IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

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

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The views expressed in this paper do not necessarily reflect the opinions of the participating agencies, nor of the Australian government.

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Contents

Tables

APPENDIX : Technical details of the Simulations

This appendix can be used in conjunction with DPRS. The simulations reported here employed the list of exogenous variables shown in DPRS, p. 104. The exogenous variable representing the percentage change in the price of other cost tickets to the oil and coal products industry (i.e. industry 56 in the ORANI 78 classification) was set at 2001.8, 2014.0 and 2025.3 in the 100, 70 and 0 per cent wage indexation simulations, respectively. These numbers were calculated to induce 40 per cent increases in the industry's unit costs. (In the three cases the elasticities of the basic price of oil and coal products with respect to the price of other tickets were found to be 0.01998, 0.01986 and 0.01975. Notice that 0.01998 x 2001.8 = 40, 0.01986 x 2014.0 = 40, etc.) All other exogenous variables were set at zero. The indexing parameters (i.e. the h's) were set at unity. The export commodities were as shown in Table 8 and the industries for which the ORANI investment theory was not operative were 17, 84, 85, 86, 103, 104, 105, 106, 107, 108 and 112 (ORANI 78 classification). As mentioned in the text, owner-operator labour in agriculture was treated as a potentially variable factor input.

(vii) contractions in the incomes of export oriented farm industries of 6 to 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 rise engendered by the rise in the price of oil is passed into money wages, the projected rise in the consumer price index falls to less than 1 per cent, whilst the fall in employment 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 the price of oil products becomes relatively more expensive. The effect of intermediate input substitution would be to reduce the cost burden to a particular industry 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.

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

by

D. P. Vincent, P. B. Dixon, B. R. Parmenter
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IMPACT PROJECT STAFF

1. 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[1] (which recommended a gradual movement of Australian oil prices to world parity), the Industries Assistance Commission 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 insofar as they relate to the rural sector (which is the principal area in which ORANI 78 represents an improvement over ORANI 77[2]). An

* The authors wish to thank Alan Powell for detailed comments on an earlier draft of this paper.

1. IAC (1976).
2. Dixon, Parmenter, Ryland and Sutton (1977).

examination of the long run benefits to be expected from the move, on the other hand, is not attempted in this paper.

A rise in the price of oil bears unevenly on different sectors.[1] 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.

As explained in section 2, that part of the move towards import parity pricing implemented in the budget of August 1978 is judged to be equivalent to an increase in the price of domestically produced oil products of about 40 per cent. This is the exogenous shock generating the simulations reported in this paper.

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 section 5.1 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.

1. As noted by the IAC (1976), p. 2.

6. CONCLUDING REMARKS

In this paper the use of IMPACT's ORANI 78 model has been illustrated by simulations designed to assess the short run adjustment problems associated with digesting the rise of oil prices to import parity. The paper has emphasized results 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 restoration of the relative price of oil to a value more in line with its social opportunity cost.

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 (1-2 year) effects :

(i) a contraction in aggregate employment of 0.8 per cent and in employment of rural workers of 2.8 per cent ;

(ii) a contraction in GNP of 0.5 per cent ;

(iii) a contraction in aggregate exports of 2.4 per cent, including contractions in exports of all but one of the agricultural export commodities ;

(iv) an expansion of aggregate imports of 0.6 per cent ;

(v) an increase in consumer prices of 2.1 per cent ;

(vi) contractions in the outputs of export oriented agricultural industries of about 0.9 to 1.8 per cent ;

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).[1] For the milk cattle industry (which produces both meat cattle and milk cattle commodities) the percentage change in the basic values price is + 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.

1. 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 ($\Sigma_{\ell} p_{\ell}^{j} \bar{S}_{\ell}^{j}$ of equation (3.3), see Table 7). The configuration of product group CRETH parameters causes the modified shares $\bar{S}_{\ell}^{j}$ to differ substantially from the ordinary product group shares in the pastoral and high rainfall zones.

The paper is organized as follows. Section 2 provides a short historical account of domestic pricing policy for crude oil. Sections 3 and 4 contain details of the specification of the agricultural sector in the ORANI model and the key assumptions underlying our simulations. Results of the simulations for macroeconomic aggregates and for individual industries and commodities with particular emphasis on the agricultural sector are in section 5. Section 6 contains concluding remarks.

2. BACKGROUND TO OIL PRICE INCREASES[1]

The price of crude oil produced in Australia has been subject to Commonwealth Government control since production commenced in the mid-1960's. Separate price fixing arrangements were set for each oil field as it commenced production. Up until September 1975, the price fixing arrangements for a particular field related domestic prices to world parity prices existing at the time that field commenced production, with appropriate allowances being made for quality differentials between imported and domestic crude together with, in some cases, an incentive loading.

In September 1975, following the upheavals in the world oil market which took place in the early 1970's, a new pricing system was introduced, ostensibly for a three year period. This system distinguished between oil from fields in production at the time and oil from future discoveries. Oil from new discoveries was to be priced at import parity less an excise of $2 per barrel. For existing fields, prices were no longer based on historic import parity but were set by the Government according to economic and technical considerations applying to each field. Underlying this price fixing arrangement was the notion of a 'satisfactory' return to the various producers - - that is, prices were adjusted to reflect anticipated changes in operating costs and the need to recover field development costs and still yield an after tax return on the investment judged to be sufficient by the Government. The resulting prices were considerably below world price levels existing at that time.

1. For a more comprehensive description of historic pricing arrangements for Australian crude, see Industries Assistance Commission (1976).

TABLE 9

PROJECTED PERCENTAGE CHANGES IN FARM INDUSTRY INCOMES

Terms in Eqn (5.3)	Pastoral Zone	Wheat-Sheep Zone	High Rainfall Zone	Northern Beef	Milk Cattle	Other Farming Export	Other Farming Import Competing	Poultry[(a)]
q_i^n	-3.71	-3.62	-4.03	-4.46	-2.80	-3.83	-2.41	-0.85
w_1^n	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
w_1^k	-5.84	-5.11	-6.56	-8.24	-1.85	-5.73	-1.34	+0.23
w_1^ℓ	-5.29	-4.96	-6.44	-8.05	-1.69	-5.69	-1.10	-
S_i^n	0.262	0.264	0.399	0.294	0.296	0.432	0.300	0.550
S_i^k	0.356	0.258	0.151	0.250	0.128	0.162	0.320	0.450
S_i^ℓ	0.382	0.478	0.450	0.456	0.494	0.406	0.380	-
Farm Income (v_1)	-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. That is, land as an input contributes nothing to value added other than as a 'factory' site.

The reason lies in this commodity's comparatively large sales (58 per cent of total sales) to industry 22 (flour and cereal products) the output of which contracts slightly.

5.3.4 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;

$$v_i = (q_i^n + w_i^n)\, S_i^n + (q_i^k + w_i^k)\, S_i^k + (q_i^\ell + w_i^\ell)\, S_i^\ell \qquad (5.3)$$

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_i^k and the q_i^ℓ 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 (5.3) are presented in Table 9 with the farm industry income results.

World prices reflect those of the dominant exporters, namely the Middle East producers. Over the 1960's, world prices of Arabian light crude were relatively stable. World prices in $US doubled between February 1972 and October 1973 to reach $2.80 US per barrel f.o.b.. Disciplined price fixing arrangements by the OPEC producing cartel enabled them to quadruple world prices between October 1973 and the end of 1974. Australian consumers of oil products were reasonably well insulated from the direct effects of this price hike because of our relatively large degree of self sufficiency[1] in oil and the maintenance of fixed prices for domestic oil over this period.

In its report on crude oil pricing[2] of September 1976, the IAC considered that, for long run resource allocation reasons, free market pricing was preferable to the existing system of price control on production from fields discovered before September 1975. However, in recognizing that immediately removing the insulation of the domestic market would add significantly to the Government's difficulties in reducing inflation, the IAC recommended a stepwise adjustment. The recommendation envisaged that full import parity pricing would be reached no later than 1985.

A new pricing scheme, similar in principle to that recommended by the IAC, was introduced from 17th August 1977. An annually increasing proportion or six million barrels a year, whichever is the greater, of crude oil from each field discovered before 14th September 1975 was priced at current import parity and the remainder sold at the fixed price for each

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1. The proportion of Australia's crude oil requirements met from domestic production climbed rapidly from the mid-1960's to a current level of around 70 per cent.

2. IAC (1976).

field which prevailed on 16th August 1977. To 30th June 1978, the specified proportion per field was 10 per cent of production, rising to 20 per cent for 1978/79, 35 per cent for 1979/80 and 50 per cent for 1980/81. Oil discovered after 14th September was to be priced at full import parity and would not be subject to excise. For the purpose of the latter calculation, import parity prices were to be adjusted by the Government at six monthly intervals.

In the August 1978 budget the Government abandoned the stepwise approach and raised the price of all Australian crude to refiners to the import parity level. This price is currently based on the official selling price in the Persian Gulf for Arabian light crude, expressed in Australian dollars at the Reserve Bank mid-rate of exchange and includes allowance for international and domestic freight charges, wharfage, insurance and quality differentials. On January 1st 1979, OPEC countries raised the world price of Arabian crude by 5 per cent. In continuing its policy of import parity pricing for indigenous crude, the Government subsequently raised the price of domestic crude to reflect the world price increase and changes in exchange rates, freight and quality differentials, etc., since the last adjustment.

The price of crude oil is only one of the two major determinants of the wholesale prices of refined oil products, the other being the level of customs and excise duties. These duties have not been increased since 1973. The steep increase in wholesale prices of refined products since the 1978 budget can be therefore attributed entirely to the sudden jump to import parity pricing of domestic crude.

wage indexation and imposes a cost price squeeze on exporting industries. Export volumes are projected to contract for 11 of the 13 export commodities. Agricultural commodity exports generally decline less than non-agricultural exports owing to the greater fixed factor intensity of the land using agricultural industries. Of the agricultural commodities, exports of meat products are hardest hit, declining by 5.5 per cent. This fall is much greater than the overall change in the output of the producing industry (18) which Table 5 reveals to be only -1.49 per cent. The price of meat products has fallen relative to other consumer goods (the price increase of meat products is only 0.2 per cent) so that consumption of meat products increases by .44 per cent and there is some diversion of output from exports to consumption.[1]

Other cereal grains (commodity A5) is the only agricultural commodity for which exports expand. The explanation for the expansion is to be found in the CRETH product transformation discussed in the previous section. In all zones, this commodity is part of the miscellaneous 'other products' category. In each zone the product transformation term, $\phi_g^j \left(p_g^j - \sum_\ell p_\ell^j \bar{s}_\ell^j\right)$, is positive and in one of the zones, the increase in the output of the commodity from relative price induced transformation towards it exceeds the contraction in output of the zone. However, it will be noted that the expansion in exports of other cereal grains exceeds the change in its output (-0.15). That is, diversion from domestic sales to exports has taken place.

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1. The major sales of meat products are to the meat products industry itself (10 per cent), to domestic consumption (55 per cent) and to export (27 per cent). The reader can check that the appropriately share weighted sum of percentage changes in these sales are consistent with the projected output change for the meat products industry.

(b) Wheat-Sheep and High Rainfall Zones

The explanation of commodity movements is considerably more 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.

5.3.3 Agricultural Commodity Exports

Projected percentage changes in export volumes for the 13 commodities for which exports are determined endogenously in this simulation have been presented in Table 8. As explained in section 5.1, the oil price increase generates domestic cost increases especially via

The IAC estimated that an immediate move to import parity pricing from the 1976 domestic pricing position would increase ex refinery prices for most products by an average of 60 per cent.[1] The estimate included an allowance for increased refinery costs arising from additional working capital requirements. However as noted earlier, some move towards import parity pricing had already taken place between the time the IAC reported and the 1978 budget. The exact increase in ex refinery prices that can be attributed to the budget decision is somewhat obscure. The oil companies are currently before the Prices Justification Tribunal trying to obtain further price increases as a result of the budget decision. Price increases averaging around 40 per cent are considered close to the mark. In the analysis presented in this paper we have imposed an increase in the basic values price of oil and coal products of 40 per cent.[2] This is probably an upper limit.

1. See IAC (1976).

2. From the point of view of the exercise - that of illustrating an ORANI general equilibrium simulation - the exact increase is of secondary importance. 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.

3. 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 fully described 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 (IO) tables[1] 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 IO tables. Consequently, six product groups were identified as agricultural "industries". They are;

1. Sheep
2. Cereal grains
3. Meat cattle
4. Milk cattle and pigs
5. Poultry
6. Other farming.

With the exception of poultry production, however, these groupings do not conform to any identifiable production units. The Australian agricultural

1. See ABS (1977).

other products -0.55 per cent.[1] 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 (3.3), the difference $(p_g^j - \sum_\ell p_\ell^j \bar{S}_\ell^j)$ 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 (ϕ_g^j) for wool/sheep is 0.104.[2] 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 term $(p_g^j - \sum_\ell p_\ell^j \bar{S}_\ell^j)$ 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 (3.3) 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 term $(p_g^j - \sum_\ell p_\ell^j \bar{S}_\ell^j)$ is +0.16 and ϕ_g^j is 4.55.[3] 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.

1. These are appropriately weighted averages of individual commodity prices. See section 3.
2. See Table 3.
3. Note that Table 3 implies that transformation elasticities are high between 'other' products and competing groups in all zones.

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. 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 these products relative isolation 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.

(a) 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,

sector is to a large extent characterised by joint production. For example, nearly all the output of the cereals-livestock complex is produced on multienterprise farms under conditions in which the production processes for individual products are highly interrelated. An implication is that input bundles cannot be uniquely attributed to the production of individual products.

A second problem with the treatment of the agricultural sector in the ABS IO 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 IO industry 6 (other farming). Two of the major products included in this category are tobacco, which is import competing, and sugar, which is an export commodity. In a model like ORANI which emphasizes international trade, it is unsatisfactory to have both import competing and exporting components in a single industrial sector.

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.[1] The exception is that

1. See DPRS, Table 13b.

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 Peninsular Gulf and Coastal Central Regions of Queensland (BAE (1974, a & b)). Industries 5 and 8 are as in the ABS 68/69 IO tables. Industries 6 and 7 produce only commodities A8 and A9 respectively.

have risen in line with the domestic consumer price index (i.e. assume $p_m = 2.1$) then from equation (5.2) it follows that the farm gate price of wool must have risen by about 0.5 per cent.[1] This is confirmed by 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.[2] 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 (5.2) 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.[3] The rise in the

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1. The value for S_{BVA1} is 0.86 and that for S_{mA1} is 0.14 so that

$$p_{A11} = \frac{p^e_{A1} - S_{mA1}\, p_m}{S_{BVA1}} = \frac{0.75 - (0.14)\ (2.1)}{0.86} \simeq 0.5 .$$

2. In fact from equation (5.1) $p^e_{A3} = -\gamma_{A3}\, x^{(4)}_{A3} = 0.09$.

3. That is, from (5.2)

$$p_{A31} = \frac{p^e_{A3} - S_{mA3}\, p_m}{S_{BVA3}} = \frac{0.09 - (.29)\ (2.1)}{0.71} \simeq -0.7 .$$

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.

Table 8 shows the projected percentage changes in export volumes (the $x_i^{(4)}$) for the endogenous export commodities. The values used for reciprocals of the world demand elasticities for Australian exports (γ_i) are also included.[1] 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 (5.1), with a rise in its at port price (p_i^e) of 0.75 per cent. If we assume that the costs of selling and delivering wool to the wharf

TABLE 8

PROJECTED PERCENTAGE CHANGES IN COMMODITY EXPORTS

Commodity	Percentage Change	Reciprocal of Export Demand Elasticity γ_i
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

1. The sources of the γ_j's are described in Dixon, Vincent and Powell (1978).

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.

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

$$Y_j = f_j(X_{1j},\ldots,X_{ij},\ldots,X_{nj}) \qquad (3.1)$$

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

$$g(Y) = h(X) \qquad (3.2)$$

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 generalized 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.[1] Producers select the mix of their

1. See Vincent, Dixon and Powell (1978).

TABLE 2

BASE PERIOD COMMODITY SHARES OF OUTPUT BY INDUSTRY

Commodities \ Industries	(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 & 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 recognized in the CRETH estimation.

margins are explicitly modelled in ORANI.[1] 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[2] in these results, its domestic price, the level of exports and the world price satisfy equations (5.1) and (5.2), as follows:

$$p_i^e = -\gamma_i x_i^{(4)} , \tag{5.1}$$

$$p_i^e = S_{BVi} p_{i1} + S_{mi} p_m , \tag{5.2}$$

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 ,

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 ,

1. See DPRS pp.55-72.
2. See footnote 1 on page 27.

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 ($\sum_{\ell} p_{\ell}^{j} \bar{S}_{\ell}^{j}$)	-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.

bundles of outputs according to relative product prices, the elasticities of transformation between products being less than infinite but greater than the zero's assumed in the Leontief case.

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

$$x_g^j = z_j + \phi_g^j \left(p_g^j - \sum_{\ell} p_{\ell}^j \bar{S}_{\ell}^j\right) \qquad (3.3)$$

where x_g^j is the percentage change in the output of the g^{th} product of the j^{th} industry,

z_j is the percentage change in an index of the general level of output of the j^{th} industry,

p_{ℓ}^j is the percentage change in the basic value price of the ℓ^{th} product of the j^{th} industry

and ϕ_g^j and the $\bar{S}_{\ell}^j$ are positive parameters with the sum over ℓ of the $\bar{S}_{\ell}^j$ equal to one.

Thus, equation (3.3) says that, in the absence of changes in relative prices, the output of each of the products of the j^{th} industry expands in proportion to the general level of activity in the industry (constant returns to scale). However, if the price of the g^{th} product rises relative to an appropriately weighted average of all product prices (i.e. $p_g^j > \sum_{\ell} p_{\ell}^j \bar{S}_{\ell}^j$), 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 ϕ_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 $\bar{S}_{\ell}^j$ are to be interpreted as modified[1]

1. The modification is explained in Vincent, Dixon and Powell (1978).

TABLE 3

VALUES FOR TRANSFORMATION PARAMETERS (ϕ_g^j)

Pastoral Zone		Wheat/Sheep Zone		High Rainfall Zone	
Commodity group	ϕ_g^j	Commodity group	ϕ_g^j	Commodity group	ϕ_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).

product shares in industry output.

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.[1] Within each of the commodity groups individual commodities are assumed to be produced in fixed proportions.[2] In equation (3.3) the product subscripts identify the commodities or commodity groups for which CRETH was estimated. For example x_1^1 is the percentage change in the output of "wool/sheep" in the pastoral zone. Under the assumption of fixed proportions within

1. For the key to the aggregations, see the note to Table 2.

2. Unfortunately the time series on which the estimation of the relevant transformation frontiers were based, were 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).

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[1] and an important supplier of investment goods to the farming industries.[2] 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.

5.3.2 Agricultural 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 $\sum_\ell p_\ell^j \bar{s}_\ell^j$ (see equation 3.3).

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.[3] These

1. Its import share is 26 per cent.
2. 58 per cent of its sales are to investment.
3. For the case of exports, the user or purchaser prices are to be defined as prices at port of exit.

link to domestic consumption helps to cushion industry 5 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.)[1] from the various cereal grains (the prices of which all decrease). This helps to keep the price increase for poultry to 1.1 per cent (half the consumer price index increase) resulting in an increase of 0.01 per cent in domestic consumption of poultry.

Outputs of industries heavily engaged in supplying the farming industries e.g., 9 (services to agriculture), 49 (chemical fertilizers)

1. The price increase in food products n.e.c. is only 0.5 per cent.

groups, the percentage changes in the outputs of both "wool" and "sheep" in the pastoral zone are also equal to x_1^1. The price changes in equation (3.3) refer to group prices. They are defined as weighted averages of individual commodity price changes where the weights are the shares of the commodities in the commodity groups.

4. ASSUMPTIONS UNDERLYING THE SIMULATIONS

In section 5 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 may in fact 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[1] assumed for the simulation are

(i) fixed industry specific capital stocks;

(ii) fixed real aggregate consumption, investment and government spending;

(iii) 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 wage rates);[2]

1. The technical specifications for the simulation reported herein are given in the Appendix.

2. It is important to distinguish the concept of wage indexation used in this paper from its popular usage. In the language used here we would say that wages were x % indexed in 1976-77 if per unit costs of labour actually rose by (xy/100) % in that year, where y is the percentage increase in the consumer price index in 1976-77.

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 agricultural 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.[1]

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

1. The reason is that the basic value price of the industry's only product (meat cattle) falls quite severely. See section 5.3.2. 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.

employed in ORANI[1] imply short-run industry supply functions of the form

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

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,[2]

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.

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1. See DPRS, sections 2 and 3. ORANI 78 is specified to accommodate CRESH (see Hanoch (1971)) production functions. Attempts to estimate parameters for the CRESH system at a disaggregated level have not been successful (see 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).

2. This is a weighted sum of the percentage changes in the prices of labour, fixed capital and agricultural land, where the weights are the shares in total primary factor costs of each primary factor. Alternatively it is the percentage change in the product price modified by percentage changes in material input prices.

(iv) a fixed exchange rate.

Assumption (i) implies that the results are short run. That is, the model determines the impact on endogenous variables of interest of an increase in the price of oil after a period long enough for local prices of all commodities to adjust to the higher oil product prices, for users of domestic inputs to decide whether or not to switch to imported supplies, for domestic suppliers to change their labour force and to change output[1] with their existing plant and for price increases to be passed on to wages and wage increases to be passed back into prices. Investment takes place but is not allowed to augment capital stocks in the solution period. A suitable calendar time interpretation of this short run would be 1-2 years. Assumption (ii) 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. The slack labour market assumption (assumption (iii)) 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

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1. 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.

70 per cent indexation levels as well as for full wage indexation.[1] The last assumption (assumption (iv)) 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 summarize, our results are to be interpreted as the percentage 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.

1. 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.

5.3 The Agricultural Sector

This section gives a detailed description of our projections of the short run effects on the agricultural sector of the oil price increase. The description is divided into several parts. Subsections 5.3.1 and 5.3.2 are concerned with the industry and commodity output results. To a large extent they follow the format of the supply response equations (3.3), i.e. they first consider the industry output responses (the z_j's). Next they describe the projections for the commodity prices (the p_ℓ^j's). They finally turn to the commodity projections, (the x_g^j's). In subsection 5.3.3 we discuss the projections for agricultural commodity exports. Subsection 5.3.4 contains results on the effects of the oil price increase on farm industry incomes.

5.3.1 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 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

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.[1] 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. Note also that the output of industry 15 (crude oil) decreases by 4.4 per cent, the same amount as for industry 56.[2]

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1. The ORANI input demand functions for domestically produced commodities are of the form:

$$x_{ilj} = x_j - \sigma_i S_{i2j}(p_{ilj} - p_{i2j}) ,$$

where x_{ilj} is the percentage change in the usage of domestic good i as an input into industry j, x_j is the percentage change in the output of industry j, p_{isj} is the percentage change in the price of good i from source s (domestic (1) or imports (2)) to industry j, σ_i is the import substitution elasticity for good i, and S_{isj} is the share of good i from source s in industry j's use of good i. In the case of demand for oil products, $\sigma_i = .34$ and the relevant import share is .17. The increase in the purchasers' price of domestic oil products relative to imports is only about 24 per cent since basic value accounts for only about 60 per cent of purchasers' price. We can assume that the average contraction in users' outputs (the x_j) is about 0.5 per cent. Substituting into the demand function gives the average $x_{56,1,j} \approx 1.9$ per cent.

2. Crude oil (commodity 15) is sold entirely into industry 56 and the relevant σ_i is zero. Hence, substituting into the import demand function from the previous footnote, $x_{15} = x_{15,1,56} = x_{56}$.

5. THE RESULTS

In this section 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.

5.1 Macro Projections

The projected effects of the oil price increase on aggregate employment, 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 : 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	-$117m.[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[1] to increase by 2.1 per cent. As explained in section 4 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 $117 million. 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 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)[2] falls with the largest contraction occurring in the rural workers category.[3] 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.

1. 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.
2. 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.
3. 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.

in consumption between consumer goods and on the extent of the relative price changes.[1] 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.

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

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).[1] A typical value is about 2.0. See DPRS, pp. 155-159.

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 predominently to household consumption provided that they are not strongly connected to international trade. However some substitution in consumption will occur because of the differential 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 of course depend on the relevant cross price elasticities

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

The cost price squeeze on trading sectors and the contraction in employment 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.[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.

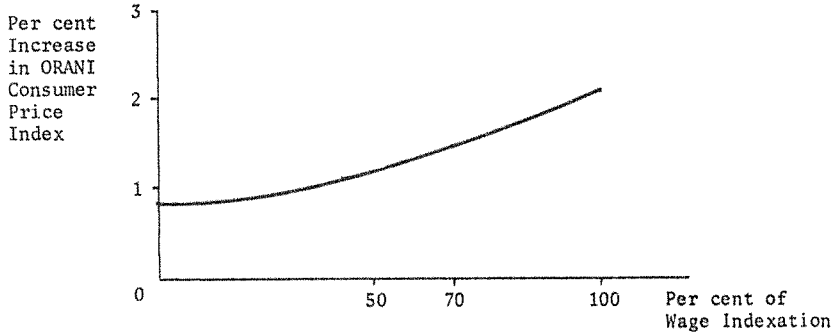

Figure 1 : Effect of the 40 per cent Fuel Products Price Increase on the ORANI Index of Consumer Prices for Different Degrees of Wage Indexation.

1. Results for the full range of endogenous variables under the 70 per cent and the zero wage indexation assumptions have been computed and are available from the authors. See also footnote 1 on page 18.

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 emphasized elsewhere[1] 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. 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.[2]

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1. See Dixon, Parmenter and Powell (1978).

2. See in particular Dixon, Parmenter and Powell (1978) pp.19-23.

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

(i) export relatedness,

(ii) import competitiveness,

(iii) dependence on sales to household consumption,

(iv) fixed factor intensity, and

(v) dependence on investment sales.

The oil price increase harms exporters (and consequently the suppliers of inputs to export industries)[1] 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 either exported 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 fertilizers) 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

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1. In ORANI exports are determined endogenously only for 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 pp.204-5.

Industry	Percentage Change in Output	Oil Products as a Percentage of Total Costs[a]
95. Water Transport	-0.93	0.88
96. Air Transport	-0.72	2.64
97. Communication	-0.30	0.09
98. Banking	-0.33	0.05
99. Finance & Life Insurance	-0.09	0.14
100. Other Insurance	-0.23	0.07
101. Investment, Real Estate	-0.30	0.12
102. Other Business Services	-0.31	0.43
103. Ownership of Dwellings	0.00	0.09
104. Public Administration	-0.00	0.19
105. Defence	0.00	1.11
106. Health	0.08	0.06
107. Education, Libraries	0.02	0.03
108. Welfare Services	-0.06	0.14
109. Entertainment	-0.12	0.24
110. Restaurants, Hotels	0.04	0.19
111. Personal Services	-0.04	0.57
112. Business Expenses	-0.30	0.06
Agricultural Commodity Outputs		
A1. Wool	-1.05	
A2. Sheep	-1.39	
A3. Wheat	-1.17	
A4 Barley	-1.02	
A5. Other Cereal Grains	-0.15	
A6. Meat Cattle	-1.45	
A7. Milk Cattle and Pigs	-0.54	
A8. Other Farming Export	-1.56	
A9. Other Farming Import Competing	-0.45	

(a) Derived from ABS (1977).

5.2 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 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.[1] 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 however 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 1-2 per cent for 64 commodities and by less than 1 per cent for eight commodities. Prices actually fall for nine commodities (see discussion in section 5.3.2).[2]

1. 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 than those shown in Table 5.
2. 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)
1.	Pastoral Zone	-0.97	2.24
2.	Wheat/Sheep Zone	-0.94	2.07
3.	High Rainfall Zone	-1.71	1.74
4.	Northern Beef	-1.49	3.59
5.	Milk Cattle	-0.56	1.35
6.	Other Farming Export	-1.69	1.90
7.	Other Farming Import Competing	-0.49	1.86
8.	Poultry	-0.47	0.15
9.	Services to Agriculture	-1.16	1.99
10.	Forestry	-1.19	4.19
11.	Fishing	-4.24	5.49
12.	Iron	-0.33	1.58
13.	Other Metallic Minerals	-1.99	0.97
14.	Coal	-4.20	0.41
15.	Crude Oil	-4.43	0.40
16.	Non-Metallic Minerals n.e.c.	-0.38	3.41
17.	Services to Mining	-0.30	1.33
18.	Meat Products	-1.49	0.14
19.	Milk Products	-0.04	0.33
20.	Fruit & Vegetable Products	-0.02	0.33
21.	Margarine, Oils & Fats	-0.66	1.39
22.	Flour & Cereal Products	-0.24	0.19
23.	Bread, Cakes	-0.02	0.82
24.	Confectionery	-0.11	0.26
25.	Food Products n.e.c.	-3.60	0.27
26.	Soft Drinks, Cordials	0.01	1.01
27.	Beer & Malt	0.04	0.32
28.	Alcoholic Drinks n.e.c.	-0.37	0.26
29.	Tobacco	-0.15	0.61
30.	Prepared Fibres	-2.02	0.16
31.	Man-Made Fibres, Yarn	-1.54	0.21
32.	Cotton, Silk, Flax	-1.34	0.13
33.	Wool & Worsted Yarns	-0.22	0.23
34.	Textile Finishing	-0.20	0.39
35.	Textile Floor Covers	-0.28	0.14
36.	Textile Products n.e.c.	-0.88	0.23
37.	Knitting Mills	-0.17	0.13
38.	Clothing	-0.19	0.14
39.	Footwear	-0.72	0.18
40.	Sawmill Products	-0.75	0.54
41.	Plywood, Veneers	-0.39	0.57
42.	Joinery & Wood Products	-0.13	0.31
43.	Furniture, Mattresses	0.50	0.21
44.	Pulp, Paper	-1.05	0.50
45.	Fibreboard	-0.61	0.21

	Industry	Percentage Change in Output	Oil Products as a Percentage of Total Costs(a)
46.	Paper Products n.e.c.	-0.38	0.70
47.	Newspapers & Books	-0.44	0.14
48.	Commercial Printing	-0.41	0.23
49.	Chemical Fertilisers	-1.14	0.40
50.	Industrial Chemicals	-1.38	0.86
51.	Paints, Varnishes	-0.28	1.11
52.	Pharmaceuticals	-0.59	0.47
53.	Soap & Detergents	-0.09	0.37
54.	Cosmetics, Toiletry	-0.07	0.23
55.	Chemical Products n.e.c.	-1.03	0.74
56.	Oil & Coal Products	-4.43	6.83
57.	Glass	-0.69	1.92
58.	Clay Products	-0.37	1.05
59.	Cement	-0.04	1.77
60.	Ready-Mixed Concrete	0.29	0.60
61.	Concrete Products	0.18	0.50
62.	Non-Metal Mineral Products	-0.24	0.89
63.	Basic Iron & Steel	-2.58	0.45
64.	Other Basic Metals	-2.49	0.41
65.	Structural Metal	-0.80	0.29
66.	Sheet Metal Products	0.02	0.33
67.	Metal Products n.e.c.	-0.79	0.33
68.	Motor Vehicles, Parts	-0.96	0.27
69.	Ship & Boat Building	-2.25	0.10
70.	Locomotives	-0.92	0.15
71.	Aircraft Building	-0.49	0.13
72.	Scientific Equipment	-0.89	0.33
73.	Electrical Equipment	-0.34	0.13
74.	Household Appliances	0.33	0.19
75.	Electrical Machinery	-0.73	0.40
76.	Agricultural Machinery	-2.26	0.25
77.	Construction Equipment	-1.19	0.12
78.	Other Machinery	-0.97	0.26
79.	Leather Products	-0.57	0.28
80.	Rubber Products	-0.59	0.33
81.	Plastic Products	-0.62	0.38
82.	Signs, Writing Equipment	-0.84	0.36
83.	Other Manufacturing	-0.33	0.25
84.	Electricity	-0.31	0.48
85.	Gas	-0.08	0.57
86.	Water, Sewerage	-0.16	0.69
87.	Residential Building	0.00	0.55
88.	Building n.e.c.	0.43	1.41
89.	Wholesale Trade	-0.64	0.93
90.	Retail Trade	-0.10	0.48
91.	Motor Vehicle Repair	-0.33	2.08
92.	Other Repairs	-0.27	0.62
93.	Road Transport	-0.90	5.71
94.	Railway Transport	-1.13	0.46