Impact Project

Impact Centre
The University of Melbourne
153 Barry Street, Carlton
Vic. 3053 Australia
Phones (03) 344 7417
Telex AA 35185 UNIMEL
Telegrams UNIMELB, Parkville

IMPACT is an economic and demographic research project conducted by Commonwealth Government agencies in association with the Faculty of Economics and Commerce at The University of Melbourne, the Faculty of Economics and Commerce and the Departments of Economics in the Research Schools at the Australian National University and the School of Economics at La Trobe University.

Paper presented to the Third Meeting of the Task Force on Applied General Equilibrium Modelling sponsored by the International Institute of Applied Systems, Analysis, Laxenburg, Austria, 25th-29th August 1986

APPLIED GENERAL EQUILIBRIUM MODELLING IN THE AUSTRALIAN INDUSTRIES ASSISTANCE COMMISSION: PERSPECTIVES OF A POLICY ANALYST

by

David P. Vincent

Industries Assistance Commission
Canberra

General Paper No. G-71 Melbourne August 1986

ISSN 0813 - 7986

ISBN 0 642 10072 1

CONTENTS

TABLES

APPLIED GENERAL EQUILIBRIUM MODELLING IN THE AUSTRALIAN INDUSTRIES ASSISTANCE COMMISSION : PERSPECTIVES OF A POLICY ANALYST

by

D.P. Vincent*

1 INTRODUCTION

The Industries Assistance Commission (hereafter Commission) is an independent statutory authority of the Australian Government. Its main function is to advise the Government on industry assistance matters.

Over the past 8 years the Commission has made regular use of applied general equilibrium modelling techniques, based on the ORANI model framework,[1] to support its analysis of industry economic policy issues. Staff of the Commission over this period have also, on numerous occasions, used the ORANI framework to assist the economic analysis process in other agencies of the Australian Government. These include the Treasury (in the context of the analysis of macroeconomic policy issues), the Bureau of Agricultural Economics (analysis of agricultural economic policy issues), the Department of Energy and Resources (analysis of resource policy issues) and the Department of Employment and Industrial Relations (analysis of employment issues).[2]

---

* I am indebted to Tony Lawson, Roger Mauldon, Alan Powell and John Sutton for helpful comments and to colleagues in the Economic Studies and Information Division of the Industries Assistance Commission for undertaking the analyses upon which I have drawn freely in writing the paper.

1 The standard ORANI model is described in Dixon et al. (1982). The model was developed as part of the IMPACT Project, a co-operative venture researching the structure of the Australian economy. The Project is supported by a number of Australian Government agencies, the most prominent being the Industries Assistance Commission, and three Australian universities. As discussed later, most applications of the ORANI framework undertaken to assist the Commission in its analysis of industry policy issues involve significant modifications to the standard ORANI model.

2 A survey of applications of the ORANI framework to industry and other policy issues is contained in the paper by Powell and Lawson (1986) presented to this conference. This survey illustrates the great flexibility of ORANI with respect to the range and types of policy issues it can analyse.

Although the Commission, in seeking to enhance the quality of its economic analysis, is a prominent user of applied general equilibrium techniques, it has relied largely on the IMPACT Research Centre,[3] an institution located 700km from the centre of government administration and quite detached from the policy advisory process, for the initial development of the ORANI model and subsequent theoretical improvements to enhance its policy relevance. The Commission lacks both the skills and the research environment necessary to undertake such developments. Commission staff maintain regular contact with Australian industry through the Commission's inquiry program, and with staff in other agencies of the Australian Government engaged in the economic policy advisory process. They are well-placed to communicate to model builders the real world relevance of the theoretical assumptions which form the building blocks of an applied general equilibrium model, and to suggest the directions more policy relevant research should take.

There is a close and continuous interaction between, on the one hand the model builder, located in a university environment and in pursuit of academic goals, and on the other hand the policy analyst, a permanent employee of the Australian Government. This interaction, which is conducted at both the formal level through meetings to discuss the direction and progress of model building research, and informally by staff to staff contacts, is mutually beneficial in a number of respects. Firstly, it ensures that model builders are kept closely informed of the direction of the economic policy debate within the government sector and of the research priorities likely to contribute to this debate. Secondly, it serves to highlight areas where existing model specification needs to be modified to better approximate reality. Thirdly, it considerably shortens the lag between the enhancement of a model and its application to the analysis of a contemporary policy problem within the Government. Fourthly, it increases the profile and exposure of model builders by ensuring that the results of analyses of economic issues of immediate concern to the Government are published in Commission reports which are widely

---

3 The IMPACT Research Centre is located on the campus of the University of Melbourne. The Centre, directed by Professor A.A. Powell, provides the IMPACT Project's basic research and development unit. See Powell (1985) for a recent account of the activities of the Centre.

circulated and subject to extensive public scrutiny and debate, both by the economics profession and by the public generally.

The Commission has now accumulated considerable experience in the use of applied general equilibrium techniques to analyse a wide variety of narrowly specific industry policy and general economic policy issues. Amongst other things this experience has served to highlight the strengths and limitations of the applied general equilibrium framework in these uses, and the problems encountered in ensuring that the economic insights derived from the models are reflected in the eventual policy outcomes. This paper provides an account of the role played by applied general equilibrium modelling, as depicted by the ORANI framework, within the Commission in the course of its framing of advice to the Government on commercial policy issues and in its consultations with other government agencies engaged in advising on other aspects of economic policy.

The paper is structured as follows. Section 2 outlines the institutional setting within which the Commission operates, its interpretation of its statutory responsibilities and the potential usefulness of applied general equilibrium analysis in fulfilling these responsibilities. Section 3 presents in some detail four recent applications of applied general equilibrium analysis by Commission staff. The applications chosen provide a convenient set of case studies with which to illustrate the type of policy question addressed, the way in which general equilibrium techniques have been used to address the question, the results obtained, and the effectiveness of the analysis in contributing to an understanding of the policy question under study. Section 4 discusses the major problems encountered in the Commission's use of ORANI to analyse industry assistance issues. Section 5 considers the issue of the communication of model results. Concluding remarks are contained in section 6.

2 THE INSTITUTIONAL SETTING

The Industries Assistance Commission is an independent statutory authority created by an Act of Parliament in 1974. Its main functions are to advise the Government on the nature and extent of assistance which should be given to Australian industries, and to report annually on the structure of industry assistance in Australia and its effects on the economy. Assistance is defined broadly to include, in addition to traditional border protection measures such as tariffs, quantitative import restrictions and export subsidies, any other form of tax, subsidy or institutional arrangement which confers a benefit on one sector of the economy at the expense of another. The Commission's focus therefore extends to all sectors of the economy and to the industrial structure of economic activity as a whole. Because of its independence, the Commission is in a position to provide disinterested policy advice in an area inevitably subject to conflicting pressures from special interest groups.

The Commission comprises no fewer than five and no more than nine Commissioners. Each is appointed by the Government for a fixed term. In addition, Associate Commissioners are sometimes appointed for particular inquiries. Commissioners and Associate Commissioners are drawn from a broad spectrum of Australian society[4] including private industry, the government sector, labour unions and the academic community: consequently, their collective expertise is wide ranging. While their role is primarily to offer advice to the Government on economic issues, there is no requirement that Commissioners have a background in, or any particular level of, understanding of economic thought.

Commissioners are assisted by a staff of permanent public servants. Most staff are trained in at least one area of economics, with microeconomics, econometrics and agricultural economics being well represented.

---

4 It is important, so as not to compromise the value of the Commission as a source of disinterested policy advice, that its membership appear balanced, that is, contain persons drawn from each of the important interest groups in the community.

2.1 The Commission's Inquiry Role

The Commission is required to inquire into and report on specific issues of industry assistance referred to it by the Government. Generally, the Government must seek the Commission's advice before it changes the structure of assistance afforded industries. There is, of course, no statutory or constitutional requirement for the Government to follow the Commission's advice, and in practice the Government in many cases does not do so.

The Commission must complete its report, including all supporting economic analysis, within a specified time period which is dependent on the nature, size and complexity of the inquiry.[5] Typically, two or three Commissioners or Associate Commissioners are appointed to a particular inquiry.

Since its creation, the Commission has completed about 400 specific inquiries. These have encompassed a wide range of economic issues which impinge on industry performance and resource allocation. They include border protection instruments, domestic industry incentives, budgetary and taxation policy issues, natural resource management, and issues concerning public choice and property rights.

2.1.1 The public inquiry process

A unique and extremely important aspect of the Commission's operations is its active attempts to encourage public participation in its policy advisory procedures and public scrutiny of its recommendations and the reasons underlying them. Public understanding of both the costs of adjustment to a more efficient industry structure and the benefits likely to accrue to the community as a whole is seen by the Commission as being crucial to overcoming the resistance of directly affected groups to a change in assistance.

---

5 The usual time period specified for a reasonably substantial reference is 12 months. The Commission also receives short term or interim inquiries in which the government seeks advice on whether any immediate action or assistance is necessary for an industry. The duration for such inquiries is for example 60 to 90 days. In these situations there is generally insufficient time to undertake any significant applied economic analysis.

After receiving a reference from the Government the Commission seeks written submissions from all interested parties - industry organizations, trade unions, domestic producers, importers and consumer groups. A draft report is prepared which generally includes an account of the activities under reference and their importance in the economy, an evaluation of the relevant economic issues, an analysis of major proposals advanced by interested parties and a discussion and analysis of options. The draft report, which is distributed to inquiry participants and to the press as well as being available to the public on request, provides interested parties with an opportunity to examine the Commission's analysis and proposals and to comment on them either through written submissions or at a subsequent public hearing.

Any person may submit evidence at a public hearing at which participants are asked to present their submission and to respond to Commissioners' questions. In their submissions, participants frequently comment, both favourably and unfavourably, on aspects of the Commission's applied modelling work. Participants may also comment on the submissions of other participants.

After taking into account the views of participants at the public hearings, the Commission issues a final report for consideration by the Government. This report is published by the Government generally prior to a government decision being taken on its recommendations.

The Commission as an institution plays no further part in the policy formation process once its report is sent to Government. However, staff are sometimes requested to undertake additional model simulations concerning possible policy options, by the departments responsible for translating the Commission's policy recommendations into actual policy.

2.2 The Commission's Policy Guidelines

In examining the issues referred to it by the Government, the Commission is required to have regard to a number of policy guidelines expressed in fairly general terms. They require that an economy-wide perspective be adopted which considers, in addition to the problems facing directly affected sectors, the welfare of the community as a whole.

Specifically, the guidelines reflect the Government's stipulated desire to:

(i) encourage the development and growth of efficient Australian industries which are internationally competitive, export oriented, and capable over the longer term of operating with minimum levels of assistance;

(ii) facilitate the adjustment of industries to structural change and persons affected by these changes, having regard to the need to minimise any social and economic hardship that may be involved; and

(iii) have regard to the activities of other industries and consumers likely to be affected by assistance changes.

2.3 The Commission's Annual Reporting Role

The Commission's annual report documents the changes in assistance arrangements afforded various activities in the Australian economy over the previous year. In addition, summary measures of the level of assistance accruing to each industry, expressed in terms of nominal and effective rates of assistance, and how assistance levels to various activities and for the economy as a whole have changed over time, are reported. This information is subsequently used both inside and outside the Commission as input into applied general equilibrium modelling and other studies measuring the effects of such assistance changes on resource allocation in the economy.

2.4 Other Commission Activities

In addition to its inquiry program and annual reporting role, the Commission is active in two other areas. The first concerns research into interrelationships within and between industries and the incentives environment in which each industry operates. The broad aim of this research is to increase public understanding of the extent and nature of various interventions and restrictions in the Australian economy and their effects on resource allocation and community living standards. The results of this research are disseminated to the Australian public

through reports on specific inquiries, the annual report, Commission discussion papers, and papers presented by staff at professional conferences and in published journals.

The second involves the responsibility of the Commission to maintain the economic models of the IMPACT Project, particularly the ORANI model, and to ensure that all agencies of the Australian Government have access to these models. In the case of the ORANI model, this requires a significant resource commitment from Commission staff. The model's input-output data base, parameter file and computer code are continually updated to incorporate newly released information on the input-output structure of Australian industries and occupations, improved estimates of parameters, model modifications and extensions, and improved computational procedures.

Within the Australian Government bureaucracy, the expertise required to apply the ORANI model to economic policy issues is concentrated heavily in the Commission.[6] Consequently, the Commission's responsibility to ensure access of the model to all other Australian Government agencies places staff in a policy-analytic consulting role to these agencies. Typically, Commission staff are briefed by staff of other agencies on the nature of the policy problem confronting them. Commission staff then determine how the model is to be used to address the problem, the appropriate choice and settings of exogenous variables, and parameter settings. Simulations are undertaken and assistance is provided with the interpretation of results. The users of the results must be sufficiently briefed on the important assumptions underlying the structure of the model to ensure that an appropriate perspective is placed on any policy conclusions drawn from them.

---

6 This is despite the attendance at very detailed training courses on the structure and use of the ORANI model, of employees of most Australian Government gencies with a potential interest in using the model for policy analysis. The experience suggests that, by and large, while the training course program has successfully conveyed to government employees outside the Commission, the potential role of the model in assisting their analysis of certain types of economic policy issues, it has not left them with sufficient confidence and expertise to conduct that analysis without assistance from the Commission.

2.5 The Role of Applied General Equilibrium Modelling in the Commission

The foregoing discussion of the Commission's responsibilities and the guidelines it must consider highlights the potential relevance to the Commission of an economy-wide analytical framework of industry and workforce composition. The guidelines explicitly recognise that assistance given to one sector will affect production, investment, and employment in other sectors and hence overall economic performance and community living standards. They require that the Commission balance the longer term gains from an improved allocation of resources against the capacity of affected industries and occupations to accommodate, in the short term, the required adjustments.

Ideally, to fulfill its statutory responsibilities, the Commission requires an analytical framework possessing the following capabilities:

(i) It must trace the interactions between producing and consuming activities in considerable detail. Existing and proposed assistance arrangements reviewed by the Commission often discriminate considerably between quite specific and closely related activities. In order to determine the impact of such arrangements and the effects of moving towards a less discriminatory assistance regime, such activities and their interdependencies must be explicitly modelled.[7]

(ii) It must incorporate at the individual activity and commodity level, the full range of assistance instruments commonly

---

7 As an example, consider the case revealed in the Commission's recent inquiry into the chemicals and plastics industries (IAC (1986b)) of the activity vinyl chloride monomer (VCM). The product of this activity is consumed as a feedstock input by the polyvinyl chloride (PVC) activity which is subsequently used to make various types of plastic products. Under current arrangements, domestic production of VCM is protected against imported VCM by an ad valorem tariff of 2 per cent. Domestic PVC is protected by a 30 per cent tariff while nominal rates of protection for using plastic product industries are 20 to 25 per cent. Clearly, each component of the production chain must be modelled separately to assess the effects of rationalising the tariff structure in this part of manufacturing industry.

applied in the Australian situation. These include tariffs and quantitative restrictions on imports, taxes and subsidies on exports, taxes and subsidies on production and sales, and set combinations of these such as those embodied in home consumption pricing arrangements for agricultural products.

(iii) It must permit both a short term analysis of the adjustment pressures likely to confront industries and occupations following a change in assistance together with a longer term analysis of the eventual effects on resource allocation and aggregate economic efficiency when resources have responded fully to the adjustment pressures imposed upon them.

In recent years a number of references sent to the Commission have involved substantial parts of Australian manufacturing industry.[8] This is likely to continue in the future.[9] In such cases it is necessary to analyse in considerable detail interactions within activities under reference as well as between these activities and the rest of the economy.

Political pressures from vested interests in Australia are such that assistance reform is generally not undertaken unless the Government can be convinced that the short term employment disruption in directly

---

8 Two examples are: (i) a just completed inquiry into the chemicals and plastics industries (IAC (1986b)), which involved analysing in detail the relationship between petrochemical feedstocks, various stages in the production of basic chemicals, formulated chemical products, and fabricated plastic products; and (ii) a current inquiry into pulp, paper, paper products and printing which encompasses the interactions between the production of pulp from waste paper or raw wood, the use of this production in a range of industries including newsprint, paper, paperboard and tissues, and paperboard containers.

9 The shift in emphasis away from specific industry references towards those encompassing wider parts of the production chain followed from a recommendation to the Government in a recent public review of the functions and performance of the Commission (Uhrig (1984)). Other recommendations in this review which have elevated the importance of applied general equilibrium modelling to the Commission's work program are: a requirement that the Commission present and evaluate a range of options in addition to its preferred option; and, a requirement that the Commission focus less on border protection and more on other industry assistance instruments.

affected sectors is manageable. The Commission's model-based analyses of the short term employment effects, which are closely scrutinised by both Government and industry, make a vital contribution to the information base in this area. The interests of labour and capital in protected sectors often put forward what the Commission considers to be exaggerated estimates of the adverse consequences for their industry of proposed assistance reductions. Such estimates are invariably derived from a partial framework. If the Commission did not possess the capacity to undertake an economy-wide analysis of adjustment pressures, the claims advanced by industry groups would go largely uncontested.

In considering the magnitude of the adjustments involved, the Commission has chosen to abstract from short term trade cycle influences and other transient shocks to the economic environment. That is, its focus has been on the short and longer term[10] implications of implementing a proposed policy recommendation assuming that all aspects of the economic environment shaping industry growth prospects, apart from those inherent in the policy change, will remain constant. This avoids taking a view about how growth prospects for the activities under reference are likely to evolve over time. Adjustment pressures as calculated therefore do not purport to measure how many jobs will be lost or gained in a particular industry but only those likely to be lost or gained as a result of the Commission's recommendations.

2.5.1 The ORANI framework

For many industry inquiries undertaken by the Commission, the value of goods under reference is small compared with GDP and the activities producing these goods have only minor forward and backward linkages with other sectors of the domestic economy and international trade. In such instances the economy-wide implications of changes in assistance to the activities can safely be ignored and a partial equilibrium treatment of

10 The short and longer term are often defined rather arbitrarily. While on occasions the Commission recommends the phased introduction of a proposed assistance change with the timing of each phase made explicit, the degree of phasing chosen reflects essentially a judgment, which is unsupported by numerical analysis, concerning the capacity of an industry to adjust.

the economic issues is considered adequate.[11]

For inquiries where activities under reference represent a significant component of industrial production and have important linkages with other sectors, the ORANI framework, a conventional general equilibrium framework of the Johansen type, is used on a routine basis. This framework has proved sufficiently flexible to incorporate the major categories of assistance arrangements identified by the Commission. The ORANI framework, being comparative-static, provides projections of the effects of a given policy change at only one point in time. These projections are identified as being either short term or longer term depending on (i) the model closure adopted and hence the degree of resource mobility envisaged to take place, (ii) values assigned to elasticity parameters, and (iii) the nature of the change under consideration.

The typical form of use of ORANI is to provide projections of the short and longer term effects of a specified economic change while abstracting from all other influences that operate to shape the development of industries and the economy as a whole.[12] This form of use corresponds closely to the Commission's interpretation of the way in which it should consider assistance changes. The absence of a treatment of short-term dynamics in ORANI has not to date been of particular concern to the Commission.

---

11 Partial equilibrium models constructed by the Commission are sometimes quite sophisticated. An example is the Commission's model of Dried Vine Fruits Production and Sales (IAC (1984)). This incorporated a treatment of: production relationships differentiated by region; sales relationships differentiated by end use (processing, household demands, export demands); competition from imports in each of the domestic uses for the products; and relationships equating supplies with demands for dried vine fruits commodities and primary factors and prices with costs in domestic production, exporting and importing.

12 In several recent industry references the government has requested that the Commission advise on longer term growth prospects for the industries concerned. To address this issue requires a consideration of how the full range of factors determining industry growth prospects, including assistance arrangements, will evolve over time. Recent work by Dixon (1986) and others suggests that a version of ORANI modified to provide forecasts as distinct from 'what if' type projections, has the potential to play an important role in forecasting industry growth prospects and identifying the key factors contributing to these prospects.

2.5.2 Special purpose industry models constructed within ORANI

Although the standard ORANI model distinguishes 112 producing activities, 114 commodity categories facing various degrees of competition with imported commodities, 10 types of labour occupations and 7 types of agricultural land, this disaggregation is generally insufficient for the type of industry analysis undertaken by the Commission. However, standard ORANI provides a convenient starting point around which so-called special purpose versions can be constructed. The Commission now has considerable expertise in constructing special purpose versions of ORANI.[13]

These models are in effect detailed industry models which elaborate linkages among component parts of the activities under reference, as well as between these parts, other sectors and to international trade. Because such models recognize that the economy is subject to overall constraints such as those imposed over the longer term by factor supplies and the foreign account, indirect linkages between the performance of industries resulting from these constraints are automatically in place.

Typically, for a one year inquiry, a modelling team of 2-3 persons has about 3 months to construct and implement a special purpose version of ORANI. In addition to the timing constraint, a computer budget constraint, and constraints on the availability of data and parameters temper the modelling ambitions of the team. Before modelling work can commence the team must develop a thorough appreciation of the activities under reference, their interrelationships, the incentive environment in which the activities operate and hence the range of policy issues likely to confront the Commission. On the basis of this information decisions are made as to which of the activities under reference and which assistance instruments require explicit modelling.

Given the time constraint under which staff operate the initial model specification stage is a crucial one. Considerable judgment is required

---

13 Some recent examples are ORANI-MILK, a model of dairy production and processing (IAC (1983)), ORANI-CHEM, a model of chemical and plastics production and sales (IAC (1986b)), and ORANI-TCF, a model of textiles, clothing and footwear activities (IAC (1986a)).

in deciding, at this early stage in the inquiry process, the factors relevant to the policy problem being analysed while abstracting from others considered to be of lesser importance. The time constraint is such that only minor modifications to the structure of the basic model can be implemented as the inquiry progresses.

After determining the set of intersectoral interdependencies and assistance instruments which require explicit modelling, the next stage involves modifying ORANI's standard input-output data base to capture these interdependencies, modifying the theoretical structure where required to incorporate economic responses not allowed for in the basic model, and assigning values to the set of parameters accompanying the model modifications.

In undertaking the modifications the team interacts closely with staff employed within the industries under reference. Industry staff may be asked to respond to a detailed questionnaire seeking (i) data on interdependencies between activities, (ii) estimates of key substitution parameters (particularly substitution elasticities between domestic and imported sources), and (iii) information upon which the Commission can conduct an econometric analysis of price responsiveness. In some industry modelling exercises close co-operation is achieved between Commission and industry staff. The benefits are mutual. The realism, quality and potential acceptance of the modelling work is enhanced through the incorporation of detailed information at the industry level. Industry staff, as well as experiencing at first hand the procedure to be followed in making an economy-wide as opposed to partial assessment of the effects of an economic change, gain access to the modelling framework.

3 SELECTED EXAMPLES OF THE USE OF APPLIED GENERAL EQUILIBRIUM MODELLING BY THE COMMISSION

In this section four recent examples of applied general equilibrium modelling conducted within the Commission are discussed in some detail. The examples have been chosen to provide a balanced representation of the type of policy issues analysed, the way in which the standard ORANI model is modified to accomodate them, and the problems encountered.

The first example refers to the analysis of marketing arrangements for the dairy industry. While the Australian agricultural sector[14] as a whole is export oriented with major parts such as wool, beef, and cereal grains operating with minimal levels of assistance, the sector contains significant pockets of highly assisted activities such as dairying. The Commission frequently receives references from the Government to advise on assistance arrangements for these activities. Assistance arrangements in agricultural activities are generally complex, involving a package of domestic instruments supported by traditional border protection measures such as tariffs and quantitative restrictions on imports.

A further complication with agriculture is that the domestic price discrimination component of the assistance package commonly requires, in addition to Australian Government legislative support, complementary legislation from each of the States in which the commodity is

---

14 An unusually large proportion of policy applications of the ORANI model have been oriented towards the analysis of issues of concern to the agricultural sector. These include changes which impinge directly on agriculture, such as changes in various types of agricultural assistance instruments, and changes whose initial effects are elsewhere but which nevertheless are important determinants of agricultural prosperity, such as changes in manufacturing industry tariffs and changes in government spending. The key factor determining the adjustment pressures on agriculture of an economic change is the extent to which that change affects the farm cost structure (closely dependent on the general level of costs in the economy) relative to the product price (determined in world markets). It is the ability of the applied general equilibrium framework to endogenise this cost-price ratio within an economy wide framework incorporating the regional specific multi-product nature of Australian agriculture that makes it a particularly useful tool for agricultural policy analysis.

produced. There is a natural tendency for the producer lobby in each State to pursue its own interests irrespective of the implications for the industry in other States. In Australia, climatic conditions, and hence dairy production technologies differ from State to State as well as between regions in each State. An essential prerequisite to achieving a policy package which is acceptable to each State industry is an analysis of the effects of any proposed assistance changes on the performance of the industry in each State as well as its performance in aggregate.

The second example refers to a study of assistance arrangements in the chemicals and plastics industries. These activities represent about 10 per cent of the value added of the Australian manufacturing sector. This study is representative of many undertaken into various parts of manufacturing. Typically, the industries involved are domestic oriented, obtaining market share against competing imports with the assistance of tariffs. In the case of chemicals and plastics, the existing structure of assistance reflects the selective imposition of tariffs to encourage local production at the expense of imports in the trading environment which existed nearly two decades earlier.

The third example is taken from a recent study into assistance for the consumption of phosphatic and nitrogenous fertilisers. In that study the analysis was broadly based, referring to assistance to agriculture relative to that for manufacturing and the relative impact on agricultural competitiveness of a range of influences including assistance measures.

The final example concerns the use of the model to address an adjustment issue of considerable importance in the contemporary Australian economic debate - that of accommodating a severe decline in the foreign terms of trade. While the Commission does not have a responsibility to advise the Government in this area, it needs to be aware of the differential pressures imposed on sectors by terms of trade changes and the appropriate macroeconomic policy responses. Analyses such as this of general macroeconomic issues are conducted periodically by Commission staff and made available to the relevant policy departments and the Australian economics profession.

3.1 Analysis of Assistance Arrangements for the Australian Dairy Industry[15]

The terms of reference for the inquiry required the Commission to report on the nature and extent of assistance that should be provided the industry. The effects of past government regulatory arrangements has been to facilitate in each State two types of activity within the industry, (i) the production of market milk (with a regulated supply and price), and (ii) the production of manufactured milk, purchased by dairy factories for processing into a range of products consumed locally and/or exported. Some such products including butter, certain varieties of cheese, skim milk powder, casein and whole milk powder (termed leviable products) are protected by differential rates of tax on domestic sales, the proceeds of which are used to subsidise exports, again at differential rates. The result is large disparities in assistance between products. The Commission's recommendations, which sought to simplify the assistance structure while reducing modestly its overall level, involved the replacement of these arrangements with a uniform domestic levy on all milk to fund a uniform rate of export subsidy of 20 per cent on all exported dairy products.

To analyse the adjustment pressures involved, ORANI-MILK, a detailed model of milk production, processing and final sales, was created within the ORANI framework. Modifications to the standard model to achieve this involved (a) the disaggregation of the single milk cattle and milk product activities into the detailed product by industry matrices of Tables 1 and 2; (b) the specification of household demand behaviour to allow for direct substitution between different types of dairy products,[16] and (c) the incorporation of joint production features in

---

15 A full report of this analysis is contained in IAC (1983).

16 The specification of household demand behaviour in standard ORANI is based on preference independence in an additive utility function. This implies that the marginal utility consumers derive from each commodity is independent of their consumption of any other commodity. While this assumption is tenable for broadly based consumption aggregates, it is not realistic at the level of dairy product disaggregation in ORANI-MILK. Using the method of Clements and Smith (1983) the 13 consumer products derived from farm milk production were allowed to interact fully in the utility function while preserving the additive preference assumption for the other broadly defined groups.

the manufacturing milk process.[17]

As shown in Table 1, six farm milk cattle activities are distinguished, one for each State. Each produces two products, its respective state milk and meat cattle (representing the sale of dairy cattle for slaughter). There is one manufactured milk activity producing seven products. Three of these (butter, skim milk powder and casein) are modelled as being produced in fixed proportions in a single manufacturing process. This process competes with four other processes (leviable cheese, non-leviable cheese, whole milk powder, other milk products) in the output mix of the activity. Production in the remainder of the economy is accounted for by a further 29 industries, eight of which are farm based producing agricultural commodities other than farm milk and dairy cattle. Some of these industries, such as chemical fertilisers and glass products, are important suppliers to the farm milk cattle and manufactured milk activities.

Table 2 indicates that each State's farm milk is sold to the corresponding state market milk industry as well as to the manufactured dairy products industry. The products of the state milk industries (the respective bottled milk commodities) are consumed by households. Manufactured dairy products are used for higher stage processing, consumed by households and exported.

Tables 1 and 2 represent only a small part of the input-output data base of ORANI-MILK. On the input side a further 30 commodity categories (with both domestic and imported components) and land, 10 types of labour occupations, and capital are distinguished. Sales of domestic and imported commodities to the 13 dairying activities and a further 29 industry categories representing the rest of the economy are modelled. All these flows are expressed in basic values. In addition there are commodity by industry matrices capturing the margins, taxes and subsidies on these flows. Since the main assistance mechanism of the dairy industry involves taxing sales to domestic consumers to subsidise exports, it is essential that the wedge between producer and consumer

17 Standard ORANI allows industries to produce a range of competing products only in the agricultural sector. This treatment was extended to manufacturing milk.

Table 1 : Production Linkages Within the Dairy Sector of ORANI-MILK[1]

Commodity/Industry	Farm Milk Sector[2]						Market Milk Sector[2]						
	NSW	VIC	QLD	SA	WA	TAS	NSW	VIC	QLD	SA	WA	TAS	Manufactured milk[2]
Farm milk (NSW)	79												
Farm milk (VIC)		82											
Farm milk (QLD)			81										
Farm milk (SA)				84									
Farm milk (WA)					76								
Farm milk (TAS)						70							
Bottled milk (NSW)							100						
Bottled milk (VIC)								100					
Bottled milk (QLD)									100				
Bottled milk (SA)										100			
Bottled milk (WA)											100		
Bottled milk (TAS)												100	
Butter													17[a]
Cheese (non-leviable)													9[b]
Cheese (leviable)													19[c]
Skim milk powder													4[a]
Casein													2[a]
Whole milk powder													7[d]
Other milk products													42[e]
Meat cattle	21	18	19	16	24	30							

1 Figures in the table denote the commodity composition of each industry's production expressed in percentages and sum to 100 down each column. For example, 17 per cent of the output by value of the manufactured milk industry is butter and 7 per cent is whole milk powder.

2 Australian States are denoted as follows: New South Wales (NSW); Victoria (VIC); Queensland (QLD); South Australia (SA); Western Australia (WA); and Tasmania (TAS).

3 The letters a,b,c,d and e denote the five production processes allowed for in the manufactured milk industry. Producers in that industry are assumed to adjust their output mix between these processes in response to changes in the relative prices received from the processes. The commodities butter, skim milk powder and casein are assumed to be produced in fixed proportions in the one manufacturing process.

SOURCE: IAC (1983), p. 201.

Table 2 : Demand Linkages Within the Dairy Sector of ORANI-MILK[a]

Commodity/Industry[b]	Farm Milk Sector[b]						Market Milk Sector[b]						Manufactured milk	29 other industries	Household consumption	Exports
	NSW	VIC	QLD	SA	WA	TAS	NSW	VIC	QLD	SA	WA	TAS				
Farm milk (NSW)							64						32		4	
Farm milk (VIC)								20					74		6	
Farm milk (QLD)									68				25		7	
Farm milk (SA)										68			25		7	
Farm milk (WA)											83		13		4	
Farm milk (TAS)												24	67		9	
Bottled milk (NSW)													2		98	
Bottled milk (VIC)													3		95	2[c]
Bottled milk (QLD)													2		98	
Bottled milk (SA)													3		97	
Bottled milk (WA)													2		98	
Bottled milk (TAS)													5		95	
Butter													13	4	50	33
Cheese (non-leviable)														1	99	
Cheese (leviable)													41	5	27	27
Skim milk powder													9	11	33	47
Casein													11	23		66
Whole milk powder													3	6	23	68
Other milk products													51	8	36	5

a Figures in the table denote sales percentages of domestically produced commodities and sum to 100 across each row. For example, row 1 indicates that 64 per cent of the total sales of Farm milk (NSW) is absorbed by the NSW bottled milk industry and 32 per cent is used for manufacturing.

b Australian States are denoted as follows: New South Wales (NSW); Victoria (VIC); Queensland (QLD); South Australia (SA); Western Australia (WA); and Tasmania (TAS).

c Australian Bureau of Statistics data indicate a small amount of exports of bottled milk. These exorts have been allocated to Victoria.

SOURCE: IAC (1983), p. 202.

prices be captured.

To illustrate the underlying economic mechanisms the effects of (a) removing current assistance arrangements and (b) adding the new assistance arrangements, were simulated separately. Under current arrangements the producer receives an equalised return from domestic and export sales with domestic sales taxed to support export subsidies. The shock in (a) was derived by calculating the extent to which the set of existing domestic taxes raised the prices of each dairy product to consumers, and the extent to which export subsidies on each product increased the prices received by producers. The Commission's recommendations of a uniform tax on all milk to finance a uniform 20 per cent subsidy on all dairy products were simulated by increasing the farm gate milk prices in each State by the extent of the required levy and by manipulating the model's export subsidy variables to increase the prices received by exporters of dairy products by 20 per cent.

Some results for the short-term[18] are shown in Table 3. They indicate negligible macroeconomic effects, only a slight though differential impact across States on dairy farm incomes, and significant compositional changes in the production, household consumption and exports of dairy products. Under existing arrangements, exports of the 'other milk products' category are heavily penalised by export subsidies to butter, leviable cheeses and skim milk powder especially, while household consumption of skim milk powder and whole milk powder is penalised relative to bottled milk. Farm incomes and labour demands in the Victorian and Tasmanian milk cattle industries increase moderately at the expense of those in other States. The output boost to manufactured dairy products from the removal of the domestic taxes on these products exceeds their output reductions resulting from the uniform levy on all milk. Victoria and Tasmania sell a greater share of

---

18 Key macroeconomic assumptions underlying the short term (considered to represent an adjustment period of about two years) are: (i) fixed capital and land in each industry with the farm owner-operator considered part of the capital stock in farm-based industries; (ii) a demand determined hired labour market with a constant real wage for all occupations; (iii) a fixed level of real domestic absorption with changes in real GDP reflected in changes in the balance of trade; and (iv) a fixed nominal exchange rate with changes in international competitiveness reflected in changes in the domestic price level relative to world prices.

Table 3 : Some Short Term Adjustment Implications of the Commission's Assistance Recommendations for the Dairy Industry[a]

Variable	Removal of current assistance			Addition of recommended assistance		
	Removal of export subsidies (1)	Removal of domestic tax (2)	Total effect[b] (3)	Addition of export subsidies (4)	Levy on all milk (5)	Net effect[b] (6)=(3)+(4)+(5)
Macroeconomic Variables						
Real GDP	0.10	0.05	0.15	-0.12	-0.01	0.02
Aggregate employment (hrs)	0.14	0.06	0.20	-0.17	-0.01	0.03
Index of consumer prices	-0.82	-0.21	-1.03	0.95	0.00	-0.07
Aggregate imports	-0.41	-0.07	-0.48	0.47	-0.00	-0.01
Aggregate exports	0.34	0.20	0.54	-0.33	-0.04	0.16
Balance of trade ($m)	107	37	144	-114	-6	24
Economy-wide real wage	0.00	0.00	0.00	0.00	0.00	0.00
Industry Outputs[c]						
Manufactured dairy products	-7.6	1.2	-6.4	8.1	-0.9	0.8
Industry Employment						
Milk cattle (NSW)	-17	-5	-22	21	-3	-3
Milk cattle (VIC)	-43	4	-39	47	-5	2
Milk cattle (QLD)	-13	-6	-19	18	-3	-4
Milk cattle (SA)	-13	-5	-18	17	-3	-4
Milk cattle (WA)	-7	-7	-14	11	-2	-5
Milk cattle (TAS)	-35	2	-33	39	-5	1
Manufactured milk	-10	2	-8	10	-1	1
Net Farm Income[d]						
Milk cattle (NSW)	-32	-10	-42	41	-6	-6
Milk cattle (VIC)	-81	7	-74	89	-10	5
Milk cattle (QLD)	-26	-11	-36	34	-5	-7
Milk cattle (SA)	-25	-10	-36	34	-6	-8
Milk cattle (WA)	-14	-13	-27	22	-4	-9
Milk cattle (TAS)	-67	4	-63	74	-9	3
Milk cattle (AUS)	-55	-1	-57	64	-8	-1
Commodity Outputs						
Butter	-21	3	-18	8	-1	-11
Cheese (non-leviable)	-13	-13	-25	5	-1	-21
Cheese (leviable)	-22	4	-18	8	-1	-11
Skim milk powder	-21	3	-18	8	-1	-11
Whole milk powder	3	5	8	8	-1	15
Casein	-21	3	-18	8	-1	-11

Other milk products	6	1	7	8	-1	15
Farm milk (NSW)	-1.9	-0.6	-2.4	2.4	-0.3	-0.4
Farm milk (VIC)	-4.9	0.4	-4.5	5.4	-0.6	0.3
Farm milk (QLD)	-1.5	-0.6	-2.1	2.0	-0.3	-0.4
Farm milk (SA)	-1.5	-0.6	-2.1	2.0	-0.4	-0.5
Farm milk (WA)	-0.8	-0.7	-1.5	1.3	-0.2	-0.5
Farm milk (TAS)	-3.9	0.3	-3.7	4.4	-0.5	0.2
Exports						
Butter	-67	8	-59	26	-3	-36
Cheese (leviable)	-94	-2	-96	32	-3	-66
Skim milk powder	-74	-17	-91	33	-3	-61
Whole milk powder	10	-12	-2	16	-2	12
Casein	-31	5	-26	12	-1	-16
Other milk products	189	27	216	131	-5	342
Household Consumption of Domestic Products[e]						
Butter	3	1	4	-2	-0	2
Cheese (non-leviable)	-13	-13	-26	5	-1	-21
Cheese (leviable)	21	15	36	-11	0	25
Skim milk powder	41	34	75	-22	1	53
Whole milk powder	-17	56	39	-10	1	31
Other milk products	-1	-3	-4	-6	-0	-10
Bottled milk (Australia)	1	-2	-0	-1	-0	-1
Imports[f]						
Butter	-51	0	-51	38	-0	-13
Cheese (non-leviable)	-39	-24	-62	30	-0	-32
Cheese (leviable)	-47	1	-45	40	-0	-5
Skim milk powder	-34	2	-31	39	-0	7
Whole milk powder	-29	19	-9	21	1	13
Casein	-8	0	-8	37	-0	29
Other milk products	-20	-2	-22	34	-0	11

a All results are expressed as percentage changes except for the balance of trade which has the units millions of 1977-78 Australian dollars at the 1977-78 exchange rate with the US dollar.
b Column sum results are subject to apparent errors due to rounding of results for individual components.
c Note that the output projection for each state milk cattle industry is the same as the output projection for the corresponding farm milk commodity. Each milk cattle industry produces milk and dairy cattle for slaughter in fixed proportions.
d Calculated as an appropriately weighted sum of the returns to labour, capital and land employed in the industry. The result for Australia as a whole is a weighted sum of the state results.
e Casein is not consumed directly by households.
f Note that base period imports for butter, skim milk powder, whole milk powder and casein are less than $2m (1977-78).

SOURCE: IAC (1983), p. 209.

their production to manufacturing milk than is the case with the other States.

3.2 Analysis of Tariff Options for Chemicals and Plastics[19]

In this inquiry the Commission was asked to advise on options available to the Government to improve the competitiveness and efficiency of the chemicals and plastics industries in ways which would enhance their contribution to the economy. The Commission considered that growth and development of these industries should be determined by market-based incentives. Its emphasis was therefore on the reform of existing government interventions, the main one being the tariff. Current ad valorem tariff rates range from zero to 45 per cent, with wide disparities in rates between similar goods. The Commission considered reductions in high levels of protection and a narrowing in assistance disparities to be prerequisites to increasing the competitiveness and efficiency of the chemicals and plastics sector.

ORANI-CHEM, a detailed model of chemicals and plastics production and sales, was constructed in order to evaluate the short and longer term implications for component parts of chemicals and plastics, and for the economy as a whole, of reform of the tariff structure for these activities. This model divides production in the economy into 55 industry groups producing 57 commodity categories. Thirty of these industry and 32 commodity categories refer to chemicals and plastics. The disaggregation was chosen to capture the effects of the existing disparate tariff rates within chemicals and plastics. Products with widely different tariff rates were identified separately. In addition, different product processes, different production streams (e.g., inorganic, petrochemical-organic) and different stages in the production chain were explicitly modelled.

The commodity and industry sectors distinguished in ORANI-CHEM are listed in Table 4. Each commodity category is classified according to its position in the production chain. The classification A denotes petrochemical feedstocks and other raw materials (petroleum and coal

19 A detailed account of the Commission's applied general equilibrium modelling work for this inquiry is contained in IAC (1986b).

products, natural gas, etc.). Classification B denotes basic intermediates (olefines, aromatics, and various organic and inorganic chemicals). Classification C denotes derivative intermediates (resins, polymers and various organic and inorganic chemicals) more advanced in the production chain. Classification D denotes plastic and rubber products while E denotes chemical products. Eight of the industries are modelled as producing either multiple products in fixed proportions or products also produced by other industries. For example the petrochemical complex represented by industry 3 (Botany olefines) produces petroleum products, olefines and aromatics, polyethylene and polypropylene. All these products are also produced by a second petrochemical complex (Altona).[20]

The input-output (IO) database for ORANI-CHEM was constructed by updating the Australian 1978-79 IO tables[21] to 1983-84 using data from the manufacturing census and other sources, then incorporating information on the input cost structure and sales disposition for each of the categories distinguished in Table 4. This information was supplied by firms and industry associations in response to a specially designed questionnaire. Firms also assisted in the specification of model parameters, particularly import substitution elasticities.[22]

The model was used to analyse the effects of four tariff options. These are: (a) ceiling 15, the Commission's preferred option, a tops-down tariff reform in which all general rates which exceed 15 per cent are reduced to 15 per cent; (b) ceiling 20 in which all general rates exceeding 20 per cent are reduced to 20 per cent; (c) broad-banding around three tiers - 2 per cent for petrochemical feedstocks and other raw materials, 15 per cent for plastic and rubber products, chemical products, synthetic resins, and other final derivative basic chemicals and 5 per cent for all other products under reference; and (d) uniform 15, a uniform general rate of 15 per cent on all products.

---

20 The two petrochemical complexes use different feedstocks and hence produce different proportions of those products.

21 This is the latest year for which IO tables are available in Australia.

22 Firms were asked to assess the changes in quantities of imports and domestic commodities in response to specified changes in relative prices. From these estimates values for the import substitution elasticities were deduced. The values used are shown in Table 4.

Table 4 : Commodities and Industries Distinguished in the ORANI-CHEM Model

Relationship to ABS Input-Output sector[a]	Commodity/Industry	Commodity number	Industry number	Industry value added as a percentage of total value added of chemical and plastics activities[b]	Position in the production chain	Import substitution elasticities	
						Short term	Longer term
	Rural	1	1			1.7	2.6
27.08	Petroleum, coal products	2	2		A	0.4	0.6
27.02	Olefines, aromatics[c]	3			B	10	10
27.02	Polyethylene[d]	4			C	25	25
27.02	Polypropylene	5			C	25	25
27.02	Ethylene oxide derivatives	6			C	25	25
27.02	Caustic soda	7			B	15	15
27.02	Polyvinyl chloride	8			C	25	25
27.02	Botany olefines		3				
27.02	Botany other[e]		4				
27.02	Altona		5				
27.02	Polyvinyl chloride (Victoria)		6				
27.02	Other organic (current tariff >15)[f]	9	7	3.8	B,C	15	15
27.02	Other organic (current tariff <15)	10	8	0.9	B,C	1	1
27.02	Other inorganic (current tariff >15)[g]	11	9	2.9	B,C	10	10
27.02	Other inorganic (current tariff <15)[h]	12	10	5.5	B,C	0.5	0.5
27.02	Styrene monomer	13	11		B	25	25
27.02	Synthetic rubber	14	12		C	25	25
27.02	Styrene resins[i]	15	13		C	25	25
27.02	Other resins (current tariff >15)[j]	16	14	4.2	C	25	25
27.02	Other resins (current tariff <15)	17	15	0.5	C	1	1
27.02	CSRC[k]	18	16		B,C	25	25
27.02	Soda ash	19	17		B	15	15
27.04	Pharmaceuticals and veterinary products[l]	20	18			2	2
27.04	Pesticides	21	19	2.2	E	1	2
27.05	Detergents	22	20	4.3	E	3	5
27.05	Soaps & toothpaste, etc	23	21	2.5	E	2	3
34.03	Pipes & fittings, conduit	24	22	2.5	D	2	2
34.03	Blow moulding	25	23	4.6	D	1	1
34.03	Other moulding	26	24	11.3	D	4	4
34.03	Extruded profiles, hose	27	25	1.0	D	5	5
34.03	Extruded films, bags	28	26	4.8	D	7	7
34.03	Extruded sheet, floor tiles	29	27	2.7	D	7	7
34.03	Vinyl calendered and coated film/sheet	30	28	1.3	D	7	7
34.03	Cellular plastics[m]	31	29	2.5	D	0.5	0.5
34.03	Reinforced and other plastics[n]	32	30	4.9		3	3
27.03	Paints	33	31	6.3	E	2	3

27.06	Cosmetics and toilet preparations	34	32	5.1	E	2	3
27.07	Other chemical products[p]	35	33	9.1	E	2	3
27.01	Chemical fertilisers	36	34		B	1.7	2.5
	Metallic ores, coal	37	35			0.5	0.7
	Oil and gas	38	36		A	0.5	0.7
	Other minerals	39	37		A	2	3
	Export food products[q]	40	38			0.5	0.7
	Non-export food products	41	39			2.2	3.3
	Textiles, clothing and footwear	42	40			3.1	4.6
	Wood, wood products	43	41			2	2.9
	Bags and containers	44	42			1.1	1.7
	Paper, paper products, printing	45	43			1.3	2.0
	Glass, clay, concrete	46	44			1	1.5
	basic metals[r]	47	45			0.8	1.3
	Metal products	48	46			1.8	2.7
	Motor vehicles	49	47			5.2	7.8
	Machinery equipment, other mfg	50	48			0.9	1.4
34.02	Rubber products	51	49		D	1.5	2.3
	Utilities	52	50			0	0
	Housing, building and construction	53	51			0	0
	Wholesale & retail trade, repairs	54	52			0	0
	Transport	55	53			1.3	2
	Business and private services	56	54			0	0
	Government services	57	55			0	0

a The ORANI-CHEM chemical and plastics industries are derived from the following ABS Input-Output Industries: 27.02 (Other basic chemicals); 27.03 (Paints); 27.04 (Pharmaceuticals, veterinary products and pesticides); 27.05 (Soap and other detergents); 27.06 (Cosmetics and toilet preparations); 27.07 (Other chemical products); 34.03 (Plastic and related products). See ABS, (1984).

b Entries for some industries are not given for reasons of confidentiality.

c Olefines and aromatics include ethylene, propylene, butadiene, benzene, toluene and xylene.

d Includes high density, low density, and linear low density polyethylenes.

e Includes chloralkali, vinyl chloride monomer, polyvinyl chloride, ethylene and derivatives, polyethylene oxide derivatives, carbon tetrachloride and perchlorethylene.

f Includes organic pigments, alkyl benzene, organic surfactants, hydrocarbon solvents, carbon tetrachloride, perchlorethylene, PO derivatives, acetone, phenol, formaldehyde, and other items.

g Includes phosphoric acid, STPP and other phosphates, titanium dioxide pigments, inorganic pigments, and other items.

h Includes sulphuric and other inorganic acids, industrial gases, and other items.

i Includes polystyrene, acrylonitrile butadine styrene, expanded polystyrene and styrene butadiene latex.

j Includes alkyd, amino, phenolic and unsaturated polyester resins and acrylic emulsions.

k Products produced by CSRC, including oxo alcohols, phthalic anhydride, phthalate plasticisers, acetic acid and vinyl acid.

l Only a small proportion is under reference.

m Includes flexible foam and rigid cellular plastics.

n Includes fibreglass re-inforced plastics, plastic tape, non-vinyl calendered and coated goods, and other plastic and related goods not elsewhere classified. Many items in this category are treated as textiles for the purposes of the Tariff. The proportion of activity in this category which is under reference is uncertain.

p Includes explosives, inks, adhesives, waxes, polishes and creams, gelatin and many other items.

q Includes all sales, both export and domestic, of meat products and sugar.

r Includes alumina.

SOURCE: IAC (1986b), Volume 2, p. 360.

Table 5 : Effects in the Short Term of Each Option on Net Value of Production (Value Added) and Labour Demand[a]

Industry	Value added $m 1983–84	DC		(a) Ceiling 15	
		Value added	Labour demand	Value added	Labour demand
Botany olefines, polypropyelene, polyethylene	b	- 4	- 3	-19	-15
Botany other	b	- 5	- 4	-25	-19
Altona	b	- 6	- 4	-23	-15
Polyvinyl chloride (Victoria)	b	-11	- 9	-43	-36
Other organic (current T>15)	b	0	0	-13	-11
Other organic (current T<15)	b	0	0	- 2	- 1
Other inorganic (current T>15)	b	0	0	- 7	- 5
Other inorganic (current T<15)	b	0	0	- 1	- 1
Styrene monomer	b	0	0	-26	-20
Synthetic rubber	b	- 8	- 7	-15	-13
Styrene resins	b	- 1	0	-19	-15
Other resins (current T>15)	b	1	1	-17	-14
Other resins (current T<15)	b	1	0	- 2	- 2
CSRC	b	-10	- 8	- 5	- 4
Soda ash	b	0	0	- 4	- 4
Basic industrial chemicals	887	-2.2	- 1.6	-15.0	-11.1
Pesticides	57	0	0	0	0
Detergents	110	- 1	0	1	1
Soaps, toothpaste, etc	63	0	0	0	0
Paints	159	0	0	0	0
Cosmetics, toiletries, etc	130	0	0	0	0
Other chemical products	230	0	0	0	0
Chemical products	749	0.1	0.1	0.3	0.3
Pipes, fittings, conduit	64	0	0	0	0
Blow mouldings	117	0	0	0	0
Other mouldings	286	0	0	- 3	- 2
Extruded profiles, hose	25	- 1	- 1	- 3	- 3
Extruded films, bags	123	- 3	- 3	- 6	- 6
Extruded sheet, floor tiles	69	- 4	- 3	- 6	- 5
Calendered and coated	32	- 4	- 3	- 7	- 6
Cellular plastics	64	0	0	0	0
Reinforced and other plastics	125	0	0	- 2	- 2
Plastic products	905	- 0.7	- 0.5	- 2.7	- 2.2
Total chemicals and plastics	2,541	- 1.1	- 0.5	- 6.2	- 2.9
Selected other sectors					
Rural	12,300	0.1	0.1	0.4	0.3
Metallic ores, coal	5,300	0.2	0.1	0.8	0.5
Oil and gas	740	- 0.7	- 0.5	- 2.8	- 2.0
Export food	2,300	0.1	0.1	0.4	0.4
Motor vehicles	2,200	0.1	0.1	0.6	0.5
Basic metals	4,000	0.1	0.1	0.9	0.5
Rubber products	390	0.1	0.1	0.3	0.3
Economy-wide measures					
Real GDP (per cent)	178,000	0.00		0.02	
Aggregate employment (persons)	6,000,000		-400		2,400

a All projections are in percentage changes from the levels they would have reached in the absence of changes in
b Value added, or net value of production, is not provided for the basic industrial chemicals industries because

SOURCE: IAC (1986b), Volume 2, p. 379.

in Chemicals and Plastics Sectors (per cent)

(b) Ceiling 20		(c) Broad-banding		(d) Uniform 15	
Value added	Labour demand	Value added	Labour demand	Value added	Labour Demand
-13	-11	-19	-15	-14	-12
-19	-15	-27	-21	-27	-21
-17	-11	-23	-15	-24	-15
-32	-27	-43	-36	-44	-37
- 8	- 6	-17	-14	- 6	- 4
- 1	- 1	- 2	- 1	11	8
- 3	- 2	-14	-10	- 2	- 1
0	0	- 2	- 1	3	3
-17	-13	-31	-23	-35	-27
- 7	- 6	-15	-13	-27	-23
-11	- 9	-17	-14	-23	-19
-15	-12	-17	-14	-22	-18
0	0	- 2	- 2	1	1
7	6	- 4	- 4	-10	- 8
0	0	-13	-11	- 4	- 3
-10.2	- 7.5	-16.5	-12.2	-13.9	-10.3
0	0	0	0	0	0
1	1	1	1	1	1
0	0	0	0	2	1
0	0	1	0	1	1
0	0	0	0	- 1	- 1
0	0	2	2	2	1
0.4	0.4	1.0	0.8	0.8	0.7
0	0	0	0	0	0
0	0	0	0	0	0
0	0	- 3	- 2	- 4	- 3
- 2	- 2	- 3	- 3	- 4	- 3
- 2	- 2	- 6	- 6	- 6	- 6
- 2	- 2	- 6	- 5	- 7	- 6
- 2	- 2	- 7	- 6	- 7	- 6
0	0	0	0	0	0
1	1	- 2	- 2	- 3	- 3
- 0.5	- 0.4	- 2.7	- 2.2	- 3.4	- 2.7
- 3.7	- 1.5	- 6:5	- 3.0	- 5.9	- 2.9
0.2	0.1	0.4	0.3	0.3	0.2
0.5	0.3	0.8	0.6	0.6	0.4
- 2.1	- 1.5	- 3.0	- 2.1	- 2.9	- 2.1
0.2	0.2	0.4	0.4	0.2	0.2
0.3	0.3	0.6	0.5	0.3	0.3
0.6	0.3	1.1	0.6	0.7	0.4
0.2	0.2	0.3	0.3	- 0.1	- 0.1
0.02	1,800	0.02	2,500	- 0.04	-3,300

the assistance arrangements for chemicals and plastics.
many of the data are confidential.

In deriving the tariff changes, consideration had to be given to the operation of current tariff preferences to imports sourced from developing countries (DCs). In some instances, the preference tariff from DCs was considered to be the operative tariff rather than the specified general tariff. A further complication concerned the Government's stated intention to replace the existing DC scheme in July 1986 with a scheme which provides a uniform preference margin of 5 percentage points. The effects of this change were modelled separately.

Table 5 contains model projections of the short term effects of each option and the announced changes to DC preferences on profitability (measured by real net value of production) and employment demand. While substantial adjustment pressures are projected on parts of basic industrial chemicals, especially at the top end of the production chain, the effects for chemicals and plastics as a whole are projected to be minor under all options.

Under the Commission's preferred option the Victorian PVC industry is projected to suffer the largest profitability squeeze. PVC is particularly sensitive to import competition and would receive a large reduction in its tariff. Unlike many chemicals and plastics which receive a cost benefit due to reduced tariffs on their inputs, Victorian PVC uses imported vinyl chloride monomer, the tariff on which will remain constant under the Commission's recommendations. The petrochemical complexes are projected to suffer considerably. While their immediate products (ethylene, propylene, butadiene) are not subject to import competition, their profitability is heavily dependent on demands for the final products which experience a reduction in their protection against imports.

The model was also used to place a perspective on the projected adjustment pressures from tariff reform by comparing them with the effects of other changes in the economic environment, in particular the very large nominal and real devaluation of the Australian dollar which occurred during the inquiry. Projections of the required devaluation to offset the effect on the profitability of basic industrial chemicals, the hardest hit sector, of the ceiling 15 tariff option indicated a nominal devaluation of about 30 per cent (zero money wage indexation) to about 50 per cent (50 per cent money wage indexation) would be

required. These results suggested that the real devaluation which occurred between January 1985 and May 1986 would have provided a boost to the profitability of this part of chemicals and plastics almost equal to the adverse effects projected to follow from the implementation of the Commission's preferred tariff option.

Longer term projections were also derived from the model. The Commission considered that output volumes and capital employed in basic industrial chemicals activities, which are extremely capital intensive, would probably remain constant for a considerable period despite the increased competition from imports. Model projections indicated the extent to which unit production costs would need to be reduced to allow basic industrial chemicals activities to maintain their output in the reduced assistance environment. Additional information on firm structure and performance was then used to assess the scope for achieving cost reductions of the order indicated.

3.3 Effects of Assistance and Other Factors on Agricultural Competitiveness

In an inquiry into whether assistance should be provided for the consumption and production of fertilisers in Australia,[23] the Commission was asked to comment on current levels of assistance to the rural sector relative to that of other sectors together with other factors affecting agricultural competitiveness.[24] The standard ORANI model was used to address these issues. Because of its quite detailed treatment of agriculture and the broad nature of the instruments under investigation, the standard model was adequate for this exercise.

Table 6 contains short term[25] projections for industry output and income of the removal of measured assistance to agricultural and manufacturing

---

23 See IAC (1985).

24 For a detailed general equilibrium-based study of the effects on agriculture of a range of economic shocks originating outside the sector see Higgs (1986).

25 The short term environment in Table 6 assumes that capital and land used in each industry remain constant. It also assumes that wages in the economy are fully indexed to the consumer price index (that is, constant in real terms) and that real absorption in the economy adjusts to maintain the balance of trade at its level before the removal of assistance.

industries. Nominal assistance rates for manufacturing industries refer to 1982-83. They include tariffs and the tariff equivalents of import restrictions. Measured agricultural assistance includes that provided by home consumption price schemes, export inspection services, tariffs, adjustment assistance, research funding, concessional credit, income tax concessions and fertiliser subsidies. Effects of removing assistance to the rural sector are simulated for both 1981-82 and 1982-83. The 1981-82 rate is more representative of the rate for the last decade.[26] The effects of removing assistance to manufacturing and to agriculture are shown separately. This allows an assessment of the extent to which assistance provided agriculture offsets the effect on agricultural performance of assistance provided manufacturing. The removal of assistance to manufacturing while maintaining assistance to agriculture is projected to increase real output of the agricultural sector as a whole by 5 per cent and the real net value of agricultural production by 13 per cent. Rural industries most dependent on exports (the mixed farming industries of the pastoral, wheat-sheep and high rainfall zones producing wool, grains and beef cattle, the northern beef industry, and the sugar cane dominated other farming export sector) benefit most. Industries with greater reliance on the domestic market for their sales benefit less. The cost burden on agriculture of assistance to manufacturing appears, in the short term, to be roughly twice the magnitude of the boost to agriculture provided by agricultural assistance at 1981-82 levels. Assistance to agriculture for 1982-83 goes close to offsetting the effects on agriculture of assistance to the manufacturing sector.

The international competitiveness of Australian agriculture is affected by many factors in addition to assistance provided manufacturing industries. These include management of the macroeconomy with respect to wages, government expenditure and exchange rate policy, and world commodity prices. As part of the analysis for the Fertiliser report, the model was used to assess the relative contribution of each of the above factors to agricultural competitiveness. For comparison, an assessment of the effects of changing the price of fertilisers was also

---

26 Disaster relief from the 1982 drought and lower export prices for some products resulted in a much higher rate of assistance to agricultural activities for 1982-83.

Table 6 : Projections of the Short Term Effects on Agriculture of the Removal of Industry Assistance[a]

Variable	Removal of assistance to manufacturing (2)	Removal of assistance to agriculture		Removal of assistance to manufacturing and agriculture	
		1981-82 assistance (2)	1982-83 assistance (3)	1981-82 assistance to agriculture (4)	1982-83 assistance to agriculture (5)
Output					
Pastoral zone	4.4	-2.5	-2.8	1.9	1.6
Wheat-sheep zone	3.9	-2.2	-2.9	1.7	1.0
High rainfall zone	5.5	-2.7	-3.3	2.8	2.2
Northern beef	9.0	-3.4	-5.2	5.6	3.8
Milk cattle and pigs	3.1	-2.1	-2.9	1.0	0.2
Other farming export (sugar cane, fruit)	9.1	-2.6	-6.8	6.5	2.3
Other farming (vegetables, cotton, oilseeds, tobacco)	2.4	-6.3	-6.4	-3.9	-4.0
Poultry	4.5	-2.2	-2.9	2.3	1.6
All agriculture[c]	5.0	-2.8	-4.0	2.2	1.0
Real Net Value of Production[b]					
Pastoral zone	12.3	-6.9	-7.8	5.4	4.5
Wheat-sheep zone	13.7	-8.0	-10.0	5.7	3.7
High rainfall zone	15.0	-7.4	-9.1	7.6	5.9
Northern beef	28.2	-10.8	-16.6	17.5	11.6
Milk cattle and pigs	7.3	-5.0	-6.8	2.3	0.5
Other farming export (sugar cane, fruit)	17.6	-5.1	-13.1	12.4	4.5
Other farming (vegetables, cotton, oilseeds, tobacco)	3.8	-9.9	-10.1	-6.2	-6.3
Poultry	10.6	-5.0	-6.7	5.5	3.9
All agriculture[c]	13.0	-7.2	-9.9	5.8	3.1

a All projections are percentage deviations from the value the variable would have taken in the absence of any change in assistance after an adjustment period of about two years.
b Represents real returns to land, capital and labour (both hired and that of the owner-operator).
c Represents a weighted average of results for the eight agricultural industries.

SOURCE: IAC (1985).

included. The results shown in Table 7 were derived from a short-run version of ORANI in which changes in the international competitiveness of the economy as a whole arising from the above factors are assumed to be reflected in changes in the balance of trade. To facilitate the comparison of effects, the size of each change has been standardised to cause the same effect on the real net value of production of agriculture. They indicate that an improvement in agricultural competitiveness sufficient to raise the real net value of agricultural production by 1 per cent could be achieved by: (i) a uniform 6.1 per cent cut in assistance to manufacturing; (ii) a 0.2 per cent reduction in real wages throughout the economy; (iii) a 5.1 per cent reduction in real government expenditure; (iv) a 3.1 per cent increase in international prices of all Australian agricultural export commodities; a 0.6 per cent devaluation of the exchange rate (assuming zero wage indexation), a 0.7 per cent devaluation (assuming 30 per cent wage indexation) and an 11 per cent devaluation (assuming 70 per cent wage indexation); and an 18.1 per cent reduction in the price of all fertilisers.

These results were useful in demonstrating that the fertiliser subsidy (which at the time represented only 6 per cent of the average user price) is a relatively unimportant determinant of agricultural competitiveness.

3.4 Macroeconomic Adjustment to a Decline in the Foreign Terms of Trade[27]

This work grew out of a request to the Commission by the Australian Treasury to estimate, using the ORANI model, the effect of the recent (calender year 1985) devaluation of the Australian dollar on the general price level under alternative assumptions concerning the degree of wage indexation.[28] Amongst other things, the results pointed to a significant improvement in the trade balance in the short term from the

---

27 The relevant paper describing this work is Fallon and Thompson (1986).

28 Australia has a centralised wage fixing system under the control of the Arbitration Commission. Information on the consumer price effects of exchange rate changes is used as input into the wage deliberations of the Arbitration Commission.

Table 7 : Size and Effects of Selected Changes Required to Increase the Real Net Value of Agricultural Production by One Per Cent in the Short Term[a]

	6.13 per cent across the board decrease in tariffs on manufacturing industries (i)	0.21 per cent reduction in real wages (ii)	5.12 per cent reduction in real government expenditure (iii)	3.09 per cent increase in all world agricultural commodity prices (iv)	0.59 per cent devaluation of the exchange rate with zero wage indexation (v)	0.68 per cent devaluation of the exchange rate with 30 per cent wage indexation	1.08 per cent devaluation of the exchange rate with 70 per cent wage indexation	18.05 per cent reduction in the price of all fertilisers (vi)
Real Output								
Pastoral zone	0.33	0.36	0.36	1.17	0.36	0.36	0.36	0.23
Wheat-sheep zone	0.31	0.29	0.30	1.08	0.29	0.29	0.29	0.37
High rainfall zone	0.44	0.18	0.44	0.73	0.18	0.18	0.18	0.40
Northern beef	0.71	0.65	0.72	0.39	0.65	0.65	0.65	0.58
Milk cattle and pigs	0.24	0.23	0.22	0.00	0.23	0.23	0.23	0.15
Other farming export (sugar cane, fruit)	0.71	0.63	0.66	-0.13	0.63	0.63	0.63	0.62
Other farming (vegetables, cotton, oilseeds, tobacco)	0.18	0.23	0.08	-0.25	0.23	0.23	0.23	0.30
Poultry	0.35	0.32	0.35	0.05	0.32	0.32	0.32	0.24
All agriculture[b]	0.39	0.33	0.37	0.53	0.33	0.33	0.33	0.37
Index of agricultural costs[d]	-0.48	-0.44	-0.48	0.19	0.15	0.24	0.59	-1.15
Real Net Value of Production[c]								
Pastoral zone	0.99	0.99	0.99	0.61	0.99	0.99	0.99	0.64
Wheat-sheep zone	1.99	1.00	1.08	1.64	1.00	1.00	1.00	1.31
High rainfall zone	1.09	1.15	1.23	1.99	1.15	1.15	1.15	1.07
Northern beef	2.23	2.02	2.23	1.20	2.02	2.02	2.02	1.80
Milk cattle and pigs	0.57	0.58	0.53	0.0	0.58	0.58	0.58	0.35
Other farming export (sugar cane, fruit)	1.28	1.32	1.29	0.0	1.32	1.32	1.32	1.19
Other farming (vegetables, cotton, oilseeds, tobacco)	0.28	0.48	0.14	-0.30	0.48	0.48	0.48	0.47
Poultry	0.84	0.81	0.85	0.12	0.81	0.81	0.81	0.55
All agriculture[b]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

a All projections are percentage deviations from the value the variable would have taken in the absence of the change specified at the top of the respective column.

b Represents a weighted average of results for the eight agricultural industries.

c Represents real returns to land, capital and labour (both hired and that of the owner-operator).

d Includes all material inputs (domestic and imported) and the price of labour.

Changes (i), (ii), (iii) and (vi) affect agricultural competitiveness by reducing production costs relative to product prices. Changes (iv) and (v) operate by increasing product prices relative to production costs.

SOURCE: IAC (1985).

devaluation should less than full indexation of money wages be achieved. This improvement has not materialised despite a substantial decline in average real unit labour costs. The major reason is considered to be the severe decline in the foreign terms of trade which has occurred since mid 1985. Over the 18 months to the end of June 1986, this decline is assessed by Commission staff to be about 21 per cent.

The standard ORANI model was used to assess the impact of this terms of trade decline (expressed in foreign import and export price movements at the 114 sector level) on economic activity, employment demand and the balance of trade in the short term. The size of the real wage and real expenditure adjustments to accommodate the projected declines in aggregate employment demand and the balance of trade were then calculated. Some results are shown in Table 8.

They indicate that, assuming fixed real wages and real expenditure, the decline in the foreign terms of trade is projected (column (1)) to reduce real GDP by 4.1 per cent, reduce aggregate employment demand by 1.3 per cent and add 7.5 billion 1984-85 Australian dollars to the balance of trade deficit. The balance of trade decline could be arrested by a 5.5 per cent cut in real domestic expenditure, but with no real wage adjustment aggregate employment demand would fall by a further 1.6 per cent (columns (2) and (3)). On the other hand, arresting the balance of trade decline with no adjustment to real expenditure could be achieved by a very large (7.6 per cent) cut in real wages (column (4)). As column (5) shows this would significantly overcompensate for the reduction in employment demand associated with the terms of trade decline. Columns (6) and (7) indicate that reductions in real domestic expenditure of 3.4 per cent and real wages of 2.9 per cent would be required to compensate for the effects of the terms of trade decline on both the balance of trade and aggregate employment demand.

Table 8 : Projections of the Short Term Effects of the Decline in the Foreign Terms of Trade and the Real Wage and Real Expenditure Adjustments Needed to 'Accommodate' the Decline

	Terms of trade decline (1)	Expenditure adjustment to offset balance of trade effect (2)	Total (3)=(1)+(2)	Real wage adjustment to offset balance of trade effect (4)	Total (5)=(1)+(4)	Real wage and real expenditure adjustments to offset balance of trade and employment effects (6)	Total (7)=(1)+(6)
Real GDP	-4.1	-1.4	-5.5	4.1	0.0	0.7	-3.4
Aggregate employment	-1.3	-1.6	-2.9	6.1	4.8	1.3	0.0
Balance of trade	-7.5	7.5	0.0	7.5	0.0	7.5	0.0
Real domestic expenditure	0.0[b]	-5.5	-5.5	0.0[b]	0.0	-3.4	-3.4
Real wage	0.0[b]	0.0[b]	0.0[b]	-7.6	-7.6	-2.9	-2.9

a All projections are in percentage changes except the balance of trade which is in billions of 1984-85 Australian dollars.
b This value was set exogenously at zero.

SOURCE: Fallon and Thompson (1986).

Comparing these results with the real wage reduction achieved to date by partial wage discounting of the price effects of the devaluation suggests that a further cut in real wages may be necessary to correct for both the initial imbalance of the trade account existing at the start of 1985 and the deterioration caused by the recent sharp decline in the foreign terms of trade. Given the size of the foreign terms of trade decline it is therefore not surprising that a turnaround on the balance of trade has not to date been observed following the devaluation.

4 PROBLEMS ENCOUNTERED IN ANALYSING ECONOMIC POLICY ISSUES WITH ORANI

Each of the applications of the ORANI model to policy issues within the government sector suffers in some degree from the following:

(i) deficiencies in the data base and parameter file;

(ii) conflict between the basic theory and the real world situation;

(iii) specifying the problem statement; and

(iv) inability to measure resource use efficiency.

A number of these problems are accentuated by the Commission's need for considerable sectoral detail in its industry assistance work. The problems are considered in turn.

4.1 Data Base and Parameters

The standard ORANI model data base is derived from the official Australian IO tables.[29] From this data base model coefficients in the form of cost and sales shares are derived. Commission staff update the data base biennially as new IO tables are released. These tables are generally about seven years out of date, current tables being for 1978-79. In applications which refer to general policy issues such as that undertaken for the Fertiliser Inquiry, the absence of a more recent data base is not of major concern. However, in detailed industry policy work, the data base becomes more critical. Key aspects, particularly those relating to import shares of the domestic market,[30] are often found to differ substantially from those in the IO tables. As far as possible staff attempt to incorporate more recent information on import shares and other aspects of the data base. Because a complete update can never be undertaken the ad hoc procedure adopted is not particularly

29 See ABS (1984).

30 In ORANI, the import share of the domestic market is an important determinant of the effects of a given reduction in assistance on an industry's activity level and employment demand.

satisfactory.[31]

A second problem with the data base which invariably arises with industry modelling studies concerns the level of aggregation. Aggregation problems are often pointed out to the Commission by industry participants who find it difficult to reconcile their detailed understanding of the structure of one small part of an industry category with the information incorporated in the model on the structure of the category as a whole. Although as indicated by ORANI-MILK and ORANI-CHEM considerable inter-industry detail is often captured in industry studies, significant aggregation problems remain. In ORANI-CHEM, for example, some sectors contained activities protected by disparate tariff rates leading to aggregation bias in determining the effects of tariff changes. Despite its treatment of regional production at the State level and a detailed treatment of manufactured dairy products far in excess of that captured in other modelling studies of the Australian dairy industry, ORANI-MILK was criticised for its failure to distinguish different supply prospects in regions within States and its lack of a treatment of wet products with short shelf lives.

The great amount of sectoral detail incorporated in industry models such as ORANI-CHEM places onerous demands on parameter values as well as data. Because IO data is required at only one point in time, the data base to support the level of disaggregation can usually be found. It is too much to expect that econometrically based estimates of all the accompanying parameters will be available or could be estimated from the available data. In several recent inquiries, the Commission has supplemented the available parameter file with information provided by firms concerning how a particular part of their industry might respond if confronted with a particular set of relative price changes. The experience has indicated that firms can confidently indicate the extent of substitution likely to follow in both the short term and longer term form a shift in relative prices.

---

31 A further problem concerns transient influences in the data base which are not 'typical' of the structure of the economy in a 'normal' year. Where these are known to be large, an attempt is made to typicalise that part of the data base.

4.2 The Applicability of the Basic Theory

The aspect of the ORANI model's theoretical structure which is most frequently refuted by real world evidence concerns its treatment of prices. Key assumptions are that basic (i.e., ex-factory) prices are uniform across users and producers and that competitive conditions exist in all economic activities - producing, importing, exporting, and transporting (margins), etc. Contradictions to these assumptions are often observed. In some cases it is possible to adjust the model to capture an alternative form of behaviour.[32] In others it is not.

On occasions projections derived from the model under the assumption of competitive behaviour although incorrect, play the valuable role of drawing attention to the deviation from competitive conditions existing in a particular part of the economy. Consider for example the results in Table 5 from the ORANI-CHEM model. They indicate that the polyvinyl chloride (PVC) activity is projected to suffer the largest decline in short term profitability from the Commission's preferred tariff option (ceiling 15). Locally produced PVC, which competes strongly with imported PVC, faces a large reduction in its tariff (from 30 to 15 per cent). Furthermore, unlike other basic chemical activities it would not receive a direct cost benefit from reduced tariffs on inputs. Its main input, vinyl chloride monomer (which accounts for over 50 per cent of the value of production of PVC and is used solely for this purpose) has a tariff of only 2 per cent. Implicit in the ORANI-CHEM story is the assumption of competitive conditions in importing. However, evidence gathered by the Commission suggested that in response to a reduction in the tariff on its product, the PVC activity would be able to negotiate a cheaper price for imported vinyl chloride monomer, the supplier of which

---

32 In a reference currently before the Commission, the model is being used to simulate industry assistance provided via export concessions. These allow for a rebate of the duty on imported inputs when used in production for exports. The imported content of domestic sales of the same good is not subject to rebate. Hence the basic cost of the good sold domestically exceeds that of the good exported, which contradicts ORANI theory. The deviation in basic prices can, however, be incorporated by disaggregating the activity into two components, one solely exported and one solely for the domestic market with each component using the same production technology and capital stock. A duty rebate on the imported inputs to the export part can then be applied without affecting directly the cost of production of the domestic part.

was an overseas parent company. The model therefore was considered to overestimate the adjustment pressures likely to be experienced by the local PVC industry.

4.3 The Problem Statement

The Commission uses the ORANI framework for 'what if' policy analysis. Results are interpreted as showing by how much the economy would deviate from its control position in a future year as a result of the implementation in the base year of the recommended changes in assistance. The control position represents the ceteris paribus position of the economy in the projection year. In short run model applications it is assumed[33] that the model's base period data base (sometimes updated to include later information on import shares, etc) provides an adequate description of the production and sales structure of the ceteris paribus economy in the solution year about two years hence.

In some instances however, the Commission is asked to advise on assistance arrangements to be implemented at a future date in a situation where the arrangements already in place are likely to change significantly and thereby change the structure of the affected industries between the present and the time at which the recommendations are envisaged to take effect. This sequence of events occurred in two recent inquiries in which the ORANI framework was used, namely the inquiry into chemicals and plastics[34] and the inquiry into textiles, clothing and footwear.[35] In the case of chemicals the problem was a minor one, involving a government decision to replace the existing system of diverse (in terms of rate and country of origin) developing country preferences (DCPs) with a uniform preference rate of 5 percentage points on all developing country imports. Hence, the effects of the Commission's recommendations needed to be assessed using a benchmark assistance environment taking into account the effects of the new DC preference arrangements on operative tariffs.

---

33 This assumption is in most instances a reasonable one.
34 IAC (1986b).
35 IAC (1986a).

In the case of textiles, clothing and footwear, the problem was a good deal more important. Currently, import quotas are in place, the tariff equivalent of which changes over time according to changes in the real exchange rate and the rate at which quota volumes are increased relative to total domestic demand for the products concerned.

To obtain model projections of the effects of changing assistance arrangements at a future date requires knowing the tariff equivalent of the present protection regime at this future date. This necessitates taking a view about how factors such as the international competitiveness of the economy will evolve between the present and the solution year. In the Commission's analysis the problem was side stepped by defining the problem statement to assume a tariff equivalent of current arrangements in the solution year equal to that in the base year. It seems likely that the only way this type of problem will be satisfactorily overcome is by generating forecasts of the underlying growth path of sectors of the economy under existing and planned assistance arrangements.

4.4 Resource Use Efficiency

The Commission has interpreted the term efficiency in its guidelines to involve encouraging a sectoral allocation of a fixed resource base such that the real national income earned by this resource base is enhanced. In pursuing a more efficient allocation of the economy's resources, the Commission is guided by the principles of international trade theory. Its approach would, however, be a good deal more convincing[36] if it could demonstrate analytically that, once resources had responded fully to the adjustment pressures imposed on activities in the short term from its recommended assistance changes, the real income earned by the economy from the 'improved' allocation of resources exceeded that earned from the existing allocation.

---

36 With the government now requiring the Commission to specify a range of assistance options together with its preferred option, the need to demonstrate the efficiency implications of particular patterns of resource use has been brought more sharply into focus.

There have been significant improvements in long run modelling with ORANI achieved by the IMPACT research team in recent times.[37] These have centred on endogenising both the GNP (income accruing to Australians being taken as an appropriate measure of national welfare) and the GDP by modelling the extent of foreign ownership.[38] Despite these improvements, ORANI remains an unsuitable framework for assessing the longer term efficiency implications of economic changes.

Its unsuitability stems from deficiencies in two areas. Firstly, at the detailed industry level with which the Commission works the standard model does not allow a general treatment of substitution prospects between commodities in production and consumption.[39] Reducing or eliminating existing distortions in production and consumption is always a key aim of the Commission's recommendations on changes in assistance arrangements. Secondly, standard ORANI , being constructed around the traditional framework of international trade theory, does not incorporate key features of industrial organization such as imperfect competition and economies of scale[40] and scope thought to be important in determining the efficiency costs of protection.[41]

---

37 See Horridge (1985) for a complete description of the improved long run closure of ORANI.

38 Early long run closures with the model (for example, Vincent (1980)) lacked a satisfactory measure of national welfare. With land and labour assumed fixed in aggregate and the absolute real rate of return in the economy assumed to be given by the world rate in this closure, an increase in GDP resulted mainly from an increase in the aggregate capital stock. To the extent to which this was achieved by an inflow of foreign capital, the increase in GDP, by failing to take into account that rentals on foreign-owned capital would accrue to foreigners, would overstate the benefits accuring to Australians from the reform under study.

39 Implementing direct substitution effects in consumption via the nested utility approach of Clements and Smith (1983) has not always proved satisfactory.

40 Evidence collected during the inquiry into chemicals and plastics identified some heavily protected components of the sector in which production was concentrated in a few firms each unable to exhaust economies of scale. This evidence sits uncomfortably with the ORANI-CHEM model assumptions of perfect competition and constant returns to scale.

41 Harris (1984) has shown that the inclusion of industrial organization concepts such as imperfect competition and scale economies into the traditional applied general equilibrium framework can lead to significantly increased estimates of the welfare costs of protection.

Work is proceeding at the IMPACT Centre to correct both deficiencies. The creation of more flexible computer programs should allow the ready incorporation into detailed industry versions of ORANI a treatment of substitution prospects in production which is constrained only by the information base.[42]

Cory and Horridge (1985) have shown how scale economies and imperfect competition can be incorporated into a Harris-style miniature version of ORANI. Preliminary results suggest that the key factor determining the size of the welfare gains to the economy from a cut in protection is the degree of imperfect competition in the home market which in turn governs the extent to which firms reduce product prices in response to a decrease in the price of the imported equivalent. Considerably more research is required before this and other features of the industrial organization approach can be incorporated into a detailed industry version of ORANI of the type used in specific inquiries.

---

42 See Pearson (1986).

5 COMMUNICATION OF MODEL RESULTS

Because the applied general equilibrium models used by the Commission are large, and therefore appear complex to non-modellers, an important challenge facing the modeller is that of communicating the insights from the models to others involved in the policy advisory process. The communication challenge exists at three levels:

(i) between the modeller and other staff involved in the inquiry process;

(ii) between the modeller and Commissioners responsible for the policy recommendations of the inquiry; and

(iii) between the Commission and outside participants in the economic debate.

5.1 Communication at the Staff Level

At the staff level the ability to analyse economic issues using applied general equilibrium models is concentrated in the Economic Studies and Information Division.[43] Staff from this and other Divisions assist Commissioners in inquiries. There is invariably a difference in opinion between modellers and other staff concerning the role that modelling should play in particular inquiries. A present Commissioner has observed "the natural tendency of modellers to promote their models and ignore those characteristics of industries and markets which cannot be readily handled, and the equally natural tendency for those who deal with the details of particular firms and markets to carp about the needs for assumptions to be more realistic".[44] While it is always easy to identify what has been left out of a model it is a good deal more difficult to assess the extent to which the omitted factors, if

---

43 The Commission also has two Inquiry Divisions with responsibility for the preparation of inquiry reports and a Policy Co-ordination and Development Division responsible for determining the approach of the Commission to assistance issues, preparing the annual report and documenting assistance levels in each sector. Staff in these Divisions are generally not oriented towards quantitative economic modelling.

44 Mauldon, et al. (1980), p. 8.

included, would modify the initial conclusions.

The main way the staff to staff communications problem has been tackled has been through the organisation within the Commission of detailed training courses on the use and limitations of applied general equilibrium modelling for economic policy analysis. As a result of such courses, some progress has been made in broadening the understanding within the Commission of applied general equilibrium modelling techniques in analysing industry assistance issues. Nevertheless, when considering industry assistance issues, most Commission staff still feel more comfortable with partial equilibrium models, such as that provided by the effective rate of protection concept, than with the applied general equilibrium approach.

5.2 Communication at the Commissioner Level

As part of the inquiry process Commissioners hold on-site discussions with major interest groups. This enables them to obtain a first-hand assessment of the way the activities under reference operate and the issues of relevance to the inquiry. As a result Commissioners often develop firm opinions concerning the appropriate set of policy recommendations and their likely effects. There is a natural tendency to seek from model analyses analytical support for these opinions. In some instances this is forthcoming and the assurances provided by the model enhance the convictions with which the recommendations are made. In others, model results contradict firmly held opinions. In the process of reconciling model results with opinions both the reasons underlying the opinions and the assumptions underlying the model are brought sharply into focus. Both may be subsequently changed. Sensitivity analysis is sometimes called for to establish the robustness of model conclusions. The outcome is invariably a more structured and internally consistent set of arguments than if the model had not been used.

An example of the importance of a model in checking an assessment gained from discussions with industry representatives was provided in the inquiry into chemicals and plastics. A view was formed from these discussions that reduced tariffs on resin inputs would enhance the growth prospects of plastic product industries. This view was unable to

Table 9 : **Decomposition of the Longer Term Effects on Plastic Product Outputs of the Commission's Preferred Tariff Option for Chemicals and Plastics (per cent)[a]**

Plastic product	Effects on plastic product output of tariff changes for: Resin inputs	Own tariff	Other inputs	Total
Pipes, fittings, conduit	0.5	-0.3	0.0	0.2
Blow mouldings	0.1	0.0	0.0	0.1
Other mouldings	1.6	-3.6	0.1	-1.9
Extruded profiles, hose	2.3	-4.8	0.3	-2.2
Extruded films, bags	7.2	-11.2	0.2	-3.8
Extruded sheet, floor tiles	4.2	-8.3	0.1	-4.0
Vinyl calendered and coated	2.6	-7.6	0.2	-4.8
Cellular plastics	0.1	0.0	0.0	0.1
Reinforced and other plastics	1.2	-2.6	0.3	-1.1
Total plastic products	2.2	-4.1	0.1	-1.8

a The additional effects of the five percentage point preference margin for DCs are included in these results.

SOURCE: IAC (1986b).

take into account the full package of tariff changes recommended at the conclusion of the inquiry. The ORANI-CHEM model, by decomposing the effects on plastic products of various components of the package of tariff changes (Table 9) was able to show the extent to which tariff reductions on the product would negate and in some instances reverse the favourable effects of reduced tariffs on resins.

5.3 Communication of Model Results to the Wider Community

Model projections of the effects of changes in assistance arrangements are communicated to the wider community through published reports on each inquiry. In this way the Commission responds directly to the challenge issued by the supporters of industry protection of "tell us where the additional jobs will come from to compensate for jobs lost in protected activities". Model projections are often widely reported and assessed in the media. The analytical framework underlying them has also been subject to close scrutiny in the newspaper columns of economic feature writers as well as in the academic community.

While the Commission's economy-wide analytical approach has now found general acceptance amongst the academic community and most government agencies with economic policy responsibilities its acceptance level in the wider community is a good deal less.[45] A major reason concerns the difficulty non-economists have in comprehending the 'what if' or ceteris paribus framework in which the model is used when analysing proposed changes in assistance. For example, while there is a strong economic logic underlying the mechanisms whereby a reduction in assistance to say basic chemicals would, ceteris paribus, result in improved job prospects in export-oriented agricultural and mining activities, it is difficult to sell this message to a community well informed by the media of the severe adjustment problems currently being experienced by these activities because of depressed world prices for their products.

The importance of gaining a measure of acceptance in the general community that the benefits of reduced assistance to industries will outweigh the costs, should not be underestimated. Unless this can be achieved the rate of progress in lowering assistance is likely to be slow. To increase acceptance of the need for change requires that the community be thoroughly informed of the benefits and costs. Projections from the Commission's economy-wide modelling framework have over the years provided valuable insights into the means whereby policies which discriminate in favour of one sector of the economy are paid for by others. However, because these projections have abstracted completely from all other factors which influence the growth prospects of industry, they have been judged on occasions by important sections of the community to be not particularly relevant. Broadening the projections to include a treatment of how other influencing factors are likely to evolve may help increase the plausibility and hence level of community acceptance of model based projections of the effects of moving towards a less interventionist industry policy stance.

---

45 For example, in presenting his views on how to revitalise Australian industry, a prominent trade union leader recently asserted that: "One urgent and essential condition for rejuvenating Australia's manufacturing industry is for the disbanding of the Industries Assistance Commission in its present form and the destruction of the ORANI model". (Halfpenny (1986), p. 6.)

6 CONCLUDING REMARKS

The Commission has a statutory responsibility to consider the effects of its industry assistance recommendations on all other sectors of the economy in addition to directly affected sectors, and on community living standards. The applied general equilibrium framework is at present the most suitable analytical framework for undertaking this task. Applied general equilibrium modelling therefore forms an integral part of the Commission's evaluation of changes in industry assistance arrangements. Such modelling provides a means of tracing in detail, in an internally consistent economy-wide framework; the mechanisms whereby assistance changes in one part of the economy impact on the overall level and distribution across all sectors of economic activity and employment. In addition, it provides projections of the orders of magnitude involved. Such modelling also permits a thorough exploration of the implications of alternative assumptions concerning the macroeconomic and microeconomic environments in which the changes are envisaged to take place. In this way, the robustness of policy insights can be checked.

Continued support for the IMPACT Project has enabled the Commission's modelling work to remain state of the art. This has enhanced the Commission's reputation in the Australian economic community and the professionalism of its applied economic staff.

The degree to which the Commission's applied general equilibrium modelling work has enhanced the quality of its analysis of economic policy issues and influenced its subsequent policy advice to Government has varied considerably from application to application. In some situations it has been possible to incorporate into the model sufficient detail to capture convincingly the essence of the problem under study. In others, the abstraction from reality provided by the model has been judged to provide an unrealistic or inadequate treatment of factors thought likely to be of importance in shaping the outcome. Nevertheless, in such situations the model has, by providing a framework around which a line of argument can be developed, imposed some intellectual rigour on the structure of the economic discussion. In addition, it has made explicit what might otherwise remain implicit while helping to sharpen perspectives about what the important and less important factors are likely to be.

Experience at the Commission has shown that it is unrealistic to expect any one applied economic model, no matter how comprehensive, to satisfy all its needs when considering industry assistance arrangements. The Commission's approach has been to exploit the flexibility of the standard ORANI model by incorporating within it highly detailed industry models. This approach, despite its heavy demands on data and parameters, has proved reasonably successful. Projections from such models have been instrumental in providing a balanced assessment of the macroeconomic and sectoral output, income and employment implications of current assistance arrangements and proposed changes to them. These projections are weighed against the projections of interest groups, particularly those representing directly affected sectors, in the ensuing public debate concerning the desirability of the Commission's recommendations.

The application of applied general equilibrium modelling to quite specific areas of economic activity has frequently revealed a conflict between the model's view of how the economy operates and real world evidence. In some instances appropriate modifications to model structure can be undertaken. In others where this is not possible, the experience provides a salutory reminder of the extent to which models of economic systems abstract from reality. They cannot hope to include all the relevant factors. From the Commission's viewpoint, the most unsatisfactory aspect of its implied general equilibrium modelling framework is its inability to determine, with any degree of confidence, the longer term effects of its recommendations and alternative proposals on the efficiency with which resources are used in the economy and the overall level of economic welfare likely to result. For these reasons applied general equilibrium modelling is viewed by the Commission principally as providing some economic rigour about the way judgments are made concerning the appropriate policy recommendations. The formulation of a quantitative model, no matter how impressive, does not remove the need for judgment.

The Commission has always been willing to expose its economic modelling to public scrutiny. Details of model structure, data base (where confidentiality requirements can be met) and parameters are either published as a matter of course or readily available. In addition, the

Commission allows interested parties to use its models, sometimes with a model closure and parameter assignment which reflects a view of how the economy operates quite contrary to its own. This serves to increase the respect of such parties for the professionalism of the Commission's applied economic analysis and its recommendations.

While the ready public exposure of its modelling work and underlying assumptions has increased the vulnerability of the Commission to unscrupulous critics, it has also significantly enriched the quality of Australian applied economic analysis, particularly in the industry policy area.

REFERENCES

ABS (1984), Australian National Accounts: Input-Output Tables, 1978-79, Australian Government Publishing Service, Canberra.

Clements, K.W. and Smith, M.D. (1983), "Extending the Consumption Side of the ORANI Model", IMPACT Preliminary Working Paper No. OP-38. Available from Industries Assistance Commission, Canberra.

Cory, P. and Horridge, M. (1985), "A Harris-Style Miniature Version of ORANI", IMPACT Project Preliminary Working Paper No. OP-54. Available from Industries Assistance Commission, Canberra.

Dixon, P.B., Parmenter, B.R., Sutton, J. and Vincent, D.P. (1982) ORANI: A Multisectoral Model of the Australian Economy North-Holland Publishing Company, Amsterdam.

Dixon, P.B. (1986), "Prospects for Australian Industries and Occupations, 1985 to 1990", The Australian Economic Review, 1st Quarter, pp. 3-28.

Fallon, J. and Thompson, L. (1986), "An Analysis of the Effects of Recent Changes in the Exchange Rate and the Terms of Trade on the Level and Composition of Economic Activity", paper presented to 15th Conference of Economists, Monash University, Australia, 25-29 August.

Halfpenny, J. (1986), "Paths to Industry Revitalisation - Union View". Paper presented to a Bureau of Industry Economics Conference on Revitalising Australian Industry - The Paths and Prospects for Long-Term Growth, Sheraton Wentworth Hotel, Sydney.

Harris, R.G. (1984), Trade, Industrial Policy and Canadian Manufacturing, Ontario Economic Council, Toronto.

Higgs, P.J. (1986), Adaption and Survival in Australian Agriculture, Oxford University Press (forthcoming).

Horridge, M. (1985), "Long-Run Closure of ORANI: First Implementation", IMPACT Project Preliminary Working Paper No. OP-50. Available from Industries Assistance Commission, Canberra.

Industries Assistance Commission, (1983), The Dairy Industry, Report No. 333, Australian Government Publishing Service, Canberra.

____, (1984), The Dried Vine Fruit Industry, Report No. 351, Australian Government Publishing Service, Canberra.

_____, (1985), Fertilisers, Report No. 372, Australian Government Publishing Service, Canberra.

_____, (1986a), The Textile, Clothing and Footwear Industries, Report No. 386, Australian Government Publishing Service, Canberra.

____, (1986b), The Chemicals and Plastics Industries, Report No. 390, Australian Government Publishing Service, Canberra.

Mauldon, R.G., Duncan, R.C., and Cronin, M.R. (1980), "Use of Economic Models Within a Policy-Oriented Organisation: The Industries Assistance Commission", mimeo. Available from Industries Assistance Commission, Canberra.

Pearson, K.R. (1986), "Automating the Computation of Solutions of Large Economic Models", IMPACT Project Preliminary Working Paper No. IP-27. Available from Industries Assistance Commission, Canberra.

Powell, A.A. (1985), "A Brief Account of Activities Over the Period 1st February 1982 to 28th February 1985 with a Prospectus for Further Developments", IMPACT Project Report No. R-05, mimeo, pp. 67. Available from Industries Assistance Commission, Canberra.

Powell, A.A., and Lawson, A. (1986), "A Decade of Applied General Equilibrium Modelling For Policy Work", IMPACT Project General Paper No. G-69. Available from Industries Assistance Commission, Canberra.

Uhrig, J. (Chairman) (1984), Review of the Industries Assistance Commission: Report, Australian Government Publishing Service, Canberra.

Vincent, D.P. (1980), "Some Implications for the Australian Economy of Trade Growth with Newly Industrialising Asia: The Use and Limitations of the ORANI Framework", in K. Anderson and A. George (eds), Australian Agriculture and Newly Industrialising Asia: Issues for Research, (Canberra: Australia-Japan Research Centre), pp. 360-395.