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MAJOR THEMES IN THE RESULTS OF PAPERS PRESENTED TO THE 1984 CONFERENCE ON TRADE POLICY MODELLING

by

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MAJOR THEMES IN THE RESULTS OF PAPERS PRESENTED TO THE 1984 CONFERENCE ON TRADE POLICY MODELLING

A. PREAMBLE

The organizers of this conference are to be congratulated for attempting to force modellers to present material in a form convenient for cross-model comparisons. However, in preparing these comments I have come to the conclusion that the guidelines given to the modellers were not quite tight enough for the organizers' purpose. With hindsight it is apparent that comparisons could more easily be made if more attempts were made to eliminate inessential differences between the modelling exercises. As well as the modellers accepting that each is to simulate a 50 per cent across-the-board cut in tariffs, they might also be encouraged to agree on a set of pre-shock tariff rates (including or excluding allowance for the tariff equivalents of quantitative restrictions), to agree on the values for certain key parameters (Armington elasticities, capital-labour substitution elasticities, etc.) and to agree on exactly what results should be presented (for example, indexes of changes in welfare or the terms of trade, on agreed definitions and details of intersectoral resource shifts specified at a level of sectoral disaggregation compatible with all the models).

Other differences between the models - differences in theoretical structure, differences in country coverage, differences in the reference year implied by the input-output data cores - would be less easy to eliminate. When these are added, it will be clear that making comprehensive comparisons of the results is very difficult. I have therefore interpreted my brief for this session quite liberally. As well as examining the extent to which the results are comparable (section E below) I shall also comment on three other aspects of trade-policy modelling where I think there is scope for the modellers to achieve a greater degree of agreement. These three aspects are computing method; the questions of trade policy which the current generation of computable general equilibrium (CGE) models could a priori be expected to elucidate; and the form in which it is most useful to present results from the models. Each of these is now discussed in turn in sections B, C and D.

B. COMPUTING

All of the papers are interested in essentially the same sort of question; namely, how, if a change in trade policy were implemented, would the economic condition of the world (or of some particular country or block of countries) differ from the condition which would pertain in the absence of the policy change. The question is what is the difference between the values Z_1 and Z_0 which some endogenous variable Z (a welfare index, maybe) would take at some hypothetical future time period t* (exhibiting short-run or long-run equilibrium) with and without the imposition of a policy change in the base period. Such "what if"

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TABLE 4 : Percentage changes in Australian employment by sector due to a 50 per cent unilateral across-the-board tariff cut

Sector	Projections DS	DPR
Agr.,for.,fishg.	0.66	5.59
Food, bevs, tobacco	0.71	3.87
Textiles	9.82	-6.41
Wearing apparel	-2.77	-3.21
Leather products	29.71	-5.26
Footwear	-0.84	-15.70
Wood products	-1.38	-0.12
Furniture & fixtures	-1.39	-0.59
Paper & paper products	-0.97	0.58
Printing & publishing	-0.06	0.46
Chemicals	-0.05	0.02
Petrol & related prods	-4.11	2.98
Rubber products	-7.75	-2.29
Non-metallic min. prods	-1.16	0.23
Glass & glass prods	-2.75	-0.14
Iron & steel	-0.69	10.00
Non-ferrous metals	11.43	8.65
Metal products	-2.44	-1.05
Non-elec. machinery	-0.17	1.76
Elec. machinery	-2.87	0.08
Transport equip.	-2.96	-7.44
Miscellaneous mfg	-2.45	-1.91
Mining & quarrying	1.70	6.62
Elec., gas, water	0.18	0.83
Construction	0.29	-0.26
Wh. & Ret. trade	-0.03	0.55
Transp., storage & comm.	0.06	1.04
Finance,etc.	-0.06	0.44
Other	-0.00	0.10

questions are the essence of policy analysis: we require a projection of the difference which the policy change would make to the world ($Z_1 - Z_0$) rather than a forecast of the state of the world in either the pre-change (Z_0) or post-change (Z_1) situations.

The Johansen (1960) method for solving CGE models produces the required answers to these "what if" questions directly, by solving the model in the percentage changes of its variables rather than in the levels. Deardorff and Stern (1983) (DS) and Dixon, Parmenter and Rimmer (1983) (DPR) both use this method. Harris (1983), Harrison (1984), Spencer (1984) and Whalley (1984) all solve their models in the levels although Harris, Harrison and Whalley report only changes. The major advantage of the Johansen method is that only linear computations are required rather than the much more demanding direct solution of a system of non-linear equations. Experience at the IMPACT Project is that, especially when modern sparse-matrix software is employed (Pearson and Rimmer, 1983), computing problems are not a binding constraint on the size and detail of the models. This does not appear to be the case for those who favour non-linear solution techniques. As well as facilitating models which are larger and more detailed and hence applicable to a wider range of policy questions, the Johansen solution technique also allows much more flexibility to model users. It is computationally trivial for example to switch variables between endogenous and exogenous categories or to make modest changes to the specification of the models. Repeated solution of the model, such as is required for Harrison's sensitivity analysis, would also be much simpler with linear methods.

What then are the offsetting disadvantages? One is that a benchmark data set is not explicitly reproduced as an equilibrium solution to the model. There can, however, be little doubt that this could be done for any conventional CGE model implemented on a well-behaved input-output data set. The theoretical underpinnings of ORANI, for example, are very similar to those of the models developed by Harrison and Whalley. The differences are in degree of detail, number of sectors, etc., none of which are in principle crucial in this context. In any case, for any model used on a routine basis for policy analysis, the computational difficulties associated with reproducing a benchmark data set would suggest that a levels solution should be computed only once, with subsequent policy simulations computed via linear methods.

A second ground for objection to the use of the Johansen method is that it involves approximation errors for any but very small shocks to the exogenous variables. In principle this is so, but experience at IMPACT (see Dixon, Parmenter, Sutton and Vincent, 1982, chapter 7) suggests that for current generation CGE models and for shocks of typical policy interest the approximation errors are small relative to other errors (data, etc.) implicit in the modelling process. Moreover, the errors can be virtually eliminated by two-step application of the linear procedure with intervening updating of the data. Dixon (1983) has successfully reproduced results from the World Bank's Korean model (Dervis, de Melo and Robinson, 1982, Ch.7) using the Johansen method with corresponding savings in computing expense. A similar exercise using Waelbroeck's WDR model (Gunning et al., 1982) is in progress at the IMPACT Centre (Meagher, 1983).

classification into the more aggregated grouping used by Whalley. Notwithstanding the problems of comparison, a fair measure of agreement between projections from the two models is evident, the main impressions being that at this level of aggregation the intersectoral changes are quite small. A shift of employment from non-traded to traded sectors is consistently projected.

Less consistency is evident, however, if we examine Table 4 which compares projections of short-run shifts in sectoral employment in the Australian economy from the models of DS and DPR. (The latter results are not reported in the DPR contribution to this conference but have been compiled by me from computer printout of the results of the ORANI simulation of a unilateral 50 per cent tariff cut using the model's standard 1974-75 data base.) In general DPR project much larger gains than DS for Australia's main export sectors (Agriculture, forestry & fishing; Food, beverages and tobacco; Mining and quarrying; and metal production). The DPR results reflect the view that the elasticity of foreign demand for the small economy's exports is quite high. Results for the import-competing sectors are less diverse (across the models) but there are some outstanding anomalies, in particular the positive projections made by DS for Textiles and Leather products. Both these are heavily protected import-competing sectors in Australia (the latter via its connections with the Footwear industry). Some of the differences between the two sets of results may be reconcilable as consequences of differences between the multi-country and single-country approaches to CGE modelling. An obvious problem with constructing the multi-country models however is the difficulty of including enough hard data about the crucial features of each of the individual economies included in the model. It is hard not to suspect that some of the greater anomalies in the DS results may reflect this problem.

TABLE 3 : Percentage changes in employment by sector in the US economy due to 50 per cent unilateral and multilateral across-the-board tariff cuts

Sector	Unilateral tariff cut		Multilateral tariff cut[a]	
	Whalley	DS[b]	Whalley	DS[b]
Agric. food	0.04	0.15-0.2	-0.04	0.1-0.9
Minerals & ores	1.08	0.40	0.32	0.1
Energy	0.78	<0.40	0.43	<0.2
Non-mech. mfg.	0.06	?	0.14	?
Machinery & transport equip.	0.30	0.2-0.5	0.78	0.25-0.3
Services & non-traded	-0.07	-0.05	-0.15	-0.04

(a) Whalley reports structural effects for a tariff cut by all regions (Table 8). DS report the results for cuts by industrialized countries only.

(b) DS (Tables 6 and 8) report employment effects at a 29-sector level. Appropriate weights for aggregation to Whalley's 6-sector classification were not readily available. Results in this column are my own impressionistic judgements as to the likely outcomes of the required aggregations.

C. THE RELEVANCE OF CURRENT CGE MODELS TO TRADE-POLICY ISSUES

Beginning from the standpoint of the literature on industrial organisation, Harris argues persuasively that models which fail to allow for the exploitation of economies of scale, often via intra-industry specialization, will understate the long term gains from trade liberalization. Dixon (1978) has argued the same case from a slightly different perspective. It is well known, and confirmed by other papers at this conference (DS, Harrison, Whalley, Spencer) that CGE models which assume constant returns to scale do indeed suggest that the potential gains are only small (see E below). Both Dixon's hypothetical examples and Harris' empirically calibrated models indicate that the new sources of gain from trade liberalization which they identify can easily swamp the traditional resource allocative and terms of trade effects. This work certainly casts severe doubts on the results from more orthodox CGE models in so far as they attempt to measure the long-run gains from freer trade.

The strictures of Harris and Dixon are less severe if we confine the use of the models to giving an indication of the short-run consequences of tariff reform. For this the implications of sunk costs are crucial. Both DS and DPR report results computed under the short-run assumptions that industry-specific capital stocks are fixed and that labour is in excess supply. From a policy viewpoint it is in any case the short-run adjustment problems believed to be associated with tariff reform, especially the employment consequences, which are the main obstacles to reform. For the case of ORANI and the Australian debate,

this case is argued more fully in Dixon, Parmenter and Powell (1984b). The main policy message, also implicit in the results presented by DPR, is that the adjustment costs are likely to be much less severe than is apparently believed by the policymakers.

D. PRESENTATION OF RESULTS

This issue is crucial if we are interested in the role of CGE models in the policy-formation process. Whalley argues that, given uncertainties with respect to parameter values, model specification, etc. we should be thinking of "modelling for insights rather than precise numbers." This has always been the view underlying the operation of the IMPACT Centre. Because of the close institutional association between IMPACT and the Australian government, the IMPACT models, especially ORANI, are now quite widely used as a source of policy information. For a number of reasons we have regarded it as very important to avoid presenting results in a black-box fashion and have always attempted to spell out in detail the main mechanisms underlying particular results and to show with simple back-of-the-envelope rationalizations how these mechanisms and the data used generate the numerical results. (These techniques are illustrated most directly in Dixon, Parmenter and Powell (1984a).) Among the reasons are the need to assure ourselves that computing errors have not been made in handling such a large system; the need to educate policy makers about the way in which the models can legitimately be used, in particular to avoid them expecting too much from the models with the inevitable eventual disappointment and loss of confidence in the usefulness of the formal mode of analysis; and the need to demonstrate what are legitimate reasons for objecting to the model's results.

TABLE 2 : Welfare effects[a] in selected countries of a 50 per cent multilateral across-the-board tariff cut by selected countries

Country \ Model	Harrison[b]	Whalley[c]	Deardorff[d] & Stern	Harris
Australia	0.02	n.r.	0.29	n.r.
Canada	0.01	0.23	0.07	4.9
EEC	0.03	0.08	-0.04	n.r.
Japan	0.03	0.11	0.02	n.r.
Singapore	0.01	n.r.	-0.24	n.r.
USA	-0.10	-0.14	0.06	n.r.

Notes

n.r. : not reported

(a) The welfare indexes for Harrison, Whalley and Harris are reported as Hicksian equivalent variations as percentages of base-period GDP. DS describe their index as "based on static partial-equilibrium measures commonly used in the literature to calculate changes in consumer and producer surplus".

(b) Results in this columm are Harrison's "point estimates".

(c) Whalley reports his welfare changes in $USb. 1977. The results in this column were converted to percentages of GDP using rough adjustments to data reported in Harrison's Table 1.

(d) DS emphasize that their model "does not readily lend itself conceptually to analysis of changes in economic welfare". Moreover their results are based on short-run assumptions.

welfare effect projected for Canada by Harris is positive and an order of magnitude larger than any of the other projections.

Table 2 tells a similar story for the case of multilateral tariff cuts. The correspondence between the results of Harrison and Whalley is slightly less close but both project a pattern of small welfare changes - losses for the US and gains for the other economies included in the Table. Again terms of trade changes are the crucial explanator of the results. With the usual caveat, the results of DS confirm the idea that the welfare effects are small and again Harris projects a welfare gain for Canada more than twenty times greater than his closest rival.

Tables 1 and 2 provide a very graphic illustration of the futility of using constant-returns-to-scale CGE models to measure the welfare effects of changes in trade policy if one gives any credence to the arguments of Harris (and Dixon).

Turning now to the impact of the tariff changes on industrial structure we find very few results which are directly comparable. Both Whalley and DS present projections of the effects on the industrial structure of US employment of both unilateral and multilateral cuts. Several problems confront any attempt to compare these results: Whalley's are long-run whereas those of DS are short-run; Whalley's multilateral-cut results refer to cuts in all regions whereas those of DS are confined to cuts in developed countries only; and each uses a different industry classification. The results are summarized in Table 3 with an impressionistic attempt by me to map the DS industry

This process is very closely related to sensitivity analysis, a topic which is addressed by a number of the papers at this conference (especially Harrison, Harris, Spencer and Whalley). Systematic sensitivity analysis (Harrison (1983), Pagan and Shannon (1983)), as well as its role in establishing the general robustness of results, might suggest crucial mechanisms in the model by showing which results are sensitive to which parameters. With the larger models, however, there are so many parameters that comprehensive sensitivity analysis is an enormous task. An alternative approach is to use one's theoretical insights into the model (the basic theoretical structure is after all often quite simple) as a guide as to which areas of sensitivity should be tested.

E. COMPARISON OF RESULTS

Because of differences (mentioned earlier) between the models and the details of the simulations conducted, it is not possible to make comprehensive comparisons between the results. For this section, I have concentrated on results from the models presented by Harris, Harrison, Whalley, DS and DPR. All these models have broadly similar theoretical structures, the major divergence being the inclusion of potential increasing returns in manufacturing by Harris. All have some degree of sectoral disaggregation and exhibit at least some overlaps in country coverage. Finally each of these modellers report results which are analogous in some dimensions.

In an effort to keep the scope of the comparisons manageable I have excluded the papers by Spencer (1984) and Keyzer (1984). The former includes only minimal sectoral disaggregation and concentrates on

a rather special problem, namely the role of the common agricultural policy of the EEC in trade liberalization. The latter presents results only for Bangladesh (not separately recognized in the other models) and largely excludes the possibility of supply adjustment. Also absent from the comparisons are the results of Grais et al. (1984), and Mercenier and Waelbroeck (1984). Neither of these papers reached me in time for inclusion although I hope to have the opportunity to integrate their results into a revised version of these comments.

Comparisons can be made in two dimensions; firstly with respect to economic welfare indexes and secondly with respect to industrial structure. Table 1 shows the effects of 50 per cent unilateral across-the-board tariff cuts on own-country economic welfare for a selection of countries. Table 2 shows the welfare effects for selected countries of a 50 per cent multilateral across-the-board tariff cut by all industrialized countries.

For the case of unilateral tariff cuts, Table 1 reveals a high degree of correspondence between the welfare results of Harrison and Whalley. Both project small welfare losses for the country making the cuts. These losses are ascribed, especially by Whalley, to terms of trade effects. The corresponding terms of trade changes are reported by Whalley but no detailed quantitative reconciliation of these with the welfare effects is offered. Some support is lent by the results of DS at least to the conclusion that the welfare effects are small. It should be remembered however that DS state explicitly that they do not believe their simulations to be very relevant to the measurement of welfare effects. The outstanding feature of Table 1, however, is that the

TABLE 1 : Percentage welfare effects[(a)] of a unilateral 50 per cent across-the-board tariff cut in the country making the cut

Country \ Model	Harrison[(b)]	Whalley[(c)]	Deardorff[(d)] & Stern	Harris
USA	-0.21	-0.19	0.03	n.r.
EEC	-0.14	-0.24	-0.03	n.r.
Japan	-0.21	-0.15	-0.01	n.r.
Canada	n.r.	n.r.	0.06	2.1

Notes

n.r. : not reported

(a) The welfare indexes for Harrison, Whalley and Harris are reported as Hicksian equivalent variations as percentages of base-period GDP. DS describe their index as "based on static partial-equilibrium measures commonly used in the literature to calculate changes in consumer and producer surplus".

(b) Results in this columm are Harrison's "point estimates".

(c) Whalley reports his welfare changes in $USb. 1977. The results in this column were converted to percentages of GDP using rough adjustments to data reported in Harrison's Table 1.

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