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An Analysis of the Output and Employment Conversion Matrices of Australia's Economy

[1]Abbas Valadkhani and [2]Tim Robinson
[1]School of Economics and Information Systems, University of Wollongong
Wollongong, Australia
[2]School of Economics and Finance, Queensland University of Technology
Brisbane, Australia

Abstract: Based on two snapshots taken from the Australian economy, this study quantifies the impacts of final demand aggregates on output and employment in various sectors using the 1989 and 1997 conversion matrices. The sectoral output and employment are linked with final demand deliveries in such a way that one can measure the impacts on changes in each component of aggregate demand, other components remaining unchanged, on output and employment. A comparison of the aggregate output and employment multipliers in 1989 to 1997 indicates that while the output multipliers have increased, the employment multipliers have declined. This means that through time, due to rising labour productivity, the various components of aggregate demand would need to grow at a faster rate in order to achieve a certain employment growth. It was also found that almost all employment generated between 1989 to 1997 was in three service industries, namely community, social and personal services; wholesale retail; restaurants and property: and business services. These are industries that are least likely to have benefited from the productivity gains that resulted from the microeconomic reforms that characterised the Australian economy during this period. On a relative basis, a rise in various components of aggregate final demand can lead to a higher employment generation in these three industries.

Key words: Output, Employment, Conversion Matrices, Australian Economy

INTRODUCTION

The linking of the demand and production sides of the economy is relevant for effective coordination of stabilisation policies and development strategies which are of paramount importance for policy makers. In macroeconometric modelling there are several ways to deal with the production block by using various types of production functions. In this study, using the 1989 and 1997 input-output (IO) tables, two conversion matrices are computed which translate final demand aggregates into sectoral output and employment. This link is important particularly in Australia, where intermediate demands among various sectors are of significant magnitudes. One should recognise that, by using an IO table in a model, the supply side has not been neglected since both intermediate and final demand encompass demand for capital goods and other factors of production [1].

Theoretical Framework: The incorporation and implementation of a demand-side IO model in macroeconometric modelling have been examined by many applied economists. The main objective of the integration of an IO system to a macroeconometric model (MEM) is to obtain a "conversion (transition) matrix" by using a base year IO table. Using various versions of the Brookings model, Fisher *et al.* [2] and Kresge [3] pioneered the use of the conversion matrix to link a national income determination model and an IO system. Some other economists who have also discussed IO analysis in a MEM framework are Klein [1,4-6], Behrman and Klein [7], Morishima *et al.* [8], Preston [9], Chalmers [10], Bodkin [11], Marzouk [12], Seguy and Ramirez [13], Sapir [14], Hebden [15], Chowdhury [16], Oshikoya [17], Bon and Bing [18].

According to Klein [5], the conversion matrix is the vehicle of transformation and has two important applications. First, by multiplying the aggregate demand components in each row of the conversion matrix, the model-builder can compute sectoral output or value added and employment. Second, by multiplying the sectoral price deflators by each column of this matrix, the aggregate final demand price deflators can be estimated [5,11]. In this study only the first application has been utilised.

To obtain the conversion matrix one may begin with the following Leontief relation:

$$X = (I-A)^{-1}F \quad (1)$$

Where, I is an identity matrix, X is a (nx1) vector of total gross output, F indicates the (nx1) vector of sectoral final demand and A is the (nxn) square matrix

of the Leontief domestic direct coefficients. This means that imports are assumed to be non-competitive and completely exogenous to the IO system. In order to measure the impacts of aggregate final demand components on the sectoral output or employment some assumptions have to be invoked.

Let us assume that C=private consumption, G=government consumption, I=gross fixed capital formation, S=changes in stocks (capital inventory), E=exports of goods and services. If these aggregates, i.e., C, G, I, S and E, shape the (column) vector and also if one accepts proportionality and constancy of the (nxm) matrix of the sectoral distribution of final demand components (D), (where n and m denote the number of sectors and aggregate final demand components, respectively) the column vector of sectoral final demand can be written as:

$$F = D \tag{2}$$

By substituting (2) into (1), it is clear that:

$$X = (I-A)^{-1}D \tag{3}$$

Since all elements of $(I-A)^{-1}$ and D in equation (3) are given by a base year IO table, H or the output conversion matrix can be computed as follows:

$$H = (I-A)^{-1}D \tag{4}$$

Regarding the first application of the conversion matrix (H) in equation (4), given the *ex ante* or *ex post* time series data of aggregate final demand components for any given time period, the sectoral output can be accordingly obtained in factor prices. In this respect, one should note that there is no constraint on these computed sectoral output. Therefore, it is necessary for the modeller to bear in mind the extent to which an increase in each component of final demand can be converted to output in various sectors. In other words, an infinite increase in each component of aggregate demand does not imply an infinite increase in output in various sectors. Equation (3) can also be written as:

$$\begin{bmatrix} x_1 \\ x_2 \\ . \\ . \\ x_n \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} & h_{13} & h_{14} & h_{15} \\ h_{21} & h_{22} & h_{23} & h_{24} & h_{25} \\ . & . & . & . & . \\ . & . & . & . & . \\ h_{n1} & h_{n2} & h_{n3} & h_{n4} & h_{n5} \end{bmatrix} \begin{bmatrix} \lambda_1 = C \\ \lambda_2 = G \\ \lambda_3 = I \\ \lambda_4 = S \\ \lambda_5 = E \end{bmatrix} \tag{5}$$

Further, the H matrix can be regarded as a comprehensive sectoral output multiplier matrix. For example, h_{ij} shows, if the jth component of aggregate demand changes by one unit, how much gross output in sector i will be changed. That is:

$$h_{ij} = \partial x_i / \partial \lambda_j \tag{6}$$

If R is a diagonal matrix which shows the ratio of employment to output (l_i/x_i) in sector i, then the sectoral employment can be computed using the following relation:

$$L = \Omega\lambda \tag{7}$$

Where, Ω=RH is the employment conversion matrix. Similar to relation (6), Ω can quantify the impacts of various components of aggregate demand on the sectoral employment. That is:

$$\Omega_{ij} = \partial l_i / \partial \lambda_j \tag{8}$$

Attention is now directed to the assumptions which have been made for capturing the conversion matrix. The question is "Can D, R and $(I-A)^{-1}$ be relatively stable over a period of time?" Put otherwise, are the followings constant: consumers' taste patterns (the D matrix or sectoral distribution of final demand deliveries), the sectoral labour to output ratios and the sectoral interdependencies, i.e., $(I-A)^{-1}$? If the time horizon lengthens, the answer probably would be no. In this study we have used the 1989 and 1997 IO tables to measure actual changes in output and employment multipliers through time using both the output and employment conversion matrices (H_{1989}, Ω_{1989}, H_{1997}, Ω_{1997}). It should be noted that the 1997 IO table is the most recent IO in Australia.

Using the column sums of H and Ω, one can also calculate the aggregate output and employment multipliers of each component of aggregate final demand as follows:

$$\Delta X_{\lambda_j} = \sum_{i=1}^{n} h_{ij}\Delta\lambda_j \tag{9}$$

$$\Delta L_{\lambda_j} = \sum_{i=1}^{n} \Omega_{ij}\Delta\lambda_j \tag{10}$$

Equation (9) shows the responsiveness of total output to a one unit of increase in each of C (or λ_1), G (or λ_2), I (or λ_3), S (or λ_4) and E (or λ_5) separately. In a similar way, keeping the other aggregate demand components unchanged, equation (10) measures changes in aggregate employment as a result of a change in each component of aggregate final demand.

The Data: Our aim is to compare the resulting conversion matrices from an earlier Australian IO table to those obtained from the most recent IO Table (1997).

Consistent IO data for the OECD countries including Australia based on direct and indirect allocations and constant and current prices are available from the OECD website free of charge under the ISIC rev2 classification in different time intervals between 1968 and 1990 (http://www.oecd.org). The earliest Australian IO table for which consistent employment data were available was the 1989 IO table. While the sectoral employment data are available in the 1997 IO table, the 1989 IO does not readily include the employment data. Therefore, we have used the OECD [19] STAN database to obtain the comparable employment data for the corresponding sectors of the 1989 IO table. The 1989 IO table was obtained from the OECD website. This table is based on ISIC rev3, while the 1997 table is based on the ANZSIC classification. The 1997 IO table [20] 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.

All transactions recorded in both tables are expressed at basic prices in million Australian dollars. While structural change in Australia has involved both the shift to service based activities and the emergence of new industries, which is reflected in the use of ISIC rev3, rather than ISIC rev2, we decided to facilitate comparisons by collapsing both classifications to a common 17 sector classification. In other words, the original 1989 and 1997 IO tables were compiled with 35 and 106 industry sectors, respectively, but for the sake of simplicity and consistency of the results, the aggregated version of these tables is employed in this study. It should be noted both IO tables are at current prices, because unlike the 1989 table, the 1997 table is not available at constant prices. We used the Microsoft Excel and the GRIMP software package to undertake the IO calculations [21].

Empirical Results and Policy Implications: The first step in the empirical work is related to the computation of the output and employment conversion matrices. Using the 1989 and 1997 IO tables and equations (5) and (7), the H and Ω matrices are represented in Table 1 and 2. However, prior to undertaking any empirical analysis it is crucial to check the accuracy of the computed conversion matrices. To this end, after substituting the five components of aggregate demand (C, G, I, S and E) in 1989 and 1997 into the equations (5) and (7), the corresponding sectoral output and employment have been computed. It was observed that the computed sectoral output and employment data were exactly equal to the actual data.

Before looking at the detail of the tables and figures, it is important to point to some significant aspects of change in the Australian economy between 1989 and 1997. Both 1989 and 1997 were unexceptional years in terms of real GDP growth which, at around 4% each year, was close to the average of the previous 40 years. Nonetheless, the period from 1989 to 1997 did see significant changes in the structure of the economy and in the characteristics of many important sectors. Many of these changes resulted from the implementation of what has become known in Australia as microeconomic reform. Australia's microeconomic reform agenda is part of a world wide phenomenon associated with the rise of supply side economics in the 1980s.

Microeconomic reform has been described as involving the implementation of government policies designed to deregulate or re-regulate product, service and factor markets in such a way as to promote competition and efficiency in relation to both domestic and international markets [22]. It has been argued that microeconomic reform will give a significant boost to Australian productivity, although the question as to whether this would be a one-off increase or a permanent rise in the rate of productivity growth is open to question [23].

The period under review here was one in which some of the most important outcomes of the microeconomic reform agenda were experienced. These included:

* Reform of the labour market involving initial restructuring of the ubiquitous centralized wage fixing process to make it more flexible and the eventual introduction of enterprise bargaining;
* Significant decreases in import tariffs which had been amongst the highest in the developed world;
* Changes to the tax system, with reductions in both company and personal income tax rates;
* The effects of the deregulation of Australia's highly regulated financial sector which was overhauled as a result of a series of enquiries carried out in the 1980s and
* The efficiency gains that accompanied privatization and corporatization of government owned enterprises.

As might be expected, these reforms had the potential to affect some sectors of the economy in terms of productivity rises to a much greater extent than others.

In the light of this background to developments in the Australian economy, we now turn to some illustrative examples of the inferences that can be drawn from the data contained in the conversion matrices. According to Table 1 and 2, from 1989 to 1997 the aggregate output multipliers (i.e. the column sums of the output conversion matrices) for all aggregate demand components have exhibited a meagre increase with the only exception being the gross fixed capital formation, which has shown a very small decline. Each element of these matrices can be regarded as a sector-specific multiplier. For instance, a 100 dollars increase in government consumption in 1997 increased the gross output by about 85 dollars in the Community, social and services sector (Table 1)

Table 1: Output Conversion Matrix, 1989 and 1997

	Private domestic consumption λ_1				Government consumption λ_2			
Sectors	1989	Rank	1997	Rank	1989	Rank	1997	Rank
Agriculture, forestry and fishing	0.0568	9	0.051	8	0.0128	14	0.011	14
Mining and quarrying	0.0205	15	0.023	14	0.0211	13	0.026	10
Food, beverages and tobacco	0.1083	4	0.099	5	0.0096	15	0.006	15
TCF and leather	0.0346	12	0.021	15	0.0081	16	0.006	16
Wood and paper products, furniture	0.0491	10	0.045	11	0.0479	9	0.030	9
Chemicals, petroleum, coal, rubber and non-metallic minerals	0.0642	7	0.053	7	0.0485	8	0.052	5
Basic metals/Fabricated products	0.0249	14	0.025	13	0.0293	12	0.020	13
Machinery and equipment	0.0403	11	0.040	12	0.0409	10	0.025	11
Other manufacturing nec	0.0030	17	0.006	16	0.0017	17	0.003	17
Electricity, gas and water	0.0592	8	0.050	10	0.0609	5	0.021	12
Construction	0.0066	16	0.006	17	0.0705	3	0.036	7
Wholesale retail, restaurants etc	0.3047	1	0.334	2	0.0668	4	0.064	4
Transport and storage	0.0720	5	0.094	6	0.0566	6	0.139	3
Communication services	0.0340	13	0.051	9	0.0335	11	0.031	8
Finance and insurance	0.0718	6	0.109	4	0.0502	7	0.037	6
Property and bus services	0.2764	2	0.350	1	0.1109	2	0.145	2
Community, social and personal services	0.1545	3	0.146	3	0.7327	1	0.849	1
$\sum_{i=1}^{n} h_{ij}$	1.38	-	1.5	-	1.4	-	1.5	-

	Gross fixed capital formation λ_3				Exports of goods and services λ_5			
Sectors	1989	Rank	1997	Rank	1989	Rank	1997	Rank
Agriculture, forestry and fishing	0.0080	14	0.017	15	0.1677	4	0.142	5
Mining and quarrying	0.0432	9	0.033	9	0.3028	1	0.305	1
Food, beverages and tobacco	0.0070	15	0.010	16	0.1478	5	0.134	6
TCF and leather	0.0068	16	0.005	17	0.0355	14	0.037	13
Wood and paper products, furniture	0.0552	7	0.047	8	0.0374	12	0.043	12
Chemicals, petroleum, coal, rubber and non-metallic minerals	0.1026	6	0.081	6	0.1083	7	0.117	8
Basic metals/Fabricated products	0.1386	4	0.089	5	0.2539	2	0.178	3
Machinery and equipment	0.1713	2	0.128	4	0.0750	9	0.115	9
Other manufacturing nec	0.0029	17	0.026	11	0.0047	17	0.010	16
Electricity, gas and water	0.0275	11	0.020	13	0.0435	10	0.032	15
Construction	0.5463	1	0.487	1	0.0087	16	0.007	17
Wholesale retail, restaurants etc	0.1504	3	0.175	3	0.1396	6	0.197	2
Transport and storage	0.0528	8	0.055	7	0.1933	3	0.132	7
Communication services	0.0116	13	0.019	14	0.0264	15	0.035	14
Finance and insurance	0.0366	10	0.033	10	0.0386	11	0.054	11
Property and bus services	0.1083	5	0.212	2	0.0970	8	0.161	4
Community, social and personal services	0.0220	12	0.021	12	0.0371	13	0.064	10
$\sum_{i=1}^{n} h_{ij}$	1.49	-	1.46	-	1.72	-	1.76	-

Note: The corresponding changes in stocks (λ_4) has not reported in this Table
Source: Calculated by the authors based on the aggregated 1989 and 1997 IO Tables

and by 14 dollars in the Transport and storage sector (Table 1).

Among the four reported columns of the output conversion matrices, it appears that an increase in the exports of goods and services has the highest multiplier effect on output in both 1989 and 1997. Overall, it can be stated that in 1997 a one dollar rise in private consumption or government consumption could increase aggregate gross output by 1.5 dollars. A similar increase in exports had an impact of 1.76 dollar on output in the same year. Therefore, on a relative basis, one can argue that policies aimed at promoting exports can precipitate output growth, particularly in the following sectors: Mining; Wholesale retail and

Table 2: Employment Conversion Matrix, 1989 and 1997

	Private domestic consumption λ_1				Government consumption λ_2			
Sectors	1989	Rank	1997	Rank	1989	Rank	1997	Rank
Agriculture, forestry and fishing	0.9263	5	0.635	5	0.2089	12	0.1397	10
Mining and quarrying	0.0777	16	0.048	17	0.0798	16	0.0538	15
Food, beverages and tobacco	0.5915	8	0.374	7	0.0524	17	0.021	17
TCF and leather	0.6681	7	0.314	9	0.1556	14	0.0822	13
Wood and paper products, furniture	0.2481	13	0.203	11	0.2422	10	0.1343	11
Chemicals, petroleum, coal, rubber and non-metallic minerals	0.3045	12	0.189	12	0.2303	11	0.1832	8
Bas__ Metals/Fabricated Products	0.1428	15	0.121	14	0.1677	13	0.0963	12
Machinery and equipment	0.3477	10	0.24	10	0.3531	8	0.1499	9
Other Manufacturing nec	0.1936	14	0.077	15	0.109	15	0.0358	16
Electricity, gas and water	0.3137	11	0.141	13	0.3226	9	0.0598	14
Construction	0.0707	17	0.056	16	0.7516	4	0.3315	5
Wholesale retail, restaurants etc	6.1448	1	4.67	1	1.348	2	0.8918	2
Transport and storage	0.789	6	0.588	6	0.6204	6	0.8716	3
Communication services	0.414	9	0.333	8	0.4081	7	0.2061	7
Finance and insurance	1.0207	4	0.729	4	0.713	5	0.2454	6
Property and bus services	1.9159	3	1.748	3	0.7686	3	0.7251	4
Community, Social and Personal Services	3.4783	2	2.314	2	16.4937	1	13.437	1
$\sum_{i=1}^{n} \Omega_{ij}$	17.65	-	12.78	-	23.03	-	17.66	-

	Gross fixed capital formation λ_3				Exports of goods and services λ_5			
Sectors	1989	Rank	1997	Rank	1989	Rank	1997	Rank
Agriculture, forestry and fishing	0.1312	15	0.215	11	2.7368	2	1.766	2
Mining and quarrying	0.1635	12	0.069	15	1.1468	5	0.631	8
Food, beverages and tobacco	0.0382	17	0.038	17	0.807	7	0.51	10
TCF and leather	0.1308	16	0.071	14	0.6841	8	0.552	9
Wood and paper products, furniture	0.2789	10	0.21	12	0.1892	16	0.191	14
Chemicals, petroleum, coal, rubber and non-metallic minerals	0.4868	9	0.288	9	0.514	12	0.413	11
Basic Metals/Fabricated Products	0.7946	4	0.428	5	1.4553	4	0.86	4
Machinery and equipment	1.4771	3	0.774	4	0.6465	10	0.691	7
Other Manufacturing nec	0.1824	11	0.312	8	0.3019	14	0.121	15
Electricity, gas and water	0.1455	13	0.058	16	0.2301	15	0.091	16
Construction	5.8223	1	4.494	1	0.0931	17	0.06	17
Wholesale retail, restaurants etc	3.032	2	2.45	2	2.8143	1	2.759	1
Transport and storage	0.5783	6	0.344	6	2.1172	3	0.828	5
Communication services	0.1418	14	0.124	13	0.3214	13	0.231	13
Finance and insurance	0.5196	7	0.222	10	0.5491	11	0.364	12
Property and bus services	0.7503	5	1.056	3	0.6724	9	0.801	6
Community, Social and Personal Services	0.4946	8	0.326	7	0.8341	6	1.005	3
$\sum_{i=1}^{n} \Omega_{ij}$	15.17	-	11.48	-	16.11	-	11.87	-

Note: The corresponding changes in stocks ($_4$) has not reported in this Table
Source: Calculated by the authors based on the aggregated 1989 and 1997 IO Tables

restaurants; Basic metals and fabricated products; Agriculture, forestry and fishing; Food, beverages and tobacco (Table 1). As a rule of thumb one can expect that, on average, a dollar increase in aggregate final demand can stimulate total gross output by roughly 1.4-1.8 dollars depending on the type of expenditure (Table 1). It should be noted that the above multipliers are based on a snapshot of the structure of the Australia's economy as captured by the actual IO tables.

The next step is to investigate how sectoral employment would change if one of the final demand components increases by one unit. Based on the conversion matrices (Table 2), it seems that the aggregate employment multipliers for all four components of aggregate

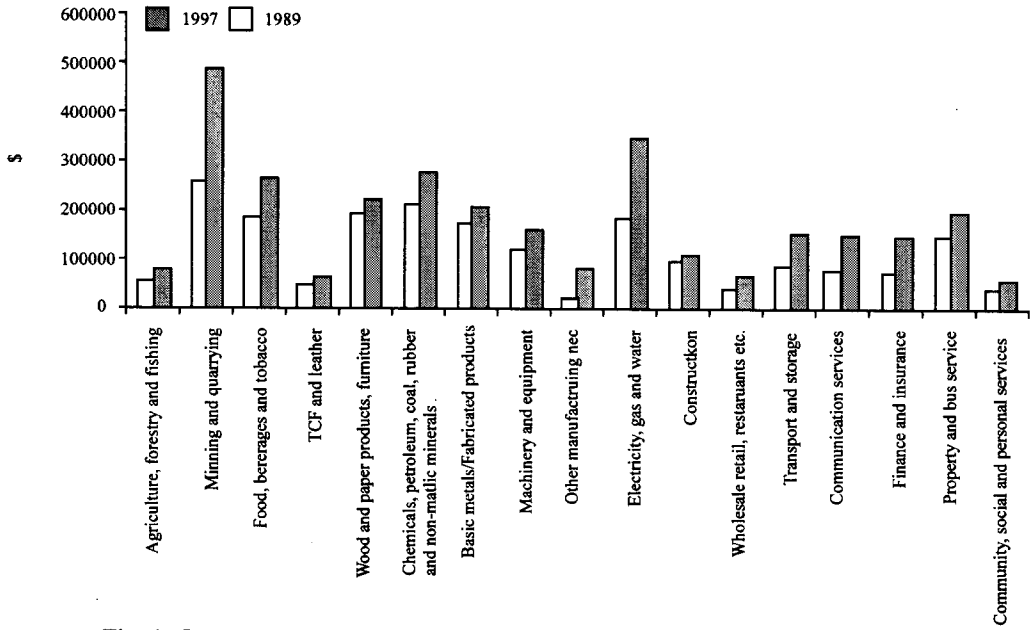

Fig: 1: Output per unit of labour in various sectors of australian economy, 1989 and 1997
Source: Calculated by the author based on the aggregated 1989 and 1997 IO tables and OECD [19]

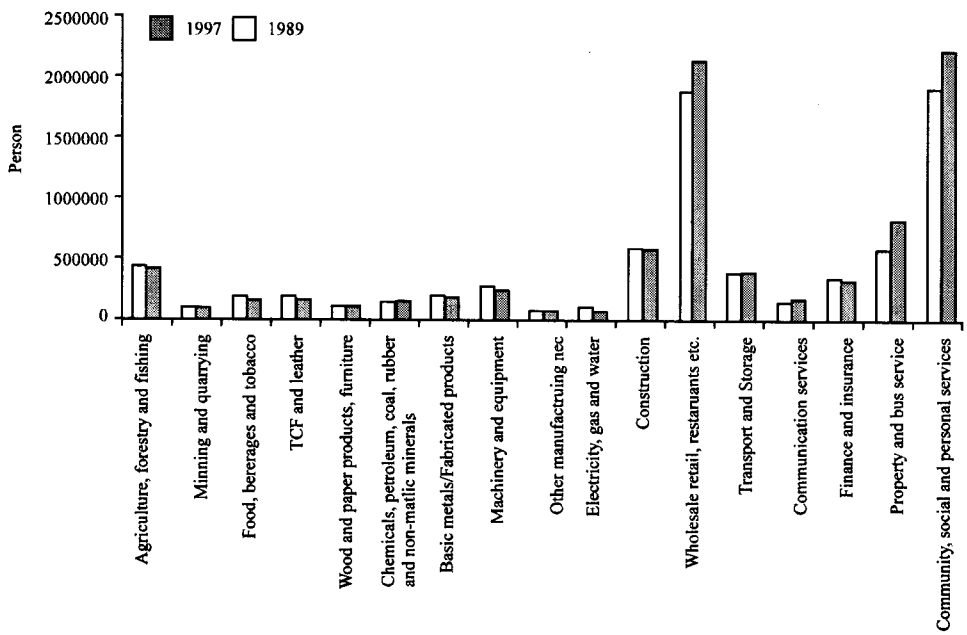

Fig. 2: The number of persons employed in the various sectors of the australian economy, 1989 and 1997
Source: ABS [20] and OECD [19]

demand have declined between 1989 and 1997 (Table 2). For example one million dollars increase in private consumption could create almost 18 full-time jobs in 1989 whereas the same stimulus in 1997 led to the creation of less than 13 jobs. According to Table 1, the aggregate output multipliers show an upward trend through time. By contrast, based on Table 2 the employment multipliers exhibit a shrinkage between 1989 and 1997. To a large extent this issue relates to the rising level of labour productivity.

Figure 1 clearly indicates that output per unit of labour has increased in each and every one of the 17 sectors between 1989 and 1997, even in labour-intensive service industries. However, the rise in productivity is more pronounced in more capital-intensive industries such as Mining and quarrying and Electricity, gas and

water. Not only are these industries amenable to productivity enhancing technological change but they are also industries that have reaped the benefits of many aspects of microeconomic reform. These include labour market reform, privatisation and corporatization of state owned enterprises and for those industries with large export markets, the benefits of a lower Australian dollar that resulted from tariff reductions and deregulation of the foreign exchange market. Figure 2 shows that service industries constitute the bulk of employment in the Australian economy; the number of jobs created by non-service industries is negligible or declining and almost all the new jobs created between 1989 and 1997 were in the service industries. These employment-generating industries, which are amongst the industries whose productivity is least affected by microeconomic reform are in order of importance, as follows: community, social and personal services; wholesale retail and restaurants; and property and business services. On the other hand, as Fig. 1 indicates finance and insurance, which did not change its fourth ranking over the period, did show labour productivity growth which was more akin to that of the previously mentioned capital-intensive industries than to the other service industries. Along with technological change in the area of information technology, this increase can be, at least in part, attributed to deregulation of the finance sector that occurred in the 1980s as part of the microeconomic reform agenda.

A cursory look at Table 2 shows how we can reinforce the creation of employment in these three sectors. With a sector-specific employment multiplier of 13.43, the community, social and personal services industry is very responsive to an increase in government consumption. Based on the structure of Australian's economy in 1997, one million dollars increase in government expenditures created at an aggregate level about 18 full-time jobs. Of these 18 jobs, more than 13 were in the community, social and personal services industry. On the other hand, it seems that a similar increase in private consumption, on a relative basis, can increase employment in the wholesale retail and restaurants industry more than the other industries. It should be noted that the above three industries have also the largest employment multipliers in relation to a change in private and government consumption and to some extent exports. This means that, given the present structure of the economy, if various components of final demand were to increase, the overwhelming majority of the created jobs would be within the above three service industries.

Despite the declining employment multipliers, it is important to note that the aggregate employment multiplier for government consumption has the highest magnitude compared to the other three components of aggregate final demand (i.e., C, I and E) in both 1989 and 1997. In 1997 a million dollars rise in government consumption could create 18 jobs, suggesting that for approximately each $56,000 spent, one full-time job was created. The same increase in C, I and E could create 13, 11.5 and 12 jobs, respectively in 1997. This suggests that, in times of high unemployment, the most effective (but not necessarily the most efficient) way of creating employment is through increased government expenditure.

It should be recognized that purchasing power parity studies indicate that labour-intensive services are often more costly to produce in rich countries than in poor countries [24, 25] and so one might expect that these sectors (like community, social and personal services; wholesale retail, restaurants etc. and property and business services) to be increasing in relative labour cost and employment figures as the country grows. More broadly, Baumol [26] also argues that the rising production cost in labour-intensive industries, such as the arts, health care and education, is inevitable. The rising rate of public-sector price deflator well above the aggregate GDP deflator in recent times can be explained by the low productivity of labour-intensive government activities compared with the relatively capital-intensive private sector [27].

Gundlach and Wö mann [28] examined changes in the productivity of schooling for six East Asian countries, supporting the view that the cost of schooling rose by more than the price of other services in 1980 to 1994. It can be argued that increases in employment in service industries may be attributed to declining relative productivity. According to Gundlach and Wö mann [28] the relative fading productivity of the education sector in East Asian countries relates to a marked decline in the pupil-teacher ratio. Therefore, it is quite normal that labour-intensive services such as education and community services are highly likely to continue to grow faster in terms of employment and at the same time they will enjoy lower productivities for an advanced country such as Australia. In relation to this issue, using a different sectoral classification, Valadkhani [29] has found that the following industries are not only the fastest growing (in terms of annual employment growth during the 1985-2000 period) and the largest sectors (in terms of their share in total employment and salary and wages in the year 1996-97), but also possess relatively higher employment elasticities: retail trade; construction; health and community services; property and business services and education. It can be argued that these important industries will play a substantial role in generating employment in the foreseeable future.

CONCLUSION

This study has linked the sectoral output and employment to the final demand deliveries for 17 major sectors in 1989 and 1997. It has identified and discussed the expenditure categories and sectors that give large multiplier outcomes with a view to illustrating some of the ways in which policies designed to meet objectives such as increased GDP or employment growth might be framed. This discussion has occurred in the context of the microeconomic reform agenda that has brought significant structural reform to the Australian economy over the period in question. Nonetheless, this brief discussion of the relevance of a knowledge of sectoral multipliers for policy development has only scratched the surface of the possible interpretations that might be placed on the data.

As discussed by Valadkhani [29], one should recognize that the use of IO systems for *ex ante* forecasting is very limited due to the following restrictive assumptions: (1) homogeneity of output; (2) zero rates of substitution between inputs and infinite elasticity of supply of factors of production; (3) fixed proportions between inputs and outputs; (4) absence of economies of scale; (5) linearity in the cyclical impact and (6) exogeneity of primary inputs and final demand components. IO models cannot capture the importance of major asymmetries that exist over the business cycle and the dynamic and feedback effects on factor prices, the exchange rate, consumption, public expenditure, exports and imports. Therefore, the restrictive assumptions embedded in an IO system make generalisations and forecasting difficult but the objective of this study was to analyse the impacts of various aggregate demand components on the sectoral output and employment as they occurred in an *ex post* (rather than *ex ante*) sense. In other words, the elements of the computed conversion matrices have been used in this study to reveal how the Australian economy actually reacted to such shocks at the time. Thus the findings are, to some extent, indicative of the forces at work.

REFERENCES

1. Klein, L.R., 1965. What kind of macroeconomic model for developing economies?, The Econometric Annual of the Indian Economic J., 13: 313-324.
2. Fisher, F.M., L.R. Klein and Y. Shinkai, 1965. Price and Output Aggregation in the Brookings Econometric Model. In: Duesenberry, J. *et al.* (Eds.), The Brookings Quarterly Econometric Models of the U.S., Rand McNally, Chicago.
3. Kresge, D.T., 1969. Price and Output Conversion: A Modified Approach. In: Duesenberry, J. *et al.* (Eds), The Brookings Quarterly Econometric Models of the U.S, Rand McNally, Chicago.
4. Klein, L.R., 1978. The supply side. American Econ. Rev., 68: 1-7.
5. Klein, L.R., 1983. Lectures in Econometrics North-Holland, Amsterdam.
6. Klein, L.R., 1989. Econometric Aspects of Input-output Analysis. In: Miller, R.E. *et al.* (Eds.), Frontiers of Input-Output Analysis. Oxford University Press, Oxford, pp: 3-21.
7. Behrman, I.R. and L.R. Klein, 1970. Econometric Growth Models for the Developing Economy. In: Eltis, W.A. *et al.*, (Eds.), Induction, Growth and Trade: Essays in Honour of Sir Roy Harrod, Clarendon Press, Oxford.
8. Morishima, M. (Ed), 1972. The Working of Econometric Models. Cambridge University Press, Cambridge.
9. Preston, R., 1972. The Wharton Annual and Industry Forecasting Model. Economic Research Unit of the University of Pennsylvania, Philadelphia.
10. Chalmers, J.A., 1972. On linking supply and demand in macro models of developing countries: with an illustration involving Thailand. Malayan Econ. Rev., 17: 121-142.
11. Bodkin, R.G., 1976. A Large-scale Input-output Econometric Model of the Canadian Economy (CANDIDE). In: Polenske, K.R. and J.V. Skolka (Eds.), Advances in Input-Output Analysis, Ballinger, Cambridge, Mass, pp: 27-44.
12. Marzouk, M.S., 1975. An econometric model of Sudan. J. Develop. Econo., 1: 337-358.
13. Seguy, R.M. and J.A. Ramirez, 1975. The use of input-output analysis in an econometric model of the Mexican economy. Ann. Econ. Social Measurement, 4: 531-552.
14. Sapir, A., 1976. A note on input-output analysis and macroeconometric models. J. Develop. Econ., 3: 377-383.
15. Hebden, J., 1983. Applications of Econometrics. Philip Allan, Oxford.
16. Chowdhury, A., 1984. Integration of input-output and macroeconometric models: A review of alternative methodologies. Singapore Economic Review, 29: 97-115.
17. Oshikoya, T.W., 1990. The Nigerian Economy: A Macroeconometric and Input-Output Model. Praeger, New York.
18. Bon, R. and X. Bing, 1993. Comparative stability analysis of demand-side and supply-side input-output models in the UK. Appl. Econ., 25: 75-79.
19. OECD, 1994. STAN Database for Industrial Analysis, OECD, Paris
20. Australian Bureau of Statistics (ABS), 2001. Australian National Accounts: (1996-97) Input-Output Tables, Cat. 5209, Canberra.
21. West, G.R., 1993. Input-Output Analysis for Practitioners: An Interactive Input-Output Software Package User's Guide Version 7.1 (GRIMP). School of Economics, The University of Queensland, Brisbane.
22. Robinson, T., M. Quayle and W. McEachern, 1994. Macroeconomics, A Contemporary Introduction. Thomas Nelson, Melbourne.
23. Otto, G., 1997. Productivity Growth and Economic Policy in Australia. Department of the Parliamentary Library Research Paper, 19, 1996-97, Australian Parliamentary Library, Canberra.
24. Dowrick, S., 2001. True international income comparisons: correcting for bias in fixed price measures and exchange rate measures. The Economic Measurement Group Workshop, 30th March, University of New South Wales, Sydney.
25. OECD, 2001. Problem Areas in Calculating Times Series of PPPs, OECD, Paris.
26. Baumol, W.J., 1997. Baumol's Cost Disease: The Arts and Other Victims, (Baumol, W.J. and R. Towse, Eds.), Edward Elgar, Northampton, Mass.
27. Fordham, B.O., 2003. The political and economic sources of inflation in the American military budget. J. Conflict Resolution, 47: 574-93.
28. Gundlach, E. and L. Wö mann, 2001. The fading productivity of schooling in East Asia. J. Asian Econ., 12: 401-17.
29. Valadkhani, A., 2003. Using input-output analysis to identify Australia's high employment generating industries. Australian Bull. Labour, 29: 199-217.