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THE ORANI-INCOME DISTRIBUTION MODEL: LABOUR MARKET ISSUES

by

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Meagher and Parmenter (1985), "Some Short-run Effects of Shifts from Direct to Indirect Taxation", IAESR Working Paper No. 10/1985, September.

Meagher and Agrawal (1986), "Taxation Reform and Income Distribution in Australia", Australian Economic Review, 3rd Quarter, 33-56.

Nguyen, D.T. and Siriwardana, A.M. (1986), "The Relationship Between Output Growth and Unemployment: A Re-examination of Okun's Law in Australia", Paper presented to the 15th Conference of Economists,Monash University, Melbourne, August.

Okun, A.M. (1962), "Potential GNP: Its Measurement and Significance", in Proceedings of the Business and Economic Statistics Section of the American Statistical Association, Washington, D.C; reprinted in Okun, A.M. (1970), The Political Economy of Prosperity, W.W. Norton and Company, New York.

Peters, R.W. and Petridis, A. (1985), "Employment, the Labour Force and Unemployment in Australia: A Disaggregated Approach", Australian Economic Review, 4th Quarter, 51-67.

Shorrocks, A.F. (1980), "The Class of Additively Decomposable Inequality Measures", Econometrica Vol.48, No.3, 613-25.

Tella, A. (1965), "Labour Force Sensitivity to Employment By Age, Sex", Industrial Relations, Vol. 4, No.2, 69-83.

Ursi, V. (1986), "Matrices of Employment by Occupation: Australia, 1971, 1976 and 1981", IAESR Working Paper No. 8/1986, September.

Withers, G. (1984), Comments on B.P. Stewart and L.S. Williams, "Towards an Aggregate Theory of Labour Supply and the Labour Market", in A.J. Kaspura (ed.), Labour Force Participation in Australia: The Proceedings of a Conference, Bureau of Labour Market Research Monograph Series No.1, AGPS, Canberra.

Woytinsky, W. (1940), "Additional Workers and the Volume of Unemployment in the Depression", Social Science Research Council Pamphlet Series No.1, Washington D.C.

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REFERENCES

Bureau of Labour Market Research (1985), "Who's in the Labour Force? A Study of Labour Force Participation", Research Report No.7, AGPS, Canberra.

Craigie, R. (1979), "Some Comments on the ABS Occupational Classification System and the IMPACT Occupational Grouping", IMPACT Project Preliminary Working Paper No. IP-08, July.

Dixon, P.B., Parmenter B.R., Sutton, J. and Vincent, D.P. (1982), ORANI: A Multisectoral Model of the Australian Economy, North-Holland, Amsterdam.

Dixon, P.B., Meagher, G.A. and Parmenter, B.R. (1985) "Analysing the Effects of Change in the Structure of Taxation via the ORANI-NAGA Model of the Australian Economy", paper presented to the Ninety-Eighth Annual Meeting of the American Economic Association, New York.

Dixon, P.B., Parmenter, B.R. and Horridge, M. (1986), "Forecasting Versus Policy Analysis with the ORANI Model", IAESR Working Paper No. 4/1986, June.

Dunlop, J.T. (1938), "The Movement of Real and Money Wage Rates", Economic Journal, Vol. 48, No. 191, 413-34.

Douglas, P. (1930), Real Wages in the United States, 1890-1926, Cambridge, Massachusetts.

Foster, W.F. (1981), "Gross Flows in the Australian Labour Market: A First Look", Australian Economic Review, 4th Quarter, 57-64.

Gregory, R.G. (1984), "Labour Force Participation -- The Way Ahead: An Applied Economist's Perspective", in A.J. Kaspura (ed.), Labour Force Participation in Australia: The Proceedings of a Conference, Bureau of Labour Market Research Monograph Series No.1, AGPS, Canberra.

Johansen, L. (1960), A Multisectoral Study of Economic Growth, North-Holland, Amsterdam.

Kalisch, D. (1982), "The Output Loss from Unemployment: Okun's Law Revisited", Bureau of Labour Market Research Working Paper No. 10.

Kennedy, R.V. (1970), "The Meaning and Measurement of Potential Gross National Product in Australia", Economic Record, Vol. 46, No.115, 341-54.

Keynes, J.M. (1936), The General Theory of Employment, Interest, and Money, Macmillan and Co., London.

Keynes, J.M. (1939), "Relative Movement of Real Wages and Output", Economic Journal, Vol. 49, No.193, 34-51.

ENDNOTES

1. Note that inputs are regarded as non-specific to products. Inputs merely generate a general capacity to produce which can be used to produce a variety of products. The optimal product-mix is derived through a revenue-maximization procedure.

2. The occupational classification is defined on the basis of skill differentiation (Craigie, 1979).

3. Only recently has ORANI been used for forecasting purposes. For a discussion of the differences between the forecasting and policy-analytic uses by ORANI, see Dixon et al. (1986).

4. Note that the use of Okun's Law in ORANI-IDM would be appropriate in a forecasting implementation of the model, where the aim of the simulation is to replicate the real world at a particular period in the future.

5. This was done by first mapping from the 112-industries classification used in ORANI to a 43-industries classification used in the 1981 Census data. Next, a mapping was established between these 43 industries and 67 occupations using 1981 Census data. The methodology for doing this is described fully in Ursi (1986). Finally, these 67 occupations were mapped to the 62 IHS occupations.

ABSTRACT

The ORANI model of the Australian economy is a useful tool for analysing a wide range of policy issues. One of its major limitations, however, is that, as yet, there is only one representative consumer in the model. This obviously limits the usefulness of the model for analysing distributional and welfare issues. Research is currently being undertaken at the IMPACT Centre (jointly with the Institute of Applied Economic and Social Research at the University of Melbourne) to overcome this limitation. This paper describes the output of Phase I of the research project; a tops-down model that was used to analyse the effect of taxation reform on the distribution of income among individuals. The results of that analysis were based on unit record data from the 1981-82 Income and Housing Survey (IHS). The paper also discusses some labour market issues pertaining to this version of the model. In particular, it critically evaluates two alternative ways of specifying the effect of employment changes on persons belonging to various labour force categories in the economy.

Labour force participation behaviour is critical for the proposed income distributional closure of ORANI. The proposed method would use available estimates of the parameters describing such behaviour without, however, hard-wiring these parameter estimate into the model. As the supply of labour market data and empirical studies improves, the participation parameters can be easily updated.

participation decisions are made jointly along with other consumer decisions regarding consumption, saving, leisure, and hours of work.

Thirdly, the study is not integrated into the theory of household decision-making since it measures the participation responses of individuals in response to changes in their own employment opportunities only. Thus, it ignores cross-effects among members of a given household. Models of household decision-making, however, show that these cross-effects may be significant. For example, the loss of a job by the male in a certain household might be an important factor in influencing the participation behaviour of other members of his household; in particular of his spouse and children.

It should be noted that the approach outlined above is extremely flexible and is not dependent on any particular set of behavioural parameters for participation. In particular, as more and better data become available, improved and/or updated behavioural coefficients can easily be incorporated into this scheme.

6 CONCLUSION

This paper describes current research aimed at making the ORANI model more suitable for the analysis of distributional issues. In particular, a method of linking employment changes in ORANI to changes in the personal distribution of income is proposed. This proposal necessarily involves an exploration of labour market issues. In doing so, it is found that Okun's Law is not a suitable basis for establishing this link when ORANI-IDM is used for policy-analytic simulations.

THE ORANI-INCOME DISTRIBUTION MODEL: LABOUR MARKET ISSUES

by

Nisha Agrawal*

1 INTRODUCTION

ORANI is a computable general equilibrium model in the tradition of Johansen (1960). Its theory, data requirements and solution procedure are comprehensively documented in Dixon, Parmenter, Sutton and Vincent (1982). The model has been applied many times in analyses of the effects on industries, occupational groups and regions, of changes in policy variables (e.g., tariff rates) and in other aspects of the economic environment (e.g., world commodity prices).

Despite its applicability to a wide variety of issues, however, the standard version of ORANI has one major limitation: it is not well suited to analysing certain important distributional issues. This is because the income-expenditure loop in the model is not closed. Given some shock to the economy, the model describes the changes that result in the distribution of income among factors, but not among households, the corporate sector and the government. This limitation

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* I would like to thank Alan Powell and Peter Dixon for helpful comments.

has been partially overcome through the development of the NAGA model, which is used in conjunction with ORANI to handle distribution between the public and private sectors. NAGA is described in appendices to Meagher and Parmenter (1985) and Dixon et al. (1985).

Research is currently being undertaken at the IMPACT Project (jointly with the Institute of Applied Economic and Social Research) to extend the ORANI model to make it useful for analysing other distributional issues of interest. In its extended form, the model will be capable of analysing the effect of economic changes on the distribution of income among various sectors in the economy (corporate, government and household) and also among various households in the economy (with different incomes and demographic characteristics).

A prototype of this extended model has already been used by Meagher and Agrawal (1986) to analyse the effects of taxation reform on the distribution of personal incomes. This version of the model will be referred to as the ORANI-Income Distribution Model (henceforth, ORANI-IDM) in the rest of the paper. In the tax reform analysis using the model, results from an ORANI-NAGA simulation were used to update unit record data from the 1981-82 Income and Housing Survey (IHS), and the outcomes for several groups in the economy were then measured using various distributional statistics.

The interface between the ORANI-NAGA model and the IHS data involves transferring certain macroeconomic data from the former to the latter. It also involves specifying a breakdown of the sources for the supply side of the labour market in ORANI. Ideally, of course, this breakdown should not only be able to capture the distributional effects

employment, then in the mining industry 94 males and 6 females will lose jobs. In the TCF industry, the corresponding numbers are 36 males and 64 females. An analysis of gross flows data by Foster (1981) shows that upon leaving employment, females are three times more likely to withdraw from the labour force than are males. Hence, the job losses due to the terms-of-trade shock are likely to have a much larger effect on the unemployment rate, and therefore on the government budget deficit (because of the rise in unemployment benefit payments combined with the fall in revenue from income taxes), than the ones due to the tariff reduction. From this example it is also clear that the two shocks are likely to differ significantly in how they alter the distribution of income between the sexes.

Clearly then, the approach outlined above has certain merits. Its main weakness, however, is that it is dependent upon obtaining reliable estimates of participation elasticities with respect to variables that influence participation behaviour. These might not always be easy to obtain. While the P & P study is the most disaggregated and recent one available, it has certain limitations. P & P estimated the various participation responses for 2 separate sub-periods: for 1966-1974 and for 1974-1983. They find that for some demographic groups, these responses vary significantly over the 2 periods.

Secondly, the equation estimated by P & P is a reduced form equation that has no explicit micro-underpinnings. The study does not examine participation behaviour within a consistent utility-maximizing framework for rational individuals. Theoretically at least,

the manufacturing sector, only 6 per cent are part-time jobs; the corresponding figure for the services sector is 20 per cent. This uneven distribution of F-T and P-T jobs across industries along with their uneven distribution across various demographic groups, implies that a change in the industrial composition of output, and hence of labour demand, is likely to have widely differing effects upon the employment opportunities of different demographic groups. Further, given the widely varying responses in the participation behaviour of different demographic groups (as measured by P & P, for example), this implies a highly variable relationship between aggregate employment and aggregate unemployment, which in turn has significant fiscal and distributional implications. A simple example will help clarify this proposition.

Let us compare the effects of two economic changes of current policy concern: a terms-of-trade decline and a tariff reduction in the textile-clothing-footwear (TCF) industry. This example will help shed some light on how the labour market consequences, the fiscal implications and the distributional effects of these shocks are likely to differ.

Suppose the terms-of-trade decline leads to a loss of 100 jobs in the mining industry (a major exporter) while the tariff reduction leads to a similar loss in the TCF industry. These identical changes in the numbers of jobs lost, however, are likely to have very different effects on unemployment. The reason is the different participation behaviour of males and females together with the different distribution of jobs between the sexes in the two industries. If we assume that jobs lost are in the same proportions as existing

of the shock on persons belonging to various labour force categories in the economy, but should also be consistent with labour market theory and data.

The aim of this paper is to provide a description of ORANI-IDM and to discuss some pertinent labour market issues. In particular, two alternative methods for decomposing labour supply into its various sources are presented, and their relative merits and demerits discussed. The remainder of the paper is structured as follows. Section 2 contains a description of ORANI-IDM. A brief review of the labour market in ORANI is presented in section 3. Section 4 discusses one method of calculating the sources of labour supply in ORANI-IDM using Okun's Law. It also points out the limitations of this approach. Section 5 discusses an alternative approach that explicitly models the participation behaviour of various groups in the economy. Finally, section 6 concludes the paper with a brief summary.

2 AN OVERVIEW OF THE INCOME DISTRIBUTION MODEL

As stated in section 1, the model used by Meagher and Agrawal (1986) to analyse the distributional effects of taxation reform is only a prototype of the model they are currently developing. In the version of the model used for that study (i.e.,in ORANI-IDM), the link between the factors used in the production of commodities and the ownership of those factors by individuals was fully established. In other words, a methodology was developed for assessing the effects of changes in the functional distribution of income (the distribution among factors) on the personal distribution of income (the distribution among individuals). No link, however, was established between changes in the personal

distribution of income and changes in the demand for various commodities. This will be done in Phase II of the research project, in which unit record data from the newly released Household Expenditure Survey (HES) for 1984 will be incorporated into the model. Once this link is established, the output-income-expenditure-output loop in ORANI can be completed, i.e.,feedback effects from changes in the demand for commodities arising from changes in income distribution will then influence the output of these commodities.

ORANI-IDM, the output of Phase I of the research project, is a tops-down model in which the effect of an economic change (policy or other) on the distribution of personal incomes is calculated in two stages. First, unit record data from the 1981-82 Income and Housing Survey are updated to incorporate the income changes indicated by the solutions of the ORANI-NAGA model. Second, the corresponding changes in various distributional statistics, including the Shorrocks I_0 index (Shorrocks, 1980) are computed and assessed. This scheme was adopted by Meagher and Agrawal (1986) to examine the distributional effects of a shift in the tax mix from direct to indirect taxation.

An understanding of this procedure can be gained by glancing at Figure 1. We started with pre-tax incomes (box 1), added some information on taxes and transfers (box 2), computed disposable incomes (box 3), and finally computed various statistics which measured the degree of inequality in the existing income distribution (box 4). Following an economic change (in our case, the tax reform) (box 5), we evaluated the effects of this change using an economic model (in our case, the ORANI-NAGA model) (box 6) and then used the solutions to

TABLE 2

FULL-TIME/PART-TIME AND MALE/FEMALE DISTRIBUTION BY INDUSTRY

Industry	Full-time Jobs (thousands)			Part-time Jobs (thousands)			All Jobs (thousands)
	Male	Female	Total	Male	Female	Total	Total
1. Agriculture	262	50	312	16	66	82	394
2. Mining	86	5	91	1	1	2	93
3. Food, beverages, tobacco	120	37	157	3	17	20	177
4. Textiles, clothing, footwear	34	53	87	1	10	11	98
5. Paper and wood	139	35	174	3	12	15	189
6. Chemicals and minerals	82	20	102	0	5	5	107
7. Metal products	191	15	206	2	4	6	212
8. Transport equipment	221	41	262	2	7	9	271
9. Other manufacturing	41	20	61	1	4	5	66
10. Electricity, gas & water	132	7	139	0	1	1	140
11. Construction general	173	9	182	4	13	17	197
12. Special trade	208	11	219	11	26	37	256
13. Wholesale trade	253	67	320	7	35	42	362
14. Retail - stores	87	88	175	8	56	64	239
15. Retail - motor vehicles	135	18	153	5	15	20	173
16. Retail - other	117	80	197	10	84	94	291
17. Road transport & storage	129	13	142	5	15	20	162
18. Other transport & storage	171	22	193	3	4	7	200
19. Communication	102	26	128	1	6	7	135
20. Finance	84	63	147	3	10	13	160
21. Insurance	37	28	65	2	6	8	73
22. Property & business	146	62	108	11	58	69	177
23. Public administration & defence	243	76	319	2	16	18	337
24. Health & veterinary services	86	182	270	5	105	120	390
25. Education services	155	145	300	16	95	111	411
26. Other community services	103	48	151	9	34	43	194
27. Recreation	32	17	49	8	18	26	75
28. Restaurants	69	44	113	12	72	84	197
29. Other services	18	25	43	6	23	29	72
All Industries	3658	1307	4965	157	818	975	5940

and marital status in the two markets. This can be confirmed by examining Table 2 (compiled from the IHS data) which shows the distribution of F-T and P-T jobs as well as the distribution of males and females across 29 industries. It can be easily calculated from this table that of all males who participate, only 4 per cent do so in the part-time market; the corresponding figure for women is almost 10 times as large (39 per cent). Alternatively, of all part-time jobs, males account for only 16 per cent of them, while the remaining 84 per cent are accounted for by women. Hence, in examining the distributional effects of an economic change, it is important to examine how the change affects F-T job opportunities relative to P-T ones.

Secondly, it is consistent with other studies which suggest that labour force participation in Australia is determined more by job opportunities rather than by wage and non-wage income effects. For example, Gregory's (1984) study of female participation behaviour, has presented evidence showing a close relationship between employment rates and labour force growth rates for women, and argues that their participation rate is primarily determined by employment opportunities rather than wage rates. Evidence suggests that this might be true for other groups as well (Withers, 1984).

Finally, this approach has some important policy implications. Table 2 presents evidence from the IHS data base to support the well-known empirical fact that the distribution of F-T and P-T jobs varies considerably across industries (Bureau of Labour Market Research, 1985, pp. 44). It shows, for example, that only 7 per cent of all part-time jobs are in the manufacturing sector, while almost 90 per cent are in the services sector. Looking at it differently, of all jobs in

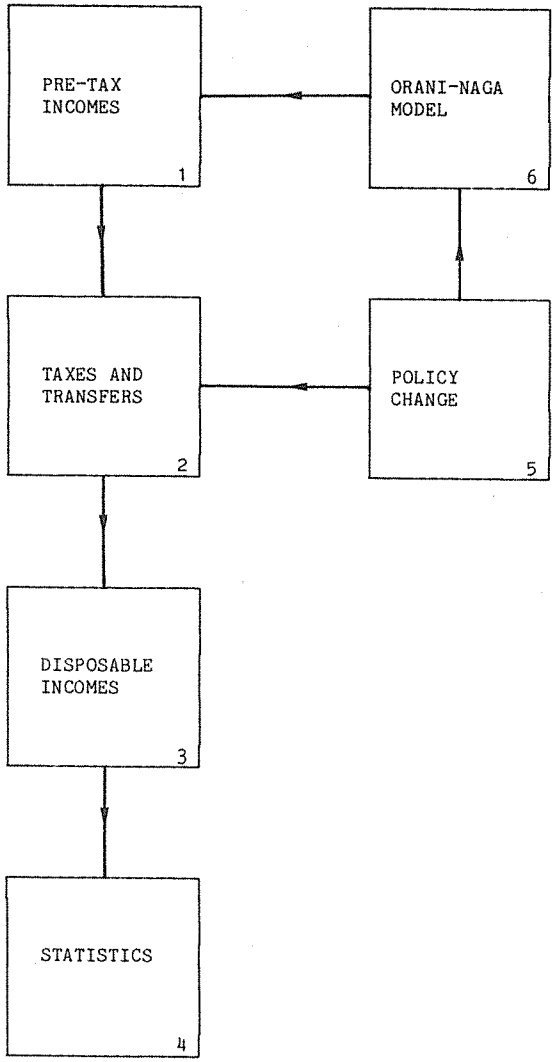

FIGURE 1: OVERVIEW OF ORANI-IDM

update the pre-tax incomes. Since the change involved alterations in the tax and transfer systems, the data used to calculate the new disposable incomes (box 2) were suitably modified. Finally, we recomputed the inequality measures and used them to compare the degree of inequality in the pre- and post-shock distributions of income.

Following a shock, the pre-tax IHS data were adjusted in 3 ways:

(1) Factor incomes were adjusted to reflect computed changes in factor prices;

(2) Incomes from transfer payments were assumed to be indexed to the consumer price index, and were adjusted accordingly;

(3) The population weight attached to each person in the IHS data was adjusted to reflect computed changes in the proportions of persons belonging to each of the labour force categories in the economy: employed, unemployed, and not in the labour force.

The first two adjustments are quite straightforward: all values required are obtained directly from the ORANI-NAGA simulation. It is the third set of adjustments which require some additional calculations and assumptions, and which we focus and elaborate upon below.

All persons on the IHS data tape can be classified into 3 categories according to their labour force status: employed, unemployed and not in the labour force. Further, each person in the sample has a

(7) Once movements in and out of the labour force have been taken into account, we can calculate the change in the numbers entering and leaving the workforce for each of the demographic groups. These can be used to adjust the weight attached to each person in the IHS data who is not in the labour force according to the demographic characteristics of the person.

(8) An increase in employment is met from two sources: the previously unemployed and the new entrants to the labour force. Once we know the change in the number of persons employed (for each demographic group) and the number of new entrants to the labour force (also for each demographic group), we can calculate the change in the number of persons unemployed (belonging to each of these groups). The IHS data tape provides information about whether a currently unemployed person is looking for F-T or P-T work. This can be used to calculate the change in the numbers of persons in each of these categories. These numbers can then be used to adjust the weight attached to each previously unemployed person depending on his/her age, sex and marital status, and depending on whether the person was looking for F-T or P-T work. The same procedure can be used following a decrease in employment.

The main attractions of using this approach are that it is easy to comprehend and implement. In addition, it is also consistent with recent developments in labour economics. For example, it recognizes the importance of market segmentation into F-T and P-T markets, and the fact that workers are distributed unevenly by age, sex

(4) Next, we break down the total job changes in each market (F-T and P-T) into changes in the number of jobs for each of the demographic categories for which we can obtain values for participation elasticities. Let us assume, for example, that we adopt the 7 categories in the P & P study. In the absence of any information about how the changes in the demand for workers in each occupation are distributed across these demographic groups, we make the simplifying assumption that the demographic composition of workers in each occupation remains unchanged. This assumption can be easily replaced when more information becomes available through future research in this area.

(5) We then aggregate the job changes across occupations to get the total change in the job opportunities for each of the demographic groups. This is done separately for the F-T and P-T employment changes.

(6) Next, we assume that the participation behaviour of persons belonging to each of these 7 demographic groups changes in response to the change in their employment opportunities. An increase in employment leads to increased participation from those previously not in the labour force. The degree of responsiveness varies depending upon whether the new opportunities are in F-T or P-T work, and upon the demographic characteristics of each person. A decrease in employment leads to some persons joining the pool of unemployed and some withdrawing from the labour force. Again, the behaviour depends upon the factors listed before.

population weight attached to her/him which reflects the number of persons in the population that this individual represents. A change in the demand for labour, following an ORANI simulation, leads to a change in the number of persons employed, and this leads to further changes in the number of persons belonging to the other two categories. The weights attached to each person in the sample therefore need to be adjusted to reflect the new proportions of persons in the various labour force categories.

To undertake these adjustments, we need to decompose the effect of the change in the number of employed persons into a change in the number of unemployed persons and a change in the number of persons not in the labour force. In the tax reform analysis, this was done by establishing an output-unemployment relationship using Okun's Law (Okun, 1962), which enabled us to calculate the change in the number of persons unemployed for a given change in output.

Given the change in the number of employed persons (from ORANI), and the change in the number of unemployed persons (using Okun's Law), the change in the number of persons belonging to the remaining category (those outside the workforce) was calculated as a residual. This was done by assuming that the population as a whole remained unchanged (in the short-run) as a result of the tax reform. Before elaborating on this methodology in section 4, the next section provides a brief review of the labour market in ORANI. This will help clarify the discussions in the remainder of the paper.

3 THE LABOUR MARKET IN ORANI

In ORANI, the demand for labour is endogenized and fully specified. It is derived as the result of a cost minimization process by the producers. Each producer is assumed to minimize unit costs of production, subject to given input prices and technological constraints. The production technology is shown in Figure 2. At the top level, intermediate inputs, primary factors, and 'other cost tickets' (miscellaneous production costs) are combined in fixed proportions to produce a given activity level.[1] At the next level, capital, labour and agricultural land (used only in agricultural industries) are combined according to CRESH technology to produce the required primary factors. Finally, at the lowest level, several occupational types of labour are combined, again using CRESH technology, to produce the composite labour input.[2]

Theoretically at least, each industry in ORANI (currently, 112) uses all occupations of labour (currently, 10). The demand for labour of a particular occupation m by industry j, L^d_{mj}, can be written as:

$$L^d_{mj} = L^d_{mj}\ (L^d_j,\ W_1,\ W_2,\ldots,\ A) \quad . \qquad (1).$$

It is a function of the industry's total demand for labour, L^d_j, of the relative prices of the different types of labour, W_m, and of various technical change variables, A. These labour demands can be aggregated across industries to obtain the total demand for labour for each occupational group, L^d_m as:

than F-T coefficients. It supports other evidence that shows that different demographic groups exhibit noticeably different participation behaviour.

Such a study could be usefully incorporated into our income distribution model to capture the differential effects of economic change on various demographic groups in the labour market. This could be done as follows:

(1) Suppose an economic change alters the demand for labour by various industries. From ORANI (using the standard assumption of no change in hours worked per person due to the shock) we get the change in the demand for persons by each of the 112 ORANI industries.

(2) We map these to the 62 IHS occupations.[5] This enables us to calculate the change in the number of persons employed in each of 62 occupations. These numbers can be used to adjust the weight attached to each employed person according to his/her occupation. This was the procedure adopted in Meagher and Agrawal (1986).

(3) Next, we decompose the total job changes in each occupation into changes in the number of F-T and P-T jobs. This could be done using the assumption that the ratio of F-T to P-T jobs in each occupation remains the same as the initial one in the IHS data base.

TABLE 1

LABOUR FORCE PARTICIPATION AND EMPLOYMENT, 1974 TO 1983

Dependent variable: participation rate	Estimated coefficients		Elasticity at means	
	Full-time employment (b_1)	Part-time employment (b_2)	Full-time employment	Part-time employment
Male teenagers (15-19)	.4639[a]	1.3884[a]	.330	.188
Female teenagers (15-19)	.3769[a]	.7917[a]	.232	.159
Young adult males (20-24)	.0794	.0835	.069	.004
Prime males (25-54)	.2571	.0659	.242	.002
Senior males (55+)	.9119[a]	1.1429[a]	.799	.107
Married women	.8959[a]	1.2248[a]	.486	.494
Non-married adult women(20+)	.8977[a]	.7588[a]	.692	.120
Aggregate	.4419[a]	.8395[a]	.351	.121

(a) Significant difference between full-time and part-time coefficients at 5 per cent level.

Source: Peters and Petridis (1985).

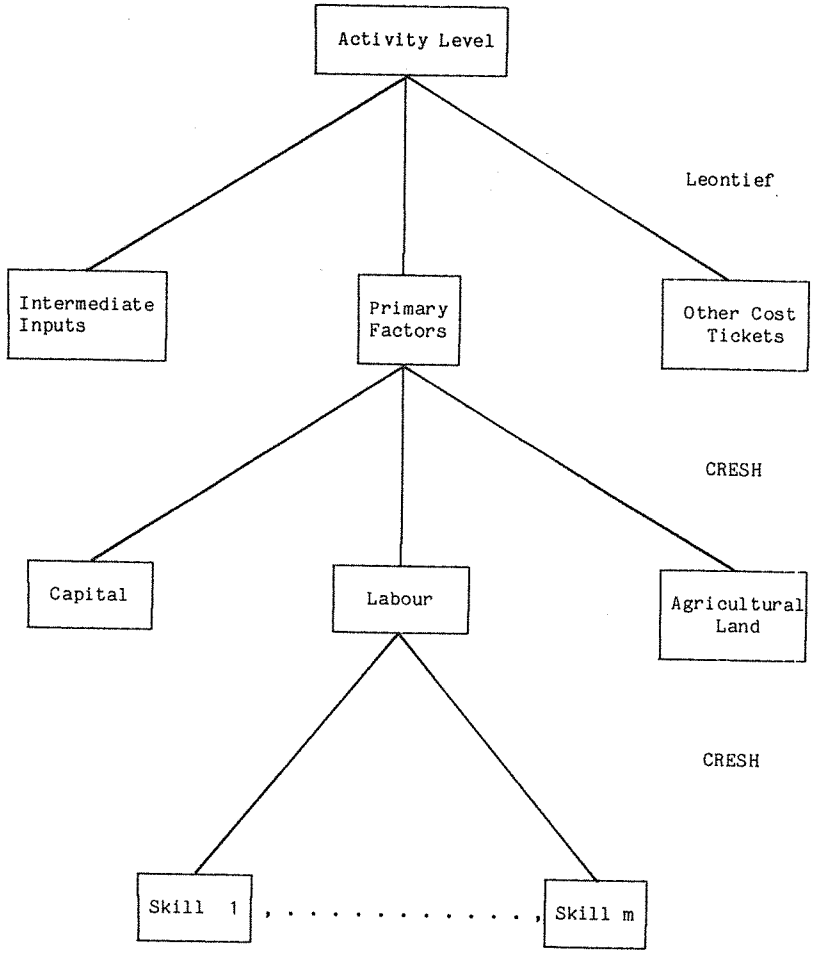

FIGURE 2 : PRODUCTION TECHNOLOGY IN ORANI

$$L_m^d = \sum_{j=1}^{112} L_{mj}^d \quad . \qquad (2).$$

The supply side of the labour market is left unspecified in the ORANI model. Given the existing flexible facility for choosing which variables should be endogenous and which should be exogenous that characterizes the ORANI computing system, the user can specify in any simulation, whether:

(1) wages are set exogenously with employment of person-hours endogenized; or

(2) employment of each occupation is set exogenously (at its full-employment or some other level) and wages endogenized.

In either case, it is assumed that each industry is operating on its demand curve for labour; that is, that employment and labour demand are equal. Unemployment is possible under both (1) and (2) since it is not required that labour supply and employment are equal. Given the current state of the labour market in Australia, with slack labour markets and institutionally set wages, the first closure seems to be the more appropriate one. It is therefore often the one adopted in standard, short-run ORANI simulations and is the one adopted here.

For most ORANI simulations, it is sufficient to evaluate the magnitude of the employment change that results from an economic shock, without any need to specify the breakdown of the effect of the employment change on various groups. For income distributional analyses, however, this additional information is crucial. Given an increase in employment, for example, it is important to know what

P & P estimate the participation responses of various demographic groups to changes in their probability of being employed. The employment ratio (the ratio of total employment to the working-age population) is interpreted as a proxy for the probability of being employed. The following equation is fitted for each of 7 demographic groups:

$$PR = \text{constant} + b_1\ FTER + b_2\ PTER \quad , \qquad (3)$$

where

PR = the labour force participation rate

FTER = the group-specific full-time employment ratio

PTER = the group specific part-time employment ratio.

The coefficients b_1 and b_2 capture the magnitude of the 'employment opportunity effect', which measures the discouragement to labour force participation of a shrinking job market and encouragement to participation of an expanding one (Tella, 1965). It should be noted that the authors attempted to improve the specification in equation (3) by including additional arguments such as wage and income variables. These variables were dropped later, however, since "the results were never satisfactory enough to give up the more clearcut intepretative value of the original equation."

The results of their estimations for the period 1974 to 1983 are presented in Table 1. The table shows a marked dispersion of F-T employment coefficients and, for the groups for whom P-T employment is important (teenagers and married women), significantly higher P-T

previously outside the workforce in response to a change in their employment demand (obtained from ORANI). The change in the number of unemployed persons could then be calculated as a residual, under the assumption that the population remained unchanged as a result of the economic shock under consideration. For example, suppose that a tariff reduction caused employment demand to increase by 10 workers. Suppose also, that this increase in employment opportunities induced 3 non-participants now to enter the workforce. Then, we can surmise that the number of unemployed persons must have declined by 7 due to the tariff reduction.

While a breakdown of the effect of employment changes on the aggregate number of those unemployed and the aggregate number of those outside the workforce is important, it is still only a starting point. As described earlier, the strengths of the discouraged worker and the additional worker effects depend on the demographic characteristics of individuals and the households to which they are attached. For distributional analysis, it is desirable to capture these differing effects. This could be done by classifying the population according to demographic characteristics, and using estimated values of participation elasticities for each of these groups. One recent source for these elasticity values is the P & P study. They measure the value of these elasticities, not only for various demographic groups, but also for full-time (F-T) and part-time (P-T) labour markets,separately. This has been done to take account of the segmentation of labour markets into F-T and P-T markets, with very different wages and hours-of-work packages offered in the two markets.

proportion of the newly created jobs are filled by those previously unemployed, and what proportion by those who were previously not in the workforce but have now been encouraged to participate in response to the increase in their employment opportunities. Since the income profiles and demographic characteristics of these two potential sources of workers vary considerably, the distributional impact of a change hinges significantly upon its relative impact on these two groups.

This paper presents two alternative methods of measuring this breakdown of the effect of employment changes on the unemployed and on those outside the workforce. The first is the one outlined in section 2: it uses Okun's Law and was adopted in ORANI-IDM. The second is a new proposal that explicitly models the participation behaviour of various individuals. In the next section, we elaborate on the first methodology. In particular, we point out the unsuitability of applying an empirical relationship like Okun's Law to the comparative-static experiments performed using ORANI.

4 APPLICATION of OKUN'S LAW TO ORANI-IDM

4.1 Okun's Law

In his study of business cycles in the U.S. economy during the period 1945-60, Okun observed an empirical relationship between output changes and unemployment changes that later came to be known as Okun's Law. According to this 'law', a decrease of one percentage point in the unemployment rate was accompanied by an increase in real GNP of 3.2 per cent. Since then, numerous alternative empirical specifications of Okun's Law have been investigated for the American economy, with

remarkably similar results, typically suggesting between a 2 and 3 to 1 relationship between output and unemployment.

A number of studies (Kennedy, 1970; Kalisch, 1982; Nguyen and Siriwardana, 1986) have estimated the value of Okun's coefficient for Australia. Kennedy's study covered the 1950 to 1968 years and estimated a value of 5 for Okun's coefficient. Kalisch focused on a later sample period, 1960 to 1980, during which unemployment became significantly higher, and established a value of 2.8 for the coefficient (a number quite similar to Okun's own results). More recently, Nguyen and Siriwardana (henceforth, N & S) estimated the value of Okun's coefficient for the period 1959-1985 and confirmed the estimates from both the previous studies; they estimated a value of 4.5 for the pre-1974 period and a value of 3 for the period since. They found that in Australia, Okun's relationship underwent a structural change around the third quarter of 1974; after this break, the unemployment rate became more responsive to variations in output.

In their study on tax reform, Meagher and Agrawal used a post-1974 value of 3 for Okun's coefficient for Australia. This value was used to establish a 3 to 1 link between output changes (obtained from ORANI) and unemployment changes. This approach, however, is unsuitable for the reasons discussed below.

4.2 Apparent Inconsistency Between ORANI and Okun's Law

Okun's Law asserts that a reduction in unemployment, measured as a percentage of the labour force, has a much larger than proportional effect on output. Clearly, the addition of 1 per cent of a given labour

among those whose labour force participation is discretionary. To operate, this effect needs a pool of economically inactive individuals who have a reasonable expectation of obtaining employment if they enter the labour force. (Note that we are thus postulating differential degrees of slackness in the labour market, an idea which is not captured in the 'slack-labour-market' closure of ORANI). Thus, it is argued that teenagers and married women are the main sources of additional workers. In addition to being a function of the sex, age and marital status of persons, the additional worker effect is also likely to depend upon the socio-economic status of the households. For example, it is likely to be small for families whose main breadwinner is in a skilled or professional occupation with reasonably secure job prospects.

Since the discouraged worker effect and the additional worker effect work in opposite directions, theoretically at least the sign of the relationship between net changes in participation and changes in employment is ambiguous. A number of recent empirical studies (see, for example, Peters and Petridis, 1985) show, however, that while the relative importance of these two effects varies considerably among different demographic groups, the discouraged worker effect dominates the additional worker effect for all groups. This is true, for example, for the 7 demographic groups (classified according to age, sex and marital status) in the Peters and Petridis (henceforth, P & P) study. This implies that an increase in employment opportunities results in a net increase in the number of participants in the labour force.

A study evaluating participation elasticities could be usefully incorporated into our income distribution model. It would enable us to directly measure the change in the number of persons

in their employment opportunities. As stated earlier, for income distribution analysis it is essential to know the breakdown of the effect of employment changes on these two potential sources of labour supply. There is no mechanism in ORANI, however, to measure these relative impacts.

One possibility is to try to evaluate directly the effect of changes in employment on changes in participation behaviour. Short-term movements of persons in and out of the labour force are hypothesized to occur due to the operation of two effects: the 'discouraged worker effect' (attributed to Douglas, 1930), and the 'additional worker effect' (attributed to Woytinsky, 1940). A brief description of these effects will help facilitate the analysis.

(1) The discouraged worker effect - in a slack labour market, some persons withdraw from the labour force when they are convinced that job hunting is a hopeless pursuit. Also, some people who would ordinarily have entered the labour force, do not do so for the same reason. This is known as the discouraged worker effect. The operation of this effect varies with respect to the age, sex and marital status of persons. For example, it is more likely to operate in the case of married women (who instead continue domestic activity) and youths (who continue education). Discouragement is also likely to be apparent in older workers who retire early instead of persevering with the job search.

(2) The additional worker effect -- in a slack labour market, the loss of a job by a family's main breadwinner might induce other family members to enter the workforce to supplement family income. This is known as the additional worker effect. It implies a change in behaviour

force to the ranks of the employed would increase employment by only slightly more than 1 per cent: by 100/(100-U) per cent to be exact, where U is the unemployment rate. If the work week and average labour productivity were unchanged, the increment to output would be only that 1+ per cent. The 3 per cent result implies that considerable output gains in a period of rising utilization must stem from some or all of the following:

(a) greater productivity
(b) longer average weekly hours
(c) induced increases in the size of the labour force.

Of these factors, the largest output increases were caused by the accompanying productivity gains: these alone accounted for almost 50 per cent of the output changes. An apparent inconsistency arises here between the positive productivity-output relationship revealed by Okun's Law and the inverse one postulated by the ORANI model. In ORANI, in the standard short-run policy-analytic closure with slack labour markets, output increases are accompanied by a decline in both average and marginal labour productivity. This productivity decline occurs because capital per worker declines, as more labour is now employed with the same given stock of capital. On the other hand, part of the productivity increase underlying the empirical validation of Okun's Law stems from the secular increase in the capital stocks.

The inverse relationship between output and productivity in short-run ORANI simulations is the standard one postulated by theory. The positive empirical relationship, however, has also been verified by

several studies, including Okun's. What explains this inconsistency? This question is addressed in the next sub-section.

4.3 Resolution of the Inconsistency

As stated in section 1, ORANI has been widely used to analyse the effects of economic changes on various groups of interest. These applications of ORANI have always been of a comparative static nature, i.e., they have been concerned with questions of how different the economy would be with and without the changes under investigation.[3] In this policy-analytic mode, the effect of the change in the variable under investigation on other variables of interest is isolated. Hence, the ceteris paribus assumption is explicitly invoked, i.e., it is assumed that all other variables except the one changed remain invariant.

Hence, in the tax reform analysis using ORANI, it was explicitly assumed that of all the exogenous variables in the model, only those relating to the tax and transfer structure changed; all other exogenous variables such as average hours worked per person, capacity utilization, capital stocks, technology and market structures were assumed to remain unchanged as a result of the tax reform. These, however, are the very factors responsible for the positive output-productivity relationship measured empirically by Okun: they obviously cannot be held constant in the real world.

This inconsistency between the outcome of comparative static exercises and the outcome of empirical measurements from the real world is of historic significance as well. It was observed and commented upon

by economists as early as in the 1930's (see, for example, the exchange between Dunlop (1938) and Keynes (1936, 1939)). Keynes wrote in the General Theory (1936) that under perfect competition, and "with a given organization, equipment and technique ...," the inverse output-productivity relationship was "simply the obverse of the familiar proposition that industry is normally working subject to decreasing returns in the short-run ...." As Dunlop (1938) pointed out, however, the problem arises in "directly assuming the statement valid for the actual economic system regardless of the qualifications ...." It is precisely because of changes in organization, equipment and technique and changes in the degree of monopoly, that productivity rises with output during the course of cyclical fluctuations in activity in the real world.

Clearly then, Okun's Law and comparative static simulations with ORANI relate to totally different types of economic changes, and in retrospect it was therefore inadvisable to incorporate Okun's Law into our policy-analytic implementation of ORANI-IDM.[4] Instead, for our current purposes, it would be more desirable to relate employment changes directly to changes in participation behaviour. This could be done as outlined in the following section.

5 MODELLING PARTICIPATION BEHAVIOUR

An increase in the demand for labour, under the assumption of slack labour markets in ORANI, leads to an increase in the number of persons employed. These newly employed come from two sources: those who were previously employed, and those who were previously not in the