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Revised version of a paper presented at
the Global Agricultural Trade Policy
Project, San Diego Workshop,
November 12-14, 1987

DOMESTIC TRADE DISTORTIONS AND AUSTRALIAN AGRICULTURE

by

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General Paper No. G-83 Melbourne April 1988

ISSN 0813 7986 ISBN 0 642 10264 3

ABSTRACT

According to a recent report published by the United States Department of Agriculture (Ballenger, Dunmore, and Lederer (1987)), of the 12 major agricultural producing countries, Australia provides the least assistance to its agricultural sector. In this paper the ORANI model is used to show the effects of removing these relatively low levels of assistance. It is also shown that if the assistance given to Australia's manufacturing industries in the form of protection from imports is taken into consideration, then Australia is actually taxing its agricultural sector.

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1. INTRODUCTION

Agriculture has been for the most part exempt from the conditions contained in the General Agreement on Tariffs and Trade (GATT).[1] As a result, world agricultural trade has for decades been subject to a myriad of distortions initiated by numerous agricultural producer organizations and governments.[2] Currently, protection afforded to agricultural industries is a growing topic of interest worldwide. This mood of reevaluation is evident in the initiative of the Cairns group, in the Davos proposal, and in the US mid-1987 proposals.[3] Partially as a result of these initiatives, agricultural trade distortions are currently being given some attention at the Uruguay Round of multilateral trade negotiations. However, some commentators (e.g., Carmichael (1986)) believe that reform of the international agricultural trading system is most likely to be achieved by a better understanding in each of the major agricultural producing countries of the deleterious effects at home of their own domestic trade distortions. In this paper estimates are presented of the effects of unilaterally

removing assistance to Australia's agricultural and manufacturing industries.

In the case of Australia, the effects of subsidies and protection given to her agricultural and manufacturing industries is a long-standing issue which goes back at least as far as the Brigden Committee Report (1929). Rather than review the debate on protection here, the reader is referred to Edwards and Watson (1978), Lloyd (1978), and Cobb (1983). Recently this issue received much public attention in Australia when the National Farmers' Federation (1985) made a submission to the Prime Minister on farm costs. The submission stated that, from the viewpoint of farmers, protection given to Australia's manufacturing industries is easily the costliest of government interventions. Furthermore, the deleterious effects of such protection were claimed to outweigh any government benefits received in the form of fertilizer subsidies, etc., by a considerable margin.[4]

To analyse the impact on Australian agriculture of removing assistance requires an economic model that captures: the larger domestic economic environment within which the Australian agricultural sector operates; the vulnerability of the agricultural sector to competition on world markets; and the ability of agriculture to adapt its product-mix to changing circumstances. The ORANI model of the Australian economy (developed by Dixon, Parmenter, Sutton and Vincent (1982)) is ideally suited for such an analysis.[5] ORANI characterizes the operation of the economy in a series of equations describing:

(1) the demand for commodities and primary factors (labour, capital, and agricultural land) by intermediate and final users;

(2) the supply of commodities by domestic producers;

(3) the relationship between commodity prices and the costs of production;

(4) balances between commodity and factor supplies and their demands; and

(5) various descriptors of the macroeconomy (e.g., gross domestic product, the balance of trade, aggregate price indexes) built up explicitly from their microeconomic components.

The equations are derived from microeconomic assumptions about the behaviour of producers and final consumers, about technology and household preferences, and about market structures.

ORANI is a computable general equilibrium (hereafter CGE) model which represents the latest generation of structurally detailed economy-wide models. ORANI has a special multi-product treatment of industries in the agricultural sector which is probably unique among such models.[6] Another novel characteristic of agricultural sector modelling in ORANI is the treatment of the agricultural data base supporting the model. The 1977-1978 data base has been augmented using a time-series of data from 1967-68 to 1982-83 to reflect typical conditions in the agricultural sector. The notional typical year is interpreted for the most part as an average over a particular period; for example, the average values of shares of returns to land in gross operating surplus are imposed. However, if a significant trend was

evident in a share, then the most recent in-sample trend value was imposed; this procedure was followed for example, in the case of the share of exports in total sales of live sheep.[7]

An additional noteworthy feature of the version of ORANI used here is its inclusion of equations which describe the distribution of revenue between the public and private sectors. These additional equations comprise the ORANI National and Government Accounts module (NAGA) developed by Meagher (1983, 1984) and by Meagher and Parmenter (1985). Finally, the ORANI model is solved in a linearized form (following Johansen (1960)) using GEMPACK, a general purpose software system for CGE models developed at Impact by Pearson and Codsi (1988).[8]

The rest of the paper is organized as follows. In section 2 a brief description is given of the various forms of assistance given to Australian agriculture and some subsidy equivalent measures of this assistance are presented. In section 3 the economic environments assumed for the ORANI simulations are defined. The results are presented in section 4. First discussed are the short-run (two-year) effects on key macroeconomic variables. Then the effects on sectoral outputs and farm incomes are studies in detail. Some concluding remarks are offered in section 5. Finally, an appendix documents some of the technical details involved with the ORANI simulations.

2. ASSISTANCE TO AUSTRALIAN AGRICULTURE

The Industries Assistance Commission (hereafter IAC) has conducted two major studies of the assistance given to Australian agriculture; see IAC (1983 and 1987). These studies found that

agricultural assistance is provided through a wide range of measures which increase producers' gross returns either directly by assisting output (e.g., domestic pricing arrangements) or indirectly by assisting the value-adding factors used in the activity (e.g., income tax concessions and drought relief). Assistance is also provided through schemes which reduce input costs (e.g., fertilizer subsidies). In this section a brief discussion is presented of the various types of assistance along with the estimates made by IAC (1987) of the assistance levels for 1984-85, the latest year for which detailed estimates are available. A description of how these different types of assistance are converted into producer subsidy equivalents is given in the appendix.

2.1 Assistance to Output

Many Australian agricultural products are assisted by one or more of the following: home consumption pricing schemes; export diversification schemes; export incentive schemes; export inspection services; government purchasing policies; import restrictions (including tariffs, quantitative trade restrictions, and quarantine restrictions); local content schemes; marketing support; price stabilisation funds and underwriting arrangements; production bounties; restrictions on substitute products; and sales tax concessions on output. Estimates of the levels of output assistance given to Australian agricultural commodities are given in Table 1. Rather than discuss these in detail the reader is referred to IAC (1983 and 1987). Here we briefly expand on some of the more significant measures of output assistance.

Domestic pricing arrangements for major export commodities have been the principal form of output assistance to agricultural

TABLE 1: ESTIMATES OF ASSISTANCE GIVEN TO AUSTRALIAN AGRICULTURAL COMMODITIES*

($m 1984-85 prices)

Commodity[a]	Assistance to Output: Domestic Price Arrangements [I]	Assistance to Output: Other Assistance [II]	Assistance to Value-Adding Factors [III]	Assistance to Inputs[b] [IV]	Total Assistance [I] + [II] + [III] + [IV] [V]	Value of Output [VI]
A1. Wool	0.0	27.2	57.1	8.2	92.5	2,288.5
A2. Sheep	0.0	5.1	10.9	1.8	17.8	509.5
A3. Wheat	43.1	4.0	46.5	14.8	108.4	2,836.9
A4. Barley	0.0	0.4	9.2	4.6	14.2	574.5
A5. Other Cereal Grains						
- Maize	0.0	0.0	0.3	0.0	0.3	38.2
- Oats	0.0	0.1	2.3	2.3	4.7	161.4
- Oil Seeds	0.0	0.0	2.5	0.4	2.9	134.5
- Rice	8.4	0.0	1.6	0.1	10.1	117.9
- Sorghum	0.0	0.1	2.4	0.4	2.9	168.5
	8.4	0.2	9.1	3.2	20.9	620.5
A6. Meat Cattle	0.0	19.9	78.9	29.6	128.4	2,075.0
A7. Milk Cattle and Pigs						
- Manufacture	122.5	6.5	13.2	1.2	143.4	509.6
- Market	220.0	6.6	13.6	1.2	241.4	528.8
- Pigs	0.0	0.2	5.2	-23.1	-17.7	406.1
	342.5	13.3	32.0	-20.7	367.1	1,444.5
A8. Other Farming (Sugar Cane, Fruit and Nuts)						
- Apples and Pears	4.4	1.2	2.9	0.1	8.6	177.0
- Bananas	0.5	0.0	1.2	0.0	1.7	73.5
- Citrus	0.0	24.1	2.0	0.1	26.2	123.4
- Deciduous Canned Fruits	2.5	0.1	0.9	0.1	3.6	18.9
- Dried Vine Fruits	13.0	0.2	1.4	0.1	14.7	76.4
- Sugar Cane	68.2	0.3	8.7	2.3	79.5	515.3
	88.6	25.9	17.1	2.7	134.3	984.5
A9. Other Farming (Vegetables, Cotton, Oilseeds and Tobacco)						
- Cotton	7.0	0.0	5.8	0.2	13.0	326.4
- Honey	0.2	0.1	0.3	0.0	0.6	21.0
- Onions	0.0	0.5	0.3	0.0	0.8	38.8
- Potatoes	0.0	10.1	1.1	0.2	11.4	136.1
- Tobacco	0.0	17.1	1.1	0.0	18.2	63.4
- Tomatoes	0.0	1.1	0.7	0.1	1.9	80.2
- Other Vegetables	0.0	1.6	1.0	0.2	2.8	119.2
	7.2	30.5	10.3	0.7	48.7	785.1
A10. Poultry						
- Eggs	24.8	0.1	2.7	-8.2	19.4	233.6
- Poultry	0.0	0.0	8.9	-25.0	-16.1	510.3
	24.8	0.1	11.6	-33.2	3.3	743.9
Total	514.6	126.6	282.7	11.7	935.6	12,862.9

* Source: Industries Assistance Commission (1987).

a For a detailed description of the subcategories of the ORANI agricultural commodity classifications see Higgs (1986, Table 1.2).

b Note that this excludes tariffs on materials and capital, which act as a negative form of assistance.

industries in recent years (see Table 1, column [I]). These arrangements can provide assistance to producers by maintaining domestic prices above world prices. Home consumption pricing schemes are usually administered through statutory marketing authorities, supported by restrictions placed on imports of the commodity, and are exempt from the Trade Practices Act which would otherwise declare such schemes illegal.[9]

The other major form of output assistance is marketing support. The Australian government assists in the promotion of agricultural products. The largest grants in this category have been to wool.

2.2 Assistance to Value-Adding Factors

Australian agricultural producers may be assisted by one or more of the following: adjustment assistance; agricultural extension services; agricultural research; concessional credit; income taxation concessions; income equalization deposits; and natural disaster relief. Again these are only briefly discussed here. Adjustment assistance and concessional credit both refer to schemes whereby finance is made available to farmers at subsidized interest rates. Extension services are agricultural advisory services which, along with agricultural research, are supported by government funds. Significant income tax concessions are available to primary producers which are not available to other taxpayers. The three main tax concessions are: (1) the ability to depreciate certain capital items not depreciable for most commercial taxpayers, or to depreciate certain capital items at higher than scheduled rates; (2) the ability to defer certain income to subsequent financial years; and (3) tax averaging. Finally, direct assistance in the form of grants or concessional loans may be made

available in the event of natural disasters such as cyclones, floods, bushfires, and droughts.

2.3 Assistance to Inputs

Assistance is given to inputs to the agricultural industries in the form of: disease control; fertilizer subsidies; and sales tax concessions. The value of such assistance is relatively small, the most significant items being subsidies for the input of phosphatic and nitrogenous fertilizers.

3. ASSUMED ECONOMIC ENVIRONMENT

Certain features of the economy are not projected endogenously by ORANI. For these, the user of the model must specify an environment before computing a solution. In other words, there are more variables than equations in the model; therefore, the user must set values for some of the variables exogenously so that the number of unknown variables equals the number of equations.

The key features of the economic environment are as follows.[10] It is assumed that there are no shortages of labour at the going real wage rates.[11] Thus employment levels are demand determined. It is assumed that plant and equipment in use in every industry do not change (from the levels they otherwise would have reached) due to the shock under analysis (i.e., industry capital stocks in use are exogenous). Note that the short-run time period simulated allows for revisions in all industries' investment plans, for orders for capital goods to be placed and met, and for the new plant and equipment to be installed (but

not yet switched on). The length of the short run in ORANI has been estimated by Cooper (1983) as 7.9 quarters. In policy work 'about two years' is the appropriate level of precision for describing the ORANI 'short run'. Next, the ORANI model does not distinguish between changes in the relative prices of traded and non-traded goods brought about on the one hand by a change in the nominal exchange rate, or on the other hand by a change in the domestic price level. Here it is assumed that induced changes in the real exchange rate appear as changes in the domestic price level. In other words, the nominal exchange rate is the numeraire. Finally, it is assumed that both tax rates and real government expenditure are exogenous and, with the exception of tariffs, set to zero change. Thus if a shock leads to an increase in real government income, then, under these assumptions, there will be a fall in the real public sector borrowing requirement.

4. EFFECTS OF THE REMOVAL OF ASSISTANCE TO AUSTRALIAN AGRICULTURAL AND MANUFACTURING INDUSTRIES

In this section we discuss the results of ORANI simulations of the effects of the removal of assistance to Australian agricultural and manufacturing industries. To simulate the effects of the removal of assistance to the agriculture, the input costs of the agricultural industries were increased to the extent of estimated producer subsidy equivalents.[12] Where the subsidy is in the form of home consumption pricing schemes, the prices of some key downstream sales were adjusted to capture the appropriate fall in agricultural prices that would occur if these schemes were disbanded. To simulate the effects of the removal of assistance to manufacturing industries, the nominal rates of protection for Australian manufacturing industries for 1986-87 were

removed.[13] These are estimates of the extent to which tariff and quota protection raised the domestic prices of imported goods.

4.1 Macroeconomic Projections

The short-run effects of the removal of assistance to agricultural and manufacturing industries on some nominal aggregates are given in Table 2. The table also gives the reader a feel for the size of the Australian economy. The estimated impacts on the macroeconomic aggregates reported in Table 2 can be used to study the effects of removing trade distortions in terms of the sectoral balances identity. The latter may be written:

$$(E - M) \equiv (S - I) + (T - G) \quad ; \qquad (1)$$

where E and M respectively are exports and imports; S and I respectively are private savings and private investment; and T and G respectively are government income and government expenditure. Equation (1) says that if Australia absorbs more resources than it produces (i.e., if I exceeds S, and/or if G exceeds T) then the balance of trade must move towards deficit. The first thing to note is that in the base period the data satisfies the sectoral balances identity. This can be checked by substituting the appropriate values from the first column of Table 2 into equation (1).

The projected changes in terms of millions of Australian dollars at 1984-85 prices due to the removal of subsidy equivalents to the agricultural sector are given in column [I] of Table 2. These

TABLE 2: PROJECTIONS FOR SOME NOMINAL AGGREGATES*

Variable	Base Period $m 1984-85 prices	Projected Change in $m		
		Removal of Subsidy Equivalents to the Agricultural Sector [I]	Removal of Protection from Imports for the Manufacturing Sector [II]	[I] + [II] [III]
(E) Exports	34,148	-626	1,839	1,213
(M) Imports	39,005	-326	2,440	2,114
(C) Private Consumption	125,967	-1,551	-4,615	-6,166
(I) Private Investment	36,499	-390	-1,707	-2,097
(G) Government Expenditure[a]	52,136	-524	-2,463	-2,987
(G*) Government Outlays[b]	86,535	-1,163	-4,198	-5,361
(T) Government Income	71,417	-919	-4,400	-5,319
(PSBR) Public Sector Borrowing Requirement[c]	15,118	-244	202	-42
(S) Private Savings	12,361	-295	-371	-665
(Y) Gross Domestic Product	209,745	-2,765[d]	-9,386[d]	-12,150[d]

* Note that columns I, II and III contain the dollar values of deviations from control expected to occur about 2 year after the imposition of the shocks. These deviations reflect both price and quantity effects. Hence the dollar amounts in these columns correspond to the thought experiment in which, in the absence of the shock(s), the aggregate values of the variables are arbitrarily scaled to their 1984-85 values; the deviations from these values depend partly on the fact that the shock(s) are expected to be deflationary (i.e., to make prices lower than they would otherwise have been), and partly on quantity effects. The key price and quantity effects are shown in Table 3.

a This refers to government consumption plus government investment.

b This refers to all government outlays including government expenditures and transfer payments.

c Note that PSBR = G*-T, which in turn equals the negative of government savings.

d Note that these negative entries do not necessarily indicate falls in real magnitudes; see Table 3.

results can be explained as follows. The removal of the subsidy equivalents has an impact effect of causing a contraction in the agricultural sector. As agriculture is a significant export sector, the contraction in agriculture results in a decline in exports. In terms of equation (1), this corresponds to a fall in E. The revenue saved by the government through removing its assistance to agriculture is assumed not to be redistributed, rather it shows up here as an improvement in the public sector borrowing requirement (hereafter PSBR). As a result, the contraction in the agricultural sector leads to a decline in the nominal (and as we shall see, also the real) size of the economy. This tends to cause a reduction in imports, M. However, before any conclusions can be reached about the final impact on the balance of trade we must study the effect on relative prices.

Table 3 contains projections for some key price indices and real macroeconomic variables. As simulated here, the removal of assistance to agriculture is deflationary due to both the removal of the home consumption pricing schemes and the contraction in the size of the economy. All of the price indices in column [I] of Table 3 are projected to fall. The consumer price index (hereafter CPI) is projected to fall the most; this is due to the removal of the home consumption pricing schemes for agricultural products which have larger weights in the CPI relative to the other price indices. As wages are assumed to be fully indexed to the CPI, the fall in the CPI causes a fall in nominal wages. This in turn improves the competitiveness of the internationally traded sectors. This improvement in competitiveness partially offsets the decline in aggregate exports brought about by the contraction in agriculture. Aggregate imports are projected to decline due to both the contraction in the size of the economy and the

TABLE 3: MACROECONOMIC PROJECTIONS*

Variable	Removal of Subsidy Equivalents to the Agricultural Sector [I]	Removal of Protection from Imports for the Manufacturing Sector [II]	[I] + [II] [III]
Consumer Price Index (CPI)	-1.02	-4.77	-5.79
Investment Price Index (IPI)	-0.86	-5.79	-6.65
Government Price Index (GPI)	-0.97	-4.75	-5.72
Factor-Cost GDP Deflator (FCGDP)	-0.94	-4.55	-5.49
Aggregate Exports (foreign currency value)	-1.83	5.38	3.55
Aggregate Imports (foreign currency value)	-0.84	6.26	5.42
Balance of Trade	-0.14	-0.29	-0.43
Real Private Consumption	-0.21	1.10	0.89
Real Private Investment	-0.21	1.10	0.89
Real GDP[a]	-0.37	0.70	0.33
Aggregate Employment[b]	-0.52	0.93	0.41
Real Pre-Tax Wage Rate (FCGDP deflated)	-0.08	-0.22	-0.30
Government Expenditure[c]	-1.00	-4.72	-5.72
Government Outlays[d]	-1.34	-4.85	-6.19
Government Income	-1.29	-6.16	-7.45
Public Sector Borrowing Requirement[e]	-1.61	1.34	-0.27

* All projections, with the exception of the balance of trade, are percentage deviations from the value the variable in question would have taken in the absence of the shock at the head of the column. The balance of trade, while also a deviation from control, is expressed as the change in the balace of trade divided by the base-period GDP.

a Real GDP is calculated here as a weighted sum of industry output responses using value-added weights.

b This is calculated by weighting the employment by occupation projections by persons weights.

c This refers to government consumption plus government investment.

d This refers to all government outlays including government expenditures and transfer payments.

e This is equal to government outlays less government income.

improvement in competitiveness of the domestic import-competing sectors. However, the decline in exports dominates and the balance of trade (i.e., E-M) moves $300m (1984-85 prices) towards deficit. As the economy is absorbing more resources than it produces we would expect either I to exceed S, and/or G to exceed T.

Next we look at the effects on government income and expenditure. As government expenditure is assumed to remain constant in real terms, nominal government expenditure falls by $524m (1984-85 prices). However the income collected by the government also falls, in this case by $919m. On balance (T-G) is projected to decline by $395m. This exceeds the above fall in the balance of trade by $95m. Thus we would expect (S-I) to increase by $95m.

It is assumed that the percentage change in real private investment is equal to the percentage change in real disposable income. As the size of the economy declines this tends to cause a fall in real disposable income and hence in real private investment; see Table 3, column [I]. It can be seen from column [I] of Table 2 that nominal private investment falls by $390m (1984-85 prices), which is $95m more than the projected fall in private savings.

Finally, real GDP and aggregate employment are both projected to decline slightly if assistance to agriculture is removed; see Table 3, column [I]. These results largely follow from our assumption that the revenue saved by the government is used to reduce the PSBR rather than being redistributed via, say, tax cuts. The PSBR is projected to decline by $244m (1984-85 prices). The real wage rate as a cost to employers of labour (i.e., the pre-tax wage rate factor-cost GDP

deflated) is projected to fall slightly. This stimulates employment and so partially offsets the decline in aggregate employment brought about by the contraction in the real size of the economy.

We now examine the projected changes due to the removal of protection from imports for the manufacturing sector. The removal of tariffs has an impact effect of lowering the price to domestic purchasers of imported goods. Thus imports will increase as domestic purchasers switch towards the now cheaper imported goods. Furthermore, the fall in import prices causes a decline in the CPI. As wages are assumed to be fully indexed to the CPI, the decrease in the CPI flows on into wages and then back into further price reductions, etc. The end result is a 4.77 per cent decrease in the CPI. The other price indices in column [II] of Table 3 are also projected to decrease, with the largest decline occurring in the investment price index (hereafter IPI). The IPI is projected to decline slightly more due to its relatively heavier weights for imported investment goods whose prices are projected to fall significantly if nominal rates of protection are removed. The falls in these price indices improve the competitiveness of the traded sectors. This tends to partially offset the above increase in imports. However the removal of protection for manufacturing also causes an expansion in the size of the economy which causes an increase in imports. On balance, aggregate imports are projected to increase by $2,440m (1984-85 prices). Aggregate exports are projected to increase by $1,839m due to the improvement in competitiveness. The increase in imports exceeds the increase in exports and the balance of trade is projected to move $601m towards deficit.[14]

The deflationary effect of the tariff cut means that nominal government expenditure (which is assumed to remain constant in real terms) falls by $2,463m (1984-85 prices). Government income is also projected to fall, in part due to the loss of tariff revenue, by $4,400m.[15] On balance (T-G) is projected to decline by $1,937m. This exceeds the above fall in the balance of trade by $1,336m. Thus we expect (S-I) to increase by $1,336m.

The removal of manufacturing protection causes a small increase in real consumption and investment; see Table 3, column [II]. Under our closure of the model, this would tend to increase nominal investment. However the fall in the IPI (see Table 3, column [II]) dominates and nominal investment is projected to decline by $1,707m (1984-85 prices). Finally, private savings is projected to fall by $371m. Thus (S-I) increases by the expected $1,336m.

The removal of protection from imports for the manufacturing sector causes a small increase in aggregate employment and real GDP; see Table 3, column [II]. On the other hand, as simulated here, it also causes an increase in the PSBR.

Column [III] of Tables 2 and 3 shows the total effect of the removal of assistance to agricultural and manufacturing industries. Note that as the model is solved as a linear system, the total effect is simply given by the addition of columns [I] and [II]. It can be seen from Table 3 that the total package is projected to cause a fall in domestic price indices. Both aggregate exports and aggregate imports are projected to increase, with a small decline in the balance of trade. However, real aggregate consumption and investment are projected to

increase slightly, as are real GDP and aggregate employment. Furthermore, a small decrease in the PSBR is projected if assistance to both agricultural and manufacturing industries is removed.

4.2 Sectoral Output Projections

The short-run effects of the removal of assistance on industry outputs are given in Table 4. The industries have been divided into four broadly defined groups: export, export-related, import-competing, and non-traded.

It can be seen from Table 4, column [I] that, not surprisingly, the agricultural sector is projected to decline if its levels of assistance are removed. (The results for each of the individual agricultural industries are discussed in detail in the next section.) The resulting increase in agricultural prices causes a decline in the outputs of the agricultural processing industries, Meat Products, Other Food Products and Cotton Ginning, Wool Scouring and Top Making. As the removal of the subsidies is deflationary the international competitiveness of the industries in the mining sector improves. Thus we observe projected increases in the outputs of the mineral export industries. With the exceptions of Services to Mining and Water Transport, all of the export-related industries are projected to decline in output. This is largely caused by reduced demand from agriculture for their products or services. The next group of industries compete (to varying extents) with imports. Even though these industries are now slightly more competitive, given the projected fall in domestic costs, they are projected on average to experience a small decline in output. This is due to the contraction in the size of the

TABLE 4: SECTORAL OUTPUT PROJECTIONS*

	Industry	Removal of Subsidy Equivalents to the Agricultural Sector [I]	Removal of Protection from Imports for the Manufacturing Sector [II]	[I] + [II] [III]
Export				
1-8	Agriculture[a]	-2.53	3.40	0.87
12	Ferrous Metal Ores	-0.73	3.75	4.48
13	Non-Ferrous Metal Ores	0.99	4.91	5.90
14	Black Coal	1.22	6.04	7.26
18	Meat Products	-3.36	5.96	2.60
25	Other Food Products	-10.57	11.04	0.47
30	Cotton Ginning, Wool Scouring and Top Making	-1.66	2.28	0.62
64	Non-Ferrous Metals	1.19	5.86	7.05
Export Related				
9	Services to Agriculture	-2.35	2.78	0.43
11	Fishing and Hunting	-1.03	1.48	0.45
16	Other Minerals	-0.04	1.10	1.06
17	Services to Mining nec	3.17	1.88	5.05
49	Chemical Fertilizers	-2.22	3.30	1.08
70	Railway Rolling Stock	-0.14	1.29	1.15
76	Agricultural Machinery	-17.53	20.66	3.13
93	Road Transport	-0.69	1.28	0.59
94	Rail and Other Transport	-0.35	1.81	1.46
95	Water Transport	0.01	1.37	1.38
Import-Competing				
19	Milk Products	0.81	-0.46	0.35
20	Fruit and Vegetable Products	-0.39	0.11	-0.28
21	Margarine, Oils and Fats nec	-0.53	0.23	-0.30
22	Flour and Cereal Products	-0.54	0.70	0.16
23	Bread, Cakes, Biscuits	-0.05	0.24	0.19
24	Confectionery and Cocoa	0.12	-0.81	-0.69
28	Other Alcoholic Beverages	-0.65	-2.76	-3.41
29	Tobacco Products	-0.10	0.60	0.50
31	Man-Made Fibres Yarns	1.36	-29.18	-27.82
32	Cotton Yarns, Fabrics	1.05	-22.31	-21.26
33	Wool, Worsted Fabrics	0.01	-5.52	-5.51
34	Textile Finishing	0.10	-4.69	-4.59
35	Textile Floor Coverings	0.03	-5.05	-5.02
36	Other Textile Products	-0.18	-1.33	-1.51
37	Knitting Mills	0.18	-10.07	-9.89
38	Clothing	0.18	-8.38	-8.20
39	Footwear	0.82	-40.07	-39.25
40	Sawmill Products	0.19	0.49	0.68
41	Veneers and Wood Boards	0.14	-1.44	-1.30
42	Joinery and Wood Products nec	0.05	-0.04	0.01
43	Furniture and Mattresses	0.15	-0.91	-0.76
44	Pulp, Paper, Paperboard	-0.13	-0.66	-0.79
45	Bags and Containers	-0.90	0.90	0.00
46	Paper Products nec	-0.26	-0.89	-1.15
47	Newspapers and Books	-0.02	1.20	1.18
48	Commercial Printing	-0.27	0.35	0.08
50	Other Basic Chemicals	0.37	-4.29	-3.92
51	Paints, Varnishes	0.12	-2.30	-2.18
52	Pharmaceutical Goods	-0.49	1.22	0.73
53	Soap and Detergents	-0.26	0.39	0.13
54	Cosmetics and Toiletries	-0.01	0.66	0.65
55	Other Chemical Goods	0.09	-0.94	-0.85
56	Petrol and Coal Products	-0.34	0.97	0.63
57	Glass and Glass Produts	-0.03	-0.55	-0.58

... continued

TABLE 4 (continued)

	Industry	Removal of Subsidy Equivalents to the Agricultural Sector [I]	Removal of Protection from Imports for the Manufacturing Sector [II]	[I] + [II] [III]
58	Clay Products, Refractories	-0.00	1.28	1.28
62	Non-Metallic Mineral Products	-0.12	0.67	0.55
63	Basic Iron and Steel	0.01	-1.13	-1.12
65	Structural Metal Products	-0.04	0.51	0.47
66	Sheet Metal Products	-0.39	0.22	-0.17
67	Other Metal Products	0.40	-3.52	-3.12
68	Motor Vehicles and Parts	0.65	-13.18	-12.53
69	Ships and Boats	1.29	-1.11	0.18
71	Aircraft	1.00	0.70	1.70
72	Scientific Equipment	0.01	0.77	0.78
73	Electronic Equipment	0.58	-4.13	-3.55
74	Household Appliances	-0.19	-1.22	-1.41
75	Other Electrical Goods	0.78	-1.99	-1.21
77	Construction Machinery	2.32	-1.15	1.17
78	Other Machinery	0.80	-1.10	-0.30
79	Leather Products	0.31	-15.68	-15.37
80	Rubber Products	0.08	-4.01	-3.93
81	Plastic Products	-0.30	-3.06	-3.36
82	Signs, Writing Equipment	0.05	-1.24	-1.19
83	Other Manufacturing	0.21	-2.19	-1.98
	Non-Traded			
10	Forestry and Logging	2.56	-2.07	0.49
15	Oil, Gas and Brown Coal	0.09	0.43	0.52
26	Soft Drinks, Cordials	-0.18	0.26	0.08
27	Beer and Malt	-0.13	0.85	0.72
59	Cement	-0.22	1.08	0.86
60	Ready Mixed Concrete	-0.26	1.04	0.78
61	Concrete Products	-0.24	1.03	0.79
84	Electricity	-0.20	0.79	0.59
85	Gas	-0.19	0.24	0.05
86	Water, Sewerage, Drainage	-0.31	0.61	0.30
87	Residential Building	-0.19	1.00	0.81
88	Other Construction	-0.30	1.06	0.76
89	Wholesale Trade	-0.78	1.15	0.37
90	Retail Trade	-0.22	1.30	1.08
91	Mechanical Repairs	-0.33	1.58	1.25
92	Other Repairs	-0.30	1.72	1.42
96	Air Transport	-0.10	1.99	1.89
97	Communication	-0.28	0.90	0.62
98	Banking	-0.20	0.62	0.42
99	Non-Bank Finance	-0.21	0.56	0.35
100	Investment and Services	-0.16	0.46	0.30
101	Insurance	-0.21	1.20	0.99
102	Other Business Services	-0.33	0.75	0.42
103	Ownership of Dwellings	0.00	0.00	0.00
104	Public Administration	-0.07	0.14	0.07
105	Defence	0.00	0.00	0.00
106	Health	-0.11	0.88	0.77
107	Education, Libraries	-0.02	0.14	0.12
108	Welfare Services	-0.10	0.64	0.54
109	Entertainment, Leisure	-0.31	1.06	0.75
110	Restaurants, Hotels	-0.23	1.27	1.04
111	Personal Services	-0.20	1.28	1.08
112	Non-Competing Imports	-0.00	-0.00	-0.00

* All projections are percentage deviations from what the output of the sector would have been in the absence of the shock at the head of the column.

a The agricultural sector's results are disaggregated in Table 5.

economy. Note that the Milk Products industry experiences an increase in output. This is due to the dismantling of the home consumption pricing scheme for milk. The final group of industries are classified as non-traded. These industries do not have any real scope for replacing imports and therefore, with a few exceptions, they experience declines in output. Note that industries which sell mainly to the government sector (104-108) do worse than average because of the fall in real government spending (Table 3).

Column [II] of Table 4 shows the sectoral effects of the removal of protection for manufacturing industries. Recall from Table 2 that the removal of protection is deflationary, and so improves the competitiveness of the traded sectors. As a result, all of the export and export-related industries are projected to experience an increase in output. Overall the import-competing industries decline due to the removal of their protection from imports. This is particularly true for industries 31-39 (which constitute the Textiles, Clothing, and Footwear sector) and industry 68, the Motor Vehicles and Parts industry. Note that some of the import-competing industries actually benefit from the across-the-board removal of protection. This is due first of all to their improved competitiveness via the lowering of domestic costs; secondly, to the increase in real absorption; and thirdly, to their links (where applicable) to the export sector. The non-traded industries in general experience a small increase in output due to the removal of protection. These industries largely benefit from the increase in real consumption and investment that occurs.

Column [III] of the table shows the total effect of the removal of assistance to agricultural and manufacturing industries. All

of the export (including agricultural) and export-related industries benefit from the total package. The big losers are the Textiles, Clothing, and Footwear sector and the Motor Vehicles and Parts industry. On average, relatively small increases are projected for the non-traded industries.

4.3 Agricultural Output Projections

The short-run effects of the removal of assistance on agricultural industry outputs are given in Table 5. It can be seen from column [I] of the table that all the agricultural industries are projected to experience declines in output if the subsidies to agriculture are removed. The differential responses between the industries can be explained using the ORANI short-run supply function, which for industry j can be written:[16]

$$z_j = \lambda_j(p_j - \psi_j) \quad ; \tag{2}$$

where

$$\lambda_j = \sigma(1 - S_{Fj})/(S_{Fj}H_{Xj}) \quad . \tag{3}$$

In these equations the percentage change in industry j's output is represented by z_j; p_j is the percentage change in the farm-gate price of industry j's output (this is an appropriately weighted index for the multi-product industries); ψ_j is the percentage change in an index of costs to industry j; σ is the elasticity of substitution between primary factors (assumed to be 0.5 for all industries in the short run); S_{Fj} is the share of the fixed factors in industry j's primary-factor inputs; and H_{Xj} is the share of primary-factor inputs in industry j's total costs.

TABLE 5: AGRICULTURAL OUTPUT PROJECTIONS*

	Industry	Removal of Subsidy Equivalents to the Agricultural Sector [I]	Removal of Protection from Imports for the Manufacturing Sector [II]	[I] + [II] [III]
1	Pastoral Zone	-1.61	3.06	1.45
2	Wheat-Sheep Zone	-1.29	2.68	2.84
3	High Rainfall Zone	-2.13	3.87	1.74
4	Northern Beef	-3.98	6.34	2.36
5	Milk Cattle and Pigs	-1.15	1.76	0.61
6	Other Farming (Sugar Cane, Fruit and Nuts)	-6.76	6.43	-0.33
7	Other Farming (Vegetables, Cotton, Oilseeds and Tobacco)	-2.46	1.76	-0.70
8	Poultry	-1.79	3.18	1.39
	Agriculture	-2.53	3.40	0.87

* All projections are percentage deviations from what the industry outputs would have been in the absence of the shock at the head of the column.

Equation (2) suggests that we need look only at three influences to determine an industry's output response. The first is λ_j which, according to equation (3), is determined by base-period shares and an elasticity. The second is the change in the industry output price, and the third is an index of costs. The greater the fixed-factor share, S_{Fj}, and the primary-factor share, H_{Xj}, the less responsive is the industry (i.e., the smaller is λ_j). For the three zonal industries the λ_j's are as follows: $\lambda_1 = 0.75$, $\lambda_2 = 0.57$, and $\lambda_3 = 0.92$. Thus, given equal changes in output prices over costs, of the zonal industries we would expect the High Rainfall Zone ($j = 3$) to be the most responsive, followed by the Pastoral Zone ($j = 1$), and finally by the Wheat-Sheep Zone ($j = 2$).

The subsidies to the Pastoral, Wheat-Sheep, and High Rainfall Zones, as a percentage of total costs are, respectively, 4.32 per cent, 4.55 per cent, and 4.90 per cent. Thus the changes in costs to the zonal industries (ψ_j)due to the removal of these subsidies are fairly similar. Furthermore, as the zonal industries' output is largely sold as exports, and as the export demand schedules faced are fairly flat, these industries will be unable to pass on the cost increases induced by the removal of the subsidies to any significant extent. As a result the changes in output prices (p_j) will be small and roughly equal for each of the zones. Consequently, the changes in the price-cost ratios ($p_j - \psi_j$) will not differ greatly between zones. Hence the relative responses suggested by the λ_j's are indeed evident in the projections listed in column [I] of Table 5. Finally, if we make the crude approximations (for the purpose of this back-of-the-envelope calculation) that the output price of, say, the Pastoral Zone did not change (i.e., $p_1 = 0$)

and that this industry's costs increased by just the direct effect of its own subsidy removal (i.e., $\psi_1 = 4.32$), then according to equation (2) the output of the Pastoral Zone would decline by roughly 3 per cent (i.e., $0.75 \times (0 - 4.32)$), whereas the projected decline is 1.61 per cent. The main reason for the back-of-the-envelope approach over-estimating the decline is its failure to account for the second-round effects on costs due to the fall in the CPI and hence in nominal wages.

The Northern Beef industry produces only meat cattle which is largely exported after being processed by the Meat Products industry. As a result, it is not generally true that the price of unprocessed meat is determined solely on world markets. However as processing costs are not projected to change significantly here, it turns out that the price of meat cattle only changes by -0.9 per cent. The subsidy to the Northern Beef industry as a percentage of total costs is equal to 6.19 per cent. The λ_j for the Northern Beef industry is equal to 0.67. If we again make the assumption that this industry's costs increased by just the direct effect of its own subsidy removal, then according to equation (2) the output of the Northern Beef industry would decrease by roughly 4.75 per cent (i.e., $0.67 \times (-0.9 - 6.19)$), whereas the projected decline is 3.98 per cent. The back-of-the-envelope approach again slightly over-estimates the decline due to its failure to account for second-round effects on costs.

The subsidy to the Milk Cattle and Pigs industry is equal to 24.25 per cent of the total costs of the industry. As a percentage of total costs this is by far the largest subsidy to the agricultural industries. However, the output of the Milk Cattle and Pigs industry is

only projected to decline by 1.15 per cent when the subsidies are removed. This is because Milk Cattle and Pigs sells primarily to the domestic market and can pass on nearly all of the cost increase. In fact the price of the commodity milk cattle and pigs is projected to increase by 24.16 per cent. The λ_j for the Milk Cattle and Pigs industry is equal to 1.11. As 93 per cent of the output of the Milk Cattle and Pigs industry consists of the commodity 'milk cattle and pigs', we could reckon that this industry's output price increased by about 22.47 per cent (i.e., 0.93 × 24.16). Furthermore, if we assumed that its costs increased by 24.25 per cent, then according to equation (2), the output of the Milk Cattle and Pigs industry would decline by roughly 2 per cent (i.e., 1.11 × (22.47 − 24.25)). This is about double the actual projection -- the difference once again is due to second-round effects under which nominal wages are reduced due to the fall in the CPI.

The largest percentage decline in output occurs in the Other Farming (Sugar Cane, Fruit and Nuts) industry. The subsidy to this industry is equal to 13.64 per cent of its total costs. This represents the second largest subsidy as a percentage of total costs to an agricultural industry. However, unlike the Milk Cattle and Pigs industry, which receives the largest subsidy, roughly half of the output of the Other Farming industry is exported after being sent to a food processing sector. Thus the Other Farming industry is unable to pass on all the cost increases it would incur if the subsidies given to it were removed. As a result it is projected to experience a 6.76 per cent decline in output if the agricultural subsidies are removed.[17]

The Other Farming (Vegetables, Cotton, Oilseeds, and Tobacco) industry sells to a number of sectors of the economy. If the subsidies are removed, then this industry is projected to decline by 2.46 per cent. This is partially due to the decline in real consumption; see Table 2, column [I].[18]

The last agricultural industry to be discussed is Poultry. Although the subsidy to the Poultry industry is only equal to 0.44 per cent of total costs to the industry, the removal of agricultural subsidies is projected to cause a decline of 1.79 per cent in the Poultry industry. This can be explained as follows. The Poultry industry sells about half of its output to the export-oriented Meat Products sector. The decline in the output of the Poultry industry is largely due to the contraction in the Meat Products sector.[19]

Column [II] of Table 5 shows the effects on agricultural outputs of removing protection from the manufacturing sector. All of the agricultural industries are projected to experience an increase in output. However, the benefits to the agricultural sector are not uniform across the agricultural industries. The differential responses between the industries can again be explained by making reference to equation (2). First we make the approximation that the change in costs to the agricultural industries is equal to the change in the factor-cost GDP deflator of -4.55 per cent; see Table 2, column [II]. (In other words, we assume that ψ_j is equal to -4.55 for $j = 1, \ldots, 8$.) Next we assume (for the purpose of this back-of-the-envelope calculation) that the output prices of the zonal industries do not change (e.g., for the Pastoral Zone, $p_1 = 0$). Thus, according to equation (2), the output of the Pastoral Zone will increase by about 3 per cent (i.e., 0.75 × (0 -

-4.55)) which is in agreement with the projected increase of 3.06 per cent. The projections for the Wheat-Sheep and High Rainfall Zones can be explained in a similar fashion.

The Northern Beef and Other Farming (Sugar Cane, Fruit, and Nuts) industries benefit the most from the removal of protection to the manufacturing industries. As mentioned above, both of these industries sell a significant amount of their output to food processing sectors which then export their produce. The reduction in domestic costs, especially wages, improves the competitiveness of the food processing sectors, which in turn results in significant gains to the agricultural producers.

The Milk Cattle and Pigs industry and the Other Farming (Vegetables, Cotton, Oilseeds, and Tobacco) industry both sell largely to the domestic market. These industries benefit from the projected increase in real consumption. They also sell a small percentage of their output to the processing industries which are stimulated by the reduction in domestic costs. As a result these industries are only projected to experience relatively small increases in output. Finally, the Poultry industry is projected to experience a 4.44 per cent increase in output. This is largely due to increased demand from the Meat Products sector.

It can be seen from column [III] of Table 5 that, with the exceptions of small declines in the two Other Farming industries, the agricultural industries are projected to experience a net increase in output if assistance to both agricultural and manufacturing industries is removed.

5. CONCLUSION

It was shown in this paper that the net effect of removing assistance to both agricultural and manufacturing industries on the agricultural sector would be for an increase in farm output. Thus on balance, Australia is actually taxing its agricultural sector with its current set of trade distortions. On the other hand, the net effect is for a decline in output in some of the import-competing sectors. Of note are the declines projected for the Textiles, Clothing and Footwear sector and the Motor Vehicle and Parts industry.

In future research this study could be extended in a number of areas. Not all distortions that affect trade have been removed here. For example, distortions in the area of transport can have a significant effect on agricultural exports, however we have not studied these. Furthermore, the net benefits from reducing agricultural assistance are underestimated, to the extent that the reduction would be associated with the rationalization of some agricultural industries via the removal of cumbersome government regulations.

Finally, the results presented in this paper may be of particular interest given the following statement made by Australia's Prime Minister, Mr Hawke, in an address to the contracting parties of the GATT in Geneva on 22 October 1987:

> "We are prepared to negotiate a broad package of measures to reduce overall levels of effective assistance to Australian industry - including tariffs - as part of a broad-based multilateral approach. In this context, we are prepared to

eliminate, over an appropriate implementation phase, all quantitative import measures designed to protect domestic industry. This means we would phase-out all our quantitative restrictions, including tariff quotas, licensing and embargoes. This is a radical approach - but it is the kind of radical approach necessary to provide the world with its best chance to capture fully the potential gains from trade."

APPENDIX

This appendix contains three sections. The first documents the closure and the nominal rates of protection used for the ORANI simulations. The second describes the method used to calculate the size of the exogenous shocks when simulating the removal of assistance to agriculture. The third section describes how the public sector borrowing requirement projections were corrected for flows not captured by the NAGA model. All of these sections are essential for the reproducibility of the results presented in this paper.

A.1 Closure and Nominal Rates of Protection

The set of exogenous variables chosen for the ORANI simulations is defined in Table A1 in terms of the notation used by Dixon, Parmenter, Sutton, and Vincent (1982) and Meagher and Parmenter (1985). The input-output and elasticities files as documented in Bruce (1985) were used for this study. The values for the user-specified indexation parameters that were assumed are as in Higgs (1986, Table A1.2).

Table A2 shows the nominal rates of protection for Australian manufacturing industries for 1986-87. These are estimates of the extent to which tariff and quota protection raised the domestic prices of imported products. For example, the nominal rate of protection for motor vehicles is 27.10 per cent. Thus in 1986-87 an imported car costing $10,000 at the port of Melbourne would cost $12,710 by the time it cleared customs.

TABLE A1: THE SET OF EXOGENOUS VARIABLES FOR THE ORANI SIMULATIONS

Exogenous Variable	Subscript Range	Number	Description
ORANI Variables[a]			
$p^m_{(i2)}$	i=1,...,g.	g	C.i.f. foreign currency import prices
t(i2,0),v(i2,0)	i=1,...,g.	2g	Tariff terms
t(is,jk),v(is,jk)	i=1,...,g, s,k=1,2, j=1,...,h.	8g	Ad valorem and specific sales-tax terms
t(is,3),v(is,3)	i=1,...,g, s=1,2.	4g	
v(i1,4)	i∈G.[b]	g	Selection of specific export-tax terms and complementary selection of export volumes
$x^{(4)}_{(i1)}$	i∉G.		
t(i1,4)	i=1,...,g.	g	Ad valorem export tax terms
a's (exluding a(j))	subscript ranges can be read from Table 23.2 in DPSV	$4g^2h + 5g^2 + 7gh + Mh + 8h + 3g + \sum_{j=1}^{h} N(j)$	Technological changes and changes in household preferences
$k_j(0)$	j=1,...,h.	h	Current capital stocks
n_j	j=1,...,h.	h	Use of agricultural land in each industry
$f^{(1)}_{(g+1,1)}$		1	Wage shift variables
$f^{(1)}_{(g+1,1,m)}$	m=1,...,M.	M	
$f^{(1)}_{(g+1,1)j}$	j=1,...,h.	h	
$f^{(1)}_{(g+1,1,m)j}$	m=1,...,M. j=1,...,h.	Mh	
$f^{(5)}_{(is)}$	i=1,...,g, s=1,2.	2g	'Other' demand shift terms
$f^{(2)}_{j}$	j∉J.[c]	h-J*	Exogenous investment
$f^{e}_{(i1)}$	i=1,...,g.	g	Shifts in foreign export demands

...continued

TABLE A1 (continued)

Exogenous Variable	Subscript Range	Number	Description
$f^{(1)}_{g+2,j}$	$j=1,\ldots,h.$	h	Shifts in the price of 'other cost' tickets
q		1	Number of households
ϕ		1	The exchange rate, \$A per \$US, say
NAGA Variables[d]			
f_R		1	The ratio of real private investment expenditure to real household consumption expenditure
g_R		1	Real government consumption expenditure
θ		1	Shock control variable
α_P		1	Payroll tax rate
α_V		1	VAT tax rate
α_L		1	Labour income tax rate
α_K		1	Capital income tax rate
f_W		1	Shift variable wage indexation

Total = $4g^2h + 5g^2 + 15gh + 2Mh + 13h + 15g + M + \sum_{j=1}^{h} N(j) + 11 - J^* = 6,084,052$[c]

a Notation and further details are explained in Dixon, Parmenter, Sutton and Vincent (1982), hereafter DPSV.

b G is the set of commodities for which export demands are determined endogenously. The set G, together with the export demand elasticities, is listed in Higgs (1986, Table 2.2).

c J is the set of industries for which investment is endogenous. The set $\{j \in J\}$ for which the rate-of-return theory is considered inappropriate, consists of industries 17, 84, 85, 86, 94, 103-108, 111 and 112. For a key to the industry numbers see Higgs (1986, Table 5.2).

d Notation and further details are explained in Meagher and Parmenter (1985).

e For the version of ORANI used here:

g	(the number of commodities)	= 114
h	(the number of industries)	= 112
M	(the number of occupations)	= 10
J*	(the number of industries for which investment is endogenous)	= 99 .

TABLE A2: NOMINAL RATES OF PROTECTION FOR 1986-87*

	Commodity	Nominal Rate of Protection (per cent)
18	Meat Products	0.00
19	Milk Products	25.26
20	Fruit and Vegetable Products	11.20
21	Margarine, Oils and Fats nec	6.75
22	Flour Mill Cereal Products	8.39
23	Bread, Cakes, Biscuits	0.46
24	Confectionery and Cocoa	15.75
25	Other Food Products	10.10
26	Soft Drinks, Cordials	10.68
27	Beer and Malt	30.67
28	Other Alcoholic Beverages	20.56
29	Tobacco Products	7.25
30	Cotton Ginning, Wool Scouring and Top Making	2.13
31	Man-Made Fibres, Yarns	30.63
32	Cotton Yarns, Fabrics	28.57
33	Wool, Worsted Fabrics	12.19
34	Textile Finishing	36.20
35	Textile Floor Coverings	33.67
36	Other Textile Products	18.94
37	Knitting Mills	63.04
38	Clothing	64.03
39	Footwear	63.53
40	Sawmill Products	5.09
41	Veneers and Wood Boards	18.88
42	Joinery and Wood Products nec	12.46
43	Furniture and Mattresses	22.27
44	Pulp, Paper, Paperboard	9.27
45	Bags and Containers	20.60
46	Paper Products nec	20.94
47	Newspapers and Books	0.48
48	Commercial Printing	18.99
49	Chemical Fertilizers	0.97
50	Other Basic Chemicals	11.76

... continued

TABLE A2 (continued)

	Commodity	Nominal Rate of Protection (per cent)
51	Paints, Varnishes	13.43
52	Pharmaceutical Goods	6.21
53	Soap and Detergents	17.56
54	Cosmetics and Toiletries	6.07
55	Other Chemical Goods	11.19
56	Petrol and Coal Products	0.12
57	Glass and Glass Products	6.09
58	Clay Products, Refractories	3.65
59	Cement	3.26
60	Ready Mixed Concrete	0.00
61	Concrete Products	0.61
62	Non-Metallic Mineral Products	8.90
63	Basic Iron and Steel	8.58
64	Non-Ferrous Metals	2.68
65	Structural Metal Products	12.51
66	Sheet Metal Products	15.14
67	Other Metal Products	17.35
68	Motor Vehicles and Parts	27.10
69	Ships and Boats	14.80
70	Railway Rolling Stock	17.44
71	Aircraft	1.64
72	Scientific Equipment	4.68
73	Electronic Equipment	19.03
74	Household Appliances	22.59
75	Other Electrical Goods	18.24
76	Agricultural Machinery	7.09
77	Construction Machinery	17.45
78	Other Machinery	12.96
79	Leather Products	8.53
80	Rubber Products	21.98
81	Plastic Products	19.82
82	Signs, Writing Equipment	12.69
83	Other Manufacturing	15.59

* Source: Unpublished Industries Assistance Commission estimates.

A.2 Calculation of the Exogenous Shocks When Simulating the Removal of Assistance to Agriculture

In this section we first estimate the producer subsidy equivalents of the assistance given to Australian agriculture. The magnitudes of some "correction" shocks are then calculated to appropriately capture the price effects when the home consumption pricing schemes are removed.

Subsidy Equivalent Measures

Recall from Table 1, column [IV] that the IAC has made estimates of the total level of assistance given to agricultural commodities in 1984-85. To simulate the effects of the removal of assistance these estimates must first be converted to the appropriate units given the ORANI model's base-period prices and production levels.

The IAC (1987) estimates of the 1984-85 levels of assistance and value of output by commodity are given in columns [I] and [II] of Table A3. Next, in column [III] of the table, the ratio of the level of assistance, or commodity subsidy equivalent, to the value of output is calculated. This ratio is then multiplied by the value of output in the base period (see column [IV]) to produce estimates of the subsidy equivalents in terms of the base-period prices and with respect to the base-period production levels, see column [V].

The next step is to convert the commodity subsidy equivalents listed in column [V] of Table A3 to industry subsidy equivalents. This was done according to the base-period mix of commodities produced by

TABLE A3: CALCULATION OF THE BASE-PERIOD AGRICULTURAL COMMODITY SUBSIDY EQUIVALENTS

Commodity	1984-85 Subsidy Equivalent[a] ($m 1984-85 prices) [I]	1984-85 Value of Output[b] ($m 1984-85 prices) [II]	Ratio of Subsidy Equivalent to value of Output (i.e.,[I]/[II]) [III]	Typical-Year Value of Output[c] ($m 1977-78 prices) [IV]	Typical-Year Subsidy Equivalent ($m 1977-78 prices) (i.e., [III] × [IV]) [V]
A1. Wool	92.5	2,288.5	0.0404	1,508.74	60.95
A2. Sheep	17.8	509.5	0.0349	578.67	20.20
A3. Wheat	108.4	2,863.9	0.0382	921.07	35.18
A4. Barley	14.2	574.5	0.0247	176.51	4.36
A5. Other Cereal Grains	20.9	620.5	0.0337	161.64	5.45
A6. Meat Cattle	128.4	2,075.0	0.0619	803.59	49.74
A7. Milk Cattle	367.1	1,444.5	0.2541	985.00	250.29
A8. Other Farming (Sugar Cane, Fruit and Nits)	134.3	984.5	0.1364	1,257.67	171.55
A9. Other Farming (Vegetables, Cotton, Oilseeds and Tobacco)	48.7	785.1	0.0620	956.61	59.31
A10. Poultry	3.3	743.9	0.0044	400.42	1.76
Total	935.6	12,862.9		7,749.93	658.79

[a] See Table 1, column [V].
[b] See Table 1, column [VI].
[c] Source: Higgs (1986).

each of the industries; see Higgs (1986, Table 3.1). The resulting matrix of subsidy equivalents by commodity and industry is given in Table A4. The industry subsidy equivalents are listed in the final column of the table.

All that remains now is to explain how the effects of the removal of the industry subsidy equivalents listed in Table A4 were simulated. This was done by making use of the "other costs" input category for each of the agricultural industries. Note that an exogenous increase in "other costs" is equivalent to the imposition of a production tax. Column [II] of Table A5 contains the inputs of "other costs" in the base period. It is possible to simulate the effects of the removal of the industry subsidy equivalents by exogenously setting the appropriate percentage change in "other costs"; see column [III] of Table A5.

Correction for Home Consumption Pricing Schemes

The above producer subsidy equivalent shocks will result in increased costs to the agricultural producers which is appropriate if we are simulating the removal of a subsidy. However the above shocks also tend to result in increased domestic agricultural prices which is not appropriate if we were attempting to capture the effects of the removal of a home consumption pricing scheme. Recall from Table 1, column [I], that part of the subsidy to agriculture consists of home consumption pricing schemes. These act to raise the price to domestic consumers of products within such arrangements. Therefore we must correct, where possible, for the effects of the above shocks on prices when the subsidy is in the form of a home consumption pricing scheme.

TABLE A4: SUBSIDY EQUIVALENTS TO THE AGRICULTURAL SECTOR*

Industry	Commodity										
	A1 Wool	A2 Sheep	A3 Wheat	A4 Barley	A5 Other Cereal Grains	A6 Meat Cattle	A7 Milk Cattle and Pigs	A8 Other Farming (Sugar Cane, Fruit and nuts)	A9 Other Farming (Vegetables, Cotton, Oilseeds and Tobacco)	A10 Poultry	Total Subsidy by Industry
1. Pastoral Zone	12.69	2.00	1.64	0.21	0.14	4.55	0.13	0.06	0.80		22.21
2. Wheat-Sheep Zone	26.17	10.32	32.73	3.67	3.83	13.51	15.37	0.41	2.27		108.27
3. High Rainfall Zone	22.10	7.88	0.82	0.48	1.48	15.21	5.97	0.90	3.35		58.19
4. Northern Beef						12.88					12.88
5. Milk Cattle and Pigs						3.59	228.81				232.40
6. Other Farming (Sugar Cane, Fruit and Nuts)								170.19			170.19
7. Other Farming (Veg., Cotton Oilseeds and Tobacco)									52.89		52.89
8. Poultry										1.76	1.76
Total Subsidy by Commodity[a]	60.95	20.20	35.18	4.36	5.45	49.74	250.29	171.55	59.31	1.76	658.79

* These figures are estimates of the subsidy equivalents of the various forms of government assistance given to agriculture in terms of millions of 1977-78 Australian dollars.

[a] Source: derived from IAC (1987); see Table A3, column [V].

TABLE A5: THE EXOGENOUS SHOCKS TO "OTHER COSTS" REQUIRED TO SIMULATE THE EFFECTS OF THE REMOVAL OF THE AGRICULTURAL INDUSTRY SUBSIDY EQUIVALENTS

Industry	Industry Subsidy Equivalent[a] ($m 1977-78 prices) [I]	"Other Costs"[b] ($m 1977-78 prices) [II]	Exogenous Shock to "Other Costs" (percentage change) {i.e., 100 × [I]/[II]} [III]
1. Pastoral Zone	22.21	21.62	102.74
2. Wheat-Sheep Zone	108.27	88.04	122.98
3. High Rainfall Zone	58.19	33.91	171.60
4. Nothern Beef	12.88	4.47	288.13
5. Milk Cattle and Pigs	232.40	29.04	800.34
6. Other Farming (Sugar Cane, Fruit and Nuts)	170.19	60.42	281.68
7. Other Farming (Vegetables, Cotton, Oilseeds and Tobacco)	52.89	38.79	136.36
8. Poultry	1.76	44.02	4.00

[a] See Table A4.
[b] Source: Bruce (1985).

Approximately two-thirds of total assistance to agriculture due to home consumption pricing schemes is for milk (both manufacture and market); see Table 1, column [I]. Below we explain how to correct for the effects of the above shocks on the price of the commodity milk cattle and pigs. The first step is to estimate the value of the home consumption pricing scheme in terms of base-period prices and with respect to base-period production levels. This is done by taking the ratio of the estimated values in Table 1 of the home consumption pricing scheme ($342.5m 1984-85 prices) to the value of total assistance ($367.1m 1984-85 prices) and multiplying it by the subsidy equivalent for the commodity milk cattle and pigs as reported in Table A4 ($250.29m 1977-78 prices). This results in an estimated value of $233.52m 1977-78 prices (i.e., (342.5/367.1) × 250.29).

The second step is to note that in the base period nearly all the sales of the milk component of the commodity milk cattle and pigs were to the Milk Products industry. This represented a sale of $609.94m 1977-78 prices. Thus we would expect a reduction in the costs of milk purchased by the Milk Products industry of 38.29 per cent (i.e., 100 × 233.52/609.94) if the home consumption pricing scheme were disbanded. However, due to the component of the shock to "other costs" that accounts for the home consumption pricing scheme, the price of milk is projected to increase by approximately 23.71 per cent (i.e., 100 × 233.52/985.00, where the base-period total sales of milk cattle and pigs is $985.00m 1977-78 prices).

The third and final step is to compute the size of the shock to "other costs" in the Milk Products industry that will both cancel out

the effect on this industry's costs of the above 23.71 per cent increase in the price of milk, plus capture the desired effect of a 38.29 per cent fall in the price of milk to this industry. In other words, what percentage change in "other costs" is equivalent to a 62 per cent (i.e., 23.71 + 38.29) fall in the price of milk sold to the Milk Products industry? The input of "other costs" in the base period to the Milk Products industry is $36.07m 1977-78 prices. Thus a 62 per cent fall in the cost of milk to this industry, which equals $378.16m (i.e., 0.62 × 609.94m), is equivalent to a 1,048.41 per cent (i.e., 100 × 378.16/36.07) decrease in the input of "other costs".

The next home consumption pricing scheme we correct for is for wheat. As above, the first step is to estimate the value of the home consumption pricing scheme in terms of base-period prices and with respect to base-period production levels. This is done by taking the ratio of the estimated value in Table 1 of the home consumption pricing scheme ($43.1m 1984-85 prices) to the value of total assistance ($108.4m 1984-85 prices) and multiplying it by the subsidy equivalent for wheat reported in Table A4 ($35.18m 1977-78 prices). This results in an estimated value of $13.99m 1977-78 prices (i.e., (43.1/108.4) × 35.18).

The second step is to note that, due to the component of the shocks to "other costs" that accounts for the domestic pricing scheme for the producers of wheat, the price of wheat is projected to increase by 0.41 per cent. This is calculated as follows. The elasticity of the farm-gate price of wheat with respect to "other costs" in the Wheat-Sheep Zone (which produces 93 per cent of the total output of wheat in the base period) is 0.0259. Next we note that $13.99m (1977-78 prices) represents a 15.89 per cent increase in "other costs" in the

Wheat-Sheep Zone. Thus a 15.89 per cent increase in "other costs" would generate a 0.41 per cent (i.e., 15.89 × 0.0259) increase in the price of wheat.

The third step is to note that in the base period domestic sales of wheat to non-wheat producing industries was $127.43m 1977-78 prices. Thus we would expect a fall in the price of wheat to domestic purchasers of approximately 10.98 per cent (i.e., 100 × 13.99/127.43) if the home consumption pricing scheme were disbanded. Furthermore, of the $127.43m (1977-78 prices) domestic sales of wheat, $63.44m is sold to the Flour and Cereal Products industry. This sale represents approximately 12 per cent of total costs to the Flour and Cereal Products industry. The remaining $63.99m of wheat is largely sold to non-wheat producing agricultural industries. However these sales represent a relatively small percentage of total costs in these industries.

The final step is to compute the size of the shock to "other costs" in the Flour and Cereal Products industry (which accounts for approximately 90 per cent of domestic non-agricultural sales of wheat in the base period) that will both cancel out the effect on this industry's costs of the above 0.41 percent increase in the price of wheat, plus capture the desired effect of a 10.98 per cent fall in the price of wheat if the domestic price arrangements were disbanded. In other words, what percentage change in "other costs" is equivalent to an 11.39 per cent (i.e., 0.41 + 10.98) fall in the price of wheat sold to the Flour and Cereal Products Industry? The input of "other costs" in the base period to the Flour and Cereal products industry is $18.42m, 1977-78 prices. Thus an 11.39 per cent fall in the price of wheat to this industry, which equals $7.23m (i.e., 0.1139 × $63.44m), is

equivalent to a 39.25 per cent (i.e., 100 × 7.23/18.42) decrease in the input of "other costs".

A.3 The Public Sector Borrowing Requirement Projections

In this note we explain how the PSBR projections reported in Tables 2 and 3 were corrected for flows not captured in the NAGA model. Recall that the PSBR is equal to government outlays less government income. It is assumed that the flows not captured by NAGA only effect government outlays. Prior to any corrections being made, the NAGA model projected a $742m (1984-85 prices) decline in government outlays if assistance to agriculture were removed. This projection failed to account for the direct savings to the government from the subsidies being removed. These direct savings can be estimated from Table 1. Total assistance to agriculture is equal to $935.6m (1984-85 prices), however $514.6m is in the form of domestic price arrangements. Thus roughly $421.0m (i.e., 935.6 - 514.6) of assistance is direct government outlays. This amount needs to be subtracted from the projected decrease in government outlays of $742m to give a corrected projection of a decline of $1,163m. In other words, a reduction of 1.34 per cent (i.e., 100 × 1,163/86,535) is the corrected projection for government outlays.

To calculate the corrected PSBR projection we subtract the projected decline of $919m (1984-85 prices) in government income from the above reduction of $1,163m in government outlays. This produces a corrected PSBR projection of a fall of $244m. In other words, a fall of 1.61 per cent (i.e., 100 × 244/15,118) is the corrected projection for the PSBR.

NOTES

* The author is indebted to Nisha Agrawal, John Kelso, Tony Lawson, Tony Meagher, Alan Powell, David Vincent and the participants of the workshop in CGE Modelling at the University of Melbourne and at the San Diego Workshop on Global Agricultural Trade Policy for comments and assistance.

1. This was initially due to efforts by the United States, and then due to representations made by the Europeans at the Kennedy Round; see Dam (1970) and Rausser and Wright (1987).

2. See, for example, Ballenger, Dunmore, and Lederer (1987).

3. See Stoeckel and Cuthbertson (1987).

4. Note that Parmenter (1986) found that the National Farmers' Federation (who based part of their submission on work by Clements and Sjaastad (1985)) had actually overestimated the cost penalty of manufacturing protection. However, the revised estimate is still easily the largest item among the cost penalties suffered by farmers due to government intervention in the economy.

5. Other studies which have used the ORANI model to look at the implications of protection and which report results for the agricultural sector include Dixon, Powell, and Parmenter (1979), Crowley and Martin (1982), Dixon, Parmenter, and Powell (1982), Quiggin and Stoeckel (1982), Dixon, Parmenter, Powell, and Vincent (1983), Dixon (1985), and Industries Assistance Commission (1985).

6. See Vincent, Dixon, and Powell (1980).

7. Australian agricultural production and profitability exhibits marked year-to-year variability, largely as a result of fluctuations in both climatic conditions and world prices. It is important therefore that the data base of a model designed to yield policy insights, as opposed to forecasts, captures typical-year features and not transient influences. For more details see Adams (1984), Higgs (1985), and Adams and Higgs (1986). Note that the non-agricultural part of the model is calibrated from the 1977-78 input-output table; see Australian Bureau of Statistics (1983) and Bruce (1985).

8. See also Pearson (forthcoming) and Agrawal and Meagher (1987). Note that the process of solving the linear equations uses the Harwell sparse matrix code; see Duff (1977).

9. See Parmenter, Sams, and Vincent (1981) for a study of the allocative effects of home-price schemes using the ORANI model.

10. A complete list of the variables selected as exogenous is given in Table A1.

11. That is the percentage change in the pre-tax wage rate is exogenous and set equal to the percentage change in the CPI.

12. For the technical details see Appendix.

13. The nominal rates are listed in Table A2. See also Parmenter (1977) and Lawson (1984) for a description of how the tariff rates are calculated in ORANI, and Chai and Dixon (1985) for the estimation of the average rates of protection.

14. This result is at variance with ORANI results in which the closure holds real absorption constant (e.g., Dixon, Parmenter, Sutton, and Vincent (1982, chapter 7)). In the simulations reported here, the expansions in consumption and investment lead to the increase in imports outstripping the increase in exports.

15. Note that this is only a rough estimate of the effect of the tariff cut on government income. This is due to the tension between the 1986-87 tariff rates which are used to shock relative prices and the implicit tariff rates in the NAGA module. However, as the tariff equivalents of quotas are relatively insignificant in 1986-87 due to the depreciation of the Australian dollar, the tension is less than it would otherwise have been.

16. See Higgs (1986, Appendix A.2) for the derivations of equations (2) and (3).

17. Note that $\lambda_6 = 1.65$.

18. Note that $\lambda_7 = 3.09$ and the subsidy to the Other Farming (Vegetables, Cotton, Oilseeds, and Tobacco) industry is equal to 6.20 per cent of its total costs.

19. The Meat Products industry is modelled as using unprocessed meat inputs in fixed proportions. Note that $\lambda_8 = 2.97$.

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