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TARIFF REFORM AND THE DISTRIBUTION OF HOUSEHOLD INCOMES

by

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ABSTRACT

In this paper we show that reducing industry protection in Australia is likely to increase the average real disposable income of the household sector. The relative winners and losers of tariff reform would depend upon the specific outcome of the wage fixation processes. This is because the level of the real wage rate is an important determinant of the level of economic activity in the economy, and hence, of the real incomes accruing to various factors, including labour. The analysis depends on simulations using an extended version of the ORANI model of the Australian economy. That is, the 'standard' version of the ORANI model has been augmented with data from the 1981-82 Income and Housing Survey.

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TARIFF REFORM AND THE DISTRIBUTION OF HOUSEHOLD INCOMES

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I INTRODUCTION

It is widely understood that tariffs enhance profits and employment in protected industries. What is less immediately obvious is that they also reduce profits and employment in certain adversely affected industries. In other words, they lead to a redistribution of income from individuals employed in non-protected industries to those employed in protected ones through mechanisms that are somewhat complex and can require quite sophisticated economic analyses for their delineation.

In Australia, the quality of information available about the effects of protection policy has been significantly advanced by the development of the ORANI model and its subsequent adoption as a standard tool of analysis by the Industries Assistance Commission.[1]

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* I am grateful to Tony Lawson and Alan Powell for helpful comments on an earlier draft of this paper. This paper is an output from a project which aims to provide a detailed elaboration of income distributional issues within a computable general equilibrium framework. This project is being carried out collaboratively by Tony Meagher (at the Institute of Applied Economic and Social Research, University of Melbourne) and the author.

[1] For a recent review of the role of the ORANI model in the Commission, see Industries Assistance Commission (1987).

ORANI has been widely used to analyse the effects of tariff reform on a number of macro and structural variables of the economy. As far as the effects of tariff reform on distributional variables are concerned, the standard version of the ORANI model (as described by Dixon *et al.* (1982)) provides projections for changes in the distribution of employment across 112 industries and across 10 skill-based occupations. In addition, by augmenting the ORANI model with data from the 1981-82 Income and Housing Survey (IHS) and from the 1981 Census, Agrawal and Meagher (1988a) were able to analyse the effects of tariff reform on the distribution of employment across various groups differentiated on the basis of socio-economic characteristics. The latter included demographic characteristics, migrant status, area of residence and level of qualifications.

In this paper, we extend the above analysis and examine the effects of tariff reform on the distribution of income across 40 types of households. The analysis depends on simulations using an extended version of the ORANI model augmented as before with data from an updated version of the 1981-82 IHS database and from the 1981 Census.

The rest of the paper is set out as follows. The simulations are specified in Section II. Section III provides further details of our model. Some aggregate results are presented and analysed in Section IV. Section V contains the distributional results. Finally, Section VI concludes with a discussion of the policy implications of this study.

II SPECIFICATION OF THE SIMULATIONS

II.1 *The Tariff Cuts*

Table 1 provides estimates of the nominal levels of protection provided to manufacturing industries as at 31 December, 1987. These are estimates of the extent to which tariff and quota protection raised the domestic price of imported goods at that time. We assume that the government removes all protection to all manufacturing industries in Australia. In other words, we simulate the effects of imposing a 100 per cent cut in the rates of protection listed in Table 1.

II.2 *The Assumed Economic Environment*

In the following sections, we report results for two simulations. Three aspects of the economic environment should be borne in mind when assessing these results.[2] The first concerns the level and composition of real domestic absorption. It is assumed that real private absorption and both its components (i.e., private consumption and private investment) vary in direct proportion to real private sector disposable incomes. Further, real public investment varies directly with real private investment, i.e., the shares of the public and private sectors in aggregate investment remain unchanged. We also assume that real current government expenditures on goods and services are exogenously determined.

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[2] A complete list of the variables selected as exogenous is given in Table A1 of the Appendix in Higgs (1988).

TABLE 1

Nominal Rates of Protection at 31 December 1987

ORANI COMMODITY No.	Name	Nominal Rate of Protection (per cent)
20	Meat products	0.61
21	Milk products	22.11
22	Fruit and vegetable products	8.58
23	Margarine, oils and fats n.e.c.	7.00
24	Flour mill and cereal food products	8.43
25	Bread, cakes and biscuits	0.48
26	Confectionery and cocoa products	16.10
27	Other food products	7.19
28	Soft drinks, cordials and syrups	10.60
29	Beer and malt	28.59
30	Other alcoholic beverages	19.00
31	Tobacco products	7.00
32	Cotton ginning, wool scouring, etc.	8.72
33	Man-made fibres, yarns, etc.	34.05
34	Cotton yarns, broadwoven fabrics, etc.	29.44
35	Worsted and woollen yarns, etc.	12.70
36	Textile finishing	39.70
37	Textile floor coverings, felt, etc.	35.86
38	Other textile products	22.45
39	Knitting mills	67.31
40	Clothing	68.15
41	Footwear	57.50
42	Sawmill products	5.14
43	Veneers and manufactured wood boards	15.40
44	Joinery and wood products n.e.c.	12.60
45	Furniture and mattresses	22.48
46	Pulp, paper and paperboard	9.80
47	Bags, fibreboard containers	20.73
48	Paper products n.e.c.	21.50
49	Newspapers and books	0.46

... continued

Table 1 continued

ORANI COMMODITY No.	Name	Nominal Rate of Protection (per cent)
50	Commercial printing	19.25
51	Chemical fertilisers	1.02
52	Other basic chemicals	12.72
53	Paints and varnishes	13.80
54	Pharmaceutical products, etc.	5.49
55	Soaps and detergents	5.90
56	Cosmetics and toilet preparations	18.10
57	Other chemical products	11.47
58	Petroleum and coal products	0.14
59	Glass and glass products	6.10
60	Clay products and refractories	3.82
61	Cement	1.00
62	Ready mixed concrete	0.00
63	Concrete products	1.28
64	Other non-metallic mineral products	9.56
65	Basic iron and steel	9.22
66	Basic non-ferrous metals and products	4.22
67	Structural metal products	13.24
68	Sheet metal products	16.02
69	Other metal products	18.44
70	Motor vehicles and parts, etc.	28.73
71	Ships and boats	14.92
72	Railway rolling stock and locomotives	17.50
73	Aircraft	1.80
74	Photographic and scientific equipment	7.94
75	Electronic equipment	19.87
76	Household appliances and water heaters	23.90
77	Other electrical equipment	21.02
78	Agricultural machinery	7.64
79	Construction machinery, etc.	22.01
80	Other machinery and equipment	14.42
81	Leather products	9.88
82	Rubber products	21.86
83	Plastic and relatic products	19.89
84	Signs, writing and marking equipment	14.13
85	Other manufacturing	21.95

Source: Dee (1988).

Finally, apart from tariff rates, all rates of direct and indirect taxation are assumed to be constant.

The second aspect of the economic environment concerns the operation of primary factor markets. In the labour market, we take real wage rates as exogenously determined and assume that, in each occupation, labour is in excess supply at the going wage rate. This implies that any induced changes in the demand for labour appear as changes in employment. Since the tariff cut affects the consumer price index (CPI), a pivotal variable for real wage determination, a scenario must be specified to describe the response of the nominal wage rate. In the spirit of sensitivity analysis, we present results for two scenarios, one representing "real wage maintenance" (i.e., no change in the CPI-deflated real wage rate) and the other representing "full wage discounting" (i.e., no change in the nominal wage rate).

In other factor markets, it is assumed that industry-specific physical capital and (where appropriate) land in use do not respond to the policy changes simulated, so that rental rates adjust to ensure that these factors remain fully employed. In this sense, our simulations should be considered to be short run.[3]

The third central aspect of the economic environment concerns our choice of the numeraire. In both simulations, the nominal exchange rate is exogenous and all price changes are measured relative to it. This means that changes in the real

[3] The duration of the ORANI short run has been estimated to be about two years (Cooper, McLaren and Powell (1985)).

exchange rate appear as changes in the domestic price level rather than as changes in the nominal exchange rate.

III THE MODEL

III.1 *An Overview*

The ORANI multisectoral model of the Australian economy is well known, having been applied by many users to a wide range of policy issues.[4] 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 describe the national and government accounts. This extension, referred to as the NAGA model, is specified in Meagher and Parmenter (1985 and 1987). A record of the relevant ORANI database can be found in Blampied (1985), while the NAGA database used in our simulations is listed in Agrawal and Meagher (1988a).

Our strategy for generating distributional results consists of using the projected values of a number of "interface" variables obtained from the ORANI-NAGA simulations[5] to revise data contained in the pre-shock unit records of the IHS database to form post-shock records. Distributional results are obtained by computing distributional statistics from the pre-shock records and comparing

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[4] Powell and Lawson (1989) provide a review of many of the policy applications of ORANI.

[5] The equations of the ORANI model are solved using the GEMPACK general purpose software system for CGE models (Pearson (1988), and Codsi and Pearson (1988)). The process of solving the linear equations used the Harwell sparse matrix code (Duff (1977)). NAGA is solved using the procedure documented in Agrawal and Meagher (1987).

them with corresponding statistics computed from the (revised) post-shock records.

The IHS database consists of two sets of unit records, one for individuals and one for income units. The former set contains data on various characteristics of individuals, such as their age, sex, employment status and occupation. The second set contains data that pertain to income units (or to other aggregations of individuals into groups such as families or households); examples of such data are the nature of housing occupancy and the number of children. The two sets of unit records can be linked together if necessary. In other words, it is possible to assign each individual to a particular income unit. It is further possible to aggregate the data to either the family or household level if desired, as is done in this study.

In our model, it is individuals (rather than households) that belong to occupations, earn incomes and pay taxes. Hence, it is at the individual level that we revise the unit record IHS data to calculate post-shock incomes. However, in this paper we are interested in examining the effects of tariff reform on the distribution of income across different types of households rather than across individuals. For this purpose, each individual in the database has been assigned to one of the 40 different types of households that have been distinguished in this study. Household results are then obtained by aggregating over the relevant individual results.

To examine the effect of an economic shock on the average disposable income of households of type h, we first need to calculate

the pre-shock value of this income. To do so, we need three sets of data. First, we need data on the pre-shock disposable income, Y_{ih}, of every individual i belonging to a household of type h in our sample (h = 1 ,...., H). Second, we need a value for the weight in the population, IW_{ih}, attached to each individual in our sample. Finally, we need estimates of the number of households, N_h, belonging to household type h. With these three sets of data, we can calculate the average pre-shock disposable income, Y_h, of households of type h as follows:

$$(1) \qquad Y_h = \frac{\sum_{i \varepsilon h} Y_{ih} \times IW_{ih}}{N_h} , \qquad h = 1, ..., H.$$

All of these data are available from the IHS. Following an economic shock, all three determinants of average disposable household income in equation (1) are likely to change. We revise the unit records in the IHS database to take account of these changes. The procedure for adjusting each of the three components of equation (1) is described in detail in the following sub-sections.

Before we describe how we obtain the post-shock unit records, it should be noted that the pre-shock records have themselves been derived by updating the unit records for individuals in the 1981-82 IHS so that the data in these records conform to historical values for 1984-85.[6] In particular, the population weight attached to each individual in the database was adjusted to reflect the

[6] The updating procedure is described fully in Agrawal and Meagher (1988b).

numbers belonging to various employment status categories in 1984-85. Further, individuals' incomes from each source were adjusted so that they summed to aggregate values of the corresponding income types obtained from the national accounts for 1984-85. The latter process also involved 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.[7] Note that in this updating procedure, no adjustment has been made to any data contained in the income unit records; that is, the socio-demographic profile in the updated database reflects the situation in the 1981-82 IHS.

III.2 *Revising Individual Incomes*

The information contained in the unit records for individuals in the IHS database includes the amount of (pre-tax) income every person receives from each of 23 sources of income. The pre-shock disposable income, Y_{ih}, of individual i belonging to household type h can be calculated by first summing across the various sources to obtain the individual's aggregate pre-tax income and then applying the provisions of the 1984-85 Australian personal income tax system to calculate his/her disposable income. The details of these tax calculations are described in Agrawal (1987b).

Following an economic shock that affects various factor prices, the individual's income from different sources is likely to

[7] These imputations were undertaken to make the IHS database conceptually consistent with the national accounts data underlying ORANI. They are described in Agrawal (1987a).

change. To take account of these changes, we revise his/her recorded income as follows. The 23 sources of income identified in the IHS are aggregated into the 9 sources listed in the left-hand side of Table 2 (as described in Agrawal (1987a)). Following a shock, the income from each of these 9 sources is updated according to the projected value of the particular commodity or factor price index assigned to it in the right-hand side of Table 2. Thus, for example, each individual's income from wages, salaries and supplements is updated according to the projected value of the pre-tax nominal wage rate, while his/her rental income is updated according to the return to capital in the ownership of dwellings industry (explained below); and so on. The projected values for the various commodity and factor price indices listed in Table 2 are obtained from ORANI-NAGA simulations.

Once the incomes from various sources have been revised, for each individual we can aggregate across the different sources to obtain the value for his/her aggregate post-shock pre-tax income. The post-shock disposable income of the individual can then be calculated from this income by applying the provisions of the 1984-85 Australian personal tax system to the income recipient.

III.3 *Revising Individual Weights*

As noted above, in the unit records for individuals, each person included in the IHS sample is assigned a weight, IW_{ih}, which reflects the number of people in the population that the person represents. Thus, summing these weights over all individuals in our (updated) database gives us an estimate of the total adult population

TABLE 2

Procedure for Revising Pre-Tax Incomes

	Income Source	Updated According to Variable
1	Wages, salaries and supplements	Pre-tax nominal wage rate (*w*)
2	Imputed and actual rental income	Return to capital, ownership of dwellings (*r*)
3	Imputed income from agricultural land	Return to land, agricultural (*al*)
4	Imputed income from agricultural capital	Return to capital, agricultural (*ak*)
5	Imputed income from non-agricultural capital	Return to capital, excluding ownership of dwellings and agriculture (*nk*)
6	Dividends	Return to all capital, excluding ownership of dwellings (*ok*)
7	Interest income	Consumer price index (*cpi*)
8	Other income	Consumer price index (*cpi*)
9	Income from government benefit payments	Government benefit index (*gbi*)

in 1984-85. Similarly, summing across the individual weights, IW_{ih}, of all individuals i belonging to a household of type h, would give us an estimate of the total number of individuals belonging to this household type.

In our simulations, an economic shock alters the distribution of the population across various labour-force categories and across various occupations. Our general methodology for revising the weights of individuals in the database to reflect the effects of a shock is as follows. First, we work out the percentage change in the total number of persons in some category where the available data and theory will support such an exercise. We then revise the population weight of each individual in this category by a percentage change equal to that in the membership of the category as a whole. By splitting the population into a number of mutually exclusive, exhaustive categories, we can use this method to revise the weight of every individual in the database. The details of this procedure are as follows.

The individual weights are adjusted via a three-step procedure, the first of which is to solve the ORANI-NAGA model. The solution of this model determines the effect of each policy simulation on a wide range of macro and structural variables of the economy, including employment changes in each of the 112 ORANI industries. In ORANI, the labour demand equations define the total demand for person-hours -- the product of persons and average hours worked per person (Powell, 1983). A shock to the ORANI-NAGA model produces changes in the demand for person-hours by each of the 112 industries. Additional assumptions, concerning changes in hours per

worker, are required to convert these projections into projections of changes in the number of persons employed. We assume that the average hours worked per person remain constant. Using this assumption, we calculate the change in the number of persons employed in each industry.[8]

The second step of the procedure consists of converting these changes in the number of persons employed by the 112 ORANI industries to changes in the number of persons employed by the 61 occupations identified in the IHS database.[9] This conversion assumes that the occupational composition of the labour force employed in each industry remains constant in each simulation. The 112-industry by 61-occupation employment matrix required for this conversion was obtained from the 1981 Census of Population and Housing.

The third step of the computational procedure utilizes the unit record data for individuals in the IHS database. Each person in this database can be classified into one of three labour-force categories: *employed*, *unemployed*, or *not in the labour force*. In our simulations, changes in employment by occupation (as calculated in Step 2) lead to changes in the employment of various individuals. Since the labour force participation of individuals responds to changes in their employment opportunities, this changes the number of workforce participants. Finally, these changes in employment and in the number of workforce participants together

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8 For the simulations undertaken in this paper, the employment projections for the 112 ORANI industries are contained in Appendix 1.

9 For our simulations, the employment projections for these occupations are contained in Appendix 2.

cause a change in the number of persons unemployed. We revise the individual weights in the IHS database to reflect these changes in the numbers of persons belonging to the various labour-force categories. Depending on whether the person is employed, unemployed, or not in the workforce, his/her individual weight is revised as follows:

(i) Employed persons

If employment for a particular occupation is calculated to increase by x per cent at Step 2 above, the individual weight attached to each employed person in the IHS sample who belongs to that occupation is increased by x per cent.[10] Thus, for example, if a simulation leads to a 5 per cent increase in the demand for miners, we increase the individual weight attached to each employed miner in our sample by 5 per cent. After this adjustment, the database will contain 5 per cent more employed miners than it did before these changes were made. These revisions are made to reflect changes in the aggregate level of employment, and in its occupational composition, in the post-shock economy.

(ii) Persons not in the labour force

Next, the employment change in each occupation is decomposed into changes in full-time and part-time employment, which are further

[10] This procedure is applied to all employed persons except owner-operators in IHS occupation numbers 3 (Medical practitioners, dentists), 19 (Farmers, farm managers), 21 (Other rural workers) and 27 (Road transport drivers). For these four categories, we assume that the change in employment demand is reflected not in a change in the number of persons employed but in a change in the hours worked per person. This has been done because these occupations contain a high proportion of owner-operators, and the stock of physical capital and land are fixed in our short-run simulations.

decomposed into changes in employment for each of seven demographic groups. In this decomposition we assume that the employment share of each of the 14 groups in each occupation remains the same as in the pre-shock unit record data. Summing across occupations then gives the changes in the numbers employed for 14 categories differentiated by full-time and part-time employment and by demographic group.

The seven demographic groups identified above have been previously distinguished in a study by Peters and Petridis (1985). In that study, the authors have estimated the participation responses of member of these seven groups to changes in the probability of their being employed. These responses have been estimated separately for changes in full-time and part-time employment. We have converted these estimates into elasticities of labour-force participation with respect to employment for the 14 categories by using group means of labour-force participation rates and of employment ratios obtained from the IHS data. These elasticities are reported in Agrawal (1989). Once we know the changes in the full-time and part-time employment of each demographic group, we use these elasticities to determine the changes in the number of workforce participants for each demographic group. These numbers indicate the participation responses of workers to changes in their employment opportunities. We use them to adjust the individual weight attached to each person who is not in the workforce as follows.

The IHS database classifies all non-participants in the workforce into two groups: those who have looked for work in the 12 months preceding the survey and those who have not. We use the

values calculated for the change in the number of participants in each demographic group to adjust the weight attached to non-participants belonging to the former category, i.e., those who have looked for work in the previous 12 months. For the other non-participants, the weight is not adjusted at all. It is assumed that these persons include retired and other workers who are unresponsive to short-term changes in their employment opportunities.

(iii) Unemployed persons

Given the change in the number of persons employed (from step (i)) and the change in the number of participants (from step (ii)), we calculate the change in the number of persons unemployed as a residual, by assuming that the size of each of the seven demographic groups is unaffected by the shock. This number is obtained for each of the seven demographic groups and is then used to adjust the corresponding individual weights.

III.4 *Revising Household Weights*

In the income unit records, each income unit in the sample is assigned a weight which represents the number of income units in the population that this income unit represents. In other words, by summing across all the income unit weights, we can obtain an estimate of the total number of income units in the economy. Further, by selecting all the heads of *families* out of all the heads of income units in our sample and summing across their income unit weights (not their *individual* weights), we can obtain an estimate of the total number of *families* in the economy. Similarly, by selecting

all the *household* heads and summing across their income unit weights (to which we hereafter refer to as their household weights) we can obtain an estimate of the total number of *households* in the economy. Thus, in our pre-shock world, we calculate the total number of households, N_h, belonging to type h by summing across the household weights attached to every individual i who *heads* a household of type h.

Following an economic shock, the number of households belonging to each type distinguished in our study is likely to change. This is because household types are defined partly by income source, which can be affected by the employment status of the head, which in turn is affected by the shock. For example, following an economic shock that results in an increase in aggregate employment in the economy, it is likely that the number of households that have earned income as their principal source of income (one of the characteristics that distinguishes households in our model) goes up. To take account of these changes, we adjust the household weight attached to each household head as follows.

Suppose an economic shock leads to an expansion of activity in the mining sector and leads to, say, a 5 per cent increase in the demand for miners. According to the assumptions of our model, this will lead to a 5 per cent increase in the number of employed miners. As described above, we adjust for this change by selecting all employed miners in our database and increasing the *individual* weight attached to each miner by 5 per cent. After this adjustment, there will be 5 per cent more employed miners in our database than there were before the shock; the numbers of persons belonging to

other labour force categories are appropriately reduced to account for the change in the labour force status of some of their members.

To determine how the shock affects the number of households belonging to each type distinguished in our study, we need to make an additional assumption: we assume that employers do not discriminate against individuals on the basis of their status within their household. To revert to our previous example, we assume that the increased employment of miners will be distributed equally amongst jobseekers, irrespective of whether or not the prospective employee is a household head. In our example, this implies that the number of households headed by employed miners will be 5 per cent greater after the shock. To take account of this change, we select all household heads in our sample who are employed miners and increase their *household* weight by 5 per cent.[11] Similarly, we adjust for all other projected changes in the labour-force status of household heads by adjusting the *household* weight of all *household heads* by the same percentage that we adjust their *individual* weights. Summing across the new household weights attached to all individuals who head households of type *h* then gives us the post-shock estimate of the number of households that belong to this type of household.

[11] The household weight is non-zero for only the head of each household; all other members of a household receive a zero household weight.

IV AGGREGATE RESULTS

IV.1 *Macro Results*

Table 3 contains projections of the effects of tariff removal on a number of key macro variables of the ORANI-NAGA model. As an example of the interpretation of these projections, consider the value 5.96 for export receipts in Simulation I (row 1, column 1). The projection maintains that, about two years after the removal of all tariffs on manufacturing commodities, export receipts will be about 6.0 per cent higher than they would have been in the absence of the reform.

Detailed discussions of similar ORANI-NAGA macro results are available in Agrawal and Meagher (1988a) and hence will not be repeated here. However, a selective review is provided below since an understanding of the macro results is essential for the understanding of the distributional results.

The impact effect of the tariff reform is to make imports cheaper relative to domestically-produced import-competing goods, leading to an increase in imports and a reduction in output and employment in the import-competing sector. Thus, as a result of the impact effect, the balance of trade (BOT) tends to deteriorate and aggregate employment tends to fall.

However, the tariff removal also lowers domestic costs via reductions in the domestic prices of imported inputs to production. Hence, it induces an improvement in the competitiveness of the

TABLE 3

Projected Effects on Selected Macro Variables*

	Variable	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
1	Export receipts	5.96	1.46
2	Import expenditures	6.77	7.11
3	Balance of trade surplus	-0.28	-1.06
4	Real gross domestic product	0.74	-1.19
5	Aggregate employment (persons)	1.08	-1.54
6	Consumer price index	-5.27	-2.63
7	Nominal wage rate	-5.27	0.00
8	Real wage rate (CPI deflated)	0.00	2.63
9	Real disposable labour income	0.98	0.99
10	Real disposable capital income	0.84	-2.52
11	Real private sector consumption	1.15	-0.10
12	Real private sector absorption	1.15	-0.10

* Simulation results are expressed as percentage changes for all variables except the balance of trade surplus, which is expressed as a percentage of GDP. ORANI users will notice that these results give more gain from tariff reform compared to earlier results because of the income/consumption link introduced here through the use of NAGA.

export sector. When the real wage rate is fixed in terms of the CPI, as in Simulation I, this improvement is considerably enhanced by a reduction in the nominal wage rate. The CPI falls because the tariff cut reduces the domestic prices of imported consumption goods. On the other hand, the foreign prices of export goods are not directly affected. Hence, if the nominal wage rate falls in line with the CPI, the real wage rate remains unchanged from a worker's point of view but declines from the point of view of an exporter. The induced effect of the tariff reform, therefore, is to lower domestic prices, increase exports and increase output and employment in the exporting sector.

The projections in Table 3 represent the total effect of the tariff reform. In Simulation I, the increase in import expenditure due to the impact effect is roughly equal to the increase in export receipts due to the induced effect, with a net deterioration in the BOT of 0.3 per cent of gross domestic product (GDP). In terms of employment, the induced effect is stronger than the impact effect, with aggregate employment increasing by 1.1 per cent. This growth in employment is the main factor responsible for the 1.2 per cent growth in real private sector (i.e., the household plus the corporate sector) disposable income and consumption.

In Simulation II, the nominal wage rate is assumed to remain constant and the magnitude of the induced effect is correspondingly reduced. The increase in export receipts is only a quarter of the increase in Simulation I, and the BOT deteriorates by 1.1 per cent of GDP. Aggregate employment is now influenced more by the impact effect than the induced effect, and falls by 1.5 per cent.

The contraction in economic activity reduces profitability in the shrinking sectors and causes a slight decline in real private sector disposable income and consumption (by 0.1 per cent).

IV.2 *Results for Labour Market Aggregates*

Table 4 contains the projected changes in the numbers of persons belonging to each of six labour force categories. It reveals that in Simulation I, the tariff reform causes a 0.8 per cent increase in the number of full-time jobs and a somewhat larger increase in the number of part-time jobs (1.0 per cent). The reason why part-time job opportunities increase by more than full-time ones is that the main growth in employment in this simulation occurs in the relatively large non-traded sector of the economy, which offers greater scope for part-time work than the other sectors. This is because private absorption, which increases in this simulation, is concentrated relatively heavily on the output of the non-traded sector. The increase in employment under Simulation I causes an increase in workforce participation. This is reflected in the fall in the number of persons who were not in the workforce but had previously looked for work (by 12.1 per cent). The increase in employment also causes a decrease in the number of persons unemployed and looking for either full-time work (by 5.5 per cent) or part-time work (by 4.7 per cent).

In Simulation II, the tariff reform causes a fall in both full-time (1.6 per cent) and part-time (1.2 per cent) employment. The aggregate decline in employment occurs because the job losses in the shrinking import-competing sector dominate the job gains in the

TABLE 4

Projected Effects on the Numbers of Persons Belonging to Various Labour Force Categories*

	Labour Force Category	Number of persons in 1984-85 aged 15+ (in thousands)	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
1	Employed -- full-time	5,500	0.77	-1.63
2	Employed -- part-time	1,136	1.01	-1.16
3	Unemployed -- looking for full-time work	549	-5.54	10.29
4	Unemployed -- looking for part-time work	70	-4.67	10.39
5	Not in the labour force			
	(a) Have looked for work in the preceding year	165	-12.09	23.72
	(b) Have not looked for work in the preceding year	4,512	0.00	0.00
	Aggregate	11,932	0.00	0.00

* Simulation results are expressed as percentage changes.

expanding exporting sector. Since the import-competing sector offers relatively greater scope for full-time rather than part-time jobs, its decline causes a relatively larger fall in full-time employment. As employment contracts, some of the previously employed workers join the pool of unemployed workers, while others withdraw from the workforce. This is reflected in the increase in the numbers of persons belonging to both these categories in Table 4.

IV.3 *Results for Factor Price Changes*

Table 5 contains the projections for a selection of ORANI-NAGA variables describing factor price and commodity price changes. In Section III we had discussed how these projections are used to update the incomes from various sources for each individual in our sample. Thus, for example, in Simulation I, each individual's income from wages, salaries and supplements is reduced by 5.27 per cent (the value for w in Simulation I), their income from rent is decreased by 1.49 per cent (the value for r in Simulation I) and so on. Below, we discuss the projections contained in Table 5.

The projected change for the pre-tax nominal wage rate (w) under each simulation merely reflects the assumption made regarding the wage-fixation process. In Simulation I, we assumed "full wage indexation", i.e., that the nominal wage rate remains fully indexed to the CPI. Thus, since the CPI falls by 5.27 per cent in Simulation I, so does the pre-tax nominal wage rate. In Simulation II, on the other hand, we assumed "zero wage indexation", i.e., that the nominal wage rate is not indexed to the CPI. Instead, we assumed that it remains constant.

TABLE 5

Projected Effects on Various Price Indices*

	Variable	Symbol	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
1	Pre-tax nominal wage rate	*w*	-5.27	0.00
2	Return to capital, ownership of dwellings	*r*	-1.49	-3.67
3	Return to land, agricultural	*al*	8.76	1.21
4	Return to capital, agricultural	*ak*	8.33	1.17
5	Return to capital, excluding ownership of dwellings and agriculture	*nk*	-0.97	-2.74
6	Return to capital, excluding ownership of dwellings	*ok*	-0.43	-2.52
7	Consumer price index	*cpi*	-5.27	-2.63
8	Government benefit index	*gbi*	-5.27	-2.63

* Simulation results are expressed as percentage changes.

The second variable in Table 5 is the return to capital in the ownership of dwellings industry (*r*). This industry represents the utilization of the housing stock of the economy. Hence, the rental rate of the capital stock in this industry is the rental price of housing. In our simulation, the housing stock in use is assumed to be unaffected by the shock, so that housing rents tend to vary directly with real private consumption. Hence, increases in real private sector consumption in Simulation I (see Table 3) bid up real housing rents (i.e., relative to the CPI) while decreases in real private sector consumption in Simulation II bid down real housing rents.

The third to the sixth variable in Table 5 are returns to various fixed factors (land and capital) in the model. The real returns to these factors in each industry vary directly with the output of that industry. Since the quantity of land and capital available for use in each industry are fixed in the short-run, any increase in the output of an industry has to be obtained by hiring more labour. As the fixed factors become relatively scarce, their rents are bid up.

As discussed in Section IV.1 above, the tariff reform improves the international competitiveness of the economy and leads to an expansion of the output and employment in the exporting sector. As a result, the returns to agricultural land (*al*) and agricultural capital (*ak*) increase under both simulations. However, these increases are substantially greater in Simulation I because of the significant fall in the pre-tax nominal wage rate in this simulation. The fall in the labour costs facing exporters in Simulation I reinforces the fall in their material input costs that results from the decrease in the domestic prices of imported inputs to production.

The outputs of the non-agricultural industries are influenced primarily by domestic demand conditions.[12] Therefore the returns to fixed factors in these industries tend, on average, to vary directly with private sector absorption. Hence, the increase in real private sector absorption in Simulation I (see Table 3) bids up the average real returns to non-agricultural capital (*nk*, *ok*). In Simulation II, the minor change in real private sector absorption (see Table 3) leads to a correspondingly small change in the real return to non-agricultural capital.

Finally, we note that the projected changes in the last variable in Table 5, namely, the government benefit index (*gbi*) merely reflect the assumptions made about the degree of indexation of government benefits to the CPI. In both simulations, we have assumed that all government benefit payments are fully indexed to the CPI, i.e., that they are maintained in real terms.

V DISTRIBUTIONAL RESULTS

In this section, we analyse the effects of tariff reform on the distribution of income across households that have been differentiated on the basis of the following characteristics:

[12] The only exception is the output of the mining industry, which is primarily influenced by export demand. Mining industries, however, account for a relatively small share of the total output of the non-agricultural sector.

(1) principal source of income,

(2) nature of housing occupancy,

(3) age of household head,

(4) number of adults, and

(5) number of children.

Households were decomposed according to the characteristics distinguished above unless the sample size prevented us from doing so. Thus, for example, because of the small number of single parent households in our sample, this group was only decomposed on the basis of their principal source of income. If we decompose all households according to only the first three characteristics listed above, we can identify 10 major categories of households, whereas if we decompose them further according to the remaining two characteristics we obtain the more disaggregated 40-household classification. In the following discussion, we refer to results for both levels of classifications.

Table 6 contains the projected changes in the distribution of nominal disposable incomes across 40 types of households. Column 1 of the table contains the values of the average disposable household income for each type of household in 1984-85. Columns 2 and 3 contain projected changes in these incomes for Simulations I and II, respectively.

Before we examine the results presented in Table 6, we would like to remind the reader about an important feature of our model. Unlike in the real world, in our model the tax system is fully indexed to the CPI. Hence, inflation does not alter the real rate of

TABLE 6

Projected Changes in the Nominal Disposable Incomes of 40 Types of Households

Household Characteristics						Average Disposable Household Income in 1984-85 (dollars)	Simulation I* (Fixed real wage rate)	Simulation II* (Fixed nominal wage rate)
Principal source of income	Nature of housing occupancy	Age of household head	Number of adults	Number of children	No.			
Earned income	Owning home	Under 65 I	1	0	1	22,908	-3.95	-1.46
			2	0	2	31,066	-4.20	-1.37
				1	3	30,737	-4.18	-1.15
				2	4	32,870	-4.25	-1.35
				3+	5	31,150	-3.64	-1.63
			3	0	6	32,592	-4.21	-1.26
				1+	7	30,981	-4.03	-1.64
			4	0	8	31,156	-4.06	-1.92
				1+	9	30,912	-4.10	-1.73
			5+	0	10	35,700	-4.84	-1.60
				1+	11	35,124	-4.40	-1.92
		65+ II			12	24,375	-3.78	-2.11
	Buying/renting home	Under 65 III	1	0	13	19,103	-5.09	-0.84
			2	0	14	33,681	-5.00	-0.83
				1	15	28,650	-4.88	-0.91
				2	16	28,117	-5.04	-0.88
				3+	17	28,550	-4.88	-0.90
			3	0	18	50,058	-4.90	-1.03
				1+	19	39,163	-4.96	-1.16
			4	0	20	60,360	-5.19	-0.83
				1+	21	39,251	-5.30	-0.70
			5+	0	22	60,809	-5.15	-0.15
				1+	23	50,491	-5.36	-0.77
		65+ IV			24	51,743	-4.76	-1.81
	Single parents	V			25	20,158	-4.85	-1.24

... continued

Table 6 continued

Household Characteristics					No.	Average Disposable Household Income in 1984-85 (dollars)	Simulation I* (Fixed real wage rate)	Simulation II* (Fixed nominal wage rate)
Principal source of income	Nature of housing occupancy	Age of household head	Number of adults	Number of children				
Unearned income	Owning home	Under 65 VI	1	0	26	16,381	-4.12	-3.29
			2	0	27	25,911	-4.19	-2.94
				1+	28	34,813	-3.92	-3.23
			3+	0	29	31,503	-3.83	-3.21
				1+	30	29,965	-3.29	-3.20
		65+ VII	1		31	15,405	-4.17	-2.80
			2+		32	25,450	-4.40	-2.76
	Buying/renting home	Under 65 VIII	1	0	33	11,204	-4.33	-3.23
			2	0	34	22,892	-4.33	-3.40
				1+	35	20,438	-4.65	-3.03
			3+	0	36	43,670	-3.84	-4.28
				1+	37	28,512	-4.91	-2.31
		65+ IX	1		38	10,843	-5.17	-2.63
			2+		39	26,469	-5.19	-2.03
	Single parents	X			40	13,358	-5.04	-2.72
Aggregate						29,182	-4.66	-1.60

* Simulation results are expressed as percentage changes.

taxation of an individual through bracket creep. In other words, it is the real and not the nominal rates of taxation that are exogenous in our model. This needs to be kept in mind in interpreting the simulation results contained in Table 6.

Table 6 reveals that in both simulations, all types of households experience a decline in their nominal disposable incomes.[13] This is because the removal of tariffs leads to a decline in costs and prices and hence to a decline in nominal incomes from most sources in both simulations. As we have seen earlier (in Table 5), the only nominal incomes to increase in both simulations are those accruing to agricultural land and agricultural capital; nominal income from wages remains constant (by assumption) in Simulation II; all other nominal incomes register a decline in both simulations. The significant decline in nominal wages (by 5.3 per cent) in Simulation I is largely responsible for the fact that average nominal household incomes decline by over three times as much in Simulation I (by 4.7 per cent) as compared with their declines in Simulation II (by 1.6 per cent).

Table 6 also reveals that within each simulation, there are significant differences in the effects of tariff removal on the nominal incomes of different types of households. In Simulation I, the income declines range from a maximum of 5.4 per cent for households of type 23 (consisting of earning, home buying/renting, younger

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13 Note that all results reported in this paper are generated from the comparative static policy analytic (rather than forecasting) version of ORANI. As with any comparative static analysis, our results do not represent the actual evolution of the economy. Rather, they give a broad picture of how much difference the policy change would make to the economy after about two years of adjustment.

households with five or more adults and with one or more child(ren)) to a minimum of 3.3 per cent for households of type 30 (consisting of non-earning, home-owning, younger households with three or more adults and with one or more child(ren)). In Simulation II, the range of effects is even wider. In the second simulation, tariff removal leads to a maximum decline in nominal incomes of 4.3 per cent for households of type 36 (consisting of non-earning, home buying/renting, younger households with three or more adults and no children) and to a minimum decline of only 0.2 per cent for households of type 22 (consisting of earning, home buying/renting, younger households with five or more adults and no children).

Comparing across the two simulations, we notice from Table 6 that there are significant differences in the way that particular types of households are affected by the removal of tariffs under the different conditions of the two simulations. More specifically, we note that types of households that would be relatively favourably affected by the removal of tariffs under the conditions of one simulation, would instead be relatively unfavourably affected by the implementation of the same change under the conditions of the other simulation. For example, we find that households of type 23, which we had identified above as the type likely to experience the maximum nominal income loss in Simulation I, are also the type likely to experience one of the lowest income losses in Simulation II. It can be checked from Table 6 that the relative situations of the other three types of households that we had identified above as those experiencing income declines at the extreme ends of the range in each simulation are also similarly reversed if we adopt the conditions of the other simulation.

Underlying the differences in the distributional results of the two simulations are differences in the way that various factors of production are rewarded under the two simulations. In particular, the relative changes in wages and salaries and in rental incomes are especially influential in determining the distribution of household incomes. This is because we distinguish between households on the basis of whether or not their primary source of income is earned income (of which the most important type is wages and salaries) and whether or not they own their homes outright (since (imputed) rental incomes accrue largely to such home-owners).

The relative rewards to various factors are influenced by the way labour responds to the tariff reform. Following the removal of tariffs, labour has a choice: it can either absorb the gains from reform in the form of employment increases, as it does in Simulation I, or it can enjoy them as real wage increases, as it does in Simulation II. As we have seen above, one of the consequences of the real wage maintenance in Simulation I is that those owning labour will be relatively less favourably rewarded than those owning other resources such as dwellings or other forms of capital. In contrast, in Simulation II, the resultant increase in real wages rewards owners of labour by more than it rewards owners of other factors. These differences are important for understanding the distributional results presented in this paper.

The results contained in Table 6 arise as a result of the interaction of a complex set of underlying mechanisms. In particular, for each type of household, the projected change in its real

disposable income is a function of the distribution of its members and of its heads across the 61 occupations and the 6 labour force categories identified in Table 4, and of the proportion of income that its members derive from different sources of income. Hence, though possible, it is not always easy to disentangle all the separate influences underlying the aggregated household results derived from the results for various individuals belonging to that type of household. To aid in the identification of the major influences, we disaggregate the distributional results according to each of the characteristics that defines the household types. The results for this breakdown are contained in Table 7.

If we examine the results in Table 7 for the disaggregation of households according to only the first two of the decomposition characteristics, i.e., according to the principal source of income and the nature of housing occupancy, we find that there are some important differences in the results for the two simulations. An understanding of these differences can significantly enhance our understanding of the results contained in Table 6.

Table 7 reveals that in Simulation I, households whose principal source of income is earned income experience relatively larger nominal income losses (of 4.8 per cent) as compared with the losses (of 4.4 per cent) of those whose principal source is unearned income. In Simulation II, this situation is reversed; now it is the households that are primarily dependent on earned income that experience the relatively smaller income losses (of 1.0 per cent), whereas those primarily dependent on unearned income experience the relatively larger losses (of 2.8 per cent). This is because, as

TABLE 7

Breakdown of Distributional Results by Household Characteristics

Household Characteristic		Proportion of All Households Described by Characteristic	Average Disposable Household Income in 1984-85 (dollars)	Projected Changes in Nominal Disposable Income*	
				Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
1.	***Principal Source of Income***				
(1.1)	Earned	69.5	32,767	-4.83	-1.03
(1.2)	Unearned	30.5	21,008	-4.42	-2.79
		100.0			
2.	***Nature of Housing Occupancy***				
(2.1)	Owning home outright	36.3	26,630	-4.15	-2.18
(2.2)	Buying/renting	63.7	30,637	-4.92	-1.30
		100.0			
3.	***Age of Household head***				
(3.1)	Under 65 years	81.2	30,916	-4.70	-1.43
(3.2)	65 or more years	18.8	21,717	-4.49	-2.52
		100.0			
4.	***Number of Adults***				
(4.1)	One	22.3	16,128	-4.56	-2.13
(4.2)	Two	53.6	28,990	-4.66	-1.51
(4.3)	Three	10.1	39,190	-4.62	-1.56
(4.4)	Four	8.1	41,149	-4.79	-1.34
(4.5)	Five or more	5.9	46,924	-4.99	-1.11
		100.0			
5.	***Number of Children***				
(5.1)	Zero	61.9	28,481	-4.61	-1.77
(5.2)	One	13.7	31,621	-4.76	-1.36
(5.3)	Two	15.9	29,580	-4.81	-1.23
(5.4)	Three or more	8.5	29,621	-4.60	-1.49
		100.0			
	Aggregate	--	29,182	-4.66	-1.60

* Simulation results are expressed as percentage changes.

discussed above, different factors are rewarded differently in the two simulations. In the first simulation, wages and salaries (the main type of earned income) fall relative to unearned incomes such as rents and dividends, whereas in the second simulation they undergo a relative rise (see Table 5).

The second important difference between the two simulations is the effect they have on households that differ according to their nature of housing occupancy. Table 7 reveals that in Simulation I, households that own their homes outright (and therefore receive substantial (imputed) rental incomes) experience relatively smaller nominal income losses (of 4.2 per cent) as compared with the losses (of 4.9 per cent) of those that are currently buying or renting their homes. Again, this situation is reversed in the second simulation; we now find that it is the home-owning households that experience greater income falls (of 2.2 per cent) than the non-home-owning ones (of 1.3 per cent). Again, this can be explained with reference to our earlier discussion which explained why rental incomes rose relative to other types of incomes in Simulation I and fell in Simulation II (see Table 5).

The remaining results in Table 7 and the more prominent results in Table 6 can be broadly explained with reference to the interaction of the two influences discussed above. For example, Table 7 reveals that in Simulation I, the nominal income losses of households headed by persons aged under 65 years are higher than those of households with older heads and that in Simulation II, this situation is reversed. Our database reveals that of the two groups of households, those with older heads derive a higher proportion of

their income as unearned income (because they contain a relatively higher proportion of retired persons) and they also contain a higher proportion of outright home-owners (for obvious reasons). By combining this information with our previous discussion of the relative rewards to various factors, it is easy to understand why older households experience relatively smaller losses than their younger counterparts in Simulation I and relatively larger losses in Simulation II.

Returning to the results in Table 6, we find that we can now explain some of the more prominent results in this table by referring to the interaction of the two influences (i.e., the principal source of income and the nature of housing occupancy) discussed above. For example, we notice that all 11 types of households belonging to major category III (i.e., household numbers 13-23) experience above average nominal income losses in Simulation I and below average losses in Simulation II. The principal source of income for this group of households is earned income and their nature of housing occupancy is buying/renting. As discussed above, given the effect of the two simulations on the relative rewards to labour versus capital in the form of dwellings, both these sets of factors prove relatively disadvantageous under the conditions of Simulation I and relatively advantageous under the conditions of Simulation II. Similarly, an understanding of these two influences is sufficient to explain the relative effects of the simulations on the nominal incomes of all five types of households belonging to major category VI (i.e., household numbers 26-30). These households have the opposite principal source of income and nature of occupancy as households of category III (examined above). The relative situation of this group of

households in each simulation is likewise the opposite of the situation of those belonging to category III. In other words, this group of households is relatively favourably affected in Simulation I and relatively unfavourably affected in Simulation II.

The previous discussion provides a broad understanding of the results contained in Table 6. Of course, to explain the results in greater detail than we have, we would have to examine the underlying database in even greater depth. That is not attempted here. Instead, we turn to examining the effects of tariff removal on the real incomes of households.

The removal of tariffs not only affects the nominal incomes received by households, but it also effects the purchasing power of these incomes. As discussed earlier in Section IV.1 above, the CPI falls by 5.3 per cent in Simulation I and by 2.6 per cent in Simulation II. In Table 8 we present the effects of tariff removal on the real disposable incomes of households. These results have been obtained by deflating the nominal incomes changes in each simulation by the relevant CPI.

Table 8 reveals that the two simulations differ considerably in their effect on the distribution of real disposable household incomes. In Simulation I, tariff removal leads to an increase in the real disposable income of 38 out of the 40 types of households distinguished in the study. These 38 types account for over 95 per cent of all households in the economy. The remaining two types of households suffer very minor real income losses (of 0.03 and 0.09 per cent). In contrast, in Simulation II we find that the average real

TABLE 8

Projected Changes in the Real Disposable Incomes of 40 Types of Households

Household Characteristics						Simulation I* (Fixed real wage rate)	Simulation II* (Fixed nominal wage rate)
Principal source of income	Nature of housing occupancy	Age of household head	Number of adults	Number of children	No.		
Earned income	Owning home	Under 65 I	1	0	1	1.32	1.17
			2	0	2	1.07	1.26
				1	3	1.09	1.47
				2	4	1.02	1.27
				3+	5	1.63	0.99
			3	0	6	1.06	1.36
				1+	7	1.24	0.99
			4	0	8	1.21	0.70
				1+	9	1.17	0.89
			5+	0	10	0.43	1.03
				1+	11	0.87	0.71
		65+ II			12	1.49	0.52
	Buying/renting home	Under 65 III	1	0	13	0.18	1.79
			2	0	14	0.27	1.80
				1	15	0.39	1.71
				2	16	0.23	1.74
				3+	17	0.39	1.73
			3	0	18	0.37	1.60
				1+	19	0.31	1.46
			4	0	20	0.08	1.80
				1+	21	-0.03	1.93
			5+	0	22	0.12	2.47
				1+	23	-0.09	1.86
		65+ IV			24	0.51	0.81
	Single parents	V			25	0.42	1.39

... continued

Table 8 continued

Household Characteristics						Simulation I* (Fixed real wage rate)	Simulation II* (Fixed nominal wage rate)
Principal source of income	Nature of housing occupancy	Age of household head	Number of adults	Number of children	No.		
Unearned income	Owning home	Under 65 VI	1	0	26	1.15	-0.67
			2	0	27	1.08	-0.31
				1+	28	1.35	-0.61
			3+	0	29	1.44	-0.58
				1+	30	1.98	-0.57
		65+ VII	1		31	1.10	-0.17
			2+		32	0.87	-0.13
	Buying/renting home	Under 65 VIII	1	0	33	0.94	-0.60
			2	0	34	0.94	-0.77
				1+	35	0.62	-0.40
			3+	0	36	1.43	-1.66
				1+	37	0.36	0.31
		65+ IX	1		38	0.10	0.00
			2+		39	0.08	0.59
	Single parents	X			40	0.23	-0.10
Aggregate						0.61	1.03

* Simulation results are expressed as percentage changes.

income gains from tariff reform are not so equally distributed across all the different types of households. In particular, only households whose principal source of income is earned income experience real income gains while most households whose principal source is unearned income experience real income losses. As a result, in the second simulation the real income gains are shared amongst only about 75 (rather than 95) per cent of all households.

The differences between the distributional effects of the two simulations are caused by the difference in the assumptions we have made about how labour reacts to tariff reform in the two simulations. If it enjoys the benefits of reform in the form of real wage (rather than employment) increases, then the burden of adjustment is placed on the unemployed workers, i.e., on those receiving unearned incomes (as is evident from Table 8). Not only do the average real incomes of such households suffer a fall in Simulation II, but as unemployment increases, the number of households primarily dependent on unearned incomes goes up as well.[14] In contrast, in the first simulation, the increase in aggregate employment leads to a decrease in the number of households primarily dependent on unearned incomes.

VI CONCLUSION

This paper shows that, on average, the household sector is likely to experience real income gains of 0.6 - 1.0 per cent as a result of tariff reform. The distribution of these gains across different types

[14] The projected changes in the numbers of households belonging to each type are contained in Appendix 3.

of households, however, depends critically upon how these gains are shared between the employed and the unemployed workers. If the deflationary situation following the reform is allowed to translate into real wage increases, then only about three fourths of all households are likely to enjoy real income gains while the remaining quarter are likely to suffer real income losses. In addition, under these conditions, income is transferred from the worse-off to the better-off households. In contrast, if the reform is accompanied by a fall in nominal wages so that real wages are maintained, then the gains from reform are likely to be shared more equally by the different types of households. Under such a situation, over 95 per cent of all households are likely to enjoy gains in real incomes while the remaining households are likely to experience only very minor losses. The latter outcome may be preferred since it does not place the burden of adjustment on the weaker sections of society.

One limiting assumption of this study is that the appropriate price deflator for the nominal incomes of all types of households is the same. In other words, we are assuming that all types of households have the same expenditure patterns so that the purchasing power of their incomes will be similarly affected by the tariff reform. This is clearly a restrictive assumption. In future research, we plan to relax this assumption and to examine how the removal of tariffs affects the prices of various consumption commodities and how this in turn affects the real incomes of different types of households with differing expenditure patterns.

APPENDIX 1

Projected Effects on Employment by Industry*

ORANI INDUSTRY No.	Name	Trade Category	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
1.	Pastoral zone	E	6.36	0.22
2.	Wheat-sheep zone	E	6.75	0.66
3.	High rainfall zone	E	7.91	0.72
4.	Northern beef	ER	14.39	1.92
5.	Milk cattle and pigs	ER	3.55	-0.12
6.	Other farming (sugar, fruit & nut)	ER	10.43	1.46
7.	Other farming (veg., cotton, seeds, tobacco)	NT	2.59	-0.88
8.	Poultry	ER	5.85	0.73
9.	Agricultural services	ER	3.72	0.22
10.	Forestry and logging	NT	-2.40	-2.13
11.	Fishing and hunting	E	2.43	0.08
12.	Ferrous metal ores	E	10.25	2.28
13.	Non-ferrous metal ores	E	10.62	1.69
14.	Black coal	E	12.57	2.16
15.	Oil, gas and brown coal	NT	4.63	0.26
16.	Other minerals	IC	2.23	-1.89
17.	Services to mining	ER	2.17	0.76
18.	Meat products	E	7.99	1.04
19.	Milk products	NT	-0.36	-0.74
20.	Fruit and vegetables	NT	0.29	-0.92
21.	Margarine, oils and fats	IC	0.33	-2.01
22.	Flour and cereal products	NT	1.14	-0.51
23.	Bread, cakes and biscuits	NT	0.30	-0.20
24.	Confectionery and cocoa	IC	-1.00	-2.52
25.	Other foods products	E	16.90	3.00
26.	Soft drinks and cordials	NT	0.30	-1.37
27.	Beer and malt	NT	1.59	-0.67
28.	Other alcoholic drinks	IC	-3.16	-8.00
29.	Tobacco products	IC	0.72	-0.41
30.	Cotton ginning, etc.	E	2.87	-3.84

... *continued*

Appendix 1 continued

ORANI INDUSTRY No.	Name	Trade Category	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
31.	Man-made fibres, yarns	IC	-38.51	-47.20
32.	Cotton yarns and fabrics	IC	-24.96	-31.56
33.	Worsted and woollen yarns	IC	-6.06	-8.75
34.	Textile finishing	IC	-5.81	-8.00
35.	Textile floor overlays	IC	-5.56	-9.28
36.	Other textile products	IC	-1.66	-4.97
37.	Knitting mills	IC	-10.75	-12.77
38.	Clothing	IC	-9.56	-11.38
39.	Footwear	IC	-37.25	-42.92
40.	Sawmill products	IC	0.91	-2.64
41.	Veneers and boards	IC	-1.09	-3.74
42.	Joinery and wood nec	IC	0.02	-1.75
43.	Furniture and mattresses	IC	-0.04	-2.94
44.	Pulp, paper and paperboard	IC	-0.56	-4.01
45.	Bags, fibreboard boxes	IC	1.36	-1.75
46.	Paper products nec	IC	-1.03	-3.87
47.	Newspapers and books	IC	1.50	-1.28
48.	Commercial printing	IC	0.48	-1.76
49.	Chemical fertilisers	ER	5.73	0.24
50.	Other basic chemicals	IC	-6.93	-12.86
51.	Paints, varnishes	NT	-3.22	-5.67
52.	Pharmaceutical goods	IC	1.95	-1.83
53.	Soaps and detergents	IC	1.42	-0.70
54.	Cosmetics and toiletries	IC	0.02	-1.48
55.	Other chemical goods	IC	-0.97	-4.59
56.	Petrol and coal products	IC	1.74	-1.40
57.	Glass and glass products	IC	-0.84	-4.34
58.	Clay products; refractories	IC	1.70	-0.95
59.	Cement	NT	1.97	-0.38
60.	Ready mixed concrete	NT	1.96	-0.43
61.	Concrete products	NT	1.53	-0.34
62.	Non-metallic ore goods	IC	0.93	-1.15
63.	Basic iron and steel	IC	-1.70	-4.43
64.	Other basic metals	E	11.10	1.63
65.	Structural metal ores	IC	0.57	-1.50
66.	Sheet metal products	IC	0.20	-1.83
67.	Other metal products	IC	-4.84	-8.36
68.	Motor vehicles and parts	IC	-17.99	-23.72
69.	Ships and boats	IC	-1.43	-1.27
70.	Locomotives	ER	1.45	-0.49

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Appendix 1 continued

ORANI INDUSTRY No.	Name	Trade Category	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
71.	Aircraft	IC	0.68	-1.16
72.	Scientific equipment	IC	0.73	-1.15
73.	Electronic equipment	IC	-4.88	-8.60
74.	Household appliances	IC	-1.26	-4.41
75.	Other electrical goods	IC	-2.47	-4.51
76.	Agricultural machinery	ER	25.47	6.23
77.	Construction machinery	IC	-1.95	-2.99
78.	Other machinery and plant	IC	-1.54	-3.18
79.	Leather products	IC	-16.66	-20.89
80.	Rubber products	IC	-5.06	-8.95
81.	Plastic products, etc.	IC	-3.74	-7.73
82.	Signs; writing gear	IC	-1.86	-4.94
83.	Other manufacturing	IC	-5.14	-8.85
84.	Electricity	NT	1.55	-2.15
85.	Gas	NT	0.29	-2.82
86.	Water; sewers and drains	NT	1.38	-1.10
87.	Residential building	NT	1.76	-0.15
88.	Other construction	NT	1.27	-0.36
89.	Wholesale trade	NT	1.59	-1.43
90.	Retail trade	NT	1.67	0.25
91.	Mechanical repairs	NT	2.22	-0.49
92.	Other repairs	NT	2.33	-0.36
93.	Road transport	ER	1.46	-0.78
94.	Rail and other transport	ER	1.97	-0.26
95.	Water transport	ER	1.98	-0.38
96.	Air transport	IC	2.55	-0.91
97.	Communication	NT	1.43	-1.68
98.	Banking	NT	0.90	-1.37
99.	Non-banking finance	NT	1.76	-2.42
100.	Investment and services	NT	1.40	-2.79
101.	Insurance and services	NT	1.60	-1.53
102.	Other business services	NT	1.17	-1.75
103.	Ownership of dwellings	NT	1.89	-1.68
104.	Public administration	NT	0.14	-0.24
105.	Defence	NT	0.00	0.00
106.	Health	NT	0.98	-0.72
107.	Education, libraries	NT	0.14	-0.13
108.	Welfare and religion	NT	0.68	-0.51
109.	Entertainment, leisure	NT	1.37	-1.01
110.	Restaurants, hotels	NT	1.58	-1.15
111.	Personal services	NT	1.85	-1.56
112.	Non-competing imports	NT	-0.00	-0.00
	Aggregate employment		1.08	-1.54

* Simulation results are expressed as percentage changes. The trade categories are: export (E), export related (ER), import competing (IC), and nontraded (NT).

APPENDIX 2

Projected Effects on Employment by Occupation*

IHS OCCUPATION No.	Name	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
1.	Architects, engineers, surveyors, professional	0.85	-1.98
2.	Chemists, physicists and other physical scientists	1.15	-1.47
3.	Medical practitioners, dentists	0.96	-0.72
4.	Nurses, including probationers and trainees	0.95	-0.73
5.	Professional medical workers nec	1.19	-0.46
6.	Teachers	0.17	-0.17
7.	Law professionals	1.07	-1.57
8.	Artists, entertainers, writers and related workers	1.05	-1.14
9.	Draftsmen and technicians nec	0.55	-1.93
10.	Other professional, technicial and related workers	0.59	-1.52
11.	Administrators and executives, government, nec	0.62	-0.35
12.	Employers, workers on own account, managers, nec	0.87	-1.64
13.	Book-keepers and cashiers	1.10	-1.36
14.	Stenographers and typists	0.74	-1.38
15.	Other clerical workers	0.85	-1.43
16.	Insurance, real estate salesmen, auctioneers, valuers	1.40	-1.56
17.	Commercial travellers and manufacturers' agents	0.75	-2.11
18.	Proprietors, shopkeepers, salesmen, shop assistants	1.55	-0.32
19.	Farmers and farm managers	6.44	0.44
20.	Farm workers, including farm foremen	5.39	0.15
21.	Other rural workers	0.80	-0.95
22.	Miners, quarrymen, mineral prospectors, etc	8.79	1.21
23.	Pilots, navigators and ships officers	2.27	-0.62
24.	Railway firemen and drivers	2.51	-0.25
25.	Postmasters	1.45	-1.57
26.	Postmen and messengers	1.37	-1.55
27.	Road transport drivers	1.42	-0.94
28.	Railway guards and conductors	1.95	-0.29
29.	Stationmasters, inspectors and supervisors, transport	1.87	-0.35
30.	Other railway workers and traffic controllers	1.84	-0.62

... *continued*

Appendix 2 continued

IHS OCCUPATION No.	Name	Simulation I (Fixed real wage rate)	Simulation II (Fixed nominal wage rate)
31.	Telecommunication workers	1.15	-1.56
32.	Other transport and communications workers	1.81	-0.42
33.	Spinners, weavers, knitters, dyers, etc	-14.56	-18.78
34.	Tailors, cutters, furriers, etc	-6.60	-8.74
35.	Leather cutters, sewers, etc	-27.00	-31.75
36.	Furnacemen, rollers, drawers, etc	0.13	-4.14
37.	Watchmakers, jewellers, etc	0.37	-2.33
38.	Mechanics, plumbers, metal machinists	-0.14	-3.02
39.	Electrical and electronic workers	1.13	-1.69
40.	Metal and electrical production process workers	-3.58	-7.33
41.	Carpenters, cabinet makers, etc	0.75	-1.50
42.	Painters and decorators	0.48	-1.68
43.	Bricklayers, plasterers, construction workers	1.34	-0.54
44.	Compositors, printing machinists, engravers, etc	0.41	-2.03
45.	Millers, bakers, butchers, brewers, etc	3.61	0.04
46.	Potters; tobacco, chemical, paper production workers	-0.23	-3.77
47.	Paper products, rubber, plastic production workers	-2.37	-5.44
48.	Packers, wrappers and labellers	0.47	-2.69
49.	Excavating and lifting equipment operators	1.12	-1.80
50.	Storemen and freight handlers	0.27	-2.47
51.	Labourers nec	0.45	-2.27
52.	Fire brigade, police, protective services workers	0.77	-0.87
53.	Housekeepers, cooks, maids and related workers	1.26	-0.98
54.	Waiters, bartenders	1.56	-1.09
55.	Caretakers, cleaners (buildings)	0.80	-1.34
56.	Barbers, hairdressers and beauticians	1.82	-1.46
57.	Launderers, dry cleaners and pressers	0.17	-2.49
58.	Athletes, sportspersons and undertakers	1.51	-1.01
59.	Photographers	1.33	-1.38
60.	Service, sport, recreation workers nec	1.06	-0.78
61.	Members of armed services	0.00	0.00
	Aggregate Employment	1.08	-1.54

* Simulation results are expressed as percentage changes.

APPENDIX 3

Projected Changes in the Number of Households Belonging to Each of 40 Types of Households

Household Characteristics						Proportion of All Households Contained in Type of Household in 1984-85	Simulation I* (Fixed real wage rate)	Simulation II* (Fixed nominal wage rate)
Principal source of income	Nature of housing occupancy	Age of household head	Number of adults	Number of children	No.			
Earned income	Owning home	Under 65 I	1	0	1	1.2	0.52	-1.15
			2	0	2	4.2	0.48	-0.93
				1	3	0.9	0.79	-1.10
				2	4	1.8	0.37	-0.83
				3+	5	1.2	0.51	-0.64
			3	0	6	2.3	0.53	-1.14
				1+	7	0.7	0.66	-0.60
			4	0	8	1.5	0.30	-0.66
				1+	9	1.0	0.13	-0.86
			5+	0	10	1.2	0.67	-1.56
				1+	11	0.9	0.63	-0.42
		65+ II			12	1.3	0.28	-0.28
	Buying/renting home	Under 65 III	1	0	13	7.1	0.41	-0.73
			2	0	14	10.8	0.38	-0.90
				1	15	5.3	0.32	-0.78
				2	16	9.5	0.63	-1.20
				3+	17	4.9	0.69	-0.99
			3	0	18	3.0	-0.01	-0.44
				1+	19	1.8	0.26	-0.51
			4	0	20	1.8	0.31	-0.76
				1+	21	2.6	0.62	-1.22
			5+	0	22	1.6	0.37	-1.65
				1+	23	1.6	0.63	-0.99
		65+ IV			24	0.8	0.22	-0.25
	Single parents	V			25	0.7	0.64	-0.59

... continued

Appendix 3 continued

Household Characteristics						Proportion of All Households Contained in Type of Household in 1984-85	Simulation I* (Fixed real wage rate)	Simulation II* (Fixed nominal wage rate)
Principal source of income	Nature of housing occupancy	Age of household head	Number of adults	Number of children	No.			
Unearned income	Owning home	Under 65 VI	1	0	26	1.8	-0.68	1.08
			2	0	27	2.3	-0.26	0.98
				1+	28	0.6	-0.42	3.57
			3+	0	29	0.6	-0.80	1.43
				1+	30	0.4	-0.98	2.38
		65+ VII	1		31	5.1	0.08	-0.01
			2+		32	6.9	-0.03	0.21
	Buying/renting home	Under 65 VIII	1	0	33	2.0	-2.09	3.44
			2	0	34	1.4	-0.98	2.27
				1+	35	1.5	-2.89	5.72
			3+	0	36	0.6	-2.33	4.64
				1+	37	1.0	-1.96	3.54
		65+ IX	1		38	2.7	0.02	-0.03
			2+		39	1.9	0.06	-0.06
	Single parents	X			40	1.5	-0.80	1.43
Aggregate						100.0	--	--

* Simulation results are expressed as percentage changes.

REFERENCES

Agrawal, N. (1989) "The Effects of Structural Change on Employment, Unemployment and Labour Force Participation", *Labour Economics and Productivity* (forthcoming). Currently available as IMPACT Project *General Paper* No. G-88, November 1988.

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

Agrawal, N. (1987b) "Calculating Disposable Incomes for the 1984-85 Version of the IHS Database", *Research Memorandum* No. OA-394, Industries Assistance Commission, Canberra, December.

Agrawal, N. and G.A. Meagher (1987) "How to Compute Solutions with the NAGA Add-on to the ORANI Model", *Research Memorandum* No. CA-129, Industries Assistance Commission, Canberra, September.

Agrawal, N. and G.A. Meagher (1988a) "Tariff Reform and the Distribution of Employment", IAESR *Working Paper* No. 6/1988, University of Melbourne.

Agrawal, N. and G.A. Meagher (1988b) "Updating the 1981-82 Income and Housing Survey Database to 1984-85", *Research Memorandum* No. OA-396, Industries Assistance Commission, Canberra, January.

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

Codsi, G. and K. R. Pearson (1988) "GEMPACK: General-Purpose Software Suite for Applied General Equilibrium and Other Economic Modellers", *Computer Science in Economics and Management* , Vol. 1, pp. 189-207.

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", Piggot, J. and J. Whalley (eds.), *New Developments in Applied General Equilibrium Analysis*, Cambridge University Press, Cambridge.

Dee, P. (1988) "ORANI Tariff Rates: December 1987 and Projections for Mid-1990's" *Research Memorandum* No. OA-436, Industries Assistance Commission, Canberra, September.

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

Higgs, P. J. (1988) "Domestic Trade Distortions and Australian Agriculture", IMPACT Project *General Paper* No. G-83, April.

Industries Assistance Commission (1987) *A Guide to the IAC's Use of the ORANI Model*, AGPS, Canberra.

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.

Pearson, K.R. (1988) "Automating the Computation of Solutions of Large Economic Models", *Economic Modelling*, Vol. 5, pp. 385-395.

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

Powell, A.A. (1983) "Aspects of the Design of BACHUROO, An Economic Demographic Model of Labour Supply", in A.C. Kelley, W.C. Saunderson and J.G. Williamson (eds.), *Modeling Growing Economies in Equilibrium and Disequilibrium*, Duke Press Policy Studies, Durham, N.C.

Powell, A.A. and A. Lawson (1989) "A Decade of Applied General Equilibrium Modelling for Policy Work", forthcoming in Lars Bergman, Dale W. Jorgenson and Erno Zalai (eds), *General Equilibrium Modeling and Economic Policy Analysis*, Blackwell, New York.