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# MICROECONOMIC REFORM AND STRUCTURAL CHANGE IN EMPLOYMENT

## Introduction

This paper reports in detail on research originally undertaken in support of the Industry Commission's 1995–96 Annual Report. The theme of the Annual Report was microeconomic reform, productivity and equity. One of the issues addressed was the links between microeconomic reform and the rate of structural change in employment.

Since the mid 1980s, Australian governments have implemented a broad range of microeconomic reforms aimed at improving the use of the nation's resources. Table 1 outlines many of the major reforms in Australia since 1970. The list is indicative of the type and timing of reforms rather than being comprehensive.

The increasing pace of microeconomic reform, such as tariff reductions and the commercialisation of government business enterprises (GBEs), may alter the rate at which employment in different industries is being created or reduced.

There are concerns that microeconomic reform policies are increasing the rate of structural change in employment<sup>1</sup> and that this may be creating adjustment problems. Microeconomic reform may lead to an expansion in output and employment of some industries and a contraction of others. This will result in some industries increasing employment while the corresponding share of employment in other industries will be reduced.

The aim of this paper is to analyse structural change in employment in Australia between 1972 and 1995 and to examine whether microeconomic reform policies have influenced the rate of this change. The analysis is undertaken in two stages. First, the overall annual rate of structural change is estimated using an index that measures the composition of industry employment. This is a summary of the overall change in the industry structure of employment in the economy. If microeconomic reform has increased the rate of structural change in employment, then with all other factors that may influence structural change held constant it may show up as an increase in the index compared with earlier years.

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<sup>1</sup> Defined as the rate at which jobs in different industries are being created and reduced.

Table 1: Major microeconomic reforms since 1970

<i>Year</i>	<i>Reform description</i>	<i>Industries most directly affected</i>
1973	Across the board reduction in tariffs of 25 per cent	Manufacturing
1983	Some GBEs start to pay dividends; Steel Plan announced	Electricity, gas and water; Manufacturing
1984	Reforms to statutory marketing authorities and assistance to agriculture commence; Car Plan announced	Agriculture Manufacturing
1985	Australian dollar floated and barriers to movements of foreign capital and entry of foreign banks reduced	Finance & business services
1986	Rate of return reporting for GBEs first introduced; TCF Plan announced	Electricity, gas & water; Manufacturing
1988	Tariff and quota reductions to be phased in over the next four years; Financial and price reforms to telecommunications industry; Move towards enterprise-based agreements; First Commission of Audit on government finances	Manufacturing; Transport & communication; Public administration & defence
1989	Three year reform program for waterfront and shipping includes the introduction in the stevedoring industry of enterprise-based agreements, reducing average crew sizes; Greater corporatisation, privatisation, commercialisation and contracting out of government activities (including GBEs)	Transport & communication Electricity, gas & water; Public administration & defence
1990	Duopoly of aviation industry ended and privatisation commenced; User-pays introduced in many ports; Second telecommunications carrier permitted and access to telecommunications network arranged	Transport & communication
1991	Further tariff reductions announced; Agreement to introduce tax equivalent regimes for GBEs	Manufacturing; Electricity, gas & water
1992	Further electricity reforms, such as the establishment of the National Grid Management Council	Electricity, gas & water
1993	New telecommunications carrier; Casemix funding for hospitals introduced	Transport & communication; Community services
1995	National Competition Policy Agreement	Electricity, gas & water; Transport & communication

*Sources:* IC Annual Reports (various)

However, microeconomic reform is likely to be only one of a number of factors that contribute to structural change in employment. The second stage assists in identifying the factors contributing to the change in the structure of employment. This is achieved by examining the sources of employment change in each industry and investigating whether these sources are likely to be associated with microeconomic reform or other factors.

For example, during the period of microeconomic reform, employment in Electricity, gas and water may have fallen due to improvements in labour productivity. This fall may be partially offset by an increase in demand for these services. Even if labour productivity contributed to structural change, its contribution to the overall change may be small because of other factors unrelated to microeconomic reform.

It could be concluded that microeconomic reform policies have had an impact if two observations can be made. First, the rate of structural change increases over the period associated with microeconomic reform. Second, in those industries where microeconomic reform has been concentrated, there has been a large amount of structural change, particularly as a result of improvements in labour productivity or changes in prices that are likely to have been associated with microeconomic reform.

### **Structural change in employment 1972 to 1995**

A commonly used measure of the extent of structural change in employment in the economy is the rate or coefficient of (compositional) structural change.

Over any period, the coefficient of structural change is defined as:  $\frac{1}{2} \sum |x_{i,t} - x_{i,t-1}|$  where  $x_{i,t}$  and  $x_{i,t-1}$  represent each industry's share of total employment at the end (t) and beginning (t-1) periods respectively. If the differences in each industry's shares of employment were simply summed, taking into account their positive and negative signs, the gains and losses would cancel out. For this reason the absolute value of the differences are summed, then halved to facilitate interpretation. For a more comprehensive discussion, see OECD (1992) and Dixon (1982).

The coefficient (or index) of structural change is measured as an annual rate of change (OECD 1992). When there is a large movement in the shares of many industries, the index is large and when changes in shares are few or small, the index is small. A value of zero would indicate that each industry had the same share of total employment in both periods.

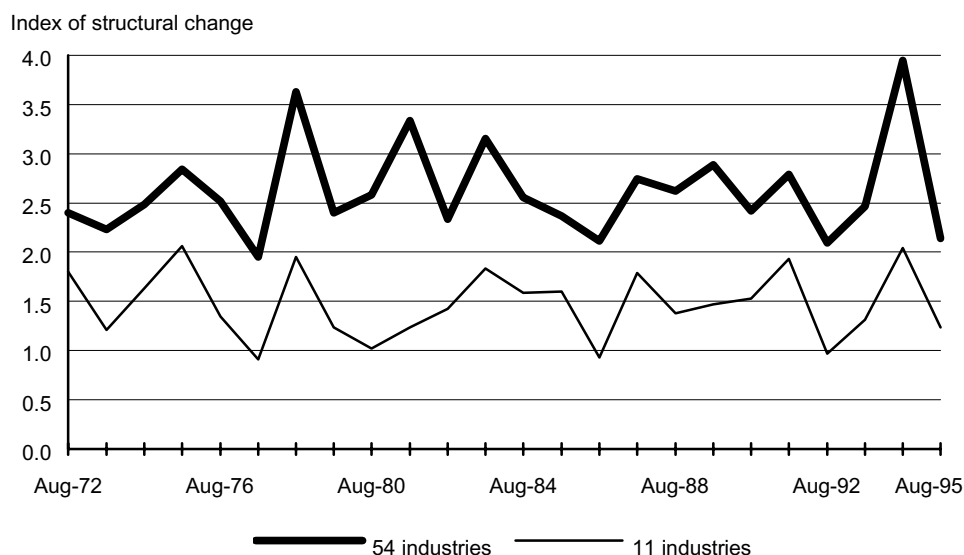


As the index measures changes in industry shares, it does not reflect changes in the level of total employment (or unemployment) which may result from structural change. It only examines changes in the industry composition of employment.

It should also be recognised that the index only measures net movements in employment between industries. Net measures of employment change are smaller than gross changes in employment because net measures do not include all increases and decreases in employment within an industry over a period. For example, one business in an industry could have a large number of job losses while another could be increasing employment. So long as they are in the same industry classification, they are not captured by the index.

The index of structural change in the Australian labour market over the last two decades is shown in Figure 1. The index is calculated using two different levels of industry disaggregation. The higher measure is calculated using employment data disaggregated into 54 industries while the lower measure aggregates employment into 11 industries. As expected, a higher level of industry disaggregation is associated with a higher value of the index as it captures more movement in employment between industries. The two measures however, move closely together.

Figure 1: Index of structural change in employment, 1972–1995



Sources: Commission estimates based on ABS Cat. No. 6204.0 and ABS Labour Force Survey, unpublished data

If microeconomic reform has had a significant impact on the structure of employment, one may expect to observe an increase in the index of structural

change from the mid 1980s, the period when reform gathered pace in the economy (Table 1). This interpretation assumes that other factors affecting structural change are constant over the period or cancel each other out.

Although structural change fluctuates from year to year, since the 1970s there has been no observable increase in the long term trend rate of structural change in the labour market (Figure 1).

One reason why microeconomic reform has not had an observable impact on the rate of structural change in employment could be that structural changes in employment are occurring within an industry, such as increases in part-time employment. Another reason is that the contribution of microeconomic reform to structural change is small relative to that arising from other sources. A further possibility is that the increase in structural change from reform is occurring coincidentally with a matching decrease from other factors.

### **Sources of change in employment 1977–78 to 1992–93**

In this section, the change in employment over a given period in each industry is decomposed into a range of factors. In turn, these factors are linked to institutional changes which occurred over the period (Table 1) to see if there is any relationship between microeconomic reform and the various factors which contribute to observed structural change. Thus, insights may emerge about the extent to which microeconomic reform and other factors are influencing the rate of change in employment between different industries.

An input–output framework is used to determine the contribution of factors to changes in employment in each industry. The contributing factors are:

- labour productivity;
- demand for final goods by consumers, government and investment;
- export demand for final goods;
- import demand for final goods, or import substitution of final goods;
- the demand for imported goods used in the production process, or import substitution of intermediate goods; and
- demand for goods used as inputs into production, or input–output coefficients.

This input–output approach has recently been applied by Gregory and Greenhalgh (1996) and the OECD (1992) to examine structural change and its effect on labour demand. The method and data used in this paper are detailed in

the Technical Appendix. For additional information on the method, see Gregory and Greenhalgh (1996).

An input–output framework is used because input–output tables (see Box 1) provide information on the linkages between industries. Input–output tables show how the output of each industry in the economy is used as either inputs into the production process of domestic industry (intermediate demand), or as goods for final demand (including investment), or as goods for export. The tables also describe the extent to which imports are used as inputs to the production of domestic goods or as final demand.

**Box 1: The structure of input–output tables**

The basic structure of an input–output table is illustrated below. It is an industry by industry table, where the rows represent the output of an industry and the columns show the input-mix of an industry. Each row specifies how the output of the corresponding industry *i* is used as either an intermediate input, for final consumption, investment or for exports. Each column in the intermediate inputs matrix shows the inputs that were required to produce the output of industry *j*.

	<i>Intermediate inputs to production for industry j</i>	<i>Final goods for household and government consumption</i>	<i>Gross fixed capital expenditure by the private and public sector</i>	<i>Exports</i>	<i>Total output</i>
Output of industry <i>i</i>	Intermediate input matrix	Final demand matrix			

Information on labour productivity (the labour–output ratio) in each industry allows changes in industry employment to be connected to output changes, and therefore sources of growth in output (see Box 2).

**Box 2: Illustrating the decomposition framework**

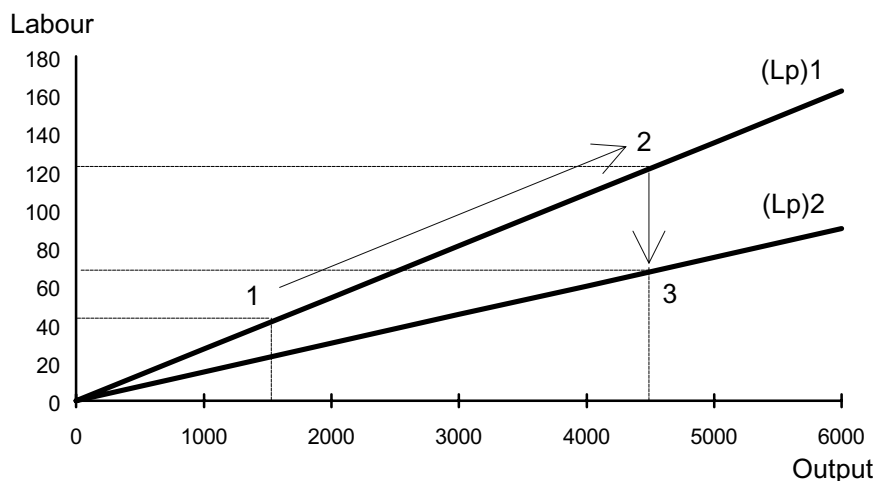
The diagram below illustrates how changes in employment are decomposed into two sources – output and labour productivity. First, an expansion in output from 1500 to 4500 units would increase the amount of labour used from 40 units to 120, all else constant. However, an improvement in labour productivity decreases the amount of labour required per unit of output. That is, the slope of the labour requirement line changes from (Lp)1 to (Lp)2. This means that the amount of labour needed to produce the new output level of 4500 units is reduced from 120 to 70. Mathematically, this is expressed by the formula:

$$\Delta L_t = l_{t-1}(\Delta Q_t) + (\Delta l_t)Q_t$$

where  $\Delta L_t$  is the change in employment between the two periods;  $\Delta Q_t$  is the change in output between the two periods;  $l_{t-1}$  is the inverse of labour productivity in the first period; and  $\Delta l_t$  is the change in the inverse of labour productivity between the two periods. In the example, the change in employment is:

$$\begin{aligned} \Delta L_t &= 40 / 1500(4500 - 1500) + (70 / 4500 - 40 / 1500)4500 \\ &= 80 - 50 \end{aligned}$$

The change in output increases employment by 80 while the change in labour productivity decreases employment by 50 — resulting in an overall increase in employment of 30.



Input–output tables capture both the direct and indirect effects of changes that influence each industry’s output and employment. For example, a policy change which increases the demand for Manufacturing output, directly increases

employment in that industry. Also, an increase in final demand for the output of another industry (for example, Construction) may also (indirectly) increase employment in Manufacturing, because the Construction industry purchases intermediate inputs from the Manufacturing industry.

Table 2 illustrates how changes in each of the sources of change directly affect employment within an industry.

**Table 2: Sources of employment change and their direct effect on employment**

<i>Sources of employment change</i>	<i>Direct effects on employment</i>
Labour productivity	For a given level of output, increases in labour productivity reduce employment in the industry.
Final demand	Increases in final demand increase employment in an industry.
Export expansion	As with final demand, increases in exports increase employment in an industry as more goods are produced in Australia.
Import substitution of final goods	Increases in import penetration of final goods decrease employment in an industry (as a result of a decrease in the proportion of final demand produced domestically).
Import substitution of intermediate goods	Increases in import penetration of intermediate goods decrease employment in the industries producing the goods.
Intermediate input coefficients	Decreases in the intermediate input coefficients decrease employment in an industry. If there is a decrease in the output of industry 1 that is required to produce a unit of output in industry 2, this decreases employment in industry 1.

To assess the effect of microeconomic reform on the sources of structural change in employment, sources of employment change by industry between two periods are analysed. The first period is between 1977–78 and 1983–84 and the second is between 1983–84 and 1992–93. These three years were selected because:

- input–output data are available;
- the two periods correspond to periods before and after the implementation of most microeconomic reforms; and
- each period experienced similar parts of the business cycle (recessions occurred in Australia in the early and late 1980s).

Changes in the industry composition of employment are based on an eleven industry disaggregation. This is the most disaggregated industry breakdown possible given problems in obtaining consistent data from 1977–78.

Public administration and defence and Community services are not included in the analysis because the measures of real output in these industries are not made independently of employment in these industries.<sup>2</sup>

#### *Sources of structural change in employment 1977–78 to 1983–84*

Total employment increased between 1977–78 and 1983–84 at an average annual rate of 0.50 per cent (Table 3).<sup>3</sup> Employment in all industries increased apart from Manufacturing and Construction. These increases were concentrated in the services sector, particularly Electricity, gas and water, Finance, property and business services and Transport and communication. Employment growth was also strong in Mining.

Table 3 shows how the six sources of change contributed to the average annual percentage changes in employment in each industry between 1977–78 and 1983–84. The percentage change estimates are based on Table A1 (see Technical Appendix), which shows the absolute changes in industry employment decomposed into each source of structural change.

Changes in domestic final demand had the greatest effect on changes in industry employment, increasing the average annual growth in employment by 2.20 per cent (Table 3). Domestic final demand captures the effects on industry employment of factors such as changes in the pattern of consumption and business investment due to changes in tastes, incomes, population, relative prices and government policies. The general growth in the economy (increase in domestic final demand) contributed to increases in employment in all industries. This was particularly the case for Construction and Agriculture.

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<sup>2</sup> The measures of real output for these industries assume that there has been no change in labour productivity. This is because the estimates of output are based on input costs, including wages, salaries and supplements.

<sup>3</sup> Excluding Public administration and defence and Community services.

Table 3: Sources of average annual employment growth, per cent, 1977–78 to 1983–84<sup>b</sup>

Industry	average annual employment growth	change due to change in labour productivity	change due to change in gross output	Breakdown of changes due to change in gross output				
				dom. final dem.	export demand	import subs. of final dem.	import subs. of intermed. dem.	input-output coeff.
Agric.	0.84	-2.21	3.05	3.76	1.04	-0.03	-0.51	-1.20
Mining	3.04	-3.39	6.43	0.96	3.73	-0.22	1.05	0.90
Manuf.	-1.51	-0.75	-0.76	1.54	0.36	-0.50	-0.92	-1.25
EGW	4.61	-0.85	5.45	2.79	0.36	-0.14	-0.22	2.66
Constr.	-2.51	-7.77	5.26	4.96	0.03	-0.01	-0.01	0.28
W&R trade	0.67	0.09	0.58	1.15	0.24	-0.07	-0.19	-0.55
Trans. & comm.	2.06	0.60	1.46	1.91	0.21	0.07	0.02	-0.75
Fin. & bus. serv	4.46	0.70	3.76	2.45	0.35	-0.13	-0.20	1.28
Public admin. & def.	a	a	a	a	a	a	a	a
Comm. services	a	a	a	a	a	a	a	a
Rec. & other services	1.62	-0.58	2.20	2.76	0.00	0.12	0.00	-0.68
<b>Total<sup>a</sup></b>	<b>0.50</b>	<b>-1.13</b>	<b>1.63</b>	<b>2.20</b>	<b>0.37</b>	<b>-0.15</b>	<b>-0.33</b>	<b>-0.45</b>

a Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

b The change due to change in gross output may not be equal to the sum of breakdown of changes because of rounding.

Sources: Commission estimates based on ABS Cat. Nos. 6204.0, 5204.0, 5206.0, 5209.0, 6405.0, 6411.0, 6412.0 and 6414.0

Labour productivity had the second largest impact on changes in employment, contributing an average decrease in employment of 1.13 per cent a year (Table 3). The industries with the most significant declines in employment growth due to improvements in labour productivity were the Construction, Mining and Agriculture industries. It should be noted that changes in labour

productivity (as measured in this paper) will not only reflect changes in output per person hour, but also changes in hours worked per person. The contribution of changes in output per worker to changes in employment will include both changes in output per person hour as well as changes in the hours worked per person.

The next greatest influence on overall industry employment was changes in the intermediate input coefficients which reduced average annual employment growth by 0.45 per cent. This refers to changes in a particular industry's output used to produce each unit of other industry's (and its own) output. Changes in input-output coefficients may result from technological change, changes in the composition of goods produced by industry or changes in the relative price of inputs. It is likely that the introduction of new technology would decrease the quantity of inputs used per unit of output leading to reduced employment in those industries producing the inputs. Changes in the input-output coefficients affected employment growth most in the Electricity, gas and water, Finance, property and business services, Agriculture and Manufacturing industries. In the case of Electricity, gas and water and Finance, property and business services, these changes contributed to an increase in employment.

Changes in international trading patterns had only a small effect on industry employment growth. Changes in industry employment due to import substitution of final and intermediate goods and services reduced the growth in total employment in the economy by 0.48 per cent each year. Growth in export demand had a particularly large effect in Mining, contributing 3.73 per cent a year to the industry's employment growth (Table 3). Exports and import replacing activity together reduced industry employment by only 0.11 per cent across the economy.

In the case of Manufacturing, increases in import substitution reduced employment by 1.42 per cent a year. Lower tariffs could have been a factor contributing to the increase in import substitution, reducing the output of the domestic industry. Employment also decreased in Manufacturing because of improvements in labour productivity, which contributed to a decrease of 0.75 per cent each year. This may have been due in part to changes in the level of industry assistance because increased import competition may have encouraged firms to improve their productivity, particularly labour productivity. Changes in input-output coefficients also contributed to a decrease in Manufacturing employment (1.25 per cent each year). This may indicate that technological change had a greater effect on employment change than reductions in assistance (microeconomic reform), although such technological progress may be associated with microeconomic reform.



In Electricity, gas and water, employment reductions due to improvements in labour productivity were more than offset by employment growth due to increased output.

### *Sources of structural change in employment 1983–84 to 1992–93*

Total employment increased between 1983–84 and 1992–93 at an average annual rate of 2.61 per cent.<sup>4</sup> Employment increased in all service industries except for Electricity, gas and water and Transport and communication. Employment also declined in Manufacturing, Mining and Agriculture (Table 4).

The average annual rate of employment growth between 1983–84 and 1992–93 was higher than between 1977–78 and 1983–84. This period also saw the implementation of significantly more microeconomic reforms than between 1977–78 and 1983–84 (see Table 1). Employment growth between 1983–84 and 1992–93 is mostly attributable to the higher rate of growth in output, which increased annual employment by 4.00 per cent compared with 1.63 per cent in the earlier period (Tables 3 and 4).

Table 4 shows that the most important sources of growth in employment were changes in domestic final demand, labour productivity and exports.

Increases in labour productivity reduced average annual employment growth across all industries by 1.38 per cent between 1983–84 and 1992–93. It had the greatest effect on employment in Mining, Transport and communication and Electricity, gas and water, the last two of which were directly affected by microeconomic reforms over the period (Table 1).

Comparing Tables 3 and 4, export expansion had a much greater effect on changes in industry employment between 1983–84 and 1992–93 than during the previous period. This is consistent with Dixon and McDonald (1993) who found that there were large increases in the value and volume of exports between 1986–87 and 1991–92. Employment growth in Mining and Manufacturing due to export growth was particularly high which may have led to increased employment growth in Transport services. The growth in manufacturing employment due to export growth may be partly due to microeconomic reform in the Manufacturing industry over the period (Table 1).

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<sup>4</sup> Excluding Public administration and defence and Community services.

Table 4: Sources of average annual employment growth, per cent, 1983–84 to 1992–93

Industry	average annual	change due to	change due to	Breakdown of changes due to change in gross output				
	employment growth	change in labour productivity	change in gross output	dom. final dem.	export demand	import subs. of final dem.	import subs. of intermed. dem.	input-output coeff.
Agric.	-0.10	-2.95	2.86	0.90	1.31	-0.40	-0.20	1.24
Mining	-1.40	-9.41	8.01	0.78	6.47	-0.25	-0.92	1.93
Manuf.	-0.58	-2.95	2.37	1.64	2.06	-0.78	-0.41	-0.14
EGW	-3.97	-8.57	4.60	2.67	0.92	-0.18	-0.16	1.35
Constr.	3.76	3.31	0.45	0.91	0.11	-0.01	-0.02	-0.54
W&R trade	3.36	0.89	2.47	2.70	0.62	-0.13	-0.06	-0.66
Trans. & comm.	-0.54	-8.73	8.19	3.86	2.53	-0.15	-0.55	2.50
Fin. & bus. serv	7.07	0.94	6.14	3.42	0.87	-0.09	-0.11	2.05
Public admin. & def.	a	a	a	a	a	a	a	a
Comm. services	a	a	a	a	a	a	a	a
Rec. & other services	11.32	2.93	8.39	6.64	0.34	-0.06	-0.06	1.54
<b>Total<sup>a</sup></b>	<b>2.61</b>	<b>-1.38</b>	<b>4.00</b>	<b>2.66</b>	<b>1.29</b>	<b>-0.29</b>	<b>-0.22</b>	<b>0.56</b>

a Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

Sources: Commission estimates based on ABS Cat. Nos. 6204.0, 5204.0, 5206.0, 5209.0, 6405.0, 6411.0, 6412.0 and 6414.0

Between 1983–84 and 1992–93, changes in input–output coefficients increased average annual employment growth overall, but decreased employment growth in Wholesale and retail trade, Construction and Manufacturing (Table 4). Changes in input–output coefficients had the greatest effect on employment growth in Transport and communication, Finance and business services and Mining.

As previously explained, technological change may reduce input requirements over time, which in turn reduces employment. However, employment increases due to changes in input–output coefficients may occur if, with increasing specialisation, industries purchase goods and services from other industries which they may have previously produced themselves. This would change the input–output coefficients for industries producing goods and services used as intermediate goods by other industries, increasing their employment. As Transport and communication and Finance and business services provide services to other industries, the large contributions to growth in these two industries from changes in input–output coefficients may indicate increasing specialisation or contracting out by other industries as business strives for greater efficiency.

Dixon and McDonald (1993) and Gregory and Greenhalgh (1996) have also noted increases in the use of intermediate inputs, which accounted for most of the decline in total factor productivity over the late 1980s and early 1990s. Dixon and McDonald attribute this decline to the recession in the early 1990s which resulted in excess capacity (for example, under-utilisation of capital) and labour hoarding (under-employment of labour).<sup>5</sup> Gregory and Greenhalgh attribute the increase in the use of intermediate goods by manufacturing to contracting out and specialisation.

### **Microeconomic reform and structural change in employment**

One way to assess the influence of reform policies on industry employment is to consider any changes in the sources of structural change between the period before most microeconomic reforms, and the period during which most reforms were implemented. Tables 3 and 4 show that total employment growth was greater in the period 1977–78 to 1983–84 than 1983–84 to 1992–93, and that different factors influenced changes in industry employment in each period. If microeconomic reform is generating change in the later period, we would expect to find a great deal of change in those industries where reform policies have been concentrated.

In both periods, labour productivity was an important source of change in industry employment, but its impact was greater between 1983–84 and 1992–93, the period associated with most microeconomic reform. During this period, labour productivity decreased employment to the greatest extent in Mining, Electricity, gas and water and Transport and communication. In the latter two

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<sup>5</sup> Excess capacity and labour hoarding occur when inputs (such as capital or labour) are difficult or costly to reduce in response to a fall in output.

industries, reform activity centred around improving the performance of GBEs. Corporatisation and the injection of competition, such as the ending of the two airline agreement in the Transport industry, are examples of such reforms. New standards of performance and accountability for GBEs have been introduced and improvements sought in efficiency in the general government sector. As government supplies many essential goods and services to Australian business, reducing the inefficiencies in these areas will help reduce the cost of doing business, increasing the international competitiveness of domestic industry. However, microeconomic reform is unlikely to be the direct cause of the improvement in labour productivity in the Mining industry.

In Manufacturing, the average annual decrease in employment due to improved labour productivity was greater between 1983–84 and 1992–93 compared with the earlier period.

International trade, which includes changes in import substitution and exports, made a greater contribution to employment growth during the later period, mainly due to increases in export demand (Tables 3 and 4).

Average annual employment growth due to increases in exports was strongest in the Mining, Manufacturing and Transport and communication industries between 1983–84 and 1992–93 (Table 4). Between 1986–87 and 1990–91, Dixon and McDonald (1993) noted that manufacturing exports increased at more than three times the rate of exports produced by the Agriculture and Mining industries, mainly because of the real appreciation of the Australian dollar following financial deregulation.

Cyclical fluctuations in the economy also influence industry employment. The two periods examined were selected to reflect similar stages of the business cycle. Despite this, the recession of the early 1990s may have been an explanation for the input–output coefficients having an expansionary effect on employment between 1983–84 and 1992–93, as firms may have had excess capacity and retained staff. This may also have been due to increasing specialisation of industry, where industries increasingly ‘bought in’ goods or services that they previously produced themselves.

The above discussion provides evidence that microeconomic reform has probably influenced employment in those industries where significant microeconomic reform has taken place. However, microeconomic reform is not a plausible explanation for the labour productivity improvements in Mining. As suggested above, cyclical economic fluctuations and increasing specialisation are other factors which appear to have affected employment change over the period.

## **Conclusion**

There are many factors that can contribute to structural change in employment. These include technological change, changes in the trade environment and the pattern of growth in the economy. Microeconomic reform can also be a factor. This paper has examined data on the rate of structural change in employment and analysed the contribution of a range of factors to changes in employment.

The overall rate of structural change in employment has been stable over time and did not increase substantially after the mid 1980s, when most microeconomic reform took place. Analysis of the sources of change in industry employment suggests that microeconomic reform may have influenced change at the industry level. Support for this is drawn from linking the sources of employment change in each industry to specific microeconomic reforms. For example, labour productivity in Electricity, gas and water has increased at a time of significant reform in this sector. In addition export growth, which may be indirectly affected by microeconomic reform, influenced industry employment growth over the period of reform.

However, not all changes in industry employment are due to microeconomic reform. It appears that while microeconomic reform is contributing to an improvement in performance, it has not led to an increase in the overall rate of structural change in employment. This is likely to be due to its overall impact being small relative to all the other factors influencing structural change.

**Attachment A: Sources of changes in employment**

Table A1: Sources of absolute changes in employment ('000s), 1977–78 to 1983–84

<i>Industry</i>	<i>change in employment</i>	<i>change due to change in labour productivity</i>	<i>change due to change in gross output</i>	<i>Breakdown of changes due to change in gross output</i>				
				<i>dom. final dem.</i>	<i>export demand</i>	<i>import subs. of final dem.</i>	<i>import subs. of intermed. dem.</i>	<i>input-output coeff.</i>
Agric.	19.6	-51.4	71.0	87.4	24.3	-0.8	-11.9	-27.9
Mining	15.1	-16.8	31.9	4.8	18.5	-1.1	5.2	4.5
Manuf.	-113.5	-56.2	-57.3	116.0	27.0	-37.4	-69.1	-93.7
EGW	31.0	-5.7	36.6	18.8	2.4	-0.9	-1.5	17.9
Constr.	-72.7	-224.8	152.1	143.6	0.9	-0.2	-0.3	8.2
W&R trade	48.4	6.3	42.1	83.5	17.5	-5.4	-13.7	-39.8
Trans. & comm.	55.3	16.2	39.1	51.2	5.6	1.9	0.5	-20.2
Fin. & bus. serv	125.9	19.6	106.3	69.2	10.0	-3.6	-5.6	36.2
Public admin. & def.	a	a	a	a	a	a	a	a
Comm. services	a	a	a	a	a	a	a	a
Rec. & other services	36.6	-13.0	49.6	62.3	-0.1	2.7	0.1	-15.4
<b>Total<sup>a</sup></b>	<b>145.7</b>	<b>-325.8</b>	<b>471.4</b>	<b>636.6</b>	<b>106.1</b>	<b>-44.8</b>	<b>-96.3</b>	<b>-130.2</b>

a Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

Sources: Commission estimates based on ABS Cat. Nos. 6204.0, 5204.0, 5206.0, 5209.0, 6405.0, 6411.0, 6412.0 and 6414.0

Table A2: Sources of changes in employment shares (per cent), 1977–78 to 1983–84

Industry	change in	change due to	change due to	Breakdown of changes due to change in gross output				
	employment shares	change in labour productivity	change in gross output	dom. final dem.	export demand	import subs. of final dem.	import subs. of intermed. dem.	input-output coeff.
Agric.	0.16	-1.13	1.29	1.76	0.43	0.02	-0.26	-0.67
Mining	0.25	-0.40	0.65	0.08	0.37	-0.02	0.13	0.09
Manuf.	-3.05	-1.11	-1.95	2.03	0.44	-0.82	-1.46	-2.13
EGW	0.56	-0.13	0.69	0.30	0.04	-0.02	-0.02	0.38
Constr.	-1.76	-5.27	3.51	3.29	0.02	0.00	-0.01	0.22
W&R trade	-0.24	-0.13	0.11	1.11	0.29	-0.11	-0.27	-0.91
Trans. & comm.	0.84	0.34	0.50	0.86	0.04	0.04	0.01	-0.45
Fin. & bus. serv	2.25	0.44	1.82	1.06	0.17	-0.07	-0.11	0.76
Public admin. & def.	a	a	a	a	a	a	a	a
Comm. services	a	a	a	a	a	a	a	a
Rec. & other services	0.51	-0.28	0.79	1.06	0.00	0.06	0.00	-0.33
<b>Total<sup>a</sup></b>	<b>0.00</b>	<b>-7.41</b>	<b>7.41</b>	<b>11.57</b>	<b>1.80</b>	<b>-0.92</b>	<b>-2.00</b>	<b>-3.05</b>

a Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

Sources: Commission estimates based on ABS Cat. Nos. 6204.0, 5204.0, 5206.0, 5209.0, 6405.0, 6411.0, 6412.0 and 6414.0

Table A3: Sources of absolute changes in employment ('000s), 1983–84 to 1992–93

<i>Industry</i>	<i>change in employment</i>	<i>change due to change in labour productivity</i>	<i>change due to change in gross output</i>	<i>Breakdown of changes due to change in gross output</i>				
				<i>dom. final dem.</i>	<i>export demand</i>	<i>import subs. of final dem.</i>	<i>import subs. of intermed. dem.</i>	<i>input-output coeff.</i>
Agric.	-3.2	-96.2	93.1	29.4	42.6	-12.9	-6.4	40.4
Mining	-11.0	-73.5	62.6	6.1	50.5	-1.9	-7.2	15.1
Manuf.	-52.9	-268.7	215.9	149.9	187.6	-71.2	-37.4	-13.1
EGW	-45.4	-98.0	52.6	30.6	10.5	-2.1	-1.8	15.4
Constr.	123.4	108.6	14.7	29.9	3.6	-0.5	-0.6	-17.7
W&R trade	337.4	89.2	248.1	271.0	62.4	-12.7	-5.8	-66.7
Trans. & comm.	-21.6	-351.0	329.5	155.4	101.7	-6.0	-22.1	100.5
Fin. & bus. serv	337.6	44.6	292.9	163.2	41.4	-4.2	-5.5	98.0
Public admin. & def.	a	a	a	a	a	a	a	a
Comm. services	a	a	a	a	a	a	a	a
Rec. & other services	373.4	96.5	276.9	219.0	11.1	-2.0	-1.9	50.7
<b>Total<sup>a</sup></b>	<b>1 037.8</b>	<b>-548.4</b>	<b>1 586.2</b>	<b>1 054.4</b>	<b>511.4</b>	<b>-113.5</b>	<b>-88.7</b>	<b>222.6</b>

a Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

Sources: Commission estimates based on ABS Cat. Nos. 6204.0, 5204.0, 5206.0, 5209.0, 6405.0, 6411.0, 6412.0 and 6414.0



Table A4: Sources of changes in employment shares (per cent)  
 1983–84 to 1992–93

<i>Industry</i>	<i>change</i>	<i>change</i>	<i>change</i>	<i>Breakdown of changes due to change in gross</i>				
	<i>in</i>	<i>due to</i>	<i>due to</i>	<i>output</i>				
	<i>employ-</i>	<i>change</i>	<i>change</i>	<i>dom.</i>	<i>export</i>	<i>import</i>	<i>import</i>	<i>input-</i>
	<i>ment</i>	<i>in</i>	<i>in gross</i>	<i>final</i>	<i>demand</i>	<i>subs. of</i>	<i>subs. of</i>	<i>output</i>
	<i>shares</i>	<i>labour</i>	<i>output</i>	<i>dem.</i>		<i>final</i>	<i>intermed</i>	<i>coeff.</i>
		<i>product</i>				<i>dem.</i>	<i>. dem.</i>	
		<i>-ivity</i>						
Agric.	-1.47	-1.79	0.31	-0.37	0.22	-0.25	-0.13	0.84
Mining	-0.52	-1.60	1.07	0.00	0.93	-0.04	-0.19	0.37
Manuf.	-4.85	-4.91	0.06	-0.21	2.78	-1.43	-0.78	-0.29
EGW	-1.25	-1.96	0.71	0.25	0.18	-0.05	-0.04	0.38
Constr.	0.63	1.84	-1.21	-0.94	0.06	-0.01	-0.01	-0.31
W&R trade	1.25	1.62	-0.36	0.55	0.69	-0.25	-0.14	-1.21
Trans. & comm.	-2.11	-7.62	5.51	2.03	1.73	-0.13	-0.57	2.44
Fin. & bus. serv	3.55	0.89	2.66	0.58	0.51	-0.07	-0.11	1.74
Public admin. & def.	a	a	a	a	a	a	a	a
Comm. services	a	a	a	a	a	a	a	a
Rec. & other services	4.79	1.99	2.80	1.86	0.10	-0.02	-0.03	0.89
<b>Total<sup>a</sup></b>	<b>0.00</b>	<b>-11.54</b>	<b>11.54</b>	<b>3.75</b>	<b>7.20</b>	<b>-2.25</b>	<b>-2.00</b>	<b>4.84</b>

a Public administration and defence and Community services are omitted because the measures of real output assume no change in labour productivity. The total also excludes these industries.

Sources: Commission estimates based on ABS Cat. Nos. 6204.0, 5204.0, 5206.0, 5209.0, 6405.0, 6411.0, 6412.0 and 6414.0

## Technical Appendix

### Decomposing changes in industry employment

Factors affecting structural change can be examined by decomposing the changes in industry employment into changes in industry output and labour productivity. Using input–output data, changes in industry output can be decomposed further. Employment change in each industry can therefore be decomposed into changes in:

- labour productivity;
- the quantity of the industry’s output demanded by households, governments and business investment (domestic final demand);
- the quantity of the industry’s output demanded by foreigners (exports);
- the quantity of imports used for domestic final demand which compete with the industry’s output (import substitution of final demand);
- the quantity of imports used as inputs by all domestic industries which compete with the industry’s output (import substitution of intermediate demand); and
- the quantity of an industry’s output which is used as an input to production by all industries (input–output coefficients).

Changes in each industry’s employment can be decomposed into changes in each of these factors as follows. The change in employment in industry  $i$  between period  $t-1$  and period  $t$  is given by:

$$L_{it} - L_{i,t-1} = l_{it}Q_{it} - l_{i,t-1}Q_{i,t-1} \quad (1)$$

where:

$L_{it}$  = employment in industry  $i$  at time  $t$ ;

$Q_{it}$  = gross output produced by industry  $i$  at time  $t$ ; and

$l_{it} = L_{it} / Q_{it}$  (inverse of labour productivity at time  $t$ ).

The change in industry employment, substituting  $l_{it}$  and taking first differences is:

$$\Delta L_{it} = l_{i,t-1}(\Delta Q_{it}) + (\Delta l_{it})Q_{it} \quad (2)$$

where:

$\Delta L_{it}$  = change in employment in industry  $i$  between period  $t-1$  and period  $t$ .

To further examine the sources of change in each industry (due to each of the six factors listed above), changes in gross output,  $Q_{it}$ , can be decomposed using an input–output framework. This can be achieved as follows.

(2) domestic production of good  $i$  can be decomposed into:

$$Q_i = u_i^w \left( \sum_j a_{ij} Q_j \right) + u_i^f F_i + E_i \quad (3)$$

where:

$W_{ij}$  = intermediate demand for the output of industry  $i$  by industry  $j$ ;

$a_{ij} = W_{ij}/Q_j$  the share of good  $i$  in industry  $j$ 's output;

$u_i^w = W_i^d/W_i$  the proportion of the intermediate demand that is produced domestically;

$u_i^f = F_i^d/F_i$  the proportion of the final demand that is produced domestically;

$F_i$  = final demand for the output of industry  $i$ ; and

$E_i$  = export demand for the output of industry  $i$ .

Equation (3), rewritten in matrix form is:

$$Q = u^w A Q + u^f F + E$$

To solve for gross output:

$$Q = B(u^f F + E) \quad (4)$$

where:

$B = (I - u^w A)^{-1}$  or the inverse of  $(I - u^w A)$ ;

$A$  = the matrix whose elements are all of the  $a_{ij}$ ; and

$b_{ij}$  = elements of the matrix  $B$ .

Change in output is given by:

$$\Delta Q_{it} = B_t (u_t^f F_t + E_t) - B_{t-1} (u_{t-1}^f F_{t-1} + E_{t-1})$$

which can be further decomposed into<sup>6</sup>:

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<sup>6</sup> See OECD (1992 pp. 115) and 125 for a more detailed derivation.

$$\Delta Q_{it} = B_{t-1} (u_{t-1}^f (F_t - F_{t-1}) + (E_t - E_{t-1}) + (u_t^f - u_{t-1}^f) F_t) + (u_t^w - u_{t-1}^w) W_t + u_{t-1}^w (A_t - A_{t-1}) Q_t$$

For a particular industry  $i$ :

$$\begin{aligned} \Delta Q_{it} &= \sum_j b_{ij,t-1} u_{j,t-1}^f (F_{jt} - F_{j,t-1}) && \text{effect of changes in domestic final demand} \\ &+ \sum_j b_{ij,t-1} (E_{jt} - E_{j,t-1}) && \text{effect of changes in exports} \\ &+ \sum_j b_{ij,t-1} (u_{jt}^f - u_{j,t-1}^f) F_{jt} && \text{effect of changes in the import substitution of final goods} \\ &+ \sum_j b_{ij,t-1} (u_{jt}^w - u_{j,t-1}^w) W_{jt} && \text{effect of changes in import substitution of intermediate goods} \\ &+ \sum_j b_{ij,t-1} u_{j,t-1}^w \sum_k (a_{jkt} - a_{jk,t-1}) Q_{kt} && \text{effect of changes in input-output coefficients} \end{aligned} \tag{5}$$

Substituting (5) into (2) gives the components of changes in employment for each industry (Table T1). Two decompositions are presented in the table. The first year weights the changes in the components (for example, final demand and exports) by the structure of the economy in the initial or base year. The second year uses the structure of the economy in the final year as weights.

Table T1: Formulae for decomposing changes in industry employment

<i>Factors affecting changes in employment in industry i</i>	<i>Measure using initial year structure as weights</i>	<i>Measure using final year structure as weights</i>
Labour productivity	$(l_{it} - l_{i,t-1}) \mathcal{Q}_{it}$	$(l_{it} - l_{i,t-1}) \mathcal{Q}_{i,t-1}$
Domestic final demand	$l_{i,t-1} \sum_j b_{ij,t-1} u_{j,t-1}^f (F_{jt} - F_{j,t-1})$	$l_{it} \sum_j b_{ijt} u_{jt}^f (F_{jt} - F_{j,t-1})$
Export expansion	$l_{i,t-1} \sum_j b_{ij,t-1} (E_{jt} - E_{j,t-1})$	$l_{it} \sum_j b_{ijt} (E_{jt} - E_{j,t-1})$
Import subs. of final goods	$l_{i,t-1} \sum_j b_{ij,t-1} (u_{jt}^f - u_{j,t-1}^f) F_{jt}$	$l_{it} \sum_j b_{ijt} (u_{jt}^f - u_{j,t-1}^f) F_{j,t-1}$
Import subs. of intermed. goods	$l_{i,t-1} \sum_j b_{ij,t-1} (u_{jt}^w - u_{j,t-1}^w) \mathcal{W}_{jt}$	$l_{it} \sum_j b_{ijt} (u_{jt}^w - u_{j,t-1}^w) \mathcal{W}_{j,t-1}$
Input–output coefficients	$l_{i,t-1} \sum_j b_{ij,t-1} u_{j,t-1}^w \sum_k (a_{jk,t} - a_{jk,t-1}) \mathcal{P}_k$	$l_{it} \sum_j b_{ijt} u_{jt}^w \sum_k (a_{jk,t} - a_{jk,t-1}) \mathcal{P}_{k,t-1}$

Source: OECD (1992)

### Data sources

The following data by industry were used in the decomposition analysis:

- employment;
- real gross output;
- real final demand for domestic production;
- real final demand for imports;
- real exports;
- real intermediate demand by industry, for domestic goods; and
- real intermediate demand by industry, for imports.

All data, except for employment was obtained from the Australian input–output tables. The Australian input–output tables are only available in nominal terms, so the data were converted to real terms by applying relevant price indexes and implicit price deflators to the nominal input–output data.

Specific export, import and other price indexes by industry were applied, where available, to the relevant components of the input–output tables. Implicit price deflators for GDP by industry were calculated and applied to all the other components of demand for that industry (see below).

The sensitivity of the results to the choice of price deflators was checked by comparing this method with using the industry–specific GDP deflators only and no price indexes. Similar results were obtained from the two methods.

The 1977–78, 1983–84 and 1992–93 input–output tables were aggregated to 11 Australian industries (Table T2). This was the greatest level of disaggregation for which consistent industry–specific implicit price deflators for GDP could be calculated.

**Table T2: Industry definitions**

<i>Industry sectors used in the decomposition analysis</i>	<i>Industry sectors in input-output tables</i>	<i>Gross product by industry at current prices</i>
Agriculture	Agriculture; Forestry, fishing, hunting	Agriculture, forestry and fishing
Mining	Mining	Mining
Manufacturing	Manufacturing (15 subsectors)	Manufacturing
Electricity, gas and water	Electricity, gas and water	Electricity, gas and water
Construction	Construction	Construction
Wholesale and retail trade	Wholesale and retail trade; Repairs	Wholesale trade; Retail trade
Transport, communication	Transport, communication	Transport; Communication
Finance, property and business services	Finance, property and business services; Ownership of dwellings	Finance and insurance; Property and business services; Ownership of dwellings
Public administration and defence	Public administration and defence	Government administration and defence
Community services	Community services	Education; Health and community services
Recreational, personal and other services	Recreational, personal and other services	Accommodation, cafes and restaurants; Cultural and recreational services; Personal and other services

### *Export price indexes*

Price indexes of exports of goods and services produced by the Agriculture, Mining and Manufacturing industries were applied to the current price estimates of exports for these industries.

### *Import price indexes*

The current price estimates of final and intermediate import demand by industry were obtained by subtracting the indirect allocation of imports for intermediate and final demands for each industry from the direct allocation of imports.

Estimates for real imports were obtained by applying price indexes of imports of goods and services produced by the Agriculture, Mining and Manufacturing industries to final and intermediate import demands at current prices for these industries.

Price indexes for imported goods and services produced by the Agriculture, Mining and Manufacturing industries and used by Manufacturing were applied to relevant current price estimates of intermediate imports used by Manufacturing.

### *Other price indexes*

Price indexes for home produced goods and services produced by the Agriculture, Mining and Manufacturing and Electricity industries and used by Manufacturing were applied to the relevant components of domestic intermediate demands of the Manufacturing industry, at current prices.

Price indexes of articles produced by the Manufacturing industry were applied to domestic intermediate and final demands of all industries at current prices, for Manufacturing output.

### *Implicit price deflators for output by industry*

Industry-specific GDP price deflators were calculated by dividing estimates of GDP at current prices by industry by constant price estimates.

Although these deflators apply only to value-added by industry, they were also applied to current price estimates of intermediate, final, export and import demand, for which price indexes were not available. If price movements of goods and services used as inputs differ from those used for final demand, the deflators will under or over estimate intermediate output by the difference.

### *Employment*

Data on employment was obtained from the ABS publication, Labour Force Australia 1978–1995, catalogue number 6204.0. Industry employment data is classified according to the Australian Standard Industrial Classification (ASIC). As the new Australian and New Zealand Standard Industrial Classification (ANZSIC) was only available from 1994, the industry concordance provided by the ABS was used to convert ANZSIC data for 1994 and 1995 to ASIC.

The data were aggregated into 11 industries to obtain employment by industry consistent with the input–output industry classification used in this analysis. The data were published on a quarterly basis, so the average industry employment over the four quarters was used for 1977–78, 1983–84 and 1992–93.



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