

Uses and Abuses of AGE Models

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This is a topic where we have all had our own experiences. My experience has been in a government agency, in the Australian Industry Commission. Some of you of course work in other government agencies, and your experiences may have been like mine in some ways, and in other ways different. Many are in academia, and your experience may be quite different. But you may still find this has some interest, as an account of how the other half live.

In talking about abuses of AGE models for obvious reasons I won't be mentioning any names; but let me just say that the people involved in those exercises are very competent people, very experienced in AGE modeling, and people for whom I have a lot of professional respect. So these abuses are significant observations: they don't just prove the general point that any technology can be misused by incompetents.

Thinking about this topic, I thought something like this. AGE modeling is much of the time a long and lonely business. We spend months, or in some cases years, putting a database together, and then we spend a long time debugging the programs and experiments; and sometimes we need to raise our heads from the keyboard, and look at the long-run goals that make it all worthwhile. And sometimes when we do this we realize that it's not worthwhile: that we've been spending our lives in producing trash. Or that what we're doing isn't going to make any difference. And this seems kind of sad, for people who only live once. So it seems worthwhile to raise our heads from the keyboard a little earlier, to avoid these unrewarding outcomes, and try and get some better outcomes.

In this topic of 'Uses and Abuses, I will first talk about some examples of abuses of AGE models, then about some uses, and then to talk about some dubious uses; where by dubious uses I mean applications that seem to achieve something worthwhile but at the same time are somehow not fully professionally rewarding. Finally I will talk about some practices that seem to have worked in conducting to rewarding outcomes, and avoiding unrewarding outcomes.

Many of you as experienced modelers are well aware that a prime field for model abuse is in choosing parameter settings and closures. But while this may be familiar, I think it's worthwhile to tell one horror story, involving most of the kinds of abuse that can be practiced in this area of tendentious parameter settings and closures. It is a substantial question what we mean by 'substantial', in a field where there can be wide legitimate differences of opinion on many matters.

We're going to model trade liberalization, so our starting point is that trade liberalization is a good thing, and since it's a good thing we know it must have substantial welfare benefits. So we come to consider our trade elasticities, and we know that the Whalley school favors low elasticities, and the IMPACT camp favors high elasticities, and with a little bit of insight we can see that the elasticities should be a bit higher than even the IMPACT camp favor. And we know that elasticities are lower over the short run and higher over the long run, so we have the insight that the right time frame for choosing the elasticities is long run.

And the next thing we need to consider is the closure. And here we know that in the standard long-run closure, with fixed endowments of labor, capital, and land, nothing much is likely to happen to aggregate production; and with nothing much happening to production, we're not likely to get any large welfare gains. But we also know that in many short-run closures, labor employment is endogenous, with real wages fixed, and in these closures we can get big increases in production. So our second major insight is that the right time frame for the closure is short run.

Now with this closure, we're going to get increases in production by lowering tariffs, so that consumer prices fall and these feed into lower [money] wages and these make it more worthwhile for firms to employ more labor. But these tariff cuts are going to have a fiscal impact, and if we offset this with tax increases in other areas we may undo the beneficial effects on wages of the tariff cut. So our last major insight is that we'd better not have well specified government fiscal accounts in the model.

Now it's worth at this point taking a closer look at how we are going to get welfare benefits out of this model. We are going to model trade liberalization mainly through tariff reductions, and these tariff reductions are indirect tax cuts that are going to lower consumer prices relative to producers' output prices. So with wage rates linked to the consumer price index, we are going to reduce own-product real wage rates; and this will increase the incentives for firms to hire more workers. But it's clear at this point that the welfare gains we get will have nothing to do with gains from trade; they are gains from applying a relaxation in fiscal policy to bribe workers to accept lower own-product wage rates. With tariffs as the main instrument of industry assistance, we get fiscal stimulus along with trade liberalization; but clearly with other forms of assistance we could get the opposite combination. For example, if the coal industry in the EC receives assistance in the form of output subsidies, then removing this assistance will promote trade in coal, but at the same time it will represent a fiscal tightening with adverse welfare effects. So with different assistance instruments we can reverse the appearance of gains from trade.

This does not matter much in a one-application model. We've got the results we need for the job at hand; there may be some problem about what time frame they apply to, but we can handle that with good drafting. But at this point we can begin to see what it can mean to describe parameter settings and closures as tendentious. These are settings we can live with only for the job at hand; if a different job for the same model comes along, we're going to have to reverse many of these decisions, for reasons that have nothing to do with our view of the world. So it seems reasonable to describe these settings as tendentious.

Now this work was not done in the Industry Commission, but by a small outside group, and I think it illustrates one merit of policy analysis in government agencies. Bureaucrats are criticized rightly for many things, but they do typically have to maintain some continuity and consistency in approach. So it's not so easy for a government agency to make tendentious choices for one application and then walk away from them and make the opposite choices for the next application.

Another unfavorable outcome that happens frequently is that the model is fine, and the simulation is fine, but the analysis is trash. Some of you may have seen the popular psychology books by a

neurophysiologist named Sachs. One topic discussed in these books is conditions involving massive selective memory loss. These conditions involve loss of short-term memory, so that the victim has normal memory of his life up to the onset of the disease, but no later memory. And in some of these conditions – and these are serious and sad conditions – the victim is unaware of his loss of memory. If you ask one of these people what he did last night, he will give you a coherent and normal-sounding answer, but one unrelated to fact. His answer is made up on the spot, and he doesn't realize that he is just making it up. If you ask him about his home and his family, he will give you some reasonable-sounding reply; and if you ask him tomorrow, he won't recognize you, but he will give you another reasonable-sounding reply, totally unrelated to what he said yesterday, and totally unrelated to reality.

The technical term for this behavior is *confabulation*. A lot of confabulation goes on in simulation analysis.

Preparing for this course I was looking at simulations that have been done in the growth and development area, and among these I saw a paper about the effects on Australia of rapid growth in some East Asian economies. According to the simulations in this paper, the effects on Australia of rapid growth in East Asia were adverse. Now this is a rather unexpected result, and you would naturally want to see a convincing explanation for it, and the paper does offer a reasonable-looking explanation. The explanation is that growth in East Asia is associated with stronger investment opportunities in East Asia, and capital flow into East Asia from other regions. One of these regions is Australia; so growth in East Asia leads to a reduction in the Australian capital stock. Now the government taxes capital, so the marginal social benefit of capital exceeds the marginal social cost. So the reduction in capital in Australia is welfare-reducing for Australia.

Now this is a logical explanation, and sounds like something that might well happen in reality; but it certainly does not happen in that model. In the model there are no taxes on foreign-owned capital. So whatever is driving the Australian welfare losses, it does not seem to be the capital outflow. The explanation that has been offered does not connect with what is happening in the model; it's a confabulation. And this is common; quite a lot of simulation analysis is really confabulation.

Turning from abuses to uses, I suppose the reason why AGE modeling came into being in the first place was to address problems that are too complex to work out in the head or on the back of an envelope. And it does sometimes happen that an AGE study makes a contribution of exactly this kind; not very often, in my own experience, but sometimes.

One example of this that I was involved in was in a study of tax concessions to owner occupiers. In Australia, as in the United States and many other countries, the direct tax system treats ownership of one's own home more favorable than other forms of investment. Working out the effects of reducing these disparities is a complex problem: the home is both a capital asset and a consumer durable, it's not clear how much the disparities switch capital between housing and other domestic investments, how much they affect total domestic investment, how much they affect capital inflow from abroad. Building a general equilibrium model seemed a sensible way of addressing these issues.

So we built a model for the study, or rather we extended the ORANI model, adding financial assets, distinguishing between equity and loan capital and setting up inwards and outwards foreign investment flows. And we got answers to the questions about investment reallocation and the rest that we would not have been able to get by simpler methods, but also we got some insights that we had not been looking for. The experience change my thinking at least about the importance of direct taxes. We spend a lot of time looking at very moderate commodity taxes and assistance measures, while there are massive disparities in capital taxation, and disparities involving some very sensitive flows. It also made me realize that it does not really make sense to talk about something as simple as the desirability or otherwise of encouraging capital inflow into Australia: the welfare effects of an increase in net capital inflow will be completely different depending on whether it comes about through equity investment from abroad, foreign lending, or reductions in Australian-owned assets overseas.

So sometimes we use AGE models to get insights into complex problems; but in my experience, not very often. More frequent is the situation where we use models to demonstrate what we knew all along, or should have known all along. For instance we quite often seem to need to run AGE models to demonstrate the application of the law of comparative advantage. We've all presumably come across the idea somewhere along the line that trade patterns respond to not absolute but comparative advantage, but we often seem to need to perform AGE simulations and defend them at length to convince our colleagues, and perhaps ourselves, of the application of the law in particular circumstances.

This brings us to the third part of the subject, dubious uses. By dubious uses I mean uses which seem to achieve some worthwhile purpose, but which are in some way not fully professionally satisfying. The Industry Commission has several times in recent years has published in its Annual Report AGE-based estimates of the economic benefits of various microeconomic reforms. For example, one part of a reform package might be an improvement in productive efficiency in the state electricity supply authorities; and there might be efficiency improvements in transport, and so on.

Now we don't really need to run a general equilibrium model to work out that running things better is likely to be a good idea. And we shouldn't really need the model to work out for us that if we can find some way to reorganize production to stop wasting inputs of say five billion dollars a year, then the economic benefits of the reorganization are likely to be somewhere about five billion dollars a year. Nevertheless these simulations do seem to serve some useful function. They draw attention to some real economic costs and opportunities, and extracting the estimates from the model seems to enhance their profile and credibility. So it seems that we're doing something useful: we are running valid simulations, and getting a message across that is true and important. And the fact that the simulations are in a sense trivial has at least this advantage, that we can be confident that we are getting the answer right.

On the other hand this approach does have some problems. While we are convincing people of something true, we seem to be convincing them for the wrong reason; they believe the model not because they understand how it works, but because they don't understand it; the model derives its

authority in their eyes from being opaque and mysterious. And over the longer run this could lead to trouble, if users become disillusioned and realize that their belief in the model had no rational basis.

The other problem is with our own professional satisfaction. Even if the model is serving a useful PR function, from a professional point of view the way to get better policy information on productivity reform is not running it through a general equilibrium model, but getting better estimates of the potential for productivity gains and on ways of achieving that potential.

So a range of outcomes is possible, ranging from highly rewarding to completely unrewarding, and now I want to spend the time that is left discussing practices that lead to the more rewarding outcomes. This part of the talk may be particularly institution-specific; it's based very much on my experience in the IC, and it may not apply at all well say to working as an academic.

The first practice is not to define yourself as an AGE modeler. If you define yourself as a modeler, then you are committed to addressing every issue as a modeling question, but some issues are just not ripe for AGE modeling. To have a worthwhile model you need some worthwhile theory and worthwhile data, and if these are not around you may be better off doing a theoretical study or a descriptive study. So if you define yourself as an economist, you have the flexibility to do this. And if you do a modeling study, once you've got the results you need to connect them up with the pre-existing theory, and here again you need to define yourself as an economist and not just a model jockey.

The second practice is to keep it simple. We usually overestimate when we begin a study how much complexity we need in the model to get a worthwhile story out of it. And of course we always underestimate the time and effort to get the complexity functioning.

Often very simple points can be the most important. Even if they're not intellectually challenging they're often what policy makers most need to know, and they're often not obvious beforehand. In the extreme, if data problems are getting in the way of developing the model, then there's likely to be a market for a purely descriptive study. If the data problems are tough for you, they're tough for everybody, and in that situation people find a lot of use and interest just looking at tables that give them a feel for the size and shape of the sector under examination. Often the most read part of a modelling write up can be a data appendix.

The general law is that the optimal level of complexity is always lower *ex post*. There's been no mathematics in the talk so far, so this may be time to introduce some notation. Let C^* denote the optimal degree of complexity, and $E[C^*](t)$ the modeler's estimate of C^* as held at time t . Then $E[C^*](t)$ decreases monotonically over time; and it has a vertical asymptote, sometime slightly after or slightly before the project deadline.

I've often felt, and often heard people say, 'I wish we'd tried something simpler.' I've never yet heard anyone say, 'Gee, I wish we'd done something more complex.'

The last practice that seems to conduce to rewarding outcomes is, wherever possible, to make your business that of supplying analyses of economic issues, not just supplying model results. You can't always do this, but when you can't, you do lose a lot of value from the simulation. Your client may not understand your results, and she almost certainly doesn't understand the model as well as you do, its limitations and the things it's useful for and the assumptions underlying it. And you miss out doing the vital step, of relating the results back to the theory and the facts of the issue.

We do need to remember always that the job doesn't start when the final printout lands on the desk, that's just when it starts. You're running the model because somebody needs some insights into some problem, and the best job you can get is to supply him the best insights that the model, taken together with the non-modelling background, can generate. This gets back to the previous point, about being an economist not just a modeler.

If you can provide a study that does justice to what your audience knows already about the situation, and which also provides one clear insight that they didn't have already, then you're likely to make a sale. Thank you.