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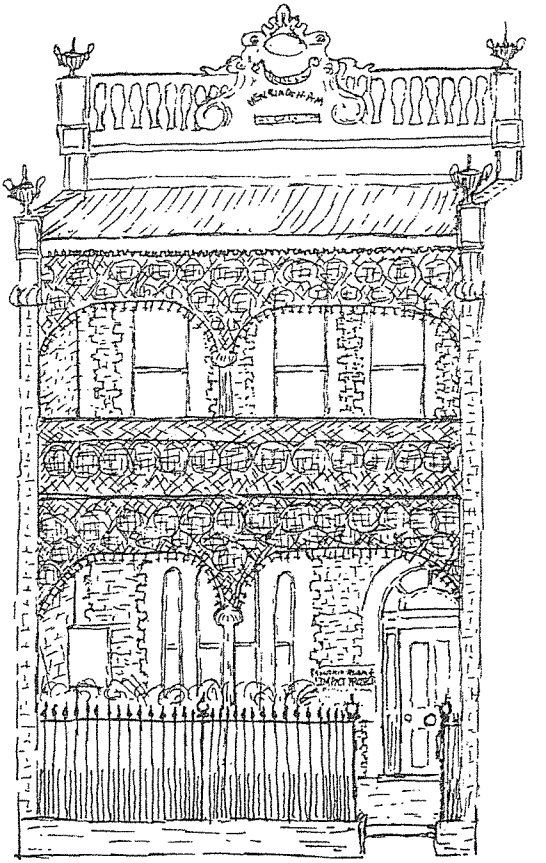
Impact Project Report



ALAN A. POWELL

A brief account of activities over the period 31st March 1985 to 31st December 1987 with a prospectus for further developments.

IMPACT is an economic and demographic research project which aims to improve the publicly accessible policy information system available to government, private and academic analysts. The Project is convened by the Industries Assistance Commission and conducted by Commonwealth Government agencies in association with the University of Melbourne, La Trobe University, and the Australian National University.

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COVER

The Nineteenth Century remodelled Townhouse

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IMPACT PROJECT REPORT

A brief account of activities over the period

1st March 1985 to 31st December 1987,

with a prospectus for further developments

by

ALAN A. POWELL

Director

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The Impact Project is a cooperative venture researching the structure of the Australian economy and building a policy information system to assist others to carry out independent analysis. The project is convened by the Industries Assistance Commission and is currently supported by:

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AUSTRALIAN NATIONAL UNIVERSITY

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DEPARTMENT OF EMPLOYMENT, EDUCATION AND TRAINING

DEPARTMENT OF IMMIGRATION, LOCAL GOVERNMENT AND ETHNIC AFFAIRS

DEPARTMENT OF THE ARTS, SPORT, THE ENVIRONMENT, TOURISM AND TERRITORIES

INDUSTRIES ASSISTANCE COMMISSION

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UNIVERSITY OF MELBOURNE

IMPACT is directed by Alan A. Powell, Ritchie Professor of Research in Economics at the University of Melbourne. The Project's Basic Research and Development Unit is housed just off campus of the University of Melbourne at:

153 Barry Street, Carlton, Victoria 3053 Australia.

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A Brief Account of Activities over the Period
1st March 1985 to 31st December 1987, with
a Prospectus for Further Developments

by

Alan A. Powell*
Director

1. INTRODUCTION

I last issued a report of this type in April 1985 (Powell (1985a)). The purpose of the present document is to brief the participating universities and Commonwealth agencies, and other interested parties, on developments in the project over the intervening period.

This report is organized as follows. A brief recapitulation of the aims of the project is given in Section 2. In Section 3 institutional arrangements (including staffing) are briefly sketched. A summary is given in Section 4 of a recent overview of a decade's experience in the use of applied general equilibrium analysis as a policy tool in Australia (Powell and Lawson (1986)). Most activity in this field has been based on the ORANI suite of models developed at Impact. Section 5 contains an overview of the work program. Prospective developments are discussed in the sixth and final section.

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* I wish especially to thank Mike Kenderes for assistance in the preparation of this report. I am also grateful for comments to Philip Adams, Nisha Agrawal, George Codsi, Philippa Dee, Peter Higgs, Mark Horridge, John Madden, Dean Parham, Brian Parmenter, Ken Pearson, and Tony Lawson. The last-mentioned is also the coauthor of the review paper (Powell and Lawson (1986)) which is updated and summarized in Section 4 below.

It should be emphasized that this report does not (except in passing) deal with the modelling facility located within the Industries Assistance Commission (IAC) in Canberra. A good overview of how this facility operates in the policy advising environment has been provided recently by Vincent (1986). Rather, present coverage is confined to the basic research and development unit located at the University of Melbourne.

2. AIMS OF THE PROJECT

In this section I draw freely on Powell (1983). At the time of the Project's inception in 1975, the Chairman of the IAC, as Convenor of the participating Commonwealth agencies, issued a paper describing the Project's aims in detail (Rattigan (1976)). Other published material on the role of the Project appeared in Powell (1977), Powell and Parmenter (1979), Craigie (1979) and Dixon, Powell and Parmenter (1979). The previously mentioned review by Powell and Lawson, which became available in 1986, also contains reflections on management experience and the institutional environment of the Project.

The major goal, then as now, was to upgrade the tools available to government, and to the public, for the analysis of policy. The Project would do this indirectly, at arm's length from executive government. The Project itself would not, in general, become involved in direct policy advice; rather it would upgrade the policy information system by work in the following areas:

1. data gathering and editing,
2. economic model building,
3. computer systems development,

and

4. training of personnel.

The Project's resources did not permit the gathering of primary data; hence the assistance of the Australian Bureau of Statistics (ABS) in retabulating and extracting data from already existing sources was, and remains, crucial. The data files developed in the areas of industry structure, the labour market and international trade, were designed to provide a summary of the available factual information pertinent to policy analysis in the various fields covered by the participating agencies.

The economic models (briefly described below) were to be policy-analytic in nature, designed to answer hypothetical questions such as:

1. How would employment demand in each of about 100 industry groups spanning the economy change as the result of applying certain specified approaches to the restructuring of industry?

2. Could the macroeconomic health of the economy be improved by implementing a wage-tax bargain?

3. What would be the regional and occupational implications of implementing such a bargain? Which industries would gain, and which lose?

Above all else, the models were to recognize the interconnected nature of markets for commodities and factors of production. They were to provide a systematic basis for tracing, through input-output and other linkages, the passage of any given shock across the economy. The models developed should, either separately or when interfaced with each other, provide sufficient scope for in-depth analysis of policy in the several areas covered by the sponsoring agencies.

The main models developed by Impact are listed in Table 1, where a brief description of their scope is given. The major industry structure and labour demand model ORANI is implemented using the GEMPACK suite of software developed by Pearson and Codsi (see Appendix 2). This code is highly portable; ORANI is currently accessible on nine mainframe computers in Australia. It is routinely used by researchers who were not involved in building it. The GEMPACK code, moreover, gives users great flexibility to modify existing models, or to build their own, without the need for a team of computer professionals. GEMPACK not only solves the problem of providing good access to the Impact models at moderate cost, but as well has made it possible to build special-purpose ORANI models, each focusing on a particular issue. Some of these models are reviewed below in Section 4.

Personnel training takes two forms. First, by assembling a team consisting largely of public servants outposted from the participating agencies under senior academic leadership, in-house

Table 1

Details of Models Developed at Impact*

Name of Model [Major Focus]	Scope	Remarks
BACHUROO [Labour Supply]	Demographic projections by sex and by single years of age, by 4 marital status categories, based either on conventional demographic scenario writing or on economic scenarios which drive the demography via econometric modelling. Household formation, labour force participation.	Formerly maintained on CSIRONET by the Bureau of Labour Market Research, Canberra. The disestablishment of the Bureau in 1986 led to the loss of the model**.
ORANI [Industry Structure, International Trade, Labour Demand]	The industrial composition of the economy, relative prices, international trade, and demand for labour, by about 112 industries and ten occupational groups. Routine disaggregatiuon to State level available. Available in several special-purpose versions.	Maintained on a NAS computer by the Industries Assistance Commission and on University of Melbourne VAX computer by the Impact Research Centre and the IAESR; widely available via GEMPACK.
ORANI-MACRO	As for ORANI, but with feedback to, and from, the macroeconomic environment.	Available on VAX computers at Monash and Macquarie Universities.
SNAPSHOT [Industry Structure, Technological Change]	A consistency framework for synthesising a picture of the future economy on the basis of detailed technological scenarios.	SNAPSHOT is rarely used currently, ORANI in long-run mode providing a superior alternative for most purposes.

* Entry points to the literature of these models are: for BACHUROO, Sams and Williams (1983); for ORANI, Dixon, Parmenter, Sutton and Vincent (1982); for ORANI-MACRO, Cooper and McLaren (1983); and for SNAPSHOT, Dixon and Vincent (1980).

** The prospects for salvaging the model are currently being investigated by Impact staff.

professional skills in the policy analysis field have been enhanced, especially in the case of the IAC (Impact's principal sponsor). Moreover, as part of this team approach it has been possible to combine project work with higher degree candidature in many instances.

Second, intensive training courses in the use of the models are held from time to time. These are open to the government, private, and academic sectors. Graduates of these courses can use the models in their own professional situations. In fact, seven formally structured courses were held up to the end of 1984; since then the need to redevelop all of our software in a cheaper environment than CSIRONET (the former site of our computer systems) has precluded holding courses until relatively recently. About 200 economists have had intensive hands-on training in the use of at least one of the models. Most of these professionals work in the public sector. Future training courses are likely to maintain ORANI as their focus, but as well to give participants experience in the techniques of modifying models for special purposes. It is expected that a course will be offered during 1988.

3. CURRENT STAFF AND INSTITUTIONAL ARRANGEMENTS

3.1 Participating Institutions

At the beginning of the triennium which commenced on July 1st 1985, the Commonwealth agencies participating in the Project were:

Bureau of Agricultural Economics (BAE)

Bureau of Industry Economics (BIE)

Bureau of Labour Market Research (BLMR)

Department of Arts, Heritage and Environment (DAHE)

Department of Immigration and Ethnic Affairs (DIEA)

Industries Assistance Commission (IAC)

Following the abolition of the BLMR in 1986, its membership reverted to the department (Employment and Youth Affairs) to which the Bureau was attached. A major reorganization of the Federal Public Service after the national election in 1987 resulted in the list of participating agencies shown above on page (ii).

The IAC, whose Chairman acts as Convenor, provides the secretariat for the Project. The University of Melbourne, La Trobe University, and the Australian National University participated throughout the triennium.

Under current arrangements, the work program is overseen by a Management Committee consisting of one representative from each of the participating institutions under the chairmanship of a representative from the IAC. The Committee meets quarterly. Only the Commonwealth agencies, which jointly are accountable for the use of federal funds, vote on the expenditure of those funds. The Director is responsible for all aspects of the research design and for the professional guidance of all personnel working on the Project.

3.2 Personnel

At the date of writing, the researchers at the Impact Research Centre consist of myself, three outposted IAC professional staff (Dr

Nisha Agrawal, Mr George Codsi and Dr Mark Horridge), two professionals respectively from La Trobe University (Dr Ken Pearson) and the University of Melbourne (Dr Peter Higgs), plus one Ph.D student from the Australian Bureau of Agricultural and Resource Economics (Mr Philip Adams). These are supported by a secretary-stenographer, and by two part-time clerical/administrative/research assistants.

Early in the triennium, there was somewhat stronger IAC representation. As the IAC's own personnel resource base shrank, the number of outposted professionals was reduced from five to three. The slack was taken up by short-term appointments financed by a University of Melbourne special research grant (which has now expired). Under this grant it was possible to finance one year of each of Dr Higgs' and Dr Pearson's appointments. La Trobe has financed a second year of Dr Pearson's full-time research, most of which will be spent at Impact, under a special study program.

One of the current IAC-outposted professionals (Dr Mark Horridge) was a graduate student at Impact earlier in the triennium. Two of the current staff (Dr Nisha Agrawal and Dr Peter Higgs) came to Impact after completing doctorates overseas. Whilst there has been some change in the composition of the group over the period reviewed, its total size has been more or less at the current level throughout. The exhaustion of special avenues of university financed support will reduce the size of the non-student full-time research group from 6 to 4 early in the coming triennium. To avoid this would require Commonwealth agencies to outpost additional personnel; or (alternatively) a substantial increase in cash grants to the Project enabling additional staff to be hired.

3.3 Cooperative Work Outside the Participating Institutions

Outside the participating universities, close research links are maintained also with Dr Russel Cooper (Macquarie University), Mr John Madden (University of Tasmania), Associate Professor Keith McLaren (Monash University), and Dr Truong P. Truong (University of New South Wales). Mr John Madden (Madden (1987)) is in the process of building a two-region model which disaggregates Tasmania from the rest of the Australian economy. He will implement this model with the GEMPACK facility developed at Impact. Drs Cooper and McLaren (1987) are developing new systems of consumer demand equations, one or more of which will be used by Impact in our planned redevelopment of this side of the ORANI suite of models. Dr Truong (1986) and colleagues (Hall, Truong and Nguyen (1987)) have been developing special-purpose versions of ORANI which focus on the energy market.

4 A SYNOPTIC REVIEW OF A DECADE OF USE OF IMPACT PROJECT MODELS

In this section I draw heavily on a recent review by Powell and Lawson (1986) of applications of applied (or computable) general equilibrium analysis to the problems of the Australian economy. Earlier survey material may be found in Dixon, Parmenter, Sutton and Vincent (1982, Section 50), Parmenter and Meagher (1985) and Powell (1985a).

Apart from the applications discussed in the sections below, the ORANI modelling project has generated a substantial stream of literature on the reliability of estimated computable general equilibrium (CGE) responses (Pagan and Shannon (1985, 1987)) and on the appropriate values of parameters (IAC

(1984b), Cronin (1985) and Powell (1985b)). A review of the entire Project was made half-way through its first decade by Freebairn (1980).

Because of the Impact Project's policy of open access to its models, we cannot be aware of all the applications which have been made, particularly in the government sector. Our coverage therefore has a bias towards model simulations which have been publicly reported. It includes not only the Impact models, but the eight other applications of computable general equilibrium models of Australia that are known to us.

The publicly documented studies are listed in Table 2, while Table 3 identifies unpublished applications of which we are aware. One of the unusual features of the Impact Project has been its cross-institutional affiliations and the conscious decision to encourage as wide as possible use of the models. To give more indication of this, in the discussion that follows, applications are considered in terms of six broad categories of users.

4.1 Applications by the Impact Team

The wide range of applications to which the ORANI model is amenable has been illustrated in numerous papers produced by the Impact team over the last decade. Three strands of activities can be identified:

(a) analyses of the effects of particular economic shocks, with varying emphasis on industries, occupations and the macroeconomy;

(b) examination of the robustness of these analyses to changes in the parameters, data and/or closure of the model;

(c) the identification of policy options which, according to the model, would achieve important macroeconomic objectives (e.g., policies to increase employment without running into further trade balance or inflation problems).

The applications chosen by the modellers also identify some of the key economic issues perceived to have influenced the direction of the Australian economy over the last 10 years; an idea of the scope of these issues is given by the subject headings of Table 2.

The emphasis on protection reflects not only the strong institutional links between Impact and the IAC, but also the importance that has been attached to this topic generally by applied economists in Australia. It should be noted that although these studies indicate the extent to which different groups win or lose from industry assistance, important efficiency gains from trade reform (e.g., via scale effects) are not captured except in recent exploratory work by Cory and Horridge (1985), and by Horridge (1987a,c).

4.2 Applications by the Industries Assistance Commission

The use of CGE models by the IAC is covered in some depth in the review paper by David Vincent (1986). In these remarks an attempt is made to give some idea of the breadth of applications of the ORANI model.

Table 2: Selective Bibliography of

Application	Policy Simulations Conducted by: Impact	IAC	Other Federal Agencies
A. Effects of Protection	Powell (1977) Dixon, Parmenter Ryland, Sutton (1977) Dixon, Parmenter, Sutton (1977) Powell, Parmenter (1979) Wright, Cowan (1980) Parmenter, Sams, Vincent (1981) Dixon, Parmenter, Sutton, Vincent (1982) Powell (1982) Cooper (1983) Higgs, Parmenter, Powell (1984) Dixon, Parmenter, Powell (1984) Cooper, McLaren, Powell (1985) Dixon, Parmenter, Rimmer (1986)	IAC (1977) IAC (1982b) IAC (1987a) IAC (1987b) IAC (1987c)	Crowley, O'Mara, Campbell (1983)
B. Exchange Rates	Powell (1977) Dixon, Parmenter, Sutton (1977) Dixon, Parmenter, Powell (1982, 1983) Higgs (1987b)	Fallon, Thompson (1987)	
C. International Trade (other)	Vincent (1980a)	IAC (1979)	Bateman (1984)
D. Terms of Trade	Dixon, Harrower, Powell (1977) Dixon, Parmenter, Sutton (1978b) Dixon, Parmenter (1987a) Agrawal, Meagher (1987)	Fallon, Thompson (1987) IAC (1987a) Vincent (1986)	
E. Supply Shocks (i) - Oil	Vincent, Dixon, Parmenter, Sams (1979, 1980) Vincent (1980b)		

Australian CGE Policy Applications (a)

State Governments & Regional Modellers	Academics/Graduate Students	Private Sector
Dixon, Parmenter, Sutton (1978a) IAC (1981c) Higgs, Parmenter, Rimmer, Liew (1981) Madden, Challen, Hagger (1981) Liew (1982) Dixon, Parmenter, Sutton, Vincent (1982) Parmenter (1983a) Higgs, Parmenter, Rimmer (1983) Fraser, Salerian (1986) Brown, Camilleri (1986)	Evans (1972)* Klijn (1974)* Meltzer (1980) Aislabie (1981, 1983, 1985) Warr, Parmenter (1984) Parmenter, Meagher (1985) Siriwardana (1985)* Horridge, Parmenter, Warr (1987) Hepburn (1987)	Chai, Dixon (1985) Dixon, Parmenter, Rimmer (1985, 1986) Higgs (1986b)
Hagger, Challen, Madden (1983)	Horne (1985)	Business Council of Australia (1985) Higgs (1986b)
	Warr, Lloyd (1983) Dixon, Johnson (1986)	
		Higgs (1986b) Higgs, Stoeckel (1987)
	Higgs (1981)	

... continued

Table 2: (continued)

Application	Policy Simulations Conducted by: Impact	IAC	Other Federal Agencies
(ii) - Mining (resources boom)	Dixon, Harrower, Powell (1977) Dixon, Parmenter, Sutton (1978b) Powell, Parmenter (1979) Higgs, Parmenter, Powell (1984)		Stoeckel (1970)*
(iii) - Technical Change	Dixon, Vincent (1980)* Rimmer (1984)		BIE (1981a)*
(iv) - Drought		Vincent (1983)	Campbell, Crowley, Demura (1983)
F. Macroeconomic Policy - expanding activity without inflation or trade balance problems	Dixon, Powell, Parmenter (1979) Parmenter (1983b) Dixon, Powell (1984)	IAC (1982c)	
G. Other Employment and Wage Issues	Dixon, Parmenter, Sutton (1978b) Higgs, Parham, Parmenter (1981) Powell (1985c)		
H. Immigration			Norman, Meikle (1985)
I. Government Taxes, Charges, Expenditure and Regulations	Cooper, McLaren (1983) Meagher, Agrawal (1986) Horridge (1987b) Agrawal, Meagher (1987) Agrawal, Meagher, Parsell (1987)	IAC (1986a,d) Dee (1987b)	BAE (1985)

State Governments & Regional Modellers	Academics/Graduate Students	Private Sector
IAC (1981c) Madden, Challen, Hagger (1982) Fraser (1984, 1986a)		Cook, Porter (1984) Higgs (1986a,b)
Madden, Challen (1983)		
Bonnell, Parmenter, Rimmer (1985)	Norman (1981) Parmenter, Meagher (1985) Dixon, McDonald, Meagher (1984) Feltenstein (1986a,b)* Sugden (1987)	Higgs (1986b)
Challen, Hagger, Madden (1983, 1984)	Corden, Dixon (1980) Bonnell, Chew, Dixon (1984) Bonnell, Parmenter, Rimmer, Scorgie (1985) Cook, Dixon (1982) Dixon, Bonnell (1982) Bonnell, Dixon (1983)	
Ministry of Economic Development, Vic. (1982) Madden, Challen, Hagger (1983) Burke (1983, 1984) Meagher, Parmenter, Rimmer, Clements (1985) Meagher, Parmenter (1986) Parsell (1987) Fraser (1986b)	Castle, Guest (1980) Meagher (1983, 1986) Piggott (1983)* Parmenter, Meagher (1985) Chapman, Vincent (1985, 1986, 1987) Liew (1985) Meagher, Parmenter (1985) Blampied (1986)	Higgs (1986b)

... continued

Table 2: (continued)

Application	Policy Simulations Conducted by: Impact	IAC	Other Federal Agencies
J. Industry Studies			
- long run prospects	Dixon, Harrower, Powell (1977)		BIE (1981b)* Fitzpatrick, McKeon (1982)*
- agriculture	Vincent, Ryland (1981) Dixon, Parmenter, Powell (1982, 1983) Dixon, Parmenter, Powell, Vincent (1983)	IAC (1983c,d) Vincent (1986) IAC (1987e)	Crowley, Martin (1982) Quiggan, Stoeckel (1982) Campbell, Crowley Demura (1983)
- glass, glassware		IAC (1987d)	
- construction			
- fertilisers		IAC (1982a) IAC (1985a,b)	BAE (1984)
- forestry, timber		IAC (1981b)	
- mining			
- food			PJT (1979)
- textiles, clothing		IAC (1986b)	
- chemicals, plastics		IAC (1986c) Vincent (1986)	
- petroleum products		IAC (1986a,d)	
- iron and steel	Rimmer (1984)	IAC (1983a,b)	
- motor vehicles		IAC (1978) IAC (1981a) IAC (1984a)	
- transport			Lawson (1979)
- tourism			
- pulp, paper, printing		IAC (1987f)	
- defence			Bateman (1984) Liew (1985)

(a) All citations except those indicated by a * refer to applications of ORANI.

State Governments & Regional Modellers	Academics/Graduate Students	Private Sector
	Dixon (1986) Dixon, Parmenter (1986, 1987b)	
	Dixon (1985a,b)	Parmenter (1985) Higgs (1986b)
		Dixon (1987a)
Madden, Hagger (1985)		Johnson (1985) Higgs (1986a)
	Truong (1986) Hall, Truong, Nguyen (1987)	
Hagger, Madden, Challen (1984)		

Table 3

Summary of Unpublished Applications Carried Out for Australian Government Agencies

Application	Client/Date
Production of aircraft in Australia	Australian Government Aircraft Study Group (1979); Hawker-Siddeley (1983)
Distortions inhibiting food processing	Bureau of Agricultural Economics (BAE) (1986)
Costs to farmers of assistance to manufacturing	BAE (1985); IAC submission to Technical Group on Farm Costs, Treasury (1985)
Expansion of mineral exports	BAE (1981)
Changes in world demands for meats	BAE (1979, 1980)
Deterioration in the balance of trade	BAE (1986)
Various shocks to the Australian economy	IAESR for the Bureau of Labour Market Research (1985)
Reductions in the cost of coastal shipping	Business Regulation Review Unit (BRRU) (1986)
Costs of tighter safety regulations on manual handling	BRRU (1987)
Changes in the price of sugar	Department of Business and Consumer Affairs (1979)
Protection of textiles, clothing and footwear	Department of Industry, Technology and Commerce (1986)

... continued

Table 3 (continued)

Application	Client/Date
Departmental review of policies	Department of Primary Industries and Energy (DOPIE) (1987)
Effects of changes in funding of wool promotion	DOPIE (1987)
Oil price rises	Department of National Development (1978, 1979); Treasury (national wage case 1980)
Disruption of oil supplies	Department of Resources and Energy (1985)
Assistance to agricultural industries	Submission by W. A. McKinnon, Chairman of the IAC, to the (Balderstone) Working Group on Agricultural Policy (1982)
Effects of assistance on migrants	Submission by W. B. Carmichael, Chairman of the IAC, to the (Jupp) Committee of Review of Migrant and Multicultural Programs and Services (1986)
Payroll tax exemptions	Ministerial Task Force on Long Term Economic Growth (1985)
Increased road and rail freight charges	National Road Freight Industry Inquiry (1984)
Price increases resulting from the devaluation of the Australian dollar	Treasury (1985)

Nowadays the model is used for most major IAC inquiries in which inter-industry or economy-wide effects may be important, e.g., chemicals and plastics (IAC (1986c)), glass and glassware (IAC (1987d)), iron and steel (IAC (1983a,b)), motor vehicles (IAC (1978, 1981a)), pulp, paper, paper products and printing (IAC (1987f)), textiles, clothing and footwear (IAC (1986b)), wheat (IAC (1987e)) and wood products (IAC (1981b)). In some instances partial equilibrium models with similar behavioural assumptions to the ORANI model are used; the results of these smaller models may in turn be used as an input to the ORANI model. An example of this is provided by the inquiry into Heavy Commercial Vehicles (IAC (1984a)).

Acceptance of ORANI within the IAC was gradual. Initially there was scepticism, both about the model's ability to capture the likely effects of changes in assistance to an industry on the rest of the economy, and about its ability to deal realistically with important specific features of the industry under review. The latter problem was largely overcome by the development of procedures to model such industries in greater detail while remaining within the ORANI framework (see Vincent (1986)).

The model's treatment of inter-industry and economy-wide effects was accepted more readily for agricultural-sector inquiries such as that into fertilisers (IAC (1982a, 1985a,b)). This readier acceptance reflects, in part, a consensus on the applicability of competitive theory to behaviour in agriculture, as well as the relatively strong detail on multiproduct agricultural industries built into the standard version of ORANI (Dixon, Parmenter, Powell and Vincent (1983)).

The inquiry into the taxation of petroleum products (IAC (1986a,d)) represented an interesting development of the use of ORANI in the IAC. Taxes on petroleum products are a significant source of revenue to the Australian Government and are levied on intermediate usage and final consumption. The model was used to analyse the effects of these taxes on international competitiveness and resource allocation, taking into account the implications for the Government's net budgetary position, as well as the effects of tax exemptions on intermediate usage. These simulations required the addition of a large amount of fiscal detail to the ORANI mainframe. Recent developments in computer packages (Pearson (1986) and numerous computer documents by Pearson and Codsi -- see Appendix 2) mean that such major modifications can now be handled on a routine basis.

ORANI has also been used for more general studies of the effects of protection and other economic factors on the Australian economy (IAC (1977, 1979, 1982b,c, 1987a)).

4.3 Applications by Other Commonwealth Agencies

Much of the use of Impact models by other federal agencies is unpublished or undocumented. Some agencies have used Impact training courses to develop the in-house expertise necessary to carry out their own applications. Most rely on the IAC, or occasionally the Impact Research Centre or the Institute of Applied Economic and Social Research (IAESR) at the University of Melbourne to do the analysis for them. (The IAC has a formal responsibility to provide such assistance to other federal agencies.) Several of the unpublished studies of which we know are listed in Table 3.

These applications again demonstrate the diversity of uses to which the ORANI model has been put; but more importantly, a glance at their dates indicates that this usage is growing. This reflects increased acceptance of the general equilibrium approach to policy analysis as well as the steady diffusion of staff with training in this field (gained in most cases at the IAC and/or Impact).

The major public sector user (other than the IAC) has been the Bureau of Agricultural Economics (BAE), which has a long standing record in applied economic research and which, until recently, had a Director who built a CGE model for his doctoral thesis (Stoeckel (1978)). In 1987 the scope of the BAE was expanded to include resource economics, the new institution being known as the Australian Bureau of Agricultural and Resource Economics (ABARE). Several papers published by the Bureau's officers are listed in Table 2. They have used ORANI to analyse the effects on agriculture of protection for manufacturers (Crowley, O'Mara and Campbell (1983), Crowley and Martin (1982), Quiggan and Stoeckel (1982)), as well as the general economic effects of a major continent-wide drought (Campbell, Crowley and Demura (1983)). They have also used results from ORANI in submissions to IAC inquiries (e.g., BAE (1984)) and to the Economic Planning Advisory Council (EPAC) (BAE(1985)). In 1987 ABARE undertook a major study designed to examine priorities for policies falling within the ambit of the Department of Primary Industries and Energy. The ORANI model was used as a basis for analysing the intersectoral effects of changes in assistance to a wide range of industries. Other studies are in progress.

The Bureau of Transport Economics (BTE) used ORANI to analyse the economy-wide effects of increased road and rail charges (Lawson (1979)), while the Bureau of Industry Economics (BIE) used Impact's SNAPSHOT model to explore the long-run implications for Australian industries of foreseen technical changes (BIE (1981a,b), Fitzpatrick and McKeon (1982)).

In association with the Committee for Economic Development of Australia (CEDA), the Department of Immigration and Ethnic Affairs used the ORANI and BACHUROO models in a major study of the economics of immigration. The study included long-run simulations of the effects of immigration on industries (Norman and Meikle (1985)). The ORANI model has even been used to consider the strategic defence implications of disruptions to Australia's overseas trade (Bateman (1984)).

4.4 Applications by State Governments and by Regional Modellers

The ORANI Regional Equations System (ORES) was developed by the Impact team (Dixon, Parmenter and Sutton (1978a)). This approach to regional disaggregation followed the 'tops-down' procedure (as developed initially by Leontief, Morgan, Polenske, Simpson and Tower (1965)). There was widespread interest in this development, presumably because nothing (other than unconstrained input-output) had previously been available to analyse the effects of national policies on the Australian States. Work for the Treasury of the New South Wales Government (Dixon (1987b)) used ORES to disaggregate, to the State level, medium-run forecasts for the Australian economy.

With State and Federal support, the Centre for Regional Economic Analysis (CREA) was set up at the University of Tasmania in 1980. It has used the ORANI-ORES model for much of its analysis. Topics analysed by Challen, Hagger and Madden (C, H and M) of CREA include the impact on the Tasmanian economy of reductions in protection (M, C & H (1981)), the devaluation of the Australian dollar (H, C & M (1983)), the mining boom (M, C & H (1982)), and a decline in tourism (H, M & C (1984)).

Regional modelling was enhanced by allowing explicitly for regional industries in the national ORANI model. These industries were located entirely in one region. This strategy provided a richer story at the regional level. The improvement in the analyses is demonstrated in papers by Higgs, Parmenter, Rimmer and Liew (1981) and Higgs, Parmenter and Rimmer (1983), which re-examined the regional effects of protection using this new method. The latter may be seen as a compromise between the 'tops-down' approach of ORES, and the extremely data-hungry 'bottoms-up' approach (Liew (1982, 1984)). In Tasmania, CREA took up this new methodology with applications to the effects on the State economy of subsidising employment (Challen, Hagger and Madden (1983)), technological change (Madden and Challen (1983)) and the export of woodchips (Madden & Hagger (1985)). This hybrid approach was also followed in IAC (1983d, 1987f).

Regional modelling was subsequently taken up at the University of Western Australia, illustrated in papers by Fraser (1984, 1986) on the effects on the State economy of the expansion of mining and a study by Fraser and Salerian (1986) of the regional effects of protection. More recently the Melbourne Institute of Applied Economic and Social Research (IAESR) commenced work on the economy of the Northern Territory (Bonnell, Parmenter and Rimmer (1985)). Work in progress by Madden

(1985, 1987) disaggregates the economy into two major parts: the region of focus (Tasmania) and the rest of Australia. The model treats the two tiers of government, federal and state, in a fairly detailed way.

The Victorian Government has used ORANI to study the effects on Victoria of changes in electricity pricing (Ministry of Economic Development, Victoria (1982)) and of changes to indirect taxes and to workers' compensation charges (Burke (1983, 1984), Meagher and Parmenter (1986)), while the South Australian Government sponsored a study (Meagher, Parmenter, Rimmer and Clements (1985)) of proposed changes to taxation of the wine industry, which is an important activity in that State.

4.5 Applications by Academics, including Graduate Students

Since its inception, the Impact Project has encouraged the involvement of Australian academic economists. Undergraduates, graduates and teaching staff have all made contributions to the theoretical framework, to parameterising the models, and to applying them to a large range of issues.

There are about 20 universities in Australia. Economists from at least 12 of them have contributed to or made use of the ORANI model. Although in part this reflects the mobility of academics associated with the original development of the model, it also reflects a wide recognition of the model's usefulness as a tool for applied economics, as well as the Project's policy of open access.

The first applications emanated from universities in Melbourne, where the Impact Project was being developed. Relative to the

traditional effective rate concept, Meltzer (1980) demonstrated the superiority of a practical general equilibrium approach for explaining the resource allocative effects of protection, while Norman (1981) was able to use ORANI to attach some numbers to the famous Swan (1963) diagram of internal and external balance.

In the late 'seventies and early 'eighties, Peter Dixon led a strong team of applied general equilibrium modellers at La Trobe University, whose work focused on the effects of structural change on different labour market groups (Dixon and Bonnell (1982), Cook and Dixon (1982), and Bonnell and Dixon (1983)), and on the effects of fiscal policies on industries (Meagher (1983)). This interest in fiscal issues had precedent in the work of Corden and Dixon (1980), who used ORANI to see if a cut in hourly labour costs made possible by lower direct taxes could improve employment without creating budgetary problems for the Australian economy. More recently, Chapman and Vincent (1985, 1986, 1987) used the model to see if the removal of payroll taxes could be beneficial to the health of the macroeconomy.

Several undergraduates have used ORANI for honours work, including Higgs (1981), Hepburn (1987) and Sugden (1987). Respectively, they studied oil pricing policy, the effect of variable tariff heights, and the implications of moving to a broadly based consumption tax. Their respective universities were La Trobe, Melbourne and Macquarie. At the Australian National University another honours candidate (Hooi (1983)) evaluated the Impact Project's estimates (Alaouze, Marsden and Zeitsch (1977), Alaouze (1977)), of the Armington (1969, 1970) elasticities used by ORANI.

The final strand of academic research which I will mention examines various protective devices. Warr and Parmenter (1984) analysed

government procurement policies, while Warr and Lloyd (1983) estimated the impact of Australia's trade policies upon less developed countries. A study of the effects of a 'Buy Australian' policy has been published recently (Horridge, Parmenter and Warr (1987)).

The Institute of Applied Economic and Social Research (IAESR) is directed by Peter B. Dixon, who was Associate Director of the Impact Project until 1984. The Deputy Director of the IAESR is Brian R. Parmenter, a former Acting Director of Impact. Work at the IAESR over the last four years has focused on the use of ORANI for short-run (Dixon, McDonald and Meagher (1984)) and long-run (Dixon (1986)) forecasts, and the analysis of taxation (Dixon (1985a) and Meagher and Parmenter (1985)). Currently, work in association with the Impact team is extending the use of ORANI to analyse income distribution issues (Meagher and Agrawal (1986), Agrawal and Meagher (1987), Agrawal (1986a) and Agrawal, Meagher and Parsell (1987)). A steady stream of papers analysing Australia's protection policy, international trade possibilities and the agricultural sector also has been produced (Dixon (1985a,b), Dixon and Johnson (1986)). The focus of recent applied work has been strongly on the adjustment of the Australian economy to our poor terms of trade (e.g., Dixon and Parmenter (1987)).

4.6 Private Sector Applications

The first users of the ORANI model in the private sector were various business organisations such as the National Farmers' Federation (NFF), the Confederation of Australian Industry (CAI) and the Business Council of Australia (BCA). Use tended to be confined to the reporting

of other applications, rather than initiating new work. A recent example is the BCA (1985), which looked at estimates of the price effects of the devaluation of the Australian dollar generated by different models, including ORANI. A simplified version of ORANI was used by the Monash Centre for Policy Studies for a report (sponsored by the Australian Mining Industry Council (AMIC)) on the quantitative impact of the minerals sector on the Australian economy (Cook and Porter (1984)).

More recently, the NFF asked the IAESR at the University of Melbourne to carry out a study of the costs to farmers of protection of manufactures (Parmenter (1985)). ORANI-based analysis of the same issue was also undertaken by the IAC and the BAE, and the three studies were submitted to a Technical Group on Farm Costs established by the Australian Government in 1985 (thankfully no large divergence of opinion emerged from the three studies!). The estimated magnitudes of the effect on farm costs were significantly lower than estimates based on the approach of Clements and Sjaastad (1983), which had provided the stimulus for the establishment of the Technical Group.

This is probably a portent of things to come. Increasingly, we can expect a number of ORANI-based analyses of the same subject to be undertaken by different interest groups and submitted to government. If, due to different closures, parameters or shocks, the results differ widely, CGE policy analysis will have come of age.

To date, the major work undertaken with a significant element of private sector sponsorship at the Impact Research Centre is the

comprehensive study by Higgs (1986b) of adjustment pressures on the agricultural sector. This was supported, in part, by the Australian Wool Corporation. Subsequently Higgs (1986a) undertook a similar, but much briefer, analysis of the mining sector for the Mining Industry Council (AMIC). Other sponsored work at Impact includes an analysis of the sensitivity of the results of tariff simulations to assumptions about Australia's export responsiveness (Dixon, Parmenter and Rimmer (1985)). However, the greatest impetus for future use of the ORANI model by the private sector is likely to come via the IAESR.

The IAESR's first CGE-based study to be sponsored by a company was an analysis of the short-term economic effects of environmental constraints on forest industries (Johnson (1985)). Work on the macroeconomic and sectoral consequences of shorter standard working hours in the construction and related industries was commissioned by the Master Builders' Federation of Australia (Dixon (1987a)). Major extensions of the ORANI model into medium-term forecasting were sponsored by the Royal Bank of Canada (Dixon (1986)) and by AMIC (Dixon and Parmenter (1987a,b)). Most recently, the IAESR's forecasting facility has been put to use in a study of the prospects for industries to 1991-92 in the light of Australia's current trading difficulties -- this work was commissioned by ESANDA Ltd. Developments at the IAESR and Impact on the use of CGE modelling in portfolio selection (e.g., Higgs (forthcoming 1988a)) seem likely to attract further private sector interest.

4.7 Evidence of Successful Transfer

One criterion for judging the success of an open access policy information system is the extent to which the system has been used by professionals who were not intimately involved in its construction. On

this basis, the ORANI suite of models has been exceptionally successful. Of the 160 distinct citations listed in Table 2 and the 25 undocumented applications listed in Table 3, all but 8 were applications of Impact models, mostly of ORANI. In fact, of the 185 items listed in these two tables, 174 were applications of ORANI. If we define as the "model builders" the authors of the definitive ORANI volume (Dixon, Parmenter, Sutton and Vincent (1982)), plus myself (as director) and Dr R. Rimmer (who was heavily involved in producing ORANI code), then of these 174 applications of ORANI, 111 did not involve any model builder as an author. The user-friendliness of the GEMPACK code with which ORANI is now implemented, moreover, will improve future accessibility.

4.8 Professional and Academic Recognition

As noted in my last Report (Powell (1985a)), the scientific community recognized the value of the research done by the Impact Project when, in 1984, the Royal Society of Victoria presented its Research Medal to Professor Dixon and myself.

Members of the Impact Project staff and associated researchers are regularly invited to contribute to international fora on policy modelling. Recent examples include Dr Horridge's attendance at the International Conference on Economic Modelling in the OECD countries held in London in June 1986; the Third Meeting of the Task Force on Applied General Equilibrium Modelling held at the International Institute of Applied Systems Analysis, Laxenburg, Austria, in August 1986 (attended by myself and Dr Higgs from Impact, and by Messrs Lawson and Vincent from the IAC); and Dr Higgs' attendance in November 1987 at the Second Workshop on the Economy-wide Effects of Agricultural Trade Policy (held in San Diego).

I will conclude this section by quoting from a recent overview by Corden (1987) of Australian research in economics (especially as reported in the pages of The Economic Record). Professor Corden began his review as follows:

> "What can one say about The Economic Record in recent years? For this article I have taken twenty issues of the Record - from March 1980 to December 1984 - and looked at them in more detail. My aim is to give some flavour of the topics dealt with, as well as discussing the crucial issue of style.
>
> Over the years, usually well before 1980, Australian economists have made a number of special contributions, i.e., more than just applying standard models and techniques that have been developed abroad and applying them to Australian issues. In recent years, the most important area in Australian economics - an area reflected in many contributions in the Record - is the work associated with the IMPACT project. This is a joint government-University of Melbourne activity directed by Alan Powell. It has generated a number of models of the economy, principally the celebrated ORANI general equilibrium neo-classical (non-monetary) model which, in its degree of detail and the care with which

its various components have been worked out and estimated, is internationally unique. Of course there is plenty of scepticism about big models of this kind, and care has to be taken not to make excessive claims for their results. These depend utterly on the assumptions of the model and the various estimated relationships that have been put into them.

The ORANI model is the work of a team led by Peter Dixon of Melbourne University. Freebairn published a review article of the whole IMPACT project, with an evaluation (March 1980), and Corden and Dixon used ORANI for analysing the tax-wage bargain 'free lunch' proposal (September 1980). Dixon and Vincent used IMPACT for analysing the likely effects of technical change (December 1980) and Parmenter, Sams and Vincent (June 1981) used it to analyse who pays for home consumption pricing schemes. Cooper and McLaren (June 1983) expounded how the macro and Orani modules of IMPACT interfaced, and Pagan reviewed the main book on the ORANI model, written by Peter Dixon and colleagues (June 1983). Warr and Lloyd (December 1983) used ORANI for their simulations in answering the question do Australian trade policies discriminate against less developed countries?"

He concluded with:

> "Over the years some significant contributions have come from Australia - one need only mention the names of Swan, Salter and Kemp, among others. More recently Turnovsky, a New Zealander based for several years at the ANU, has published prolifically on macro-theory in international journals. The main contributions have tended to be in international economics. Of course, Australian economists could do better. For example, they could do more fundamental work, with an analytical basis, on Australia's unique industrial relations system. But in the last ten years or so Australia's special contribution has been in neo-classical general equilibrium model-building, through the IMPACT project, notably the ORANI model of Dixon and colleagues."

5. OVERVIEW OF THE WORK PROGRAM

During the triennium under review, most of the work by the basic research and development unit has been directed at widening the scope of our models, especially by research in the following areas:

(A) the analysis of long-run issues, including foreign ownership and international capital flows;

(B) the inclusion of industries which are subject to economies of scale and non-competitive pricing behaviour;

(C) the ability to analyse detailed proposals about changes in tax structures;

(D) the integration of financial and monetary markets into our modelling of the real economy;

(E) the incorporation of sufficient detail about the household sector to enable the income distributional impact of policy and other shocks to be studied;

and

(F) the integration of computable general equilibrium modelling and portfolio analysis.

Items (A) through (E) reflect the needs of the participating agencies for tools which enable them to obtain detailed economy-wide projections of the economic and social effects of policy and other changes in prospect. This model-widening thrust has been complemented by some

deepening of experience in model applications, such as Higgs' (1986b) major agricultural study, by a start on refurbishment of the parameter file on household demand behaviour, and by the development of flexible and portable software for economic modelling. Item (F) is likely to have spin-offs for the forecasting use of CGE models, and for corporate planning.

During the period covered by this review, three research topics were developed which had been canvassed in my last Report (Powell (1985a)). They were:

(a) a Harris-style version of ORANI: modelling scale economies and non-competitive behaviour;

(b) the extended Walrasian Paradigm: incorporating monetary and financial markets into economy-wide modelling;

and

(c) flexible and portable software for policy modelling.

As foreshadowed in my 1985 Report, an additional topic is being jointly researched with the IAESR; namely:

(d) adding the personal income distribution to the range of issues which can be analysed with the ORANI suite of models.

Another project, substantially financed under a separate grant to my Chair by the Wool Industry Research Trust Fund of the Australian Wool Corporation, was completed during the triennium; namely:

(e) the impact of external shocks on Australian agriculture.

In addition to the above, work has started in two other areas:

(f) respecification of consumer demand in the ORANI suite of models, with particular emphasis on the performance of this aspect of the models in simulations involving large changes, and on capturing changes in patterns of demand due to changes in the income distribution and in demography;

and

(g) the possible use of ORANI-style models in portfolio selection.

The remainder of this section reviews each of the above in the order (e), (a), (b), (c), (d), (f), (g). A brief summary of the current status of each is given in Table 4.

5.1 The Impact of External Shocks on Australian Agriculture

This work culminated in the publication of an Oxford monograph late in 1986 (Higgs (1986b)), which represents the most intensive, and best documented, application of ORANI to a particular sector of the economy. It takes full advantage of the 'typical year' (Adams (1984)) approach incorporated into the ORANI data base (Higgs (1985b), Bruce (1985c), Blampied (1985)). In keeping with its sponsorship, the ultimate focus of the study was woolgrowers' real incomes. The external shocks examined were:

(i) changes in world demand conditions for agricultural exports;

(ii) changes in protection of manufactures;

(iii) changes in activity in the minerals sector;

(iv) a hypothetical move towards indirect taxation;

(v) changes in the Australian exchange rate;

and

(vi) the implementation of a macroeconomic recovery package comprising wage restraint and stimulation of aggregate demand.

In tracing the transmission of these shocks through the economy to the farm gate, Higgs' monograph presents a lucid explanation of many key mechanisms in ORANI. The insights so provided are relevant to non-agricultural as well as to agricultural applications. A very detailed account is given of how changes in product prices and input costs at the farm gate translate into changes in output and income. The option of changing the product mix, which characterizes so much of Australian agriculture, is seen as a key adaptation by farmers and graziers confronted with a changing economic environment. Higgs' study is a durable product because detailed instructions are given on how to rescale results to reflect shocks of different sizes to those reported, and on how to convert results computed under conditions of full wage indexation into those which would pertain under alternative assumptions about wage rigidity. His results are presented in a way which will allow policy analysts to make use of them for many years to come.

5.2 Modelling Scale Economies and Non-competitive Behaviour in an Economy-wide Framework

In the context of a tiny pedagogical model, Dixon (1978) showed that the existence of international intra-industry specialization

Table 4: Current Status of Research Topics under Development at the Impact Project Research Centre

a. Research proposals undertaken in the triennium ending June 30th 1988 which were canvassed in the prospectus issued in April 1985*

Topic	Status as at 31 December 1987	Scope for further development?
(a) Incorporation of non-competitive pricing behaviour and economies of scale into applied general equilibrium modelling.	One Ph.D complete (Dr M. Horridge); several papers released reporting on pilot simulations with the new methodology.	Yes; such additional work would involve the selection of one or a few industries in which scale is important (e.g., motor vehicles), and the assembly of a suitable data base, followed by detailed scenario writing and computation.
(b) Incorporation of monetary and financial assets into applied general equilibrium analysis without losing the advantages of the Walrasian system.	One Ph.D about 2/3rds complete (Mr. P.D. Adams).	Yes; the completion of this work will yield an operational prototype from which more realistic explorations of the interplay between real activity and financial markets can be made.
(c) Flexible software for policy modelling, giving users the scope to modify existing models easily and quickly, or to build their own models from scratch with a saving of at least 85 per cent in software developments costs.	On target. Currently available code has been successfully transferred to 7 different research establishments, using widely differing mainframes and operating systems. Facility for users to specify their model using only algebraic language currently confined to VAX/VMS sites. However a personal computer (PC) version is expected soon.	Yes; portability of our most advanced code should be extended to include all potential user sites. Improvements to code for generating and manipulating data bases supporting models is desirable. At present, users present their model as an algebraic statement after linearization. Future development will automate this phase, and allow automatic elimination of linearization errors.

b. Research projects undertaken in the triennium ending June 30th 1988 which were not canvassed in the prospectus issued in April 1985*

Topic	Status as at 31 December 1987	Scope for further development?
(d) A general equilibrium facility for analysing the effects on the personal income distribution of changes in policy and in other aspects of the economic environment [jointly with the IAESR].	Prototype interfacing the HES data base with the ORANI model at advanced stage of development: 1 published paper, and 2 working papers issued (N. Agrawal and G.A.Meagher).	Substantial. Feedbacks from income distributional changes onto pattern of occupational employment, etc., yet to be developed.
(e) The impact of external shocks on the Australian agricultural sector [funded mainly by the Wool Industry Research Trust Fund].	Completed with the publication of P.J. Higgs's Adaptation and Survival in Australian Agriculture (Melbourne: Oxford University Press, 1987), pp. xxx + 320 and in three working papers.	Further applications should be done in user establishments, not basic research unit.
(f) Respecification of consumer demand in ORANI with emphasis on large-change solutions and on compositional changes due to changing income distribution and demography.	One exploratory paper issued (Chung and Powell); more in preparation.	Substantial. Recent developments in the empirical analytics of consumer demand offer substantial scope for improvement, as does the availability of HES unit record data.
(g) The integration of applied general equilibrium modelling with portfolio analysis.	Three exploratory working papers issued; more in preparation (P.J. Higgs).	Substantial. Challenge will be to develop an appropriate data base mapping the productive assets of corporations by industry.

* Alan A. Powell, "Impact Project Report: 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, University of Melbourne, April.

("cross hauling"), plus economies of scale in production, would lead to estimates of the advantages of free trade which are much higher than those captured by traditional models such as ORANI (Dixon, Parmenter, Sutton and Vincent (1982)). Given the existence in Australia of some protected industries in which scale economies are known to be important (e.g., motor vehicles, chemicals), it follows that standard ORANI simulations must seriously underestimate the costs of protection.

The first empirical general equilibrium work on these issues was Canadian (Harris (1984a,b)). This work tended to confirm Dixon's surmise. Work at Impact began with Mark Horridge's candidature for the Ph.D, and concluded (at least for the time being) with the submission in mid-1987 of the thesis for which he was awarded the doctoral degree: namely,

> "The Longterm Costs of Protection: An Australian Computable General Equilibrium Model" (Horridge (1987a)).

Because the costs of protection are best handled as a long-run issue, the first task confronted by Horridge was to implement the long-run closure of ORANI prototyped in Dixon, Parmenter and Rimmer (1984) and in Horridge and Powell (1984). This represented a major development of standard ORANI; that is, of a CGE model without scale economies -- this work is reported in Horridge (1985b). Harris' ideas on scale and on non-competitive pricing were then investigated in an Australian context using a miniature ORANI model incorporating these features (Cory and Horridge (1985)). This was followed by simulations with a modified version of the full ORANI model (Horridge (1987c)). Although the model

is full-sized, the data base relating to scale economies is hypothetical, as is the characterization of non-competitive price behaviour. So whilst the thesis and the associated working papers cited above identify precisely the points at which further empirical evidence is needed, they do not settle definitively the question of how much Australia's system of protection is costing (in terms of GNP foregone, say). The results do confirm earlier insights; if, for example, the motor vehicles and parts (MVP) industry as a whole had a scale elasticity of 1.25, then a 25 per cent cut in the tariff on MVP would lead to a gain in real GNP of 0.23 of one per cent; in the absence of scale economies the benefit is only one third as large (0.07 per cent). Such results have not been obtained previously in the context of detailed economy-wide model of Australia.

Obtaining precise information on pricing behaviour and on scale economies, as they apply to various Australian industries, is an information gathering task well beyond the resources of the Impact Project. Such data gathering would require both the cooperation of particular industries, and the resources of a relatively large organization (such as the IAC or the BIE). The effort would be costly. What could be gained, however, is in many ways attractive: scenarios on the long-term consequences of different approaches to restructuring could be investigated in detail. Such work could provide realistic estimates of workforce displacement and reabsorption in different specialized processes within existing manufacturing industries (as identified at the input-output level). If, for example, the government required detailed analysis of the long-run effects of the motor vehicle plan now in place, and of alternatives, the above methodology offers the best prospect for obtaining reliable insights.

5.3 Flexible and Portable Computer Software for Policy Modelling

Software development has been a major thrust of Impact's work program in the triennium under review. In my last Report (Powell (1985a)) I gave a preview of the software development program as then foreseen by our chief software specialist, Ken Pearson (1986). To recapitulate, it was envisaged that most of the steps involved in designing, writing and implementing computer programs to solve large models, could be automated. The major goals were:

(a) to reduce the cost of building new policy models, and of altering existing ones, by freeing the economic modeller from many of the erstwhile time-consuming tasks involved in translating his algebraically and numerically specified model into a computer implementation;

(b) to make the ORANI suite of models, and other models, readily portable between computer installations.

The vehicle which already has made substantial progress in achieving these twin goals is a software suite called GEMPACK, designed and built by Ken Pearson and George Codsi. The philosophy behind GEMPACK is described in Pearson (1986). The facility at its present stage of development has been extensively documented, with more than 800 pages of text currently available (see Appendix 2). What has been achieved so far?

In Pearson (1986) some 15 steps are identified, many or all of which must be followed in the specification and implementation of a

large comparative static economic model. These steps range from algebraic development of the theory, followed by data mobilization, through the creation of suitable computer code, to the final execution of that code to produce simulations. Most of the steps in the code creation process can, in principle, be automated; that is, higher level code can write the special-purpose computer programs needed to implement particular models. Such an approach can eliminate the very large input of professional computer programmer time which would otherwise be needed to mount each once-off modelling exercise.

The most advanced of the currently available GEMPACK facilities, namely TABLO, effects such an automation of the (formerly) very time-consuming task of converting an algebraic statement of a linearized model (in Johansen form) into the special-purpose code needed to implement it. For models of this type, this will cut that part of the cost of development represented by computer program creation by approximately 85 per cent. Moreover, this technology is easily transferrable between different computer installations and between different computers. Finally, there is a version of TABLO which fits on current generation personal computers, making it possible to implement medium-sized Johansen models at very low cost.

Apart from TABLO, other facilities available in GEMPACK allow the orderly assembly and manipulation of the large (sometimes huge) data-base/parameter files required in the numerical specification of a model, as well as examination and editing of such files. Further utilities allow the user to verify that each step in the implementation process has been executed correctly.

5.4 Incorporating Monetary and Financial Markets into Economy-wide Modelling

Like all models in the strict Walrasian tradition, the standard version of ORANI (Dixon, Parmenter, Sutton and Vincent (1982)) deals exclusively with real variables and relative prices. Approaches to the incorporation of monetary and financial variables within ORANI were canvassed by Powell, Cooper and McLaren (1983) and Cooper, McLaren and Powell (1985). One option, for which antecedents in the literature are still few (but see Feltenstein (1986a,b)) is what we have called "the extended Walrasian paradigm". In this scheme the demand for assets (including money) is modelled explicitly within a multiperiod framework. This enables the "price of money" to be treated as just another relative price, and hence for inflation to be endogenized.

Philip D. Adams, an economist from the ABARE, is researching the Extended Walrasian Paradigm (EWP) in his work towards a doctorate. In Adams (1986a) he situates the EWP within the history and recent development of economic theory. In Adams (1987c), he fleshes out an operational version of the EWP as applied to the macroeconomic and monetary closure of ORANI. A crucial detail in this framework is the modelling of household consumption and asset holding behaviour as simultaneous decisions. A closed form system, ELESA (the Extended Linear Expenditure System with Assets) is derived in Adams (1986b). To the best of my knowledge, this represents the first example in the literature of an integration of the consumer and portfolio problems which yields a tractable closed-form system, suitable alike for econometric estimation and for use in an intertemporal applied general equilibrium setting. The data base to allow econometric work to begin has been collated in Adams (1987b).

This work is on target. First results with the implementation of the overall framework should become available in the latter half of 1988.

5.5 Progress Report on the Joint IAESR-Impact Income Distribution Project

In the standard version of ORANI (Dixon, Parmenter, Sutton and Vincent (1982)), there is no mapping from the functional distribution of income (wages and profits) into the personal or household distribution of income. The availability of unit record data from the Australian Bureau of Statistics 1981-82 Income and Housing Survey (IHS) makes such a mapping possible. This possibility has been exploited by Meagher and Agrawal (1986) who use this survey data (with aggregates updated) to implement such a mapping in the context of their study of the distributional effects of proposed taxation reforms. To do this they needed to use the NAGA (Meagher and Parmenter (1985)) fiscal extension of the ORANI model, as indeed they did in their analysis of different policy responses to the 1980's decline in Australia's terms of trade (Agrawal and Meagher (1987)).

Consonant with the distributional focus of this research, Dr Agrawal contributed a paper on the economic effects of public housing programs in Australia to a recent IAESR social issues symposium (Agrawal (1987a)). Other papers by her on the distributional theme concern the use of adult equivalence scales (Agrawal (1987b)), the sources of male/female inequality (Agrawal (1986b)), and labour-market issues relevant to the IHS-augmented ORANI-NAGA model (Agrawal (1986a)).

The most recent application of this augmented model is an analysis of options for fiscal reform (Agrawal, Meagher and Parsell (1987)). Unlike much of the literature (including most current Australian writing other than Dee (1987b)) on this topic, these three authors make explicit allowance for involuntary unemployment. In this and the other applications discussed above, the Impact-IAESR team -- Dr Agrawal from Impact and Dr Meagher (and more recently, also Mr Parsell) from the IAESR -- have established a methodology for analysing the impact on the personal distribution of income of a wide variety of policy actions and other shocks. This is already an advance over the alternative methodology used, for example, by the economic researchers who provided estimated impacts of tax changes to the participants in the July 1985 tax summit. The advance consists of taking explicit account of the effects generated by the tax changes, both on the macroeconomic climate and on the occupational composition of labour demand. What remains to be captured (see Section 6 below) is the feedback from income distributional changes onto such variables.

5.6 Modelling Consumer Demand

Work on respecification of the consumer demand equations in ORANI started during my tenure of the McKethan-Matherly Senior Research Fellowship at the University of Florida during January-April 1987. The impetus for this redevelopment was the discovery by Professors Theil (the McKethan-Matherly Eminent Scholar) and Clements (of the University of Western Australia) that the assumption of constant marginal budget shares was seriously violated by recently available international cross sectional data (Theil and Clements (1987)). This implied that models,

such as the Linear Expenditure System (LES) and those belonging to the Rotterdam family, were misspecified -- at least in those situations (such as CGE simulations) in which very large changes in real income are a possibility. Theil and Clements developed a system which (like LES) assumes additive preferences but which (unlike both LES and Rotterdam) allows marginal budget shares for individual commodities to vary in response to income changes: the marginal budget share for food, for example, was found to decline as per capita real income increased.

For Engel effects, Theil and Clements used Working's Law, which states that the proportion of the budget devoted to a commodity increases linearly with the logarithm of real total expenditure (Working (1943)). Dr Ching-Fan Chung (McKethan-Matherly Post-Doctoral Fellow) and I used Theil and Clements' framework to fit a consumer demand system to 33 years of Australian national accounts data (Chung and Powell (1987)). This work uncovered, and proposed a solution to, some anomalies which arose in estimating the demand for housing.

The additive preference version of Theil and Clements' system, however, has one potentially serious disadvantage from the viewpoint of applied general equilibrium analysis: although budget shares are guaranteed to sum to unity across commodities, there is no guarantee that such budget shares individually lie between zero and one. This is a problem in common with all models using Working's Law, including the AIDS (Almost Ideal Demand System) model of Deaton and Muellbauer (1980)). A new model, MAIDS (Modified AIDS) has recently been proposed by Cooper and McLaren (1987).

Relative to AIDS, MAIDS may sacrifice the property of exact aggregation over consumers in return for improved regularity properties. In particular, in MAIDS it is always guaranteed both that budget shares sum to unity and that no individual commodity share can ever become negative.

Dr Cooper and Associate Professor McLaren, and Dr Agrawal and I, are currently involved in initial empirical trials with this new system. It seems possible to combine its advantages with those of additive preferences.

5.7 Portfolio Analysis

This project is attempting to develop a forward-looking approach to portfolio management. The first step involves selecting a CGE Model and specifying future economic scenarios for its exogenous variables. The CGE model is then solved for the effects of the economic scenarios on, for example, industry rates of return. These projections are then mapped from industries to corporations according to their base-period holdings across industries. Finally, the expected return and risk is projected for any given portfolio of corporate stocks.

So far, two preliminary working papers and one draft paper have been produced on this topic. The first of these (Higgs (1987a)) describes a miniature version of ORANI, MO87, built as a prototype for generating portfolio-analytic decision rules within a CGE framework. The second preliminary working paper develops a technique for forecasting with CGE models (Higgs (1987c)). The third paper -- in draft form at this stage (Higgs forthcoming 1988a)) -- uses this forecasting technique with MO87 to develop a forward-looking approach to portfolio analysis.

During 1987, Dr Higgs gave seminars on this project at the University of Melbourne's Workshop in CGE Modelling (February and June); the Graduate School of Management, University of Melbourne (July); and the University of British Columbia, Vancouver (November).

Future work will entail completing the above draft paper; refining the forecasting technique; and using the full ORANI model (as opposed to the miniature model) to study the prospects for some portfolios consisting of corporate stocks listed on the Australian exchanges.

5.8 Seminars and Visitors

During the triennium, the Impact Project continued to share a Workshop in Computable General Equilibrium Modelling with the other members of the University of Melbourne's Department of Economics and with the Institute of Applied Economic and Social Research. This workshop serves the following roles:

(i) an open forum for Australian CGE modellers to discuss work in progress;

(ii) a venue in which graduate students, not only from the participating universities, but from all Australian Universities, can present their ideas at critical stages in the development of a CGE thesis;

(iii) an avenue via which visiting academics from overseas can communicate latest developments to the Australian profession.

The list of topics and speakers for the 95 meetings held during the period March 1985 through December 1987 is given in Appendix 3. Distinguished overseas visitors during this period included:

Professor George Bitros, Athens School of Economics
Professor Soren Blomquist, University of Stockholm
Mr Andrew Dilnot, Institute for Fiscal Studies, London
Professor Andrew Feltenstein, University of Kansas
Professor Richard Harris, Queens University, Canada
Professor Hendrik Houthakker, Harvard University
Professor Walter Isard, Cornell University and
University of Pennsylvania
Professor Michael Percy, University of Alberta
Professor Sherman Robinson, University of California at Berkeley
Professor Lars Werin, University of Stockholm

During the period covered there were 27 graduate student presentations. A total of 20 Australian residents travelled interstate to address the workshop.

5.9 Review of Current Documentation

The profile of recent documentation is shown in Table 5. The biggest items, each with roughly 30 per cent of the page total, were extensions of the ORANI suite of models, applications of the standard version of ORANI, and GEMPACK documentation. Consistent with Impact's tool-building role, the functional split-up of this literature heavily

Table 5

Profile of Recent Impact Documentation*

Topic/ Model	Data and Parameter Estimation	Method/ Expositions	Applications	Computer Manuals	Sub Totals
ORANI					
-standard version	155 (4.9)	206 (6.5)	497 (15.6)	37 (1.2)	895 (28.1)
-extensions	149 (4.7)	771 (24.2)	125 (3.9)	67 (2.1)	1112 (34.9)
GEMPACK	0	46 (1.4)	0	833 (26.1)	879 (27.6)
Interfaced Models	0	21 (0.7)	0	0	21 (0.7)
BACHUROO	0	21 (0.7)	0	0	21 (0.7)
Other	112 (3.5)	101 (3.2)	45 (1.4)	0	258 (8.1)
Sub-Totals	416 (13.1)	1166 (36.6)	667 (20.9)	937 (29.4)	3186 (100)

* The entry in the table is the number of pages from the total set of documents listed in Appendices 1 and 2. The period covered by the table is 1st March 1985 through 31st December 1987. The number in parenthesis is the percentage of total pages. Some percentages do not add exactly to marginal totals due to rounding.

emphasised methodological and expositional papers (37 per cent) and computer manuals (29 per cent). Some 13 per cent of the page total was devoted to data and/or parameter estimation. Given that the parameter file of the ORANI model was estimated mostly in the 1970's, this last-mentioned category is likely to expand in the next triennium as updating of the model's parameters proceeds.

Project members and associates are encouraged to attempt publication of their work independently of Impact. Recent experience is summarized in Table 6. Some 20 titles were published or accepted for publication during the 33 month period reviewed, 8 of them overseas. Among the latter was Dr Higgs' Oxford monograph (Higgs (1986b)).

6. PROSPECTUS FOR FURTHER DEVELOPMENT

Three factors impinge upon the proposed work program. First, the policy-information system based on the ORANI suite of models is a durable tool. Its durability, however, is not absolute, but depends critically on maintenance (to offset depreciation) and on refurbishment (to avoid obsolescence). Without these continuous inputs the tool will rapidly become unusable. That is, the models will only be useful to policy makers provided their theoretical bases, their data bases, the estimation of their parameters, and their computer implementations, are kept up to the state of the art.

Second, the direction of model development remains responsive to the evolving needs of the participating agencies.

Table 6

Impact Project Research Documents Independently Published

March 1985 - December 1987*

Item	Where Published?		Sub-Total
	Locally	Overseas	
Monographs	-	1	1
Journal articles			
published	8	2	10
accepted for publication	2	1	3
Chapters in books	-	1	1
Conference volumes			
papers published	2	1	3
accepted for publication	-	2	2
Sub-totals	12	8	20

* Includes some titles forthcoming 1988. Based on Appendix 1.

Third, from Table 4 it is seen that of the seven topics developed during the review period, all but one have considerable potential for further work. These six topics can be further divided into those where such additional development could reasonably be attempted by the Impact basic research and development group alone, and those which would require cooperation with other bodies and/or the injection of new resources. For the purposes of this classification it is assumed that enough support can be found to keep the full-time Impact basic research staff unchanged at seven (six professionals plus one graduate student). Then the topics split as in Table 7.

6.1 Further Development of Software

The GEMPACK software development program has reached the stage where applied general equilibrium modellers need only be able to write down their linearized model algebraically, and to give the numerical details of their data base/parameter file. All coding operations are then handled automatically by the TABLO facility within GEMPACK. Relative to the erstwhile state of the art, the availability of TABLO saves about 85 per cent of computer professional inputs into the implementation of a CGE model in the Johansen class.

As impressive as these developments are, there remains the question of eliminating linearization errors (which could be important in some simulations involving relatively large shocks). The methodology for improving the performance of Johansen solutions under large changes was worked out in detail by Dixon, Parmenter, Sutton and Vincent (1982, Sections 35 and 47). These procedures are amenable to automation. An important goal in the GEMPACK development program for the forthcoming triennium will be to provide this "large change" facility as an option.

Table 7

Provisional Prospectus of Topics for Development
in the Triennium Commencing July 1st 1988

A. List of topics which could be (further) developed without reliance on establishing new cooperative arrangements or major new injections of funds*

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1. Flexible and portable computer code for economic modelling.

□ 2. Integration of modern investment theories, including expectational variables, into practical applied general equilibrium analysis.

3. Incorporation of income distributional detail into applied general equilibrium analysis.

4. Revision of the consumer demand specification of ORANI to allow :

   (a) more reliable large-change simulations, and
   (b) the recognition of demography and income status as determinants of consumption patterns.

B. List of topics which could be (further) developed, but which would require cooperation of other institutions and/or a major new injection of funds

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□ 5. Incorporation of financial and monetary variables into applied general equilibrium analysis without losing the advantages of the Walrasian system -- extension to full-scale policy simulations with a detailed economy-wide model.

□ 6. Detailed work on economy-wide implications of restructuring an industry (e.g., motor vehicles) in which scale economies are important.

□ 7. Use of applied general equilibrium analysis in portfolio selection rules for financial institutions.

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* The list in part A of the table assumes that six full-time professionals, plus at least one full-time graduate student, can be funded as part of Impact's normal operations.

□ New topic.

At the present time, GEMPACK users obtain their results as a printable computer file. The latter is not readily amenable to further manipulation. In many applications, however, a facility for further processing of a solution file would be very helpful. Examples of frequently made post-solution manipulations include aggregation, disaggregation, retabulation, and regression analysis. It is intended to upgrade the facilities for post-solution processing of results as part of the forthcoming GEMPACK work program.

The TABLO facility, and other GEMPACK procedures, are available in PC (personal computer) as well as in mainframe versions. The PC versions at this stage are prototypes: their user-friendliness can be enhanced considerably with further work. Moreover, it seems that it is now possible to design software which will allow ORANI and models of similar size to be implemented on the latest generation of PCs, including IBM ATs and Macintoshes. These developments are planned for the next triennium.

The various GEMPACK facilities (see Appendix 2 for documentation) currently require explicit linking by a user wishing to use two or more of them. Simultaneously with the prospective developments sketched above, it will be possible to improve the user-friendliness of the overall suite of software. This will involve integrating all of the existing facilities, as well as the prospective ones outlined above, into a single user-friendly package.

To sum up thus far: during the forthcoming triennium it is planned to complete the following developments of GEMPACK:

(a) a facility to eliminate Johansen linearization error, or large change facility;

(b) a facility for easier post-solution processing of results;

(c) better PC versions of GEMPACK facilities, with the capability of solving very large models;

(d) a new fully integrated version of GEMPACK, providing easier access to existing facilities and to (a) and (b), and offering better user interfaces (screen displays, prompts, etc.).

During the triennium a start will be made on the major remaining automation-susceptible task; namely, the algebraic linearization of a non-linear model written in the levels of the variables.

6.2 Integration into CGE Modelling of Modern Investment Theories

During 1985 the University of Melbourne financed the appointment of Mr Peter J. Wilcoxen, a Travelling Harvard Scholar, to a research appointment in the Department of Economics. This appointment was under the terms of a grant to facilitate the integration of research in that Department with that conducted under the auspices of my Chair.

Mr Wilcoxen developed practical methods for harnessing insights available from modern control theory into models of investment decisions (Wilcoxen (1985a,b)). His emphasis on operational

tractability was motivated by the desire to imbed modern intertemporal models of investment behaviour within an applied general equilibrium framework. In Wilcoxen (1987) he describes a first successful implementation of these ideas (albeit on a tiny prototype).

Recent developments at the IAESR (see Section 4.5 and 4.6 above) have tended to emphasise more dynamic concerns than was common in the early ORANI literature. An extension of Wilcoxen's work to full-scale modelling offers an overlap of interest between the IAESR and Impact. Thus in the proposal outlined below there may be scope for a joint appointment of a suitable researcher, or for assembling a small team from members of both these research units.

It is proposed that Wilcoxen's method for obtaining the solution path for investment be implemented within an extended version of the ORANI model. This will allow the effects of anticipated and unanticipated changes in variables such as the company income tax rate to have real effects on the size and composition of investment, with consequent impacts on a wide range of variables, including occupational labour demands, and industry outputs. "Rational" and other forms of investors' expectations can be accommodated within this framework.

From the policy-analytic point of view, the proposed enhancement of ORANI will improve the realism and directness with which issues concerning investment can be addressed to the model. This development will also allow some new mechanisms to be investigated from a forecaster's perspective.

6.3 Income Distributional Closure of ORANI

This topic is being researched jointly with the IAESR -- see Section 5.5 above. As indicated there, the methodology as currently developed allows for policy changes to affect the personal distribution of income via induced changes in the markets for commodities and in the markets for labour and other factors. This has added new insights into tax policy (Meagher and Agrawal (1986), Agrawal, Meagher and Parsell (1987)) and into different policy responses to the fall in Australia's terms of trade (Agrawal and Meagher (1987)).

The next major development in the program involves specifying feedbacks from the distribution of income onto patterns of demand and saving. The basic data sources to support this work are the 1981-82 ABS Survey of Income and Housing (IHS) and the 1984 ABS Household Expenditure Survey (HES).

The impact of a changing income distribution on demand patterns and saving will be estimated by first identifying about a dozen household types within which consumption behaviour might reasonably be expected to be somewhat homogeneous. Age of household head, workforce status of members, and numbers of dependent children are among the relevant classificatory variables. The HES data will be used to estimate demand functions for each group and, if practicable, savings behaviour as well. Total consumption of any commodity is obtained as the weighted sum over groups of the amounts purchased by each household type. Changes in the distribution of income, therefore, will feed directly into the pattern and volume of national consumption.

Apart from purely developmental work, within the coming triennium one or more monographs illustrating applications of the new methodology can be expected. The extended version of ORANI, with detailed modelling of the household and government sectors, should fill an important (but previously empty) niche in the policy economist's tool-kit, putting the assessment of the distributional impact of policy and other economic changes onto a routine basis.

6.4 Re-estimation of Consumer Demand

As we have seen in the last section, estimation of the demand behaviour of different socio-demographic groups forms an integral part of the Income Distribution study. When complete, this work will provide the option of respecifying standard ORANI to include several, rather than just one, representative consumers. In the process the estimated demand parameters of course are made more up-to-date, better reflecting recent experience in the Australian economy.

Apart from these questions of capturing income distributional and demographic effects on consumption, and of keeping an up-to-date parameter file, the planned work on consumer demand will provide the opportunity to improve the overall specification in the way outlined above in Section 5.6. The newly available functional forms are better suited to CGE analysis than those currently used, especially in the context of simulations involving large-changes. This is why we have planned that the large-change facility within GEMPACK, and the improved demand specification, should come on stream at about the same time.

This work will be greatly assisted by the continuing cooperation on technical matters of Associate Professor K.R. McLaren (of Monash University) and Dr R.J. Cooper (of Macquarie University), who are applications-oriented theorists with international reputations in the relevant field.

6.5 Other Topics

Each of the three topics listed in part B of Table 7 has potential for further development. After the completion of prototype work, the extended Walrasian paradigm will probably need some years of careful probing before its reliability as a practical policy tool can be definitively established. At the present time my plan is to review the different approaches to monetizing CGE models -- including approaches such as Cooper, McLaren and Powell (1985) and Dee (1986) -- after the submission, sometime in 1988, of Philip Adams' doctoral dissertation. Further work will then depend on the availability of suitable personnel.

As indicated above in Section 5.2, we now have available a suitable methodology for investigating the consequences of altering the protective arrangements affecting industries in which scale economies are an important feature (Horridge (1987a)). Detailed work on the long-term consequences of restructuring one or a few selected industries would require the cooperation of these industries, and considerable manpower, in the assembly of a suitable data base. Impact stands ready to cooperate in such a venture, or to direct it, if this work is assigned priority and resources.

The project on the integration of CGE and portfolio analysis naturally falls into the following sequence:

(i) the use of a CGE model and scenarios on exogenous variables to forecast rates of return in different industries;

(ii) the translation of these rates of return, and information on their variability, into information on the rates of return, and variances of rates of return, of corporations having different mixes of industry activity (i.e., different industry portfolios);

(iii) the determination of improvements in the portfolios (of corporate stocks) of individuals or financial institutions which could be made on the basis of the forecast values of the exogenous variables in (i).

How much of this project should be supported publicly, and how much privately? There are several considerations favouring a measure of public support. First, the knowledge of the method for improving portfolio choice is clearly a public good. Second, and quite apart from portfolio analysis, the elucidation of the role of CGE models in forecasting clearly has applications in the public usage of such models. Third, to the extent that the proposed methods ultimately are successful in improving the performance of financial institutions, there is a public benefit in prospect. But clearly research on what portfolio

adjustment is optimal for a given individual or financial institution should not be supported publicly since the benefits of such research are largely captured by the private user.

At the present stage of planning, some work on this topic will continue during the first five months of 1988, focusing especially on the use of CGE models in forecasting situations. This work will concentrate on aspects which will complement, rather than compete with, the current development of this topic by the IAESR (e.g., Dixon (1986, 1987b)).

Subject to the perceived priorities of the supporting agencies, and the identification of resources, development of any or all of the three topics above could be accelerated. Equally, new topics would be considered on their own merits, in the light of financial feasibility and the possibility of attracting personnel with suitable skills.

APPENDIX 1

IMPACT PROJECT PAPERS

1st March 1985 - 31st December 1987

Document Number (Issue Date)	Author/s	Title/Publication Details
Reports		
[Periodical progress report]		
R-05 (April 1985)	Alan A. Powell	IMPACT Project Report: A Brief Account of Activities over the Period 1st February 1982 to 28th February 1985, with a Prospectus for Further Developments (University of Melbourne), pp. vi + 67.
[Monograph produced with support from the Australian Wool Industry Research Trust Fund]		
R-06 (Dec 1986)	Peter J. Higgs	Adaptation and Survival in Australian Agriculture - A General Equilibrium Analysis of Economic Shocks Originating Outside the Domestic Agricultural Sector (Melbourne: Oxford University Press, 1986), pp. xxx + 320.
General Papers - I Series		
[Papers with methodological interest and/or data bases spanning more than one model]		
IP-22 (June 1985)	Peter J. Higgs	The IDE ASEAN-Korea-US-Japan Input-Output Data Base, pp. 112.

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Appendix 1 (continued)

IP-23 (July 1985)	Peter J. Wilcoxen[a]	Numerical Methods for Investment Models with Foresight, pp. 47.
I-24 (Aug 1985)	Chris M. Alaouze	The IMPACT Trade Flow Data Base, pp. 35.
IP-25 (Oct 1985)	Peter J. Wilcoxen[a]	Computable Models of Investment with Foresight, pp. 73.
IP-26 (Feb 1986)	Russel J. Cooper and Keith R. McLaren[b]	A Generalized Intertemporal Model of Commodity Demands and Labour Supply, pp. 21.
IP-27 (March 1986)	K. R. Pearson	Automating the Computation of Solutions of Large Economic Models, pp. 28. Forthcoming in Economic Modelling.
IP-28 (Nov 1986)	Philip D. Adams	From ELES to ELESA: A Linear Expenditure System with Assets, pp. 32.
IP-29 (Dec 1986)	Nisha Agrawal	ORANI-Income Distribution Model: Labour Market Issues, pp. 32.
IP-30 (Feb 1987)	Peter J. Higgs	Forecasting with a Computable General Equilibrium Model, pp. 43.
IP-31 (Aug 1987)	Nisha Agrawal and G. A. Meagher[d]	Distributional Effects of Alternative Policy Responses to Australia's Terms of Trade Deterioration, pp. 74.
IP-32 (July 1987)	Nisha Agrawal	Analysing Distributional Issues Using Equivalent-Adult Disposable Incomes, pp. 30.

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Appendix 1 (continued)

IP-33 (July 1987)	George Codsi and Ken Pearson	Influences of the Application Environment on the Development of Software for Large Economic Models, pp. 18. Also in Commercial Software Engineering: A Way Ahead, Proceedings of Australian Software Engineering Conference, May 1987, The Institution of Radio and Electronics Engineers, Australia, pp. 199 - 207 (1987).
IP-34 (Oct 1987)	Philip D. Adams	Australian Household Wealth Statistics for the Estimation of the Extended Linear Expenditure System with Assets, pp. 90.
IP-35 (Nov 1987)	Peter J. Wilcoxen[a]	Investment with Foresight in General Equilibrium, pp. 50.

General Papers - G Series

[General information papers, applications papers, published shorter versions of previously issued papers and published papers not separately issued]

G-60 (March 1985)	Pamela Williams	Progress Report on an Economic-Demographic Model for Australia, pp. 21.
G-62 (June 1985)	Alan A. Powell	Short-Run Applications of ORANI: An IMPACT Project Perspective, Australian Economic Papers, Vol. 24, No. 44, pp. 37-53.
G-63 (Dec 1985)	Ian A. Bruce	A General Equilibrium Analysis of the Effects of Ceasing Government Production of Exotic Softwood Trees in Australia: Research Proposal, pp. 62. The first part of this paper appeared under the title "Should Pines be Privatised?" in Economic Papers, Vol. 5, No. 1, March 1986, pp. 60-73.

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Appendix 1 (continued)

G-64 (Jan 1986)	Chris W. Blampied	Telecom Australia: Cross-Subsidies and Taxes, pp. 40.
G-65 (Jan 1986)	Peter J. Higgs	Australian Mining and the Economy: A Computable General Equilibrium Analysis, pp. 47. Also in Resources Policy, Vol. 12, No. 2, June 1986, pp. 117 - 132.
G-66 (Sept 1984)	K. R. Pearson and Russell J. Rimmer	Sparse Matrix Methods on the VAX 11/780. In Proceedings of the 1984 European DECUS Symposium, Amsterdam (Marlboro, Massachusetts: Digital Equipment Corporation, 1985), pp. 545 - 552.
G-67 (April 1985)	K. R. Pearson and Russell J. Rimmer	An Efficient Method for the Solution of Large Computable General Equilibrium Models, Mathematics and Computers in Simulation, Vol. 27, No. 2/3, pp. 223 - 228.
G-68 (Dec 1985)	L. H. Liew	The Impact of Defence Spending on the Australian Economy, Australian Economic Papers, Vol. 24, No. 45, pp. 326 - 336.
G-69 (Nov 1986)	Alan A. Powell and Tony Lawson	A Decade of Applied General Equilibrium Modelling for Policy Work, pp. 61. Paper presented at the Third IIASA Task Force Meeting on Applied General Equilibrium Modelling, Laxenburg, August 1986 (Revised November 1986).
G-70 (Sept 1986)	G. A. Meagher and Nisha Agrawal(d)	Taxation Reform and Income Distribution in Australia, pp. 44. Also in Australian Economic Review (Special Issue), 3rd Qtr 1986, pp. 33 - 56.

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Appendix 1 (continued)

G-71 (Aug 1986)	David P. Vincent[c]	Applied General Equilibrium Modelling in the Australian Industries Assistance Commission: Perspectives of a Policy Analyst, pp. 54. Paper presented at the Third IIASA Task Force Meeting on Applied General Equilibrium Modelling, Laxenburg, August 1986.
G-72 (Sept 1987)	Mark Horridge, Brian R. Parmenter and Peter G. Warr[d]	Buying Australian, The Economic Record, Vol. 63, No. 182, pp. 231 - 246.
G-73 (Oct 1986)	Nisha Agrawal	Sources of Inequality between Male and Female Incomes in Australia, pp. 40.
G-74 (March 1987)	A. R. Pagan and J. H. Shannon[e]	How Reliable are ORANI Conclusions? The Economic Record, Vol. 63, No. 180, pp. 33 - 45.
G-75 (Dec 1987)	Philip D. Adams	Agricultural Supply Response in ORANI, Review of Marketing and Agricultural Economics, Vol. 55, No. 3 (forthcoming August 1988).
G-76 (forthcoming Aug 1988)	Philip D. Adams	Comparisons of Recent Estimates of Agricultural Supply Elasticities for the Australian Economy, Review of Marketing and Agricultural Economics, Vol. 56, No. 2 (forthcoming August 1988).
G-77 (Aug 1987)	Nisha Agrawal	The Economic Effects of Public Housing Programs in Australia, pp. 45. Also in Institute of Applied Economic and Social Research, Housing Australians, Proceedings of the 1987 Social Issues Conference, University of Melbourne, 1987, pp. 79 - 123.

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G-78 (June 1987)	John Fallon and Lynne Thompson[c]	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. Australian Economic Review, 2nd Qtr 1987, pp. 24 - 36.
G-79 (Sept 1987)	Peter J. Higgs	How Domestic Economic Conditions Influence the Real Exchange Rate, pp. 12. Forthcoming in Review of Marketing and Agricultural Economics, Vol. 56 (April 1988).
G-80 (Sept 1987)	Peter J. Higgs and Andy Stoeckel[h]	The Impact of a Range of Economic Policies on Australia's Balance of Trade, pp. 28.
G-81 (Dec 1987)	Nisha Agrawal, G. A. Meagher and B. F. Parsell[d]	Analysing Options for Fiscal Reform in the Presence of Involuntary Unemployment, pp. 35.

ORANI Developmental Papers

OP-53 (July 1985)	Ian A. Bruce	The Sensitivity of ORANI 78 Projections to the Database Used, pp. 45.
OP-54 (June 1985)	Peter Cory and Mark Horridge	A Harris-Style Miniature Version of ORANI, pp. 77.
OP-55 (April 1986)	Chris W. Blampied, Mark Horridge and Alan A. Powell	The Behaviour of the Major Extractive Industries in Long-Run Closures of ORANI: A Proposal, pp. 40.
OP-56 (June 1986)	Peter B. Dixon, B. R. Parmenter and Mark Horridge[d]	Forecasting Versus Policy Analysis with the ORANI Model, pp. 27. This paper also appears as IAESR Working Paper No. 4/1986, University of Melbourne. Chapter 28 in Homa Motamen (ed.), Economic Modelling in the OECED Countries (London: Chapman and Hall, 1987), pp. 653 - 666.

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Appendix 1 (continued)

OP-57 (Sept 1986)	Philip D. Adams and Peter J. Higgs	Calibration of Computable General Equilibrium Models from Synthetic Benchmark Equilibrium Data Sets, pp. 37.
OP-58 (Sept 1986)	Truong P. Truong	ORANI FUEL: Incorporating Inter-fuel Substitution into the Standard ORANI System, pp. 47.
OP-59 (Nov 1986)	Mark Horridge and Ian A. Bruce	A Modified Theory of Investment for ORANI, pp. 43.
OP-60 (Feb 1987)	Philip D. Adams	Short-run Macroeconomic Closure of ORANI: An Alternative to the IMPACT Paradigm, pp. 102.
OP-61 (April 1987)	Ching-Fan Chung and Alan A. Powell[f]	Australian Estimates of Working's Model under Additive Preferences: Estimates of a Consumer Demand System for Use by CGE Modelers and Other Applied Economists, pp. 86.
OP-62 (Aug 1987)	Mark Horridge	Increasing Returns to Scale and the Long Run Effects of a Tariff Reform, pp. 58.
OP-63 (Sept 1987)	Peter J. Higgs	MO87: A Three-Sector Miniature ORANI Model, pp. 96.
OP-64 (Nov 1987)	Mark Horridge	The Long-Run Costs of Tighter Safety Restrictions, pp. 44.

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Appendix 1 (continued)

Computer Manuals (other than for GEMPACK)(g)

C6-01 (Feb 1986)	Philip D. Adams	A User's Guide for Computing Detailed Short-run Agricultural Sector Results with the Melbourne Version of ORANI 78, pp. 37.
C7-01 (Nov 1985)	Mark Horridge	How to Use the Longrun Programs to Extend or Modify an ORANI Solution, pp. 67.

(a) Work financed under a special research grant by the University of Melbourne to its Department of Economics for the purpose of integrating the research program of the Ritchie Research Chair (held by Professor Powell) into that department.

(b) Work financed by Macquarie University and Monash University.

(c) Work carried out by the IAC's operational unit in Canberra.

(d) Work carried out jointly with IAESR.

(e) Research directed by Professor Adrian Pagan.

(f) Joint research with the McKethan-Matherly Eminent Scholar Chair, University of Florida.

(g) GEMPACK documentation is listed separately in Appendix 2.

(h) Joint research with the Centre for International Economics.

APPENDIX 2

CURRENT GEMPACK DOCUMENTATION

(as at 31st December 1987)

GEMPACK Document Number (Issue Date)	Author/s	Title
GED-2 (April 1986)	G. Codsi and K. R. Pearson	Choosing a Set of Variables, first edition, pp. 44.
GED-3 (May 1986)	G. Codsi and K. R. Pearson	SAGEM User Manual, first edition, pp. 53 + 72.
GED-5 (April 1986)	K. R. Pearson	Two Standard Implementations, within GEMPACK 1, of Short-run ORANI with 1977/8 Data, pp. 6 + 18.
GED-6 (April 1986)	K. R. Pearson	Standard Implementation, within GEMPACK 1, of the Skeletal Version of ORANI, first edition, pp. 4 + 1.
GED-7 (May 1986)	G. Codsi and K. R. Pearson	User Manual for GEMPIE and ORPIE, first edition, pp. 19 + 56.
GED-8 (May 1986)	K. R. Pearson	An Overview of GEMPACK 1, first edition, pp. 8.
GED-11 (June 1986)	G. Codsi and K. R. Pearson	GEMPACK Glossary, first edition, pp. 24.
GED-12 (Oct 1986)	K. R. Pearson	Installing GEMPACK Software on Different Computers, second edition, pp. 55.

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Appendix 2 (continued)

GEMPACK Document Number (Issue Date)	Author/s	Title
GED-13 (Nov 1986)	G. Codsi and K. R. Pearson	A Tutorial on How to Implement Economic Models Using GEMPACK Software, first edition, pp. 170.
GED-14 (Nov 1986)	G. Codsi and K. R. Pearson	Reference Manual for the Implementation of Economic Models Using GEMPACK Software, first edition, pp. 111.
GED-15 (Oct 1986)	K. R. Pearson	Installing a Software Implementation of ORANI, first edition, pp. 8.
GED-16 (Oct 1986)	A. Mikkelsen and K. R. Pearson	How to Use Header Array Files to Access Data for Economic Models, first edition, pp. 29.
GED-17 (Nov 1986)	K. R. Pearson	GEMPACK on VAX Computers, first edition, pp. 9.
GED-18 (Nov 1986)	K. R. Pearson	How to Modify Data for Economic Models - The Program MODHAR, first edition, pp. 45.
GED-19 (July 1987)	K. R. Pearson	An Introduction to GEMPACK on IBM PC and Compatible Microcomputers, first edition, pp. 21.
GED-20 (Sept 1987)	G. Codsi and K. R. Pearson	Implementing Economic Models Using TABLO, first edition, pp. 69 + 12.

APPENDIX 3

PROGRAM OF THE WORKSHOP IN COMPUTABLE GENERAL EQUILIBRIUM ECONOMICS

March 1985 - December 1987

Date	Speaker	Topic
	1985	
Convenor: Alan A. Powell		
Thurs 28 March	Mr Ian Bruce Impact Research Centre	The Sensitivity of ORANI Projections to the Data Base Used
Wed 3 April	Dr Tony Meagher and Mr Brian Parmenter IAESR	Some Short-Run Effects of Shifts from Direct to Indirect Taxation
Thurs 11 April	Dr Peter Cory Impact Research Centre and Boston University Mr Mark Horridge Impact Research Centre	A Harris-Style Miniature Version of ORANI
Thurs 18 April	Mr Peter Wilcoxen University of Melbourne and Harvard University	A Partial Equilibrium, Rational Expectations Perspective on Corporate Investment
Tues 23 April	Mr Wolfgang Ernst IAESR	Optimised Economic Policy: A Feasibility Study on LPK-MO, A Linear Programming Version of Miniature ORANI
Fri 3 May	Mr John Shannon University of Melbourne and ANU	Sensitivity Analysis for Linearized CGE Models
Thurs 9 May	Dr Russel Cooper Macquarie University	Consumer Demand and Portfolio Choice

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Appendix 3 (continued)

Tues 4 June	Prof Richard Harris Queens University	Reaction to Proposals by Cory and Horridge for a Harris-Style Australian Model - I
Wed 5 June	Prof Richard Harris Queens University	Reaction to Proposals by Cory and Horridge for a Harris-Style Australian Model - II
Thurs 13 June	Mr Peter Higgs La Trobe and Harvard Universities and University of Melbourne	A Multi-Country Data Base for CGE Modelling
Thurs 27 June	Mr Chris Blampied Impact Research Centre	Telecom Australia: Cross-Subsidies and Taxes
Wed 3 July	Mr Ken Sawers Australian National University	The General Equilibrium Consequences of Iron and Steel Imports
Wed 10 July	Mr Peter Wilcoxen University of Melbourne and Harvard University	Numerical Methods for Investment Models with Foresight
Thurs 18 July	Dr Truong Truong and Dr Ross Chapman University of New South Wales	General Equilibrium Modelling of Some Issues in Energy Policy: A Preliminary Proposal
Thurs 25 July	Mr Philip Adams Impact Research Centre	Agricultural Supply Behaviour in ORANI: The Construction and Use of a Typical Year Data Base
Tues 30 July	Dr Andrew Feltenstein International Monetary Fund	A Dynamic General Equilibrium Analysis of Financial Crowding Out: Theory with an Application to Australia
Thurs 8 Aug	Dr Mark Thomas University of Virginia and Australian National University	CGE Models and Research in Economic History

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Appendix 3 (continued)

Thurs 15 Aug	Mr Peter Wilcoxen University of Melbourne and Harvard University	A Prototype Multi-Period GE Model with Foresight
Thurs 12 Sept	Mr Peter Higgs Harvard and La Trobe Universities and Impact Research Centre	Adaptation and Survival in Australian Agriculture
Thurs 26 Sept	Mr John Shannon University of Melbourne and Australian National University	How Reliable are ORANI Conclusions?
Thurs 3 Oct	Mr Chris Blampied Impact Research Centre	Long-Run Modelling of Mining in ORANI: A Proposal
Thurs 10 Oct	Mr Ian Bruce Impact Research Centre	A GE Analysis of the Effects of Ceasing Government Production of Exotic Softwood Trees in Australia: Research Proposal
Thurs 17 Oct	Mr Mahinda Siriwardana Centre for Economic Policy Research Australian National University	CGE Modelling in a Historical Context: Victoria 1880
Thurs 24 Oct	Mr Peter Higgs Harvard and La Trobe Universities and Impact Research Centre	Calibration and All That
Thurs 31 Oct	Professor Peter Dixon, Dr Tony Meagher, Mr Brian Parmenter, IAESR and Professor Alan Powell Impact Research Centre	Forecasting versus Policy Analysis with the ORANI Model

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Appendix 3 (continued)

1986

Thurs 20 Feb	Mr John Fallon IAC	System-Wide Estimation of Trade Elasticities for CGE Models
Thurs 27 Feb	Dr Philippa Dee IAC	Financial Modelling in ORANI: An Application to Korea
Thurs 6 March	Dr Nisha Agrawal Impact Research Centre	Distributional Effects of International Debt: A General Equilibrium Model of the Philippines
Thurs 13 March	Prof Peter Dixon, Mr Brian Parmenter, Mr Mark Horridge, Impact Research Centre	Adapting ORANI to Forecasting Applications
Thurs 20 March	Dr Glenn Harrison University of Western Ontario and University of Melbourne	How Reliable is Applied General Equilibrium Analysis?
Thurs 27 March	Dr Ken Pearson La Trobe University and Impact Research Centre	Automating the Computation of Solution of Large Economic Models
Thurs 3 April	Mr Philip Adams Impact Research Centre	Money in CGE Modelling: Past, Present and Future
Thurs 10 April	Professor Alan Powell and Mr Chris Blampied Impact Research Centre	The Behaviour of Mining Industries in Long-Run Closures of ORANI: Insights from the Theory of Optimal Extraction -- 2nd Progress Report
Thurs 24 April	Mr Wolfgang Ernst IAESR	GDP Price Deflators in a GE Model

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Appendix 3 (continued)

Thurs 1 May	Dr Nisha Agrawal Impact Research Centre Dr Tony Meagher IAESR	Taxation and Income Distribution: Preliminary Studies
Thurs 8 May	Dr Glenn Harrison University of Western Ontario and University of Melbourne	On the Aggregation of Input-Output and General Equilibrium Models
Thurs 22 May	Prof Michael Percy University of Alberta and University of Tasmania	Economic Rents, Government Policy and Industrial Structure
Thurs 29 May	Dr John Piggott University of Sydney	Applied General Equilibrium and Household Production
Thurs 5 June	Mr David Vincent IAC	Stabilization and Adjustment in Commodity-Dependent Developing Countries: Findings from a Collection of Studies Centred around Country-Specific CGE Models
Thurs 19 June	Dr Rodney Tyers Australian National University	Analysis of International Trade in Agricultural Products: Simulation Modelling of Commodity Markets
Thurs 26 June	Professor Peter Lloyd University of Melbourne	Economies of Scope in Agriculture: the CRETH Multiple Output Production Function
Thurs 3 July	Dr Truong Truong University of NSW	Inter-fuel and Inter-factor Substitutions in ORANI
Thurs 10 July	Dr Glenn Harrison University of Western Ontario and University of Melbourne, and Ms E.E. Rutstrom, Stockholm School of Economics	Trade Wars: Computing Nash Equilibria in General Equilibrium Models

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Appendix 3 (continued)

Thurs 17 July	Dr Peter Higgs and Mr Philip Adams Impact Research Centre	How Much Difference Does Typicalization of a Data Base Make? -- Standard Tariff Experiments of ORANI with 1977-78 Data
Thurs 24 July	Dr Keith McLaren Monash University	A Generalized Intertemporal Model of Commodity Demands and Labour Supply

Convenor: Peter J. Higgs

Thurs 14 August	Mr Philip Adams Impact Research Centre	Money in CGE Modelling: Further Developments
Thurs 21 August	Professor Alan Powell Impact Research Centre	A Decade of Applied GE Modelling for Policy Work
Thurs 4 Sept	Mr Andrew Dilnot Australian National University and Institute for Fiscal Studies London	Tax and Social Security Modelling: Lessons from the UK
Thurs 11 Sept	Mr Brian Parmenter IAESR	Further Developments on Australia's Debt
Thurs 18 Sept	Mr Wolfgang Ernst IAESR	Preliminary Results on Shadow Prices from ORANI-LP
Thurs 25 Sept	Dr Christine Smith Griffith University	Is there an Alternative to ORANI for State Based Economic-Demographic Projections?
Thurs 2 Oct	Mr David Johnson IAESR	Jorgenson's Applied Demand Analysis and Australian Data
Thurs 9 Oct	Mr John Shannon University of Melbourne	Some Approaches to Sensitivity Analysis of CGE Models

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Appendix 3 (continued)

Thurs 16 Oct	Dr Ken Pearson Impact Research Centre and La Trobe University Mr George Codsi Impact Research Centre	The Computation of CGE Models: Streamlining the Calculations of Shares etc., from the Data Base
Thurs 13 Nov	Dr Nisha Agrawal Impact Research Centre	Labour Market and Distributional Issues in General Equilibrium Modelling
Thurs 20 Nov	Mr Mark Horridge Impact Research Centre Mr Ian Bruce Industries Assistance Commission	Investment Parameters in the ORANI Model

1987

Thurs 19 Feb	Professor Lars Werin University of Stockholm and IAESR	An Applied General Equilibrium Model of the Asset Markets in Sweden
Thurs 26 Feb	Dr Peter Higgs Impact Research Centre	Forecasting with a CGE Model
Thurs 9 Apr	Professor George Bitros Athens School of Economics	Measuring Product Prices under Conditions of Quality Change: The Case of Passenger Cars in Greece
Thurs 16 Apr	Dr Philippa Dee, IAC	A Fiscal ORANI
Thurs 23 Apr	Dr Ardo Hansson University of British Columbia	Political Regime Changes and Exchange Rate Determination
Thurs 7 May	Dr Warwick McKibbin Reserve Bank of Australia	Policy Analysis with the MSG Model

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Appendix 3 (continued)

Thurs 21 May	Dr Godfrey Lubulwa La Trobe University	Road Haulage Deregulation: Simulations with ORANI
Mon 25 May	Professor H.S. Houthakker Harvard University	A New Function for Describing Income Distribution
Tues 26 May	Professor Sherman Robinson, University of California	Externalities and Productivity: A Model of Export-led Growth
Wed 27 May	Professor Sherman Robinson, University of California	Macroeconomics and CGE Models: Theory and Modelling Strategies
Thurs 28 May	Dr Ken Pearson La Trobe University	The World Bank Packages GAMS and HERCULES for CGE Modelling
Thurs 4 June	Dr Guay Lim University of Melbourne Dr Tony Meagher, IAESR	Modelling Taxation and Financial Flows
Thurs 11 June	Dr Peter Higgs Impact Research Centre	A Forward Looking Approach to Portfolio Analysis Using a CGE Model
Thurs 18 June	Dr Tony Meagher and Mr Brian Parmenter IAESR	A CGE Model of the Northern Territory
Thurs 25 June	Dr Nisha Agrawal Impact Research Centre Dr Tony Meagher, IAESR	Distributional Effects of Alternative Policy Responses to Australia's Terms-of-Trade Deterioration
Thurs 2 July	Mr Bruce Parsell IAESR	Reductions in Government Expenditures in the ORANI Framework
Thurs 16 July	Dr Nisha Agrawal Impact Research Centre	Analysing Distributional Issues Using Equivalent-Adult Disposable Incomes

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Appendix 3 (continued)

Thurs 23 July	Mr David Johnson IAESR	Economic Forecasts of the Goulburn Valley
Thurs 30 July	Professor Alan Powell Impact Research Centre	Australian Estimates of Working's Model under Additive Preferences
Thurs 6 August	Mr George Codsi Impact Research Centre	A Forward Looking Approach to Software for CGE Modelling
Mon 10 August	Professor Walter Isard Cornell University and University of Pennsylvania	New Directions in, and Applications of, Global Economic Modelling
Thurs 13 August	Mr Philip Adams Impact Research Centre	Calibration of a CGE Model that Incorporates Money
Thurs 27 August	Mr Jens Breckling, BAE Dr Andy Stoeckel Centre for International Economics and Ms Sally Thorpe, BAE	A General Equilibrium Model for the European Community
Thurs 3 Sept	Professor Peter Dixon Mr Brian Parmenter IAESR	Modelling the Long-Run Supply Behaviour of Mining Industries
Thurs 10 Sept	Dr Mark Horridge Impact Research Centre	Increasing Returns to Scale and the Long-Run Effects of a Tariff Reform
Thurs 17 Sept	Mr George Codsi Impact Research Centre Dr Ken Pearson La Trobe University	Why CGE Modellers will Never Need to Write Code Again: the GEMPACK Program TABLO
Thurs 24 Sept	Professor Alan Powell Impact Research Centre	Making Working's Law Work Better

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Appendix 3 (continued)

Thurs 1 Oct	Professor Soren Blomquist, University of Stockholm and ANU	Intertemporal Models of Consumption, Savings and Labour Supply
Thurs 15 Oct	Mr Mohammad Jaforullah University of Adelaide	Flexibility of Production Functions in Applied General Equilibrium Models
Thurs 22 Oct	Mr Jayatilleke S. Bandara La Trobe University	Dutch Disease Effects of Capital Inflow: the Case of Sri Lanka
Thurs 29 Oct	Dr Mark Horridge Impact Research Centre	Long-Run Economy-Wide Effects of Tighter Safety Regulations on Manual Lifting
Thurs 5 Nov	Dr Peter Higgs Impact Research Centre	Domestic Trade Distortions and Australian Agriculture
Mon 9 Nov	Mr Paul Gretton IAC	Modelling Export Supplies and Industry Transformation Prospects
Thurs 12 Nov	Mr David Johnson IAESR	A Theoretical Discussion of Poverty Indices
Thurs 26 Nov	Dr Nisha Agrawal IMPACT Research Centre Dr Tony Meagher and Mr Bruce Parsell, IAESR	Analysing Options for Fiscal Reform in the Presence of Involuntary Unemployment
Wed 2 Dec	Mr Lars Westin University of Umea	Interregional CGE Modelling
Thurs 10 Dec	Mr Chris Murphy Australian National University	An Analysis of the Steady-State Properties of a Macro-econometric Model
Thurs 17 Dec	Mr John Madden CREA (University of Tasmania) and IAESR	A Two-Region Model of the Australian Economy: Preliminary Results

REFERENCES

Papers issued by the Impact Project may be obtained by writing to:

The Impact Project Information Officer
Mr Mike Kenderes
Industries Assistance Commission
P.O. Box 80
BELCONNEN ACT 2616
Australia,

who will supply a catalogue on request.

(Note: AGPS = Australian Government Publishing Service.)

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