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THE SHORT-TERM EFFECT OF DOMESTIC OIL PRICE INCREASES ON THE AUSTRALIAN ECONOMY WITH SPECIAL REFERENCE TO THE AGRICULTURAL SECTOR

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The rise in the domestic price of oil products implied by the new import parity pricing policy for domestic crude oil is likely to pose some problems for macroeconomic management. In this paper an attempt has been made to quantify the short-run adjustment problems involved, using the ORANI 78 model of the Australian economy. Results are presented for a range of variables of interest, including macroeconomic variables, industrial and workforce composition and farm incomes. With fixed real wages, farm incomes are projected to decline by between 6 and 8 per cent.

Introduction

The recent move towards import parity pricing for Australian crude oil is an example of a policy change for which there is a strong case in terms of the long-run allocation of resources in the economy but which involves short-run costs. In its 1976 report on crude oil pricing (which recommended a gradual movement of Australian oil prices to world parity), the Industries Assistance Commission (IAC 1976) lists in some detail both the long-run benefits and short-run costs of adjusting Australian oil prices towards world levels. It is not our intention in this paper to re-enter the discussion of an appropriate oil pricing policy. Rather, we take the decision to move towards import parity as given, and use the ORANI 78 model to quantify some of the dimensions of the short-run adjustments involved, especially in so far as they relate to the rural sector. An examination of the long-run benefits to be expected from the move, on the other hand, is not attempted in this paper.

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A 40 per cent increase in the price of domestically produced oil products is the shock generating the simulations reported in this paper. An increase of about this magnitude is judged to be the effect on domestic oil prices of that part of the move towards import parity pricing which was implemented in the budget of August 1978.[1] A rise in the domestic price of oil bears unevenly on different sectors (e.g. IAC 1976, p. 2). In particular, since it increases domestic prices relative to foreign prices, the short-run costs of the move are borne most heavily by exporting and import competing industries. Because of international competition, these trading sectors find it difficult to pass on cost increases.

An issue of current concern is the extent to which price rises attributable to the new oil pricing policy should be allowed to feed into the wage structure. Our results indicate that the severity of the short-run adjustment problems engendered by the oil price rise do indeed depend critically upon the extent to which it is allowed to flow through into money wage increases. Our arguments below, in the section on results, suggest that the oil price policy must reduce the full employment level of wages in the short run. It follows that some short-run squeeze on the cost of labour (achieved possibly via partial indexation) will be necessary to avoid the potentially damaging consequences for total employment stemming from the rise in the price of oil and to facilitate the required reallocation of factor rewards towards the previously undervalued oil resource.

The Specification of the Agricultural Sector in ORANI 78

ORANI is a large-scale multi-sectoral model of the industrial and employment structure of the Australian economy. The 1977 version of the model is described fully in Dixon, Parmenter, Ryland and Sutton (1977) (hereafter DPRS). The core of the data base for the model is the ABS 1968/69 Input-Output (I/O) tables (ABS 1977) which distinguish 109 industry sectors. In addition, the model disaggregates the labour force into 9 occupational groups.

The simulations reported here used the 1978 version of the model (ORANI 78) which incorporates some improvements over the earlier specification. Minor amendments have been made to the data base and to the treatment of commodity taxes but the main change is in the specification of the agricultural sector. In ORANI 77 the agricultural sector conformed strictly to the conventions employed by the ABS in the 1968/69 I/O tables. Consequently, six product groups were identified as agricultural industries. They are; sheep, cereal grains, meat cattle, milk cattle and pigs, poultry and other farming. With the exception of poultry production, however, these groupings do not conform to any identifiable production units. The Australian agricultural sector is characterised to a large extent by joint production. For example, nearly all the output of the cereals-livestock complex is produced on multi-enterprise farms under conditions in which the production processes for

[1] The reasons for this judgment were explained in some detail in an earlier version of this paper (Vincent, Dixon, Parmenter and Sams 1979). Our results can be adapted easily by readers who prefer to investigate the effects of a change of some other size. The ORANI model is linear in percentage changes of the variables. Hence, readers who wish to compute the effects of, say, a 20 per cent increase in oil product prices can simply divide the results by two.

individual products are highly interrelated. An implication is that input bundles cannot be attributed to the production of individual products.

A second problem with the treatment of the agricultural sector in the ABS I/O tables is that it masks regional differences in production technology which, because of climatic and biological factors, are extremely important in the Australian context. The regional cost of production surveys of the Bureau of Agricultural Economics (BAE) provide an ideal data base for the recognition of these factors.

A final, more specific, problem concerns the I/O product/industry 6 (other farming). Two of the major components included in this category are tobacco, which is import competing, and sugar, which is an export commodity. In a model like ORANI which emphasises international trade, it is unsatisfactory to have both import competing and exporting components aggregated into a single commodity classification.

In ORANI 78, the agricultural sector has been respecified as a 10-commodity by 8-industry system. The agricultural industries and commodities are listed in Table 1. For the non-agricultural sectors there is a one-to-one correspondence between industries and commodities, as was the case in ORANI 77. With one exception, industries 9-112 in ORANI 78 correspond to industries 7-109 in ORANI 77 (DPRS 1977, Table 13b). The exception is that industry 12 (coal and crude petroleum) from ORANI 77 has been split, in ORANI 78, into industry 14 (coal) and industry 15 (crude petroleum). The exporting part of the composite industry has thus been separated from the import-competing part. ORANI 78 also contains a new dummy industry (113) to facilitate the treatment of non-competing imports.

TABLE 1
ORANI 78 Agricultural Commodity Industry Code

Commodity number	Description	Industry number	Description
A1	Wool	1	Pastoral Zone
A2	Sheep	2	Wheat-Sheep Zone
A3	Wheat	3	High Rainfall Zone
A4	Barley	4	Northern beef
A5	Other cereal grains	5	Milk cattle and pigs
A6	Meat cattle	6	Other farming export
A7	Milk cattle and pigs	7	Other farming import competing
A8	Other farming export	8	Poultry
A9	Other farming import competing		
A10	Poultry		

Notes: The commodity 'other farming export' contains the export oriented products sugar and fruits. 'Other farming import competing' contains tobacco, vegetables and other minor products. Industries 1-3 are those designated by the BAE in their Australian sheep industry survey (BAE 1973). The fourth, 'northern beef', is defined to include the Kimberley Region of Western Australia, the Northern Territory, the Peninsula Gulf and Coastal Central Regions of Queensland (BAE 1974*a*, *b*). Industries 5 and 8 are as in the ABS 68/69 I/O tables. Industries 6 and 7 produce only commodities A8 and A9, respectively.

Each of the 8 agricultural industries is now modelled as producing a bundle of commodities. Table 2 shows the base period shares of the agricultural commodities in the total value of output of each of the agricultural industries. Note that each column sum in the table is unity. In ORANI 77, agricultural production functions are of the usual single output, multi-input form

$$Y_j = f_j(X_{1j}, \ldots, X_{ij}, \ldots, X_{nj}) \tag{1}$$

where Y_j is the output of commodity j
and X_{ij} is the input of type i into the production process for commodity j.

In ORANI 78 these are replaced by multi-output, multi-input functions of the form

$$g(Y) = h(X) \tag{2}$$

where Y and X are vectors of outputs and inputs, respectively. That is, each agricultural industry is assumed to combine a bundle of non-product-specific factors into a generalised capacity to produce a bundle of outputs. For all but the first three agricultural industries, the function g, which defines the bundle of outputs, takes a Leontief form. That is, outputs are produced in fixed proportions. For the first three industries, the function g takes the CRETH form (Vincent, Dixon and Powell 1978). Producers select the mix of their bundles of outputs according to relative product prices, the elasticities of transformation between products being less than infinite but greater than the zeros assumed in the Leontief case.

Agricultural supply functions implied by the CRETH production technology and optimising behaviour by producers are included in ORANI 78 in the percentage change form

$$x_g{}^j = z_j + \phi_g{}^j \, (p_g{}^j - \Sigma_l \, p_l{}^j \, S_l{}^{j*}) \tag{3}$$

where $x_g{}^j$ is the percentage change in the output of the gth product of the jth industry,
z_j is the percentage change in an index of the general level of output of the jth industry,
$p_l{}^j$ is the percentage change in the producers' or 'basic value' price of the lth product of the jth industry
and $\phi_g{}^j$ and the $S_l{}^{j*}$ are positive parameters with the sum over l of the $S_l{}^{j*}$ equal to one.

Thus, equation (3) says that, in the absence of changes in relative prices, the output of each of the products of the jth industry expands in proportion to the general level of activity in the industry (constant returns to scale). However, if the price of the gth product rises relative to an appropriately weighted average of all product prices (i.e. $p_g{}^j > \Sigma_l \, p_l{}^j \, S_l{}^{j*}$), then the percentage increase in the output of that product will exceed that of the industry. The strength of the relative price effect depends on the parameter $\phi_g{}^j$, which reflects technical possibilities for inter-product transformation. Values for these parameters for the three CRETH industries are presented in Table 3. Finally, the weights $S_l{}^{j*}$ are to be interpreted as modified[2] product shares in industry output.

[2] The modification is explained in Vincent, Dixon and Powell (1978).

TABLE 2

Commodity Shares of Output by Industry

Commodity \ Industry	(1) Pastoral Zone	(2) Wheat-Sheep Zone	(3) High Rainfall Zone	(4) Northern beef	(5) Milk cattle and pigs	(6) Other farming export	(7) Other farming import competing	(8) Poultry
A1 Wool	0·618a	0·251a	0·463a					
A2 Sheep	0·127a	0·088b	0·131b					
A3 Wheat	0·096b	0·443c	0·032c					
A4 Barley	0·001b	0·033d	0·012c					
A5 Other grains	0·005b	0·046e	0·023c					
A6 Meat cattle	0·137c	0·088f	0·229d	1·000	0·234a			
A7 Milk cattle and pigs		0·030e	0·055c		0·766a			
A8 Other farming export		0·010e	0·055c			1·000		
A9 Other farming import competing	0·016b	0·011e					1·000	
A10 Poultry								1·000

Source: Derived from BAE (1973).
Note: The lower case letters identify commodity groups within the industries recognised in the CRETH estimation.

Table 3 gives less commodity detail than Table 2. This is because it was necessary within each of the three CRETH industries to aggregate certain commodities for the purposes of estimation.[3] Within each of the commodity groups, individual commodities are assumed to be produced in fixed proportions.[4] In equation (3) the product subscripts identify the commodities or commodity groups for which CRETH was estimated, and the price changes refer to group prices, defined as weighted averages of individual commodity prices where the weights are the shares of the commodities in the commodity groups.

TABLE 3

Values for Transformation Parameters ($\phi_g{}^j$)

Pastoral Zone		Wheat-Sheep Zone		High Rainfall Zone	
Commodity group	$\phi_g{}^j$	Commodity group	$\phi_g{}^j$	Commodity group	$\phi_g{}^j$
Wool/sheep	0·1041	Wool	0·2976	Wool	0·0631
Meat cattle	1·6129	Sheep	0·2342	Sheep	0·1153
Other products	4·5455	Cattle	0·5181	Cattle	0·3745
		Wheat	1·6129	Other products	3·8462
		Barley	0·5208		
		Other products	1·3158		

Source: Derived from Vincent, Dixon and Powell (1978).

Assumptions Underlying the Simulations

In the following section we present the results of a simulation in ORANI 78 of some effects of a 40 per cent increase in the basic value price of domestically produced oil and coal products (industry 56). The price change was imposed on the model via an increase, of an appropriate size, in the unit price of 'other cost' tickets to the industry. This is exactly equivalent to the imposition of a production tax on the industry. It is important, therefore, to note that our analysis does not allow for any increase in the profitability of domestic oil production which in fact may have resulted from the implementation of the import parity pricing policy. What we are simulating is not the effects of the policy on the oil industry itself but the effects on the rest of the economy of the consequent increase in domestic oil costs.

The key features of the economic environment assumed for the simulation are:

(a) fixed industry specific capital stocks;
(b) fixed real aggregate consumption, investment and government spending;
(c) a slack labour market for all occupations with 100 per cent indexation of wage costs to the ORANI consumer price index (i.e. fixed real costs per unit labour); and
(d) a fixed exchange rate.

[3] For the key to the aggregation, see the note to Table 2.

[4] Unfortunately, the time series on which the estimation of the relevant transformation frontiers was based, was not detailed enough to support an econometric analysis of the transformation behaviour of components of the 'other products' categories. However, the fixed proportions assumption is appropriate for wool/sheep in the Pastoral Zone (see Vincent, Dixon and Powell 1978).

Assumption (a) implies that the results are short run. Although sufficient time is allowed for investment expenditure to be reallocated across industries in accordance with changing rates of return, insufficient time is allowed for the changed investment plans to alter the availabilities of industry capital stocks. Hence, the short run reflects the gestation lag on capital formation. Given this lag, the model determines the impact on endogenous variables of interest of an increase in the price of oil after local prices of all commodities have adjusted to the higher oil product prices and price increases have been passed on to wages and wage increases passed back into prices. Time is allowed for users of domestic inputs to decide whether or not to switch to imported supplies and for domestic suppliers to change their labour force and to change output with their existing plant. In the case of the three CRETH industries, it is also assumed that the *composition* of output has fully adjusted to the new relative commodity prices. A suitable calendar time interpretation of this short run would be 1 to 2 years.

Assumption (b) indicates that the simulations abstract from any effects which oil prices may have on real domestic absorption. The latter is regarded as determined independently of domestic oil prices by other arms of government policy (fiscal and monetary policy, for example) which are not modelled in ORANI. Note that we are assuming that both the volume of real domestic absorption and its allocation between consumption, investment and government spending are held fixed. We are ignoring any changes in the pattern of demand which may result from the precise means by which the implied adjustments in macroeconomic policy are implemented. Our results will be closest to the 'final' effects when the adjustments are made by methods which do not themselves interfere with relative prices. Thus an underlying assumption is that any increased tax revenue from oil sales is offset by reductions in direct, rather than other indirect, taxes. All that we are then missing are any effects which changes in work leisure preferences or changes in the distribution of income may have on the pattern of expenditure.

The slack labour market assumption (assumption (c)) would seem to be appropriate for the current state of the Australian labour market. Employment levels are thus assumed to be demand determined. The associated assumption of 100 per cent wage indexation indicates that we wish to separate, in our analysis, the effects on the economy of changing oil prices from the effects of changing real wages. However, because the level of indexation of wages is a critical factor in determining the inflationary effects of the fuel price increase, we give results for the ORANI index of consumer prices assuming zero and 70 per cent indexation levels as well as full wage indexation.[5]

The last assumption (assumption (d)) fixes the numeraire in the model. Changes in domestic prices relative to world prices in this simulation are accommodated by changes in the domestic price level rather than by changes in the exchange rate.

To summarise, our results are to be interpreted as the percentage

[5] Note that we could, in any case, deduce all the results for the case of, say, 70 per cent wage indexation from our 100 per cent solution, using the method suggested in Dixon, Parmenter and Powell (1978, pp. 8-9).

changes in the endogenous variables which would be generated in the short run by a 40 per cent increase in the price of domestically produced oil products if neither real domestic absorption nor real wages were allowed to change following the price change.

The Results

We present results for a selection of endogenous variables: industry and commodity outputs, commodity exports, incomes of agricultural industries and various macroeconomic aggregates. All quantity projections refer to the constant real wage scenario.

Macro projections

The projected effects of the oil price increase on aggregate employment, by occupation, real gross national product, aggregate exports and imports, the balance of trade and the index of consumer prices are set out in Table 4.

TABLE 4

Macro Projections: 40% Oil Price Increase

Variable	Projection[a]
Aggregate employment[b]	−0·79
Employment—professional white collar	−0·45
skilled white collar	−0·55
semi- and unskilled white collar	−0·54
skilled blue collar (metal and electrical)	−1·03
skilled blue collar (building)	−0·04
skilled blue collar (other)	−0·61
semi- and unskilled blue collar	−0·94
rural workers	−2·77
armed services	0·00
Real gross national product (GNP)	−0·52
Aggregate exports (foreign currency value)	−2·43
Aggregate imports (foreign currency value)	0·60
Balance of trade	−$137m[c]
Index of consumer prices	2.13

[a] All projections are percentage changes with the exception of the balance of trade which has units 'millions of 1968/69 Australian dollars'.
[b] Employment is measured in hours rather than number of jobs.
[c] Note that this is equivalent to approximately 3·12 per cent of exports in the base period.

The price level projection is the key to understanding the overall result. With 100 per cent wage indexation, a 40 per cent increase in the basic values price of oil products causes the ORANI consumer price index[6] to increase by 2·1 per cent. As explained in the previous section, this change is to be interpreted as a shift in domestic prices relative to world prices and is, therefore, directly reflected in the aggregate international trade results. The balance of trade is projected to deteriorate by $137m. The major part of this is accounted for by the 2·4 per cent contraction in exports. In addition, there is a small expansion in imports (0·6 per cent). The import expansion and export contraction

[6] The percentage change in the ORANI consumer price index is computed as a weighted average of the percentage changes in the purchasers' prices of consumer goods where the weights are commodity shares in aggregate consumer spending.

produce a reduction in real GNP of 0·5 per cent. The trade projections, in turn, are clearly evident in the employment results. The 40 per cent rise in the price of oil products causes a 0·8 per cent contraction in aggregate employment. Employment in all categories (except armed services)[7] falls, with the largest contraction occurring in the rural worker category.[8] This fall reflects the *comparatively* large contraction in the activities of the rural export industries. The next largest employment contraction is in category 4 (skilled blue collar, metal and electrical). Relative to other occupations, employment of this category is heavily concentrated in import competing industries.

The cost/price squeeze on trading sectors and the contraction in labour demand would be moderated if the commodity price rises engendered by the change in oil pricing did not flow through into money wage increases. Since payments to labour represent about 50 per cent of total costs in the base period, the level of wage indexation assumed is a major factor in determining the inflationary impact of the oil price increase. The relationship between the level of wage indexation and the increase in the consumer price index that results is illustrated in Figure 1. With zero wage indexation (fixed *money* wages), the consumer price index increases by 0·85 per cent. With 70 per cent wage indexation, the consumer price index increases by 1·46 per cent.

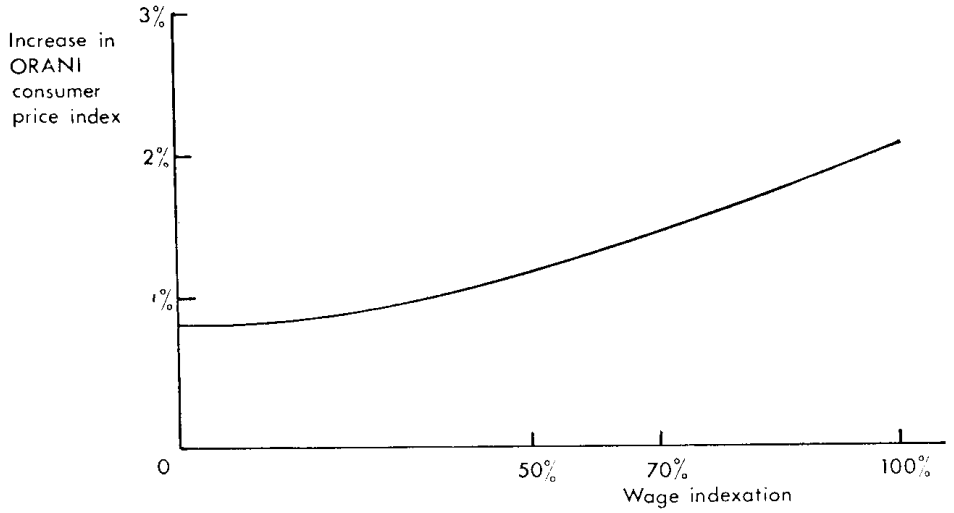

FIGURE 1
Effect of the 40 per cent fuel products price increase on the ORANI index of consumer prices for different degrees of wage indexation.

In general, the results in Table 4 should be interpreted as indicating the nature of the short-run macroeconomic problems that are likely to confront policy makers following the introduction of import parity pricing for domestic crude oil. We have emphasised elsewhere (Dixon,

[7] The percentage change in the output of industry 105 (defence) (the sole employer of the armed services) is exogenously set at zero in the experiment.

[8] The category 'rural workers' includes both hired agricultural labour and the labour inputs of owner-operators. Since the labour input of owner-operators is comparatively fixed in the short run, the projection of a 2·77 per cent reduction in the use of rural labour is likely to understate the reduction in the use of hired agricultural labour.

Parmenter and Powell 1978) the importance of the level of real wage costs as well as the level of aggregate demand in securing satisfactory macroeconomic performance. An implication of our analysis here is that, at constant real wage costs and a constant level of aggregate demand, the existing employment level would not be maintained. In other words, the implication is that the new oil pricing arrangements reduce the full employment level of real wages. The policy also reduces the real rentals accruing to most types of capital, consequently reallocating factor returns from both labour and (non-oil) capital towards a previously undervalued factor, crude oil reserves.[9] This necessary transfer of factor returns can be facilitated by partial wage indexation. The potential benefits of this from the point of view of domestic inflation (and thus of domestic employment) are illustrated in Figure 1. The difficulty in attempting to restore domestic employment via an increase in aggregate demand alone is that the balance of trade problem, already evident in Table 4, would be exacerbated (Dixon, Parmenter and Powell 1978, pp. 19-23).

The general pattern of the industry output results

The contraction in GNP of 0·5 per cent represents an average output response across all industries in the economy. Before considering in some detail the output response for agricultural commodities and industries, it is useful to summarise some of the influences likely to be important in explaining output responses generally. Two issues are important here: firstly, the extent of the cost penalty which a particular industry incurs as a result of the oil price increase and, secondly, the responsiveness of that industry's output to cost increases.

The size of the *direct* effect on costs for a particular industry will depend on the share of oil and coal products (industry 56) in that industry's total costs. These shares are shown in Table 5. For most industries, the share is very small indeed, generally less than 1 per cent. Exceptions include industry 93 (road transport) (5·7 per cent), industry 56 itself (6·8 per cent) and most of the primary industries (2 to 5 per cent). Hence, apart from these industries, we would not expect the direct effect of the fuel price increase to add much to costs. Indirect cost increases arise from the price increases occurring in other intermediate inputs and employed labour. Basic values prices increase by more than 2 per cent for 34 commodities, by between 1 and 2 per cent for 64 commodities and by less than 1 per cent for eight commodities. Prices actually fall for nine commodities.[10]

The responsiveness of industry outputs to cost increases depends on five major characteristics of the industries:

(a) export relatedness;
(b) import competitiveness;

[9] Whether or not the companies working existing or prospective oil deposits are allowed to retain the additional share of the GNP implicitly imputed to the oil resource under the new pricing policy is a separate issue. Various tax or royalty arrangements would expropriate either the windfall gain element accruing to existing reserves and/or part of the return to new discoveries. The importance of the latter for the incentive to explore for oil is, of course, one of the resource allocation arguments for the new pricing policy.

[10] These price results are not presented here but may be obtained from the authors.

TABLE 5
Industry and Commodity Outputs

Industry	Percentage change in output	Oil products as a percentage of total costs[a]	Industry	Percentage change in output	Oil products as a percentage of total costs[a]
1. Pastoral Zone	—0·97	2·24	34. Textile finishing	—0·20	0·39
2. Wheat-Sheep Zone	—0·94	2·07	35. Textile floor covers	—0·28	0·14
3. High Rainfall Zone	—1·71	1·74	36. Textile products n.e.c.	—0·88	0·23
4. Northern beef	—1·49	3·59	37. Knitting mills	—0·17	0·13
5. Milk cattle	—0·56	1·35	38. Clothing	—0·19	0·14
6. Other farming export	—1·69	1·90	39. Footwear	—0·72	0·18
7. Other farming import competing	—0·49	1·86	40. Sawmill products	—0·75	0·54
8. Poultry	—0·47	0·15	41. Plywood, veneers	—0·39	0·57
9. Services to agriculture	—1·16	1·99	42. Joinery and wood products	—0·13	0·31
10. Forestry	—1·19	4·19	43. Furniture, mattresses	0·50	0·21
11. Fishing	—4·24	5·49	44. Pulp, paper	—1·05	0·50
12. Iron	—0·33	1·58	45. Fibreboard	—0·61	0·21
13. Other metallic minerals	—1·99	0·97	46. Paper products n.e.c.	—0·38	0·70
14. Coal	—4·20	0·41	47. Newspapers and books	—0·44	0·14
15. Crude oil	—4·43	0·40	48. Commercial printing	—0·41	0·23
16. Non-metallic minerals n.e.c.	—0·38	3·41	49. Chemical fertilisers	—1·14	0·40
17. Services to mining	—0·30	1·33	50. Industrial chemicals	—1·38	0·86
18. Meat products	—1·49	0·14	51. Paints, varnishes	—0·28	1·11
19. Milk products	—0·04	0·33	52. Pharmaceuticals	—0·59	0·47
20. Fruit and vegetable products	—0·02	0·33	53. Soap and detergents	—0·09	0·37
21. Margarine, oils and fats	—0·66	1·39	54. Cosmetics, toiletry	—0·07	0·23
22. Flour and cereal products	—0·24	0·19	55. Chemical products n.e.c.	—1·03	0·74
23. Bread, cakes	—0·02	0·82	56. Oil and coal products	—4·43	6·83
24. Confectionary	—0·11	0·26	57. Glass	—0·69	1·92
25. Food products n.e.c.	—3·60	0·27	58. Clay products	—0·37	1·05
26. Soft drinks, cordials	0·01	1·01	59. Cement	—0·04	1·77
27. Beer and malt	0·04	0·32	60. Ready-mixed concrete	0·29	0·60
28. Alcoholic drinks n.e.c.	—0·37	0·26	61. Concrete products	0·18	0·50
29. Tobacco	—0·15	0·61	62. Non-metal mineral products	—0·24	0·89
30. Prepared fibres	—2·02	0·16	63. Basic iron and steel	—2·58	0·45
31. Man-made fibres, yarn	—1·54	0·21	64. Other basic metals	—2·49	0·41
32. Cotton, silk, flax	—1·34	0·13	65. Structural metal	—0·80	0·29
33. Wool and worsted yarns	—0·22	0·23	66. Sheet metal products	0·02	0·33

Industry	Percentage change in output	Oil products as a percentage of total costs[a]	Industry	Percentage change in output	Oil products as a percentage of total costs[a]
67. Metal products n.e.c.	—0·79	0·33	95. Water transport	—0·93	0·88
68. Motor vehicles, parts	—0·96	0·27	96. Air transport	—0·72	2·64
69. Ship and boat building	—2·25	0·10	97. Communication	—0·30	0·09
70. Locomotives	—0·92	0·15	98. Banking	—0·33	0·05
71. Aircraft building	—0·49	0·13	99. Finance and life insurance	—0·09	0·14
72. Scientific equipment	—0·89	0·33	100. Other insurance	—0·23	0·07
73. Electrical equipment	—0·34	0·13	101. Investment, real estate	—0·30	0·12
74. Household appliances	0·33	0·19	102. Other business services	—0·31	0·43
75. Electrical machinery	—0·73	0·40	103. Ownership of dwellings	0·00	0·09
76. Agricultural machinery	—0·26	0·25	104. Public administration	—0·00	0·19
77. Construction equipment	—1·19	0·12	105. Defence	0·00	1·11
78. Other machinery	—0·97	0·26	106. Health	0·08	0·06
79. Leather products	—0·57	0·28	107. Education, libraries	0·02	0·03
80. Rubber products	—0·59	0·33	108. Welfare services	—0·06	0·14
81. Plastic products	—0·62	0·38	109. Entertainment	—0·12	0·24
82. Signs, writing equipment	—0·84	0·36	110. Restaurants, hotels	0·04	0·19
83. Other manufacturing	—0·33	0·25	111. Personal services	—0·04	0·57
84. Electricity	—0·31	0·48	112. Business expenses	—0·30	0·06
85. Gas	—0·08	0·57	Agricultural commodity outputs		
86. Water, sewerage	—0·16	0·69	A1. Wool	—1·05	
87. Residential building	0·00	0·55	A2. Sheep	—1·39	
88. Buildings n.e.c.	0·43	1·41	A3. Wheat	—1·17	
89. Wholesale trade	—0·64	0·93	A4. Barley	—1·02	
90. Retail trade	—0·10	0·48	A5. Other cereal grains	—0·15	
91. Motor vehicle repair	—0·33	2·08	A6. Meat cattle	—1·45	
92. Other repairs	—0·27	0·62	A7. Milk cattle and pigs	—0·54	
93. Road transport	—0·90	5·71	A8. Other farming export	—1·56	
94. Railway transport	—1·13	0·46	A9. Other farming import competing	—0·45	

[a] Derived from ABS (1977).

Note that total costs for an industry include all intermediate input costs, hired labour costs and other costs such as indirect taxes together with a return to fixed capital (including land in the case of agricultural industries), working capital and the labour inputs of owner-operators. The cost shares of industry 56 in total *purchased input costs* would of course be much larger.

(c) dependence on sales to household consumption;
(d) fixed factor intensity; and
(e) dependence on investment sales.

The oil price increase harms exporters (and consequently the suppliers of inputs to export industries)[11] by increasing their costs (shifting their domestic supply curves upwards) without shifting the foreign demand curve for their products. The agricultural industries 1-6 are all export industries in that most of the commodities in these industries are exported either directly (e.g. wool) or indirectly (e.g. meat cattle). Export related industries are those which, although not exporting directly, produce commodities which are sold mainly to export industries. Commodity A6 (meat cattle) is a good example of such a commodity. Meat is not exported on the hoof but only after processing in industry 18 (meat products). Other examples are commodities A7 (milk cattle and pigs), A8 (other farming export) and A10 (poultry). Industries 9 (services to agriculture) and 49 (chemical fertilisers) are also strongly export related. Large sales of commodity A7 are made to industries 18 (meat products) and 19 (milk products). A substantial part of the output of commodity A10 also is sold to industry 18. Commodity A8 is largely sold to industry 25 (food products n.e.c.). Industries 9 and 49 supply the exporting rural industries.

Import competing industries form a second group which may face difficulties in passing on the increase in domestic costs arising from the oil price increase. The extent to which an industry competes with imports depends both on the share of imports in the total absorption by the domestic economy of commodities classified to that industry and on the users' elasticity of substitution between imports and the domestic source. Industries with base year import shares exceeding 15 per cent of domestic production include 21, 24, 28, 31, 32, 35, 36, 40, 44, 50, 52, 55-58, 67, 68, 71-73, 75-81, 83. A number of import competing industries receive a fair amount of natural protection from imports by virtue of the fact that substitution elasticities between their outputs and competing imports are low. The relevant substitution elasticities vary from 6·8 (industry 39, footwear) to zero (industry 15, crude oil).[12] A typical value is about 2·0 (see DPRS 1977, pp. 155-9).

Since aggregate real consumption is held constant, the oil price increase can be expected to exert only a minor influence on the outputs of industries whose products are sold predominantly to household consumption, provided that they are not strongly connected to international trade. However, some substitution in consumption will occur because of the impact of the oil price increase on the *relative* prices of consumer goods. The extent of the reallocation of the consumer budget that occurs will depend, of course, on the relevant cross-price elasticities in con-

[11] In ORANI, exports are determined endogenously for only a group of major export industries. In the simulation reported here exports are endogenous for the following commodities: wool, wheat, barley, other cereal grains, fishing, iron, other metallic minerals, coal, meat products, food products n.e.c., prepared fibres, basic iron and steel and other basic metal products. These commodities constitute about 70 per cent of total exports in the data base. For the remaining commodities, changes in exports were specified exogenously to be zero (see DPRS 1977, pp. 204-5).

[12] Because of non-price-rationing of domestic crude to refiners, the import substitution elasticity for crude oil is effectively zero.

sumption between consumer goods and on the extent of the *relative* price changes.[13] Industries which are not closely connected to international trade and which make sales of more than 30 per cent of their output to household consumption include: 19, 20, 23, 26, 27, 43, 53, 74, 84, 85, 91, 92, 99, 100, 103, 106, 109-11. Output responses for these industries all lie within the range −0·5 to +0·5 per cent.

The degree of fixed factor intensiveness has an important influence on the size of the short-run output response. Since both capital and land are fixed, industries with high land and capital shares in primary factor costs cannot easily change output by changing their employment of labour (which is the only available option in the short run). Industry 12 (iron) is the clearest example. Despite being an export industry, its output reduction is limited to 0·33 per cent because of its high capital intensity.

Finally, the output response of industries primarily supplying investment goods will depend on the way in which the fixed aggregate investment budget is reallocated amongst industries, following the oil price increase. For example, a larger than average output contraction in the agricultural export industries will lead to a reallocation of the investment budget away from agricultural industries. Hence, industries supplying investment goods to agriculture will suffer. Industry 76 (agricultural machinery) is an outstanding example. The construction related industries (88, 60, 61), on the other hand, gain from the reallocation of investment.

Before leaving this section it is interesting to note that the output of industry 56 (oil and coal products) falls by 4·4 per cent. Industry 56 sells its output to intermediate usage (71 per cent), household consumption (22 per cent) and exports (7 per cent). The change in exports is exogenously set to zero and household consumption collapses by 13 per cent owing to the adverse relative price movement. Intermediate usage falls by between 1·5 and 2 per cent because of the contraction in activity in the domestic economy and because of substitution towards imports triggered by the relative increase in the price of the domestic product. The weighted sum of these percentage changes in the usage categories explains the 4·4 per cent reduction in total usage of domestic oil and coal products.[14]

Agricultural industry results

There are sixteen industries either in, or closely tied to, the agricultural sector. They are the industries engaged in agricultural production (1-8), those which are significant suppliers of agricultural inputs (9, 49, 76) and the important processors of agricultural products (18-20, 25, 30). Eleven of these sixteen show output reductions of greater than

[13] The values in the ORANI parameter file of the parameters characterising commodity consumption functions were derived from the linear expenditure system (DPRS 1977, pp. 41-50). Values currently in use are documented in Tulpulé and Powell (1978).

[14] Note also that the output of industry 15 (crude oil) decreases by 4·4 per cent. Since the elasticity of substitution between domestic and imported crude is set at zero in the model (see footnote 12), this industry's output is forced to change by the same percentage as that of its sole user, industry 56. As noted in the section on the assumptions made, this paper does not purport to give an accurate analysis of the effects of the new oil price policy *on the crude oil industry itself.*

0·9 per cent. (Outputs of 7 of the 9 agricultural commodities fall by more than one per cent.) By comparison, only 13 of the 96 industries not closely tied to agriculture contract by as much as 0·9 per cent.

Industries 1-4 and 6, which produce mainly export commodities, all show *comparatively* large output contractions. The major factor explaining differences in output performance between these industries is not the differences in their intermediate input structures but differences in their labour intensities. The CES production functions employed in ORANI[15] imply short-run industry supply functions of the form

$$z_j = \{\sigma_j S_w^j/(1 - S_w^j)\}(p_j - w_j)$$

where z_j is the percentage change in the output of industry j,
p_j is the percentage change in the unit price of value added in industry j,
w_j is the percentage change in the unit cost of labour in industry j,
σ_j is the elasticity of substitution between primary factors in industry j,
S_w^j is the share of labour in primary factor cost in industry j.

Values for the p_j, w_j, S_w^j, z_j and σ_j taken from either the ORANI computations or data base are shown in Table 6.

TABLE 6

Components of Supply Functions: Selected Agricultural Industries

Industry number	Description	p_j	w_j	S_w^j	σ_j	z_j
1	Pastoral Zone	—3·5	2·1	0·26	0·5	—0·97
2	Wheat-Sheep Zone	—3·1	2·1	0·26	0·5	—0·94
3	High Rainfall Zone	—2·8	2·1	0·40	0·5	—1·71
4	Northern beef	—5·1	2·1	0·29	0·5	—1·49
6	Other farming export	—2·3	2·1	0·43	0·5	—1·69

The high rainfall (3) and other farming export (6) industries are considerably more labour intensive (less fixed factor intensive) than the other industries in the group. Hence, their short-run output responses are greater. The specialist beef producer (northern beef) shows the next most severe output contraction. It is only slightly more labour intensive than industries 1 and 2 but experiences a much greater price fall. The reason is that the basic value price of the industry's only product (meat cattle) falls quite severely. In addition, the industry's value added is squeezed on account of its intermediate input structure. Oil is a comparatively large share of its costs.

Industries 5 (milk cattle), 7 (other farming import competing) and 8

[15] See DPRS (1977, sections 2 and 3). ORANI 78 is specified to accommodate CRESH (Hanoch 1971) production functions. Attempts to estimate parameters for the CRESH system at a disaggregated level have not been successful (Vincent, Dixon and Powell 1978) and, in the present version of the model, a common value (0·5) for the elasticity of substitution between labour, land and capital was used. Hence, CRESH collapses to CES. Within the IMPACT project, different pairwise elasticities of substitution between labour, land and capital have been estimated for the agricultural sector as a whole (see Vincent 1977 and Ryland and Vincent 1978).

(poultry) show much lower output contractions (about 0·5 per cent) than the agricultural industries considered so far. Industry 5 produces mainly commodity A7 (milk cattle and pigs). Domestic consumption absorbs more than half of the output of this commodity via industry 19 (milk products). With aggregate consumption fixed in real terms, this strong link to domestic consumption helps to cushion industry 5 (milk cattle) from the adverse effects of the oil price rise. Industry 7 produces only commodity A9 (other farming import competing). As well as including the import competing commodity tobacco, this commodity category contains the non-traded fruit and vegetables which pass to household consumption either directly or via the processing industry 20 (fruit and vegetable products). The tobacco component, in effect, receives a good deal of protection from imports. Manufacturers pay a reduced rate of duty on their imports of leaf, provided they use a specified proportion of Australian leaf in their products. In terms of the model, the substitution elasticity between imported and domestically produced tobacco leaf is assumed to be close to zero. Hence, it is assumed that domestic producers of tobacco leaf can readily pass on increased costs to domestic users. The sole output of industry 8 is commodity A10 (poultry). Sixty-two per cent of this is sold directly to consumption and the remainder to consumption and exports via industry 18. While poultry suffers from the oil price increase because of its export linkage via industry 18 (the output of which contracts by 1·5 per cent) it gains from its consumption linkage. The poultry industry also uses considerable amounts of export-linked commodities as inputs, e.g. stockfeeds manufactured in industry 25 (food products n.e.c.) from the various cereal grains (the prices of which all decrease). This helps to keep the price increase in poultry to 1·1 per cent (half the consumer price index increase), resulting in a small increase in domestic consumption of poultry.

Outputs of industries heavily engaged in supplying the farming industries, e.g. 9 (services to agriculture), 49 (chemical fertilisers) and 76 (agricultural machinery), all decline. While 9 and 49 decline by about the same amount as the industries they supply, the output of 76 falls by double this amount. Industry 76 is an import competitor and an important supplier of investment goods to the farming industries. It suffers from the reallocation of the investment budget away from the export oriented agricultural industries.

Of the agricultural commodity processing industries, three (18, 25, 30) are export industries and therefore are among the principal losers from the oil price increase. Industries 19 and 20, on the other hand, sell almost entirely to domestic consumption. Output changes for these industries are consequently small.

Agricultural commodity outputs by industry (the CRETH results)

Percentage changes in commodity outputs for each of the CRETH industries and percentage changes in the basic value prices of the commodities are shown in Table 7. In this section we first explain the price changes and then the output changes which are triggered by them. To assist in interpreting the results, the table also includes percentage changes in the industry outputs and in the industry CRETH share-weighted prices, i.e. the $\Sigma_i p_i^j S_i^{j*}$ (see equation 3).

TABLE 7

Projected Percentage Changes in Commodity Outputs by Industry and in Prices

Commodity	Pastoral Zone	Wheat-Sheep Zone	High Rainfall Zone	Commodity price (basic values)
A1 Wool	—0·89	—0·60	—1·68	0·43
A2 Sheep	—0·89	—1·19	—1·91	—1·76
A3 Wheat	—0·25	—1·21	—0·99	—0·86
A4 Barley	—0·25	—1·03	—0·99	—0·87
A5 Other grains	—0·25	0·05	—0·99	—1·19
A6 Meat cattle	—2·03	—1·29	—2·21	—1·37
A7 Milk cattle	—	0·05	—0·99	1·42
A8 Other farming export	—	0·05	—0·99	0·25
A9 Other farming import competing	—0·25	0·05	—	1·47
Industry output[a]	—0·97	—0·94	—1·71	
CRETH share-weighted prices for industries ($\Sigma_i p_i^j S_i^{j*}$)	—0·71	—0·69	—0·03	

[a] Note that the share-weighted sum of the changes in commodity outputs in each zone (where the shares are shares in base year zone outputs) equals the percentage change in the output of the zone.

The basic value commodity prices are equivalent to farm-gate prices. That is, they represent prices received by the producer and exclude the margins (trade, transport and commodity taxes) which are included in the prices paid for the commodities by users.[16] These margins are explicitly modelled in ORANI (DPRS 1977, pp. 55-72). The importance of an explicit treatment of them in the model's price accounting system can be illustrated using the results presented in Table 7.

Consider, first, commodity A1 (wool) which is almost all exported either directly or indirectly via sales to the export industry 30 (prepared fibres). Since the level of exports for wool is determined endogenously in these results, its domestic price, the level of exports and the world price satisfy equations (4) and (5), as follows:

$$p_i^e = -\gamma_i x_i^{(4)}, \tag{4}$$

$$p_i^e = S_{BVi} p_{i1} + S_{mi} p_m, \tag{5}$$

where p_i^e is the percentage change in the at port export price of commodity i,

$x_i^{(4)}$ is the percentage change in the level of exports of commodity i (for an explanation of (4) see DPRS 1977),

p_{i1} is the percentage change in the basic value price of commodity i,

p_m is the percentage change in the price of margins services,

γ_i is the reciprocal of the foreign elasticity of demand for commodity i, and

S_{BVi} and S_{mi} are, respectively, the share of basic value and margins in the at-port export value of a unit of commodity i.

[16] For the case of exports, the user or purchaser prices are to be defined as prices at port of exit.

Table 8 shows the projected percentage changes in export volumes for the endogenous export commodities. The values used for reciprocals of the world demand elasticities for Australian exports are also included.

TABLE 8

Projected Changes in Commodity Exports

	Commodity	Percentage[a] change	Reciprocal of export demand elasticity γ_i.[b]
A1	Wool	−0·98	0·77
A3	Wheat	−1·23	0·08
A4	Barley	−1·79	0·05
A5	Other cereal grains	2·71	0·05
11	Fishing	−7·90	0·05
12	Iron	0·95	0·05
13	Other metallic minerals	−1·03	0·05
15	Coal	−10·44	0·05
18	Meat products	−5·52	0·06
25	Food products n.e.c.	−11·66	0·05
30	Prepared fibres	−2·97	0·38
63	Basic iron and steel	−12·45	0·05
64	Other basic metals	−5·44	0·05

[a] For detailed discussions of these results see Vincent, Dixon, Parmenter and Sams (1979).

[b] The sources of the γ_j s are described in Dixon, Vincent and Powell (1978).

Returning to the particular case of wool, we see that the reduction in its volume of exports of (0·98 per cent) is associated, via equation (4), with a rise in its at port price of 0·75 per cent. If we assume that the costs of selling and delivering wool to the wharf have risen in line with the domestic consumer price index (i.e. assume $p_m = 2·1$) then, from equation (5), it follows that the farm-gate price of wool must have risen by about 0·5 per cent.[17] This is confirmed in Table 7.

Pursuing a similar chain of reasoning for wheat we are able to explain the result that, although the output and export volumes of wheat have fallen, the farm-gate price of wheat is projected to decline. Since the foreign elasticity of demand for wheat is assumed to be greater than that for wool, the rise in the at-port export price of wheat induced by the fall in its export volume is smaller. In addition, the share of margins in the at-port price of wheat (S_{mA3}) is 0·29, significantly higher than was the case for wool (0·14). Given this, equation (5) indicates that, assuming once again a rise in the price of margins services of the same order as the rise in the general price level, the farm-gate price of wheat actually falls. The rise in the cost of transferring wheat from the farm to the port more than absorbs the slight increase in the at-port price. The movements shown in Table 7 in the basic value prices of the remaining exported agricultural commodities, A4 and A5, can be explained in analogous ways. Similar explanations can also be made for the changes in the basic prices of sheep (A2), meat cattle (A6) and other farming export (A8). In these cases, however, costs incurred in the relevant processing industries must be considered in addition to the other margins costs involved in moving the product from the farm to the port.

[17] The value for S_{BVA1} is 0·86 and that for S_{mA1} is 0·14.

The explanation for the comparatively favourable movement in the basic values prices of milk cattle (A7) and other farming import competing (A9) is derived from the relative isolation of these products from world trade.

We turn now to the results for commodity outputs by industry which reflect the operation of the CRETH product-product transformation triggered by the relative changes in the farm-gate prices of the commodities.

The Pastoral Zone

Recall from Table 3 that, for the Pastoral Zone, CRETH was estimated for three product groups: wool/sheep, meat cattle and other products. Within each group, individual commodities are assumed to be produced in fixed proportions so that in Table 7 the projected percentage change in output is the same for each component of a commodity group within any given industry. The outputs of wool and sheep in the Pastoral Zone are both projected to decline by 0·89 per cent, for example. Basic values price changes for the commodity groups in the Pastoral Zone are as follows: wool/sheep +0·06 per cent, meat cattle —1·37 per cent, other products —0·55 per cent.[18] That is, the price at the farm gate of wool/sheep has risen relative to the prices of both the other groups. The extent of price-induced product transformation, however, will depend on the ease of transformation between products as well as the relative price change. For example, consider the wool/sheep result. In equation (3), the difference between the price of wool/sheep and the CRETH share-weighted prices of the three product groups is +0·77, i.e. favourable to wool/sheep. However, the estimated transformation parameter, ($\phi_g{}^j$), for wool/sheep is 0·104 (see Table 3). This implies low transformation elasticities between wool/sheep and the other two commodity groups. Hence, the positive contribution to wool/sheep output from the relative price change in its favour is small and the net effect is a contraction in wool and sheep output only a little less than the contraction in output of the zone. In the case of cattle, however, the relative price term is —0·66 and the transformation parameter is 1·613. This leads to an output contraction of 1·07 per cent from the transformation component of equation (3) which, together with the zone output component, results in an output contraction for cattle of 2·03 per cent. For the 'other' commodity group, the price of which has fallen relative to wool/sheep and increased relative to cattle, the relative price term is +0·16 and the transformation parameter is 4·55.[19] Hence, the favourable output response from the relative price-induced transformation towards 'other' products is large (+0·72) and the net effect after taking into account the contraction in Pastoral Zone output is an output contraction of 0·25 per cent for the commodities of the 'other' group.

Wheat-Sheep and High Rainfall Zones

The explanation of commodity movements is considerably more

[18] These are appropriately weighted averages of individual commodity prices (see the section on the specification of the agricultural sector).

[19] Note that Table 3 implies that transformation elasticities are high between 'other' products and competing groups in *all* zones.

lengthy in these zones because of the larger number of competing products. The interested reader can verify the results by referring to the relevant information on transformation parameters (Table 3) and changes in zone outputs and commodity prices (Table 7). In short, the output of commodities in the 'other' group expands slightly in the Wheat-Sheep Zone and there are contractions of more than 1 per cent for wheat, barley, meat cattle and sheep and of 0·6 per cent for wool. In the High Rainfall Zone the outputs of all commodities contract by 1 per cent or greater, with meat cattle, sheep and wool showing the largest contractions and the commodities in the 'other' category the smallest.

To a large extent the results of Table 7 depend on the transformation, and hence cross-price elasticities, between product groups in each zone. The weakest part of the story is the assumption (forced upon us by the limitations of the data base for estimation) that commodities are produced in fixed proportions in the 'other' products group in each zone. However, in all zones, the commodities in this group constitute only a small proportion of total commodity outputs.

Farm industry incomes

Percentage changes in nominal incomes for each of the farm industries (industries 1-8) are presented in Table 9. We define farm industry income as the return to farm labour (hired and owner-operator), farm capital and land. Hence the percentage change in farm industry income in industry i (v_i) is calculated as:

$$(6) \qquad v_i = (q_{in} + w_{in})\, S_{in} + (q_{ik} + w_{ik})\, S_{ik} + (q_{il} + w_{il})\, S_{il}$$

where the q_i are the percentage changes in the employment of labour (n), capital (k) and land (l) in industry i,
the w_i are percentage changes in the corresponding prices,
and the S_i are the corresponding shares in value added.

Since our simulation is short run, both the q_{ik} and the q_{il} are zero: industry specific capital and land stocks are held constant in the short run. Percentage changes in each of the components of the RHS of equation (6) are presented in Table 9 with the farm industry income results.

For agricultural industries producing mainly export commodities, farm industry incomes decline by about 4 to 6 per cent in nominal terms or about 6 to 8 per cent in real terms. The largest decline occurs for northern beef. This industry has no alternative commodity prospects to meat cattle. Hence, the basic values price of the industry falls by the same amount as that for meat cattle (1·37 per cent).[20] For the milk cattle industry (which produces both meat cattle and milk cattle commodities) the percentage change in the basic values price is

[20] It will be recalled from Table 7 that basic values prices for the commodities wool, other farming export, other farming import competing and milk cattle actually increase, thus modifying the fall in basic values prices of multi-product industries producing these commodities in conjunction with other commodities. For example, basic values price changes for the BAE multi-product industries are —0·21 per cent (Pastoral Zone), —0·57 per cent (Wheat-Sheep Zone) and —0·32 per cent (High Rainfall Zone). These industry prices should not be confused with the CRETH share-weighted prices of equation (3) (see Table 7). The configuration of product group CRETH parameters causes the modified shares (S_i^j*) to differ substantially from the ordinary product group shares in the Pastoral and High Rainfall Zones.

TABLE 9

Projected Percentage Changes in Farm Industry Incomes

Terms in equation (6)	Pastoral Zone	Wheat-Sheep Zone	High Rainfall Zone	Northern beef	Milk cattle	Other farming export	Other farming import competing	Poultry[a]
q_{in}	−3·71	−3·62	−4·03	−4·46	−2·80	−3·83	−2·41	−0·85
w_{in}	2·13	2·13	2·13	2·13	2·13	2·13	2·13	2·13
w_{ik}	−5·84	−5·11	−6·56	−8·24	−1·85	−5·73	−1·34	0·23
w_{il}	−5·29	−4·96	−6·44	−8·05	−1·69	−5·69	−1·10	—
S_{in}	0·262	0·264	0·399	0·294	0·296	0·432	0·300	0·550
S_{ik}	0·356	0·258	0·151	0·250	0·128	0·162	0·320	0·450
S_{il}	0·382	0·478	0·450	0·456	0·494	0·406	0·380	—
Farm income (v_i)	−4·51	−4·08	−4·65	−6·42	−1·27	−3·97	−0·93	0·81

[a] Note that the poultry industry does not 'use' land, i.e. land as an input contributes nothing to value added other than as a 'factory' site.

+0·77. After taking into account this increase, the percentage decrease in farm industry income is comparatively small. For the other farming import competing and poultry industries, the same situation applies. The basic values prices of the commodities these industries produce (and, hence, the basic values prices of the industries) increase: hence the comparatively small falls in industry incomes.

Concluding Remarks

In this paper, IMPACT's ORANI 78 model has been used to assess the short-run adjustment problems associated with the rise of domestic oil prices to import parity. In the paper, results have been emphasised for agricultural commodities and industries, for the analysis of which ORANI 78 is particularly well suited. The paper has not dealt *at all* with the long-term benefits expected to flow from the new oil price policy.

Our results suggest that a 40 per cent increase in the ex-refinery price of oil products, under slack labour market conditions with real wages and real domestic absorption held constant, produces the following *short-run* (1 to 2 year) effects:

(a) a contraction in aggregate employment of 0·8 per cent and in employment of rural workers of 2·8 per cent;
(b) a contraction in GNP of 0·5 per cent;
(c) a contraction in aggregate exports of 2·4 per cent, including contractions in exports of all but one of the agricultural export commodities;
(d) an expansion of aggregate imports of 0·6 per cent;
(e) an increase in consumer prices of 2·1 per cent;
(f) contractions in the outputs of export oriented agricultural industries of about 0·9 to 1·8 per cent;
(g) contractions in the incomes of export oriented farm industries of between 6 and 8 per cent in real terms.

The size of these effects depends critically on the wage indexation assumption; if, for example, none of the commodity price rises engendered by the rise in the price of oil are passed into money wages, the projected rise in the consumer price index falls to less than 1 per cent, whilst the fall in labour demand is of the order of 0·2 per cent.

As with all studies of an applied nature, our results are conditional on the assumptions underlying the economic structure of the model we have used. In particular, it should be noted that the model does not permit industries to substitute between alternative energy sources and other intermediate inputs as oil products become relatively more expensive. The effect of intermediate input substitution would be to reduce the cost burden to oil-using industries from the oil price increase. The extent of such intermediate input substitution, however, is likely to be small, particularly in the short run.

The value of our analysis lies not so much in the detailed numerical projections as in indicating the nature of the short-run adjustment problems likely to accompany the increase in crude oil prices. In particular, we hope that our indication of the relative vulnerability of different industries and commodities to adjustment pressures, and our explanations of the reasons for this differential vulnerability, will prove helpful in policy discussions.

References

Australian Bureau of Statistics (1977), *Australian National Accounts Input-Out Tables, 1968/69*, Canberra.

Bureau of Agricultural Economics (1973), *The Australian Sheep Industry Survey: 1967-68 to 1970-71*, Australian Government Publishing Service, Canberra.

———— (1974*a*), *The Northern Territory and Kimberley Region Beef Cattle Industry: 1968-69 to 1970-71*, Beef Research Report No. 13, Australian Government Publishing Service, Canberra.

———— (1974*b*), *The Queensland Beef Cattle Industry: 1968-69 to 1970-71*, Beef Research Report No. 14, Australian Government Publishing Service, Canberra.

Dixon, P. B., Parmenter, B. R., Ryland, G. J. and Sutton, J. (1977), *ORANI, A General Equilibrium Model of the Australian Economy: Current Specification and Illustrations of Use for Policy Analysis*, First Progress Report of the IMPACT Project, Vol. 2, Australian Government Publishing Service, Canberra.

————, Vincent, D. P. and Powell, A. A. (1978), An international trade scenario, IMPACT Project Research Memorandum, Melbourne.

————, Parmenter, B. R. and Powell, A. A. (1978), Structural adjustment and the macroeconomy, Discussion Paper No. 16/78, School of Economics, La Trobe University, Melbourne.

Hanoch, G. (1971), 'CRESH production functions', *Econometrica* 39(5), 695-712.

Industries Assistance Commission (1976), *Crude Oil Pricing*, Australian Government Publishing Service, Canberra.

Ryland, G. J. and Vincent, D. P. (1978), Empirical estimation of the CRESH production function, IMPACT Working Paper No. OP-12, Melbourne.

Tulpulé, A. and Powell, A. A. (1978), Estimates of household demand elasticities for the ORANI model, IMPACT Preliminary Working Paper No. OP-22, Melbourne.

Vincent, D. P. (1977), 'Factor substitution in Australian agriculture', *Australian Journal of Agricultural Economics* 21(2), 119-29.

————, Dixon, P. B. and Powell, A. A. (1978), The estimation or supply response in Australian agriculture: the CRESH/CRETH production system, IMPACT Working Paper No. G-12, Melbourne (forthcoming in *International Economic Review*).

————, ————, Parmenter, B. R. and Sams, D. C. (1979), The short-term effect of oil price increases on the Australian economy with special reference to the agricultural sector, Conference Workshop Paper, Australian Agricultural Economics Society, Canberra.