IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

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PROJECTIONS OF AUSTRALIA'S WORLD TRADE OPPORTUNITIES : MID AND LATE NINETEEN EIGHTIES

by

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1. INTRODUCTION

The object of this study is to prepare a set of scenarios about Australia's international trading prospects through the latter half of the 1980's. The study aims to identify underlying trends in the world's excess demand function for our exports and in its excess supply function for our imports. While the projections are designed primarily for use with the IMPACT framework, they may also be of interest for other purposes which require medium term commodity projections as data.

At the outset it is important to bear in mind the restricted framework in which the projections are made.[1] First, they refer to average trade opportunities in a nominal year and not to a specific year. The projections abstract from the effects of seasonal conditions, of short term business cycle fluctuations, and of temporary changes in policies of all types. Second, the concern is with real changes affecting relative

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1. The term projections is used here in the sense of conditional estimates of the future.

changes in trade opportunities. For example, for those commodities for which Australia can be regarded as a small country the concern is with changes in relative world prices only. Third, the paper is concerned only with establishing the likely directions and broad magnitudes of change, rather than with precise measures. The inherent uncertainties in making projections make it unrealistic to pursue a goal of greater accuracy; some idea of the order of inaccuracy will be noted.

Given the uncertainties of making projections, the paper specifies a number of alternative scenarios. The important factors singled out for parametric treatment are rates of economic growth and of world trading opportunities, relative rates of technological change, and the operation of commodity cartels, particularly for oil. The projections are conditional on a number of assumptions. The principal ones are set out explicitly.

2. METHODOLOGY

Three approaches to the development of projections are considered - time series analysis, market models and literature review. To a large extent the three approaches complement each other.

Time series projections using the naive no change projection, the same rate of change projection, and the time trend regression projection are evaluated. The analysis is applied to five year moving average relative prices for selected Australian export and import commodities using post war data. The accuracy of five year and ten year ahead time series

model projections for 1965, 1970 and 1975 prices are evaluated. Hopefully these results serve to indicate the likely order of accuracy of time series projections for the future as well.

The time series data provide background information for the economic market models. The two modes of analysis complement each other in the sense that a satisfactory causal model for projecting should be able to explain past changes in relative trade opportunities.

Market models are developed as the principal projection method. Changes in trade opportunities are seen as resulting from technological changes, from economic development, and from the repercussions of social, political and institutional changes on world demand, supply and pricing of different commodities. For the main part the discussion focuses on partial equilibrium analysis for particular commodities. Interrelationships are allowed for in an informal way and some attempt is made to enforce consistency assumptions as required by a general equilibrium model.

An important part of the economic analysis involves assessing the importance of Australia as a world trader in particular commodities and the structure of the world market. Particular attention is devoted to assessing whether, over the longer term, Australia can be regarded as a small country in the sense that what it imports or exports has a negligible influence on world prices. In those cases in which the small country assumption is a reasonable approximation, the projection method focuses on changes in the terms of trade for the commodity caused by relative shifts in world supply and demand. For other commodities consideration has to be given also to the price elasticity of the world excess demand function facing Australia.

The approach adopted is illustrated by the following formal model which is compatible with the type of world trade information required by the ORANI model.[1] Take the case of a single homogeneous commodity, ignore transport costs, and assume a freely competitive world market. As an approximation assume the rest of the world's (that is the world less Australia) supply and demand functions for a commodity are

$$D = F_1 P^{-\eta} \quad , \tag{1}$$

and

$$S = F_2 P^{\varepsilon} \quad , \tag{2}$$

where D is rest of world demand, S is rest of world supply, F_1 is an index of demand shift factors (e.g., income and population), F_2 is an index of supply shift factors (e.g., technology and investment), P is world price, and η and ε are (absolute) values of price elasticities of demand and supply. Australia's net trade (either exports E or imports M) function is

$$X = D - S \quad , \tag{3}$$

where X refers to either exports or imports by Australia. (If X has a negative sign, it represents imports.)

Now, in (3), taking time derivatives and dividing by X, an expression for the proportional change in the world excess trade supply or demand function facing Australia can be derived as

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1. Dixon, Parmenter, Ryland and Sutton [1977].

$$x = \frac{D}{X}(f_1 - \eta p) - \frac{S}{X}(f_2 + \varepsilon p) \quad , \tag{4}$$

$$= \frac{D}{X}(f_1 - f_2^*) - \frac{D}{X}(\eta + \varepsilon^*)\, p \quad , \tag{5}$$

with $f_2^* = \frac{S}{D} f_2$ and $\varepsilon^* = \frac{S}{D}\varepsilon$ where $x = (dX/dt)/X$, $p = (dP/dt)/P$, $f_i = (dF_1/dt)/F_i$ and all other terms are as defined. Alternatively, function (5) may be inverted to express price as the dependent variable

$$p = (f_1 - f_2^*)/(\eta + \varepsilon^*) - \frac{X}{D} x/(\eta + \varepsilon^*) \quad , \tag{6}$$

$$= f^e - \gamma x \quad , \quad ,$$

where $f^e = (f_1 - f_2^*)/(\eta + \varepsilon^*)$ and $\gamma = X/[D(\eta + \varepsilon^*)]$. The first of these is a variable and the second a parameter of the ORANI model. They may be interpreted respectively as the rate of growth of the foreign price of the good in question under conditions in which the Australian export/import level for that commodity does not change, and (minus) the elasticity of the world price with respect to Australian exports/imports of that commodity.[1]

A number of properties of the functions (5) and (6) are of special interest for the projections exercise. The effect of Australian exports (or imports) on the world price declines as Australian trade relative to the level of world demand declines, with Australia being regarded as a small country in the limiting case when $X/D \to 0$. Further, as $X/D \to 0$, $f_2^* \to f_2$ so that shifts in the real market price focus on relative rates of shift in the world supply and demand curves f_1 and f_2 respectively. Relaxing the simplifying assumptions of homogeneous

commodities, no transport costs and free markets will operate to reduce the price elasticity term $\frac{D}{X}(\eta + \varepsilon^*)$ in (5) and to increase the price flexibility term γ in (6).

A third and complementary aspect of the projection methodology adopted embraces a review of some of the diverse literature dealing with commodity markets and/or projections. Particular attention is given not only to the reported projections but also to how they were derived, the key assumptions used, and the reasons underlying the divergent results obtained from different studies.

3. TIME SERIES ANALYSIS

This section considers observed world prices for selected commodities traded by Australia over the post war period. The analysis focuses on two issues. The first is an objective description of past changes in relative commodity prices and trade opportunities facing the Australian economy in recent times. The historical time series information when combined with economic, technical and political information, enables an evaluation of the principal factors explaining changes over time in world prices. The insights gained in this way in turn are helpful in arriving at forward projections.

Second, pure time series methods of projection are evaluated as one means of developing estimates of future trade opportunities. In a sense, such projections are very simple because of the absence of any causal

analysis. In another sense however they can be regarded as the reduced form approach to causal models. To illustrate, suppose we have a simple model of a market for a commodity of the form :

$$Q^d = a_1 + b_1 X^d - c_1 P + e_1 \quad ; \tag{7}$$

$$Q^s = a_2 + b_2 X^s + c_2 P + e_2 \quad ; \tag{8}$$

$$Q^s = Q^d = Q \quad ; \tag{9}$$

$$X^d = f_1(T, \cdot) \quad ; \tag{10}$$

$$X^s = f_2(T, \cdot) \quad ; \tag{11}$$

where Q^d and Q^s are quantities demanded and supplied, P is commodity price, X^d is a vector of demand shift factors, e.g., income and population, X^s is a vector of supply shift factors, e.g., technology, and T is time. Equations (7) and (8) are typical (and quite general) supply and demand functions. A simple market clearing identity is given in (9) with the assumption that both P and Q are endogenous variables. Solving (7) - (9) for the reduced form equations, we have for P ,

$$P = \Pi_0 + \Pi_1 X^d + \Pi_2 X^s + v \quad . \tag{12}$$

To project P in (12) it is necessary to make estimates of the future values of X^d and X^s .

Frequently in projection exercises the exogenous variables such as income, population and technology are assumed to grow according to a

time trend. A general form of the underlying assumption is given by (10) and (11). Then, substituting into (12), the projection for P becomes

$$P = \Pi_0 + \Pi_1 f_1(T, \cdot) + \Pi_2 f_2(T, \cdot) \quad , \tag{13}$$

or

$$P = g(T) \quad . \tag{14}$$

This is in effect a pure time series trend projection.

The simple model of (7) - (11) can be generalised to include many commodities and to allow for complex autoregressive moving average processes for the time series functions in (10) and (11) (see, for example, Zellner and Palm [1974] and Wallis [1977]).

Three simple variants of time series projection methods are used to estimate relative prices for commodities in 1965, 1970 and 1975 from the viewpoints of five and ten years prior to those dates. Analysis of the projection errors may give a guide to the potential accuracy of the procedure for the future as well as an historical picture for the specific time period considered.

3.1 Data

Data on world prices for selected commodities imported and exported by Australia over the period 1948-49 to 1976-77 were obtained from the Australian Bureau of Statistics (ABS) in the case of export commodities and from the Reserve Bank of Australia (RBA) in the case of import commodities.

For the export commodities continuous series are available for wool, meats, dairy products, dried and canned fruits, sugar, hides and tallow, metals and coal, and gold. Shorter series are available for a much finer disaggregation of the commodity group metals and coal. ABS made available data for 1959-60 onwards for coal, iron and steel, copper, zinc and lead, and silver and for 1969-70 onwards also for iron ore, bauxite and alumina, and mineral sands. No export prices for manufactured goods are recorded; however many of these prices are captured in the import commodities. The price data are recorded as price indices. The export prices are measured f.o.b. at main Australian ports of export.

The import commodities are food, beverages and tobacco, crude materials inedible, mineral fuels and lubricants, base metals (chemicals), metal manufactures (manufactured goods by material), textiles, non-electrical machinery, electrical machinery, transport equipment, and miscellaneous. The last has not been used. While the indices "attempt to measure prices f.o.b. at the time commodities enter Australia," it is doubtful whether the existing data base would allow the construction of a c.i.f. series whose movements could be distinguished reliably from those of the f.o.b. series.

The raw price indices were subjected to two types of tansformations. First, because the focus of the study was on relative price movements, each commodity price index was divided by the average of the aggregate export and import price indices (that is, each price index was expressed relative to an index of all prices). Clearly, a number of approximations are involved here. For example, the denominator includes as a

component the numerator and the weighting of commodities in the denominator changes over time. To some extent the choice of a normalizing price is arbitrary. In view of these and other reservations it is considered that the transformed indices provide a good but not a precise indication of movements in relative prices over time.

Second, since the area of interest is with trend movements in relative prices, five year moving average prices are used. Again, the averaging period and filter weights are somewhat arbitrary but hopefully the averaging process removes most of the price variation due to seasonal and business cycle effects.

Algebraically, the price series used in the time series analysis can be represented as

$$y_{it} = \frac{2}{5} \sum_{r=-2}^{2} x_{i,t+r} / (x^{m}_{t+r} + x^{e}_{t+r}) \quad , \qquad (15)$$

where y_{it} is the relative five year moving average price of commodity i in year t, $x_{i,j}$ is the price index for commodity i in year j, and x^{m}_{j} and x^{e}_{j} are the values of aggregate import and export price indexes in year j. In the analysis, t runs from 1952-53 to 1974-75.

A number of limitations of the data used in the time series analysis should be borne in mind in interpreting the results drawn below. Not all traded commodities are covered and there is a high level of commod[illegible] aggregation. To a large extent these difficulties could be overcome by using the data compiled by Marsden and Milkovits [1977]. Unfortunately these data extend back only to 1968-69 and are of limited usefulness for the analysis of longer term trends which is the concern of

the current exercise. As noted above there is a degree of arbitrariness in the two data transformations and this means that the series provide a rough indication only. Even so, it is considered that the data provide a reasonable basis for drawing general observations about trends in relative world prices of commodities traded by Australia.

3.2 Historical Relative Price Movements

Some summary information describing movements of relative five year moving average prices of selected Australian export and import commodities over the period 1952-53 to 1974-75 are shown in Table 1 and for some mineral commodities over the period 1962-63 to 1974-75 in Table 2. This and other information can be used to illustrate some important characteristics of post war trends in relative world prices facing the Australian economy.

In most cases the time trends do not explain a high proportion of variation of the relative price movements over the sample period. For about a half of the commodities the coefficient of variation exceeds ten per cent. Significant time trends were found for 7 of the 11 export commodities and for 6 of the 9 import commodities. Thus, after allowing for steady trend changes in relative prices, and after removing a large part of short term economic fluctuations, there remains considerable unexplained variation in relative prices. The unexplained effects would include the effects of discrete technological changes, discrete changes in institutional marketing arrangements, and some residual business cycle effects.

Several patterns are discernible among particular commodities. The most striking case concerns mineral oil and petroleum products. Their relative prices declined at a slow rate until the OPEC cartel was formed

TABLE 1

Variation in Five Year Moving Average of Relative Price Indices[1] for Exports and Imports of Australian Products 1952-3 to 1974-5

Commodity	Coefficient of Variation[2] %	Time Trend Regression[3]		
		Coefficient	't' Value	R^2
Wool	14.3	-.01897	-8.89	.79
Meats	20.2	.02584	7.31	.72
Dairy	6.5	-.00449	-3.12	.32
Cereals	4.9	-.00337	-2.32	.20
Fruits	8.1	.00318	1.40	.09
Sugar	16.9	.00644	1.19	.06
All Exports	5.8	-.00706	-6.53	.67
Food Imports	5.2	-.00116	.72	.02
Crude Materials	2.9	.00238	-3.45	.36
Petroleum Products	30.6	.01914	2.05	.17
Base Metals	5.9	.00080	.44	.01
Metal Manufactures	11.7	.01394	6.00	.63
Textiles	6.9	.00157	.71	.02
Non-elect. Machinery	14.2	.01778	6.81	.69
Electrical Machinery	9.2	.00700	2.86	.28
Transport Equipment	7.5	.00279	1.26	.07
All Imports	5.9	.00706	6.53	.67

Notes:
1. Price series as described in equation (15).
2. Defined by 100 (standard deviation)/(mean).
3. Time trend regression of the form $y_{it} = a + bt$ with $t = 1$ for 1952-53, $t = 2$ for 1953-54 etc..

Source : Export prices, ABS; import prices, RBA.

TABLE 2

Variation in Five Year Moving Average of Relative Price Indices[1] for Selected Mineral Exports 1961-2 to 1974-5

Commodity	Coefficient of Variation[2] %	Time Trend Regression[3]		
		Coefficient	't' Value	R^2
Coal	16.5	.0382	6.28	.77
Iron and Steel	3.7	-.0017	.74	.04
Copper	20.3	.0257	1.54	.17
Lead and Zinc	9.2	.0170	3.25	.47
Silver	15.6	.0510	6.02	.75

Notes: See Table 1.

in 1973. Then their prices rose by more than double their previous relative values in a series of discrete steps. Since 1976 their relative prices have stabilized at new levels, with a slight tendency to decline. A similar price pattern occurs for other fuels, including coal, and to a lesser extent for energy-intensive commodities such as aluminium. There has been an underlying downward trend in the relative prices of wool, dairy products, cereals and crude materials for use in manufacturing, although there have been some periods of rising prices.

The limited data for the prices of mineral products does not reveal significant time trends, except for the upward movement in the price of coal. Prices appear to be highly volatile, with the level and the rate of change of world economic activity being important determining forces. Harris [1975] quotes some calculations by Resources for the Future indicating a long term real price level for mineral commodities (from 1870 to 1960) which is stable, with a tendency (if one exists at all) to decline very slightly.

Consistently rising relative prices for metal manufactures, electrical machinery, non-electrical machinery and meats were reversed in the mid 1970's when the trend became downwards. To a large extent the trend reversal was associated with the doubling of real prices of energy and the general slump in the rate of growth of developed economies in the post-1973 period.

No significant trends were found for sugar, fruits, food imports, base metals, textiles or transport equipment. In the case of fruits and textiles there was a marked decline in relative prices during the 1970's.

The matrix of correlation coefficients between the relative five year moving average prices for the selected commodities shown in Tables 3 and 4 indicates that there is a high level of correlation between the price movements for several commodity groups. This correlation is particularly marked for the manufactured goods other than textiles - metal manufactures, non-electrical machinery, electrical machinery and transport equipment - for which the partial correlation coefficients exceed 0.95. Underlying the high correlation is the similarity of relative labour, capital and material costs and technological advances.

3.3 Time Series Model Projections

Three types of time series model projections were considered:

1. The naive no change projection, i.e., the current relative price ;
2. The same rate of change projection, i.e., relative price changes at the same rate as the price change over the previous period ;
3. The trend projection, i.e., the time trend regression projection.

Projections are reported for the years 1964-65, 1969-70 and 1974-75 using projection horizons of five and ten years. The results of some of the projections are reported in Tables 5 through 8 in terms of percentage projection error and in terms of percentage mean absolute projection error by years and commodities. By and large the projection errors are substantial in each of the three years considered in the cases of both export and import commodities.

TABLE 3

Correlation Matrix[1] for Five Year Moving Averages of Relative Price Indices of Selected Commodities Traded by Australia, 1952-53 to 1974-75

	Meat	Dairy	Cereals	Fruits	Sugar	Food Imports	Crude mat.	Petrol-eum	Base Metals	Metal man.	Text-iles	Non-Elect	Elect	Trans. Equip.
	-.61	.12	.44	-.84	.28	-.91	-.82	.41	-.87	-.83	-.66	-.82	-.83	-.87
		.23	-.82	.50	-.73	.79	.45	-.93	.72	.88	.88	.92	.87	.86
y			-.25	-.16	.18	-.08	-.46	-.21	-.23	-.06	.15	.02	.03	.02
als				-.32	.51	-.67	-.24	.73	-.52	-.68	-.61	-.74	-.67	-.67
ts					-.09	.86	.69	-.29	.86	.77	.61	.74	.79	.83
r						-.41	-.43	.84	-.51	-.63	-.64	-.63	-.55	-.51
imports							.71	-.59	.91	.93	.77	.93	.93	.96
e Materials								-.34	.77	.70	.55	.67	.66	.70
oleum									-.62	-.80	-.89	-.83	-.79	-.74
metals										.96	.81	.92	.94	.94
l manuf.											.91	.99	.99	.98
iles												.93	.94	.91
elect.													.99	.98
trical														.99

s: 1. Correlation coefficients based on y_{it}'s as described in equation (15).

TABLE 4

Correlation Matrix for Five Year Moving Averages of Relative Price Indices of Selected Commodities Traded by Australia, 1961-62 to 1974-75

	Coal	Iron & Steel	Copper	Lead & Zinc	Silver
Wool	.32	-.37	-.62	-.21	-.67
Meat	-.83	.38	.91	.71	.60
Dairy	-.03	.73	-.08	.08	-.45
Cereals	.64	-.36	-.72	-.47	-.35
Fruits	-.67	.51	.70	.66	.54
Sugar	.88	.18	-.96	-.81	-.92
Food imports	-.67	.34	.86	.47	.65
Crude materials	-.35	-.25	.65	.26	.86
Petroleum	.91	-.23	-.93	-.81	-.66
Base metals	-.81	-.14	.93	.75	.96
Metal manuf.	-.87	.15	.98	.76	.82
Textiles	-.84	.34	.89	.75	.61
Non-elect.	-.81	.27	.93	.69	.72
Electricals	-.81	.31	.92	.69	.70
Transport Equip.	-.76	.35	.90	.63	.67
Coal		.06	-.89	-.94	-.70
Iron & Steel			.07	-.11	-.18
Copper				.79	.87
Lead & Zinc					.67

TABLE 5

Percentage Error in Five-Year-Ahead Projections of Five-Year Moving Average of Relative Prices[1] for Selected Commodities : Naive Projection Method[2]

Commodity	Percentage Projection Error[3]			Percentage Mean Absolute Projection Error
	1964-65	1969-70	1974-75	
Wool	2.6	-29.2	12.2	14.7
Meats	9.1	18.9	-34.8	20.9
Dairy	2.1	2.0	-20.1	8.1
Cereals	-2.8	-8.4	12.8	8.0
Fruits	-10.3	-0.7	-7.1	6.0
Sugar	-3.5	-15.7	37.0	18.7
Food Imports	-7.4	6.2	-14.1	9.2
Crude Materials	-5.1	2.3	-5.4	4.3
Petroleum Products	-17.3	-6.3	61.7	28.4
Base Metals	-3.4	2.2	-15.4	7.0
Metal Manufactures	3.7	9.7	-18.0	10.5
Textiles	1.3	2.1	-29.3	10.9
Non-elect. Machinery	4.2	13.2	-22.7	13.4
Elect. Machinery	0.3	6.9	-26.2	11.1
Transport equipment	-4.8	6.1	-26.2	12.4
Percentage Mean Absolute Projection Error	5.2	8.7	22.9	

Notes: 1. Price series as described in equation (15)

2. Projection is given by $\hat{y}_{t+r} = y_t$

3. Percentage projection error is given by $100.(y_{t+r} - \hat{y}_{t+r})/y_{t+r}$.

TABLE 6

Percentage Error in Five-Year-Ahead Projections of Five-Year Moving Average of Relative Prices[1] for Selected Minerals : Naive Projection Method[2]

Commodity	Percentage Forecast Error[3]		Percentage Mean Absolute Projection Error
	1969-70	1974-75	
Coal	14.8	25.9	20.4
Iron & Steel	4.8	-10.8	7.8
Copper	29.6	-54.1	41.8
Lead & Zinc	8.3	-9.2	8.7
Silver	26.9	-1.6	14.3
Percentage Mean Absolute Projection Error	16.9	20.3	

Notes: See Table 5.

TABLE 7

Percentage Error in Five-Year-Ahead Projections of Five-Year Moving Average of Relative Prices[1] for Selected Commodities : Projections based on Same Rate of Change[2]

Commodity	Percentage Projection Error[3]			Percentage Mean Absolute Projection Error
	1964-65	1969-70	1974-75	
Wool	26.6	-32.6	37.9	32.4
Meats	-10.5	11.5	-60.3	27.4
Dairy	12.7	-4.1	-17.6	11.5
Cereals	-2.6	-5.5	20.2	9.4
Fruit	-35.4	9.7	-6.3	17.1
Sugar	-8.3	-11.6	48.6	22.8
Food imports	-19.7	13.1	-21.1	18.0
Crude materials	-11.3	7.2	-15.6	11.4
Petroleum products	-22.5	12.2	64.1	32.9
Base metals	-15.1	5.5	-17.9	12.8
Metal manufactures	-14.5	6.3	-29.4	16.7
Textiles	-10.6	0.8	-32.1	14.5
Non-elect. machinery	-17.1	9.6	-37.6	21.4
Transport equipment	-21.1	10.6	-33.9	21.9
Percentage Mean Absolute Projection Error	16.3	9.8	31.8	

Notes:

1. Price series as described in equation (15).
2. Projection is given by $\hat{y}_{t+r} = y_t + (y_t - y_{t-r})$
3. Percentage projection error is given by $100.(y_{t+r} - \hat{y}_{t+r})/y_{t+r}$.

TABLE 8

Percentage Error in Ten-Year-Ahead Projections of Five Year Moving Average of Relative Prices[1] of Selected Commodities : Naive Projection Method[2]

Commodity	Percentage Projection Error[3]			Percentage Mean Absolute Projection Error
	1964-65	1969-70	1974-75	
Wool	-23.4	-25.8	-13.4	20.9
Meats	28.7	26.3	-9.4	21.5
Dairy	-8.6	0.1	-22.5	10.4
Cereals	-2.9	-11.4	5.4	6.6
Fruit	14.7	-11.1	-7.9	11.2
Sugar	1.2	-19.8	29.5	16.8
Food imports	5.0	-0.8	-7.0	4.3
Crude materials	1.2	-2.7	-3.0	2.3
Petroleum products	-12.0	-24.5	59.3	31.9
Base metals	8.2	-1.2	-12.9	7.4
Metal manufactures	22.0	13.1	-6.5	13.9
Textiles	13.2	3.4	-26.6	14.4
Non-elect. machinery	25.6	16.9	-5.4	16.0
Elect. machinery	16.7	7.2	-17.5	13.8
Transport equipment	11.5	1.6	-18.6	10.6
Percentage Mean Absolute Projection Error	13.0	11.1	16.3	

Notes: See Table 5.

Comparing the projection techniques, in most cases the no change naive projections are more accurate than both the same rate of change and the time trend regression projections. To simplify the subsequent discussion, only the no change naive projections for five years ahead and ten years ahead reported in Tables 5, 6 and 8 are discussed below.

From a comparison of the projections for different years it is apparent that the projection errors are influenced to some extent by the particular year for which the projections are made. The errors are, in general, larger for 1974-75 than for 1964-65 and 1969-70. In part the difference can be associated with the effects of the OPEC oil cartel on energy prices and the violent commodity price fluctuations of the 1970's relative to the 1960's.

For the five year ahead projections reported in Tables 5 and 6 the distribution of the (absolute) percentage projection error was

less than five per cent	31 per cent
between five and ten per cent	25 per cent
between eleven and twenty per cent	22 per cent
greater than twenty per cent	22 per cent .

The average percentage projection error for the three projection years for most of the commodities exceeded five per cent.

A similar picture can be drawn for the ten year ahead projections reported in Table 8. In general, the projection errors for the ten year ahead price estimates are only a little larger on average than those for the five year ahead projections.

Clearly the projection errors reported here are influenced by the data used - in particular the highly aggregated nature of the commodity prices, the way in which the price indices were transformed to depict average relative price movements, the commodities selected and the time period.

Given these reservations, some important conclusions follow. In particular, the results indicate that simple time series projections can lead to projection errors well in excess of twenty per cent and that on average the errors are not less than five per cent.

4. COMMODITY ANALYSIS

This section brings together data on past price movements, economic theory, institutional arrangements and other commodity projection studies to assess past and likely future changes in the demand for, supply of and pricing of different commodities. The discussion proceeds at two levels. Initially the emphasis is of a general nature. At a later stage it becomes more specific and aimed towards making quantitative estimates of price elasticities of supply and demand and of relative shifts of the supply and demand functions. In all cases it is worth recalling that the estimates are conditional on the simplified models used, the available data and the estimation procedure, and that all the estimates are subject to sampling errors. In a subsequent section the quantitative estimates are brought together in summary form to satisfy the input needs of the ORANI model using the framework described by functions (1)-(6) above.

4.1 Agriculture[1]

4.1.1 General Considerations

Here a general evaluation of factors causing shifts in the demand for and supply of agricultural commodities is given. Shifts in demand stem from population growth, income growth, government policies, tastes and (to a limited extent) changes in the prices of agricultural commodities relative to other products. U.N. 'medium' population projections (quoted in OECD [1977]) estimate an annual rate of population increase for the 1980's of about 1.0 per cent per annum for OECD countries and the USSR, 2.2 per cent per annum for Asian countries, 2.7 per cent per annum for Latin American countries, and 2.9 per cent per annum for African countries. The projections suggest an ageing of the population and increasing urbanisation. Both these factors tend to reduce the demand for food.

Economic growth provides a small stimulus to demand for agricultural products. In the developed countries the income effect is relatively small. FAO estimates (quoted in OECD [1977]) for developed countries yield income elasticities of demand of 0.08 for all foods and 0.22 for animal proteins. In the developing countries the estimated income elasticity of demand is higher at 0.22 for all food and 0.56 for animal proteins. In some of the developing countries the income constraint is best considered in terms of available foreign reserves to purchase food on the world market.

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1. This section draws heavily on material in FAO [1970], OECD [1976], USDA [1974], Harris [1974] and Campbell [1976] and to reference material used in these studies. For particular commodities, data and information is drawn from BAE Situation and Outlook Reports and from papers presented at an International Seminar on the Role of Australia and New Zealand in World Agricultural Trade [1978].

Historically world agricultural trade has been increasing relatively slowly at about three per cent per annum as compared with six per cent for minerals and ten per cent for manufactures. Projections by Leontief et al. [1977] anticipate continuation of the slow rate of growth of world agricultural trade over the remainder of this century.

Government trade and national agricultural policies play a critical role in influencing the effective demand for agricultural products in the world market. Present policies in most OECD countries effectively insulate their domestic agricultural sectors from outside influences. These policies have objectives of food self-sufficiency and of income support for domestic agriculture. In most cases domestic prices are maintained substantially above world prices - inhibiting consumption at the same time as inducing extra domestic production. Typically the policies operate in such a way that imports are regulated as residual supplies with the effect of restricting market access independently of world prices and of shifting market instability onto the freer segments of the world market. That is, the import demand function is almost perfectly inelastic. There has been a trend towards increased protection of agriculture in the main food importing countries (compared to lower protection of manufactured goods). Additional entrants to the EEC would be associated with continuation of this trend as was exemplified by the contractionary implications for world agricultural trade of the entry of the U.K. to the EEC in the early 1970's.

Prospects for an effective opening up of agricultural markets in the OECD countries by the mid 1980's are not very good. Even if policy changes were to be made, long transitional periods would be required to facilitate the required level of structural adjustment and to placate politically vocal rural pressure groups. Rapid economic growth

seems to facilitate the process of structural adjustment and this, rather than policy changes, is likely to be more important in achieving improved access of agricultural products to the OECD countries by the mid-1980's.

Considerable uncertainty exists about policies affecting future levels of food imports into the centrally planned economies. To some extent availability of foreign exchange has an important influence on their policies. The OECD, FAO, and Leontief et al. anticipate some increases in import requirements of the centrally planned economies in the 1980's and note that there may be substantial variations in their import requirements to meet short term changes in domestic demand and particularly supply.

Increases in effective demand from the successfully developing countries, including Singapore, Taiwan, Malaysia, Mexico, Brazil and the members of OPEC, may be quite substantial. In part the growth will be tied to opportunities for these countries to expand exports of manufactured goods. Optimistic projections, for example those by Kasper [1973], anticipate per capita income growth rates in excess of five per cent per annum for these countries. Together with population growth and relatively high food income elasticities of demand, these estimates imply a rapid growth of food imports in the 1980's.

For other less developed countries, including those of South Asia, substantial increases in effective demand for food imports are considered unlikely. For balance of payments and other reasons Leontief et al. and others have argued that the major thrust for increased food supply in these countries will have to come from increases in their own agricultural output rather than from imports.

Turning to supply, the principal influencing factors are the availability of land, labour and capital, input costs, technology, seasonal conditions, and government policy. Most authoritative reports suggest that we have more than ample land, labour and capital resources to support a greatly enlarged agricultural sector if economic conditions so justify. Estimates by FAO, OECD, Clark [1970] and others indicate that less than half the land arable with current technology is used intensively. However, the utilization of this potential capacity will require substantial investments in opening up land, irrigation, fertilizers and so on. This implies that the aggregate supply of agricultural products is upwards sloping but far from infinitely inelastic.

Modern agriculture, particularly in the developed world, is becoming increasingly dependent on purchased inputs whose prices are closely tied to prices in the rest of the economy. This degree of interdependence is expected to increase. It means that costs of production in agriculture will be closely related to costs of production in other commodities. The correlation is relatively more important for the more highly processed agricultural products.

A greater degree of interdependence is developing within the agricultural sector. This is exemplified by the growing importance of intensive feeding of livestock and the consequent dependence of livestock production costs on costs of cereals and protein feeds.

A driving force in the past expansion of agricultural production has been the development and application of new technology. Despite some pessimistic prognostications to the contrary, several bodies

(including OECD) anticipate continuation of past trends of productivity growth in the production, processing and distribution of agricultural commodities. There are also considerable unexploited opportunities for the adoption of existing technology.

There is ample evidence that agricultural production in the aggregate and more so for specific commodities is responsive to output prices. In all cases however there are considerable lags in response to changes in economic incentives.

When information on trend shifts in the demand for and supply of agricultural commodities in the commercial world market is combined, it seems likely that there will be a continuation of the secular deterioration in the terms of trade of agriculture vis-à-vis most other commodities. Increases in demand associated with population and income growth and continuation of present trade policies for agricultural commodities seem likely to be less than the expansionary effects of technology on agricultural supply. This conclusion is drawn by FAO [1968], OECD [1976], USDA [1974], Harris [1974], Campbell [1976], Leontief et al. [1977] and others. In general these authorities refute the spectre of a global food shortage advanced by the Club of Rome in its first report, by Erlich and Erlich [1972] and others. The increasing dependence of agriculture on inputs from other sectors of the economy will restrict the declining terms of trade to small falls.

4.1.2 Wool

Conditions applying in the world market for unprocessed and semi-processed wool closely correspond to those of a competitive market model. While there are policies which interfere with the free flow of

trade, for example those of the USA, they essentially involve tariffs and production subsidies which primarily affect the position of import demand curves rather than the price elasticities of these curves.

Australia produces about thirty per cent of the world's wool and a higher proportion of apparel wool. It is appropriate to anticipate that the price received for Australian wool will be responsive to Australian quantity produced. The principal alternative supplying countries are New Zealand, South Africa, USSR, Uruguay and the USA.

A number of studies have reported a range of estimates of the price elasticity of demand for wool. Most studies report an inelastic demand of - 0.5 or less. For the USA the estimates include - 0.27 to - 0.5 (Powell, Polasek and Burley [1963]), - 0.56 (Ferguson and Polasek [1962]), - 0.32 (Donald, Lowenstein and Simon [1963]) and - 0.4 to - 0.6 (Horner [1952]). For the U.K. estimates include - 0.23 to - 0.30 (Emmery [1967]) and - 0.4 to - 0.6 (Horner [1952]). Two estimates for Japan are - 0.12 to - 0.31 (Smallhorn [1973]) and - 0.51 (Byron [1965]). Duane [1973] estimates - 0.22 for the world excluding USA and Gruen [1960] reports an estimate of - 0.33 to - 0.5 for France. In its reference on Promotion of Rural Products, the IAC [1976] argued on subjective grounds that the price elasticity could be greater than that shown by the above econometric studies. The study of inter-fibre substitution by Minford [1975] gives some empirical support for this view.

The study by Dalton and Taylor [1975] includes an estimate of the world excess demand curve for Australian wool (i.e., world demand less rest of world supply) of from - 0.97 to - 4.35, with the higher (absolute) elasticity being associated with higher wool prices.

Estimates of the elasticity of supply of wool for the other principal wool producing countries (except USSR) have been reported by Witherall [1969]. He estimates long run elasticities of supply of 0.72 for New Zealand, 0.76 for South Africa, 0.20 for Argentina, 0.48 for Uruguay and 0.32 for the USA. Wool production was found to compete against wheat and beef and to be complementary with lamb.

A number of factors cause shifts in the demand for raw wool over time, with population and income being the most important. Estimates of the income elasticity of demand for wool include 0.17 for Japan by Smallhorn [1973] and 0.34 for the USA by Donald, Lowenstein and Simon [1963]. Cyclical variations in economic activity have important effects on demand (for example see Dalton and Taylor [1975]), but this is of less concern over the longer run. Projections by the BAE [1977] to 1980 estimate shifts in wool demand of just over 1.5 per cent per annum through income and population growth. These projections were based on an assumed population growth of 1.0 per cent per annum and a real per capita income growth of 4.7 per cent per annum.

The possibility of changes in trade and agricultural policies regarding wool - for example, dismantling USA tariff protection and production subsidies - would mean significant shifts in the excess demand function for Australian wool.

Prices of competing fibres, particularly those for synthetics, affect the demand for wool. Dalton and Taylor [1975] estimate a cross price elasticity of demand of from 0.1 to 0.5 depending on the level of prices of wool and synthetics. To a large extent synthetic prices are closely tied to petroleum prices, labour costs and machinery costs.

There may however be further technologically induced reductions in the costs of manufacturing synthetics. These reasons lead the BAE to assume constant real prices for synthetic fibres over the next decade.

Shifts on the supply side are difficult to specify. Genetic and animal husbandry productivity gains in wool production have been fairly small and seem likely to continue to follow past trends. The important productivity gains have come from expansion of the volume of pasture forage, due particularly to improved pasture species and fertilizer. To a large extent these gains have been intermixed with the livestock - grains production system and it is difficult to disentangle technology specific to sheep production. Political considerations have been important in influencing productivity and supply of wool, particularly in the USSR, South America and South Africa, where there is great uncertainty about future developments.

Post-war shifts in world demand for and supply of wool suggest that supply has grown at a slightly faster rate than demand, leading to a decline in the real price of wool. One scenario would be to extrapolate continuation of this trend by setting the supply shift to be at least as great as the demand shift associated with income and population growth.

4.1.3 Wheat

There are a number of important policy considerations which have a significant bearing on wheat trade and cause trade to deviate from a free market model. In particular, EEC policy effectively insulates production and consumption decisions in the EEC from world price movements. Western Europe produces about 15 per cent of total wheat production. In the USA production has for most of the post war period been constrained by

acreage restriction programs. It is evident that the desired set-aside acreage is positively related to world wheat stocks and negatively to world prices. Similar (but less important in terms of volume of production) arrangements have been used by Canada and Australia in certain years of very high world grain stocks and depressed prices. Many importing countries impose tariffs on wheat and impose even higher tariffs on wheaten flour. While wheat production and consumption in the centrally planned economies is influenced to a large extent by policy decisions, over the longer term it is highly probable that these policy decisions respond in the same direction to price changes as would be suggested by a competitive model.

Several writers have argued that the world export market for wheat is better modelled as a duopoly or oligopoly model than as a competitive model. McCalla [1966] developed a duopoly model in which the USA either by itself or in tacit agreement with Canada (and perhaps in some years Australia) effectively set the world price with reference to USA production costs. Recently Alaouze et al. [1976] suggested an oligopoly arrangement among the main wheat exporting nations. Unfortunately the evidence for such models is vague, depending more on evidence of stock holding, production restrictions and statements of intention (which because of the bargaining situation are hard to obtain and verify), rather than on observed constancy of prices and market shares. Australia provides just over two per cent of world wheat production. Her exports are about three per cent of world less Western Europe wheat consumption. In the light of observed variations in relative export shares for the major exporting countries - USA, Canada, Australia and Argentina - it is likely that in the longer term Australia could market marginal increases in exports (say plus or minus fifty per cent of current average exports) without signifi-

Even though international wheat and grain agreements have been formed it has been argued that they have effectively worked only when the set price and quantity ranges approximated those consistent with longer term market trends. Also, marginal sales have been permitted outside the agreements.

To summarise the discussion so far, it seems reasonable to accept as a working hypothesis that over the longer term the demand for Australian wheat exports is approximately that of a freely competitive model involving the world less the EEC.

Several estimates of the own price elasticity of demand for wheat have been reported in the literature. An UNCTAD report [1975] estimates the long run demand elasticity at - 0.1 to - 0.3 for developed countries and - 0.2 to - 0.5 for developing countries. Estimates reported in Johnson, Grennes and Throsby [1977] are - 0.2 for USA and Canada, - 0.3 for Europe and Argentina and - 0.33 for Japan.

A range of estimates of the elasticity of supply of wheat have been reported. An UNCTAD report [1975] estimates the long run supply elasticity at low levels of 0.2 to 0.4 for developed countries and 0.1 to 0.3 for developing countries. Long run elasticities of supply reported by Askari and Cummings [1977] include 0.46 to 0.98 for the U.K., 0.62 to 1.30 for Canada and 1.58 for New Zealand. With respect to the USA, because of policy measures to restrict production, it is likely that the initial own price response would be very high if the price rise were accompanied by a simultaneous relaxation of provisions to set arable acreages aside. Subsequently, supply would become less responsive, with an own price elasticity of unity or less, as obtained in studies using pre-war data by Nerlove [1958] and others.

Turning to demand shifts, the main factors to consider are population, income and trade policy effects. In the case of the developed countries, income effects are very small and perhaps negative. For the developing countries the income elasticity is probably no more than 0.2. The potentially important demand shifts concern trade and agricultural policies aimed at protecting domestic agriculture, which also operate (via artificially high prices) to reduce domestic demand. Projections by FAO, OECD, USDA and others anticipate only small increases in world import demand for wheat. Changes will be very small or negligible for OECD countries, the USSR and Eastern Europe. There will be some increase in effective demand from the more successful developing countries due to both income and population growth.

Most authorities anticipate further technological gains which will reduce wheat production costs. OECD considers it not unlikely that yield increases will be adequate to meet the additional demand without any additional acreage. Further advances in mechanisation at the production, harvesting and transportation levels are anticipated.

The combined evidence on prospective shifts in supply and demand suggests that the observed decline in the real price of wheat over the past decade will continue into the future.

4.1.4 Other Grains

Australia is a relatively small producer and exporter of other grains including barley, oats, sorghum and corn and can be treated as a small country. Except at very high feed grain prices and/or very low wheat prices feed grains and wheat follow independent markets in terms of demand, but there are some supply inter-relationships.

There seems to be a consensus that the outlook for feed grains is for continuation of the observed downward trend in the real price. Even though feed grains are used for feeding livestock, the income elasticity is less than unity. Further technological change is expected to shift the supply curve at least as fast as the demand curve.

Estimates of the elasticities of long run supply and demand reported in UNCTAD [1975] are - 0.1 to - 0.7 for the demand price elasticity and 0.1 to 0.4 for the supply price elasticity.

4.1.5 Beef and Veal

The world market for beef (and veal) is significantly influenced by agricultural, trade and health regulation policies which to a large extent control market access. These policies and some of their effects on Australian export prospects are described in Reeves and Hayman [1975] and Freebairn and Gruen [1977]. Here a brief sketch only is provided.

Imports into the USA are regulated either directly or under the threat of imposition of the Meat Import Law. Market access is regulated so as to expand at the same rate as the domestic industry. Further, the operation of the scheme has involved the allocation of fixed import shares to the main exporting countries, principally Australia and New Zealand. Exporters to the US receive the domestic American price, which over the long term usually has been well in excess of the world price.

Similar market access arrangements exist for exports to Canada, Sweden and a few other countries.

In Japan imports are strictly regulated by quotas. Import quotas are determined primarily to meet projected gaps between domestic supply and demand. They are largely independent of world price levels. In recent years the global quota has been shared at quasi-constant ratios between Australia, New Zealand and the USA. While domestic Japanese prices are far in excess of world prices, variable levies are set so that the exporter to Japan receives only the world price.

Beef imports into the EEC are regulated by a complex system of variable levies and often also quotas. With the exception of special quotas for selected developing countries, different exporting countries are able to compete freely for the global EEC quota. To a very large extent the EEC quota is determined independently of world prices. It is determined largely by domestic policy considerations. Generally domestic EEC prices have exceeded world prices with the difference being absorbed by variable levies. To a large extent competitive forces are used in deciding who has access to the EEC global quota. Currently this quota is negligible.

For other importing countries a competitive model is advanced as a working hypothesis. Even so, there remain a number of quota arrangements tariffs and levies restricting the free flow of imports. Included in this group of countries are the centrally planned economies for which it is assumed that, over the longer term, policy decisions adjust in a similar direction to those suggested by competitive market response.

Present policies affecting the market for Australian beef and veal exports can be classified as follows :

(i) Predetermined quota sales to USA, Canada, Sweden and some others at above world prices ;

(ii) Predetermined quota sales to Japan and some others at the world price ;

(iii) Competitive tendering to the rest of the world .

In terms of average 1971-73 figures we have :

Australian exports to USA, Canada and Sweden - 506,000 tonnes

Australian exports to Japan - 121,000 tonnes

Australian residual production (i.e., production less exports to USA, Canada, Sweden and Japan) as a per cent of Rest of World consumption (World less USA, Canada, Sweden, Japan, EEC and Australia). - 4.8 per cent.

The last of these figures suggests that Australia can be regarded as a small country as regards exports to the Rest of World as defined.

In view of the volatility of government policies, there must be uncertainty about the continuation of the above policy stances into the mid and late 1980's. For the want of better information it will be assumed that such policies continue over the projection period. Regarding the USA market, the OECD [1977] projects that export quotas will expand by between 1.5 and 2.0 per cent per annum over the projection period. Current real USA prices are projected to continue. Similar assumptions are made for Canada and Sweden.

Japan's projection of her beef import requirements to 1985 is about 100,000 tonnes, of which Australia's traditional share has been 80 per cent. Some consider 100,000 tonnes to be more of a target rather than a realistic projection. It is likely that this target will be exceeded because of relatively fast rates of economic growth which will make it difficult for Japan to constrain beef consumption levels to those implicit in the 100,000 tonnes projection.

Concerning projections of shifts in Rest of World demand and supply curves for beef over the projection period, there must be considerable uncertainty. Demand shifts will come from population growth - - and here developing countries with relatively high projected population growth rates are important - - and from income effects. In importing developing countries and in the centrally planned economies the income elasticity probably is quite high, while it seems to be lower in the exporting countries which now have near saturation levels of per capita beef consumption. Rates of growth of world trade as they influence the level of foreign funds available to the Rest of World importing countries will significantly influence the rate of demand expansion for beef imports.

There are potential opportunities for further and substantial improvements in the productivity of beef production in New Zealand, the South American exporting countries and the centrally planned economies. To some extent political attitudes and directives will be important factors. Taking the longer term view and ignoring short term periods of marked price fluctuations, the OECD [1977] considers that potential growth in the availability of export beef at around current real prices will be at least as great as the growth in demand for imports under present policy arrangements.

4.1.6 Sheepmeats

Sheepmeats cater for at least three quite distinct categories of world import demand. The greater part of mutton exports, particularly to the developed countries, is used as a filler product in the production of processed meat products. About 80 per cent of Australian

sheepmeat exports are exports of mutton and most of this goes to Japan for use in processed meat products. An emerging market for mutton, particularly in the Middle East countries, is the direct consumption of sheep carcass meat. A third outlet for sheepmeat is the market for lamb, which seems to be regarded, particularly in the developed countries, as a luxury meat.

To a large extent the world market for sheepmeat approaches that of a competitive market model, although there are some impediments to trade. In the USA, mutton is included in the global meat import quota whereas lamb is not. In effect meat exporters to the USA have preferred to ship more lucrative beef rather than mutton. Currently, sheepmeat exports to the EEC are relatively free of trade restrictions, except for a 20 per cent tariff. Discussions, however, are proceeding, with one set of possible outcomes involving greater use of import restrictions. Since the U.K. is the principal importer of lamb, policy changes in the EEC would have very important effects on the world sheepmeat market. So far sheepmeat exports to the Middle East, Greece, Korea and other developing Asian countries have been relatively free of trade restrictions. Imports to the USSR and Eastern Europe are policy determined but it is likely that the policy actions are partly related to market forces.

Australia produces about 15 per cent of world sheepmeat production and supplies about a quarter of world sheepmeat trade. It is relatively more important in terms of mutton than lamb. The principal alternative producers are the USSR, New Zealand, South America, Turkey and the U.K., with New Zealand being the dominant exporting country.

It is difficult to specify estimates of the key demand and supply price elasticities. Demand for mutton as an input into processed meat is highly elastic because of ready substitutes, whereas it would be less elastic for those countries consuming mutton as carcass meat. For the USA, George and King [1971] estimate a demand price elasticity for lamb and mutton of - 2.6. In the case of supply, mutton is very much a by-product of the wool industry and it is likely that the supply elasticity of mutton with respect to its price is very low. There is some support from Australian studies for a somewhat higher supply elasticity for lamb. Askari and Cumming [1977] report estimates of the supply elasticity for lamb in the U.K. as from 1.5 to 4.0. Obviously there has to be much uncertainty about the price elasticities of demand and supply for sheepmeats because of the extreme product heterogeneity and the limited amount of econometric work which has been done for the industry outside Australia.

Shifts in the demand for sheepmeats seem likely although again there must be great uncertainty about the magnitudes. It is likely that mutton becomes an inferior good at high income levels but this may not be an important depressing effect in the growing Middle Eastern markets and in other developing countries. Lamb demand on the other hand seems to be very income responsive. George and King [1971] estimate the income elasticity for lamb and mutton in the USA as 0.5. Part of the favourable income effect in the Middle Eastern countries will be associated with investment in infrastructure to handle greater imports. A potential demand depressant is the possibility of some countries, particularly the EEC, adopting more protectionist policies against sheepmeat imports. On balance there is a reasonable probability that demand for sheepmeats will increase over the projection period via population and income effects.

A large part of the argument as to future shifts in the supply of sheepmeats rests with the future development of the wool industry. For consistency we here argue that there would be some expansion effects from productivity gains in sheep husbandry and from technology gains in pasture production.

Overall, it may be reasonable to assume that shifts in the supply of and demand for sheepmeats will about balance each other over the projection period, but it would be no great surprise if this did not eventuate.

4.1.7 Sugar

On first impressions the world (cane plus beet) sugar market seems a long way from that of a competitive model, but over the longer term the implications of trade and agricultural policies may not greatly restrict the free flow of sugar between buyers and sellers. Since 1960 the USA has had a continuing ban on the importation of Cuban sugar. This has had the effect of increasing world sugar transportation costs by forcing Cuban sugar to find more distant markets and the USA to find more distant sources. Up to 1975 USA policy placed a minimum level for domestic prices. In part this was achieved by giving import quotas to exporters. Between 1975 and 1977 the USA was a free market but since 1977 a programme to set minimum domestic prices has been introduced. However, it is likely that the floor price is only a little (if at all) above a long run free market price.

As with other agricultural commodities the EEC has a set of policies which tend to insulate sugar production and consumption from world price changes. To a lesser extent Japan and other countries also have policies of this kind. Tariffs are used extensively.

A large part of world trade in sugar is conducted via long term bilateral trade agreements. While these agreements ignore many short term sugar market aberrations it is probable that over the longer term they reflect market trends.

The recently negotiated International Sugar Agreement (ISA), to run for five years from 1977, places restraints on export outlets for Australian sugar. Australia has been given a basic quota of 2.35 million tonnes - - somewhat below recent exports. Further, at low world prices (as at present), this quota can be reduced by as much as 15 per cent. Negotiated prices are set in at $US 11 - 21 cents/lb. f.o.b. (about $A215-415 f.o.b./tonne) which compares with early 1978 depressed prices of around 7 cents/lb.. Similar quota arrangements have been negotiated for other exporting countries. Most major exporting countries are signatories to the agreement.

Effective operation of the ISA would constrain the nature of the demand for Australian export sugar. Past experience with sugar and other commodity agreements suggests that the ISA will operate only if its provisions clearly correspond with long term market forces, and the negotiators have certainly borne this in mind. On this basis some probability must be given to Australia's export market for sugar in the late 1980's being roughly as depicted by the provisions of the current ISA.

An alternative scenario is one associated with dismantling of the ISA and quasi-free trade with a relatively inelastic EEC import requirement. Under current production and trading patterns Australia produces about three per cent of world sugar production and its exports

account for about four per cent of world (EEC excepted) sugar consumption.

A number of estimates of key long run sugar price demand and supply elasticities are available. Estimates reported by UNCTAD [1975] for the demand elasticity are - 0.21 for developed countries and - 0.42 for developing countries. A similar pattern of demand elasticities was noted by Snape [1963]; although in general his estimates were slightly higher, ranging from - 0.3 to - 1.0. Gemmill [1977] reports estimates of the long run supply elasticity for USA sugar at 1.74 for beet and 1.57 for cane. Supply elasticities reported in Askari and Cummings [1977] include 0.73, for the Punjab region of India and as low as 0.13 to 0.16 for the Philippines.

Shifts in the demand for sugar will come primarily from population expansion and from changes in tariffs and other forms of restrictive trade policies. Income effects are very small, especially for developed countries.

On the supply side productivity gains are expected from new varieties, better fertilizers and improved management practices; as well as new and more efficient machinery for harvesting, processing and transporting sugar. These should continue to reduce real production costs over the projection period.

On balance it is likely that under present trade policy arrangements the world supply curve for sugar will shift as fast as the world demand curve.

4.1.8 Dairy Products

Dairy products include butter, cheeses, skim milk powder, whole

The export market opportunities for Australian dairy products are significantly influenced by national agricultural and trade policies. Most, if not all, developed countries protect their domestic industries from world prices and in most cases domestic prices are several times greater than world prices. For example, the EEC has a system of variable levies and export restitutions which effectively set the domestic price for dairy products at two or three times the world price level. The USA and Canada have a system of global and country quotas and tariffs to protect their domestic industries at prices well in excess of world prices, while in Japan quotas and variable levies protect a domestic industry with prices as high as five times world levels. Imports are strictly controlled in other European countries. Imports of dairy products by developing countries and by the centrally planned economies are controlled in most cases by state trading authorities.

An important consequence of these policy interventions in the dairy markets is that a large part of the world production and consumption of dairy products is insulated from the effects of changes in the availability and price of Australian dairy product exports. The EEC is a net exporter and the supply of these exports is essentially independent of world prices. North America and Japan are net importers and again their import requirements are independent of world prices. Little is known about the import demand functions of the centrally planned economies, although it seems probable, at least over the longer term, that their imports are responsive to world prices and to available foreign exchange. For many of the developing countries (which together take over half of world dairy exports), imports appear to be responsive to prices, to domestic income levels, and to the availability of foreign exchange.

From the above considerations an argument can be made that the export demand for Australian dairy products is price responsive and that Australia cannot be regarded as a small country. Import needs of developed countries in the Northern Hemisphere are almost totally unresponsive to Australian export prices. Some exports to these countries, particularly by New Zealand and some developing countries, are given preferential access. EEC exports, which average around a third of world exports, are substantially policy determined. Australia supplies about 15 per cent of exports in the residual world market, New Zealand being our principal competitor. To some extent this market importance is offset by price responsive production in the developing countries of Asia, Africa and Latin America.

In the residual markets involved in world trade it is likely that both demand and supply price elasticities are low at around - 0.2 and - 0.4 for demand and 0.2 to 1.0 for supply.

There has to be great uncertainty about future shifts in the supply and particularly in the demand functions for dairy products. Uncertainty about demand shifts stems primarily from the critical importance of policy imposed constraints on world trade. Policy changes which would have small effects on outcomes in the domestic dairy sectors of the developed countries would, at the same time, have far greater effects on the demand prospects for Oceanic exports. Current discussions in the EEC and in North America could thus markedly shift the demand for Oceanic exports. In the developing countries income and population growth will have positive effects on demand for dairy products, as will technological change on the supply of dairy products.

If we assume continuation of present dairy industry policies over the projection period - - and many, including the OECD, FAO and BAE consider this to be a likely scenario - - then it is reasonable to anticipate continuation of the past downward trend in the real prices received for exports of dairy products. Nevertheless, the possibility of favourable policy changes should not be ignored.

4.1.9 Fruits

It is convenient to consider three categories of fruit : fresh pome fruits (apples and pears); canned fruits (mainly peaches, pears, apricots and pineapple); and dried vine fruits.

To a large extent policy interventions affecting the free flow of fruits in world trade take the form of tariffs which, while shifting the import demand curve to the left, do not effectively segment the world market.

As an approximation Australia can be regarded as a small country in the area of fruit exports. Her dried vine fruit exports are about ten per cent of the level of rest of world consumption. It is much less important in the area of fresh and canned fruits. Because of the importance of transport costs and to a lesser extent product differentiation, the demand for Australian fruit exports would in fact be less elastic than that assumed by the simplified model. Even so, it seems likely that (taking a longer term average view) marginal changes (plus or minus twenty per cent of current export levels) in Australian fruit exports would have a negligible effect on export prices received.

Real export prices for apples and pears declined substantially during the late 1960's and 1970's. In part this arose because of the growth of atmospheric storage of fruit which effectively nullified the seasonal advantage of imports from Oceania in Northern Hemisphere markets and because of U.K. entry to the EEC. Both factors will be of less importance for future price changes.

The BAE estimates that heavy plantings of fruit trees in Europe, South Africa, New Zealand and South America in the late 1960's and early 1970's will result in future production rising at least as fast as demand increases due to population and income. Thus continuation of low real prices is anticipated for the longer run.

For canned fruits the BAE anticipates continued downward pressure on the real price. The income elasticity for canned fruits is not high, especially in the developed countries, and increased plantings in Europe, South Africa and the USA promise increases in production.

In the case of dried vine fruits the BAE foresees little change over the longer term in the general level of world production and demand, and consequently projects a continuation of current average real prices.

4.2 Wood Products[1]

Wood provides two major raw materials - sawlogs and pulpwood.

Timber imports into Australia are a small proportion of world production and of world trade, and so she can be regarded as a small country.

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1. This section is based on the BAE study [1977] and studies referenced therein.

In its recent assessment of future trends to the end of the century the BAE study [1977] concluded :

> "it cannot be established from the supply/demand data available that overall demand will continue to exceed supplies. The size of the resource is enormous in comparison to the predicted usage levels ....."

The study does warn, however, that because of unreliable and incomplete data it is very difficult to be definite about future trends and some studies projecting real price rises for wood were reviewed. While there has to be uncertainty about the future trend in wood prices it is likely that they will remain at about current real levels.

4.3 Petroleum[1]

Australia imports a small proportion of world oil production and can be regarded as a small country for the purposes of this study. Future oil prices seem likely to be primarily influenced by two considerations : the availability of reserves relative to consumption, and institutional pricing arrangements.

The availability of oil reserves is influenced by demand and supply considerations. Demand is primarily related to levels of economic activity. Estimates of the income elasticity of demand for energy in general and oil in particular vary with countries, time periods and the methodology employed. Many estimates fall around the unity figure. Other factors which on available evidence appear to have a lesser effect on demand include the price of oil, the price of alternative energy products, technology, government regulations and "jaw-boning" to conserve.

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1. Information for this section was drawn from CEDA publications.

Supply considerations include expenditure on search, technology, and (of increasing importance) the price received. The latter affects the economics of new fields and rates of extraction from existing fields. Different assumptions about the future paths of these causal variables lead to a number of estimates of the years of supply to be expected from known reserves.

While the estimates vary, none suggest that known reserves will be exhausted before 1990 and many project the life of known reserves into the next century (e.g., Leontief et al. [1977], the United Kingdom Flowers Report [1972], the OECD [1977] and studies quoted in Harris [1974]). There is also a high probability that additional reserves will be proven in the future. For these reasons it is doubtful that diminishing reserves of oil will of themselves exert a significant force towards higher prices for oil by 1985. This finding is reflected in the price projections of the Leontief et al. study.

The hazardous part of the exercise of projecting oil prices relates to uncertainty about the future strategy and actions of the OPEC oil cartel. This was the body which effectively quadrupled the price of oil in the last three months of 1973. Since then the cartel has continued to hold-up and increase nominal oil prices although real oil prices have declined somewhat from 1975 to the present period.

Many arguments have been advanced for lower future oil prices. The higher prices have facilitated increased production of non-OPEC oil (e.g., development of the North Sea fields and higher extraction rates). There may be a substantial increase in USSR and Chinese oil exports. Many policy initiatives aimed at oil conservation may turn out to be effective; current indications, however,

offer little support for substantial savings. The most likely cause of a drop in future oil prices will be a breakdown in the OPEC cartel. This would seem to require a reduction or slowdown in the rate of growth of demand for OPEC oil, refusal of its smaller population countries (Saudi Arabia, Kuwait, UAE and Qatar) to act as the main supply adjusters, a political upheaval, or some combination of the above. It seems unlikely that these events will occur to the extent of allowing falls in nominal prices, but constant nominal prices would mean lower real prices for at least the remainder of the next decade.

Factors which would favour a projection of rising real oil prices include pressure exerted by OPEC countries for higher real income together with the assumption that the demand for OPEC oil is inelastic over the longer term, rapid world economic growth, strengthening of the cartel, and active decisions of the smaller countries to restrict production so as to reserve their wealth in oil rather than in foreign currencies and assets. The latter could be a vital factor in influencing decisions to increase productive capacity to meet anticipated demand growth.

There is some evidence from public statements that OPEC cartel members desire to maintain the purchasing power of their oil resources by maintaining real prices.

With existing knowledge there seems no satisfactory way of choosing between the alternatives. It might be useful to consider three possible scenarios for 1985 :

(1) constant real oil prices ;

(2) rising real oil prices, say a fifty per cent rise by 1985 over 1977 levels ;

(3) constant nominal oil prices and falling real prices, say a twenty per cent fall by 1985 compared to 1977 levels.

The different oil price scenarios will have implications for other world prices and general trade conditions. First, prices of other forms of energy will move in sympathy with oil prices and so too will energy intensive commodities. Note, however, that for many traded products energy costs are less than 10 per cent of total production costs. Second, higher oil prices probably will directly and indirectly induce a lower level of real effective demand for all types of imports by the developed and developing countries. While oil price changes initially have essentially a redistributive role (from oil importers to oil producers and exporters), the process of redistribtuion causes structural frictions and higher prices cause uncertainty which at least in the experience of the early 1970's resulted in falls of GDP.'

4.4 Minerals[1]

Important Australian mineral exports are coal (29 per cent of 1976-77 mineral exports by value), iron ore (22), bauxite, alumina and aluminium (13), nickel (5), copper (4), lead (4), zinc (3), and mineral sands (3).

4.4.1 General Considerations

Here consideration is given to a general evaluation of factors causing shifts in the demand for a supply of Australian minerals on the world market.

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1. Information for this section was drawn from Zimmermann [1974], Harris [1975], Harris [1977], Smith [1978], McDonald et al. [1977] and many studies referenced therein.

Minerals for the main part are raw material inputs. Their demand is a derived demand. The demand for iron ore and coking coal is largely determined by the demand for steel which in turn is a major input for the transport, machinery and building and construction industries. The demand for aluminium, copper, lead and zinc is closely related to demands for transport equipment and for building and construction. It is estimated that the motor vehicle and construction industries use some 40-50 per cent of steel, lead, zinc, copper and aluminium output. Ultimately the demand for minerals is indirectly related to both the level and the rate of change of economic activity. Several pieces of evidence suggest that over the longer term consumption of most minerals grows at a slower rate than real income and further that the income elasticity falls off at higher income levels. At the aggregate level and over the longer term the demand for minerals is expected to rise with real incomes but at a slower rate, particularly in the more developed countries.

Prices and particularly relative prices of different minerals and of substitute material inputs have important effects on the demand for individual minerals. For many uses of minerals there are ready substitutes (e.g., copper and aluminium in electrical uses, steel, aluminium, timber and plastics in buildings and vehicles, and tin, glass and paper in packaging).

Demand for minerals has been and is likely to continue to be influenced by technology. For example, the amount of coal required to produce a unit of electricity has declined substantially (about fifty per cent since 1920), and the greater strength of alloy steels has reduced the amount of steel required for many purposes as well as opening markets for new uses.

There are considerable time lags before the full response of the demand for minerals to changes in prices (and to a lesser extent to changes in aggregate economic activity) are realized. Lags stem from the large and complex investment in mineral using activities, the long lives and specialized nature of the equipment, the relative importance of fixed or overhead costs, and the time required and costs involved in changing and learning to operate different production processes effectively

There is great uncertainty in evaluating the availability and cost of minerals in the future. There is uncertainty about new discoveries of ore bodies, about the effect of technological change on mining and extraction costs and about demand due to substitution possibilities associated with technological change and changes in relative prices.

From the many published estimates of available mineral reserves there is little evidence that the world faces a shortage of raw mineral deposits for at least the next couple of decades if present long term average prices prevailed. Estimates of the life of proven reserves for most minerals run into the next century (for summaries see Harris [1977] Smith [1978] and Leontief et al. [1977]). Possible exceptions are lead and zinc. Further, proven reserves are a very conservative estimate of actual reserves. Most firms find it worthwhile to prove reserves only to meet requirements of current investments. In general, the level of proven reserves has been found to be positively related to the level of returns to mining. Even so, in most cases it is true that additional reserves of most minerals tend to have a lower quantity and/or quality of minerals per tonne mined or to be in less accessible locations. That is, the static supply function for raw materials is a positively shaped function.

To a large extent mining costs are tied to the costs of labour, machinery and energy required for the mining, transport and processing of minerals. To date technological changes in the methods of mining, transport and processing of minerals have tended to offset cost increases due to the mining of more costly ore bodies. Although there must be some uncertainty in this area, a number of studies quoted by Harris, Radetzki, Leontief and others contend that requirements over the next decade will be obtained at about constant real costs with enhanced technology offsetting the rising costs of mining poorer ore bodies.

An interesting insight into the pattern of technological change, mineral discoveries and costs of mineral extraction is given by McAllister [1976, p. 62] :

> "The historical pattern has been for consistent improvements in technology to provide mineral products at progressively lower prices, and, at the same time, to maintain reserves at more or less standard operational levels of 15-20 years ... There is no reason to believe that technological advances are slowing down, and several areas of probable advances are recognizable. Geologists, geophysicists and geochemists will probe deeper and deeper in their search for ore, and engineers will improve recovery techniques, reduce energy consumption, and continue to improve materials handling in low-grade ores. Improved design, substitution and recycling may, in some measure, alleviate the pressures of demand."

Most new mineral projects, and quite a number of extensions to existing projects, are very large scale and capital intensive, involving the investment of hundreds of millions of dollars. Generally they involve long lead and set-up times. Fixed costs are a dominant component of costs. Thus, the short run (perhaps up to a couple of years) supply function is not very responsive to either output price or variable input cost price changes.

There is evidence that for most minerals the longer term supply function is far more price responsive. Also, the response is influenced by projected deficiencies between estimated future demand and current installed or planned capacity. That is, apparent quantity short-falls are as much an incentive for supply expansion as are present average price levels.

There are a number of arguments regarding whether there are market access limitations for Australian mineral exports, and whether changes in our export levels would significantly affect the price received. Here we consider the arguments in the longer run context.

To a large extent the world market for unprocessed and semi-processed minerals is relatively free of trade barriers. Certainly domestic producers can be vociferous when imports threaten to cause a sharp and substantial reduction in domestic production and prices. On a short term basis anti-dumping provisions may be invoked. In some cases tariffs are imposed on a longer term basis, but their effect is not considered to be very great.

In the world scene Australia is not a dominant supplier except for a few metals. It produces less than ten per cent of the world's iron ore, black coal, nickel, lead, zinc and copper, about forty per cent of the world's

current bauxite production, and most of the rutile. In the latter two cases the dominance is somewhat countered by potential alternative sources at about the same longer term costs.

Australia is however a dominant supplier of some minerals to particular markets, for example she provides about 50 and 40 per cent respectively of Japan's iron ore and coal, and it is sometimes argued that in this case she is a large country. Further arguments are needed, however, for this situation to be construed to support the hypothesis that the price at which Australian exports sell is significantly related to the quantity sold. These are that Japan could not purchase from other producers and that we could not sell to other buyers at about world prices and/or that there are institutional factors restricting changes in market shares.

One possibility for the isolated market argument involves transport costs. Particularly for the lower value per unit minerals such as iron ore, coal and bauxite, Australia may have to discount f.o.b. prices substantially to shift exports from Japan to, say, Europe. A similar argument can be made for Japan seeking other sources of imports. While such a gap exists it probably is quite small since a large part of freight costs are involved in loading and unloading with distance costs being less important. More importantly, the extent of any monopoly power clearly is bounded.

A number of institutional considerations have been advanced in support of the hypothesis that market access for Australian mineral exports may be restricted by non-price factors. First, long term contracts may operate to solidify current market shares. Although a number of contracts are already written and others can be expected to be written, they do not cover all of the [illegible]

ments during the projection period. At the margin, and this margin may exceed a third of anticipated imports of 1985-90, prices of alternative import sources will be an important consideration.

It has been argued that Japan, and other countries, have a policy of diversification of supplies. Reasons include the desire for a portfolio to cover risks of unreliability of supply due to industrial strikes and political upheavals. But note that stocks also are held for such contingencies. Policy statements about desired diversification ratios are broad statements of intention rather than explicit figures - in part this is necessitated by bargaining roles. Past experience gives the fixed market share hypothesis very little, if any, support.

Even over a period as short as 1970-76 there have been marked changes in market shares in Japanese coal and iron ore imports. Australia's coal share rose from a low of 32 per cent in 1970 to a high of 43 per cent in 1974 and was 38 per cent in 1976. Over the same period the USA share fell from 53 to 38 per cent. For Japanese iron ore imports Australia's share rose from 40 per cent in 1970 to 50 per cent in 1976, Brazil's share almost doubled to 20 per cent, while that of other countries fell. Observed experience does not support a strong or rigorous version of market sharing arrangements on the part of principal buyers over the longer term.

From the viewpoint of sellers, to date there is limited evidence of longer term collusive arrangements which effectively solidify market access for Australian minerals. It is possible that effective cartel arrangements might be formed over the projection period.

While Japan is a dominant outlet for many of our minerals she is not the only outlet. Over 10 per cent of our iron ore and coal exports go to the EEC. Other sales are being made to the successful developing

countries in the Asian-Pacific area, to the Middle East and to Latin America. The diversity of export outlets signifies that such markets can be serviced. In many of these our sales are a very small part of total consumption.

One counter argument to treating Australia as a large country is the observed under-utilization of capacity and stockpiling during periods of very depressed world mineral demand (such as in 1977). That is, Australian exports have fallen with world demand. This may be only a short term phenomenon which is not of concern in a long term projection of average incomes. Further, it says nothing about shares in a long term situation of expanding world demand.

To summarize, most arguments point to treating Australia as a small country with a number of possible exceptions. First, while the argument seems valid for changes in export quantities in a situation of expanding world demand there may well be some demand price inelasticity with a situation of falling world demand. This phenomenon is more important in a short run context. Second, because of the importance of transport costs the f.o.b. price may reflect some price elasticity with sales to more remote countries. Third, for bauxite and mineral sands Australia is a sizeable world producer.

Over the longer run, mineral prices tend towards long run costs plus normal profit levels. This behaviour is particularly apparent in the case of minerals where long term contracts covering both price and quantities have been formulated as a prerequisite to the opening up of new the extension of old mines involving large capital expenditure. In other cases the longer run forces of supply and demand tend towards a price and quantity yielding normal profits.

Looking forward to the 1980's, there are a number of experts who consider that the trend for mineral prices is more likely to be down or stable rather than up. Smith says "It is reasonable to believe that the real prices of mineral raw materials will be subject to a steady but relatively slow increase until the end of the century."[1] Leontief et al. indicate no substantial rise in real prices to 1990 even given that there are no new discoveries between now and then. Studies summarized by Harris, including calculations by Resources for the Future, point to continuation of the trend from 1870 to 1960 which is stable, with a tendency (if one exists at all) to decline very slightly. The McAllister study quoted above favours constant real mineral prices over the longer run.

4.4.2 Iron Ore

Australia supplies about ten per cent of the world's iron ore. For the reasons advanced in the previous section it will be assumed that the price elasticity of demand for Australian iron ore exports is highly although not perfectly elastic in the longer run.

The demand for iron ore is primarily determined by demand prospects for steel which, in turn, is closely related to the level and the rate of change of world economic activity. For those export markets close to Australia (mainly Japan and the emerging steel industries in such countries as Korea, Philippines, Taiwan and the Middle East oil countries) steel industry demand will be influenced in part by their opportunities to export steel and steel products to Europe and North America. The income elasticity of demand for steel is about unity - - perhaps a little higher

1. Smith [1978], p. 140.

during the early phases of industrial expansion, and lower at higher income levels. Projections prepared by the International Iron and Steel Institute reveal a marked slowdown in the rate of growth of the world steel industry for the period 1970-85 as compared to 1955-70 of from 5.7 per cent per annum to 4.5 per cent per annum.

There is some controversy about the price elasticity of demand for steel. Estimates vary from - 0.1 to - 0.85. However, a number of writers consider that, given the extensive list of alternative materials to steel, the long run price elasticity of demand would be greater. Since iron ore has few substitutes in steel making (scrap metal being a minor exception), and since it comprises less than a third of the cost of steel, the price elasticity of demand for iron ore would be low.

On the supply side there are very extensive deposits of iron ore for which real mining and transport costs are unlikely to be much above current real levels. Further technological advances can be anticipated and there are a number of lower cost mining methods now known which are yet to be fully implemented.

No estimates of the price elasticity of supply were found. Given the picture of estimated reserves it seems highly probable that the long run supply elasticity would be high. If this hypothesis is correct, then, taking the longer term picture, the future real price of iron ore will be at around current levels.

Several other studies project iron ore prices to remain roughly constant over the projection period. Smith allows some probability for a small rise in real prices. Leontief et al. estimate constant real prices to 1990.

Estimates of future volumes of Australian iron ore exports into the 1980's by the Bureau of Mineral Resources, Smith, and McDonald et al. yield average annual growth rates of from 3.5 to 5.0 per cent per annum.

4.4.3 Coal

It is convenient to consider the coal market in the context of at least two categories of coal: coking coal and steaming coal. Coking coal demand is closely tied to requirements of the steel industry, in a similar manner to that discussed for iron ore. Steaming coal is used primarily in the production of heat and energy. Currently the price of coking coal is approximately double that for steaming coal.

Although an important supplier of coal to particular markets, Australia produces only about 2.5 per cent of world black coal production. In 1976 about 80 per cent of Australia's coal exports of 31 million tonnes went to Japan and just under 90 per cent of these exports were coking coal for use by the steel industry. An increasing proportion has been steaming coal for use by electricity generators. Australia provides just under 40 per cent of total Japanese coal imports with the USA and Canada being the dominant alternative suppliers. About 10 per cent of Australian coal exports go to Europe.

Our customers in the Asian-Pacific region can readily source their supplies from the vast coal resources of the USA, Canada, China, the USSR, India and Korea is likely to be very price elastic, particularly for steaming coal. While coke is an important input into the steel industry there are some opportunities at the margin for altering processing methods

so as to substitute different forms of energy for coal. Clearly in the case of providing heat and generating electricity there are a large number of alternative sources of energy. In most cases extensive and expensive investments in capital will be required to substitute one fuel for another, and thus there will be long adjustment lags in changes in coal demand as a result of realignment of the relative prices of different energy sources.

Shifts in the demand for coking coal are tied to developments in the steel industry (particularly the industries in Japan and to a lesser extent in Korea, Taiwan and the Philippines). While growth of the steel industry in Japan is expected to be relatively moderate at around four per cent per annum, the growth rate is expected to be almost double that in the emerging countries. To an important degree faster growth in these other countries will be associated with slower growth in Japan. Even so, the overall level of world economic activity and of steel export opportunities to Europe and North America will have a significant influence on the demand for coking coal in Australia's area of interest.

Shifts in the demand for steaming coal are influenced by levels of economic activity as they affect the demand for energy, by prices of alternative forms of energy, and by technological change. The income elasticity for energy seems to exceed unity. The rapid rise in oil prices following the formation of the OPEC oil cartel ushered in a phase of substitution of coal for oil in many areas of heat and energy production. Given the long lags and large scale investments required, the substitution process still has some way to go. Also, government policy in the U.S., Japan and other countries favours the substitution of coal for oil in heat and energy production. Coal technology (e.g., gasification and liquification) may

greatly extend the use of coal as a solid, liquid or gaseous fuel in future. However, it is doubtful that these developments will greatly influence the demand for coal until well into the 1980's or even later.

There are immense proven reserves of coal. No shortages of coal at about current mining and extraction costs are anticipated for the remainder of this century and certainly the anticipated life of proven reserves extends beyond the projection horizon of interest in this paper. The ready availability of coal reserves seems to imply that over the longer term the long run supply elastiicty is very high. No specific estimates were found.

In practice coal prices have been closely related to prices of alternative sources of energy and particularly that of oil. In the time series analysis a partial correlation coefficient for Australian coal export prices and oil import prices of 0.97 was estimated. However, coal prices rose less steeply than oil prices. Between 1972-73 and 1976-77 coal prices rose about 3.5 fold as opposed to about 6.0 fold for oil. From this data it can be argued, at least as a working hypothesis, that coal price changes follow oil price changes with a factor of around a half. As was argued above for petroleum, there has to be uncertainty about future oil prices. Thus, alternative coal price scenarios corresponding to the oil price scenarios are postulated.

Several estimates of the future export sales of Australian coal have been made. Smith [1978] projects sales of around 40 million tonnes of coking coal and 15 million tonnes of steaming coal per annum by the mid-1980's. Similar figures were advanced by de Ruiter of the Shell Coal Company (quoted in The Age, 4th April, 1978). This gives an annual growth rate of sales of about 10 per cent per annum. McDonald et al. [1977] project total coal

exports of 41.5 million tonnes in 1980 (an annual growth rate of 6.6 per cent from 1975 to 1980) and 54 million tonnes in 1983 (an annual growth rate of 9.2 per cent from 1980 to 1983) with a rising proportion of steaming coal. BMR [1977] estimates of the real value of Australian coal exports to 1985 are somewhat lower and imply an annual growth rate of about 5 per cent per annum.

4.4.4 Bauxite, Alumina and Aluminium

The three products are considered together since alumina absorbs 93 per cent of all bauxite produced and 97 per cent of alumina is used to produce primary aluminium. Bauxite production is basically a mass soil mining and transportation activity. Alumina is refined mineral bauxite. Alumina, when converted by electrolysis, becomes aluminium. The last stage accounts for about two-thirds of the average cost of aluminium. Between one-fifth and one-third of production costs of aluminium is electricity costs and less than ten per cent is bauxite costs. The three production stages tend to occur in different physical locations and have different technologies.

Australia has become a dominant producer of bauxite and alumina in little more than a decade. While prior to 1965 Australia's production was negligible in world terms, she now produces about 30 per cent of world bauxite. About two-thirds of Australian bauxite is processed into alumina and the other one-third is exported. Very little aluminium is currently exported.

The world aluminium industry is a highly concentrated and integrated industry. While its products have been less subject to price fluctuations than other minerals following short term demand shifts, past

Extensive work aimed at estimating the elasticity of demand for aluminium has been done by Charles River Associates [1971]. The price elasticity of demand was found to be quite high, with long run estimates of - 1.4 for the USA, - 1.2 for Europe, no meaningful estimate for Japan and - 0.7 for other countries. Significant cross elasticities with copper, steel and other products were found.

Given that bauxite and alumina make up about 10 and 25 per cent respectively of the cost of aluminium, and using the theory of derived demand, the price elasticity of demand for bauxite can be put at between - 0.1 and - 0.4.

There has to be uncertainty about the elasticity of supply for bauxite and alumina. No estimates were found. The volume of proven reserves relative to consumption needs indicates no pending scarcity of the raw material. This suggests that the long run supply elasticity probably is very large.

The consumption of aluminium has grown substantially over the post-war period. In part this has been due to income effects. Charles River Associates [1971] estimate the elasticity of demand for aluminium with respect to levels of economic activity at about unity. They argue that a large part of the expansion in aluminium demand has resulted from the substitution of aluminium for other products like steel and timber due primarily to relative price changes and to a lesser extent due to relatively faster technological changes favouring the demand for aluminium at the expense of its substitutes. If this analysis is correct, then projections of the growth in world aluminium consumption by a Spectator Report reference in McDonald et al. [1977] of 8 per cent per annum in the 1980's and of 6 per cent per annum over the period 1970-85 by the Stanford Research Institute

referenced in Harris [1974] appear to be too high as estimates of shifts in the demand curve. A figure comparable to world economic growth would seem to be more likely. This is partly because it is unlikely that past rates of technological change that made possible falls in the real price of bauxite and alumina in the past will continue over the projection period. The industry is highly mechanised and based on large scale production units. Real production costs are not expected to fall very much as a result of technological changes over the projection period. The scope for price-induced substitution towards aluminium also is narrowing, as indicated by the Leontief et al. [1977] study, which anticipates constant real prices for bauxite into the 1980's.

Several studies have made estimates of Australian exports of bauxite and alumina for the projection period. Estimates by the Stanford Research Institute, McDonald et al., and Smith argue that Australia's share of world bauxite production will continue to increase into the mid-1980's. The Stanford group estimates Australian bauxite production to rise at 7.5 per cent per annum, and this is supported by McDonald et al., who project Australia's bauxite and alumina exports to grow at the same rate as their estimates of world aluminium consumption. Smith estimates the value of Australia's bauxite/alumina/aluminium exports to grow at 8 - 10 per cent per annum in real terms. By comparison, the increase in the real value of exports estimated by the Bureau of Mineral Resources is substantially lower at about 4 per cent per annum.

4.4.5 Copper

Copper provides a useful illustration of export market prospects for a number of mineral products with relatively high unit values of which Australia is a relatively small world producer[1]. It also is a mineral for which an econometric analysis has been reported (Fisher, Cootner and Bailey [1975]).

Fisher, Cootner and Bailey argue that producers consider or set a long run price to reflect what they believe to be a sustainable and profitable long run level of price. Producers then decide on what quantity to supply at this price. Consideration is given to current prices and stocks and to proven reserves in forming expectations. Recycled copper is an important consideration and appears to constitute about 30 per cent of the quantity of copper processed. Consumers take price as given. Demand is influenced by the level of industrial activity, changes in the level of activity, and the price of substitute metals (of which aluminium is important). Speeds of adjustment by producers and consumers are very slow. Lags stem from the time required to bring mines into production, the high component of fixed costs in existing mines, and the time required to adjust processes to use different mixes of metals.

The results obtained by Fisher, Cootner and Bailey are interesting. On the supply side, Nerlovian partial adjustment models were estimated for the principal producing countries - USA, Chile, Canada, Zambia and Rest of World. Quite large estimates of the long run elasticities

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1. Australia produces less than five per cent of world copper.

of supply were obtained - - 1.67 for the U.S., 0.40 for Chile, 14.84 for Canada and 1.68 for Rest of World. Estimates of long run demand elasticities were 0.90 for the U.S., 0.19 for Europe, 0.09 for Japan and 0.92 for Rest of World. Significant cross price elasticities with respect to aluminium were found. Elasticities with respect to the level of economic activity were also significant, with the long run estimate generally being just under unity. The economic activity variable was found to be the dominant factor in shifting the quantity demanded.

Because of the time response lags on both the production and consumption side, the world copper market is characterized by considerable short run price fluctuation, apparently around a fairly constant real long run price. This suggests that the new discoveries and technological gains in the mining, processing and transport of copper have shifted the world supply curve outwards at about the same rate as the level of economic activity and other factors have shifted the world demand curve. Shifts in demand are related mainly to shifts in the level of economic activity and to a smaller extent to changes in relative prices of copper and substitute products. Supply shifts come from discovery of new ore bodies, discovery of new and more efficient mining and processing methods and from mechanisation. To some extent these shifts may be related to market prices.

If a long term view of average conditions in the late 1980's is taken, it may not be unreasonable to assume that the supply of copper will shift at about the same rate as demand.

4.4.6 Lead and Zinc

Australia produces about 13 per cent of world lead and 5 per cent of world zinc output. No estimates were found of the long run supply or demand elasticities of either lead or zinc.

There is considerable uncertainty about the future demand for lead. Large uses for lead are as petroleum additives (an issue of considerable environmental debate) and in wet batteries (an area of potential far-reaching technological change). Even assuming that no more reserves of lead and zinc at present cost levels are proven and that existing consumption trends continue, Leontief et al. [1977] find that lead and zinc prices are unlikely to rise significantly before 1990. The Bureau of Mineral Resources [1977] projects only very small increases in the export of Australian lead and zinc in the 1980's.

4.4.7 Nickel

Australia produced just under 10 per cent of world mine output of nickel in 1975. Although the Australian share has been increasing, Australia can essentially be regarded as a price taker in world nickel markets and to a large extent follows price leadership by Inco of Canada. The latter, according to Charles River Associates [1971] set long run price to cover costs plus normal benefits.

Like other minerals the demand for nickel is closely related to both the level and changes in the level of economic activity in the main industrial countries. Even with Inco of Canada's price leadership role, world nickel prices play some role in market adjustment especially over the longer term.

On present indications there are vast reserves of nickel deposits relative to demand which could be mined at prices slightly in excess of the present very depressed levels. Currently the nickel industry is confronted by considerable excess capacity. For these reasons an assumption of continuation of present average real prices seems a likely scenario for nickel.

There is a little information on demand and supply price elasticities. Charles River Associates [1971] estimate the USA aggregate demand price elasticity at about - 1.0. While no estimates of the supply price elasticity were found, the ready availability of reserves suggests that, taking a long term view, the long run supply elasticity is large.

4.4.8 Mineral Sands

Australia is a major supplier of mineral sands. It supplies about 95 per cent of the rutile and 30 per cent of ilmenite. Given that ilmenite production is some ten times that of rutile, Australia's share of the world mineral sands market is about a third.

There is considerable uncertainty about both the future demand for and supply of mineral sands, and little is known about their long run elasticities. Demand is influenced by levels of economic activity, by technological change and by prices of alternative materials. Supply is influenced by technology and to an increasing extent by environmental considerations as they affect the opportunity to mine and the cost of mining. The only available estimate of future prospects is that of the Bureau of Mineral Resources which projects a stagnant and perhaps falling real value of exports for 1985.

4.4.9 Uranium

The market prospects for Australian uranium are currently dominated by political considerations. Given that certain lags are inevitable, it is doubtful whether Australia will export much uranium by 1985.

4.5 Manufactured Commodities

With respect to both the import and the export of most manufactured commodities, it is reasonable over the longer term to consider Australia as a 'small' country in the sense that she can buy and sell over a large quantity range without significantly affecting the world price level.

To a large extent world price levels for manufactured goods can be discussed in terms of the supply cost of goods with little consideration being given to demand effects. For many goods the long run cost curve approximates a horizontal line once scale economies have been achieved. This arises as a consequence of labour and capital being the predominant cost items, with only a few products involving a significant proportion of costs on commodity-specific inputs, especially over the longer term. Most marketing strategies, particularly when considered in the long term, effectively operate to set prices which are proportional to long run average product costs. Here it is not really important whether the pricing strategy is based on that of the perfect competition model, various monopoly and oligopoly models, normal cost pricing, or some other, so long as the long term strategy does not change over time.

Projecting technology change clearly is a hazardous task. However some interesting implications of product cycle models and the geographical dispersion of technology for relative commodity prices can be suggested.

A number of writers have contributed both directly and indirectly to the literature on product cycle development in the context of development of an industry and of incorporating a dynamic element in trade models. Both considerations seem relevant in the present context. New products and new production techniques are developed in the highly developed countries and initially are relatively costly. The technology is skill intensive and provides opportunities for innovators to reap quasi-monopoly returns. In addition there will initially be learning costs and perhaps costs to persuade users to adopt the new product or technical process.

With the progress of time the costs of new products or of producers using new technology are expected to fall. General knowledge of the technology means that greater consideration can be given to production in areas with more favourable relative resource endowments. For example, it is likely that production of a new and high-technology product which uses considerable unskilled or semi-skilled labour will shift from the innovatory labour-expensive country to a developing country with a more favourable relative endowment of unskilled and semi-skilled labour. This pattern has occurred with many components of the electronics industry. In time competitive forces and the lapsing of patents contribute to a fall in prices.

The product cycle model suggests that world prices of relatively new products and of products which have recently been (or soon will be) significantly affected by technological change will fall relative to world prices of older commodities in which recent technological change has been less rapid. On this count we could anticipate relative price falls for products of the aerospace and electronics industries as compared with the metal products and automobile industries.

The geographical transfer of technology and concurrent geographical relocation of production of labour-intensive low-skill commodities (such as textiles, clothing, footwear, and simpler metal products) tends to act as a break on price rises for these commodities relative to more capital- and skill-intensive commodities. These considerations are particularly important in the context of developing countries in Australia's neighbouring region. During the twentieth century the production of many labour-intensive low-skill commodities has shifted from North America and Northern Europe, first to Southern Europe and Japan, then to the earlier developing countries of Latin America and South East Asia, and now to the later developing countries of South East Asia, Latin America and Africa. One effect of the geographical relocation of these industries has been to reduce the impact of rising real labour costs in developing countries on the world price of labour intensive commodities.

Many of the developing South-East Asian countries have been actively pursuing export-led development strategies involving large scale production of relatively low-skill and labour-intensive commodities. To a considerable extent exports of these countries are substituting for world

exports from Japan, Southern Europe and other medium developing countries. Continued development in these areas should ensure that relative world prices of low-skill labour intensive commodities do not increase over the projection period.

To an important extent the rate of development of South East Asian countries will depend on their own policies towards free trade and on opportunities available to them to develop export markets for low-skill labour-intensive commodities. Krueger [1978] has argued on the basis of economic logic and empirical observation that the rate of development of developing countries is directly related to export growth in commodities in which the countries have a comparative advantage. Similar sentiments are advanced by Kasper [1978]. While Australia is a small country in world trade terms for the exports of South East Asian countries it is still true that the removal of Australian trade barriers to exports of these countries would contribute to the ease of export expansion and consequently to the rates of growth of South East Asian economies.

Some projections of the real prices of selected manufactured goods produced by the Leontief et al. [1977] project are shown in Table 9. The prices were obtained as the dual solution of the input-output model for North America. The prices are set at base unity for 1970 reflecting the input-output structure and value added proportions of the base year 1970. Changes in real prices to 1980, 1990 (and 2000 which are not shown) stem from changes expected in input-output coefficients, modification of value-added proportions in terms of expected changes in labour productivity, and changes in real prices of base materials.

TABLE 9

Relative Price Vector Projections Yielded by Leontief et al Study

	Actual 1970	Projected	
		1980	1990
Textiles	1.000	1.0097	.9376
Wood and cork	1.000	1.0929	1.0317
Furniture	1.000	.9833	.9032
Paper	1.000	1.0301	1.0132
Rubber	1.000	.9872	.9419
Industrial chemicals	1.000	.9339	.9440
Fertilizer	1.000	.9800	1.0400
Motor vehicles	1.000	1.0114	.9640
Shipbuilding	1.000	.9387	.8195
Aircraft	1.000	.9769	.8900
Metal products	1.000	1.0684	1.0321
Machinery	1.000	.9528	.8687
Electric machinery	1.000	.9829	.8945
Scientific Instruments	1.000	.9270	.8175
Watches, clocks	1.000	.9591	.8703

Source: Leontief, W. et al., The Future of the World Economy, (New York : Oxford University Press, 1977), Tables 73, 74 and 75.

The projections can be sorted into two groups :

Near stable real prices (price changes in 1990 being less than ten per cent of the 1970 level) - textiles, wood and cork, paper, rubber, industrial chemicals, fertilizers, motor vehicles, metal products.

Falling prices (fall in real price between 1970 and 1990 of more than ten per cent) - furniture, shipbuilding, aircraft, machinery, electrical machinery, scientific instruments, watches and clocks.

It is worth noting that for all the products considered the real rate of price change is less than one per cent per annum. The estimates are particularly sensitive to assumptions about relative rates of technological change. There is a need for further information on this important area to supplement the study by Leontief. If historical behaviour is replicated the real prices of a large proportion of manufactured goods will move together (Table 3).

4.6 Summary

This section summarizes the information discussed above in terms of the elasticities of demand and supply for Australian traded goods and non-price shifts in world demand and supply curves. Specifically, in the terminology of the model drawn up in section 2 it places approximate estimates on the terms :

elasticity of demand : $$1/\gamma = (\eta + \frac{S}{D}\varepsilon)\frac{D}{X} \quad ; \qquad (16)$$

percentage shift of curve : $$f^e = (f_1 - \frac{S}{D} f_2)/(\eta + \frac{S}{D}\varepsilon) \quad , \qquad (17)$$

where, as before, η is the elasticity of demand, ε is the elasticity of supply, D is rest of world demand, S is rest of world supply, X is Australian exports (or imports if $X < 0$), f_1 is percentage shift (along horizontal axis) of rest of world demand and f_2 is percentage shift (along horizontal axis) of rest of world supply.

Estimates of long run price elasticities of demand for Australian agricultural and mineral exports are reported in Table 10 for a variety of assumptions about key parameters in formula (16). For all commodities the minimum estimate is in the elastic zone. Only for wool, sheepmeats, dairy products and bauxite and alumina are estimates less than five. If the International Sugar Agreement is effective then the demand for export sugar will be price inelastic; otherwise it is estimated to be highly elastic. For other export commodities little would be lost by assuming an infinitely elastic export demand. The actual numbers reported in the last column of Table 10 clearly are crude estimates only. In particular it is likely that they overestimate the (absolute) elasticity because the model ignores product heterogeneity (real or imagined), transport costs and the effects of some trade constraints. Long run supply price elasticities for Australian imports of petroleum products, manufactures and other commodities are regarded as infinite.

Some estimates of shifts in the demand and supply curves which affect the net excess supply or demand curve for Australian imports and exports respectively are reported in Table 11. To a large extent shifts

TABLE 10

Estimates of Elasticity of Demand for Australian Export Commodities and Underlying Assumptions

Commodity	Australian Export Market	Australian Exports as per cent of Consumption in defined market E/D (per cent)	Rest of World		Export D Elastic $(\eta+(\frac{D-E}{D}$
			Demand Elasticity η	Supply Elasticity ε	
ool	World apparel wool	40	0.2 to 1.0	0.5 to 0.7	1.3 to 3.
heat	World less EEC ,	3	0.2 to 0.4	0.2 to large[2]	13.3 to 1
ther grains	World	small[1]	0.1 to 0.7	0.1 to large[2]	large
eef (1)	Quotas to N. America, Sweden, Japan	not applicable	small[4]	small[4]	small
eef (2)	World less W. Europe, N. America, Japan	5	0.4 to 1.0	0.5 to 1.0	17.7 to 3
heepmeats	World	15	0.4 to 1.5	0.2 to 2.0	3.8 to 21
airy	World less W. Europe, N. America, Japan	15	0.2 to 0.4	0.2 to 1.0	2.5 to 8.
ugar (1)	Effective International Sugar Agreement	not applicable	small[4]	small[4]	small
ugar (2)	World less EEC	4	0.3 to 0.5	0.5 to 1.5	19.5 to 4
resh fruits	World	small[1]	no data	no data	large
anned fruits	World	small[1]	no data	no data	large
ried fruits	World	10	0.5 to 1.0	about 1.0	14.0 to 1
ron Ore	World } transport costs may effectively	10	prob. small	1.0 to large[5]	9.0 to la
oal	World } restrict influence further	3	prob. large	1.0 to large[5]	large
auxite & Alumina	World }	30	0.1 to 0.4	1.0 to large[5]	2.5 to la
opper	World	5	0.2 to 0.9	1.5 to large[5]	35.0 to l
ead & Zinc	World	10	no data	no data	probably
ickel	World	10	about 1.0	large[5]	large
ineral Sands	World	33	no data	no data	no estimat

. less than a few per cent
. large if USA releases diverted land
. elasticity of greater than, say, 20
. negligible
. large on assumption of available ore bodies at about current production costs.

TABLE 11

Estimates of Non Price Shifts in Net Export or Demand Functions Facing Australia and Underlying Assumptions

(Per cent per Year on Average)

Commodity	Demand Curve Shifts[1]		Supply Curve Shift[2]	Net Shift Effects on on Price[3]	Independent Information on Net Price Shift and Other Comments
	2% income per capita $f_1(1)$	4% income per capita $f_1(2)$	f_2	$(f_1\frac{(D-E)}{D}f_2)/(\eta+\frac{(D-E)}{D}\epsilon)$	
ol	2.0	2.5	2.5	0.35 to 2.00	n.a.
eat	1.9	2.3	2.5	-1.5 to zero	Key other factor is European trade policy.
her grains	2.5	3.5	2.5	zero to 2.50	n.a.
ef-quotas	3.0	4.5	n.a.	no change	Primarily a quantity effect. Key factor is policy.
ef - other markets	3.0	4.5	2.5	0.25 to 2.22	Key factor is foreign reserves for planned and developing countries.
eepmeats	2.5	3.5	2.5	0.12 to 2.42	Oil prices and effect on Middle East Demand.
iry	n.a.	n.a.	2.5	n.a.	Key other factor is N. Hemisphere country dairy policies.
gar	1.9	2.3	2.5	-0.75 to -0.10	Important policy factors.
esh Fruits	n.a.	n.a.	n.a.	n.a.	Fall of 0.0 to 2.0 per cent.
nned Fruits	n.a.	n.a.	n.a.	n.a.	Fall of 0.0 to 1.0 per cent.
ied Fruits	n.a.	n.a.	n.a.	n.a.	No change.
on ore	3.5	5.5	n.a.	zero to small increase	Key is technology.
al	n.a.	n.a.	n.a.	n.a.	Price largely tied to oil price scenario.
uxite & Alumina	3.5	5.5	n.a.	zero to small increase	Key is technology.
pper	3.5	5.5	n.a.	zero to small increase	Key is technology.
ad & Zinc	n.a.	n.a.	n.a.	n.a.	n.a.
ckel	3.5	5.5	n.a.	zero to small increase	Key is technology.
neral Sands	n.a.	n.a.	n.a.	n.a.	n.a.
od products	n.a.	n.a.	n.a.	n.a.	Possible fall.
troleum	n.a.	n.a.	n.a.	n.a.	Key factor is policy of OPEC cartel.
nufactures	n.a.	n.a.	n.a.	n.a.	Key factor is technological change. For one picture see Table 9.

a. not applicable or no suitable data.

Includes population growth of 1.5% per annum. Income can be regarded as including some trade relaxation effect in case of agricultural commodities. No specific consideration is given to cross product substitution effects or to demand technology effect.

Primarily a technology effect. Set arbitrarily at 2.5 per cent which approximates historical economic growth rate of [illegible] agricu[illegible]

[illegible]

due to income and technology effects are illustrative, although hopefully they are within a zone that might be observed. Commodities where policy factors are key variables and where they might reasonably be anticipated to alter over the projection period are also reported. If nothing else, the table highlights key factors, the difficulty and potential sources of error in making projections, and the uncertainty which must surround such an exercise.

5. Scenarios

The preceding discussion has indicated a large number of uncertain factors which could have a significant impact on the world trade opportunities facing Australia over the 1980's. It seems convenient to explore in more detail three main groups of factors :

1. Developments in world trade opportunities for Australian agricultural and mineral products particularly as they affect market access ;
2. Developments in commodity cartel arrangements and particularly that of the OPEC cartel as it affects world energy prices ;
3. Relative rates of technological change.

Developments in world trade are taken to involve a number of considerations including economic growth rates in different parts of the world and policies of freer international trade. Economic growth of itself flows over into more imports. It would also seem to facilitate (in the context of domestic political objectives and constraints) initiatives for

countries to relax or at least not increase trade restraints. In terms of world agricultural market access, faster economic growth in Europe is likely to reduce the necessity to bolster the current protectionist stance of the EEC and to reduce the extent of surplus dumping. It is also likely to raise the level of USSR and Eastern European demand, as well as the level of other European, Japanese and North American demand. It will certainly be associated with rising demand from the developing countries of Asia, the Middle East, Africa and Latin America.

In terms of minerals, economic growth will work to expand the aggregate level of imports in mineral products and Australia would be expected to participate in this growth. Turning to manufactures, since Australia essentially is a small country and since the long run cost (and supply) curves of most manufactured products are highly elastic, it is doubtful that different likely rates of longer term economic growth will significantly alter real manufactured commodity prices.

Relaxation of trade restraints would operate primarily to increase Australia's quantitative access to existing agricultural and mineral markets rather than to influence the price received for the products. In the case of those agricultural products of which Australia is only a marginal supplier of domestic needs, small policy changes could have substantial trade implications. This applies less to minerals, although marginal changes in access of steel imports to Europe and North America would have marked implications for exports of iron ore and coking coal to Japan and to the developing steel industries of South East Asia.

It is conceivable that over the next decade there could occur institutional changes which will affect the regulation of world supplies and prices of commodities and thus substantially alter current real price

levels. There is a high degree of concentration of world supplies of a number of energy and mineral products. It is worth noting that the OPEC cartel represents an amalgam of several countries of widely divergent political idioms which was able to restrict supply and force up price. Up till now, this is the only case of a cartel successfully maintaining prices above what might be considered the longer run market equilibrium for an extended period. Other commodities (perhaps bauxite and copper) may be future candidates. International commodity agreements such as the present one for sugar can operate to solidify current market shares.

Certainly an interesting set of scenarios to consider is one in which real prices of petroleum are projected to fall, to stay constant, and to rise over the projection period. Higher petroleum prices will flow on to other forms of energy, particularly coal, and to a lesser extent to energy-intensive commodities such as aluminium. As with the experience of the OPEC price hikes of the early 1970s it seems reasonable to argue that rising real energy prices will have a depressing effect on rates of world economic growth and an even greater depressing effect on world trade growth.

Projections of relative rates of technological change for different commodities is a hazardous task even for a period as short as a decade ahead. At the more aggregate commodity level the effects of relative changes in technology on production costs are likely to be much less than would be the case for a finer level of commodity aggregation. Whilst the certainty that important errors will be made is recognised, it has been necessary to fall back on the assumption that the effect of technological changes on the relative costs of production of different

commodities will be very small over the production period or will follow the estimates implicit in the Leontief et al. [1977] study.

Some Specific Scenarios :

1. Relatively Rapid Growth of World Trade and Constant Real Energy Prices

2. Relatively Slow Growth of World Trade and Constant Real Energy Prices

3. Relatively Rapid Growth of World Trade and Falling Real Energy Prices

4. Relatively Slow Growth of World Trade and Rising Real Energy Prices

5. Relatively Rapid Growth of World Trade and Rising Real Energy Prices

6. Relatively Slow Growth of World Trade and Rising Real Energy Prices

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