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WHEN MODELLERS BEHAVE LIKE
LAWYERS: HAVE WE LOST
THE PLOT?

by

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The Centre of Policy Studies (COPS) is a research centre at Monash University devoted to quantitative analysis of issues relevant to Australian economic policy. The Impact Project is a cooperative venture between the Australian Federal Government, Monash University and La Trobe University. COPS and Impact are operating as a single unit at Monash University with the task of constructing a new economy-wide policy model to be known as *MONASH*. This initiative is supported by the Industry Commission on behalf of the Commonwealth Government, and by several other sponsors. The views expressed herein do not necessarily represent those of any sponsor or government.

ABSTRACT

Australia has made outstanding contributions to the use of quantitative economic models in public policy discussions. That leading role is now threatened by the increasing use of econometric modellers in an advocacy, lawyer-like role, rather than as impartial sources of the best available technical advice. This development became inevitable once it became fashionable in Canberra during the mid 1980s to deny the existence of public goods and to force the funding of economic intelligence garnering increasingly into the private sector. This paper argues that we are all the losers.

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WHEN MODELLERS BEHAVE LIKE LAWYERS: HAVE WE LOST THE PLOT?

by

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1. Introduction

Recent times have seen an increasingly befuddled press become at once mesmerized by, yet simultaneously sceptical about, the nowadays commonplace use of quantitative economic models to support arguments in policy debate. The clash between the policy position on the protection of passenger motor vehicles taken by the South Australian government and the view of the Industry Commission provides a stark example¹ — the former's arguments were bolstered by simulations with MM2 and other proprietary models², while the latter relied heavily on the MONASH model³.

Not that there is anything wrong with, nor surprising about, the idea that different modellers might produce simulations suggesting different policy conclusions. Even in the case of modellers using precisely the same model, this can happen, and indeed has happened relatively frequently with Australia's only fully public-domain policy model, ORANI⁴. The different results in such cases will be relatively easily traced to the modeller's different choices about one or more of:

- **data** (the provenance of all quantitative modelling is based on the factual evidence or data base to which it appeals)
- **parameters** (these are the magnitudes of key constants that determine behaviour in the model)
- **relevant equations** (models consist of sets of equations, among which only a few will usually be crucial in determining a particular model result)
- **closure** (this is the decision about which variables are to be taken as given, and which are to be determined by the model)
- **shocks** (the changes in policy or external circumstances that are to be analysed).

* I am grateful for comments to Ken Wallis (who broadly agrees with me) and to Matthew Peter (who tends not to). My debt to the former for pointing me towards the key U.K. references in the subject matter of this paper is large. The sole responsibility for the views expressed, and for any errors or omissions of fact, rests with me.

1 See, e.g., the press report by Deans and Jacobsen (1997).

2 MM2 is the acronym for the Mark II Murphy Model; it is described briefly in Powell and Murphy (forthcoming 1997), pp. 402-30.

3 MONASH, under development at the Centre of Policy Studies at Monash University, is the successor to the ORANI model (Dixon, Parmenter, Sutton and Vincent, 1982). Provisional documentation of MONASH may be found in Centre of Policy Studies (1994); Adams and Dixon (1995) and Adams, Dixon, McDonald, Meagher and Parmenter (1994), provide examples of a published application.

4 By "fully public-domain" I mean a model that can be used at nominal (marginal) cost by any qualified professional and whose equations, parameters and closure can be routinely altered by the user without seeking special assistance from the model builder. Of necessity, such a model is fully publicly documented.

In non-technical language, this says that the two modellers have made different *assumptions*, each viewing her/his choice as the more 'reasonable' (read: 'relevant to the real world'). With the crucial assumptions identified, they can be debated. In the case where different models are involved, the work of the Economic Modelling Bureau of Australia (EMBA) in organizing a series of *models comparisons conferences* has been helpful for establishing some of the reasons for the differences between the simulation properties of the models, as were some conferences that pre-dated the Bureau's activity in this field.

The 1989 conference run by Mark Upcher under the joint auspices of the Treasury and the ANU's Centre for Economic Policy Research was especially fruitful at teasing out the differences between the Australian module of the McKibbin-Sachs Global (MSG) model and the then extant version of the Murphy Model (see Parsell, Powell and Wilcoxon (1991)). This was possible only because the youthful model builders (Warwick McKibbin and Chris Murphy) were prepared to devote substantial amounts of time to assisting the investigators (Bruce Parsell, Peter Wilcoxon and myself) mounting the model comparison. I believe:

- (a) that this type of interaction is roughly what could be expected under the institutional arrangements that prevail in England where the major econometric model builders are funded by a common patron, the Macroeconomic Modelling Consortium, which comprises the Economic and Social Research Council (ESRC), the Treasury and the Bank of England, and is managed by the ESRC. The Consortium requires, as a condition for funding the research, that the model builders should interact in this intensive way with the ESRC's Macroeconomic Modelling Bureau under Ken Wallis' leadership at the University of Warwick. Results from models that have not been checked out independently are simply not admissible in the policy debate. The Bureau is also required to include under its purview the Treasury model, which is in the public domain by law and of which updated versions are released annually. From time to time, other models (e.g., those of the Bank of England and of Oxford Economic Forecasting) also have been deposited voluntarily with the Bureau to meet the requirement for admissibility in the policy debate⁵.

However, under current Australian conditions I find it difficult to believe:

- (b) that the proprietors of any well established commercial model (not even the very same McKibbin and Murphy who gave such excellent cooperation to a models comparison conference some eight years ago) could be motivated to put the necessary amount of time and effort into this type of exercise. Because the instigators of models comparisons work (especially EMBA) lack the teeth of the ESRC's modelling bureau, it will only be possible to coax or cajole the modellers into providing the profession with the documentation and access required for independent scrutiny: the bottom-line requirements of the commercial imperative will not allow otherwise.

⁵ More detail on the structure of the macroeconomic modelling industry in the United Kingdom, including a comparison from an industrial organization point of view with France and the United States, will be found in Smith (1994).

Of itself this need not stifle the policy debate, nor lead to serious damage to quantitative economic modelling as an accepted and useful (though, of course, partial) tool for helping policy makers in their deliberations. But this sanguine perspective is based on the premise that the commercially based models compete against other models that are supported publicly and which are fully exposed, messy interstices and all, to rigorous peer group review. The supporting arguments for this conclusion are set out in the sections below.

This short paper is written in the hope that it will stimulate discussion among modellers and their clientele — especially their public-sector clientele — as how to get the best out of formal quantitative models as an input to policy discussions. Section 2 explains why models used for public policy discussion must be properly documented. It reviews the requirements for modelling work to be accorded scientific standing, and identifies economies of scope and scale in model production. The institutional implications of the latter are discussed, as well as the (in my view, exemplary) U.K. response to them. Section 3 continues the institutional theme, summarizing lessons gleaned over two decades at the Impact Project. Section 4 explains why fully publicly documented and accessible models are still needed. The principal points of the paper are summarized in the concluding Section 5.

2. Why full public disclosure is necessary⁶

Economics, perhaps more than any other line of social inquiry, aspires to the status of a science. Our inability as economists to conduct controlled experiments puts us at a disadvantage. But instead of minimizing this disability, all too often we have accentuated it by failing to implement those straightforward measures that are taken as routine in the physical sciences. In particular — and as was forcefully pointed out a decade ago by Dewald, Thursby and Anderson (1986) — too often we have not even taken the standard precautions needed to ensure that our work can be replicated.

The requirement of replicability supplies the first reason for maintaining a detailed record of any research undertaking. The researchers themselves have finite memories; without detailed written records even they, in many instances, would not be able to reproduce their own work at a later date. But should they put this record in the public domain?

Scientific status of modelling work

Independent replication by others is widely and wisely accepted as an absolutely basic requirement of scientific work. This is why it is incumbent on researchers to *publicly* document both their methods and materials sufficiently to allow other workers to reproduce reported results. If this condition is not met, the results are not accorded scientific standing and are not taken seriously by other scientists.

Already we perceive a tension here in the current Australian climate: if models which are used to support public policy arguments lie outside the public domain, how can these arguments provide a credible basis for decision making?

⁶ This section draw liberally on my *Foreword* to Hertel (ed.) (1997).

What is required to ensure replicability? In the issue carrying the paper by Dewald *et al.* cited above, the editors of the *American Economic Review* announced that it was their policy to publish papers

'only where the data used in the analysis are clearly and precisely documented, are readily available to any researcher for purposes of replication, and where details of the computations sufficient to permit replication are provided' (p. v).

In the case of economy-wide modelling work, this can amount to a tall order. To take just one well known example — the ORANI model — a listing of the model's data base and parameter file runs to 646 pages (Kenderes and Strzelecki, 1991). The equations of the model itself, their interpretation and illustrative simulations are documented in a 372-page monograph (Dixon, Parmenter, Sutton and Vincent, 1981), in working papers, and in a journal literature too voluminous to cite here.

Economies of scale and scope in modelling

Given that a practical policy and/or forecasting model involves a very heavy investment in intellectual effort, data garnering and documentation, it would be amazing if economists did not recognize the potential for economies of scale and scope. The realization of such economies requires model builders to see most of the model's core ingredients — such as its standard or default equation listing, data base and parameter file — as public goods. Around such publicly (or semi-publicly) available tools we would expect a community of modellers to develop. And indeed the last two decades saw such a community develop around the models (especially ORANI) at the Impact Project, whose example proved compelling enough to inspire one courageous individual to attempt something similar on a global scale (Hertel 1994).

The perspective that I am taking here views the resources available to support research as too few, and the issues to be analysed as too pressing, for opportunities to be squandered by engaging in the wrong sort of replication while failing to attend to the right sort of replication as outlined above. By the 'wrong' sort of replication I mean unnecessary duplication: that is, two or more individuals or groups making separate demands on research resources to produce essentially the same product, be it a data-base, a parameter file, or a core model. The extent to which model building has been privatized in Australia arguably has reached this socially wasteful stage. What is more, the previously publicly provided infrastructure is aging, conditions of access are becoming worse, and documentation lags are increasing.

Institutional impediments and institutional innovation

Most of the resistance to sharing resources in modelling can be traced to just two sources: (1) funding difficulties and (2) the academic imperative. If a common, open-access research facility is to be created, how does one elicit enough cooperation among the potential clientele to ensure that attempted free-riding does not sink the venture? If academic recognition, promotion and tenure seem to be more available to 'loners' who keep their research cards very close to their vests, how can a community of modellers develop around a common modelling resource base?

On the question of funding, leaving matters to the private sector will fail to reap the rewards that demonstrably come from cooperation. Leaving it to the

private sector most likely will lead to proprietary models where almost all of the incentives are to share nothing — only if we are exceptionally lucky might we see the formation of one or more research consortia backed by some of the larger players.

For the latter to work, all putative members of a research consortium must recognize that without cooperation all are likely to be worse off. Having faced up to this, they must then agree to behave as responsible members of their modelling community. This implies meeting a share of the funding where possible, and agreeing that modelling infrastructure developed in-house will be shared by consortium members. If the backers are exceptionally publicly spirited, they just may agree to sharing their model with the community at large. But there has been very little of this type of activity in Australia, and none of it over sustained periods.

The academic imperative will remain an obstacle as long as promotion and tenure committees — not to mention referees and editors of journals in applied economics — continue to reward novelty at the expense of the usefulness of research outputs. Over time I hope that we will see more and more academic researchers and editors realize that a quality piece of applied analysis which builds on an existing core model and database offers better professional opportunities than implementing some new twist for its own sake on a toy model with data of doubtful provenance and questionable relevance to any real world problem.

The United Kingdom came to terms with these institutional failings in the early 1980s when a parliamentary committee stated that it 'was not satisfied that the [then] present arrangements produce[d] the most useful model-based evidence for the Committee, for Parliament, or the public.'⁷ The Committee went on to note:

'neither in evidence to the Committee nor in published work is there any sustained systematic process of inter-model comparison, tracking down the reasons for differences between models and the justification of them ... There is no general access to models for users outside the forecasting teams, or any means by which they can themselves make inter-model comparisons in which they may be interested. There is no generally agreed process of testing...'

(Treasury and Civil Service Committee of the House of Commons, session 1980-81, Chapter 10)⁸

These observations provided the momentum that ultimately led to the establishment of the ESRC Macroeconomic Modelling Bureau at Warwick in 1983, and to its maintenance since then as the quality assurance device for the U.K. profession. It is able to discharge this role because of its independence, and the requirement already alluded to that publicly financed modellers deposit their complete models (including databases) with the Bureau. The latter is then in a position to 'undertake direct comparisons across models of the U.K. economy at all stages ...' (Wallis, 1993b, p. 227).

⁷ Here I am drawing shamelessly on the account provided in Wallis (1993b, p. 227).

⁸ Cited in Wallis, *loc. cit.*

3. *Lessons from the Impact Project experience*

The Australian community of policy modellers with an orientation towards applied general equilibrium was largely created at the Impact Project. Many key figures of the community either participated in some way in the development of the ORANI or the MONASH model under Peter Dixon and associates; or else attended training courses organized by the Project. Such training courses provide the ultimate in the public exposure of a model. From the viewpoint of those attending, the principal advantages are that such a course:

- gives quick access to the core model, data base and computing system;
- establishes contact with a network of researchers having overlapping interests;
- gives hands-on experience with manipulating a state-of-the-art model for policy analysis; and
- serendipitously achieves many of the aims of refresher courses in economic theory and policy analysis.

From the viewpoint of the profession, the detailed knowledge of the model gained on a course is taken back into the institution or firm employing the course graduate, so that accurate knowledge of how the model works becomes diffused among the model-using clientele.

The story of the success of the family of ORANI-based models has been documented at length in Powell and Lawson (1990), Vincent (1990), Powell and Snape (1993) and Dee (1994). This success would not have been possible without generic software allowing modellers routinely to modify those parts of the ORANI theory that were not adequate to the task in hand, to eliminate unnecessary detail by aggregating over sectors/agents not currently under focus, and to amplify sectors of current interest by adding additional equations and data. The GEMPACK software suite developed by Ken Pearson and associates (see Harrison and Pearson 1996) put all of this on a routine basis.

Apart from the importance of modelling flexibility to the clientele, and of human capital formation through training courses, other 'lessons' gleaned from Impact's two decades of experience (as summarized by Powell and Lawson 1990 or Powell and Snape, 1993) suggest that a project which aims to provide the infrastructure for a focused modelling community:

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, emphasizes that a policy-oriented model will be of limited use if no policy adviser uses it with enthusiasm.

As we have noted above, 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 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 model, including its database/parameter file 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.

4. The continuing need for well documented and publicly accessible models

Well documented models in the public domain are capable of being well understood and used by participants in policy debates who are fully at arm's length from the model builders; such models consequently form a reference standard to which all modelling in a given discussion can be related. If a commercial model with relatively restricted public accessibility is used in debate and is claimed to be superior, in some way, to publicly documented and accessible models, the onus would then be on the user of the commercial model to point out the differences by fully exposing at least those parts of the commercial model that are under contention. If the supply of publicly documented and accessible models becomes sparse or non-existent, however, there is no reference standard and little chance that debates among modellers on technical matters will generate anything but confusion and public ridicule, a result which the Press can be relied upon to promote with glee.

It became fashionable in Canberra during the mid 1980s to deny the existence of public goods and to force the funding of economic intelligence garnering increasingly into the private sector. This has created opportunities for many talented modellers to set up shop as service providers. Several of them understandably packed up the tool kit built in the public and academic sectors and proceeded to add value and to differentiate the product to suit the conditions of the market place. Those left behind in academia and in the public sector faced an increasingly hostile climate in which developmental work was claimed not to be a matter of public concern since competition among private model proprietors would serendipitously provide the modelling infrastructure. Clients in the public sector need only purchase products off the shelf and all would be well.

Antecedents of existing models and the knowledge base for modelling

The first point to make in rebuttal of the above view is that *all* of the current Australian models that are highly regarded by the profession — or if not the models themselves, then at least their direct lineal antecedents — were initially (and usually substantially) developed in academia or in public institutions. If seminal work in private-sector models is occurring (and there is some), it is hard to see how it can spread at all rapidly to the rest of the profession: the commercial imperative obviously is a substantial impediment. No private proprietor will

willingly place a model fully in the public domain if her/his livelihood depends upon reaping rents from it.

Frankly, I find this situation alarming. The current tendency of Australian governments to purchase economic modelling services 'off the shelf' means that all model proprietors are focused on pleasing their clients (in itself a good thing) *in the narrow context of whatever issue is current* (a serious danger to clear thinking and honest scientific work). It would be far too easy for modellers whose livelihoods depend on pleasing the client, either consciously or unconsciously, to tune their models to the client's requirements, *irrespective of the empirical provenance* of the parameter values and other model settings that they feel compelled to adopt in the light of the client's expressed needs and preferences. This is known in semi-technical language as *fudge-factoring*: that is, endogenizing the assumptions to produce the required result⁹.

In case any should take offence at the implications of the above paragraph, let me make it clear that the validity of the point of view that I am expressing here does not require one to believe that such lapses from grace actually take place. For proper public policy formation in a democracy it is necessary that all arguments supporting a given policy option are based on honestly stated premises. The ordinary citizen may read that Dr X or Professor Y is a highly acclaimed modeller and that her/his model implies that the government should do Z. Such a citizen is entitled to assume that any modeller with high prestige in the profession will be addressing the issue as honestly and dispassionately as she/he can. *The citizen is also entitled to assume that the standards of the profession promote such objectivity by utilizing the ordinary common-sense precaution of independent peer-group scrutiny and evaluation.* In a world dominated by privately financed models, there can be no such guarantee.

From the kind of scenario I have painted above it is not hard to imagine the situation deteriorating to the point where quantitative economic modellers become regarded by the clientele as not much more than 'hired mouths' — once it becomes widely accepted that non-publicly accessible models provide acceptable fuel for policy disputes, the temptation to use modellers as lawyers will be irresistible. And so much the more so as non-experts in modelling become fully aware that the available factual evidence rarely is strong enough to support one model specification or set of parameter values definitively to the exclusion of all others.

5. Summary and conclusion

Underlying my arguments above have been three propositions. I regard the truth of the first as self-evident, and the desirability of the remaining two as clear. They are:

- (1) No modeller will willingly place a model fully in the public domain if her/his livelihood depends upon reaping rents from it.

⁹ In another terminology this (or something very similar) is known as 'If only' (as distinct from 'What if?' simulation — with 'simulation' possibly encompassing both of its connotations; see Wallis (1993a, p. 125).

- (2) Only models in the public domain are readily open to independent authentication¹⁰.
- (3) No model which has not been independently authenticated should have standing in public policy discussions.

Conditional on the truth of (1), a strict interpretation of the desiderata (2) and (3) would exclude most contemporary Australian models from the policy debate.

Above I have softened (2) and (3) to allow as admissible models that are well enough documented for the profession to have a good general grasp of the main mechanisms present in them, provided elements that are crucial to contentious points in the policy debate are fully publicly exposed.

I have argued that such a relaxation of standards is more manageable and less dangerous if we have well defined, publicly documented and accessible models available as a reference standard; and moreover, that the infrastructure on which private models are built has been developed almost exclusively in the public and/or academic sectors. The difficulties that modellers in these sectors are experiencing in obtaining funding means that the infrastructure is deteriorating and that the base from which most private modellers will have to work in the future may be of inferior quality.

I have noted the economies of scale and scope that underlie major modelling projects, and concluded that 'leaving it to the market' is not likely to produce an efficient outcome. I have also pointed out that the academic imperative mitigates against serious developmental work in applied modelling. This view is shared by Ron Smith (whose views derive from British, rather than Australian, experience):

'My ... conclusion is that a free market solution (which includes public sector clients buying the outputs they require from either vertically integrated or separate producers) is unlikely to generate adequate investment in basic research and development. The immediate rewards of model development work to the clients (decision-makers and academics) are too low for them to provide enough resources to motivate the teams.'

(Smith, 1994, pp. 86-87)

Finally, I have commented that the denial of the public-goods aspects of policy models by many bureaucrats since the mid-1980s has been destructive, and threatens Australia's outstanding international reputation as an intelligent user of modelling in the making of real policy decisions. With an increasing tendency to see modellers as 'hired guns' — that is, as lawyers — we are in danger of losing the plot.

¹⁰ By independent authentication I mean that an independent professional is able to check the computer implementation of the model against a full description of it provided by the model builder.

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