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Identifying Australia's High Employment Generating Industries

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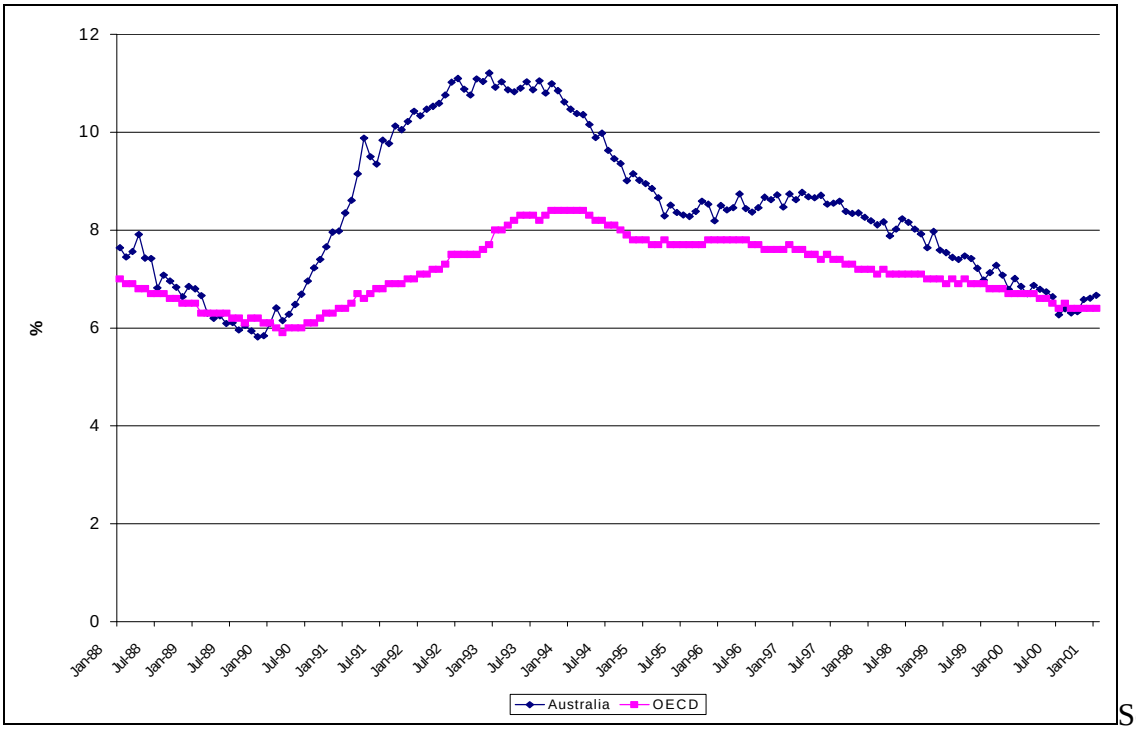
Abstract.
Using the latest Australian input-output (IO) table, this paper aims to identify the high employment generating industries. First, the direct and indirect contribution of the tradeable industries to employment are quantified by adopting the "loss of the industry" or "Shut-down of industry" approach. Second, the sectoral employment elasticities are calculated to determine the leading employment generating sectors. The empirical analysis and rankings undertaken in this study shed some light on the sectoral potentials in relation to the creation of jobs in the economy. Further, this study provides some inputs for setting the effective rate of assistance for import competing industries.

I. INTRODUCTION

Persistent unemployment and underemployment continue to pervade Australia and many other OECD countries. Figure 1 brings out very clearly that the unemployment rate in Australia has been higher than the aggregate OECD countries since 1991. Buttressed by the notion that 7-8 per cent is a "non-accelerating inflation rate of unemployment" emanating from structural factors in the economy, the Reserve Bank of Australia (RBA) is treating unemployment as an instrument to fight against inflation. As a result while unemployment is rising the RBA has been able to maintain a low inflation rate in the economy.

Many economists have undertaken extensive research on various aspects of Australia's unemployment problem. Le and Miller (2000) present a wide-ranging summary of these studies. Despite a vast literature exploring many aspects of the problem including aggregate studies of how economies generate jobs, there has been little comprehensive research undertaken on the determination of high employment generating industries. Some studies focus on a specific industry in isolation and therefore ignore the inter-industry employment generating mechanisms that may be important. See for example Smith and Hagan (1993).

Figure 1. Standardised unemployment rates (seasonally adjusted) for Australia and total OECD



Source: OECD (2001).

Therefore, it is of paramount importance to identify high employment generating industries particularly in times of high unemployment. In other words, if rising and persistent unemployment is deemed to be an important socioeconomic phenomenon, one of the solutions would be to stimulate economic activity in high employment generating industries.

In the literature there are a number of analysts who have discussed the use of IO techniques to measure the significance of a sector in terms of its contribution to output and employment. For example, Jensen and West (1985) have provided a theoretical framework underpinning the measurement of the significance of an industry in terms of output, income, employment and value added. Further, West (1993) in his IO software package (GRIMP) has included an option enabling practitioners to measure the industrial significance at both national and regional levels.

By adopting a similar approach, which is referred to as "loss of the industry" or "Shut-down of industry", Groenewold, Hagger and Madden (1993), *inter alia*, have employed a 58-industry IO model of the Australian State of Tasmania to measure the direct and indirect contributions of various sectors to regional employment.

In this paper, using a more aggregated version of the 1996-97 IO table, the sectoral employment multipliers and elasticities are calculated to identify high employment generating industries with their corresponding final demand cost requirements. However, the linkage and multiplier approaches, which are widely used in the literature, could mislead decision-makers about the identification of the key sectors because the sectoral ranking based on employment linkages may

identify relatively small industries as very important, or large-sized sectors as unimportant (Mattas and Shrestha, 1991). Therefore, to incorporate information on the relative size of an industry and its capacity to expand, sectoral employment elasticities will be calculated. The resulting sectoral rankings can be readily interpreted as the job creating potential of each sector. The rankings and empirical analysis undertaken in this study shed some light on the sectoral potential in relation to the creation of jobs in the economy.

The rest of the paper proceeds as follows. Section II presents a succinct theoretical discussion of the "loss of the industry" or "Shut-down of industry" approach to measure the direct and indirect contribution of the tradeable sectors to employment. In this section it is also explained as to how the sectoral employment multipliers and elasticities are computed. Section III uses the latest IO table to calculate the sectoral direct and indirect contribution to total employment as well as the sectoral employment multipliers and elasticities. Based on the empirical results and rankings, this section also discusses the major policy implications of the study. Concluding remarks follow.

II. METHODOLOGY

The direct or tangible importance of an industry in terms of output or employment can easily be measured by its level of output or the number of people working in the sector. However, the indirect contribution of an industry to either total output or employment is not simply observable unless the multiplier and flow-on effects are taken into account. The share of a particular industry in total employment reveals only the direct contribution of a particular industry and this naive measure overlooks the number of jobs generated indirectly in other sectors as a result of stimulating economic activity in the industry concerned.

If a sector is divorced from other industries (*i.e.* with few backward linkages) and its output is mainly exported overseas with few domestic intermediate uses it then can be argued that its indirect contribution to aggregate employment would be small and inconsequential. As a result, the total contribution (direct and indirect) of this sector to total output or employment would be similar in magnitude to its direct contribution. On the other hand, if a sector is well integrated with other industries in the economy with high and evenly distributed backward linkages, then the shut-down of this industry will have severe adverse repercussions on the other sectors of the economy in terms of output and job losses. Even if we substitute the domestically produced inputs of this sector with an equal amount of the homogeneous imported inputs, due to the inter-relationship among sectors, the significance of an industry is beyond its own output or employment share in the economy.

For example, suppose that sector 1 in an IO system is to be shut-down. What output and job-loss would result? How do we measure the output and employment losses in other industries? The indirect magnitude of this "loss of the industry" on total output produced in the economy can be evaluated by summing the output loss in all the industries (excluding sector 1) of the economy. The industrial significance of a sector such as sector 1 in terms of its total contribution to output is thus measured by the following relation:

$$S_1^Q = \overbrace{x_1}^{\text{direct effect}} + \overbrace{\sum_{i=2}^{n} \Delta x_i}^{\text{indirect effects}} \qquad (1)$$

Where x_i denotes output in sector i. Since the employment to output ratio is given for each sector in an IO table, the overall significance and contribution of an industry to total employment (S^E) can also be calculated by assuming that the sectoral employment ratios are fixed. As can be seen, in order to calculate (S^E) for tradeable sectors, S^Q first needs to be computed. Therefore, the rest of this section is devoted to the theoretical framework underpinning the measurement of indirect contribution of a tradeable industry to total output. However, it should be noted that all of the sectors in an economy are not "shut-downable". Obviously one cannot shutdown non-tradable sectors such Government administration & defence; Construction; Electricity, gas & water, etc. Therefore, it is assumed that only the tradeable sectors can be subjected to this hypothetical closure.

Following Jensen and West (1985), Groenewold, Hagger and Madden (1987, 1993), and West (1993) a theoretical model is postulated to measure the indirect sectoral contribution to aggregate output and employment using an IO system. Lets start from the following relation:

$$\mathbf{(I - A)x = f} \qquad (2)$$

where:

A is the (n x n) technical domestic coefficients;
x is the (n x 1) column vector of sectoral gross output; and
f is the (n x 1) column vector of the sectoral final demand.

Equation (2) can also be written as follows:

$$\begin{bmatrix} (1-a_{11}) & -a_{12} & -a_{13} & \cdots & -a_{1n} \\ -a_{21} & (1-a_{22}) & -a_{23} & \cdots & -a_{2n} \\ -a_{31} & -a_{32} & (1-a_{33}) & \cdots & -a_{3n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ -a_{n1} & -a_{n2} & -a_{n3} & \cdots & (1-a_{nn}) \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} f_1 \\ f_2 \\ f_3 \\ \vdots \\ f_n \end{bmatrix} \qquad (3)$$

In order to measure the indirect significance of a particular sector (say sector 1) it is assumed that this sector is "shut-down" and this restriction on the IO system can be imposed in the following manner:

$$\begin{bmatrix} 1 & 0 & 0 & \cdots & 0 \\ 0 & (1-a_{22}) & -a_{23} & \cdots & -a_{2n} \\ 0 & -a_{32} & (1-a_{33}) & \cdots & -a_{3n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 0 & -a_{n2} & -a_{n3} & \cdots & (1-a_{nn}) \end{bmatrix} \cdot \begin{bmatrix} x_1^* \\ x_2^* \\ x_3^* \\ \vdots \\ x_n^* \end{bmatrix} = \begin{bmatrix} f_1 \\ f_2 \\ f_3 \\ \vdots \\ f_n \end{bmatrix} \quad (4)$$

However, if sector 1 is removed from the system, the IO table will no longer be balanced. Hence a number of assumptions should be invoked before the indirect output loss can be measured. First, the other n-1 sectors, which used to purchase some intermediate inputs from sector 1, can outsource the required intermediate inputs from abroad through imports. In other words, the loss of output in sector 1 is offset by an equal increase in imports. That is, the intermediate inputs supplied by sector 1 to the other n-1 sectors of the economy are now imported. Second, the shut-down of this sector does not have any effect on the technology of the existing industries, which continue to operate in the economy. That is to say, the closure of a particular sector does not change the direct coefficients (input requirements) of the other n-1 sectors. Third, it is also assumed that the distribution of sectoral final demand ($f_2, f_3,\ldots,f_n$) remains unchanged.

From an IO table one knows the total output produced by sector 1 before its shut-down (x_1), and also the final demand in the other n-1 sectors. Therefore, Equation (3) can be rewritten in such a way that only pre-determined variables appear on its right hand side. That is:

$$\begin{bmatrix} 1 & -a_{12} & -a_{13} & \cdots & -a_{1n} \\ 0 & (1-a_{22}) & -a_{23} & \cdots & -a_{2n} \\ 0 & -a_{32} & (1-a_{33}) & \cdots & -a_{3n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 0 & -a_{n2} & -a_{n3} & \cdots & (1-a_{nn}) \end{bmatrix} \cdot \begin{bmatrix} f_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} (1-a_{11})x_1 \\ f_2 + a_{21}x_1 \\ f_3 + a_{31}x_1 \\ \vdots \\ f_n + a_{n1}x_1 \end{bmatrix} \quad (5)$$

According to Equation (5), the other n-1 sectors now import their required inputs from abroad rather than purchasing them from sector 1. Relation (5) can be used to calculate the output loss (Δx_i) as a result of the hypothetical removal of any specific sector from the IO system

As mentioned earlier since x_1 or initial output in sector 1 is known and also $\Delta f_2=\Delta f_3=\Delta f_4=\ldots=\Delta f_n=0$, one can use Relation (5) to compute the changes in sectoral output (Δx_i) as follows:

$$\begin{bmatrix} \Delta f_1 \\ \Delta x_2 \\ \Delta x_3 \\ \vdots \\ \Delta x_n \end{bmatrix} = \begin{bmatrix} 1 & -a_{12} & -a_{13} & \cdots & -a_{1n} \\ 0 & (1-a_{22}) & -a_{23} & \cdots & -a_{2n} \\ 0 & -a_{32} & (1-a_{33}) & \cdots & -a_{3n} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 0 & -a_{n2} & -a_{n3} & \cdots & (1-a_{nn}) \end{bmatrix}^{-1} \cdot \begin{bmatrix} (1-a_{11})x_1 \\ f_2 + a_{21}x_1 \\ f_3 + a_{31}x_1 \\ \vdots \\ f_n + a_{n1}x_1 \end{bmatrix} \quad (6)$$

Now Equations (1) and (6) can be employed to calculate the industrial significance of sector 1 in terms of total contribution to output (S_1^Q) and consequently if the fixity of the sectoral employment-output ratios is accepted, one will also be able compute S_1^E. The same computation process can be utilised to measure the total significance or contribution (S_i^E) of each and every tradeable sector.

In the rest of this section a brief discussion of the theoretical and computational foundations of the sectoral multipliers and elasticities is presented. For a detailed discussion of these issues see Mattas and Shrestha (1991); and Jensen and West (1986).

The employment multiplier can be interpreted as the impact on the aggregate employment if the final demand in sector j increases by one unit. The employment multiplier for sector j is defined as follows:

$$E_j^m = \sum_{i=1}^{n} (l_i / x_i)\, b_{ij} \qquad (7)$$

where

l_i and x_i denote the employment (number of persons) and output in sector i, respectively, b_{ij} is the i, j^{th} element of the closed Leontief inverse matrix (***B***), and n stands for the number of sectors.

As discussed earlier neither multipliers nor linkages consider the relative size and expansion capacity of an industry. High multiplier or backward linkage indices may identify relatively small industries as being important, or large-sized sectors as unimportant. Therefore, following Mattas and Shrestha (1991), the sectoral employment elasticities are utilised to identify high employment generating industries.

Employment elasticity measures the percentage change in aggregate employment in the economy resulting from one per cent change in the final demand of a given sector. Thus the employment elasticity for sector j is defined as:

$$E_j^e = \frac{\partial L}{\partial f_j} \cdot \frac{f_j}{L} \qquad (8)$$

where

L is equal to total employment in the economy,
f_j is final demand in sector i, and
$\frac{\partial L}{\partial f_j}$ is the employment multiplier for sector j.

More specifically using Equation (7) this formula can be written as:

$$E_j^e = \left[\sum_{i=1}^{n} \left(l_i / x_i \right) b_{ij} \right] \cdot \frac{f_j}{L} \qquad (9)$$

In this study Equations (7) and (9) will be used to calculate the sectoral employment multipliers and elasticities, respectively.

III. EMPIRICAL RESULTS AND POLICY IMPLICATIONS

In this paper the latest IO table (1996-97) of the Australian economy, in which competing imports are directly allocated in the second quadrant of the table, is used to generate empirical results. This 106-sector table has been compiled on the basis of the System of National Accounts 1993, which is the latest international standard for compiling IO tables and national accounts statistics (Australian Bureau of Statistics, ABS, 2001, Cat. 5209). All transactions recorded in the table are expressed at basic prices and in millions of Australian dollar. However, the table has been aggregated into 35 industries according to IO industry classification and these 35 sectors are then grouped into two major categories: 18 tradeable and 17 non-tradeable industries. Only tradeable industries are assumed to be "shut-downable" and at each stage only one industry is removed from the IO system.

The direct or tangible importance of the 18 tradeable industries in terms of employment is shown in column (1) of Table 1. Using the theoretical framework discussed in the previous section, one will also be able to quantify the indirect contribution of a particular industry to aggregate employment (S^E).

For instance, as seen from Table 1, with a hypothetical shut down of Meat and dairy products (but keeping other tradeable and non-tradeable industries in the system), it seems that only 62450 people, who are directly involved in this industry, will lose their jobs. However, due to sectoral multiplier and flow-on effects, the closure of this industry will bring about a total loss of 285225 jobs in the other 34 sectors indirectly. In this example, the indirect contribution of Meat and dairy products to aggregate employment turned out to be greater than its direct contribution!

It is stated that "gain from trade liberalisation since 1986-87 has provided the average Australian family with more than $1000 extra per year" (Department of Foreign Affairs and Trade, DFAT, 2000, p.iv). But this gain should be balanced against the number of job losses and the associated unemployment costs on society. Later in this section (Table 3) the annual sectoral final demand requirement of creating one full-time job is presented job in the economy using the sectoral employment multipliers.

Another example relates to the importance of the petroleum and coal products sector. It is naive to argue that the closure of petroleum and coal products results in the loss of only 7500 jobs. From Table 1 it is evident that if this seemingly "small sector" is shut-down, over 60000 people in other sectors of the economy will be unemployed due to the flow-on effects, yielding an indirect to direct ratio of over 8 times! On the basis of the total contribution of each sector to total employment, a sectoral ranking has also been performed in the last column of Table 1. Given the total sectoral contribution to employment (Column 3 in Table 1), the top five

important tradable industries are: Agriculture, hunting and trapping; Other machinery and equipment; Other food products; Meat and dairy products; and Paper, printing and publishing.

Although the manufacturing industries play a substantial role in employment generating activities in the economy, the growth of employment in most of the manufacturing industries has been negative since 1974. Using the OECD (1998) database, the annual average growth rates of employment in manufacturing over the three periods of 1974-84, 1984-94, and 1974-94 were approximately –1.9 per cent, –0.4 per cent, and –1.2 per cent, respectively.

Table 2 shows the breakdown of employment and corresponding annual average growth figures for major manufacturing sub sectors in 1974, 1984 and 1994. A cursory look at Table 2 reveals that employment in the majority of manufacturing industries has demonstrated a general dwindling trend since 1974.

Table 1. Direct and indirect impacts of hypothetical industry shut-down on total employment (person)

Sector	Direct (1)	Indirect (2)	Total (3)	% (1)/(3)	Rank (total)
Agriculture; hunting and trapping	355163	209789	564952	62.9	1
Forestry and fishing	22350	37476	59826	37.4	18
Meat and dairy products	62450	285225	347675	18.0	4
Other food products	85288	269035	354323	24.1	3
Beverages and tobacco products	17913	107108	125021	14.3	13
Textiles	34675	71991	106666	32.5	15
Clothing and footwear	62625	72078	134703	46.5	12
Wood and wood products	41900	60840	102740	40.8	16
Paper, printing and publishing	127838	191418	319256	40.0	5
Petroleum and coal products	7500	60197	67697	11.1	17
Chemicals	55225	153615	208840	26.4	9
Rubber and plastic products	41225	79157	120382	34.2	14
Non-metallic mineral products	45563	90127	135690	33.6	11
Basic metals and products	68363	191801	260164	26.3	8
Fabricated metal products	110150	164157	274307	40.2	7
Transport equipment	102462	176775	279237	36.7	6
Other machinery and equipment	138225	222637	360862	38.3	2
Miscellaneous manufacturing	74038	86683	160721	46.1	10

Source: Author’s calculations.

Table 2. Employment composition in major manufacturing industries: 1974, 1984 and 1994 (person)

Industry	1974	1984	1994	Annual average growth %		
				1974-84	1984-94	1974-94
Food	164848	150175	150845	-0.9	0.0	-0.4
Beverages and tobacco products	29369	24856	20155	-1.7	-2.1	-1.9
Textiles	72325	48738	47668	-3.9	-0.2	-2.1
Clothing and footwear	93130	68233	60333	-3.1	-1.2	-2.1
Wood and wood products	105639	93998	109638	-1.2	1.6	0.2
Paper, printing and publishing	119519	119768	124000	0.0	0.3	0.2
Petroleum and coal products	4579	6007	4790	2.8	-2.2	0.2
Chemicals	111727	98111	104000	-1.3	0.6	-0.4
Rubber and plastic products	50369	41046	48014	-2.0	1.6	-0.2
Non-metallic mineral products	67756	50262	50000	-2.9	-0.1	-1.5
Basic metals and products	99119	86909	62918	-1.3	-3.2	-2.2
Fabricated metal products	489827	379759	339633	-2.5	-1.1	-1.8
Transport equipment	156786	125466	94765	-2.2	-2.8	-2.5
Other machinery and equipment	211097	148991	na	-3.4	Na	na
Miscellaneous manufacturing	28741	18190	22811	-4.5	2.3	-1.1

Source: OECD (1998).

During the period 1974-94, the employment growth in all manufacturing industries was negative except for three sectors of Wood and wood products; Paper, printing and publishing; and Petroleum and coal products. Even these three sectors demonstrated a lackluster average growth of approximately 0.2 per cent per annum.

The following two factors, *inter alia*, act as a conduit for the downward trend of employment in the manufacturing industries: a) the use of capital intensive production technology and rising labour productivity; and b) the dwindling level of government assistance proxied by the nominal and effective rates of assistance.

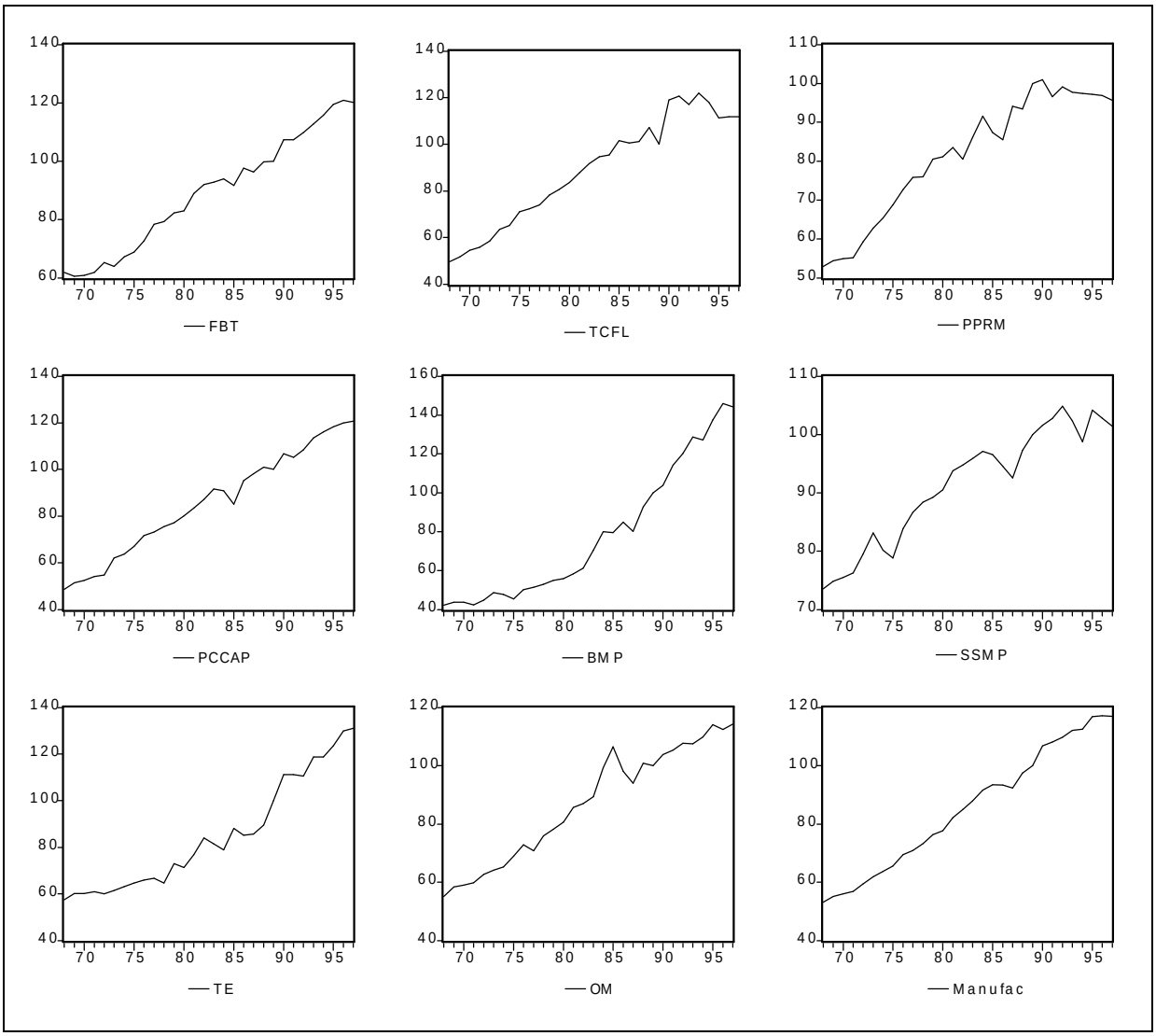
Ceteris paribus, rising labour productivity could be a harbinger of the falls in employment growth. In other words, there exists an inverse relationship between productivity and employment. As can be seen from Figure 2, there has been an overall upward trend in the sectoral labour productivity indices, interspersed with the occasional short-term fluctuations. The labour productivity index, defined as output index divided by the index of hours worked, for the aggregated manufacturing sector demonstrated relativily smooth upward trend throughout the whole period of 1968-1997 with an average annual growth of 2.9 per cent.

The second factor pertains to the impact of tariff elimination and the declining level of government support in manufacturing. Figure 3 reveals that from 1968 to 2000 the Australian government has continuously reduced its level of assistance to manufacturing, particularly after 1986 in the context of Textiles, clothing and footwear, which is regarded as a highly protected industry. The government has continued to abate the nominal and effective rates of assistance for most of the manufacturing industries since 1968 (Productivity Commission, 2000). Given the downward trend of employment in the manufacturing sector and the present government stance,

enshrined in the national competition policy, it is indubitably the case that the prospect of future employment growth in manufacturing is not very promising.

Australia has enjoyed a very low average tariff of 4.5 per cent since January 2000 and it is claimed that the tariff elimination would create an "extra 40,000 jobs" (DEFA, 2000). Apparently both the Productivity Commission and the Department of Foreign Affair and Trade have taken into account only the direct impacts of their policies. It is beyond the scope of this study to undertake a thorough "cost-benefit analysis" in terms of the net gained or lost employment opportunities resulting from trade liberalisation. Maybe forty thousand extra jobs have been created by reducing the tariff and trade barriers and exerting an increasing pressure on import competing sectors, but due to the flow-on and indirect effects discussed earlier, a large number of workers have also lost their jobs in the other inter-related sectors.

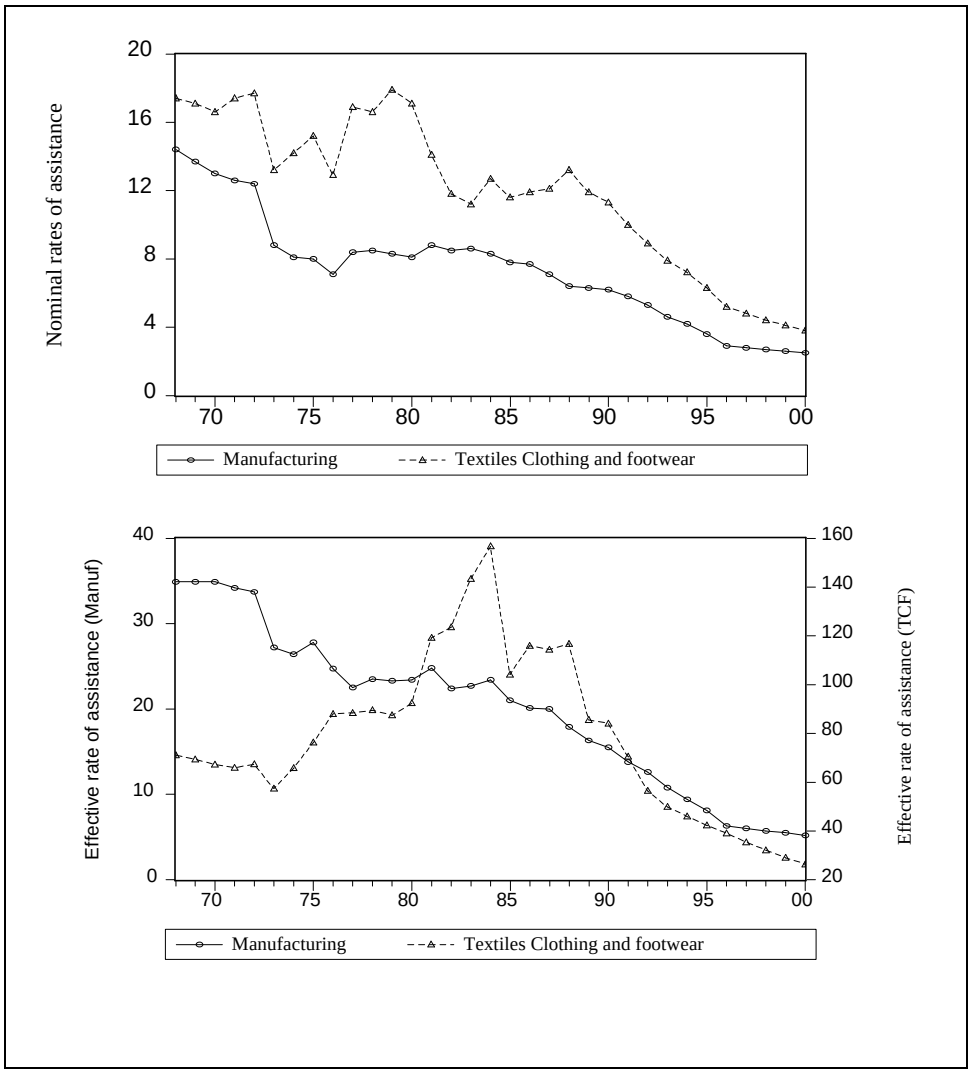
Figure 2. Labour productivity index (1989-90=100) for major manufacturing industries (1968-1997)



Source: Gretton and Fisher (1999).

Note:
FBT= Food beverages and tobacco
TCFL= Textiles, clothing, footwear and leather
PPRM= Printing, publishing and recorded media
PCCAP= Petroleum, coal, chemicals and associated products
BMP= Basic metal products
SSMP= Structural and sheet metal products
TE= Transport equipment
OM=Other manufacturing
Manufac= Total manufacturing

Figure 3. Nominal and effective rates of assistance 1968-2000



Source:Productivity Commission (2000).
Note: There are several breaks in the series reflecting also the effects of periodic revisions to industry inputs and outputs.

It is incumbent upon economists to make apparent the short and long term cost and benefits of "economic rationalism". A moderate level of government support is always necessary to provide a degree of reasonable stable support for the domestic import competing industries which are at their initial development stage. An appropriate industrial policy should avoid implementing the extreme and radical policies of either a costly protectionist view or a hasty trade liberalisation approach. Undoubtedly the reduction of tariff protection, will, in general, lead to lower production costs, lower prices and greater international competitiveness. However, according to Conlon (1999, p.201), " over a long period programs to assist industry have grown more or less willy-nilly, often as a result of political expediency rather than from any underlying economic rationale". An indiscriminate removal of the government support without considering the indirect flow-on effects can be as irrational as the heavy reliance of laggard and uncompetitive industries

on unsustainable government financial assistance. In other words, the zigzag adoption of these two extreme approaches will be equally destructive.

For instance, the Australian tuna-canning industry would be soon wiped out by free-trade policies due to unfair competition from cheap imports of Thai tuna. As another example, the New South Wales (NSW) secretary of the Textile, Clothing and Foot- wear Union, Kevin Boyd has predicted another 50,000 jobs would be lost if the government undertakes further tariff reductions (*Herald* Sun, 21/08/1997). Although the benefit and efficiency from free trade is undeniable, the employment generation can also become a crucial issue particularly in times of high unemployment. As usual in economics there is a trade-off between the short-term and long-term conflicting macroeconomic targets. According to Lewis *et al.* (1998, p.35), "when industrial protection is given to manufactures which compete with imports the usual result has been that industrial employment is bought at the cost of low productivity and expensive, inferior quality consumer goods".

Since the prospect of future employment opportunities in manufacturing is not very rosy, in the rest of this paper the prospect of the sectoral employment potential in the non-manufacturing sectors is investigated. To this end, the 1996-97 IO table has been further aggregated from 35 industries into 17 industries according to IO industry classification codes specified in ABS (2001, Cat. 5209). More specifically in this aggregation the manufacturing sub-industries form a single industry.

Equations (7) and (9) are utilised to calculate the sectoral employment multipliers and elasticities, respectively. Table 3 presents the sectoral employment multipliers and elasticities as well as a number of relevant sectoral indices for these 17 industries. Based on information presented in Table 3, the major findings are highlighted as follows:

First, the multipliers vary from 11.2 in mining to 34.3 in education. On the basis of the magnitude of the sectoral multipliers, one can calculate the cost of creating a full time job in the economy. For example in order to create an additional job in the economy, the final demand in the mining industry needs to be augmented by A$89127 pa, whereas in the context of the education sector this figure is as low as A$29172 (See Table 3).

Second, the sectoral employment elasticities also exhibit a wide degree of variability. For example a 10 per cent increase in the manufacturing final demand can lead to a 2.42 per cent expansion in the aggregate employment. While manufacturing possesses the highest employment elasticity (0.242), the elasticity for the electricity, gas and water sector is the lowest (0.014).

Third, during the period 1985-2000 the average annual employment growth in the following 8 sectors was greater than the total employment growth (2 per cent): Property & business services (5.9%); Accommodation, cafes & restaurants (4.8%); Cultural & recreational services (4%); Personal & other services (3.1%); Health & community services (3%); Construction (2.6%); Retail trade (2.6%); and Education (2.1%). It is worthwhile to recognise that of these 8 fastest growing industries, the following 5 industries are among the first top sectors in terms of magnitude of employment elasticity: Retail trade (0.209); Construction (0.17); Health & community services (0.161); Property & business services (0.138); and Education (0.12). The

share of these five industries, which can be described as key sectors, in total employment is 46 per cent.

Fourth, employment elasticities for two sectors of Electricity, gas & water; and Mining, which had an annual negative employment growth over the period 1985-2000, were as low as 0.014 and 0.037, respectively. In fact the electricity, gas & water with an annual average employment growth of -4.9 per cent had the lowest employment elasticity. Overall, it can be concluded that the fastest growing industries in terms of employment are mainly those with relatively higher elasticities and vice versa.

The Spearman correlation coefficients have also calculated between the ranking of sectoral employment elasticities and the ranking of following three variables: 1) the sectoral distribution of wages and salaries (0.88); b) the sectoral distribution of employment (0.95); and c) the sectoral employment multipliers (0.43). These correlation coefficients, showed in parentheses above, indicate that the overwhelming majority of high employment elasticity industries: a) are large in size in terms employment and this is due to the use of the sectoral employment as weights in Equation 9; b) are among those sectors which contribute to the bulk of the total salaries and wages; and c) do not necessarily have a high employment multiplier. Based on the results reported in Table 3, when unemployment becomes an acute problem, the government can play a more active role in abating the rate of unemployment by stimulating economic activity in those sectors which possess higher employment elasticities.

Table 3. Sectoral employment indicators

Sector	Sectoral distribution of[a]: %			Employment Multiplier (rank)	Cost of creating a Full time job A$	Employment Elasticity (rank)	Annual Average Employment Growth 1985-00[b] %
	Final demand	Employment	Salary & wages				
Agriculture forestry & fishing	2.6	5.1	1.5	21.8 (9)	45954	0.043 (13)	0.4
Mining	4.3	1.2	2.3	11.2 (17)	89127	0.037 (15)	-1.5
Manufacturing	17.6	14.6	14.1	18.1 (12)	55371	0.242 (1)	0.1
Electricity, gas & water	1.6	0.9	1.2	11.2 (16)	89103	0.014 (17)	-4.9
Construction	10.7	7.4	5.4	20.9 (10)	47955	0.170 (3)	2.6
Wholesale trade	5.4	5.8	6.5	22.0 (7)	45386	0.091 (8)	0.5
Retail trade	9.4	13.5	8.7	29.2 (4)	34189	0.209 (2)	2.6
Accommodation, cafes & restaurants	3.4	4.2	2.9	24.4 (6)	41051	0.062 (10)	4.8
Transport & storage	4.5	5.0	6.4	18.8 (11)	53189	0.065 (9)	0.9
Communication services	1.3	2.1	2.5	17.4 (14)	57382	0.018 (16)	1.1
Finance & insurance	3.4	3.9	6.1	18.0 (13)	55435	0.047 (12)	1.2
Property & business services	13.1	9.9	12.0	13.8 (15)	72616	0.138 (5)	5.9
Govt administration & defense	6.1	5.5	7.4	26.5 (5)	37807	0.123 (6)	0.6
Education	4.6	6.7	8.1	34.3 (1)	29172	0.120 (7)	2.1
Health & community services	6.9	8.4	9.6	30.8 (2)	32461	0.161 (4)	3.0
Cultural & recreational services	2.3	2.1	1.9	21.9 (8)	45577	0.039 (14)	4.0
Personal & other services	2.6	3.7	3.4	30.0 (3)	33338	0.060 (11)	3.1
Total	100	100	100				2.0

Sources:

a) ABS (2001).
b) Based on the ABS Labour Force Statistics Database (ABS, cat. 6203.0) by Industry (ANZSIC Classification).
c) The rest of the table is author's calculations based on the 1997 IO table.

IV. CONCLUDING REMARKS

Using the latest input-output (IO) table of 1996-97, in this paper the high employment generating industries of the Australian economy are identified by two techniques. First, the direct and indirect contribution of tradeable industries to aggregate employment have been measured by using the "loss of the industry" or "Shut-down of industry" approach. Second, the key employment generating sectors of the Australian economy have been identified on the basis of magnitude of the sectoral employment elasticities.

It is found that the manufacturing industries are very important in terms of indirect contribution to total employment in the economy. However, the overwhelming majority of the manufacturing industries have demonstrated a lackluster employment growth since late 1970s. It can be contentiously argued that the major reasons underpinning this downward trend pertain to the dwindling effective and nominal rates of assistance and the increasing labour productivity since 1980 as well as the use of more capital intensive production technology. Although the aggregated manufacturing sector has the highest employment elasticity of 0.242, the average employment growth for this sector over the period 1985-2000 was as low as 0.1 per cent per annum.

It is also found that the following 5 industries are not only the fastest growing and the largest sectors in terms of employment but also possess relatively higher employment elasticities: Retail trade; Construction; Health & community services; Property & business services; and Education. It is highly likely that these key industries will play a crucial role in generating employment in the years to come.

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