



IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

A joint study by the Australian Bureau of Statistics, the Department of Employment and Industrial Relations, the Department of Environment, Housing and Community Development, the Department of Industry and Commerce and the Industries Assistance Commission

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COMMENTS ON
P. J. BRAIN'S EVALUATION
OF IMPACT
by
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Associate Director, IMPACT
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The views expressed in this paper do not necessarily reflect the opinions of the participating agencies, nor of the Commonwealth government.

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nine criteria, 2.2 Econometric input to IMPACT,
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REMARKS

1 THE MAIN POINT

Dr. Brain summarized his recent review¹ of IMPACT by stating
that

"without substantial and fundamental amendment, it [IMPACT]
should not seriously be used to analyze the medium term
implications of policy change in the Australian economy,"
Brain [1977b, p. 106].

He reached this conclusion without a single citation of the IMPACT

* The IMPACT Project is a co-operative research endeavour in which the
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views expressed in this paper do not necessarily reflect the views of
any of these agencies, nor of the Commonwealth Government. Without
implicating them in any remaining errors or omissions, I would like to
thank my colleagues Tony Lawson, Brian Parmenter, Alan Powell and
John Sutton for comments and suggestions.

1. Brain [1977b].

applications papers, i.e., papers where IMPACT has been used for policy analysis of the Australian economy.¹ This omission is crucial because the usefulness of any model is only defined in relation to a specific purpose. To take an example from the everyday English use of the word 'model,' a tailor's dummy is perfectly adequate for displaying a suit in a shop window. It is, therefore, 'good' or 'useful' for that purpose. Such a model would not be 'good,' however, for teaching anatomy to students of surgery. And so it is with economic models. Each has its own strengths and weaknesses which implies that each should be used for some, but not other purposes. To demonstrate that the IMPACT framework is not relevant for policy purposes, therefore, would require a careful examination of the illustrative applications which have been made to date.

Section 3 contains a brief summary of some of the applications papers. Hopefully, the material there is sufficient at least to indicate IMPACT's policy relevance. Section 2 is a series of short points setting the record straight in places where Brain's review might be particularly misleading.

2 THREE MORE POINTS

2.1 Brain's nine criteria

Brain suggests nine properties 'which a medium-term econometric model - like IMPACT - should have,' Brain [1977b, p. 92]. He argues that IMPACT violates these properties and that, therefore,

1. See Dixon, Harrower and Powell [1977], Dixon, Parmenter, Ryland and Sutton [1977, ch. 4], Dixon, Parmenter and Sutton [1977a, b, c], Industries Assistance Commission [1977]. Of these papers, only Dixon, Parmenter and Sutton [1977c] could reasonably be said to have post-dated the preparation of Brain's article.

Rodgers, G. B. and R. Wéry, "Population and Employment, A Strategy for Research," World Employment Programme, International Labour Office, Geneva, March 1974 (mimeo), pp. 13.

Sandee, J., A Long-Term Planning Model for India, (New York and Calcutta : Asia Publishing House and Statistical Publishing Company, 1960).

Taylor, Lance and Stephen L. Black, "Practical General Equilibrium Estimation of Resource Pulls Under Trade Liberalisation," Journal of International Economics, Vol. 4 (1974), pp. 37-58.

Wéry, R., G. B. Rodgers and M. D. Hopkins, "BACHUE-2 : Version 1 : A Population and Employment Model for the Philippines," World Employment Programme, International Labour Office, Geneva, Population and Employment Working Paper No. 5 (July 1974) (mimeo), pp. 129.

World Employment Programme, International Labour Office, Geneva, "Economic-Demographic Modelling Activities of the World Employment Programme," July 1973 (mimeo), pp. 31.

Wymer, C. R., "A Continuous Disequilibrium Model of United Kingdom Financial Markets," in Alan A. Powell and Ross A. Williams (eds), Economic Studies of Macro and Monetary Relations (Amsterdam : North-Holland, 1973), pp. 301-319.

- Dixon, P. B., B. R. Parmenter and J. M. Sutton, "Industry Implications of International Trade Policy : Experiments with the ORANI Model," paper presented at the 48th ANZAS Congress, Melbourne, August 1977b.
- Dixon, P. B., B. R. Parmenter and J. M. Sutton, "Some Causes of Structural Maladjustment in the Australian Economy," paper presented to the Winter School, N.S.W. Branch, Economic Society of Australia and New Zealand, July 1977a (published in Economic Papers, 57, January 1978).
- Dixon, P. B., B. R. Parmenter and J. M. Sutton, "Spatial Disaggregation of ORANI Results : A Regional Balance Method," paper presented at the Second Conference of the Regional Science Association, Australia-New Zealand Society, University of New South Wales, December 1977c. (This paper has been issued as IMPACT Paper OP-19, February 1978.)
- Evans, H. D., A General Equilibrium Analysis of Protection : The Effects of Protection in Australia (Amsterdam : North-Holland Publishing Company, 1972).
- Gregory, R. G., "Some Implications of Growth in the Mining Sector," Australian Journal of Agricultural Economics, 20(2), August 1976.
- Industries Assistance Commission, Structural Change and Economic Inter-dependence, (Canberra : Australian Government Publishing Service, July 1977).
- Johansen, Leif, A Multi-sectoral Study of Economic Growth (Amsterdam : North-Holland Publishing Company, 1960; 2nd edition, 1974).
- Jonson, P. D., E. R. Moses and C. R. Wymer, "A Minimal Model of the Australian Economy," Research Discussion Paper 7601, Reserve Bank of Australia, Sydney, November 1976.
- Manne, A. S., "Key Sectors of the Mexican Economy 1960-1970," in A. S. Manne and H. M. Markowitz (eds), Studies in Process Analysis (New York : Wiley and Sons, 1963).
- Powell, A. A., The IMPACT Project : An Overview, March, 1977 - - First Progress Report of the IMPACT Project, Vol. I (Canberra : Australian Government Publishing Service, March 1977).
- Rattigan, G. A., "Notes on IMPACT," Industries Assistance Commission, Canberra, May 1976 (mimeo).

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"In no way can the model sufficiently represent the actual structure of the Australian economy,"
Brain [1977b, p. 106].

We doubt that a detailed discussion of the methodology of model building would be of general interest. Certainly it would be hard to find a consensus on all aspects of this subject among model builders. However, two comments should be made.

(a) In terms of the economic literature, there is nothing radical about the theoretical structure or methodological approach of any of the IMPACT components. Each has been developed by drawing on the accumulated experience of successful and respected model builders both in Australia and overseas.¹

(b) In many cases Brain's "essential properties" are so vaguely stated that it is not clear whether IMPACT violates them or not. (For example, property I amounts to saying that a model must have "adequate disaggregation," Brain [1977, p. 93]. Property II requires that demand determination receives "adequate emphasis and detail in the model," Brain [1977, p. 93], etc..) But

1. The components of IMPACT are MACRO, ORANI, BACHURROO and SNAPSHOT. MACRO is being based on the Reserve Bank model, RRA76 (see Jonson, Moses and Wymer [1976]). Foundations for the Reserve Bank work were established in the London School of Economics' International Monetary Research Programme (see Wymer [1973], Bergstrom and Wymer [1974] and Bergstrom [1976]). Antecedents for ORANI include Johansen [1960, 2nd edition 1974], Taylor and Black [1974] and Artus and Rhombert [1973]. The starting point for BACHURROO was the research of the International Labor Office (see World Employment Programme [1973], Rodgers and Wéry [1974], Blandy, Wéry, with others [1973], Wéry, Rodgers and Hopkins [1974].) SNAPSHOT is descended from a long line of programming models, e.g., Sandee [1960], Manne [1963], Bruno [1976] and Evans [1972].

REFERENCES

- even if it were true that IMPACT fails Brain's various tests, there would be no need to accept his conclusion. He does not explain why failure of the tests means that the model cannot 'sufficiently'¹ represent the actual structure of the Australian economy."
- 2.2 Econometric input to IMPACT
- Brain chides IMPACT for alleged failures to tap best possible data sources or to adopt best possible econometric methods. As evidence he asserts that superior work has been done in the IMP model,² of which he is the director. (Outstanding instances of this type of argument appear on pages 96, 100, 103 and 105 of his review.)
- It is impossible for us to assess Brain's claims. Almost all IMP material to which he refers is confidential and unavailable for independent professional scrutiny. By contrast, detailed working papers and reports on all completed technical aspects of the IMPACT project are published.³ These papers are given wide circulation among research economists. The feedback generated is IMPACT's insurance against overlooking potential improvements in research strategy which are feasible in terms of data, manpower and computing constraints.
1. An obvious question is : sufficiently for what?
2. IMP is an econometric model developed by the Institute of Applied Economic and Social Research at the University of Melbourne. A brief non-technical outline is in Brain [1977a]. No comprehensive technical description has been published.
3. Over the past two and a half years, about 50 IMPACT working papers and reports have been publicly circulated.
- A.I.D.A. Research Centre, Protection in Perspective, An A.I.D.A. Study of Leading Issues in the Australian Tariff System, Issued by Australian Industries Development Association, P.O. Box 998, Civic Square, A.C.T., December 1977.
- Artus, J. R. and R. R. Rhomborg, "A Multilateral Exchange Rate Model," IMF Staff Papers, Vol. 20, 1973.
- Bergstrom, A. R. and C. R. Wymmer, "A Model of Disequilibrium Neoclassical Growth and its Application to the United Kingdom," paper presented to the European Meeting of the Econometric Society, Grenoble, September 1974 (mimeo).
- Bergstrom, A. R. (ed.), Statistical Inference in Continuous Time Economic Models (Amsterdam : North-Holland, 1976), pp. x + 334.
- Blandy, Richard, Rene Wéry, with others, "BACHUE-1 : The Dynamic Economic-Demographic Model of the Population and Employment Project of the World Employment Programme," International Labour Review, Vol. 107, No. 5 (May 1973), pp. 441-449.
- Brain, P. J., "The Institute Multi-Purpose Model : an outline," Australian Economic Review, No. 3, 1977a.
- Brain, P. J., "Evaluation of the Medium Term IMPACT Model," in Protection in Perspective, An A.I.D.A. Study of Leading Issues in the Tariff System, prepared by the A.I.D.A. Research Centre and issued by Australian Industries Development Association, P.O. Box 998, Civic Square, A.C.T., December 1977b.
- Bruno, Michael, "Optimal Patterns of Trade and Development," The Review of Economics and Statistics, 49, No. 3, 1977a.
- Dixon, P. B., J. D. Harrower and A. A. Powell, "Long Term Structural Pressures on Industries and the Labour Market," Australian Bulletin of Labour, Vol. 5, June 1977.
- Dixon, P. B., B. R. Parmenter, G. J. Ryland and J. M. Sutton, ORANI, A General Equilibrium Model of the Australian Economy : Current Specification and Illustrations of Use for Policy Analysis - First Progress Report of the IMPACT Project, Vol. 2 (Canberra : Australian Government Publishing Service, August 1977).

industries with an adjustment problem. However, only the real wage explosion emerged as a likely candidate for explaining a major part of Australia's currently depressed economic conditions.

4 CONCLUDING REMARKS

Dr. Brain's condemnation of IMPACT appears to be based on a very limited understanding of the project and its purposes. His review exhibits major inaccuracies and omissions. Most important among the omissions is his failure even to mention the IMPACT applications papers.

Our view is that an economic model cannot be assessed without consideration of its applications. Therefore in section 3 we provided brief summaries of some of the relevant papers. We hope that these summaries have given the reader a picture of how IMPACT is being used, what kinds of results it is producing, and the reasons why we find the results to be plausible. Naturally, we will be delighted if the summaries induce some readers to seek more complete pictures from the cited papers.

2.3 Brain's review as a source of information about IMPACT

In the editorial introduction to Brain's review, it is suggested that :

"As the IMPACT model, like most large scale econometric models, is a complex matter, the reader can only gain a thorough insight into a model by a lengthy and time consuming process of understanding, although careful consideration of the piece following which has been prepared by Dr. Brain will short-circuit much of this process," A.I.D.A. Research Centre [1977, p. 90].

As a source of information about IMPACT, Brain's article contains far too many inaccuracies to be of value.¹ From the point of view of reassuring those who are unfamiliar with IMPACT, probably two of the more important misconceptions to put right are the following :

- (a) That the various parts of IMPACT are mutually inconsistent.
 (b) That, as claimed by Brain on page 97 of his review,

"IMPACT (at least ORANI if not MACRO) ... [assumes] that factor prices clear factor markets. This is unrealistic, especially in view of the one year solution period assumed by the ORANI users. In any case, forty years ago a depression and Keynes effectively destroyed these propositions : *it is amazing that they can be assumed in a model designed to appraise the medium term dynamics of the Australian economy*

1. Readers could refer to Rattigan [1976] for a description of the aims of IMPACT and its institutional set-up. Comprehensive non-technical material on these subjects and on the IMPACT research design are in Powell [1977]. Technical information on any aspect of the project is available via the IMPACT working paper series. A complete list of working papers will be supplied on request so that readers can identify those papers which might be of particular interest.

dominated by arbitrary proceedings, minimum wage legislation and power forces in the market." (Emphasis in the original.)

In response to (a) we note that IMPACT is currently being developed. It is not yet complete. However, a modular design strategy has been adopted so that completed parts can be used as they become available. (For example, the ORANI module has already been applied in several policy relevant studies, see section 3.) One of the unfinished tasks for the IMPACT development staff is the linking of the modules. For obvious reasons this work comes at the end of the development phase. It is clearly premature to imply (as Brain appears to do on pages 96, 97, 101, and 106 of his review) that IMPACT users will be faced with inconsistencies between the modules.

As for (b), even a superficial glance at the IMPACT applications papers reveals that ORANI can be used either with slack labour market assumptions or with clearing labour markets. The appropriate choice depends on the application. For example, in long-run¹ analysis it is sensible to assume that factor prices adjust to allow approximate full employment. On the other hand, in the short-run, factor prices and quantities might adjust too slowly to allow factor market clearing. In this case, ORANI simulations can be used to study the implications of policy changes for the level of unemployment.²

1. See Dixon, Harrower and Powell [1977]. Incidentally, this paper shows that applications of ORANI are not restricted to the "one year solution period."

2. Among the papers with a comparatively short-run focus where the slack labour market assumption has been used are Dixon, Parmenter, Ryland and Sutton [1977, ch. 4], and Dixon, Parmenter and Sutton [1977a, b].

On the influence of changes in world commodity prices, the ORANI simulations implied that most Australian industries have benefited. Some capital-good industries may be exceptions. International prices for capital goods increased relatively slowly and it is not surprising that the ORANI results showed motor vehicles, electronic equipment and aircraft building among the industries for which current difficulties may be partly attributable to shifts in international prices over the period 1968-1975. In general, however, the shifts in world commodity prices improved Australia's terms of trade. ORANI implied that the associated increase in national income and demand was sufficient to compensate the majority of industries for any adverse effects arising from changes in particular international prices.

On the real wage explosion, ORANI generated strong negative effects for outputs and employment throughout the economy. Labour intensive industries and those supplying "luxury" goods (i.e., highly income elastic goods) were shown among the heaviest losers. By comparison, ORANI assigned only minor importance to the change in female/male wage relativities. Certainly the ORANI results were consistent with the hypothesis that increases in female relative to male wages have significantly reduced female employment opportunities. On the other hand, for most industries, the female wage bill is still a fairly minor part of the total wage bill. Consequently, according to ORANI, increases in female relative to male wages pose a problem for only a few industries: textiles, footwear, pharmaceuticals, electronic equipment, leather products and some of the service industries.

The overall conclusion from the study was that each of the four phenomena, the mining boom, the changes in world commodity prices, the real wage explosion and the change in wage relativities, has presented some

In the final IMPACT applications paper to be considered here,¹

ORANI was used in an attempt to assess the relative quantitative significance of four possible sources of structural maladjustment arising from the period 1968-1975 : (1) the mining boom, (2) changes in world commodity prices (e.g., the energy crisis), (3) the increase in average real wages (the real wage explosion) and (4) the increase in female wages relative to male wages.

On the mining boom, the ORANI results were generally in accordance with the Gregory thesis.² Gregory's argument is that if a country suddenly finds an opportunity to earn large amounts of foreign currency for very little resource input, then initially its balance of trade will move towards surplus and eventually either the domestic price level will inflate relative to that of the rest of the world or the exchange rate will be revalued, or both. Whether the return to balance of trade equilibrium comes about via domestic inflation or via exchange rate adjustments, the effect will be to reduce the prices of tradeable goods (exports and imports) relative to the prices of non-tradeables. Gregory emphasises the potentially disruptive effects of this adverse movement in relative prices on those industries whose products are heavily traded. Although ORANI showed the mining boom as producing contractionary effects on the traditional export industries, the simulations indicated that most import-competing industries have not been adversely affected. The model implied that the import-competing industries have gained to a much greater extent than the export industries from the increase in national income and domestic demand associated with the mining boom.

1. See Dixon, Parmenter and Sutton [1977a].

2. Gregory [1976].

3 SOME APPLICATIONS OF IMPACT

At the current stage of IMPACT's development, only the ORANI module (an inter-industry model) has been used for policy analysis. As the other modules, MACRO (concerned with macroeconomics), BACHUROO (concerned with demographic variables) and SNAPSHOT (a long-run programming model) become operational, they too will be applied in "stand-alone" mode. Eventually, it is intended to link ORANI, MACRO and BACHUROO so that questions may be studied concerning the interaction between demographic changes and industrial changes, between industry policy (e.g., protection) and macroeconomic activity, between macroeconomic activity, labour force participation and industry policy, etc.. In the meantime, there are many ways in which the "stand-alone" modules can contribute to the analysis of important policy issues. We take some examples from experience with ORANI.

In a paper entitled Structural Change and Economic Interdependence, the Industries Assistance Commission used ORANI to illustrate its proposition that

"Whatever the nature of change it seems inevitable that there will be some who benefit from the change and some who lose. However, if action is taken to insulate those who would lose from the change this imposes additional costs of adjustment in terms of higher costs and reduced output and employment on other areas of the economy,"
Industries Assistance Commission [1977, preface].

A similar theme was developed in the IMPACT paper "Long Term Structural Pressures on Industries and the Labour Market."¹ In that paper, ORANI was

1. Dixon, Harrower and Powell [1977].

used to simulate the effects on Australia's import competing sector of further expansions in mining exports and of improvements in Australia's terms of trade (mainly via relative reductions in foreign currency prices of imports from less developed countries). The ORANI simulation indicated those import competing industries whose growth opportunities were likely to be most severely affected. A second ORANI computation was then made under the assumption that the most severely affected industries were protected so that they could at least achieve the economy-wide average rate of growth. This second simulation showed how the insulation of one group of import-competing industries from adverse effects of change could be expected to reduce the growth opportunities of other import-competing industries. The mechanism captured by the model which provided the principal explanation for this result was as follows. Restrictions on particular imports caused the model to project a weakening in the competitive position of "uninsulated" import-competing industries via an increase in the overall domestic cost level relative to the Australian dollar value of foreign commodity prices. The model implied that the unfavourable cost shift could arise either through the domestic rate of inflation or through the exchange rate, i.e., import restrictions would either increase the rate of inflation (relative to the level at which it would otherwise have been) or lead to a relative re-valuation. For the purposes at hand it was unnecessary to disaggregate the cost shift between inflation effects and exchange rate effects. In any case, such a disaggregation, depending as it does on macro monetary phenomena, falls outside the scope of ORANI. It belongs to a linked ORANI-MACRO model.

In another IMPACT paper,¹ ORANI provided the basis for an analysis of the industry output and employment effects of a uniform increase

1. Dixon, Parmenter, Ryland and Sutton [1977, ch. 4].

in all tariffs. The most striking finding was that in an environment of fixed real wages, increases in protection could be expected to have almost no impact on the overall level of employment. It appeared that increases in employment opportunities in the import-competing sector would be offset by the loss in employment opportunities in the export industries and in industries supplying the export industries. According to ORANI, the export-related industries suffer under a tariff increase because they are poorly placed to pass on cost increases in the form of higher prices. The tariff increases were projected to impose significant cost increases mainly through their effects on money wages. Increases in money wages were required to maintain real wages in the face of (1) increases in the domestic selling prices of imported household commodities, (2) increases in costs and product prices of industries relying on imported inputs and (3) increases in the prices of domestically-produced import-competing commodities resulting from a relaxation of competitive pressures.

Recently, the ORANI projections on the effects of a uniform tariff increase have been given a regional dimension.¹ The model implies that only Victoria could be expected to gain in terms of overall economic activity from a general tightening of protection. At the other extreme, Queensland and Western Australia could be expected to lose. These results reflect the regional location of Australia's import-competing and export-related activities. The Queensland and Western Australian economies are heavily export oriented and have comparatively little import-competing industry. The opposite is true for Victoria.

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