacturing industries are Chemical, petroleum and coal products, Other machinery, Paper, paper products and publishing and Basic metal products. These industries had 35, 28, 25 and 22 per cent of employment in high skill occupations in 1996, respectively, compared with the manufacturing average of 18 per cent.

Figure A.5 **Employment by manufacturing industry[a] and occupation,[b,c] 1996**



[a] Based on 2 digit ASIC industry data (with the exception of 3 digit class Motor vehicle and parts – ASIC 323). Industry titles are abbreviated, see note c in figure A.3 for full titles. [b] Note the data relates to employees, rather than employed, so excludes self employed persons. Labour force data for May 1996. [c] Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 for definitions.

Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1996, Cat. no. 6203.0).

Figure A.4 presented earlier, shows the level of imports supplied by low income countries for each manufacturing industry. Three of the four manufacturing industries with the highest share of imports from low income countries are relatively low skill labour intensive. This indicates that industries which use low skill labour more intensively tend to be more susceptible to competition from low income countries.

The four industries with the largest percentage point increases in the shares of imports from low income countries from 1981-82 to 1995-96 were Textiles (23 per cent), Clothing and footwear (19 per cent), Basic metal products (20 per cent) and Fabricated metal products (18 per cent). No consistent pattern of skill intensity or labour intensity is evident here. Industries with very low percentage point increases in shares of imports from low income countries were Chemical, petroleum and coal products (3.2 per cent), Wood, wood products and furniture (5.2 per cent) and Food, beverages and tobacco (5.3 per cent).

The average annual growth in employment by occupation from 1987 to 1996 for the different manufacturing industries is presented in table A.2. Over the decade to 1996, the general trend in manufacturing industries has been towards

more skilled employment. That is, there has been growth in employment in high skill occupations, offset by declines in employment in middle and low skill occupations. Table A.3 presents the employment data for 1987 and 1996.

Table A.2 **Average annual growth in employment by manufacturing industry and occupation,[a,b] 1987–96**

Industry	*High skill occupations*	*Middle skill occupations*	*Low skill occupations*	*Total*
	%	%	%	%
Food, beverages & tobacco manufacturing	1.3	-1.7	0.1	-0.1
Textiles	-1.6[c]	-6.8[c]	-3.5	-3.7
Clothing and footwear	-1.3	3.4	-3.4	-2.1
Wood, wood products and furniture	0.9	1.7	2.3	1.9
Paper, paper products and publishing	2.0	-2.0	0.5	0.1
Chemical, petroleum and coal products	2.3	-1.2	-0.6	0.1
Non-metallic mineral products	0.7	-2.3	-1.9	-1.7
Basic metal products	3.9	-2.6	-0.9	-0.6
Fabricated metal products	0.1	2.4	0.1	0.9
Motor vehicle and parts (323)	2.6	-5.9	1.7	-0.9
Other machinery and equipment	0.7	-2.6	-1.4	-1.2
Miscellaneous manufacturing	0.1	-0.5	-0.8	-0.6
Total manufacturing	**1.2**	**-1.5**	**-0.5**	**-0.5**

a Based on 2 digit ASIC industry data (with the exception of 3 digit class Motor vehicle and parts – ASIC 323). Note manufacturing total includes Other transport equipment (ASIC 324). **b** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 for definitions. **c** These growth rates are statistically unreliable are they are based on employment estimates below 4000, which are considered statistically unreliable by the ABS.

Source: IC estimates adapted from ABS (*Labour Force Australia*, unpublished data, 1987 to 1996, Cat. no. 6203.0).

The Textiles, clothing and footwear and Motor vehicles and parts industries experienced significant declines in protection since the mid 1980s. Employment in Textiles, clothing and footwear also declined significantly between 1987 and 1996.

A significant proportion of employment in the Textiles, clothing and footwear industries is in low skill occupations (figure A.6). Between 1987 and 1996 employment fell across all skill groups, but the decline in employment in low skill occupations was strongest. Employment in low skill occupations fell by an

average annual rate of 3.4 per cent. Total employment in TCF fell at an average annual rate of 2.6 per cent over the same period.

Table A.3 Employment by manufacturing industry[a] and skill level,[b,c] 1987 and 1996

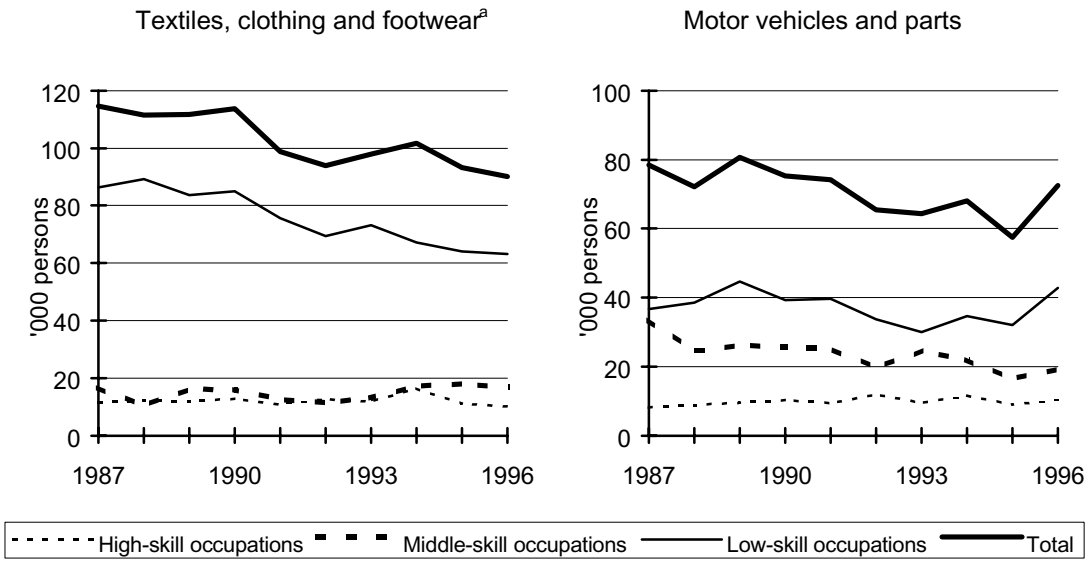
	High skill		*Middle skill*		*Low skill*		*Total*	
Industry	*1987*	*1996*	*1987*	*1996*	*1987*	*1996*	*1987*	*1996*
	'000	'000	'000	'000	'000	'000	'000	'000
Food, beverages and tobacco manufacturing	20.5	23.1	32.4	27.9	129.6	130.9	183.1	182.0
Textiles	3.6[d]	3.1[d]	6.9	3.7[d]	27.9	20.3	38.4	27.3
Clothing and footwear	7.9	7.0	9.7	13.1	58.5	42.8	76.2	62.8
Wood, wood products and furniture	7.7	8.4	42.2	49.2	38.1	46.9	87.9	104.5
Paper, paper products and publishing	26.8	31.9	40.7	34.0	57.6	60.3	125.2	126.1
Chemical, petroleum and coal products	16.1	19.8	5.0	4.5	34.8	32.8	56.5	57.2
Non-metallic mineral products	6.6	7.0	13.0	10.6	32.9	27.7	52.8	45.3
Basic metal products	10.3	14.5	22.9	18.0	37.4	34.4	70.8	66.9
Fabricated metal products	18.0	18.1	40.3	49.7	52.5	52.8	111.0	120.4
Motor vehicle and parts (323)	8.2	10.3	33.5	19.3	36.7	42.8	78.4	72.5
Other machinery and equipment	34.7	37.1	47.6	37.7	67.5	59.6	150.1	134.2
Miscellaneous manufacturing	10.2	10.3	15.1	14.4	45.9	42.5	71.1	67.2
Total manufacturing	**176.6**	**196.1**	**338.2**	**296.5**	**633.2**	**602.7**	**1 150.5**	**1 095.2**

a Based on 2 digit ASIC industry data (with the exception of 3 digit class Motor vehicle and parts – ASIC 323). Note manufacturing total includes Other transport equipment (ASIC 324). **b** Note the data relates to employees, rather than employed, so excludes self employed persons. Numbers may not add due to rounding. Labour force data for May 1987 and May 1996. **c** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See boxA.2 for definitions. **d** Estimates below 4000 are considered statistically unreliable by the ABS.

Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1996, Cat. no. 6203.0).

In 1987 the Motor vehicles and parts industry had a relatively high proportion of employment in middle skill occupations (tradespersons). Employment in middle skill occupations experienced a significant decline in the decade to 1996 — employment fell at an annual average rate of 5.9 per cent. Despite some fluctuations, in 1996 employment in low skill occupations was higher than a decade earlier. Employment in high skill occupations had also increased.

Figure A.6 **Employment in Textiles, clothing and footwear and Motor vehicles and parts industries by occupation, 1987–96**



a The Textiles, clothing and footwear industries had similar experiences in employment changes by occupation, so are combined.

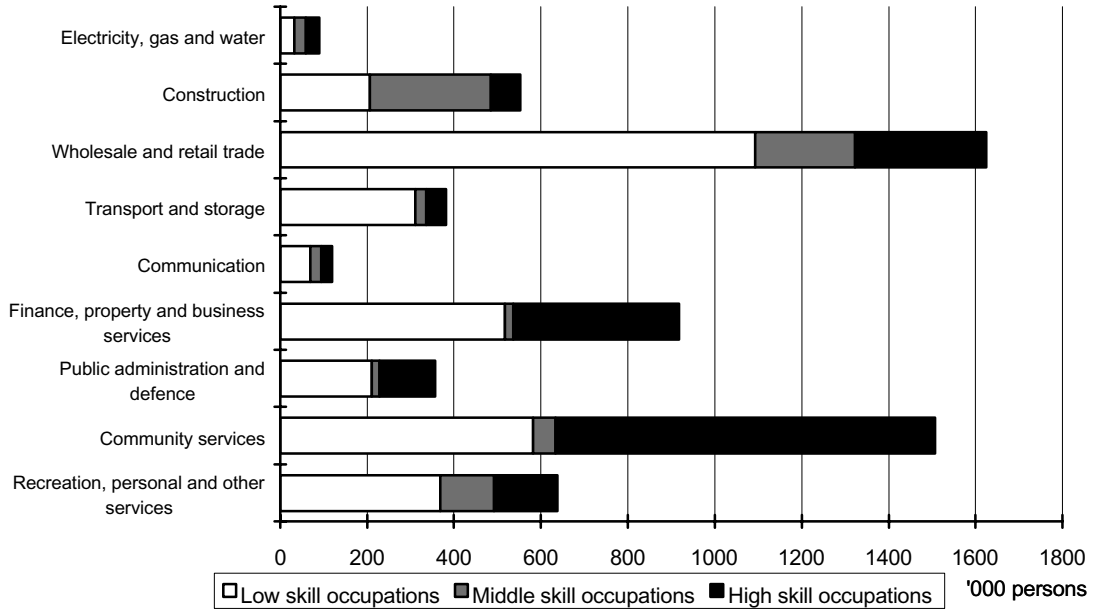
Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1996, Cat. no. 6203.0).

Services employment by skill group

Service sector employment by occupation groups is shown in figure A.7. Service industries are based on the ASIC classification. The major service sector employers are Wholesale and retail trade, Community services and Finance, property and business services.

Industries whose workforce are low skill labour intensive are Transport and storage (82 per cent of employees), Wholesale and retail trade (67 per cent), and Public administration and defence (59 per cent).

Figure A.7 **Employment by service industry[a] and occupation,[b,c] 1994**



a Based on ASIC industry data. **b** Note the data relates to employees, rather than employed, so excludes self employed persons. Labour force data for May 1994. **c** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 for definitions.
Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1994, Cat. no. 6203.0).

Employment in Community services, Finance, property and business services, and Public administration and defence are relatively higher skill intensive, with 58, 41 and 36 per cent of employment, respectively, in high skill occupations.

Public administration and defence has both proportionally more employment in high skill and low skill occupations than the services average. Middle skill employment in this industry is small, only accounting for 5 per cent of employment.

Table A.4 presents the average annual growth in employment by occupation group between 1987 and 1994. Similar to the trend in manufacturing industries, over that period there has been a shift towards more skilled employment with the strongest growth in employment occurring in the high skill occupation group.

In the seven years to 1994, employment declined significantly in the Electricity, gas and water and Communication industries, with a less marked decline in the Transport and storage industry. The strongest growth in employment occurred in the Recreational, personal and other services industry, increasing at an

average annual rate of 4.0 per cent. This industry also experienced the strongest growth in employment in low skill occupations, at 4.5 per cent a year. This accounted for a quarter of the new jobs in low skill occupations over the period. The largest contributor to the new low skill jobs was the Wholesale and retail trade industry, accounting for 36 per cent of the new jobs. Table A.5 presents the employment data for 1987 and 1994.

Table A.4 **Average annual growth in employment by service industry and occupation,[a,b] 1987–94**

Industry	*High skill occupations*	*Middle skill occupations*	*Low skill occupations*	*Total*
	%	%	%	%
Electricity, gas and water	0.4	-4.6	-8.2	-4.7
Construction	2.7	0.7	1.4	1.2
Wholesale and retail trade	2.9	1.0	2.0	2.0
Transport and storage	-0.2	-1.0	-0.1	-0.1
Communication	1.4	-6.2	-1.5	-2.1
Finance, property and business services	3.6	4.8	2.4	2.9
Public administration and defence	2.8	-2.8	-0.4	0.4
Community services	2.4	2.2	2.6	2.5
Recreation, personal and other services	3.4	3.3	4.5	4.0
Total services	**2.7**	**0.7**	**1.8**	**1.9**

a Based on ASIC industry data **b** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See boxA.2 for definitions.

S*ource*: IC estimates adapted from ABS (*Labour Force Australia*, unpublished data, 1987 to 1994, Cat. no. 6203.0).

Table A.5 **Employment by service industry[a] and skill level,[b,c] 1987 and 1994**

	High skill		*Middle skill*		*Low skill*		*Total*	
Industry	*1987*	*1996*	*1987*	*1996*	*1987*	*1996*	*1987*	*1996*
	'000	'000	'000	'000	'000	'000	'000	'000
Electricity, gas and water	31.0	31.8	35.7	25.7	59.9	33.0	126.8	90.4
Construction	56.6	68.1	265.6	279.0	186.6	206.1	508.9	553.3
Wholesale and retail trade	246.4	301.1	214.4	230.6	951.0	1 092.6	1 411.7	1 624.4
Transport and storage	46.0	45.4	26.1	24.3	312.6	311.5	384.7	381.1
Communication	23.2	25.6	39.0	25.0	77.0	69.3	139.3	120.0
Finance, property and business services	298.1	381.6	13.2	18.3	438.6	517.4	752.4	921.9
Public administration and defence	105.3	127.6	21.7	17.8	218.0	211.4	346.2	356.9
Community services	741.2	872.9	44.5	51.7	486.0	581.5	1 273.2	1 508.7
Recreation, personal and other services	116.4	146.6	97.9	122.8	271.3	368.8	485.5	638.7
Total services	**1 664.2**	**2 000.7**	**758.1**	**795.2**	**3 001.0**	**3 391.6**	**5 428.7**	**6 195.4**

a Based on ASIC industry data. **b** Note the data relates to employees, rather than employed, as excludes self employed persons. Numbers may not add due to rounding. Labour force data for May 1987 and May 1994. **c** Employment is divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 for definitions.

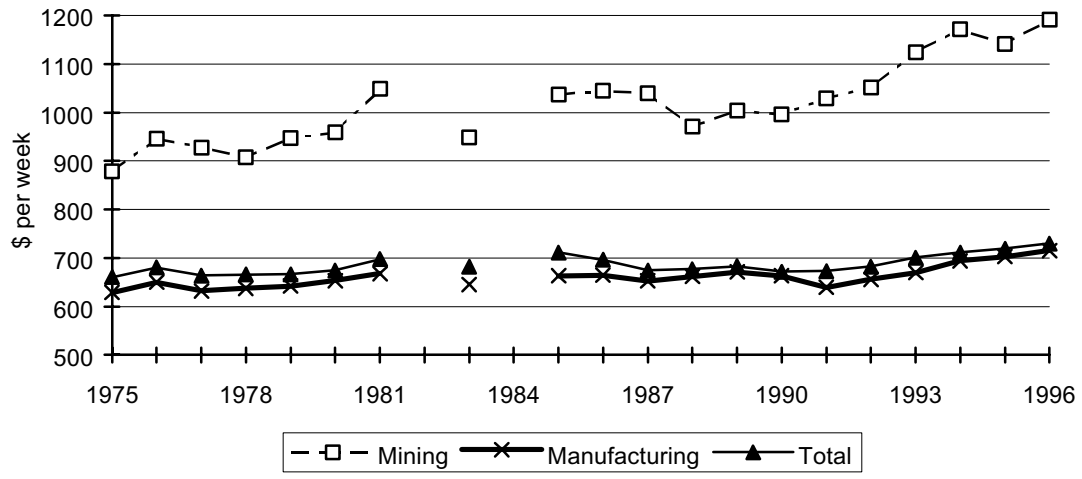
Source: IC estimates adapted from ABS (*Labour Force Australia,* unpublished data, 1987 to 1994, Cat. no. 6203.0).

A.3 Real earnings

This section uses data from the ABS survey of employee earnings and hours to examine whether there is any prima facie evidence of downward pressure on the earnings of employees in low skill occupations. Unless specifically mentioned, earnings refer to full-time average weekly total earnings (ordinary time earnings plus overtime, see ABS 1997a for definitions).

Real earnings for employees in the mining sector, while more volatile, are on average significantly higher than for employees in other sectors (figure A.8). Between 1975 and 1996, the mining sector also experienced relatively stronger growth in real earnings, increasing at an average annual rate of 1.5 per cent. In contrast, average annual growth of real earnings in the manufacturing sector was only 0.6 per cent, and economy–wide, the increase was 0.5 per cent per year.

Figure A.8 **Real total earnings[a] for full-time employees, by sector, 1975–96**



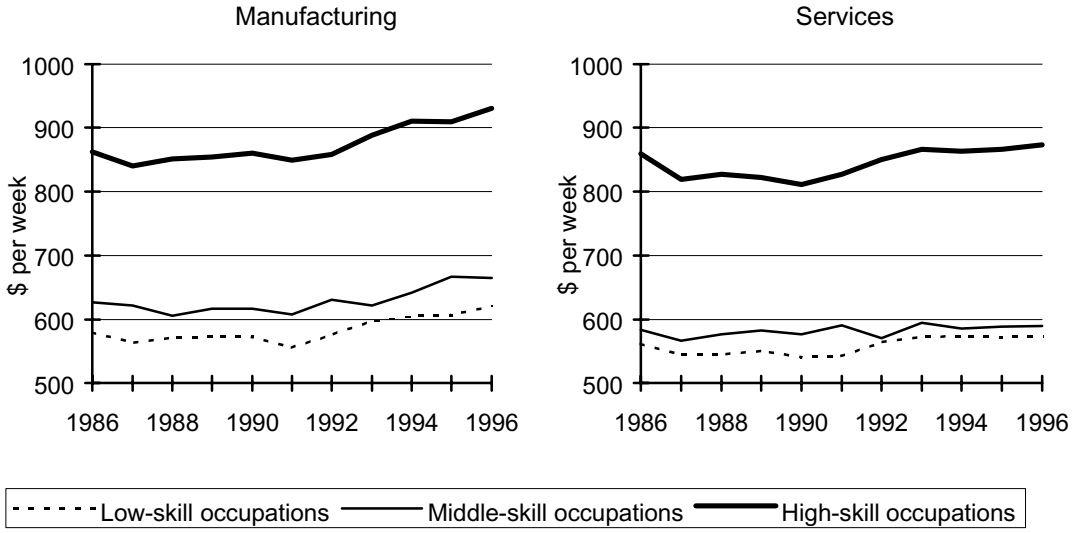
a Average weekly total earnings for full-time adult male non-managerial employees. Real earnings are nominal earnings deflated by the consumer price index, in 1996 dollars. Note the survey was not conducted in 1982 or 1984.

Data source: ABS (*Distribution and Composition of Employee Earnings and Hours*, Cat. no. 6306.0; *Consumer Price Index,* Cat. no. 6401.0).

For the manufacturing and services sectors, real earnings for employees in all skill groups were relatively stable in the late 1980s and then increased in the early 1990s (figure A.9). Growth in real earnings for manufacturing employees by skill group was consistently higher than for employees in services, particularly for those in middle skill occupations. By 1992 manufacturing employees in low skill occupations were earning more than middle skill employees in the services sector.

By sector there tends to be more overtime paid to mining and manufacturing employees. Over the last decade, overtime accounted for on average 11 per cent of total earnings for employees in the manufacturing sector, 13 per cent for employees in mining and only 4 per cent for services sector employees.

Figure A.9 **Real total earnings for full-time manufacturing and services employees, by occupation[a], 1986–96**



[a] Real earnings are nominal earnings deflated by the consumer price index, in 1996 dollars. Earnings are divided into skill levels using data disaggregated by 2 digit ASCO (first edition) occupations. See box A.2 for definitions.

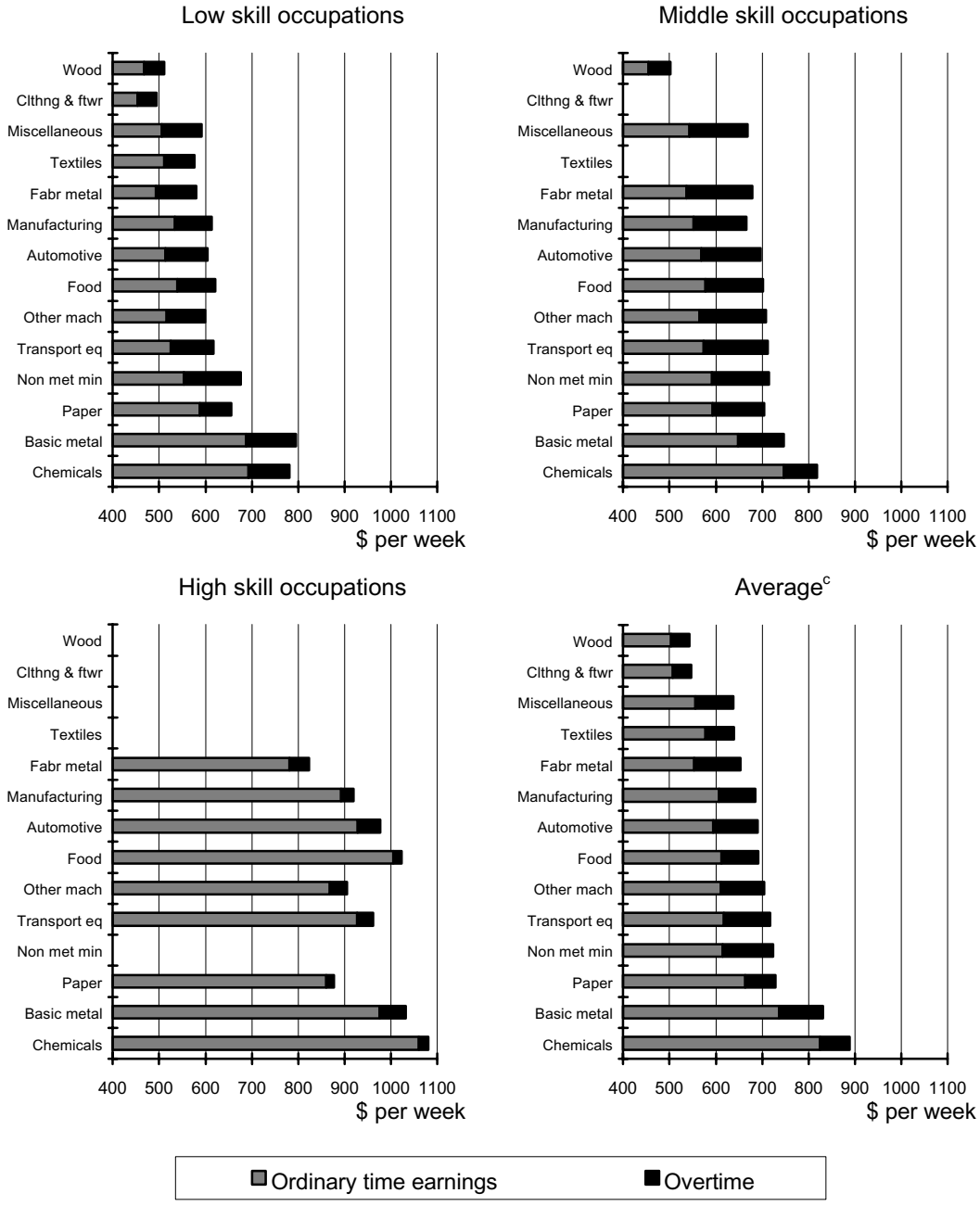
Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1996, Cat.no. 6306.0; *Consumer Price Index*, Cat. no. 6401.0).

Manufacturing industries real earnings

Earnings for employees in different occupation groups differ by manufacturing industry (figure A.10). However, across industries they demonstrate similar trends. Employees in high skill occupations earn significantly more than employees in low skill and middle skill occupations. Earnings in low and middle skill occupations are similar, but with middle skill occupations tending to earn more than employees in low skill occupations (the exceptions being the Basic metal products and Wood, wood products and furniture industries).

The differences in earnings between industries appear broadly consistent across occupation groups. Employees in the Chemical, petroleum and coal products, and Basic metal products industries earn, on average, more than the employees in the other manufacturing industries. In contrast, employees in the Wood, wood products and furniture and Clothing and footwear industries have the lowest average earnings.

Figure A.10 **Earnings for full-time manufacturing employees, by industry and occupation[a], 1995-96[b]**



a Industries are ranked according to average total earnings. Earnings for some industries in high and middle skill occupations are not presented as the sample sizes are relatively small, and therefore the data are unreliable. Industry titles are abbreviated, see note c in figure A.3 for full titles. See box A.2 for the definitions for skill groups. **b** Average of real earnings in May 1995 and May 1996. Real earnings are nominal earnings deflated by the consumer price index, in 1996 dollars. **c** Weighted average.

Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1996, Cat.no. 6306.0; *Consumer Price Index*, Cat. no. 6401.0).

Overtime accounts for more of manufacturing employees' take home pay in low and middle skill occupations than high skill occupations. The average proportion of total earnings coming from overtime between 1986 to 1996 for employees in low skill occupations ranged between 6 per cent and 19 per cent (for Clothing and footwear and Non-metallic mineral products respectively). For employees in middle skill occupations, overtime ranged from 6 per cent to 19 per cent (Clothing and footwear and Non-metallic mineral products) of total earnings. For employees in high skill occupations, overtime over the last decade averaged between only 1 and 6 per cent (Clothing and footwear and Motor vehicles and parts) of total earnings by industry. By industry, overtime tended to fluctuate with the business cycle between 1986 to 1996.

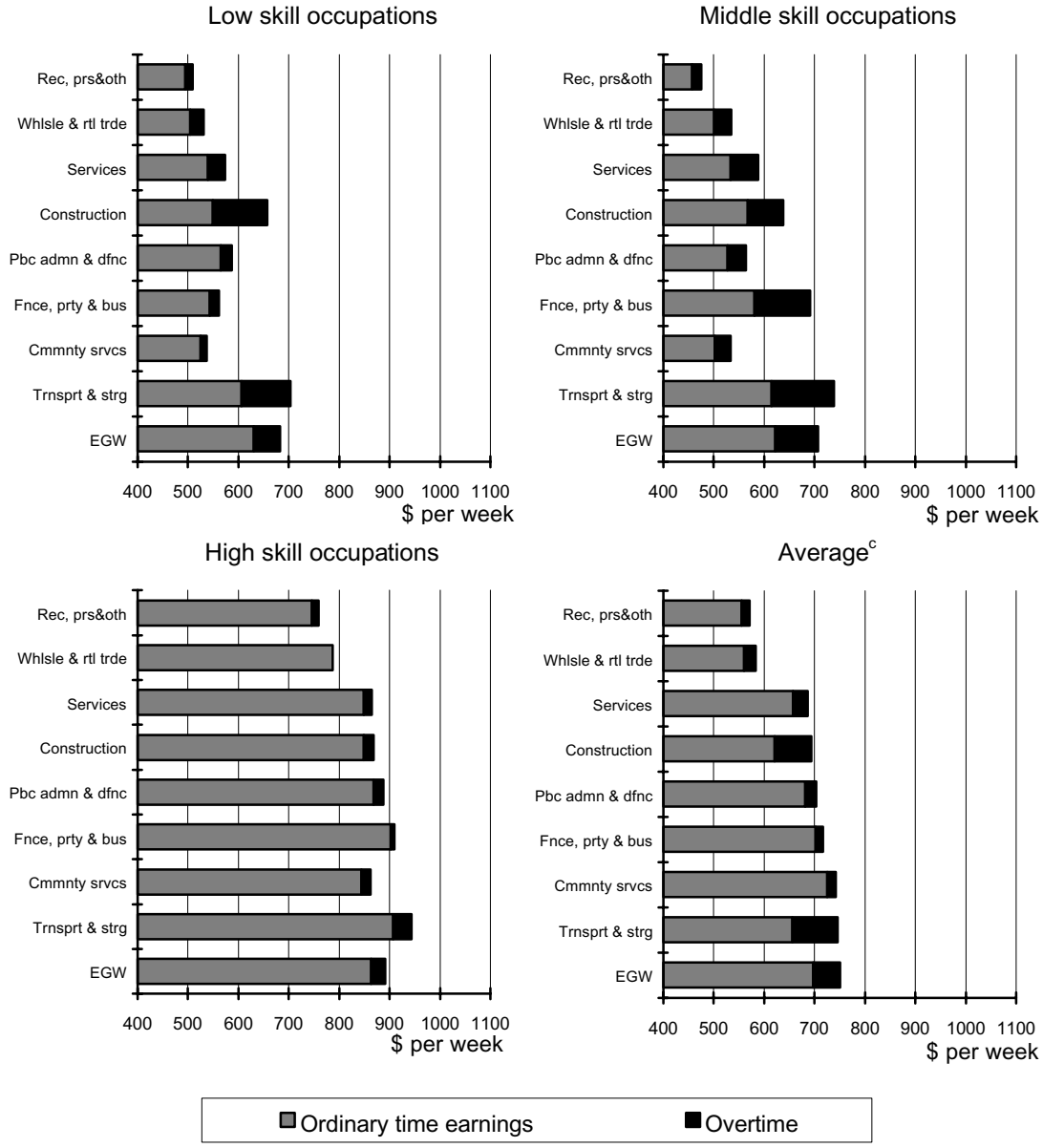
Overtime earnings in the Clothing and footwear industry are relatively low, only accounting for 5 per cent of total earnings on average between 1986-87 to 1995-96 (although in the last three years it averaged 7 per cent).

Service industries real earnings

As is the case for manufacturing industries, earnings for employees in services industries vary by industry and occupation group (figure A.11). Average earnings for employees in Recreational, personal and other services and Wholesale and retail trade are lower than in the other services industries. Electricity, gas and water, Transport and storage, Community services and Finance, property and business services employees tend to have higher earnings.

The proportion of earnings from overtime varies by industry, particularly for employees in low-skill occupations. Between 1986 to 1994, 6 per cent of total earnings for low skill employees was from overtime. Over the same period, employees in low skill occupations in the Construction and Transport and storage industries earned on average 15 and 13 per cent from overtime. Employees in middle skill occupations (tradespersons) tend to earn proportionately more from overtime than other workers.

Figure A.11 **Earnings for full-time services employees, by industry and occupation[a], 1993-94[b]**



[a] Industries are ranked according to average total earnings. Earnings for the Communications industry are not presented as the sample sizes are relatively small, and therefore the data are unreliable. See box A.2 for the definitions for skill groups. Some industry titles are abbreviated. These are: Rec, prs&oth (ASIC division L, Recreation, personal and other services), Whlsle & rtl trde (F, Wholesale and retail trade), Pbc admn & dfnc (J, Public administration and defence), Fnce, prty & bus (I, Finance, property and business services), Cmmnty srvcs (K, Community services), Trnsprt & strg (G, Transport and storage) and EGW (D, Electricity, gas and water). [b] Average of real earnings in May 1993 and May 1994. Real earnings are nominal earnings deflated by the consumer price index, in 1996 dollars. [c] Weighted average.

Source: IC estimates adapted from ABS (*Distribution and Composition of Employee Earnings and Hours*, unpublished data, 1986 to 1994, Cat.no. 6306.0; *Consumer Price Index*, Cat. no. 6401.0).

APPENDIX B

TECHNIQUE AND DATA USED IN INPUT–OUTPUT ANALYSIS

This appendix details the input–output model and data used in the input–output analysis in chapter 3. Derivation of the model is based on the technique used in OECD (1992). The model is extended here by decomposing two of the variables. The imports variable is divided into imports from high and low wage countries. The labour variable is divided into high and low skill labour. This enables changes in low and high skill employment associated with imports from low and high wage countries to be calculated.

B.1 Input–output model

The starting point for deriving the input–output model is the national accounting identity which is used to calculate gross output in each sector:

$$X_i = \sum_j W_{ij} + F_i + E_i - M_i$$

$$= \sum_j W_{ij} + F_i + E_i - M_i^h - M_i^l \qquad (1)$$

X_i = gross output of sector i

W_{ij} = intermediate demand for output of sector i by sector j

F_i = domestic final demand for output of sector i

E_i = export demand for output of sector i

M_i = total imports classified in sector i

M_i^h = high wage imports classified in sector i

M_i^l = low wage imports classified in sector i

A fixed proportional relationship is assumed between intermediate inputs and gross output in each sector. The variable a_{ij} gives the relationship between

gross output in sector j and the intermediate demand for the output of sector i by sector j.

$$a_{ij} = W_{ij} / X_j \qquad (i, j = 1,2,3,\ldots,n) \tag{2}$$

The values of a_{ij} make up an $n \times n$ matrix A, which describes the current state of technology (n is the number of industries). Changes in technology change the mix of inputs used to produce goods.

Matrix A can be incorporated into equation (1) expressed in matrix form as below.

$$\begin{aligned} X &= W + F + E - M \\ &= AX + F + E - M \end{aligned} \tag{3}$$

Imports (M) can be removed from equation (3) by adjusting intermediate demand (AX) and final demand (F) to remove their imported components.

$$X = u^w AX + \hat{u}^f F + E \tag{4}$$

where the hat ^ over u^f indicates that it is a diagonal matrix

$u_i^f = F_i^d / F_i$ are the elements of u^f

$$u^w = A^d A^{-1} \tag{5}$$

and $a_{ij}^d = W_{ij}^d / X_j$ are the elements of the A^d matrix

F_i^d and W_{ij}^d are the domestic components of final and intermediate demands.

Factors which convert intermediate and final demand into their imported components can also be constructed, m^w and m^f. The relationship $m = (1 - u)$ then holds. These factors can be disaggregated into those for imports from high and low income countries. This is done by adding h and l superscripts to the matrices. For example, m^{wh} gives the factor representing the imported component of intermediate demand from high income countries.

Rearranging equation (4) and solving for gross output yields:

$$X = (I - u^w A)^{-1}(\hat{u}^f F + E) = B(\hat{u}^f F + E) \tag{6}$$

where B is the inverse of the matrix $(I - u^w A)$.

B.2 Decomposition of employment growth

Equation (6) shows that changes in gross output for a sector can be decomposed into changes in domestic final demand, exports, technology and import penetration. Using numbered subscripts to denote two points in time, change in gross output can be expressed as follows:

$$\Delta X = X_1 - X_0 \tag{7}$$

Substituting (6) into (7) yields:

$$\begin{aligned}\Delta X &= (I - u_1^w A_1)^{-1}(\hat{u}_1^f F_1 + E_1) - (I - u_0^w A_0)^{-1}(\hat{u}_0^f F_0 + E_0) \\ &= (D_1)^{-1} G_1 - (D_0)^{-1}(G_1 - \Delta G) \\ &= (D_0)^{-1}\Delta G + [(D_1)^{-1} - (D_0)^{-1}]G_1 \end{aligned} \tag{8}$$

where $D = (I - u^w A)$ and $G = \hat{u}^f F + E$

The first term in equation (8) can be decomposed into:

$$\begin{aligned}(D_0)^{-1}\Delta G &= B_0\left[(\hat{u}_1^f F_1 + E_1) - (\hat{u}_0^f F_0 + E_0)\right] \\ &= B_0\left[(\hat{u}_1^f F_1 - \hat{u}_0^f F_1) + (\hat{u}_0^f F_1 - \hat{u}_0^f F_0) + (E_1 - E_0)\right] \\ &= B_0(\hat{u}_0^f \Delta F + \Delta E + \Delta\hat{u}^f F_1) \end{aligned} \tag{9}$$

and the second term becomes:

$$\begin{aligned}[(D_1)^{-1} - (D_0)^{-1}]G_1 &= B_0(\Delta u^w W_1 + u_0^w \Delta A X_1) \\ &= -[(D_0)^{-1} - (D_1)^{-1}]G_1 \\ &= (D_0)^{-1}(D_0 - D_1)(D_1)^{-1} G_1 \\ &= B_0(D_0 - D_1)X_1 \\ &= B_0\left((I - u_0^w A_0) - (I - u_1^w A_1)\right)X_1 \\ &= B_0\left((u_1^w A_1 - u_0^w A_1) + (u_0^w A_1 - u_0^w A_0)\right)X_1 \\ &= B_0\left(\Delta u^w A_1 + u_0^w \Delta A\right)X_1 \\ &= B_0(\Delta u^w W_1 + u_0^w \Delta A X_1) \end{aligned} \tag{10}$$

Substituting (9) and (10) into (8) yields the decomposition formula of output changes:

$$\Delta X = B_0\hat{u}_0^f \Delta F + B_0\Delta E + B_0\Delta\hat{u}^f F_1 + B_0\Delta u^w W_1 + B_0 u_0^w \Delta A X_1 \tag{11}$$

Recall that $m = (1-u)$, so that changes in m can be substituted for changes in u in the third and fourth terms.

$$\begin{aligned} u^w &= 1 - m^w \\ &= 1 - m^{wh} - m^{wl} \end{aligned} \tag{12}$$

$$\begin{aligned} \Delta u^w &= \Delta\left(1 - m^{wh} - m^{wl}\right) \\ &= -\Delta m^{wh} - \Delta m^{wl} \end{aligned} \tag{13}$$

Similarly, for final goods:

$$\begin{aligned} \Delta \hat{u}^f &= \Delta\left(1 - \hat{m}^{fh} - \hat{m}^{fl}\right) \\ &= -\Delta \hat{m}^{fh} - \Delta \hat{m}^{fl} \end{aligned} \tag{14}$$

Substituting (13) and (14) into (11) further decomposes changes in output:

$$\begin{aligned} \Delta X = \; & B_0 \hat{u}_0^f \Delta F + B_0 \Delta E - B_0 \Delta \hat{m}^{fh} F_1 - B_0 \Delta \hat{m}^{fl} F_1 \\ & - B_0 \Delta m^{wh} W_1 - B_0 \Delta m^{wl} W_1 + B_0 u_0^w \Delta A X_1 \end{aligned} \tag{15}$$

The decomposition of the change in output is used to find the decomposition of the changes in high and low skill employment.

The change in total employment can be expressed in terms of the inverse of labour productivity and the change in output as follows:

$$\Delta L = L_1 - L_0 = \hat{l}_0 \Delta X + \Delta \hat{l} X_1 \tag{16}$$

where $l = L / X$

Substituting (15) into (16) yields the decomposition of employment given in table B.1. High and low skill labour are denoted by h and l superscripts. The decomposition of changes in low and high skill employment are the same except that there are different superscripts on inverse labour productivity ($\hat{l}$).

Table B.1 **Decomposition of sources of growth in employment**

Sources of growth	*Low skill*	*High skill*
Domestic final demand expansion	$\hat{l}_0^l B_0 \hat{u}_0^f \Delta F$	$\hat{l}_0^h B_0 \hat{u}_0^f \Delta F$
Export expansion	$\hat{l}_0^l B_0 \Delta E$	$\hat{l}_0^h B_0 \Delta E$
High wage import substitution in final demand	$-\hat{l}_0^l B_0 \Delta \hat{m}^{fh} F_1$	$-\hat{l}_0^h B_0 \Delta \hat{m}^{fh} F_1$
Low wage import substitution in final demand	$-\hat{l}_0^l B_0 \Delta \hat{m}^{fl} F_1$	$-\hat{l}_0^h B_0 \Delta \hat{m}^{fl} F_1$
High wage import substitution in intermediate demand	$-\hat{l}_0^l B_0 \Delta m^{wh} W_1$	$-\hat{l}_0^h B_0 \Delta m^{wh} W_1$
Low wage import substitution in intermediate demand	$-\hat{l}_0^l B_0 \Delta m^{wl} W_1$	$-\hat{l}_0^h B_0 \Delta m^{wl} W_1$
Intermediate input use	$\hat{l}_0^l B_0 u_0^w \Delta A X_1$	$\hat{l}_0^h B_0 u_0^w \Delta A X_1$
Labour productivity growth	$\Delta \hat{l}^l X_1$	$\Delta \hat{l}^h X_1$

Percentage changes in employment due to each of the sources of growth are the same for low and high skill labour, except in the case of labour productivity growth. They are calculated by multiplying the change in the level by $100 / L_0$. The formulae for the changes in levels due to each of the sources of change (except labour productivity growth) have as their first terms $l_0 = L_0 / X_0$. Hence for all the sources of change except labour productivity growth, L_0 cancels, and the formulae left are the same for high and low skill labour. This is why labour productivity growth is the only source of change for which percentage changes are presented in table 3.2 for low and high skill labour.

B.3 Data

Input–output tables were constructed for direct and indirect allocation of imports using data obtained from the Australian Bureau of Statistics for 1986-87 and 1993-94. Data for 1986-87 were converted into 1993-94 prices using a number of different price indices. The 1986-87 import table was first calculated by subtracting the direct allocation of competing imports from the indirect allocation table. Price indices were then used to adjust the direct and import tables separately. The adjusted values for imports and the direct allocation

input–output table were added together to get an indirect allocation input–output table for 1986-87 expressed in 1993-94 dollars.

Where possible, price indices which were specific to the components of the input–output tables were used. Price indices for articles produced by manufacturing industries (ABS 1994c) were used to adjust the values of manufacturing commodities used as intermediate inputs and as final demand in the direct allocation table. Price indices for materials used in manufacturing industries (ABS 1994d) were used to adjust the total intermediate inputs used by manufacturing industries in the direct allocation table. Economy–wide total intermediate inputs, total final demand and gross output were adjusted using the GDP deflator. The all groups export price index (ABS 1994a) was used for total exports.

Industry level import price indices (ABS 1994b) were used for intermediate use and final demand categories by commodity in the import table. The exception to this was the other than manufacturing commodities row which was adjusted by the all groups import price index. Values in the direct allocation and import tables which have not been mentioned were not used in the calculations.

Data on employment by industry and skill level were those used in the descriptive analysis in chapter 2. The ratios of imports from low wage countries to those from high wage countries for each industry were derived from Department of Foreign Affairs and Trade data.

APPENDIX C

THE MONASH MODEL

This appendix explains the structure and workings of the Monash model in an intuitive fashion. Further details are provided in IC (1997a).

The Monash model is composed of three elements — a database, theory and parameters — which are embodied in the model's system of equations. These equations describe how industries and consumers respond to changes in the policy variables being studied.

The core of the Monash model is its database showing how each sector in the economy is linked to other sectors. This provides a detailed description of the structure of production and demands in the Australian economy. It accounts for taxes and subsidies on all transactions. It also includes margins which represent the costs associated with transferring a product from the firm or the wharf (in the case of imports) to consumers and other users. Examples of margins are wholesale and retail mark-ups, transport, storage and insurance costs. Taxes and margins represent the difference between the cost of providing a good or service (at the firm level) and the price paid by the user. Tariffs are treated as a commodity tax on imports.

While the database provides information about the linkages between sectors of the economy, it only does so for a particular point in time. To analyse the effects of different policies on the whole economy, assumptions need to made about how different groups in the economy are likely to respond to such change. Monash uses microeconomic theory to specify the behaviour of producers, consumers, foreigners and investors. It portrays producers seeking to minimise costs (within certain constraints) and consumers seeking (again, within limits) to maximise utility (or to minimise the cost of achieving a certain level of consumption). The results analysed in chapter 4 were produced using the assumption that production functions have constant returns to scale. Monash also has a government sector whose revenue and expenditure behaviour is modelled separately.

While economic theory guides the model's broad assumptions, many numerical parameters are required to estimate the size of the responses expected. These govern the degree to which the behaviour of producers, consumers, investors and foreigners change in response to economic signals, such as price changes.

The values for the parameters in Monash are either derived from the database or from other external sources.

C.1 Historical analysis

In the historical mode used in chapter 4 a single-period configuration of Monash was utilised. The single period was 7 years long (1986-87 to 1993-94). Using data based on the 1986-87 input–output tables as the starting point, Monash was used to generate an updated database that fits with the observed structure of the economy in 1993-94. To do this, the observed changes in economic variables between 1986-87 and 1993-94 were set as predetermined variables. The Monash model was then used to solve for the values of the remainder of the variables such that the observed values for variables were obtained. That is, it was solved for the variables whose changes over the period 1986-87 to 1993-94 were unobserved. Included in the set of unobserved variables were technical changes, household preferences, and foreign demand and supply conditions. Box C.1 uses a simple example to illustrate the key principles underlying the historical analysis.

Aggregate private household behaviour

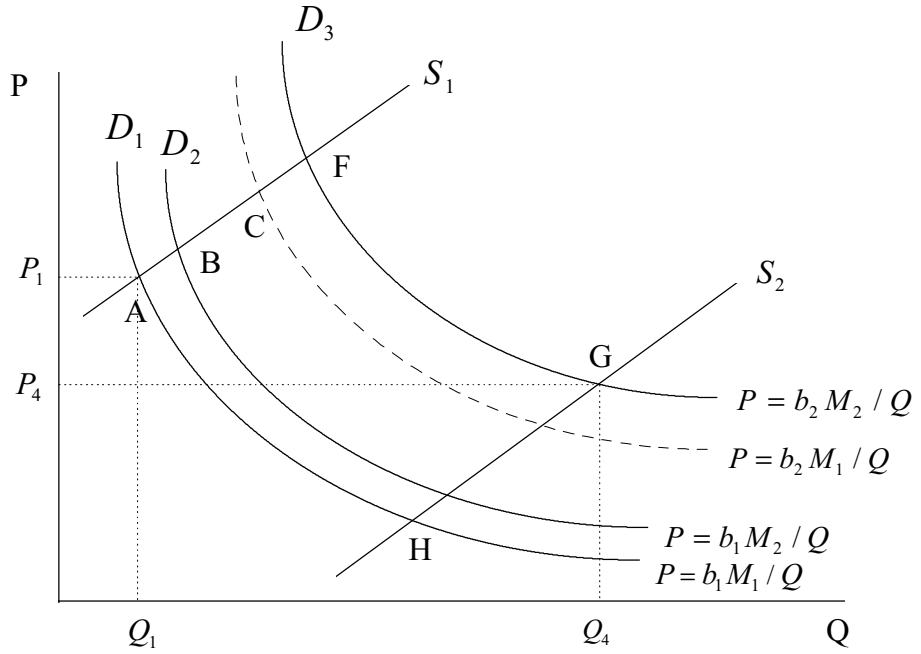
In the version of Monash used in this paper it was assumed that aggregate consumption was driven by household disposable income. Household disposable income in each year is equal to the sum of factor incomes (that is, returns to labour, capital and agricultural land); less income taxes paid; less income accruing to foreigners; plus net transfers from the government (for example, unemployment benefits).

Exports — traditional and non-traditional

Monash divides exports into two categories: traditional and non-traditional. The former category covers products for which exports account for more than 20 per cent of domestic output. This includes Wool, Wheat, Non-ferrous metal ores and Black coal. Examples of non-traditional export commodities are Motor vehicles, Petroleum products and Education.

Box C.1 Calculating preference and supply change

Take as an illustrative example, the demand for vegetables (based on a Cobb-Douglas utility function) and a linear supply function. The demand curve is given by Q = bM/P where Q is the quantity demanded, b is a parameter reflecting consumer preference for vegetables, M is income and P is the price of vegetables. Suppose that Q, M and P are observed in two periods. Point A is the observed market equilibrium in the first period, when income is M1. Point G is the observed market equilibrium in the second period, when income is M2. Because the two points A and G are market equilibria, they must have demand and supply curves passing through them.



To reconcile the observed equilibria given the specific theory being used for supply and demand, there must have occurred an increase in the preference for vegetables by consumers and a shift in the supply curve (technical change) by producers. The movement from A to B accounts for the change in quantity due to the change in income. The movement from A to C accounts for the change in quantity due to the change in preferences. The point F is the change in quantity from both changes in preferences and income, assuming supply is unchanged. The movement from A to H is the change in quantity from the shift in the supply curve. This shift in supply represents changes in production costs, which for purposes of illustration will be assumed to be solely due to changes in technology (other shifts, such as those due to lower intermediate input prices are accounted for in Monash). Combining together the shifts in demand due to income and preference changes with the technology-induced shift in supply generates the equilibrium point G. The movement from A to G is explained in terms of changes in incomes, preferences and technology.

Monash assumes that the demand for traditional exports is a function of the relevant foreign currency price and its sensitivity to increases in Australian exports (the export demand elasticity). For exports which are not highly differentiated, or where Australia has only a small share of the world market, export demands are assumed to be highly sensitive to price. That is, world prices are insensitive to the volume of exports by Australia. Where Australia has a significant share of the world or regional market (for example wool) or where commodities are highly differentiated (for example scientific equipment), exports are modelled as being price sensitive, but to a much lower degree. In these cases, Australian export volumes have some limited influence on world prices.

REFERENCES

ABS (Australian Bureau of Statistics) 1994a, *Export Price Index*, Cat. no. 6405.0, ABS, Canberra.

—— 1994b, *Import Price Index*, Cat. no. 6414.0, ABS, Canberra.

—— 1994c, *Price Indexes of Articles Produced by Manufacturing Industry,* Cat. no. 6412.0, ABS, Canberra.

—— 1994d, *Price Indexes of Materials Used in Manufacturing Industries*, Cat. no. 6411.0, ABS, Canberra.

—— 1996a, *ASCO — Australian Standard Classification of Occupations*, Information Paper, Cat. no. 1221.0, ABS, Canberra.

—— 1996b, *Labour Force, Australia,* Cat. no. 6203.0, ABS, Canberra.

—— 1997a, *Distribution and Composition of Employee Earnings and Hours*, Cat. no. 6306.0, ABS, Canberra.

—— 1997b, *Manufacturing Production, Australia*, Cat. no. 8301.0, ABS, Canberra.

Aungles, P., Dearden, L., Karmel, T. and Ryan, C. 1993, 'Through a rear-view mirror darkly: occupational change, 1971–1986', *Australian Bulletin of Labour*, vol. 19, no. 2, pp. 97–113.

Bhagwati, J. N. 1991, *Free Traders and Free Immigrationists: Strangers or Friends?*, Working Paper no. 20, Russell Sage Foundation, New York.

BIE (Bureau of Industry Economics) 1996, *Setting the Scene: Micro Reform — Impact on Firms*, Report no. 96/1, AGPS, Canberra.

Borjas, G. Freeman, R. and Katz, L. 1992, 'On the labour market effects of immigration and trade', in Borjas, G. and Freeman, R. (eds), *Immigration and the Work Force: Economic Consequences for the United States and Source Areas*, University of Chicago Press, pp. 213–44.

Borland and Foo, L. 1996, 'The composition of employment in manufacturing industry', *Journal of Industrial Relations*, vol. 38, no. 3, pp. 442–66.

—— and Wilkins, R. 1996, 'Earnings inequality in Australia', *Economic Record*, vol. 72, no. 216, pp. 7–23.

Burtless, G. 1995, 'International trade and the rise in earnings inequality', *Journal of Economic Literature*, vol. 33, pp. 800–16.

Cooper, R. 1994, Foreign trade, wages and unemployment, Paper presented at Egon Sohmen Conference, Salzburg, Austria.

de Laine, C., Lee, K., and Woodbridge, G. 1997, *Microeconomic Reform and Structural Change in Employment*, Industry Commission Staff Research Paper, AGPS, Canberra.

Dixon, P.B. and McDonald, D. 1993, *An Explanation of Structural Changes in the Australian Economy: 1986-87 to 1990-91*, EPAC Background Paper no. 29, AGPS, Canberra.

——, Parmenter, B.R. and Rimmer, M.T. 1997, *The Australian Textiles, Clothing and Footwear Sector from 1986-87 to 2013-14: Analysis Using the Monash Model: A Report to the Industry Commission*, Centre of Policy Studies, Monash University, Melbourne.

Fahrer, J. and Pease, A. 1994, 'International trade and the Australian labour market', in Reserve Bank of Australia, *International Integration of the Australian Economy*, *Proceedings of a Conference 11–12 July 1994*, pp. 177–232.

Flanders, S. and Wolf, M. 1995, 'Haunted by the trade spectre', *Financial Times*, 24 July, p. 13.

Francois, J. 1996, 'Trade, labour force growth and wages', *The Economic Journal*, vol. 106, no. 439, November, pp. 1586–1609.

Freeman, R.B. 1995, 'Are your wages set in Beijing?', *Journal of Economic Perspectives*, vol. 9, no. 3, pp. 15–33.

Gregory, M. and Greenhalgh, C. 1996, *International Trade, Deindustrialisation and Labour Demand: An Input Output Study for the UK 1979-90*, The Labour Market Consequences of Technical and Structural Change Discussion Paper no. 1, Centre for Economic Performance, University of Oxford.

Gregory, R.G. 1993, 'Aspects of Australian and US living standards: the disappointing decades 1970-1990', *Economic Record*, vol. 69, no. 204, pp. 61–76.

Gretton, P.K. and Fisher, B. 1997, *Productivity Growth and Australian Manufacturing Industry*, Industry Commission Staff Research Paper, AGPS, Canberra.

Grossman, G.M., 1987, 'The employment and wage effects of import competition in the United States', *Journal of International Economic Integration*, vol. 2, no. 1, pp.1–23.

Harding, A. 1996, Emerging trends in income inequality in Australia: 1982 to 1993-94, NATSEM paper presented to the 8th Australian Population Association National Conference, 6 December.

IC (Industry Commission) 1995a, *Assistance to Agricultural and Manufacturing Industries*, AGPS, Canberra.

—— 1995b, *Australian Manufacturing Industry and International Trade Data 1968-69 to 1992-93*, Staff Information Paper, AGPS, Canberra.

—— 1995c, *The Performance of Australian Industry*, AGPS, Canberra.

—— 1996, *Reform and the Distribution of Income — An Economy wide Approach*, Staff Information Paper, AGPS, Canberra.

—— 1997a, *Industry Commission Inquiry into the Textiles, Clothing and Footwear Industries: Modelling the Impact of Tariff Reductions*, Melbourne.

—— 1997b, *Patterns of Textile, Clothing and Footwear Trade Within APEC, 1990–94*, Research Report, AGPS, Canberra.

—— 1997c, *The Automotive Industry*, Report no. 58, AGPS, Canberra.

—— 1997d, *The Textiles, Clothing and Footwear Industries*, Report no. 59, AGPS, Canberra.

Lawrence, R.Z. 1996, *Single World, Divided Nations? International Trade and OECD Markets*, Brookings Institution Press, OECD Development Centre.

—— and Slaughter, M.J. 1993, 'International trade and American wages in the 1980s: giant sucking sound or small hiccup?', *Brookings Papers on Economic Activity, no. 2*, pp. 161–226.

Leamer, E. 1996, *In Search of Stolper-Samuelson Effects on US Wages*, NBER Working Paper no. 5427.

Machin, S., Ryan, A. and Van Reenen, J. 1996, *Technology and Changes in Skill Structure: Evidence From an International Panel of Industries*, The Labour Market Consequences of Technical and Structural Change Discussion Paper no. 4, Centre for Economic Performance and the Institute of Economics and Statistics, University of Oxford.

Meagher, G.A. 1995, Forecasting employment opportunities in Australia: an applied general equilibrium approach, Paper presented at the 11th International Conference on Input–Output Techniques, New Delhi, 27 November–1 December.

OECD (Organisation for Economic Cooperation and Development) 1992, *Structural Change and Industrial Performance: A Seven Country Growth Decomposition Study,* Paris.

—— 1996, *Employment Outlook*, Paris.

—— 1997, *Trade, Earnings and Employment: Assessing the Impact of Trade with Emerging Economies on OECD Labour Markets*, Directorate for Education, Employment, Labour and Social Affairs, DEELSA/ELSA/WP5(97)6, Paris.

Pincus, J. 1995, 'Evolution and political economy of Australian trade policies', in Pomfret, R. (ed), *Australia's Trade Policies*, Oxford University Press, pp. 53–73.

RBA (Reserve Bank of Australia) 1996, *Australian Economic Statistics 1949-50 to 1994-95*, Reserve Bank of Australia, Sydney.

Revenga, A.L. 1992, 'Exporting jobs? The impact of import competition on employment and wages in US manufacturing', *Quarterly Journal of Economics*, vol. 107, no. 1, pp. 255–84.

Sachs, J. D. and Shatz, H. J. 1994, 'Trade and jobs in US manufacturing', *Brookings Papers on Economic Activity,* no.1, pp. 1–84.

Tyers, R. and Yang, Y. 1996, *Trade with Asia and Skill Upgrading: Effects on Factor Markets in the Older Industrial Countries*, Discussion Paper no. 346, Centre for Economic Policy Research, Australian National University.

Wood, A. 1994, *North–South Trade, Employment and Inequality*, Oxford: Clarendon Press.

World Bank 1996, *World Development Report 1996*, Oxford University Press, New York.