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THE CONTRIBUTION OF APPLIED GENERAL EQUILIBRIUM ANALYSIS TO POLICY REFORM IN AUSTRALIA

by

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The Impact Project is a cooperative venture between the Australian Federal Government and Monash University, La Trobe University, and the Australian National University. By researching the structure of the Australian economy the Project is building a policy information system to assist others to carry out independent analysis. The Project is convened by the Industry Commission on behalf of the participating Commonwealth agencies (the Industry Commission, the Australian Bureau of Agricultural and Resource Economics, the Bureau of Industry Economics, the Department of Employment, Education and Training, the Department of Immigration, Local Government and Ethnic Affairs, and the Department of the Arts, Sport, the Environment, Tourism and Territories). The views expressed herein do not necessarily represent those of any government agency or government.

Abstract

THE CONTRIBUTION OF APPLIED GENERAL EQUILIBRIUM ANALYSIS TO POLICY REFORM IN AUSTRALIA

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Applied general equilibrium (GE) modelling is widely used by Australian federal government agencies involved in policy making. With the possible exception of Norway, this situation seems to be unique to Australia. The present paper traces the history of the *IMPACT Project*, an initiative of the Australian Industry (formerly Industries Assistance) Commission in association with a number of Australian universities, which has been instrumental in securing the widespread acceptance of the GE method in applied policy economics. We note, *inter alia*, that the largest loser from Australia's manufacturing protectionism, namely her export-oriented farm sector, has adopted the GE approach in pressing its case to government. We ask the question: 'To what extent has applied GE modelling been influential in achieving the turn around in Australia's stance to commercial policy?' We present the relevant evidence in abbreviated form, but leave the answer to the reader.

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THE CONTRIBUTION OF APPLIED GENERAL EQUILIBRIUM ANALYSIS TO POLICY REFORM IN AUSTRALIA*

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Interviewer: *All governments ... have had troubles with the area of industry assistance ... Have you found difficulty ... in getting politicians to listen?*

Alf Rattigan: *Yes, I think, perhaps industry assistance and the effects of it can be the same as the effects of drugs on people. That once you start to give it, the industries want more and more. ... I think the quality of life [in the industries] is pretty poor and the withdrawal symptoms are simply terrible.¹*

1. Introduction

Applied general equilibrium² modelling is unlikely to have become influential in Australian policy circles without the integrity and vision of the outstanding servant of the public interest whose words are quoted above. CGE modelling became influential not just because the tool had caught the imagination of some of Australia's best economists (notably Peter B. Dixon and colleagues who designed and implemented the *ORANI* model³ in the mid 'seventies), but because it was the *right tool* for the policy problem at hand. Given the then prevalent widespread and influential hostility in Australia towards developments which might lead to reductions in protection, CGE analysis would not have survived in policy circles if the quality of the research product had been below the very demanding standards set by Dixon's group.

Rattigan was an unlikely candidate to revolutionize policy making in Australia. In 1963 he was appointed to the Chairmanship of the Tariff Board⁴ by the late Sir John McEwen, Australia's Trade Minister and an arch protectionist justly feared for his ruthless application of *realpolitik*. Rattigan himself had no background in economics, and little in policy: in his previous appointment as Comptroller-General of Customs his duties involved mainly administrative and police work. It was widely believed that he got the Tariff

* Revised version of an invited address to the International Agricultural Trade Research Consortium Meetings, New Orleans, December 1991. Without implicating them in any remaining errors or omissions, the authors would like to thank Philippa Dee, Tom Hertel, Tony Lawson and Brian Parmenter for helpful suggestions.

¹ From an 1986 interview by Michael Schilburger on Melbourne radio station 3LO with the former chief of the Industries Assistance Commission shortly after the publication of his memoirs (Rattigan, 1986).

² The terms *applied general equilibrium* and *computable general equilibrium (CGE)* are used interchangeably throughout this paper.

³ Dixon, Parmenter, Sutton and Vincent (1982).

⁴ Succeeded in 1974 by the Industries Assistance Commission [IAC] and in 1990 by the Industry Commission [IC]. The latter agency absorbed the functions of the Interstate Commission and the Business Regulation Review Board, as well as those of the IAC.

Board job because his career 'did not reveal significant conflicts with his superiors' (and in particular, with McEwen).⁵

After a few freely admitted initial blunders, Rattigan, together with the man who was later to become his chief of staff (W. B. Carmichael), set about developing a set of coherent principles to make some sense of the Tariff Board's statutory duty to provide *independent* advice which would be in the country's general interest. He distinguished clearly between his former duties as an implementer of policies determined by the legislature, and his new role as an independent adviser. (In fact, it was conflict over this question of independence which had led to the resignation of his predecessor.⁶)

It did not take Rattigan and Carmichael long to realize that the key to a proper assessment of proposed initiatives in protection and trade policy was an *economy-wide* perspective. Reflecting Max Corden's influence, the yardstick adopted by the Tariff Board to form a view about the resource allocation effects of assistance to an industry was the effective rate of protection on its output. But as the theoretical and practical limitations of effective protection as a guide to resource pulls became evident, Rattigan and Carmichael sensed the need for an economy-wide model which would identify losers, as well as winners, from proposed policy measures (especially in the area of border protection). It was this perceived need that convinced them to support H. David Evans' work⁷ at Monash University in the early 1970s and then to initiate the Impact Project in 1975 under the direction of one of us (Powell). The IAC/IC has continued to be the major sponsor and financial contributor to Impact.

The Impact Project was set up to improve the available policy information system. Specifically it was to build policy-oriented economy-wide models, and to train people how to use them. It was quite unlike any previous Australian venture in policy analysis in that it welded academics and civil servants into an interagency research team that cut across the usual civil service prerogatives of control. For this and other reasons the Project was attacked by many powerful figures inside the Canberra establishment, went through almost continuous official reviews in the early years, and had its funding referred to Cabinet on a number of occasions.

With a few honourable exceptions, the history of the adoption of the CGE approach to policy modelling in Australia, and of its impact on trade reform, is synonymous with the history and work of the Impact Project. That history and its lessons are the subject of the remainder of this paper, which is organized as follows. In Section 2 a brief account of the change in Australia's trade and industry policy stance over the last quarter century is given. Then in Section 3 the issue of gaining acceptance for CGE analysis among policy advisers is addressed. Sections 4 and 5 respectively contain a synoptic account of Australian CGE applications relevant to policy reforms, and reflections on Australian experience in building an interface between policy-advising circles and CGE researchers. Are there lessons to be gleaned here? Would they be applicable elsewhere? We are not sure, but readers may none-the-less find our account useful. Finally, in Section 6 we respond to the basic question: has the course of actual policy been affected by CGE modelling work?

5 Glezer (1982, p. 77).

6 Glezer (1982, pp. 74-6); Rattigan (1986, pp. 7-8).

7 See Evans (1972) for the prototype upon which the first Monash model was to be built. (The project died when Evans left Australia in 1974.)

2. Trade and Industry Policy Reform in Australia: the Stylized Facts

2.1 Pre-Federation Attitudes

Considering her relative youth as a significant trading entity, protective tariffs have a long history in Australia. The first protective tariff was enacted in April 1866 by the legislature of the Colony of Victoria — 'after that, no Victorian Government ever deviated from the established policy of trade protectionism in the colony.'⁸ Victoria's trade policy stance complicated the process of federation in Australia, as the other populous and important trading colony, New South Wales, was essentially free-trade in outlook.

Notwithstanding the 'intercolonial custom troubles' that characterized the final thirty years of the last century, on the first day of 1901 the six self-governing Australian colonies became a Federation.⁹ The first government of the fledgling nation 'tried to steer a middle course but it did come down somewhat on the side of protection'.¹⁰

2.2 The Tariff-Labour Nexus: The 'New Protectionism'

The political and legislative history of protection during the first decade of federation is quite complicated, but the upshot centred around what has become known as 'the Harvester case'. The protectionists were able to advance their cause when Australia's infant agricultural machinery industry, located in Victoria, charged American competitors with 'dumping' their product on the Australian market. The Deakin government, with support of the Labor Party, responded by creating 'a direct link between tariff protection and the workman's wage'.¹¹ The Government explained how the 'new protection' would work as follows:

'The method by which it is intended to secure the payment of fair and reasonable wages is ... an exercise of the taxing power. Excise duties will be imposed on certain goods, which enjoy the benefit of a sufficient protection, and an exemption of the duties so imposed will then be made in favour of those in the manufacture of which fair and reasonable wages are paid. In this way, wherever effective protection is granted, its benefits will be limited to those manufacturers whose employees are allowed to share in them to this extent.'¹²

After some initial constitutional hiccups, the New Protectionism was implemented by the Lyne Tariff of 1907-08 in conjunction with the determination by the federal Arbitration Court in the *Harvester case* of a *basic wage* which made operational the concept of 'fair and reasonable wages'. The nexus between the interests of labour and the tariff was thus enshrined in Australian policy some 34 years before Stolper and Samuelson (1941) published their famous analysis of a mechanism to account for it.¹³

8 Reitsma (1960, p. 7).

9 *Ibid.*, p.10.

10 *Ibid.*, p.12.

11 *Ibid.*, p.16.

12 See Commonwealth of Australia (1907), quoted in Reitsma (1960, p. 16, footnote).

13 In a relatively recent epilogue, Samuelson (1981) attributes the first rigorous analysis of a tariff-labour nexus that held in terms of the absolute real wage of labour and not just labour's relative share of real income, to his late wife, Marion Crawford Samuelson (1939). For further material on the historical circumstances of Australia's commitment to the New Protectionism, see Reitsma (1960), Cain (1973) and Anderson and Garnaut (1987, pp. 42 - 51). As noted by Anderson and Garnaut (*ibid.*, pp. 30-1), however, the Australian case was really one of redistribution away from the owners of

The position was reviewed officially two decades after the enactment of the Lyne tariff. The federally commissioned *Brigden Report* of 1929¹⁴ took the view that, at least up to 1926-27, the Australian tariff had been necessary to secure the historically observed levels of real wages. This in turn implied that the high levels of immigration to Australia during her first quarter century would not have been possible without the tariff. With population growth an almost universally accepted policy goal, the tariff was thus seen as crucial to Australia's having achieved a very high priority need. Despite this retrospective view, the Brigden Committee saw *further* increases in protection as likely to 'impair the national income ... and with it the real wage'.¹⁵ These views notwithstanding, Australian governments remained openly committed to high levels of manufacturing protection through into the 'sixties.

2.3 Repudiation of the 'New Protectionism'¹⁶

The contrast between Australia's trade policy stance at the beginning and end of the last quarter century is stark. The change is perhaps most marked with respect to manufacturing industry — away from policies that sought to insulate Australian industries from foreign competition, and towards exposure to that competition. It was not that the turn was sudden, a national road to Damascus, nor has the new direction been maintained fully and consistently. But looking back from the early 1990s to the time of Rattigan's appointment to the Tariff Board in the early 1960s, it is clear that there have been marked changes in the attitudes of most sections of Australian society towards industry policy — or at least, that there were until the recent onset of a severe recession¹⁷ — together with a marked shift of policy. That shift is most explicitly signalled in the May 1988 statement of the (then) Australian Treasurer (P.J. Keating):

"In the past many so-called industry assistance arrangements introduced by successive governments have been anything but assistance. Their legacy is a less flexible economy, too reliant on protection and regulation. The way forward for Australia is not to be closetted and sheltered, but to be open and dynamic, trading aggressively in the world. Only this kind of economy can provide the employment and rising living standards that Australians aspire to."¹⁸

Announcing further reductions in protection, so that by the year 1996 there would be no tariffs higher than 5 per cent, except for motor vehicles, clothing, textiles and footwear¹⁹, in March 1991 the Prime Minister stated:

a specific factor, land, towards labour, rather than that analyzed by the Stolper-Samuelson model with its fully mobile factors of production.

14 Brigden *et al.* (1929).

15 Cain (1973, p. 10).

16 In this section we have drawn freely on material in Snape (forthcoming).

17 At 10 per cent, the unemployment rate in Australia entering the last quarter of 1991 is at a height not seen since the 1930s. Predictably, outbreaks of protectionism and xenophobia have surfaced, but have not influenced policy significantly at the date of writing.

18 Commonwealth of Australia (1988, p. 16).

19 The nature of the exceptions means that protection in place in 1996 will not be negligible. Dixon, Parmenter and Powell (1984, p. 448) estimated that of the total trade destroyed by Australian protection in the early 'eighties, about two-thirds was due to protection of motor vehicles, clothing and footwear (albeit it at much higher rates than those scheduled to apply at the end of the 'nineties).

"[T]he most powerful spur to greater competitiveness is further tariff reduction. Tariffs have been one of the abiding features of the Australian economy since Federation ... and the supposed virtues of this protection became deeply embedded in the psyche of the nation. But what in fact was the result? Inefficient industries that could not compete overseas; and higher prices for consumers and higher costs for our efficient primary producers. Worse still, tariffs are a regressive burden — that is, the poorest Australians are hurt more than the richest. ... We have rejected the views of the so-called "new protectionists" because they are simply proposing, in effect, the same discredited policies that had isolated our national economy from the rest of the world and caused the great damage we are all working to repair."²⁰

This shift towards openness and integration into the world economy has been accepted by both the major political parties in Australia. It is significant, from our current perspective, that the Treasury's background work supporting both of these statements involved simulations using the *ORANI* model.²¹

3. *Establishing Credibility*

Establishing the credibility of applied general equilibrium modelling as a tool for policy analysis took time, and involved many hurdles. Some of the latter were overtly or covertly political; others were internal to the economics profession. By the late 'seventies policy economists had become used to the idea that there was more than one sort of empirical model available. Applied macro modellers and members of the newer school of applied general equilibrium economics behaved as if the other party simply did not exist. And in Australia, two groups offered competing models for the analysis of structural issues, one CGE in orientation, the other highly pragmatic²². A great deal of time and effort had to be invested in explaining to bureaucrats and others why and how the models differed. Unfortunately, the Press often was less than helpful in this task, preferring instead to reap the maximum entertainment value from differences of opinion between the modellers.

Despite these handicaps, by the early 1980s the *SNAPSHOT*²³ and *ORANI* models were beginning to be recognized by the Press and by some

20 Commonwealth of Australia (1991, pp. 1.7 & 1.9).

21 Given the opposition of the Treasury to the Impact Project over the period 1975-82, the use by that ministry of the *ORANI* model to support the Treasurer's May 1988 statement (IAC, 1988a, pp. 19-20) is a significant signal that the acceptance of CGE modelling has filtered through to the highest policy-making levels in Australia.

22 The *IMP* model was developed by P.J. Brain and associates contemporaneously with the development of the *ORANI* suite of models. The first published account of the *IMP* model (Brain, 1977), like its successors (Brain, 1979, 1981, 1986) did not give sufficient detail for independent researchers to replicate results.

23 *SNAPSHOT* was built simultaneously with *ORANI*. The completion of the former model and the publication of results from it (Dixon and Vincent, 1980) signalled the end of the cycle of work begun by Evans and others at Monash in the early 'seventies. By the time of *SNAPSHOT*'s completion, however, the limitations of the mathematical programming approach to analyzing issues of international trade were more fully understood (partly as the result of work by Dixon and Butlin (1977)); consequently *SNAPSHOT*'s use was confined to the analysis of the consequences of foreseeable technical change (Dixon and Vincent, 1980; Bureau of Industry Economics, 1981a,b).

policy advisers as serious elements in the policy debate.²⁴ Within the Industries Assistance Commission itself, acceptance was gradual.

'Initially there was scepticism, both about the [ORANI] 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.' (Powell and Lawson, 1990)

As noted by a practitioner who formerly directed a group of modellers at the IAC, the last-mentioned development was crucial in convincing the Commission that in CGE modelling it had a powerful and widely applicable tool:

'The Commission now has considerable expertise in constructing special purpose versions of ORANI. The models are in effect detailed industry models which elaborate linkages among component parts of the activities under reference, as well as between these parts, other sectors and international trade. Because such models recognize that the economy is subject to overall constraints such as those imposed over the longer term by factor supplies and the foreign account, indirect linkages between the performance of industries resulting from these constraints are automatically in place. (Vincent, 1990, p. 299)²⁵

A partial listing of special purpose versions of ORANI is given in Table 1.

In a typical enquiry by the IC lasting about one year, a team of two or three professional modellers 'has about three months to construct and implement a special purpose version of ORANI. Before modelling work can commence the team must develop a thorough appreciation of the activities under reference, their interrelationships, [and] the incentive environment in which the activities operate ... [D]ecisions are then made ... [on] which activities under reference and which assistance instruments require explicit modelling. Given the time constraint under which staff operate, the initial model specification is crucial. ... [O]nly minor modifications ... can be implemented as the inquiry progresses. ... In undertaking the modifications the team interacts closely with staff employed within the industries under reference. Industry staff may be asked to respond to a detailed questionnaire seeking (a) data on interdependences, (b) estimates of key substitution parameters - and (c)

²⁴ The influential economics editor of the daily *Australian Financial Review* devoted the whole of his column in the weekly *National Times* to the *SNAPSHOT* study of technological change; see McGuinness (1979). He had earlier written about published ORANI simulations of structural adjustment (McGuinness, 1977). The Impact Project received considerable attention from editorial writers during the 'seventies; for example the editorial "Getting the best possible advice" in *The Australian* for April 28th, 1976.

²⁵ The IAC signalled that it both had the need of, and some capacity for building special-purpose versions of ORANI as early as 1980 (IAC, 1980, p. 45). While the early special-purpose versions did no more than automate reaggregation and disaggregation of the industries, occupations, etc., of the model, given the state of computer soft- and hardware at the time, this was quite an achievement. The computer code was written by John Sutton and Alexandra Strzelecki. Since the development of the *GEMPACK* software suite, however, it has been a routine matter to change as well the economic specification of the model — see footnote 28 below.

Table 1
Selected Special-Purpose Versions of ORANI

Version	Focus	Reference
<i>ORANI-WINE</i>	Grape and wine-growing industries in the State of South Australia; proposed wine tax	Meagher, Parmenter, Rimmer and Clements (1985)
<i>ORANI-TAS</i>	Regional economy of Tasmania	Higgs, Parmenter and Rimmer (1988)
<i>ORANI-MILK</i>	Australian dairy and dairy products industry — policy analysis	Vincent (1986,1990)
<i>ORANI-F-MILK</i>	Australian dairy and dairy products industry — forecasting	Johnson (1991)
<i>ORANI-CHEM</i>	Australian chemicals and plastics industries	Vincent (1986,1990)
<i>ORANI-TRUCK</i>	Technological change in road transport	Horridge and Johnson (1990)
<i>ORANI-NT</i>	Regional economy of the Northern Territory	Meagher and Parmenter (1990)
<i>FEDERAL</i>	Australian State-Federal fiscal relations	Madden (1990)
<i>ORANI-LFT</i>	Inter-fuel substitution in the industrial sector — tax issues	Hall, Truong and Anh (1990)
<i>ORANI-MINE</i>	Minerals and minerals processing	IC (1990b, 1991d)

information on which the Commission can conduct an econometric analysis of price responsiveness.

'... The benefits are mutual. The realism, quality and potential acceptance of the modelling work is enhanced through the incorporation of detailed information at the industry level.' (Vincent, 1990, p. 299-300)

This establishment of two-way communication between the modelling team and the 'practical men' of business has been a necessary ingredient in convincing IAC and IC Commissioners that formal modelling does, indeed, have real-world relevance.

The acquisition within policy agencies of skills allowing them, more or less on a routine basis, to undertake highly sophisticated special-purpose modelling exercises, has been crucial for the widespread acceptance of the CGE approach. Such a development would not have been possible, however, without the satisfaction of three essential preconditions. The first is the availability of professional economists trained in CGE analysis; the initial gap in

this field was filled by intensive hands-on training courses.²⁶ The second is complete and accessible documentation of the core version of the model — structural form equations, data base and computer systems.²⁷ The third is the ability to modify the core model in a routine way. It is here that a quantum leap in the technology was provided by the development by Pearson and colleagues of the *GEMPACK* software.²⁸ Because this software can be mounted on virtually any computer with adequate memory, and because it allows researchers to modify an existing model by directly rewriting its equations in an algebraic language, it has become very popular among CGE modellers in Australia and beyond. Without such a facility the skills required for custom-made CGE modelling would have been well beyond the capacity of the various Australian policy agencies now routinely using CGE analysis. And as we have seen above, without such a capability to build special-purpose models, it is unlikely that the Australian policy community would have been so strongly influenced by CGE modelling.

4. Survey of CGE Applications Influential in Policy Reform

4.1 Early Illustrative Policy Simulations

The first illustrative policy simulations with the *ORANI* model were published in 1977 (Dixon, Parmenter, Sutton and Ryland, 1977). They gave estimates of the sectoral and occupational effects of changes in the general level of tariffs and in the real exchange rate in the short run (one to two years). The tariff simulation went against the common political perception in one respect, and against received economic doctrine in another. In the political climate of the mid-'seventies there persisted a strong attachment to the traditional Australian view that tariffs on manufactures are friendly to labour.²⁹ The *ORANI* simulations, on the other hand, suggested that with institutional mechanisms in place causing real wage rigidity, an across-the-board increase in tariffs would actually lead to a *loss* (albeit small) in total employment. As far as academic perceptions went, it was widely believed at the time that an increase in protection would lead to an improvement in the trade balance. Probably because the *ORANI* parameter file implicitly put export supply responsiveness a

26 Until the mid 1980s, training courses were mounted by the Impact Project and/or the Institute of Applied Economic and Social Research at the University of Melbourne at about two-yearly intervals. These courses were residential, lasting from ten to twelve days, with about twenty-five students, and typically five or more instructors. The format consisted of lectures in the morning, practice and computing sessions in the afternoons, with homework in the evenings for which tutorial assistance was provided on call. In more recent times, each year the IC (formerly, the IAC) has mounted a non-residential course lasting two weeks (one full-time week of lectures followed by one week of exercises done on a part-time basis).

27 The Impact Project has sought to document all aspects of its work at a high level of detail. The ability of many researchers outside the project to use and to modify the *ORANI* model suggests that this effort has borne fruit. For a recent example, see Hall, Truong and Anh (1990).

28 Pearson started by identifying the sequence of steps involved in setting up and solving an applied GE model (Pearson 1986, 1988). With a first-hand knowledge of these processes, it was possible to pinpoint those elements amenable to automation (*ibid.*). This (still on-going) program of progressive automation gave birth to the *GEMPACK* software suite (Codsí and Pearson 1988, 1989; Codsí and/or Pearson (various dates); Codsí, Pearson and Wilcoxon, forthcoming; Pearson 1991).

29 See section 2.2 above.

good deal higher than many economists apparently believed, the *trade tax* effect of the tariff increase led to a greater contraction in the value of exports than in the value of imports.

The second set of illustrative simulations (Dixon, Harrower and Powell, 1977) focussed on the contrast between a flexible and a rigid approach to the absorption of structural pressures then facing the Australian economy: a boom in the minerals resources sector, and a continued drift in the relative prices of traded commodities in favour of energy and energy-intensive products, and against the labour-intensive manufactured products produced in developing countries. This paper made explicit the sectoral conflicts involved by presenting results as pay-off matrices contingent on the approach ('flexecon' or 'fixecon') adopted by the authorities. This caught the imagination of at least one influential financial journalist (McGuinness, 1977), giving these early *ORANI* simulations a wide exposure in the policy debate.

4.2 Structural Adjustment and the Macroeconomy

Within a year of the publication of the simulations on structural pressures, the Impact Project was called upon to assist a committee set up by the Australian Government to study just this issue. The *Study Group on Structural Adjustment*³⁰ was chaired by the late Sir John Crawford, who had been very prominent in Australia as a senior government official and academic throughout the postwar period. Also included in the *Study Group's* membership was the President of the Australian Council of Trade Unions, R.J.L. Hawke, who was to become Prime Minister in 1983, and the chief executive of the Ford Motor Company in Australia, Sir Brian Inglis. Crawford's *modus operandi* for this exercise was to set up seven working groups, staffed mostly by civil servants, to examine different aspects of structural adjustment. One such working party was established under the chairmanship of the Treasury with the task of relating the management of the macroeconomy to the management of structural adjustment. Painfully aware that this working group was unlikely to produce a report³¹ — the Treasury was known to be against at least this part of the exercise on principle, and suspicious of the Crawford exercise in general — and despite his own predilection for 'seat-of-the-pants' economics, Crawford asked Impact for help.

Crawford's *Study Group* rejected Impact's 1978 report, possibly because it may have been seen to take too strong a line on reform of protectionist policies. The *Study Group* itself recommended that "long-term" protection should not be reduced "while employment remains above, say, 5 per cent" (a level to which unemployment has not decreased ever since). Crawford did, however, give Impact's report the status of a public document and it was published commercially as *Structural Adaptation in an Ailing Macroeconomy* in 1979.³²

Subsequent to the publication of *Structural Adaptation* many IAC reports issued in 1979 were seen by critics as being influenced by *ORANI* simulations even when no explicit mention was made of modelling. All reformist ideas

30 The *Study Group's* final report appeared as Commonwealth of Australia (1979).

31 According to the Preface to the *Study Group's* final report, "by agreement this [working] group did not proceed to a final report" — Commonwealth of Australia (1979).

32 Dixon, Powell and Parmenter (1979).

based on *ORANI* simulations were publicly excoriated by the Deputy Leader of the Opposition:

'The IAC acknowledges that in the key *ORANI* model of the IMPACT Project, 900 variables are exogenous or predetermined, that input coefficients and thus technology are based on data at least five years old, ... and that all industries are aggregated into 109 categories, so that, for instance, there is no difference between the motor vehicle and automotive components industries.

'In such a situation the results of IAC analysis are dependent on the philosophy and prejudices of the analysts. ...

'Facing such a period of rapid change in the world economy with great uncertainty, it is imperative that structural change occur in a stable, planned manner which does not exacerbate unemployment.' (Bowen, 1979)

The government of the day was at best ambivalent.

It is well known that the economies of the Australian States are to varying degrees export-oriented and import-competing. Highly protected import-competing industries loom large in the economy of Victoria, for example, while disproportionately high shares of the economies of Queensland and Western Australia are represented by unprotected industries exporting primary commodities. *Structural Adaptation* brought into sharp focus the differential effects on States of different approaches to stimulation of employment. When an expansion of aggregate demand (absorption) was chosen, the cost pressures generated harmed industries producing internationally traded goods (and in particular, those fully exposed to international competition, especially exports); hence the gains in employment in non-traded-goods industries were offset to varying degrees by losses in vulnerable traded-goods industries. Given the high degree of insulation of her import-competing industries, this showed up in the Impact simulations as a disproportionately high share for Victoria in the short-run³³ employment gains resulting from the demand expansion.³⁴ When real wage restraint was chosen as the vehicle to stimulate employment, however, the results were just the opposite: the attendant real devaluation led to an expansion in export industries and industries dependent on them, and hence to a disproportionately large increase in employment in Queensland and Western Australia. It thus appeared it might be possible to design a balanced macro package — real wage restraint, plus fiscal expansion — which would stimulate employment and activity rather evenly across regions, industries and occupations.³⁵ This could be achieved without damaging the trade balance.³⁶

33 The simulations described in this paragraph relate to a two year adjustment period.

34 Victoria had the twin advantages of having a lower than average share of its economy in the traded sector, and within the latter, industries better insulated from foreign competition.

35 Dixon, Powell and Parmenter (1979, Ch.3).

36 Formally, the following two-instrument, two-target problem, was solved: find the (common) percentage increase in (all components of) real absorption and the percentage decline in (all) real hourly wage rates (as a cost to producers) that yields a

4.3 The Cost to Farmers of Protecting Manufacturing

Following the public forays into the policy arena by the model builders during 1977-79, acceptance of the CGE method gained momentum. By the mid-1980s leading spokesmen for the farm sector realized that GE modelling could be used effectively in the policy debate, and in particular that *ORANI* could be used to estimate the extent of the damage done to farm interests by protection of manufacturing (Quiggin and Stoeckel, 1982; Crowley and Martin, 1982; Adams, 1985). The National Farmers' Federation commissioned the (Melbourne) Institute of Applied Economic and Social Research to update the *ORANI* estimates and to compare them with conflicting estimates (National Farmers' Federation (1985), Clements and Sjaastad (1984)) derived by other methods (Parmenter 1985).

The short-run burden of manufacturing protection was found by Parmenter (1986) to be equivalent to a cut in real farm incomes of about 17 per cent. The National Farmers' Federation used these estimates in prominent public discussions with the federal government to press strongly for a continuing commitment to tariff reform.

4.4 Growing Use of GE Modelling for Policy Work

In the period of slightly more than a decade after the publication of the first results in 1977 and ending early in 1988, more than two hundred applications of CGE modelling were recorded in Australia, with 177 of them publicly documented.³⁷ At that date 190 of the 203 known CGE applications used some version of *ORANI*.³⁸ Seventy CGE applications were conducted by or for federal policy agencies, some 30 of them by the IAC on its own account.³⁹

The use of the CGE approach by Australian Federal Government agencies is shown in Figure 1. The range of issues covered in applications up to the end of 1990 is indicated in Table 2. Most recently, work by the IC has extended this range to include global environmental (IC, 1991b) and trade policy (Zeitsch, 1991) issues.

given target increase in labour employment — 3 per cent, say — and a zero change in the trade balance.

37 Powell and Lawson (1990, p. 258-9).

38 *Ibid.*

39 *Ibid.* The IC regularly carries out simulations with *ORANI* under contract to other federal government agencies and, when capacity allows, to clients in the private sector. The CGE *SALTER* model (based on the OECD's *WALRAS* model) was built by the IC under contract to the Australian Department of Foreign Affairs and Trade — see Zeitsch *et al.*(1991).

Number of CGE-based
policy studies reported⁴⁰

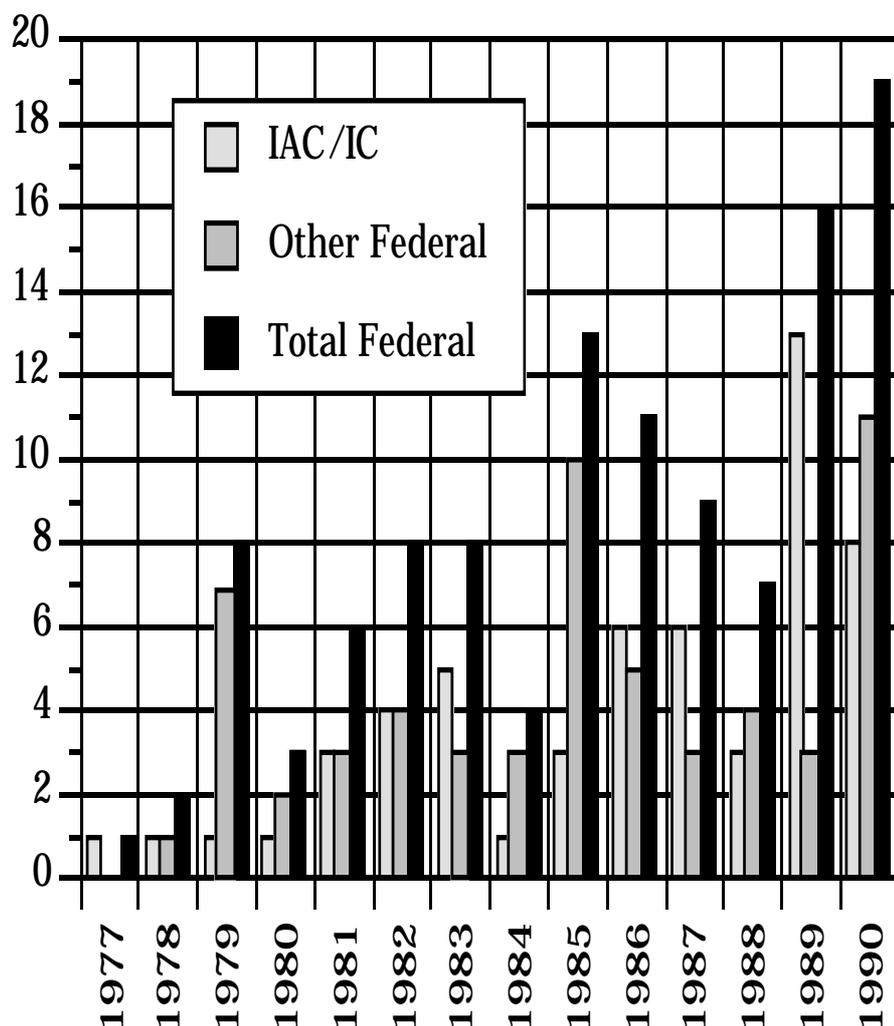


Figure 1 *Use of CGE analysis by Australian Federal agencies, 1977 – 1990*

⁴⁰ 'Number' refers to distinct entries in a list compiled from Table 2 below, Table 8.2 of Powell and Lawson (1990) (which lists known but unpublished applications of CGE modelling by federal agencies up to May 1988), plus a supplementary list of unpublished applications maintained by the IC.

Table 2
 Topics addressed by Australian Federal Agencies
 using CGE Analysis, 1977 - 1990*

Topic	Reference
1. <i>Effects of Protection</i>	IAC (1977, 1981c, 1982b,d, 1985c, 1987a,c,e, 1988a), IC(1990d), Wright and Cowan (1980), Crowley and Martin (1982), Adams (1985), Crowley, O'Mara and Campbell (1983), ABARE (1988), McDougall, Quirke and Zeitsch (1990)
2. <i>Exchange Rates</i>	Fallon and Thompson (1987)
3. <i>Terms of Trade</i>	IAC (1987e), Fallon and Thompson (1987)
4. <i>Other International Trade</i>	IAC (1979), Bateman (1984), IAC (1989a)
5. <i>Supply Shocks:</i>	
— <i>resources boom</i>	Stoeckel (1978, 1979)
— <i>technical change</i>	BIE (1981a,b)
— <i>drought</i>	Campbell, Crowley and Demura (1983), Vincent (1983)
— <i>declining crude oil production in Australia</i>	Hogan and Naughton (1990)
6. <i>Macroeconomic Policy</i>	IAC (1982c), Dee (1989a), James (1989), Sugden (1989)
7. <i>Microeconomic Reform</i>	BIE (1990), Davies (1989), Dee (1989b), IAC (1989c,f,g), IAC (1990e,f)
9. <i>Structural Adjustment and the Labour Market</i>	Butlin <i>et al.</i> (1988)
10. <i>Forecasts of Industry Structure</i>	Schmidt (1990)
11. <i>Immigration</i>	Norman and Meikle (1985), IAC (1986e)
12. <i>Recycling</i>	IC (1990c)
13. <i>Effects of Government Taxes, Grants, Charges and Regulations</i>	IAC (1986a,d), Dee (1987), BAE (1984), Dixon, Peter and Madden (1990), McDougall (1989), Thompson (1989), IAC (1989c), IAC (1989d)
14. <i>Industry Studies:</i>	
— <i>Long-run prospects of different industries</i>	BIE (1981b), Fitzpatrick and McKeon (1982)
— <i>Agriculture</i>	IAC (1982d,1983c,d, 1985c,1988b), Vincent (1986), Adams (1985) Crowley and Martin (1982), Quiggin and Stoeckel (1982), Campbell, Crowley and Demura (1983)
— <i>Chemicals, plastics</i>	IAC (1986c), Vincent (1986)
— <i>Defence</i>	Bateman (1984), Liew (1985)
— <i>Fertilizers</i>	IAC (1982a, 1985a,b), BAE(1984)
— <i>Food</i>	PJT (1979), IAC (1989c)
— <i>Forestry, timber</i>	IAC (1981b), Bruce (1988)
— <i>Glass, glassware</i>	IAC (1987d)
— <i>Iron and Steel</i>	IAC (1983a,b)
— <i>Motor Vehicles</i>	IAC (1978, 1981a, 1984a), IC (1990a)
— <i>Mining</i>	IC (1990b)
— <i>Petroleum products I</i>	IAC (1986a,d), Mannion, Tillack and Vincent (1987)
— <i>Pulp, paper, printing</i>	IAC (1987b)
— <i>Textiles, Clothing</i>	IAC (1986b)
— <i>Tourism, Travel</i>	IAC (1989e)
— <i>Transport</i>	Lawson (1979), IAC (1989e)

* This table refers only to documented studies. Based partly on Table 8.1 of Powell and Lawson (1990).

5. The Interface between Model Builder and Policy Adviser⁴¹

The range of skills, and the quantum of effort, needed to mount convincing CGE policy simulations with a large model, require a team approach. The talents needed in such a team include:

- i. Energetic leadership, the leader having intellectual grasp of the relevant subject areas and the capacity to extract the best from each member of the team.
- ii. Depth of experience in the theory and practice of GE modelling.
- iii. Expertise in data mobilization, manipulation and editing; knowledge of existing official data sources, and (preferably) contacts inside the relevant statistical agencies.
- iv. Understanding of computer operating systems and ability to mount and run software (a computer buff who will come to the rescue when the whole system collapses).
- v. Up-to-date applied econometric skills required to develop a parameter file which will stand critical scrutiny.
- vi. Public relations. (This will involve the director or deputy; anyone with lower status will not be able to function effectively in this role.)

It is likely that in the right environment the members of the team would be able to attract quality graduate students, some of whose dissertations would contribute to the work program.

How large should the team be? On the basis of experience with a model of the size of *ORANI*, the equivalent of at least ten full-time professionals is desirable, especially for the early stages of establishing a core model and a group of users within policy agencies. Ideally, in the first year or two of such an undertaking, the team size would approach 20.

The experience of Impact suggests that such a modelling exercise:⁴²

1. should not be run entirely within a university, nor entirely within the client policy agencies;
2. should be accompanied by full public documentation of data, methods, and results;
3. should have detailed involvement of the policy clientele in the design stage of model building;
4. should be at full arm's length from executive government.

The last of these recommendations involves putting some space between the practitioner who is supplying the tools and the practitioner who is crafting the policy advice. The credibility of the tools should not be left too vulnerable to misjudgments by policy analysts or to the political popularity of particular policy recommendations based on them. Item 3 above, on the other hand, emphasises that a policy-oriented model will be of limited use if no policy adviser uses it with enthusiasm. Item 2 is simply a criterion for scientific work: results must be capable of replication. Where conflicting interests are at stake, it is unreasonable to expect opponents to accept the reasonableness of

⁴¹ In this section we draw freely upon Powell and Lawson (1990, section 5).

⁴² For a detailed discussion underlying these recommendations, see Powell and Lawson *ibid.*

assumptions or the internal consistency of simulations without full documentation; moreover, they can be relied upon to invest considerable resources into unearthing any shoddy work. And in any event, abiding by best scientific practice is the assurance of quality control. Item 1 recognizes complementarities between the discipline of a civil service environment, which encourages working to a pre-announced research program, and the creativity of the academic environment, which often does not.

Finally, sponsors need to be convinced that a CGE model, including its database/parameter life, and computer systems, like any capital good, is subject to both depreciation and obsolescence. An on-going resource commitment is necessary for updating and refurbishment.

6. Concluding Remarks

To what extent has CGE modelling actually affected policy? It seems clear that the rise of economic literacy has been an important component in the evolution of policy in Australia: a symptom of this is that "economic rationalism" and "econocrats" are now under attack in some quarters. The rise of economic literacy shows up in part as a recognition of the interconnectedness of the elements of an economy, which of course is most fully captured by general equilibrium analysis. To what extent have the formalization of these interdependencies and the computing of effects of policy changes had additional effects on policy? One cannot be sure, though at the very least it is often argued that (*ceteris paribus*) those who have numbers will win the debate against those lacking them. Again (*ceteris paribus*), those who have better numbers can expect to win.

What we can say with confidence is that the necessity for Australians engaging in policy debate to put their case within an economy-wide perspective, has improved the quality of the debate substantially. To the extent that better decisions come out of better informed discussions, CGE analysis has played an important role in the evolution of policy (particularly trade policy), justifying the extraordinary efforts made by Rattigan and Carmichael to establish the method within Australian policy-advising circles.

In convincing sceptics, the problem facing trade reformers has always been the onus of telling the protectionists "where the jobs will come from"⁴³. It is often all too obvious at first sight — though often not quite so obvious with thorough analysis — where they will be lost. With the availability of CGE analysis, we are able to shed light on job and industry adjustments. While Australian policy makers are understandably nervous about possible lags — and particularly lest the appearance of these new jobs be delayed beyond the expiry of their electoral terms — their understanding of an economy-wide perspective has advanced by light years over the last thirty years. And at least for the moment, they seem to be willing to back this understanding.

43 A theme taken up by Corden (1979) in a well known expository article.

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