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THE SENSITIVITY OF ORANI PROJECTIONS OF THE SHORT-RUN EFFECTS OF INCREASES IN PROTECTION TO VARIATIONS IN THE VALUES ADOPTED FOR EXPORT DEMAND ELASTICITIES

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minor influence on the model's projections of the macroeconomic effects of an across-the-board tariff increase. The reduction in imports is slightly less with the smaller rather than with the standard parameters because domestic products are less easily substitutable for imports. The tariff increase is slightly less inflationary since the prices of domestic import-competing commodities cannot so easily be increased following the tariff-induced rise in import prices. Export industries are disadvantaged by the inflationary effects of the tariff increase and thus fare slightly better in the simulation reported in the second column than in the standard simulation. Nevertheless, the overall reduction in employment with the lower substitution elasticities is greater than that in the standard case.

The industry-output results in the table confirm that, in the tariff experiment, the main impact of reducing the import substitution parameters is felt by the import-competing industries. The smaller are the elasticities of substitution between imports and domestic output the less able are the import-competing industries to take advantage of the rise in import prices induced by the tariff increase. The main examples are in the textiles, clothing, footwear and motor vehicles sectors (industries 31 - 39 and 68). Output increases in these sectors are up to 0.7 percentage points smaller in column 2 of the table than in column 1.

Table A1 continued ....

Industry outputs		Projections(a)	
Code number	Industry description	Standard parameter values	Import substitution parameter multiplied by 0.9
91	Motor vehicle repair	-.32	-.32
92	Other repairs	-.38	-.37
93	Road transport	-.49	-.50
94	Railway transport	-.97	-.96
95	Water transport	-.61	-.59
96	Air transport	-.26	-.20
97	Communication	-.23	-.22
98	Banking	-.15	-.16
99	Finance and life insurance	-.07	-.07
100	Other insurance	-.17	-.17
101	Investment, real estate	-.09	-.10
102	Other business services	-.25	-.25
103	Ownership of dwelling	0.00	0.00
104	Public administration	-.01	-.02
105	Defence	-.00	-.00
106	Health	.01	.01
107	Education, libraries	-.00	-.00
108	Welfare services	-.10	-.10
109	Entertainment	-.10	-.09
110	Restaurants, hotels	.00	.00
111	Personal services	-.00	-.00
112	Business expenses	-.21	-.22
113	Non-competing imports	.01	.01

(a) All projections are percentage changes except for the balance of trade. The change in the balance of trade is expressed as a percentage of GDP.

The Sensitivity of ORANI Projections of the Short-run Effects of Increases in Protection to Variations in the Values Adopted for Export Demand Elasticities*

by

Peter B. Dixon B.R. Parmenter Russell J. Rimmer

1. Introduction

ORANI is a multisectoral model of the Australian economy.[1] It has been applied in studies of the effects on industries, regions and occupational groups of changes in tariffs, changes in the exchange rate, changes in wages, changes in aggregate demand, the adoption of home-price schemes for exported products, the exploitation of mineral resources, the adoption of equal pay for women, changes in domestic oil pricing policies, changes in world commodity prices and changes in the provision of subsidies to ailing industries. In all these applications, a feature of the results has been the sensitivity of the export-oriented industries to increases in the costs of labour and other inputs. In ORANI simulations, it is normally assumed that exporters face elastic foreign demand schedules for their products. This means that they cannot pass on cost increases to their foreign customers without suffering significant reductions in their sales.

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1. The model is fully documented in Dixon, P.B., B.R. Parmenter, J. Sutton and D. Vincent (1982), hereafter cited as DPSV (1982).

There is uncertainty concerning the values of export demand elasticities. In this paper we discuss the impact of adopting different values on ORANI projections of the short-run effects of increasing tariffs. We find that the ORANI projections are not very sensitive to variations in the export demand elasticities over the elastic range. From the point of view of standard ORANI-based conclusions about the short-run effects of protection, it does not matter whether we set the export demand elasticities at 2 or infinity. Only when the elasticities are set at implausibly low values (e.g., less than 1) does the usual ORANI story require significant modification.

The paper is organized as follows. In the next section we list the general conclusions that have followed from ORANI tariff simulations. Then in section 3 we review briefly the techniques for measuring export demand elasticities and some of their applications in Australia. Section 4 presents our sensitivity analysis and section 5 contains concluding remarks. As part of our commitment to AIDA and COMALCO which provided financial support for this research, we have included an appendix containing some analysis of the sensitivity of ORANI tariff results to variations in import-domestic substitution elasticities.

Table A1 continued ....

Industry outputs		Projections[a]	
Code number	Industry description	Standard parameter values	Import substitution parameter multiplied by 0.9
41	Plywood, veneers	.67	.62
42	Joinery and wood products	.22	.21
43	Furniture, mattresses	.26	.26
44	Pulp, paper	-.26	-.26
45	Fibreboard	-.28	-.31
46	Paper products n.e.c.	-.00	-.03
47	Newspapers and books	-.40	-.38
48	Commercial printing	-.02	-.04
49	Chemical fertilisers	-1.85	-1.82
50	Industrial chemicals	.53	.45
51	Paints, varnishes	.58	.52
52	Pharmaceuticals	-.56	-.53
53	Soap and detergents	.02	.02
54	Cosmetics, toiletry	.09	.09
55	Chemical products n.e.c.	.15	.11
56	Oil and coal products	-.33	-.34
57	Glass	.05	.05
58	Clay products	-.60	-.58
59	Cement	.00	.01
60	Ready-mixed concrete	.11	.12
61	Concrete products	.11	.11
62	Non-metallic mineral products	-.09	-.10
63	Basic iron and steel	-3.87	-3.86
64	Other basic metals	-2.81	-2.80
65	Structural metal	-.00	-.01
66	Sheet metal products	.15	.13
67	Metal products n.e.c.	1.02	.91
68	Motor vehicles, parts	5.58	5.07
69	Ship and boat building	.24	.25
70	Locomotives	-.36	-.35
71	Aircraft building	-.33	-.27
72	Scientific equipment	.08	.07
73	Electronic equipment	1.31	1.20
74	Household appliances	1.00	.92
75	Electrical machinery	.03	.01
76	Agricultural machinery	-3.67	-3.64
77	Construction equipment	-1.01	-1.02
78	Other machinery	-.13	-.17
79	Leather products	2.44	2.21
80	Rubber products	1.24	1.10
81	Plastic products	.73	.64
82	Signs, writing equipment	.17	.14
83	Other manufacturing	.25	.21
84	Electricity	-.25	-.26
85	Gas	.25	.23
86	Water, sewerage	-.23	-.24
87	Residential building	-.00	-.00
88	Building n.e.c.	.16	.17
89	Wholesale trade	-.31	-.33
90	Retail trade	-.06	-.06

continued ....

Table A1 : A comparison of ORANI projections of the short-run effects of a 25 per cent across-the-board tariff increase using alternative import-substitution parameters

		Projections[a]	
		Standard parameter values	Import substitution parameter multiplied by 0.9
Macro variables			
Consumer price index		2.36	2.33
Aggregate import bill ($US)		-1.53	-1.43
Aggregate export receipts ($US)		-2.94	-2.91
Balance of trade (percentage of GDP)		-0.23	-0.23
Aggregate employment		-0.36	-0.38
Industry outputs			
Code number	Industry description		
1	Pastoral zone	-2.70	-2.68
2	Wheat/sheep zone	-1.71	-1.69
3	High rainfall zone	-3.62	-3.59
4	Northern beef	-4.75	-4.71
5	Milk cattle	-.79	-.78
6	Other farming export	-2.61	-2.59
7	Other farming import competing	-.23	-.23
8	Poultry	-1.39	-1.38
9	Services to agriculture	-1.66	-1.64
10	Forestry	-.06	-.04
11	Fishing	-.71	-.70
12	Iron	-.69	-.68
13	Other metallic minerals	-1.86	-1.85
14	Coal	-2.02	-2.00
15	Crude oil	-.31	-.32
16	Non-metallic minerals n.e.c.	-.29	-.27
17	Services to mining	-1.48	-1.47
18	Meat products	-3.26	-3.23
19	Milk products	-.05	-.04
20	Fruit and vegetable products	.08	.07
21	Marge, oils and fats	-.08	-.10
22	Flour and cereal products	-3.07	-3.64
23	Bread, cakes	.00	.00
24	Confectionery	.14	.13
25	Food products n.e.c.	-3.56	-3.53
26	Soft drinks, cordials	.06	.06
27	Beer and malt	.01	.01
28	Alcoholic drinks n.e.c.	.10	.09
29	Tobacco	.09	.09
30	Prepared fibres	-1.41	-1.48
31	Man-made fibres, yarn	5.71	5.23
32	Cotton, silk, flax	3.81	3.44
33	Wool and worsted yarns	1.49	1.34
34	Textile finishing	1.08	.97
35	Textile floor covers	1.04	.94
36	Textile products n.e.c.	-.26	-.26
37	Knitting mills	4.21	3.80
38	Clothing	1.53	1.37
39	Footwear	7.26	6.59
40	Sawmill products	-.25	-.22

continued ....

Notes appear at the end of the table.

2. The main conclusions from ORANI tariff simulations

ORANI has been used in many studies of the effects of changes in protection. Some have been concerned with broad changes, e.g. the effects of a 25 per cent across-the-board increase in all tariffs. Others, especially those conducted by the Industries Assistance Commission which advises the government on protection policy, have concentrated on the effects of changing just one tariff or a small group of tariffs. Both types of studies have been repeated many times with different underlying assumptions and data inputs.

From all this work, DPSV (1982, p. 345) identify the most important general conclusions as being

"(i) that contrary to popular views, import-competing industries would not be in danger of immediate collapse under the effects of reductions of 25 per cent or even more in their rates of protection;

(ii) that increases in tariffs will destroy as many jobs as they create and will not improve the balance of trade;

(iii) that the regional effects of overall increases in protection are uneven, with the benefits concentrated in one State, Victoria, while three States, Queensland, Western Australia and Tasmania, bear the bulk of the costs; and

(iv) that tariff reform will not lead to unmanageably large adjustment problems in the short run".

Conclusion (i) is illustrated in table 4.3. This table will be explained in more detail in subsection 4.2. For the moment, we note that the column marked "Standard projection" contains short-run results obtained under standard parameter values. These results indicate that the largest increase in output arising from a 25 per cent across-the-board tariff increase is only 7.26 per cent. Similarily, ORANI projects that under a 25 per cent across-the-board tariff reduction, the most adversely affected industry would, after about two years, have a rate of output of 7.26 per cent less than it would have had in the absence of the tariff reduction. As pointed out by DPSV (1982, p.345), the key parameters in explaining this result are the elasticities of substitution between imported and domestic products. Estimates for these parameters are consistent with the fact that changes in the purchasers' prices of imported products relative to those of competing domestic products have not, in the past, been associated with violent fluctuations in import-domestic shares in local markets. The sensitivity of ORANI tariff results to changes in the substitution elasticities between imported and domestic products is discussed in the appendix.

Conclusion (ii) reflects the ORANI result that increases in tariffs impose a profit squeeze on export-oriented industries. In ORANI, these industries suffer cost increases while having limited opportunity to raise their selling prices. The cost increases arise in a variety of ways recognized in the model. Tariffs increase the costs of imported intermediate inputs and also allow the prices of some domestically produced intermediate inputs

Appendix

The sensitivity of ORANI projections of the short-run effects of a 25 per cent across-the-board tariff increase to changes in the import-substitution elasticities

In ORANI, imports and domestically produced commodities of the same commodity classification are modelled as imperfect substitutes for each other. Estimates of the elasticities of substitution between the two sources (imported and domestic) of each of the 115 commodities distinguished in the model are therefore required. This part of the ORANI data file is described in DPSV (1982, section 29.1). A detailed econometric study using newly mobilised data was conducted and the results are regarded as one of the strongest parts of the current ORANI parameter file. It is unlikely that a convincing case could be made for large variations in the standard ORANI values. Nevertheless, in this appendix, we will demonstrate the sensitivity of ORANI projections to changes in the import-substitution parameters. Table A1 contains macroeconomic and industry-output projections from two ORANI simulations (using the standard neoclassical short-run mode) of the effects of a 25 per cent across-the-board tariff increase. The first column of results was generated using standard parameter values. For the second column all the import substitution elasticities were multiplied by a factor of 0.9.

It is clear from table A1 that a 10 per cent reduction in the import substitution elasticities in ORANI has only a very

subsidies. We assume that export volumes are maintained in the face of cost increases by offsetting increases in these subsidies. Thus we assume that cost increases in the export industries are passed back to the Australian taxpayer whereas in the low elasticity simulation ($\alpha = 0.001$) reported in section 4 we assumed that cost increases are passed forward to foreign customers. Neither the case in which cost increases are passed forward to foreigners or backward to the taxpayers seems generally descriptive of the conditions under which Australian exporters operate.

One of the reasons for conducting sensitivity analyses is to guide the setting of research priorities. To obtain more satisfactory estimates of export demand elasticities than those already available would be a major research task. For example, it might involve the construction of a multicountry model so that the foreign demand functions for Australian products could be derived by explicit consideration of the substitution possibilities available to producers and consumers in Japan, US, Europe, etc.. However, nothing in this paper suggests that we should assign a high priority to such a task. On the contrary, the paper suggests that if we are satisfied that export demand elasticities are, on average, greater than two, then the exact values that we choose for them between two and infinity, do not have critical implications for ORANI results.

to be higher than they could be without tariffs. Tariffs increase wages because wages tend to move with the consumer price index. In many ORANI simulations, including those reported in this paper, it is assumed that wages are 100 per cent indexed to the CPI. Tariff increases inflate the CPI directly through their effect on the prices of imported consumer goods, and indirectly via the relaxation of competitive pressures on suppliers of import-competing consumer goods and because domestic producers pass some of the tariff-related cost increases onto consumers. By taking account of the wage-price link, ORANI implies that the cost increases generated by increases in tariffs are spread throughout the economy. At the same time, the model recognizes sharp differences between industries in their abilities to cope with cost increases. Because in standard applications of ORANI it is assumed that foreign demand curves for Australian products are highly elastic, the model normally implies that export-oriented industries are poorly placed to pass on cost increases. In most simulations of the effects of tariff increases, the consequent decline in employment in the export-oriented industries is sufficient to outweigh the increase in employment in the import-competing industries. Similarly, the decline in export receipts is projected to be sufficient to outweigh the decline in the import bill. Obviously, these results depend on the values adopted for the elasticities of foreign demand curves. The sensitivity of the ORANI tariff results to changes in these elasticities is discussed in the main part of the paper, section 4.

Conclusions (iii) and (iv) follow from (i) and (ii) with small additional amounts of information. To obtain (iii) it is necessary to recognize that Victoria has a disproportionately large share of Australia's import-competing industry and a disproportionately small share of the country's exporting activity, while Western Australia, Queensland and Tasmania have high concentrations of exporting activity. Conclusion (iv) involves considering ORANI results for the employment effects of tariff reductions in the light of occupational mobility statistics. Neither conclusions (iii) or (iv) will be pursued any further in this paper.

3. The measurement of export demand elasticities

The ORANI model contains the equation

$$P^e_{ia} = X_{ia}^{-\gamma_{ia}} F_{ia}, \quad i=1,\ldots,g, \tag{3.1}$$

where P^e_{ia} is the foreign currency received in Australia per unit of export of good i. P^e_{ia} includes payments for transport and other margins involved in the delivery of exports to Australian ports but it excludes transport costs from Australian ports to the final destination, i.e., P^e_{ia} is the f.o.b. price in foreign currency. F_{ia} is a shift variable which will increase if there is an increase in overseas demand for good i from Australia.

insist that export demand elasticities are very low. One argument sometimes advanced is that various adjustment lags mean that export demand elasticities are low in the short-run although they may be high in the long-run. Because of the eventual loss of sales, it is argued that exporters cannot exploit their short-run monopoly power and thus the absurd conclusions outlined in the previous paragraph do not follow. It seems to us that if exporters are restrained from passing on cost increases because of the long-run consequences, then they are behaving as if their short-run export demand elasticities are high.

A second version of the low elasticity argument stresses the importance of negotiations between governments and of long-term contracts. In effect, this argument denies the relevance of export demand functions such as those illustrated by figure 3.1. It implies that what Australian exporters are presented with (at least in the short-run) is not a demand curve but a price-quantity point. Simulations in which both foreign currency prices and export volumes are set exogenously have been conducted with ORANI.[1] In fact, the only significant differences between the results given in table 4.1, part A and table 4.3 for the low elasticities case ($\alpha = 0.001$) and those which would have been obtained if we had fixed the changes in foreign currency prices and export quantities exogenously at zero, are in the projections for export revenue and the balance of trade. In fixed-price-quantity simulations we introduce variable export

1. See for example, Dixon, Powell and Parmenter (1979, pp.36-40).

employment by 5 per cent with no change in the balance of trade we should increase real aggregate absorption by 51 per cent and allow real wage rates (as a cost) to increase by 56 per cent. Thus, the model implies that Australia's unemployment problems could be cured by a massive injection of aggregate demand combined with an explosion in real wage rates. The domestic economy would not produce much more (employment would increase by only 5 per cent) but the increase in absorption would be sustained by a dramatic improvement in Australia's terms of trade brought about by the exploitation of monopoly power in her export markets. Of course, a very large increase in domestic prices would accompany such a policy package (the ORANI CPI projection is a 347.5 per cent increase) but the increase in absorption available would leave plenty of scope to compensate those who suffered from the distributional consequences.[1]

We can safely assume that very few economists would accept the idea that Australia's export revenue is increased by domestic cost escalation. Nevertheless, even among economists who are prepared to adopt in their own work the usual neoclassical assumptions (e.g. utility maximizing, cost minimizing, price taking by firms and households, perfect information, etc.) which form the basis of general equilibrium models such as ORANI, there are some who

1. Alternatively the domestic inflation could be tackled via appropriate exchange rate revaluation.

γ_{ia} is a non-negative parameter. It is the reciprocal of the foreign elasticity of demand for Australian exports of good i. g is the number of goods. In standard applications of ORANI, g is 115. Equation (3.1) is illustrated in figure 3.1.

In applying ORANI, it is necessary to set values for the γ's. The values chosen for many of the γ's have no influence on the results obtained in most applications of the model including those in this paper. For commodities for which only a small percentage of the Australian output is exported, X_{ia} is normally held constant, perhaps at zero. However, for commodities where more than 20 per cent of Australian output is exported, the X_{ia}'s are normally treated as endogenous variables whose values respond to changes in costs and other influences. If X_{ia} is allowed to move, the value used for γ_{ia} will influence the projected movement in the foreign currency price, P^e_{ia}, which will, in turn, affect other variables in the model.

The commodities for which the γ's are important in this paper (i.e., those for the endogenous export commodities)[1] are listed in table 3.1 The table also contains eleven sets of values for the reciprocals of the γ's. These sets of export demand elasticities were used in the sensitivity analysis reported in section 4. The values shown in the column marked $\alpha = 1.0$ are the standard values which have been used in most of the recent applications of the ORANI model. In the final two columns we have listed estimates suggested by Cronin (1979a) and Fallon (1981). The values in the remaining columns were obtained by proportionate scaling of the standard values. The scaling factors are the α's shown at the heads of the columns.

1. In this paper the percentage changes in all the exogenous export levels are zero.

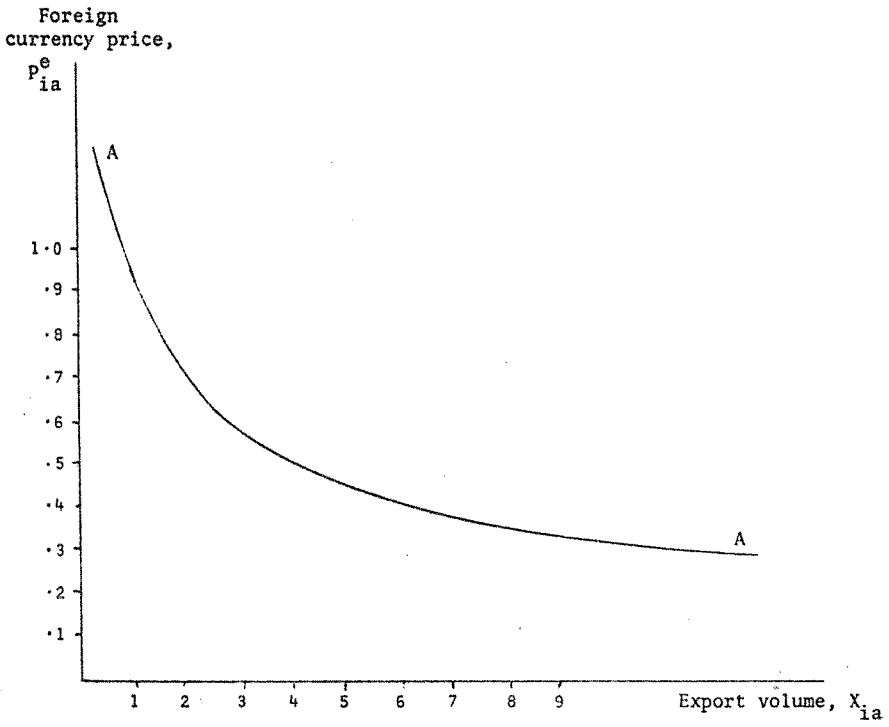

Figure 3.1 : Foreign demand curve for Australian good i. The curve AA illustrates equation (3.1) for $\gamma_{ia} = 0.5$ (i.e., the export demand elasticity is 2) and $F_{ia} = 1$. For larger values of γ_{ia}, the curve becomes steeper (less elastic) and for smaller values it becomes flatter (more elastic). Changes in F_{ia} cause shifts in the curve. For example, increases in F_{ia} cause an outward shift and can be used in ORANI to simulate the effects of increases in overseas demand for Australian good i.

conclusions (i) - (iv) in section 2. To use ORANI to support a position seriously at variance with these conclusions, we would have to believe that export demand elasticities are, on average, less than one. In that case, the foreign currency value of export revenue would be increased by reductions in export volumes brought about by, for example, production quotas, crop destruction or the imposition of export taxes. ORANI suggests that export revenues would also increase as a result of general cost escalations arising from wage increases, tariff increases,[1] and increases in indirect taxes. If export demand elasticities are set close to zero, then the model implies that general cost escalations not only increase export revenue but also improve the balance of trade. Some very strange conclusions follow. For example, consider the basic macroeconomic problem of stimulating the demand for labour without allowing a deterioration on the balance of trade. Using standard values in ORANI for the export demand elasticities, Dixon, Powell and Parmenter (1979) found that a 5 per cent increase in the demand for labour with zero effect on the balance of trade could be achieved by a 3 per cent increase in aggregate absorption combined with a 6 per cent reduction in the costs of employing a unit of labour. With very low export demand elasticities ($\alpha = 0.001$), ORANI indicates that to increase

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1. Notice that in the $\alpha = 0.05$ column of table 4.1, part A, the effect of the tariff increase on export revenue is positive.

export demand parameters, at least until the elasticities are reduced to implausibly low levels ($\alpha \leq 0.05$ [1]). At these lower levels, changes occur, especially towards the bottom of the rankings. In general, the export industries tend to rise in the ranking. Exporters are no longer constrained from passing on cost increases to their customers. Those who sell significant shares of their outputs to domestic industries which gain from the tariff increase, are therefore prepared to meet the increased domestic demand without curtailing exports, and consequently rise dramatically in the ranking. The main examples are industry 63 (Basic iron and steel) which has the motor vehicle industry as a major customer, and industry 30 (Prepared fibres) which makes large sales to the domestic textile-processing sector. Industries which fall in the ranking are lightly protected import competitors such as Sawmill products (industry 40), Forestry (industry 10) and Pharmaceuticals (industry 52). These are now relatively harder hit by the inflationary effects of the tariff increase.

5. Conclusion

The results reported in section 4 indicate that the export demand elasticities in ORANI can be varied over a wide range without leading to tariff simulation results which are inconsistent with

1. Note from table 3.1 that for $\alpha \leq 0.05$ the average export demand elasticity is less than one.

Table 3.1 : Export demand elasticities used in the sensitivity analysis reported in section 4

ORANI number	Commodity Description	Elasticities equal to α times the standard ORANI values where : α=0.001	0.01	0.05	0.10	0.25	0.5	1.0[a]	2.0	∞	Cronin's[b] estimates	Fallon's[c] estimates
A1	Wool	.0013	.013	.065	.13	.32	.65	1.3	2.6	∞	1.6	1.3
A3	Wheat	.0125	.125	.625	1.25	3.12	6.25	12.5	25.0	∞	12.5	12.5
A4	Barley	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	12.5	(12.5)[d]
A5	Other cereal grains	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	12.5	(12.5)[d]
12	Iron	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	5.0	10.0
13	Other metallic minerals	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	4.0	8.0
14	Coal	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	5.0	20.0
18	Meat products	.0167	.167	.833	1.67	4.16	8.33	16.7	33.4	∞	4.0	10.0
22	Flour and cereal products	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	(20.0)[d]	(20.0)[d]
25	Food products, n.e.c.	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	0.0	20.0
30	Prepared fibres	.0026	.026	.130	.26	.65	1.3	2.6	5.2	∞	1.6	2.6
63	Basic iron and steel	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	20.0	20.0
64	Other basic metals	.0200	.200	1.000	2.00	5.00	10.00	20.0	40.0	∞	20.0	10.0
	Average export demand elasticity[e]	.02	.16	.81	1.63	4.09	8.18	16.35	32.70	∞	8.83	12.42

(a) This column contains the standard ORANI values used in most applications of the model. They are based on Freebairn (1978).

(b) Source : Cronin (1979a).

(c) Source : Fallon (1981).

(d) Cronin and Fallon do not provide specific information for these commodities. The values used were assigned by the authors.

(e) Calculated as a weighted average of the 13 elasticities shown in the column. The weights are the shares of each product in total export revenue from the 13 products in 1974/5.

The standard ORANI estimates are based on Freebairn (1978). In obtaining their estimates, Freebairn, Cronin and Fallon all applied a version of the derived demand technique.[1] The underlying algebra for this technique starts with the equation

$$X_{ia} = \sum_{j \neq a} C_{ij} - \sum_{j \neq a} S_{ij} \quad , \tag{3.2}$$

where X_{ia} is the volume of exports of good a from Australia, C_{ij} is the demand for good i in country j and S_{ij} is the supply of good i from country j. On differentiating with respect to P^e_{ia} we obtain

$$\frac{\partial X_{ia}}{\partial P^e_{ia}} = \sum_{j \neq a} \frac{\partial C_{ij}}{\partial P^e_{ia}} - \sum_{j \neq a} \frac{\partial S_{ij}}{\partial P^e_{ia}} \quad . \tag{3.3}$$

(3.3) can be rewritten as

$$\frac{\partial X_{ia}}{\partial P^e_{ia}} \frac{P^e_{ia}}{X_{ia}} = \sum_{j \neq a} \left(\frac{\partial C_{ij}}{\partial P^c_{ij}} \frac{P^c_{ij}}{C_{ij}} \right) \left(\frac{\partial P^c_{ij}}{\partial P^e_{ia}} \frac{P^e_{ia}}{P^c_{ij}} \right) \frac{C_{ij}}{X_{ia}} - \sum_{j \neq a} \left(\frac{\partial S_{ij}}{\partial P^s_{ij}} \frac{P^s_{ij}}{S_{ij}} \right) \left(\frac{\partial P^s_{ij}}{\partial P^e_{ia}} \frac{P^e_{ia}}{P^s_{ij}} \right) \frac{S_{ij}}{X_{ia}} \tag{3.4}$$

where P^c_{ij} is the price paid by users of good i in country j and P^s_{ij} is the price received by producers. The left hand side of (3.4) is the negative of the foreign elasticity of demand for Australian good i (i.e., $-1/\gamma_{ia}$). Thus, we can express (3.4) as

$$-1/\gamma_{ia} = \sum_{j \neq a} \eta_{ij} \phi_{ija} (C_{ij}/X_{ia}) - \sum_{j \neq a} \varepsilon_{ij} \theta_{ija} (S_{ij}/X_{ia}) \quad . \tag{3.5}$$

1. Our description of the derived demand technique follows that of Cronin (1979b).

zero.[1] In the next eleven columns we have shown the rankings of the ORANI industry-output projections from simulations of across-the-board tariff increases using the sets of values for the export-demand elasticities given in table 3.1. Also included at the foot of these columns of table 4.3 are the ranges of the projections for each simulation (i.e., the biggest percentage output change and the smallest) and the rank correlation coefficient of each ranking with the ranking of the standard simulation.

Looking first at the projection ranges, it can be seen that the effect of reducing export demand elasticities (i.e., moving from the column marked $\alpha = \infty$ leftwards to that marked $\alpha = 0.001$) is to narrow the range. This is what would be expected following our explanation of the macroeconomic results in sub-section 4.1. The lower are the export demand elasticities the more inflationary is the tariff increase and the smaller is the competitive advantage over imports enjoyed by the main gainers in the simulations. The main losers (the export industries) on the other hand are less adversely affected by the inflationary effects of the tariff increase when the export demand curves facing them are inelastic.

The final row of the table indicates that the rankings of the industry-output effects are insensitive to changes in the

1. These results are similar to those produced using ORANI's 1968/9 data base and reported in detail in DPSV (1982, chapter 7 (especially table 45.4)).

Table 4.3 continued ....

Industry ORANI Code Number	Description	Standard[a] projection	Rankings of projections generated under alternative export-demand elasticities[b] Elasticities equal to α times the standard ORANI settings where : α=0.001	α=0.01	α=0.05	α=0.10	α=0.25	α=0.50	α=1.0	α=2.0	α = ∞	Cronin's estimates	Fallon's estimates
64	Other basic metals	-2.81	27	71	103	104	106	105	106	105	105	111	106
18	Meat products	-3.26	53	77	96	101	104	107	107	109	108	107	107
25	Food products n.e.c.	-3.56	79	103	110	111	112	112	108	107	104	66	108
3	High rainfall zone	-3.62	25	25	70	90	99	106	109	112	112	109	109
22	Flour and cereal products	-3.67	80	92	105	105	107	109	110	110	110	112	111
76	Agricultural machinery	-3.67	102	111	112	112	111	111	111	108	107	105	110
63	Basic iron and steel	-3.87	18	22	91	102	108	110	112	111	109	113	112
4	Northern Beef	-4.75	92	109	113	113	113	113	113	113	111	110	113
Projection range - highest		7.26	6.03	6.12	6.39	6.58	6.86	7.07	7.26	7.41	7.80	6.95	7.26
lowest		-4.75	-0.62	-0.59	-1.37	-1.99	-2.98	-3.84	-4.75	-5.57	-58.00[c]	-4.44	-4.75
Rank correlation coefficient with standard ranking (α=1)			0.45	0.67	0.86	0.92	0.97	0.99	1.00	1.00	0.98	0.97	1.00

(a) Percentage changes.

(b) See table 3.1

(c) This result gives a misleading impression of the effect on industry outputs of moving to infinite export demand elasticities. The output projection for the industry ranked 112 in this column is only -6.91 per cent. The outlying result for the 113th ranked industry (30, Prepared fibres) is caused by the extreme labour intensity of the industry in the 1974/5 data (the share of capital in its primary costs is only 0.05). The implication is that the industry's short-run supply elasticity is very high (see DPSV (1982, pp.308-311)) which, combined with the assumption of a horizontal export demand curve, renders its output extremely sensitive to domestic cost changes. The relevant feature of the current 1974/5 data may not be reliable. In any case, the assumption of an infinite export demand elasticity is particularly inappropriate for the products of this industry which consist mainly of wool tops.

where η_{ij} is the elasticity of demand for good i in country j and ε_{ij} is the elasticity of supply. ϕ_{ija} and θ_{ija} are price transmission elasticities. They are the elasticities of the user and supplier prices in country j with respect to the Australian export price.

Cronin (1979b) gives a convenient illustration of how (3.5) is used to estimate export demand elasticities. Using "notional"[1] data, he considered the case of Australian beef exports. We have summarized his calculations in table 3.2. Cronin used his illustration to emphasize the importance of the price transmission elasticities. These would be unity if there were no transport or other margins costs and beef was a homogeneous product[2] sold in a single world market free from quotas, tariffs and other interferences with trade. In this case the export demand elasticity for Australian beef would be the absolute value of the sum of the entries in column V of table 3.2 added to the sum of the

1. Cronin's numbers are invented for illustrative purposes. Fallon (1981) has reworked the Cronin example using detailed statistical sources.

2. For some products country of origin is important to consumers, e.g., Swiss chocolate has a special reputation. For these products it may be possible to estimate export demand elasticities via estimates from importing countries of elasticities of substitution between alternative sources of supply. However, with the possible exception of wool, Australia's main export products are not strongly differentiated from those of competitive suppliers.

Table 3.2 : Cronin's notional data base and worksheet for calculating the export demand elasticity for Australian beef[a]

	Country	I Consumption outside Australia C_{ij}	II Supply S_{ij}	III Demand elasticity η_{ij}	IV Supply elasticity ε_{ij}	V $\eta_{ij}(C_{ij}/X_{ia})$	VI $\varepsilon_{ij}(S_{ij}/X_{ia})$
1.	Subsistence economies	10	10	-1	1	$-3\frac{1}{3}$	$3\frac{1}{3}$
2.	Communist countries	28	27	-1	1	$-9\frac{1}{3}$	9
3.	USA, W. Europe, Japan	60	55	-1	1	-20	$18\frac{1}{3}$
4.	Open markets	2	5	-1	2	$-\frac{2}{3}$	$3\frac{1}{3}$
	Australian exports (X_{ia})		3				
	Totals	100	100			$-33\frac{1}{3}$	34

(a) Source : Cronin (1979b).

12.

Table 4.3 continued ....

ORANI Code Number	Industry Description	Standard[a] projection	Rankings of projections generated under alternative export-demand elasticities[b] Elasticities equal to α times the standard ORANI settings where : α=0.001	α=0.01	α=0.05	α=0.10	α=0.25	α=0.50	α=1.0	α=2.0	α = ∞	Cronin's estimates	Fallon's estimates
40	Sawmill products	-.25	113	113	100	94	87	82	71	67	57	85	71
84	Electricity	-.25	33	33	45	59	67	69	72	77	77	78	72
102	Other business services	-.25	96	85	79	78	75	74	73	74	75	74	73
36	Textile products n.e.c.	-.26	105	98	84	80	78	75	74	70	67	81	74
96	Air transport	-.26	103	97	85	83	80	76	75	69	69	75	75
44	Pulp, paper	-.26	108	105	88	84	83	77	76	71	70	80	76
45	Fibreboard	-.28	21	21	30	49	66	71	77	82	86	65	77
16	Non-metallic minerals n.e.c.	-.29	106	99	86	82	81	80	78	76	71	83	78
15	Crude oil	-.31	46	62	71	75	76	79	79	80	79	82	79
89	Wholesale trade	-.31	24	27	44	63	72	73	80	84	91	77	80
91	Motor vehicle repair	-.32	93	84	81	79	79	81	81	81	80	79	81
56	Oil and coal products	-.33	49	61	66	71	74	78	82	83	83	84	82
71	Aircraft building	-.33	110	108	92	91	86	84	83	79	74	86	83
70	Locomotives	-.36	71	78	87	88	89	86	84	78	68	90	84
92	Other repairs	-.38	95	88	83	81	84	83	85	86	82	87	85
47	Newspapers and books	-.40	109	107	93	92	88	87	86	85	81	89	86
93	Road transport	-.49	30	36	64	73	82	85	87	88	90	88	87
52	Pharmaceuticals	-.56	111	112	101	95	93	90	88	87	85	91	88
58	Clay products	-.60	107	104	89	89	90	88	89	91	87	95	89
95	Water transport	-.61	100	95	90	93	92	92	90	89	88	94	90
12	Iron	-.69	40	91	102	97	95	94	91	90	84	96	91
11	Fishing	-.71	74	75	82	85	91	93	92	92	92	71	92
5	Milk cattle	-.79	82	70	73	77	85	91	93	94	95	93	93
94	Railway transport	-.97	83	89	97	96	96	95	94	95	93	97	94
77	Construction equipment	-1.01	22	72	99	99	97	97	95	93	89	100	95
8	Poultry	-1.39	61	65	80	86	94	96	96	97	100	98	97
30	Prepared fibres	-1.41	11	11	15	18	41	89	97	104	113	92	96
17	Services to mining	-1.48	70	96	108	108	103	99	98	96	94	102	98
9	Services to agriculture	-1.66	84	90	98	98	98	98	99	101	101	99	99
2	Wheat/sheep zone	-1.71	75	101	107	107	102	101	100	99	98	103	100
49	Chemical fertilisers	-1.85	98	102	104	103	100	100	101	102	103	101	101
13	Other metallic minerals	-1.86	42	83	106	106	105	102	102	98	96	106	102
14	Coal	-2.02	69	106	111	110	110	104	103	100	97	104	103
6	Other farming export	-2.61	88	100	109	109	109	108	104	103	99	61	104
1	Pastoral zone	-2.70	31	68	94	100	101	103	105	106	106	108	105

29.

continued ....

Table 4.3 continued ....

Industry ORANI Code Number	Description	Standard[a] projection	Rankings of projections generated under alternative export-demand elasticities[b]: Elasticities equal to α times the standard ORANI settings where : α=0.001	α=0.01	α=0.05	α=0.10	α=0.25	α=0.50	α=1.0	α=2.0	α = ∞	Cronin's estimates	Fallon's estimates
26	Soft drinks, cordials	.06	50	43	35	34	32	34	36	38	40	38	36
57	Glass	.05	104	94	78	72	56	42	37	36	31	50	37
75	Electrical machinery	.03	97	86	75	69	57	52	38	37	29	64	38
53	Soap and detergents	.02	41	39	36	37	37	37	39	40	65	36	39
113	Non-competing imports	.01	38	35	33	36	38	38	40	43	59	33	40
27	Beer and malt	.01	65	51	43	39	42	40	41	41	41	37	41
106	Health	.01	51	45	42	40	44	41	42	42	43	39	42
59	Cement	.00	76	66	59	60	54	53	43	39	39	49	43
23	Bread, cakes	.00	78	67	58	55	52	51	44	44	42	51	44
110	Restaurants, hotels	.00	67	56	47	43	45	44	45	45	48	47	45
103	Ownership of dwelling	0.00	58	52	50	45	48	48	46	46	45	43	46
87	Residential building	-.00	59	53	51	46	49	49	47	47	46	44	47
105	Defence	-.00	60	54	52	47	50	50	48	48	47	45	48
107	Education, libraries	-.00	54	50	48	44	47	47	49	49	49	46	49
111	Personal services	-.00	55	49	46	42	46	46	50	51	50	48	50
65	Structural metal	-.00	39	37	34	38	43	45	51	52	51	59	51
46	Paper products n.e.c.	-.00	37	32	29	32	35	39	52	54	54	41	52
104	Public administration	-.01	52	47	49	48	51	54	53	53	53	52	53
48	Commercial printing	-.02	26	24	26	29	36	43	54	56	61	53	54
19	Milk products	-.05	86	74	67	65	60	55	55	55	52	55	55
90	Retail trade	-.06	81	69	63	64	59	57	56	57	55	54	56
10	Forestry	-.06	112	110	95	87	77	65	57	50	38	69	57
99	Finance and life insurance	-.07	66	59	56	56	55	56	58	59	60	56	58
21	Marge, oils and fats	-.08	101	93	77	74	68	62	59	58	44	62	59
62	Non-metallic mineral products	-.09	90	79	72	67	63	61	60	60	56	67	60
101	Investment, real estate	-.09	48	48	55	57	58	58	61	62	63	57	61
108	Welfare services	-.10	57	58	57	61	61	60	62	63	62	58	62
109	Entertainment	-.10	89	80	74	70	65	63	63	61	58	60	63
78	Other machinery	-.13	20	19	23	28	53	59	64	64	64	76	64
98	Banking	-.15	36	34	41	52	62	64	65	66	72	63	65
100	Other insurance	-.17	73	64	65	68	70	66	66	65	66	68	66
112	Business expenses	-.21	29	30	40	54	64	67	67	72	78	70	67
7	Other farming import competing	-.23	45	40	53	62	69	68	68	75	102	42	68
97	Communication	-.23	91	82	76	76	73	72	69	68	73	73	69
86	Water, sewerage	-.23	47	57	62	66	71	70	70	73	76	72	70

continued ....

entires in column VI, i.e.,

$$(1/\gamma_{ia}) = 67\tfrac{1}{3} \quad . \tag{3.6}$$

If, on the other hand, we assume that production and consumption in "countries" 1 - 3 are not influenced by Australian beef prices, perhaps because of quotas, then $\phi_{ija} = \theta_{ija} = 0$, for $j=1,2,3$. If we continue to assume that $\phi_{i4a} = \theta_{i4a} = 1$, then, from table 3.2,

$$(1/\gamma_{ia}) = 4 \quad . \tag{3.7}$$

Cronin concludes that

> "For most practical purposes the first calculation [our (3.6)] would be equivalent to employing the 'small country assumption' : that a change in the volume exported from Australia will not noticeably change the export price of a commodity. The result of the second calculation [our (3.7)] is quite inconsistent with that assumption and would support opposing policy views on certain issues. The discrepancy between the two estimates rests on conflicting assessments of the consequences of governmental intervention in market processes."
>
> Cronin (1979b, p. 72).

Cronin does not specify the issues on which (3.6) and (3.7) would support opposing policy views. The calculations in section 4 indicate that they would not lead to opposing conclusions on the main issues addressed by ORANI simulations of the effects of increases in protection.

In any implementation of formula (3.5), there is clearly room for differences of opinion regarding the values of the demand,

supply and transmission elasticities appearing on the right hand side. Consequently, it is not surprising that Freebairn, Cronin and Fallon have produced different values for the export demand elasticities, despite using the same estimating method. Among other things, the values assigned to the η_{ij}, ϕ_{ija}, ε_{ij} and θ_{ija} depend on the length of run being considered. Cronin states that his calculations are for the long run but does not give a number of years. Neither are Freebairn and Fallon very explicit about timing. However, they both give ranges on their final estimates for the export demand elasticities. For ORANI, we have assumed that Freebairn's lower bounds are suitable in short-run (2 year) simulations. It is Freebairn's and Fallon's lower bounds which are given in table 3.1.

As an alternative to the derived demand approach, some researchers have attempted to estimate export demand elasticities by direct econometric methods. This involves the application of regression techniques to equations of the form

$$\left(P^e_{ia}\right)_t = f\left(\left(X_{ia}\right)_t, \ldots\right), \qquad t=1,\ldots,T \ , \tag{3.8}$$

where the t subscript denotes time. Such exercises have had little success in generating plausible values for export demand elasticities.[1] One reason often cited for these failures is the lack of adequate time series data on commodity export volumes and

1. See for example Throsby and Rutledge (1977) and (1979).

Table 4.3 : The sensitivity of ORANI industry-output projections of the short-run effects of a 25 per cent across-the-board tariff increase to changes in export-demand parameters

ORANI Code Number	Industry Description	Standard[a] projection	Rankings of projections generated under alternative export-demand elasticities[b]										Cronin's estimates	Fallon's estimates
			Elasticities equal to α times the standard ORANI settings where :											
			α=0.001	α=0.01	α=0.05	α=0.10	α=0.25	α=0.50	α=1.0	α=2.0	α = ∞			
39	Footwear	7.26	1	1	1	1	1	1	1	1	1		1	1
31	Man-made fibres, yarn	5.71	2	2	2	2	2	2	2	2	2		2	2
68	Motor vehicles, parts	5.58	3	3	3	3	3	3	3	3	3		3	3
37	Knitting mills	4.21	4	4	4	4	4	4	4	4	4		4	4
32	Cotton, silk, flax	3.81	5	5	5	5	5	5	5	5	5		5	5
79	Leather products	2.44	6	6	6	6	6	6	6	6	6		6	6
38	Clothing	1.53	7	7	7	7	7	7	7	7	8		7	7
33	Wool and worsted yarns	1.49	8	8	8	8	8	8	8	8	7		8	8
73	Electronic equipment	1.31	14	14	11	11	10	10	9	9	9		10	9
80	Rubber products	1.24	9	9	9	9	9	9	10	10	10		9	10
34	Textile finishing	1.08	10	10	10	10	11	11	11	12	14		11	11
35	Textile floor covers	1.04	15	15	14	13	13	12	12	11	11		13	12
67	Metal products n.e.c.	1.02	13	13	12	12	12	13	13	15	12		14	13
74	Household appliances	1.00	17	17	16	15	14	14	14	14	13		12	14
81	Plastic products	.73	12	12	13	14	15	15	15	15	16		15	15
41	Plywood, veneers	.67	19	18	18	17	17	16	16	16	15		16	16
51	Paints, varnishes	.58	16	16	17	16	16	17	17	17	18		17	17
50	Industrial chemicals	.53	44	28	19	19	18	18	18	18	17		18	18
43	Furniture, matresses	.26	56	41	25	23	21	21	21	19	20		21	19
83	Other manufacturing	.25	28	23	21	21	20	20	20	21	25		23	20
85	Gas	.25	23	20	20	20	19	19	21	22	24		22	21
69	Ship and boat building	.24	99	87	69	50	28	24	22	19	19		20	22
42	Joinery and wood products	.22	64	42	28	25	23	22	23	23	23		24	23
82	Signs, writing equipment	.17	32	26	22	22	22	23	24	27	33		26	24
88	Building n.e.c.	.16	63	44	32	27	25	25	25	25	30		25	25
66	Sheet metal products	.15	35	29	24	24	24	26	26	26	26		19	26
55	Chemical products n.e.c.	.15	85	73	60	51	33	29	27	24	21		34	27
24	Confectionery	.14	72	60	38	31	26	27	28	28	27		29	28
60	Ready-mixed concrete	.11	62	46	37	33	29	28	29	29	34		27	29
61	Concrete products	.11	68	55	39	35	31	31	30	31	35		28	30
28	Alcoholic drinks n.e.c.	.10	94	81	68	58	40	33	31	30	22		35	31
29	Tobacco	.09	34	31	27	26	27	30	32	33	32		30	32
54	Cosmetics, toiletry	.09	43	38	31	30	30	32	33	32	36		31	33
20	Fruit and vegetable products	.08	87	76	61	53	39	36	34	34	28		40	34
72	Scientific equipment	.08	77	63	54	41	34	35	35	35	37		32	35

continued ....

Notes appear at the end of the table.

employment, to a given percentage change in aggregate absorption. Figure 4.3 is a plot of the response of the absorption effect of the tariff increase to changes in the export demand elasticities (i.e., a plot of row 4 from table 4.1, part B). It illustrates clearly the increasing sensitivity of absorption to changes in α as α approaches zero. Figure 4.1 contains a plot, labelled "ΔB exogenous", of the aggregate employment row from part B of table 4.1. The increased sensitivity of the employment projections to changes in α at low levels of α is reflected by the greater steepness of this plot compared to the plot of the employment responses in the simulations where ΔB is endogenous.

4.2 Industry output effects

Table 4.3 shows the consequences of changing the export demand parameters for ORANI projections of the short-run effects on industries' output levels of a general tariff increase. The first column of results are the ORANI projections of the percentage changes in industries' outputs under standard neoclassical short-run assumptions and using standard parameters ($\alpha = 1$). The projections are ranked, highest to lowest. The model projects that the main gainers from a tariff increase would be the highly protected import-competing industries and that the main losers would be export and export-related industries. The non-traded sector is not dramatically effected by tariff changes. Non trading industries, therefore, are to be found near the middle of the ranking with output projections close to

prices at a suitable level of disaggregation. The data problem is exacerbated by the need to conduct the estimation of (3.8) in the context of a system containing supply as well as demand equations. Single equation estimation procedures applied to (3.8) are likely to produce parameters reflecting both demand and supply influences. Thus, the data required for satisfactory econometric estimation of export demand elasticities extends beyond export volume and price series.

4. The sensitivity of short-run projections of the effects of a 25 per cent across-the-board tariff increase to changes in ORANI's export demand parameters

The sensitivity analysis was conducted by first making 11 simulations of the effects of a 25 per cent across-the-board increase in tariffs using the 11 sets of export demand elasticities shown in table 3.1.[1] Thus, the export demand elasticities were varied from being very close to zero (vertical export demand schedules) to being infinite (horizontal schedules, the small country assumption). Each simulation was made under standard neoclassical short-run assumptions. These assumptions are explained in detail in DPSV (1982), section 44). The main features are :

1. More accurately, we set the ORANI export demand parameters (the γ's) according to the reciprocals of the numbers in table 3.1.

(i) industry-specific capital stocks are fixed implying upward-sloping supply curves and a short-run focus. The short-run in ORANI is normally interpreted as being two years. Thus, the ORANI results in this paper are for the effects after about 2 years of a 25 per cent tariff increase,

(ii) real domestic consumption, investment and government spending are fixed,

(iii) the market for each of the model's nine types of labour is slack, and

(iv) the real wage rate for each type of labour is fixed.

4.1 Macroeconomic effects

The results of our 11 simulations for various macroeconomic variables are given in table 4.1, part A. The column marked $\alpha = 1$ contains the standard short-run ORANI projections of the macroeconomic effects of the tariff increase.[1] Under standard neoclassical short-run assumptions, the tariff increase gives domestic import-competing industries a competitive advantage vis à vis imports and thus reduces aggregate imports. The inflationary effects of the

1. For the simulations reported here, recently assembled 1974/5 input-output data were used. Complete documentation of the new data is not yet available. Similar results, generated using a 1968/9 input-output data base, are fully described in DPSV (1982, chapter 7). Chapter 4 of that book gives detailed documentation of the earlier data base.

these elasticities. As the export demand elasticities approach zero, the balance of trade becomes increasingly less sensitive to changes in absorption. In table 4.1 it can be seen that, for all values of $\alpha \leq 0.05$, although an increase in absorption still moves the balance of trade towards deficit, such an increase generates a rise in export receipts as well as in the import bill. This is because when export demand is very inelastic, a squeeze on export volumes leads to a rise in export prices sufficient to raise export revenue.[1] Both the domestic consumer price index and aggregate employment are, on the other hand, more sensitive to changes in aggregate absorption the less elastic is export demand assumed to be. This is because export prices, and thus the exportables component of the price index, are driven up to a greater extent, and because activity in the export sector is not squeezed so severely. In summary the imposition of a balance of trade constraint in the tariff simulations increases the sensitivity of the macro projections to changes in the export demand elasticities at low levels of those parameters for two reasons. Firstly, the lower are the elasticities of export demand the greater is the percentage change in domestic absorption required to eliminate a given change in the trade balance. Secondly, the lower are the export demand elasticities the more responsive are other macro variables, in particular the consumer price index and aggregate

1. Where α is greater than 0.05 in table 4.1, increases in absorption raise imports but reduce export receipts and are thus more effective in eliminating a balance of trade surplus.

-0.43 and 0.44 per cent of GDP.) Nevertheless, we have rerun[1] the simulations with aggregate absorption[2] adjusting so as to keep the change in the balance of trade at zero.

At standard parameter values (i.e., $\alpha = 1$) a cut in absorption of 0.32 per cent is required to eliminate the balance of trade deficit which would otherwise occur. Cutting absorption reduces directly the demand for imports and is also deflationary. The deflationary effect stimulates exports and generates further reductions in imports by allowing import-competing industries a competitive advantage over imports. Thus, on comparing the results under standard parameter values in parts A and B of table 4.1, we find in part B that exports are less adversely affected by the tariff cut and imports are more sharply reduced. Note, however, that the percentage changes in the import bill and export receipts in part B are not identical even although the change in the balance of trade is zero. A small balance of trade surplus appears in the base period data.

The most dramatic effect of making the balance of trade exogenous is the increase in sensitivity of the macro projections to changes in the export demand elasticities in the low range of

1. In fact it was not necessary to formally rerun the model. The new results can be deduced from available simulations under the standard environment (see DPSV (1982, section 36.1)).

2. Aggregate domestic absorption is defined as the sum of aggregate household consumption, aggregate investment and government spending. The shares of these components in the total are fixed exogenously.

Table 4.1 : Short-run projections of the macroeconomic effects of a 25 per cent across-the-board tariff increase under different assumptions about the values of export demand elasticities

Assumption about export demand elasticities / Variable	PROJECTIONS (a) Elasticities equal to α times the standard ORANI values (b) where : α=0.001	0.01	0.05	0.10	0.25	0.50	1.0	2.0	∞	Cronin's (c) estimates	Fallon's (d) estimates
A. Standard neoclassical short-run (e)											
Consumer price index	3.67	3.57	3.28	3.08	2.78	2.55	2.36	2.18	1.78	2.68	2.35
Aggregate import bill ($US)	-0.34	-0.43	-0.68	-0.86	-1.13	-1.34	-1.53	-1.68	-2.01	-1.35	-1.53
Aggregate export receipts ($US)	2.43	1.94	0.67	-0.16	-1.34	-2.19	-2.94	-3.54	-4.79	-2.42	-2.94
Balance of trade/GDP	0.44	0.38	0.21	0.11	-0.03	-0.14	-0.22	-0.30	-0.43	-0.17	-0.23
Aggregate employment (f)	0.14	0.10	-0.00	-0.07	-0.18	-0.27	-0.36	-0.43	-0.56	-0.32	-0.36
B. Neoclassical short-run with exogenous balance of trade (g)											
Consumer price index	22.95	12.80	5.58	3.90	2.60	2.01	1.62	1.37	0.94	1.99	1.62
Aggregate import bill ($US)	14.89	6.85	1.12	-0.22	-1.26	-1.75	-2.07	-2.28	-2.62	-1.84	-2.07
Aggregate export receipts ($US)	14.81	6.80	1.11	-0.21	-1.26	-1.74	-2.06	-2.27	-2.60	-1.83	-2.06
Aggregate real domestic absorption	5.48	2.70	0.73	0.28	-0.06	-0.22	-0.32	-0.39	-0.49	-0.27	-0.32
Aggregate employment (f)	3.42	1.62	0.34	0.04	-0.20	-0.32	-0.40	-0.46	-0.57	-0.37	-0.40

(a) All projections are percentage changes except for the balance of trade. The change in the balance of trade is expressed as a percentage of GDP.

(b) The standard ORANI values are in the column marked α=1.0 in table 3.1.

(c) See Cronin (1979a).

(d) See Fallon (1981).

(e) The assumptions defining the ORANI standard neoclassical short-run are discussed in DPSV (1982, section 44) and listed briefly in section 4 of this paper.

(f) This is the percentage change in the number of people employed assuming no change in the number of hours worked per employee per week in each occupation.

(g) The assumptions underlying the projections in part B of the table are identical to those defining the standard neoclassical short run (see footnote (e)) except that the balance of trade is exogenous and the level of real aggregate domestic absorption is endogenous. The shares of consumption, investment and government spending in absorption are exogenous. In terms of the DPSV notation, ΔB and f_R replace c_R and i_R on the list of exogenous variables.

tariff increase impose a cost-price squeeze on exporters which results in a fall in the foreign-currency value of exports. ORANI indicates that this fall is large enough to outweigh the reduction in imports and to generate a net move towards deficit in the balance of trade. The contraction of the export-related sector also outweighs the expansion of the import-competing sector in terms of the net employment outcome.

These results are magnified if the simulation is run with export demand assumed to be more elastic than in the standard parameter file (i.e., with the scaling factor α greater than one). Consider, for example, the polar case of perfectly elastic export demand (i.e., $\alpha = \infty$). Export prices are then fixed independently of export volumes. The tariff increase is less inflationary since the prices of exportables which are included in the domestic price index do not rise as export volumes contract. The advantage gained by import competitors, and the consequent fall in imports, is greater. Export volumes are more sensitive to domestic cost increases and reductions in these volumes produce no offsetting rise in foreign-currency prices. Despite the fact that domestic costs do not rise as sharply, these two factors are sufficient to result in a larger fall in export receipts. The greater contraction in exports more than outweighs the improved performance of the import competing sector. Both the adverse movement in the balance of trade and the fall in total employment are greater than in the standard case.

increase are largely a result of the exploitation of Australia's monopoly power in its export markets. If export demand elasticities are really this low, Australia should presumably be exploiting this power independently of its stance on tariff protection.

The export demand elasticities generated by varying α (i.e., by scaling the standard ORANI values) are hypothetical in the sense that they are advanced just to conduct sensitivity analysis rather than as realistic estimates. In the final two columns of table 4.1, results are presented based on sets of elasticity estimates which have been proposed as serious alternatives to the standard ORANI parameters. These are the estimates of Cronin (1979a) and Fallon (1981) both of which were discussed in section 3. It is clear from the table that the range of deviation from the ORANI parameters which is encompassed by these authors is not significant for the ORANI tariff projections.

Finally, we turn to part B of table 4.1. There we have repeated our sensitivity analysis holding constant in the ORANI simulations the balance of trade rather than aggregate demand. It might be argued that the government would need to adjust aggregate demand to eliminate any significant change in the balance of trade which would otherwise arise from the tariff increase. This would suggest that in assessing the effects of the tariff increase, the effects of required demand adjustments should be taken into account. In table 4.1, part A the projected effects of the tariff increase on the balance of trade are small. (They range between

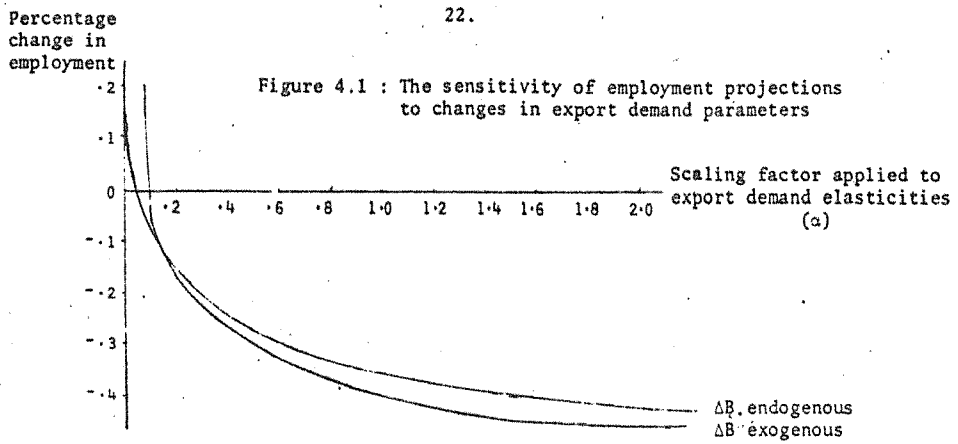

Figure 4.1 : The sensitivity of employment projections to changes in export demand parameters

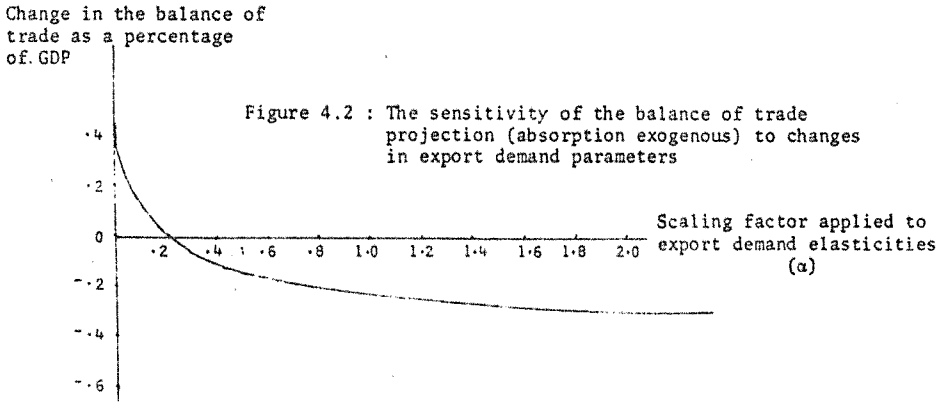

Figure 4.2 : The sensitivity of the balance of trade projection (absorption exogenous) to changes in export demand parameters

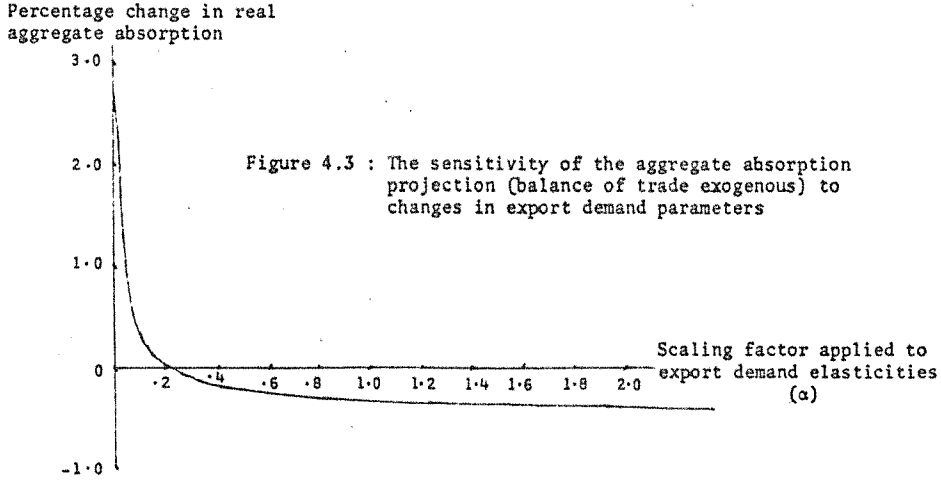

Figure 4.3 : The sensitivity of the aggregate absorption projection (balance of trade exogenous) to changes in export demand parameters

Reverse changes in the results can be observed as export demand is made less elastic (i.e., as α approaches zero). The tariff increase becomes more inflationary as the prices of exportables are made more sensitive to falls in export volumes. As domestic prices rise, the competitive advantage initially bestowed on import competitors is eroded and the fall in imports is reduced. The less elastic is export demand, the more can exporters pass on cost increases to foreign customers in the form of higher prices. When export demand elasticities fall below unity contractions in export volumes caused by cost increases lead to increases in export receipts. The relative improvement in exports eventually outweighs the relative increase in imports leading to positive balance of trade effects at low export demand elasticities (i.e., $\alpha < 0.20$). Similarly the aggregate employment effect eventually becomes positive when at very low export demand elasticities (i.e., $\alpha < 0.05$) the contraction in the export sector following the tariff increase ceases to outweigh the expansion in the import competing sector. Our explanation of the qualitative effects of reducing the export demand elasticities is summarized in table 4.2.

Quantitatively, what is most notable about the results in table 4.1, part A, is their insensitivity to variations in the export-demand elasticities. Certainly it is only at very low, probably implausibly low, elasticities that the usual ORANI-based conclusion (conclusion (ii) in section 2) concerning the signs of the effects of increases in protection on aggregate employment and

Table 4.2 : Explanation of the impact of reducing the elasticities of demand for exports on ORANI macro projections of the effects of an across-the-board tariff increase under standard neoclassical short-run assumptions

Variable	Effect of tariff increase with standard parameters (α=1)	Impact of reducing export demand elasticities	Explanation
Aggregate export receipts	Fall (2.94 per cent)	Fall is reduced and eventually reversed	Export demand schedules are steeper so that export volumes are less sensitive to domestic cost increases (i.e., to upward shifts in export supply curves) and export prices rise more rapidly as export volumes fall. When demand elasticities fall below unity, reductions in export volumes lead to increases in export revenues.
Consumer price index	Rise (2.36 per cent)	Rise in CPI is greater	Greater rise in export prices causes an increase in the exportables component of the consumer price index.
Aggregate import bill	Fall (1.53 per cent)	Fall is smaller	Greater rise in domestic prices erodes the competitive advantage vis à vis imports which the tariff increase allows.
Balance of trade	Move to deficit (0.23 per cent of GDP)	Move to deficit reduced and eventually reversed	Import bill does not fall as much but the smaller fall (and eventual increase) in export receipts more than compensates for the import effect.
Aggregate employment	Falls (0.36 per cent)	Fall is reduced and eventually reversed	Increase in activity in the import competing sector is smaller but the smaller reduction in activity in the export sector is dominant.

the balance of trade is called into question. Figures 4.1 and 4.2 give a clear picture of the insensitivity of the aggregate employment and the balance of trade projections over a wide range of variation in the export demand elasticities. The line labelled "ΔB endogenous" in figure 4.1 is a plot of the aggregate employment effect of the 25 per cent tariff increase under standard neoclassical assumptions against the value of α used to generate export demand elasticities (i.e., it is a plot of the "aggregate employment" row of table 4.1, part A). The entire range of variation for aggregate employment is only from 0.14 per cent to -0.56 per cent indicating that, whatever is assumed about export demand elasticities, tariffs do not have much to do with aggregate employment. Note moreover that it is not until $\alpha < 0.05$ that ORANI projects any increase in aggregate employment from across-the-board tariff increases. The highest export demand elasticity in the standard ORANI data file is 20. At $\alpha = 0.05$, all export demand elasticities are assumed to be one or less. If this were so, producers' organizations covering all exported commodities (or the government) could increase Australia's export revenue simply by reducing supplies to world markets.

Figure 4.2 contains a plot of the balance of trade projections from table 4.1, part A against α. It shows that ORANI projects a positive balance of trade effect for the across-the-board tariff increase only for $\alpha < 0.2$. As α increases above 0.2, there is very little change in the trade balance result. For the smaller values of α, balance of trade gains flowing from the tariff