Impact Project

Impact Research Centre, The University of Melbourne,
153 Barry Street, Carlton, Victoria 3053 Australia.

Telephone: (03) 344 7417 (*from overseas:* 61 3 344 7417)
Telex: AA 35185 UNIMEL Telegrams: UNIMELB, Parkville
Facsimile: (03) 344 5104 (*from overseas:* 61 3 344 5104)

Paper presented to the 4th Monash Tax conference on
"Flattening the Tax Rate Scale: Alternative
Scenarios and Methodologies"
Monash University, Melbourne
December 3-4, 1987

ANALYSING OPTIONS FOR FISCAL REFORM IN THE PRESENCE OF INVOLUNTARY UNEMPLOYMENT

by

Nisha Agrawal
IMPACT Research Centre
and
Industries Assistance Commission

G.A. Meagher and B.F. Parsell
Institute of Applied Economic
and Social Research

General Paper No. G-81 Melbourne December 1987

ISSN 0813 7986 ISBN 0 642 10240 6

ABSTRACT

A common feature of attempted fiscal reform around the world in the 1980's has been a move towards a flattening of the personal income tax scale. This has usually involved a reduction of the marginal tax rates on high income earners combined with several measures designed to broaden the tax base to make up for the revenue lost. Several proposed reforms are current in the contemporary Australian debate. In this paper, we examine the macro and distributional effects of one of several proposals canvassed by the Centre of Policy Studies (COPS) at Monash University, Melbourne. The revenue loss due to the flattening of the tax scale is accompanied in the COPS proposals, not by a broadening of the tax base, but by a reduction in the size of the government. The implications of such a move, in the current era of high unemployment, are explored in this paper. We also examine the implications of the scale flattening under alternative fiscal and wage scenarios. Our results are based on simulations using an extended version of the ORANI model of the Australian economy, taken in conjunction with an updated version of the unit record data from the 1981/82 Income and Housing Survey conducted by the Australian Bureau of Statistics.

CONTENTS

LIST OF TABLES

ANALYSING OPTIONS FOR FISCAL REFORM IN THE PRESENCE OF INVOLUNTARY UNEMPLOYMENT

by

Nisha Agrawal, G.A. Meagher and B.F. Parsell*

1. INTRODUCTION

In two recent papers, researchers at the Centre of Policy Studies (COPS) have argued that flattening the income tax scale will lead to significant increases in welfare and employment (see Bascand and Porter, 1986, and Bascand and Trengove, 1987). The welfare gains originate in a reduction of the deadweight losses associated with a distortion of the labour-leisure choice. The employment gains follow from increases in labour supply under an assumption of full employment. An opposite position has been adopted by Apps (1987), who criticizes the implementation of the COPS model, particularly their use of certain labour supply elasticities.

---

* The authors are indebted to Brian Parmenter and Alan Powell for their comments on an earlier draft of this paper. Financial support from the Australian Research Grants Scheme is also gratefully acknowledged.

Both sides of the controversy base their positions on results obtained from a partial equilibrium analysis of consumer behaviour. Their models are applied to individuals identified in the 1981/82 Income and Housing Survey (IHS). Our study also utilizes this database. We, however, incorporate it into a general equilibrium model of the Australian economy. This enables us to evaluate the effect of relaxing two crucial assumptions adopted in the partial equilibrium studies:

(i) that the tax reform does not affect the pre-tax money incomes (excluding government benefit payments) of individuals; and

(ii) that the tax reform does not affect the number of unemployed persons in the economy.

The studies mentioned above either assume full employment or do not explicitly deal with the problem of involuntary unemployment. In the Australian context, high levels of (presumably involuntary) unemployment have existed for many years. Under these circumstances, a full-employment model has to be regarded as a "long-run" theoretical construct which would become more empirically relevant only if full employment were to be restored at some point in the future. However, current economic conditions do not encourage optimism in this regard, and for policy purposes it becomes important to know how the analysis of the tax reform would be affected by a suspension of the full-employment assumption.

In this paper we present an analysis of the short-run consequences of flattening the tax scale under various assumptions about

the setting of other instruments of fiscal policy and about the outcome of the wage fixation process. The analysis depends on simulations using an extended version of the ORANI model of the Australian economy. Distributional effects are generated by interfacing the model with unit record data derived from an updated version of the 1981-82 Income and Housing Survey. Relevant details of the model are supplied in Section 2 of the paper, together with an account of the specification of the simulations. Section 3 contains an analysis of the macroeconomic effects of the reform and Section 4 explains the method whereby the macro results are used to generate changes in distributional variables. In Section 5 we discuss the implications of the proposed tax reform for the distribution of employment and real disposable incomes of individuals. Conclusions are drawn from the analysis in Section 6.

2. SPECIFICATION OF THE SIMULATIONS

2.1 The Model

The ORANI multisectoral model of the Australian economy is well known, having been applied by many users to a wide range of policy issues.[1] The standard version of the model is comprehensively documented in Dixon et al. (1982). In recent applications, it has often been augmented with a system of equations designed to improve its description of the national and government accounts. This extension, referred to as the NAGA model, is specified in Meagher and Parmenter (1985, 1987). The NAGA database used in our simulations is set out in

Table 1, while a record of the relevant ORANI database can be found in Blampied (1985).

To generate the distributional effects of some policy shock, a solution to the ORANI/NAGA model is first computed[2] to determine its effects on a range of macro and structural variables of the economy. A selection of these variables (concerning employment, factor prices and commodity prices) are then used to revise the incomes and population weights of the income recipients identified in the unit record data. Finally, distributional statistics for various groups are computed from the revised (post-shock) records and compared with the corresponding statistics computed from the original (pre-shock) records. This methodology is described in more detail in Section 4.

The pre-shock records themselves are derived from the 1981/82 IHS unit record data by updating weights and incomes to conform to historical values for 1984/85. In particular, the population weight attached to each individual in the database is adjusted to reflect the numbers belonging to various employment status categories. Further, individuals' incomes from each source are adjusted so that they sum to aggregate values of the corresponding income types obtained from the national accounts. The latter process also involves imputing income from sources not identified in the IHS such as interest from life insurance and superannuation funds, rent from owner-occupied housing and returns to agricultural land.

TABLE 1

NATIONAL AND GOVERNMENT ACCOUNTS, 1984/85, $ million

i	Category i	Value A_i
	Composition of GDP as income	
1	Disposable labour income	85956
2	PAYE taxes (net)	23424
3	Payroll taxes	3644
4	VAT (labour inputs)	0
5	Cost of employing labour ($\Sigma_{i=1}^{4} A_i$)	113024
6	Disposable capitalist income	66785
7	Taxes on profits and self employment	11903
8	Gross operating surplus ($A_6 + A_7$)	78688
9	Commodity taxes less subsidies	13793
10	VAT (non-labour inputs)	0
11	Other indirect taxes	9008
12	Total non-labour income ($\Sigma_{i=8}^{11} A_i$)	101489
13	Gross domestic product ($A_5 + A_{12}$)	214513
	Composition of GDP as expenditure -	
14	Private consumption	126681
15	Government consumption	41042
16	Private investment	34186
17	Government investment	17445
18	Total absorption ($\Sigma_{i=14}^{17} A_i$)	219354
19	Exports	34176
20	Imports	39017
21	Balance of trade surplus ($A_{19} - A_{20}$)	-4841
22	Gross domestic product ($A_{18} + A_{21}$)	214513
	Composition of government income -	
23	Taxes on income ($A_2 + A_7$)	35327
24	Payroll taxes (A_3)	3644
25	Commodity taxes	17263
26	VAT ($A_4 + A_{10}$)	0
27	Other indirect taxes (A_{11})	9008
28	Other government income	6388
29	Total government income ($\Sigma_{i=23}^{28} A_i$)	71630
	Composition of government outlays -	
30	Government consumption (A_{15})	41042
31	Government investment (A_{17})	17445
32	Total government expenditure ($A_{30} + A_{31}$)	58487
33	Unemployment benefits	2984
34	Other transfers to persons	18396
35	Other outlays	13605
* 36	Total government outlays ($\Sigma_{i=32}^{35} A_i$)	93472
	Other categories	
37	Public sector borrowing requirement ($A_{36} - A_{29}$)	21842
38	Net government income ($A_{32} - A_{37}$)	36645
39	Total disposable income ($A_1 + A_6 + A_9 - A_{25} - A_{28} + A_{33} + A_{34} + A_{35}$)	177868

Sources: "Australian National Accounts, National Income and Expenditure, 1985-86", ABS Catalogue No. 5204.0 and "Estimates of Expenditure and Receipts of the Commonwealth Public Account 1985-86", Budget Paper No. 5.

2.2 The Tax Reform

The tax reform considered in our simulations consists of:

(i) replacing the actual progressive income tax scale for 1984/85 with the flatter scale proposed under Option T by the Centre of Policy Studies (see Table 2);

(ii) abolishing the Medicare levy; and

(iii) replacing the spouse, sole parent, pensioner and other rebates with a general rebate of $750 per annum, withdrawn at 25 cents in the dollar for incomes exceeding $17,000.

We shall refer to this reform as Option T, although it excludes an adjustment to family transfer payments that was also part of the original COPS proposal.

To convert the reform into a policy shock that can be handled by the ORANI/NAGA model, we compute its impact effect (i.e., assuming no change in the tax base) on the average rates of tax on income from wages and salaries and income from profits and self employment. The calculation proceeds in four steps:

TABLE 2

ACTUAL AND PROPOSED PERSONAL INCOME TAX SCHEDULES

Pre-Shock Incomes		Post-Shock Incomes	
Taxable Income ($)	1984-85 Marginal Tax Rate (per cent)	Taxable Income ($)	Option T Marginal Tax Rate (per cent)
Up to 4595	0	Up to 19499	20
4596 - 12500	26.67		
12501 - 19500	30	19500 and above	30
19501 - 28000	46		
28001 - 35000	47.33		
35001 - 35788	55.33		
35789 and above	60		

(i) After deriving taxable incomes by subtracting tax deductions (values obtained from taxation statistics), from assessable incomes, the 1984/85 income tax scale and rebate structure are applied to each individual's pre-shock taxable income to determine a provisional value of total personal income tax paid.

(ii) An across-the-board reduction in the rate of income tax is imposed to bring the provisional value into line with the value ($29.3 billion) recorded in the national accounts.

(iii) Using the same allocation of deductions (as in step 1) and the same across-the-board rate reduction (as in step 2), the Option T tax scale and rebate structure are applied to the pre-shock taxable incomes. This yields total personal income tax revenue of $24.0 billion, i.e., the impact effect of the reform is to reduce personal income tax by $5.3 billion.

(iv) The reduction in personal income tax is allocated between wages and salaries ($3.5 billion) and other household factor income ($1.8 billion) in proportion to household income from the two sources in 1984/85. Assuming no change in the rate of tax on the income of incorporated enterprises, the impact effect of the reform reduces the average rate of tax on wages and salaries by 17.9 per cent and that on income from profits and self employment by 8.8 per cent.[3]

To recapitulate, Option T is modelled first as reductions in the average rates of tax on labour and capital income of 17.9 and 8.8 per cent, respectively. The ORANI/NAGA model determines the effects of these reductions on macro and structural variables of the economy, some of which are used to update the unit record data, i.e., to compute the post-shock unit records. The tax scale and rebate structure for Option T are applied to the post-shock records to compute post-shock, post-tax incomes. These are compared with pre-shock, post-tax incomes obtained by applying the actual 1984/85 tax scale and rebate structure to the pre-shock unit records.

2.3 The Economic Environment

In the sections that follow, we report results for four different simulations of the effects of Option T. The simulations differ in the assumptions made about the accompanying movements in wage rates, income tax revenue and current government expenditure on goods and services. As we have already seen, Option T not only reduces the progressivity of the income tax scale but also reduces income tax revenue, at least as far as its impact effect is concerned. In Simulation I, we assume that the government imposes an across-the-board increase in the personal income tax rate such that, when combined with Option T, its impact effect on tax revenue is zero. We further assume that wage rates and government spending remain constant in real terms when the reform is introduced. Under these conditions, no shocks are applied to the ORANI/NAGA model and the reform therefore has no effect on the macro and structural variables. The purpose of Simulation I is

to identify separately the effect of the reduction in progressivity on the distribution of post-tax incomes.

Simulations II and III focus on the role of the government's fiscal response when income tax revenue is allowed to decline. Simulation II assumes that real government consumption remains constant and that the revenue decline simply adds to the public sector borrowing requirement. Simulation III assumes that the government reduces its consumption to keep the public sector borrowing requirement constant. In both cases, the real pre-tax hourly wage rate (CPI deflated) remains constant. The wage assumptions correspond to the objective of 'real wage maintenance' that has been traditionally pursued by the Australian trade union movement when faced with increases in the consumer price index. Taken together, the two simulations distinguish between the effects of the tax reform itself and the effects of a measure that the government might undertake to maintain fiscal restraint.[4]

When the pre-tax real wage rate is held constant, the tax reform implies a 'fiscal dividend' for employed workers, i.e., an increase in the post-tax real wage rate. In the final simulation we adopt an alternative view of the outcome of the wage fixation process. In Simulation IV, we suppose that the government negotiates a tax-wage bargain with the unions in which they require only that the post-tax real wage rate does not fall when the tax reform is implemented.[5] In that case, the fiscal dividend allows a reduction in the real and nominal pre-tax wage rates. The public sector borrowing requirement is again held constant. The final simulation is designed to highlight the

importance of movements in wage rates precipitated by the tax reform in determining its eventual repercussions on the rest of the economy.

In all cases, the simulations are short run in the sense that industry-specific land and capital in use are exogenous, with rental rates adjusting to ensure that these factors remain fully employed. A suitable calendar time interpretation of the short-run adjustment period is about two years (Cooper, McLaren and Powell, 1985). The labour market is assumed to be slack. The model includes an absorption function which requires that real private consumption and investment each vary directly with real disposable income. Real public investment is assumed to move with real private investment. The nominal exchange rate is the numeraire.[6]

3. MACRO RESULTS

The ORANI-NAGA model generates results for the macroeconomy, the government accounts and a wide range of structural variables, including the industrial composition of production and the occupational composition of employment demand. In this paper, we restrict our attention to the selection of macro and fiscal variables listed in the rows of Table 3. The four columns of the table represent the four simulations described in the last section. Our results are typically presented in percentage change form. Thus the value 6.50 given for the consumer price index in the second column has the following

TABLE 3

PROJECTED EFFECTS OF FLATTENING THE TAX RATE SCALE
UNDER ALTERNATIVE FISCAL AND WAGE ASSUMPTIONS:
SELECTED MACRO VARIABLES

	Simulation	I	II	III	IV
	Fiscal Assumption	ATR[a] constant, Government expenditure[b] constant	ATR reduced, Government expenditure constant	ATR reduced, PSBR[d] constant	ATR reduced, PSBR constant
	Variable* / Wage Assumption	Pre-tax wage rate[c] constant	Pre-tax wage rate constant	Pre-tax wage rate constant	Post-tax wage rate constant
1	Factor cost GDP deflator (FCD)	0.00	6.29	-0.24	-1.96
2	Consumer price index (CPI)	0.00	6.50	0.31	-0.95
3	Private absorption deflator (PAD)	0.00	6.28	0.28	-1.35
4	Government price index (GPI)	0.00	6.13	-0.20	-4.74
5	Pre-tax nominal wage rate	0.00	6.50	0.31	-5.84
6	Pre-tax real wage rate (CPI deflated)	0.00	0.00	0.00	-4.89
7	Tax rate on profits and self-employment	0.00	-8.84	-8.84	-8.84
8	PAYE tax rate	0.00	-17.95	-17.95	-17.95
9	Post-tax real wage rate (CPI deflated)	0.00	4.89	4.89	0.00
10	Disposable labour income	0.00	11.60	1.58	2.57
11	Disposable capitalist income	0.00	7.78	0.01	5.99
12	Government transfers	0.00	6.34	2.99	-3.56
13	Nominal disposable income	0.00	9.18	1.16	3.06
14	Real disposable income (PAD deflated)	0.00	2.90	0.88	4.41
15	Export receipts	0.00	-7.08	-0.14	4.11
16	Import expenditure	0.00	5.34	-0.63	2.26
17	Balance of trade surplus	0.00	-2.10	0.09	0.24
18	Real gross domestic product	0.00	0.15	-2.34	2.73
19	Aggregate employment	0.00	0.21	-3.62	3.52
20	Real private consumption	0.00	2.90	0.88	4.41
21	Real current government expenditure	0.00	0.00	-17.23	-7.08
22	Public sector borrowing requirement	0.00	2.83	0.00	0.00

* All variables are expressed as percentage changes except the balance of trade surplus and the public sector borrowing requirement, which are expressed as percentages of gross domestic product.

a Average rate of personal income taxation

b Real current government expenditure on goods and services

c Real (CPI deflated) wage rate

d Public sector borrowing requirement

interpretation: about two years after the introduction of the tax reform, the CPI will be 6.50 per cent higher than it would have been in the absence of the reform.

The first column of Table 3 contains only zeros, in accordance with our discussion of Simulation I in Section 2. In Simulation II, the results are driven by the increase in the real disposable income of employed workers that follows from a cut in the average rate of income tax when the pre-tax real wage rate is constant. That increase is converted into an increase in real private consumption and investment via the absorption function, setting in motion a multiplier effect on domestic output and employment and increasing imports. Since the short-run supply curves slope upwards, prices rise and induce a matching increase in money wages. Hence the international competitiveness of the economy declines, exports fall and imports capture a larger share of domestic markets. As a result, there is a shift in output and employment from the traded to the nontraded sector, with a small net gain. The balance of trade moves towards a deficit and the public sector borrowing requirement increases.

In Simulation III, we suppose that the government reduces its real consumption to eliminate the expansion in its borrowing requirement. Each dollar of income tax revenue foregone as a result of the tax reform adds a dollar to private absorption, but must now be matched by a reduction of one dollar in government consumption. Because the combination of commodities purchased by the government is much more labour intensive in its production than the combination purchased by the private sector, the shift in the composition of final demand causes a

reduction in employment. As employment contracts, real disposable income and real private absorption follow, instigating a downward multiplier effect on output and employment. The eventual losses are quite substantial. The decline in demand reduces cost pressures and avoids the loss of competitiveness which occurred in Simulation II. Hence there is now little change in the balance of trade. Finally, as activity slows down, the tax base contracts and transfer payments expand, necessitating additional cuts in government spending to curtail the increase in the borrowing requirement. The eventual cost is a $7.0 billion (or a 17.2 per cent) cut in government spending rather than the $5.3 billion cut indicated by the impact effect of the reform.

In practice, the results for Simulation III could be expected to be moderated somewhat, as such large reductions in government expenditure are likely to shift the composition of private consumption in favour of commodities (health, education, etc.) that were previously supplied by the government. Such shifts are not captured in these simulations since the demands by households for items like health services in ORANI are not treated as functions of the levels of such services provided by the government. Clearly, Simulations II and III affirm that the difference in the labour intensity of the commodities purchased by the public and private sectors is capable of producing substantial macro effects for a reform of the size of Option T. Further work would be needed to evaluate the strength of these compositional effects.

In both Simulations II and III, workers who retain their jobs receive a fiscal dividend (i.e., an increase in their post-tax real wage

rate) of 4.89 per cent. In Simulation IV we assume that employed workers settle for the lesser requirement of being made no worse off by the reform. In that case the fiscal dividend can be enlisted to improve the competitiveness of the economy via substantial reductions in the pre-tax nominal wage rate.[7] Output and employment increase strongly, especially in the traded sector. However, although domestic producers increase their share of local markets, the demand for imports still increases sufficiently to prevent any marked improvement in the balance of trade. The expansion in economic activity this time increases the tax base and reduces the size of the required cut in government consumption. The change in the macroeconomic outlook for the economy induced by the change in the wage assumption is quite striking.

4. INTERFACING THE ORANI-NAGA MODEL WITH THE UNIT RECORD DATA

As indicated in Section 2, our strategy for generating distributional results depends on revising the pre-shock unit records (derived from the IHS) according to the projected values of a number of "interface" variables obtained from the ORANI-NAGA simulations. The information in the unit records includes the amount of (pre-tax) income a person received from each of the possible income sources, and a weight which reflects the number of people in the population that the person represents. The post-shock unit records are formed by revising the values of these incomes and weights.

4.1 Revising Pre-Tax Incomes

Table 4 contains projections for a selection of ORANI-NAGA variables describing factor prices and commodity prices. The projections for the pre-tax nominal wage rate and the consumer price index have already been discussed in the context of Table 3. For the remaining projections, three observations are pertinent:

(i) Returns to fixed factors in agriculture vary inversely with the pre-tax nominal wage rate, an increase in the latter being associated with a deterioration in the international competitiveness of the economy.

(ii) The return to capital in the ownership of dwellings industry increases strongly with real private consumption (see line 20, Table 3). This industry represents the utilization of the housing stock. Its price is the rental price of housing, including imputed rents on owner-occupied dwellings. In our simulations, the housing stock in use is assumed to be unaffected by the shock. Hence, increases in private consumption, as in Simulations II and IV, just bid up housing rents (actual or imputed).

(iii) The real return to capital increases most strongly under the tax-wage bargain scenario (Simulation IV).

The projections in Table 4 provide the means for adjusting the

TABLE 4

PROJECTED EFFECTS OF FLATTENING THE TAX RATE SCALE
UNDER ALTERNATIVE FISCAL AND WAGE ASSUMPTIONS:
SELECTED INTERFACE VARIABLES

	Simulation	I	II	III	IV
	Fiscal Assumption	ATR[a] constant, Government expenditure[b] constant	ATR reduced, Government expenditure constant	ATR reduced, PSBR[d] constant	ATR reduced, PSBR constant
Variable*	Wage Assumption	Pre-tax wage rate[c] constant	Pre-tax wage rate constant	Pre-tax wage rate constant	Post-tax wage rate constant
1	Pre-tax nominal wage rate	0.00	6.50	0.31	-5.84
2	Return to capital, ownership of dwellings	0.00	16.20	3.75	14.66
3	Return to land, agriculture	0.00	-9.53	0.11	8.47
4	Return to capital, agriculture	0.00	-8.98	-0.45	7.83
5	Return to capital, excluding ownership of dwellings and agriculture	0.00	6.32	-1.86	6.29
6	Return to capital, excluding ownership of dwellings	0.00	5.44	-1.78	6.38
7	Consumer price index	0.00	6.50	0.31	-0.95

* Variables are expressed as percentage changes. Variables 1 through 6 are notionally $ per relevant quantity unit.

a Average rate of personal income taxation

b Real current government expenditure on goods and services

c Public sector borrowing requirement

d Real (CPI deflated) wage rate

pre-tax incomes in the unit records. If v_i represents the variable in the ith line of Table 4 (i.e., v_1 represents the pre-tax nominal wage rate, etc.), variables are assigned to income from various sources as follows:

(a) wages, salaries and supplements - v_1

(b) imputed and actual rental income - v_2

(c) imputed income from agricultural land - v_3

(d) imputed income from agricultural capital - v_4

(e) imputed income from non-agricultural capital - v_5

(f) dividends - v_6

(g) interest - v_7

(h) other income - v_7

(i) government benefits - v_7.

A discussion of the procedures adopted for calculating all the imputed incomes listed above is provided in Agrawal (1987a). Note that we have assumed that government benefits remain fully indexed to the CPI in all four simulations.

4.2 Revising the Population Weights

All persons included in the Income and Housing Survey can be classified into one of three categories according to their labour force status: employed, unemployed or not in the labour force. In our simulations, induced changes in the demand for labour lead to changes in the number of persons employed. Since the labour force participation of

individuals responds to changes in their employment opportunities, this leads to corresponding changes in the numbers belonging to both the other categories. Thus the population weights attached to each person in the sample must be adjusted to reflect these changes in labour force participation.

In a recent study, Peters and Petridis (1985) have estimated the participation responses of seven demographic groups[8] to changes in the probability of their being employed. Using the employment rates (the ratio of employment to the working age population) as a proxy for employment probability, they fitted the following equation:

$$PR = \text{constant} + b_1 \, FTER + b_2 \, PTER \,, \qquad (1)$$

where

PR = the labour force participation rate,

FTER = the group-specific full-time employment ratio,

PTER = the group-specific part-time employment ratio.

In their view, 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. We adopt their estimates of b_1 and b_2 in our procedure for revising the population weights as follows:

(i) Assuming no change in the number of hours worked per employed person, the ORANI model determines the change in the number of persons employed in each of 112 industries. Using a mapping based on 1981 Census data, these changes are converted to the

62 occupations identified in the unit record data. The weights for employed persons are then adjusted on an occupation-specific basis to reflect changes in their employment.

(ii) Next, the employment change in each occupation is decomposed into changes in full-time and part-time employment, which are further decomposed into changes in each of the seven demographic categories considered by Peters and Petridis. In this decomposition we assume that the relevant employment shares remain the same as in the unit record data. Summing across occupations then gives the change in the number employed for 14 categories differentiated by full-time and part-time employment and by demographic group.

(iii) Using group means for the same 14 categories evaluated from the unit record data, the estimates of Peters and Petridis are converted into elasticities of labour force participation with respect to employment. Given the change in the number employed from step (ii), the change in the number of participants, and hence the residual change in the number of unemployed, can be determined - again for 14 employment categories. For discouraged workers (identified as persons who are not in the labour force, but who looked for work sometime in the twelve months preceding the IHS survey), the population weight is adjusted according to demographic category alone (i.e., changes are summed over the full-time and part-time labour markets). For unemployed persons, the

weight is adjusted according to demographic category and according to whether the person is looking for full-time or part-time work. For persons who are not in the labour force and who did not look for work in the preceding twelve month period, the weight is not adjusted at all. These persons include retired and other workers who do not respond to short-term changes in their employment opportunities.

5. DISTRIBUTIONAL RESULTS

Since our methodology involves revising the incomes and population weights of practically all persons participating in the 1981/82 Income and Housing Survey, it yields information about the distributional effects of the tax reform over the same range of social and demographic characteristics as the survey itself. It is not our purpose in this paper to attempt a review of such a comprehensive body of material. Rather we present a selection of results which serve to illustrate the differential impact of our wage and fiscal assumptions on distributional variables.

In particular, we report changes in the distribution of post-tax real mean incomes (CPI deflated) of individuals grouped by occupation, by demographic categories differentiated by age, sex and marital status, and by income deciles. We also report variations in the number of employed persons belonging to the occupational and demographic groups as a result of projected changes in their employment opportunities. As we shall see, the employment and income results can

be closely interrelated. A final table reports changes in equivalent-adult incomes by decile class, but otherwise we do not consider aggregations of individual incomes into larger income units.

Table 5 contains projections for 10 occupational groups, aggregated from the 62 groups identified in the unit record data. In the employment projections, the influence of variations in government consumption and international competitiveness across the simulations is immediately evident. Government consumption is a major determinant of the outcome for occupations 1 (professional and technical workers) and 9 (service, sport and recreation workers), and completely determines the outcome for occupation 10 (armed services). The rapid increase in employment for the export-oriented occupations 5 (farmers, fishermen, etc.) and 6 (miners) from Simulations II to III to IV reflects a corresponding rapid improvement in competitiveness. The relatively favourable result for the import-competing occupation 8 (tradesmen and production process workers) derives from the same source.

In the income projections reported in Table 5, the relative changes induced by the change in tax progressivity (Simulation I) are more or less maintained across the other simulations. As only employed persons are included in the table, the average change in incomes from one simulation to the next is determined mainly by the change in the post-tax real wage rate. Occupation 5 (farmers, fishermen, etc.) contains many owner-operators who derive a substantial proportion of their incomes from returns to capital and land, rather than from wages. Hence this occupation improves its relative position in Simulation IV, when wage increases are curtailed by the tax-wage bargain.

TABLE 5

PROJECTED EFFECTS OF FLATTENING THE TAX RATE SCALE
UNDER ALTERNATIVE FISCAL AND WAGE ASSUMPTIONS:
ALL EMPLOYED PERSONS BY OCCUPATION

Variable*	Base Year Data	Simulation I ATR[a] constant, Government expenditure constant[b] Pre-tax wage rate[c] constant	Simulation II ATR reduced, Government expenditure constant Pre-tax wage rate constant	Simulation III ATR reduced, PSBR[d] constant Pre-tax wage rate constant	Simulation IV ATR reduced, PSBR constant Post-tax wage rate constant
Employment-	('000)				
1 Professional, technical workers	883.17	0.00	1.04	-9.02	-0.15
2 Administrative, managerial workers	362.90	0.00	1.52	-1.35	4.87
3 Clerical workers	1122.27	0.00	1.18	-3.86	3.38
4 Sales workers	618.40	0.00	2.46	0.20	5.33
5 Farmers, fishermen, etc.	556.01	0.00	-6.26	-0.56	6.52
6 Miners	34.84	0.00	-9.44	-0.37	8.38
7 Transport, communication workers	321.13	0.00	0.11	-2.25	3.74
8 Tradesmen, production process workers	1945.75	0.00	0.56	-0.83	5.22
9 Service, sport, recreation workers	591.33	0.00	2.31	-4.15	3.87
10 Armed services	71.51	0.00	0.00	-17.03	-7.00
Real mean income-	($)				
1 Professional, technical workers	21086.62	2.12	6.95	7.06	3.90
2 Administrative, managerial workers	22610.24	2.71	7.76	7.21	5.92
3 Clerical workers	15800.61	-0.04	3.87	3.74	0.52
4 Sales workers	13106.77	-0.23	3.26	2.99	1.03
5 Farmers, fishermen, etc.	13060.22	0.99	3.05	4.52	5.37
6 Miners	24460.14	1.48	6.80	6.69	2.78
7 Transport, communication workers	17069.17	-0.62	3.55	3.37	0.26
8 Tradesmen, production process workers	16599.54	-1.03	3.07	2.79	0.21
9 Service, sport, recreation workers	12747.62	-0.49	2.90	2.27	-0.55
10 Armed services	22627.98	-0.88	4.00	4.03	-0.26

* All variables except those in Column 1 are expressed as percentage changes.

a Average rate of personal income taxation

b Real current government expenditure on goods and services

c Real (CPI deflated) wage rate

d Public sector borrowing requirement

Projections for individuals grouped by demographic category are given in Table 6. We see that, generally speaking, employment for all groups rises and falls with aggregate employment. However, there remains a significant difference between the fortunes of males and females. The latter tend to be concentrated in nontraded service industries, and hence their employment depends more on changes in aggregate domestic demand than on changes in international competitiveness. For that reason, females benefit more than males from the shift in employment from the traded to the nontraded sector in Simulation II, but benefit less from the improved competitiveness of the economy in Simulation IV.

The distribution of mean incomes between the demographic groups is largely conditioned by three factors. Firstly, the impact of the reduction in progressivity is prominent in all simulations, with the pattern of relative incomes established in Simulation I again being repeated across the columns. Secondly, Table 6 includes all income recipients rather than just the employed, and hence the mean income of a particular group tends to vary directly with its employment. Finally, the younger age groups are more dependent on wages and salaries as a source of income than the others, and as a result these groups fare relatively badly in Simulation IV.

So far we have established that the effect of the tax reform on employment by occupation depends significantly on the wage and fiscal assumptions (Table 5). Since workers are not uniformly distributed across occupations with respect to demographic characteristics, the

TABLE 6

PROJECTED EFFECTS OF FLATTENING THE TAX RATE SCALE
UNDER ALTERNATIVE FISCAL AND WAGE ASSUMPTIONS:
ALL INCOME RECIPIENTS BY DEMOGRAPHIC
CATEGORIES

Variable*	Base Year Data	Simulation I ATR[a] constant, Government expenditure constant[b] Pre-tax wage rate[c] constant	Simulation II ATR reduced, Government expenditure constant Pre-tax wage rate constant	Simulation III ATR reduced, PSBR[d] constant Pre-tax wage rate constant	Simulation IV ATR reduced, PSBR constant Post-tax wage rate constant
Employment-	('000)				
1 Male teenagers (age 15-19 years)	223.32	0.00	0.47	-1.31	4.93
2 Young males (age 20-24 years)	549.99	0.00	0.45	-2.39	4.26
3 Adult males (age 25-54 years)	2873.60	0.00	0.19	-2.63	4.13
4 Senior males (age 55+ years)	552.48	0.00	-0.40	-1.84	4.78
5 Female teenagers (age 15-19 years)	177.99	0.00	1.71	-2.30	4.32
6 Married women (age 20+ years)	1524.39	0.00	0.73	-3.72	3.48
7 Single women (age 20+ years)	697.55	0.00	1.35	-4.34	3.07
Real mean income-	($)				
1 Male teenagers (age 15-19 years)	8583.73	-1.24	1.27	0.62	-1.09
2 Young males (age 20-24 years)	13415.05	-1.16	2.40	1.30	-0.21
3 Adult males (age 25-54 years)	19017.84	0.14	4.83	3.03	3.04
4 Senior males (age 55+ years)	16328.14	0.71	5.19	3.91	5.60
5 Female teenagers (age 15-19 years)	7305.68	-0.92	1.52	0.50	-1.69
6 Married women (age 20+ years)	7908.55	0.07	3.11	0.54	2.65
7 Single women (age 20+ years)	12625.74	-0.53	3.29	1.29	2.25

* All variables except those in Column 1 are expressed as percentage changes.

a Average rate of personal income taxation

b Real current government expenditure on goods and services

c Real (CPI deflated) wage rate

d Public sector borrowing requirement

employment variations carry over into the distribution of income between groups differentiated by age, sex and marital status (Table 6). Furthermore, the wage and fiscal assumptions impact unevenly on different sources of pre-tax incomes (Table 4), sources which are themselves unevenly represented in the incomes of different occupational and demographic groups. Although not always as obvious, the same mechanisms underlie the results for income deciles presented in Table 7.

The deciles reported in Table 7 are based on individual disposable incomes. Two features of these decile results stand out. The first is the effect of the reduction in the marginal rate of tax on very high incomes. With two minor exceptions, the decile with the highest mean income increases its income share at the expense of all the other deciles in every simulation. The second is the effect of aggregate employment on real mean incomes. When employment falls substantially (Simulation III), the mean incomes of the lowest five deciles also fall. When employment rises substantially (Simulation IV), the mean incomes of all deciles but one increase. Clearly, the wage assumption is crucial for determining the impact of the reform on low income groups.

Distributional results such as those in Tables 5, 6 and 7 clearly contribute to the array of relevant information that one might use to assess the desirability of the tax reform. Equally clearly, the tables do not provide a direct measure of changes in welfare. Indeed, in the presence of substantial involuntary unemployment, when the hours worked by many individuals are not in accord with their preferences for

TABLE 7

PROJECTED EFFECTS OF FLATTENING THE TAX RATE SCALE
UNDER ALTERNATIVE FISCAL AND WAGE ASSUMPTIONS:
ALL INCOME RECIPIENTS BY DECILES BASED
ON INDIVIDUAL DISPOSABLE INCOMES

Variable*	Base Year Data	Simulation I ATR[a] constant, Government expenditure constant[b] Pre-tax wage rate[c] constant	Simulation II ATR reduced, Government expenditure constant Pre-tax wage rate constant	Simulation III ATR reduced, PSBR[d] constant Pre-tax wage rate constant	Simulation IV ATR reduced, PSBR constant Post-tax wage rate constant
Real mean income-	$				
1 First decile	1140	0.00	0.96	-3.86	3.77
2 Second decile	4447	-1.82	-0.43	-4.47	1.64
3 Third decile	6770	-2.67	-0.84	-2.58	-0.06
4 Fourth decile	8561	-1.85	0.82	-1.76	1.79
5 Fifth decile	10594	-0.09	1.94	-0.70	2.54
6 Sixth decile	12936	-0.04	2.88	0.46	1.93
7 Seventh decile	15504	-0.83	2.78	1.10	1.17
8 Eighth decile	18362	-2.22	2.13	0.48	0.23
9 Ninth decile	22065	-1.07	3.87	2.37	1.76
10 Tenth decile	32176	4.32	9.77	8.73	8.34
Income shares-	(per cent)				
1 First decile	0.86	0.00	-0.03	-0.05	0.01
2 Second decile	3.36	-0.07	-0.15	-0.23	-0.05
3 Third decile	5.11	-0.14	-0.24	-0.24	-0.16
4 Fourth decile	6.46	-0.12	-0.20	-0.26	-0.08
5 Fifth decile	7.99	-0.11	-0.16	-0.23	-0.04
6 Sixth decile	9.76	-0.06	-0.11	-0.17	-0.11
7 Seventh decile	11.70	-0.10	-0.15	-0.14	-0.22
8 Eighth decile	13.85	-0.31	-0.26	-0.24	-0.38
9 Ninth decile	16.65	-0.18	-0.04	-0.01	-0.22
10 Tenth decile	24.27	1.05	1.33	1.54	1.24

* Mean incomes are expressed as percentage changes. Income shares are expressed as percentage point changes in the original shares.

a Average rate of personal income taxation

b Real current government expenditure on goods and services

c Real (CPI deflated) wage rate

d Public sector borrowing requirement

labour supply, it is not obvious that the aggregate change in welfare can be measured at all. Nevertheless, measures of income can be defined to take account of a number of factors of welfare significance which have been disregarded so far. One such measure is equivalent-adult disposable income, results for which are presented in Table 8.

The measure is derived by grouping individuals into income units and pooling their disposable incomes to form a total income Y. Next, for an income unit containing A adults and C dependent children, the number of equivalent adults is defined by the relation:

$$V = 1 + \lambda_1(A-1) + \lambda_2 C ,$$

where λ_1 and λ_2 are weights. Finally, the income Y/V is assigned to each adult in the income unit. The application of this methodology in the present study is fully described in Agrawal (1987b). Following Kakwani (1986), values of 0.7 and 0.4 are assigned to the weights λ_1 and λ_2, respectively.

An important property of the equivalent-adult disposable income measure is that it assigns equal incomes to both members of a married couple regardless of their labour force status. In Table 7, the lowest income decile includes many unemployed persons and many married women who are not in the labour force. Hence, as we have already observed, a change in aggregate employment has a significant impact on the mean income of the decile. In Table 8, the married women are

TABLE 8

PROJECTED EFFECTS OF FLATTENING THE TAX RATE SCALE
UNDER ALTERNATIVE FISCAL AND WAGE ASSUMPTIONS:
ALL INCOME RECIPIENTS BY DECILES BASED ON
EQUIVALENT-ADULT DISPOSABLE INCOMES

Variable*	Base Year Data	Simulation I ATR[a] constant, Government expenditure constant[b] Pre-tax wage rate[c] constant	Simulation II ATR reduced, Government expenditure constant Pre-tax wage rate constant	Simulation III ATR reduced, PSBR[d] constant Pre-tax wage rate constant	Simulation IV ATR reduced, PSBR constant Post-tax wage rate constant
Real mean income-	$				
1 First decile	3873	-2.66	-0.70	-2.87	0.34
2 Second decile	6681	-3.08	-0.60	-1.98	-0.55
3 Third decile	7861	-2.52	0.50	-1.14	0.13
4 Fourth decile	9163	-2.25	1.22	-0.71	0.75
5 Fifth decile	10352	-1.56	2.19	0.35	1.69
6 Sixth decile	11747	-0.91	2.95	1.12	1.81
7 Seventh decile	13491	-0.24	3.67	1.92	2.05
8 Eighth decile	15753	-0.21	3.87	2.41	1.98
9 Ninth decile	18878	0.04	4.51	3.20	2.30
10 Tenth decile	27556	4.06	9.33	8.32	8.10
Income shares-	(per cent)				
1 First decile	3.09	-0.08	-0.14	-0.17	-0.08
2 Second decile	5.33	-0.17	-0.24	-0.24	-0.18
3 Third decile	6.27	-0.16	-0.22	-0.23	-0.17
4 Fourth decile	7.31	-0.17	-0.21	-0.24	-0.16
5 Fifth decile	8.26	-0.14	-0.16	-0.19	-0.10
6 Sixth decile	9.37	-0.09	-0.11	-0.14	-0.10
7 Seventh decile	10.76	-0.03	-0.05	-0.07	-0.09
8 Eighth decile	12.57	-0.04	-0.04	-0.03	-0.12
9 Ninth decile	15.06	0.00	0.05	0.08	-0.10
10 Tenth decile	21.98	0.88	1.10	1.22	1.10

* Mean incomes are expressed as percentage changes. Income shares are expressed as percentage point changes in the original shares.

a Average rate of personal income taxation

b Real current government expenditure on goods and services

c Real (CPI deflated) wage rate

d Public sector borrowing requirement

assigned incomes and tend to move up to higher deciles, increasing the mean income of the lowest decile from $1104 in Table 7 to $3873 in Table 8. With more employed people (particularly low-income married workers with dependent children) now represented in the lowest decile, the mean income of the decile becomes much more sensitive to the change in the progressivity in the tax scale but much less sensitive to changes in aggregate employment. The mean income of the highest decile falls from $32176 in Table 7 to $27556 in Table 8, but the decile continues to increase its income share substantially in all simulations.

6. CONCLUSION

In this paper we have presented four simulations of the short-run effects of introducing the proposal of the Centre of Policy Studies for flattening the tax scale (i.e., Option T). The simulations indicate that the macro effects of the reform depend crucially on the accompanying adjustments to wage rates and to the government's fiscal position. Since Option T involves a cut in the average rate of income tax, it raises the possibility of a tax-wage bargain, and hence of substantial improvements in aggregate employment (see Simulation IV in Table 3). On the other hand, if such a bargain cannot be struck, the reductions in government expenditure required to prevent an increase in its budget deficit are likely to cause a substantial increase in unemployment (see Simulation III in Table 3).

The importance of the choice of wage and fiscal scenario carries over into the distribution of employment and incomes between

various groups of individuals. Hence, from both a macro and a sectional point of view, one would need to know the circumstances under which the reform was to be implemented before being able to adopt a position on its desirability.

Methodological differences make it difficult to compare our results directly with those obtained by the COPS researchers. For example, they report an overall gain in welfare from the reform, whereas we do not even define a direct measure of welfare. The following observations are, however, apposite:

(i) We have emphasized the importance of the wage and fiscal scenarios for the final outcome, but the COPS analysts consider no alternatives for these variables. Indeed, the reductions in government spending recommended by COPS play no direct role in generating their results.

(ii) The COPS analysts claim an increase of 3.6 per cent in labour supply (and hence in employment) from Option T, even though they assume no change in the pre-tax nominal wage rate. In our Simulation IV, a reduction of 5.8 per cent in the pre-tax nominal wage rate was required to generate a similar increase (3.52 per cent).

(iii) The mechanisms producing the increase in employment in the two cases are entirely different. For COPS, the result is driven by individuals increasing their labour supply in response to reductions in their post-tax incomes, with the rest of the

economy adjusting in an unspecified way to provide the additional employment. In our case, the result is driven by the reduction in the pre-tax nominal wage rate, which improves competitiveness and increases the demand for labour. Unemployed workers respond by taking up the new employment opportunities.

The last of these observations suggests an important criterion for choosing between models adopting different methodologies: other things being equal, one might prefer the model with the more plausible adjustment mechanism over the relevant time horizon. Our own view is that, for the foreseeable future, such plausibility depends on an adequate recognition of the problem of involuntary unemployment.

ENDNOTES

1. For a recent review of this experience, see Powell and Lawson (1986).

2. The equations of the ORANI model were implemented and solved using the GEMPAK general purpose software system for CGE models (Pearson, 1986). The process of solving the linear equations used the Harwell sparse matrix code (Duff, 1977).

3. Note that the categories of the NAGA model are not sufficiently detailed to handle income taxes on transfer payments. Such taxes have been included with taxes on profits and self employment and, to that extent, the latter is overstated.

4. Indeed, the Centre of Policy Studies has proposed that Option T be accompanied by expenditure cuts of about $5 billion. It should be noted that in this paper we have not attempted to model the particular expenditure proposals of the COPS. Instead, we have opted for simulating across-the-board cuts in government spending.

5. For a discussion of the role of tax-wage bargains in recent Australian policy, see Parmenter (1985).

6. The implications of this choice of numeraire are discussed in Meagher and Parmenter (1987), p.12.

7. Note that the large reduction in the GPI relative to the other price indexes in Simulation IV is a reflection of the labour intensity of the commodities consumed by the government.

8. These demographic categories appear in Table 6.

REFERENCES

Agrawal, N. (1987a), "Adjustments to the 1981-82 Income and Housing Survey Database to Attain Conceptual Consistency with the ORANI78 Database", IMPACT Project Research Memorandum No. OA-391, October.

Agrawal, N. (1987b), "Analysing Distributional Issues Using Equivalent - Adult Disposable Incomes", IMPACT Project Preliminary Working Paper No. IP-32, July.

Apps, P. (1987), Tax and Social Security Reform: An Analysis of Equity and Disincentive Effects, Occasional Paper No. 2, Australian Tax Research Foundation, Sydney.

Bascand, G.M. and M.G. Porter (1986), "Taxes and Incentives - The Leaky Bucket", in J.G. Head (ed.), Changing the Tax Mix, Australian Tax Research Foundation, Sydney.

Bascand, G.M. and C.D. Trengove (1987), "Analysis of Tax Reform Options", Working Paper No. D116, Centre of Policy Studies, Monash University, Melbourne.

Blampied, C.W. (1985), "A Listing of the 1977-78 Balanced ORANI Data Base with the Typical-Year Agricultural Sector Implemented", IMPACT Project Research Memorandum No. OA-262, May.

Cooper, R.J., K.R. McLaren, and A.A. Powell (1985), "Short-Run Macroeconomic Closure in Applied General Equilibrium Modelling: Experience from ORANI and Agenda for Further Research", in Piggot, J. and J. Whalley (eds), New Developments in Applied General Equilibrium Analysis, Cambridge University Press, Cambridge.

Dixon, P.B., B.R. Parmeter, J. Sutton, and D.P. Vincent (1982), ORANI: A Multisectoral Model of the Australian Economy, North Hollland Publishing Company, Amsterdam.

Duff, I.S. (1977), "MA28 - A Set of FORTRAN Subroutines for Sparse Unsymmetric Systems of Linear Equations", Report R.8730, AERE Harwell, HMSO, London.

Kakwani, N. (1986), Analyzing Redistribution Policies: A Study Using Australian Data, Cambridge University Press.

Meagher, G.A. and B.R. Parmenter (1985), "Some Short Run Effects of Shifts from Direct to Indirect Taxation", IAESR Working Paper No. 10/1985, University of Melbourne.

Meagher, G.A. and B.R. Parmenter (1987), "The Short-Run Macroeconomic Effects of Tax-Mix Changes: Option C Reconsidered," IAESR Working Paper No. 1/1987, University of Melbourne.

Parmenter, B.R. (1985), "Taxes, Wages and Employment", IAESR Working Paper No. 12/1985, University of Melbourne, October.

Pearson, K.R. (1986), "Automating the Computation of Solutions of Large Economic Models", IMPACT Project Preliminary Working Paper No. IP-27, March; forthcoming in Economic Modelling.

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

Powell, A.A. and A. Lawson (1986), "A Decade of Applied General Equilibrium Modelling for Policy Work", IMPACT Project General Paper No. G-69, August.