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***Are CGE Models Still Useful in Economic
Policy Making?***

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Are CGE Models Still Useful in Economic Policy Making ?*

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Abstract

This paper develops background considerations to help better framing the results of a CGE exercise. Three main criticisms are usually addressed to CGE efforts. First, they are too aggregate, their conclusions failing to shed light on relevant sectors or issues. Second, they imply huge data requirements. Timeliness is frequently jeopardised by out-dated sources, benchmarks referring to realities gone by. Finally, results are meaningless, as they answer wrong or ill-posed questions. Modelling demands end up by creating a rather artificial context, where the original questions lose content. In spite of a positive outlook on the first two, crucial questions lie in the third point. After elaborating such questions, and trying to answer some, the text argues that CGE models can come closer to reality. If their use is still scarce to give way to a fruitful symbiosis between negotiations and simulation results, they remain the only available technique providing a global, inter-related way of capturing economy-wide effects of several different policies. International organisations can play a major role supporting and encouraging improvements. They are also uniquely positioned to enhance information and data sharing, as well as putting people from various origins together, to share their experiences. A serious and complex homework is however required, to correct, at least, the most dangerous present shortcomings of the technique.

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1. Introduction.

I shall be provocative, and even sometimes a bit dramatic. My purpose, before we plunge ourselves into the manifold interesting applications to be presented in this seminar, is to put forward a few background considerations that will help us to better frame the results of a specific model. CGE – as any modelling tool - is plagued with problems and the first step to deal with them is to be conscious of their existence and impacts. For a professor, problems are nearly his *raison d'être*, and faced with them he joyfully sets himself to study and search for solutions. However, for negotiators and policy makers, our audience in this meeting, a poorly understood shortcoming, or a debatable approach, may have serious consequences, ranging from wrong or inadequate measures to the full distrust of the technique.

Three main and serious criticisms are usually addressed to CGE efforts. First, they are too aggregate, their conclusions being then of reduced value, failing to shed light on relevant sectors or issues. Such general character makes them often a senseless exercise, as the fine print, be it in financial contracts or in economic disputes, is what matters.

At the same time, ironically, they imply huge data requirements; the combination of different sources, with varied reliability, being common currency in the applications. Timeliness, something crucial for policy decisions, is frequently jeopardised by out-dated sources, benchmarks referring to realities sometimes five years old. As stakes, situations and inter-relations change, one is many times addressing by-gones; and by-gones are by-gones ...

Finally, even if the generality makes sense and data are update, results are meaningless, as they answer wrong or ill-posed questions. Modelling demands so many shortcuts, simplifications and special assumptions that a rather artificial context is created, where the original questions lose content.

I shall, in this talk, try to provide some views on these criticisms, and I shall start with a positive outlook. I do not think the first point to be too serious. Decisions on the aggregation level are inherent to any modelling effort; *different levels answering different questions*. Any model has its own limits on the explanations it can provide, and trying to push it beyond such limits is unwise, if not silly.

The second point, though important, is a bit unfair. That data are a tough problem is common knowledge not only in the field of CGE, but in many other sophisticated applications as well. When I say this, I'm proposing neither a global excuse, nor an incentive to a careless handling of data issues, but just reminding that the problem pervades any quantitative exercise.

The crucial questions lie in the third point. I take it as very serious, requiring due consideration to the meaning of what we produce. This will be dealt in more detail in the next section.

2. The structure of a CGE economy.

The combination of the chosen assumptions with the way the economy is described and key parameters are set in a CGE model may easily produce a very bad picture indeed. Several concrete examples can be given.

A first and most telling one is the Social Accounting Matrix - SAM, the heart of any description of the economy. At the root of the SAM is the input-output (IO) matrix, a device plenty of statistical limitations. A methodological revolution – and a Columbus' egg – at the time of its creation by Nobel prize winner Wassily Leontief, the IO matrix reflects a different, outdated view of the industrial sector, hardly to be found in any modestly sophisticated economy nowadays¹. If the issue of many plants - multiple products found ingenious (partial) solutions already in the nineteen seventies², the statistical instrument itself has long overdrawn its methodological account. In a world with fragmented production processes, too many plants with multiple outputs, diversified trans-national companies activity, intense trade

¹ Leontief started work on IO methods in the thirties, last century. In the fifties, applications were already flourishing and it is perhaps fair to say that, during the seventies, the technique reached its prime (Leontief himself received the Nobel in 1973). At the second half of the eighties, it had already become evident that the amount of changes in production techniques was putting at serious risk the reliability of the instrument. Nevertheless, as known, for lack of a better alternative, it is still widely used nowadays, being compiled by most national statistical offices (see also the next footnote).

² The best known is perhaps the device created by Statistics Canada, and reproduced, in different adaptations, by other statistical offices. It uses two rectangular *commodities x sectors* matrices – nowadays called the Make (sector outputs) and Use (sector inputs) ones – which allow more flexibility and bypass some of the problems that appeared in the seventies/eighties.

flows from different origins and kind, the precision and usefulness of the matrix has, at least, considerably decreased.

Still within this context, it is unavoidable to mention the standard approaches to describing production sectors, where if manufactures and agriculture are sometimes reasonably portrayed, services usually fall short of a mortal methodological sin. I've elaborated this point in several other presentations and shall not repeat my frustration and annoyance with the way we see services modelled in most CGE versions. It is either poor or partial, it doesn't encompass all relevant sectors, when not bluntly wrong. Yet, services dynamics is crucial in nearly all economies, from the small Uruguay to the big and powerful US.

But I move on from production to the structure of demand. It is quite disturbing that, until today, we're all hostages to Paul Armington and the system he proposed in the late sixties ! Armington (1969)'s ultimate goal – compatible with the objectives of a serious international civil servant, at the IMF – was to produce a way to organise massive amounts of data. At the same time, his hierarchical combination of CES functions (aggregators) provided a nice way to account for cross-hauling in trade flows, then a very hot topic. There is no comparative advantage in his scheme, simply because this was not originally intended. But then, no country/supplier disappears from an Armington tree, and how come that we still use it nowadays to analyse the sweeping effect of Chinese exports in the world market ?

Moreover, my colleagues who insist to stick to perfect competition in their models, on the grounds of immaculate theoretical arguments and the illusion to be in a Heckscher-Ohlin framework, forget that the law of one price doesn't apply if they resort to the Armington system in their models !

Finally, there is the question of welfare. The number of issues raised by it is very great, but I shall concentrate on a special subset of them, the one related to the diverse ways to perform welfare decompositions. These are important either in the whole poverty debate, when one wants to identify which social classes are more affected by a given policy, or in arguments on the industrial structure where a closer focus on the productive sector is needed. Not always, if performed, such decompositions are done in the best way, what adds to lack of meaning of the results.

I think I don't need to pursue this list of problems to convince the audience that, many times, we're modelling something that doesn't exist. Were we in the field of literature, many of us would be serious candidates to authorship of novels in the style of Adolfo Bioy-Casares or Gabriel Garcia Marques³, just to mention two Latin American outstanding writers of fantastic novels; but this is not the case, and we must address these shortcomings. Before doing it, I'll prepare the ground by saying a few words on the actual practice of CGE modelling.

3. Better framing CGE activities.

The first thing that adds to the difficulty in theoretically, and practically, rescuing CGE from the above sharp criticism is the ignorance gap between policy makers on one side and modellers on the other. How and when to use the models ?

Perhaps the gap is unavoidable, as negotiators and politicians are not obliged to master the subtleties of economic theory and data handling needed to implement a model. Notwithstanding, this makes it much harder to build up a defence against negative arguments, as the answers to them might sound too technical and equivocal, lacking the power to change prejudices or previously set opposing minds.

The only way out to this dilemma is to construct a trust relationship between the two groups. This brings forward an old, and often forgotten, practical rule: CGE models are more useful the more constant is their use in the specific setting at stake. A learning time is mandatory, involving modeller, the technical model building personnel and the users. CGE activity is not a one-shot operation like the production of hot-dogs, it requires an enduring interaction within the whole team concerned, so that policy makers, even if unaware of the theoretical and statistical details, 'feel the model' and know how to use it, in the sense of which questions are fit for that tool. At the same time, the modeller, by progressively

³ Though completely out of the subject of this presentation, I dare to suggest *El Sueño de los Héroes* and *La Invención de Morel* as sample masterpieces from Bioy and, of course, *Cien Años de Soledad* as regards Garcia Marques, for all CGE modellers who haven't yet enjoyed the pleasure of these apparently odd, though fully consistent (general surreal-equilibrium) models of reality.

understanding the actual problem, becomes more able to formulate better, more realistic assumptions and improvements.

I'm afraid at least half of the frustration with CGE models comes from a single trial, usually in a haste, which often results both expensive and vapid. Government departments, domestic and international organisations, as well as private ventures should put in their minds that CGE modelling requires continuity; without allocating a minimum *permanent* staff to it, results will very likely be disappointing.

Together with a steadier and more sustainable approach to the modelling activity, more concern should be given to interpretation and scenario building. This part of CGE activity is so crucial that it must go far beyond the technical staff, in order to add real meaning to the figures produced. Again, another source of disappointment and distrust is when one sees a similar pattern of results for Bolivia and, say, Denmark, receiving the same interpretation. Without creative, serious but rich interpretation, CGE results become even further away from reality. But a good interpretation is often already contained in a well posed and intelligent question: the scenario.

The other point is that models are always a tool, translating a specific view, and so they should be coupled with other analyses. Which ones, in particular ?

Here I confess to have optimistically preached, until recently, the marriage of CGE efforts with correspondingly tailored partial equilibrium ones. Nowadays, unfortunately, such marriage looks ever more the impossible union of a schizophrenic bridegroom – the partial equilibrium model – with a *too general and absent-minded* bride. Many times, there is no way to see the links between a soundly based partial equilibrium aggregation level and the corresponding sectoral dynamics in the CGE experiment. One reason is the mismatch between assumptions; not only really juicy specific disaggregations hardly complement CGE sectors, but concepts and theories akin to both are usually not compatible.

This does not invalidate the use of very detailed analyses at the 6-digits product level, for instance. A galaxy of indicators and techniques, mostly shrewd variations on Balassa's revealed comparative advantages index, is now available, and can produce valuable

exploratory answers. However they enjoy no theoretical background, standing more as a set of statistical findings.

How to closer match both partners in this fake marriage ? Trying to pursue this poses deeper theoretical challenges than previously imagined. Does this mean that there are no possible measures to deal with this gap ? Should we throw both babies out with the (not very clean) water ?

I think that such questions call for a more relaxed, flexible attitude towards CGE modelling. One advantage of this standpoint is that we can devise less common uses for our models. I give one example from what I call a sequence, or combination of models.

It is well-known that static CGE produces one-shot answers, which, from a starting point, yield a final, end – usually long-run – outcome. We don't know what happens between these two extreme points, what, even in life in general, is always the best part. Think, to stay in the economic context, of adjustment, i.e., all the pain and joy experienced by (intermediate) losing and winning sectors, respectively. Dynamic models can sometimes provide answers to this, but usually at the price of an even more aggregate and simplified model.

Why not then construct a set of sequenced scenarios that would, in a stepwise fashion, describe the more likely intermediate outcomes ? The results of the previous scenario would be the 'base-year' configuration for the next one. Not only can a chain of scenarios be built up, but even one of models as well. If, in this path to the final equilibrium, it makes sense to suppose that some parameters or behavioural characteristics might change, why not accordingly modify the model, together with the sequence of scenarios ?

The same more flexible attitude calls for an additional effort to more effectively include, or rather adapt, the spatial dimension to our models. This does not mean to treat the different regions in an economy as individual "countries", connected by the internal trade flows, but rather to establish *true regional links*. I suspect the importance of this, not only in huge countries like Argentina or Brazil, but even at smaller dimensions, doesn't need to be emphasised.

In the same vein, ideally, there should be many models for the same problem. Though we should prevent waste, some redundancy in a technique with such a wide scope is positive. Different models add to better grasping the mechanics of each one individually and, not infrequently, offer complementary views. I can't avoid thinking of the Australian case, where quite a few models related to agriculture co-exist, contributing to a solid CGE culture in negotiations and policy making. But one could say that Australia, a wealthy country, is no example for our Latin American economies ...

Finally, rather than trying to marry the CGE bride to a partial equilibrium gentleman, I think it more relevant to couple the model or its results with precise econometric models or characterisations. Econometrics, which for sometime was considered opposed to the CGE toolkit, can provide innovative and efficient ways to both extend and improve the quality of CGE results.

I turn now to provide a few answers to the theoretical shortcomings raised in section 2.

4. A glimpse on needed theoretical improvements.

At this point, nobody would deny the dire need of theoretical improvements. The first area, where they are urged 'for yesterday', is the already mentioned services. Questions of regulation, or related to GATS' mode 4 trade (movement of people), are but two examples of serious omissions. They, and nearly any other, will have an impact on the data requirements, the computation of barriers to trade in services being still in its infancy, beyond conducted usually in a way decoupled from the CGE needs and structure.

The theoretical approaches set forth by Markusen (1989) rank among the best I know to deal with services, but the number of experiments using them is still scarce. Jensen *et al.* (2004), for instance, contains interesting insights, though the methodology doesn't cover all sectors. The variety of services is one of the great problems in correctly dealing with them in a full CGE framework.

The second area encompasses the diversified treatment of welfare and welfare analysis. Here, interesting progresses have taken place, though often disregarded.

In the context of a static CGE model, under imperfect competition, Smith and Venables have proposed a very interesting sectoral welfare decomposition. It comprises six different components, related to a direct effect – associated to scale economies, a competitiveness one - if firms in the sector become more competitive, a variety one – related, of course, to a love-of-variety effect (that usually presupposes a Spence-Dixit-Stiglitz utility), a diversion one – roughly related to classical trade diversion effects, and variations in the (sector) exports and imports terms of trade. In spite of its very enlightening and useful character, it is somewhat surprising to see that, to the extent of my knowledge, apart from the authors themselves and this speaker⁴, nobody resorted to such decomposition !

Then, within the same area, there is the whole plethora of poverty studies coupled with CGE. Many people forget that, in the late seventies, Piggott and Whalley, simulating the impact of fiscal policies, pointed to the right way of addressing such questions. They used a model with 100 household groups, each with a tree structure, where equilibrium was found simultaneously. Nowadays it is much more common to see modellers importing the CGE results to feed the so-called micro-simulations. This theoretically daring procedure, in my view, may work or not. Many times it is wrongly used, thanks to sheer incompatibility between the assumptions of both techniques. I feel much more comfortable to advocate the approach originally proposed in Piggott and Whalley (1985), even if sometimes the household decomposition must be more modest.

In a more theoretical note I would like to call attention to the very important, and again somewhat overlooked, welfare decompositions implicit in the proposal by Lloyd and Schweinberger (1988). They rely on the trade expenditure function, whose arguments are the vector of domestic prices, that of factor prices, the one of (household) factor endowments and the utility level of consumers. Studied, in different though similar guises by trade theoreticians - like Peter Neary, in, for instance, Neary and Schweinberger (1986), and his later proposal for a trade restrictiveness index, Anderson and Neary (2002) -, the trade expenditure function is a source of varied and interesting welfare decompositions, its possible interpretations lying at the heart of such procedures. Though in two subsequent (co-authored) papers Peter Lloyd has developed part of its potential applications, Lloyd and MacLaren

⁴ See, for instance, Gasiorek *et al.* (1992) and Flôres (2003). The former contains a brief theoretical explanation of the welfare decomposition.

(2002), Lloyd and Schweinberger (1997)⁵, it is, nevertheless, far from having been fully exploited in the CGE context, and more efforts should be concentrated on this.

Improvements in the demand side of our models are of course another urgent need. I particularly favour a greater use of the Gorman polar form, but feel unable to strengthen my pledge, given the lack of empirical evidences. Those still attached to the Armington structure could perhaps combine it with different specifications for the utilities at lower levels of the tree, what could add more flexibility to this standard approach⁶.

Another missing and difficult item in the static framework is investments. A hot topic in any modern trade agreement, though more suitable to a dynamic approach, it should not be absent in certain static contexts. Recent work by Grenadier (2000, 2002), combining game and option theory to describe decisions to quit or invest in a given sector, can provide a clue to an innovative treatment of investment in static CGE. By grafting within the sectoral (imperfect competition) game in the model an option on investment, a dynamic and more realistic flavour can be given even in a static setting.

The number of brand new areas of research can continue, and I think that this short list can already serve as evidence that actually a gigantic research agenda lies in waiting.

5. Conclusion.

After sketching this broad picture, not always positive, maybe some could argue that we should stop the seminar here, making no sense to present a diversified portfolio of applications if so many doubts and problems surround CGE modelling. Born optimists, on the other hand, may nurture the dream that, one day, CGE results will play the same role that the Black-Scholes option pricing model enjoys in derivatives markets, where people don't care any more whether it is right or wrong, and take the implied volatility figure provided by the model as a key – and true ! - market parameter.

⁵ The 1997 paper has a more theoretical goal, being related to generalisations of the Stolper-Samuelson theorem.

⁶ After the talk, David Laborde reported on alternative, new research being conducted on this subject at CEPII (Paris, France).

I would be neither too pessimistic nor optimistic, though I think that CGE models can come closer to reality. However, their use is still scarce to give way to a fruitful symbiosis between negotiations and simulation results. If this is a valid prospect, maybe I've already answered that, in spite of the difficulties, they are still useful in policy making; but, exactly, why ?

Here, my statements are far from new, and can be found in any good textbook on the subject. As long as CGE continues to be *the only available technique providing a global, inter-related way of capturing economy-wide effects of several different policies*, it will stand as a useful methodology.

In fact, this is the sole motive why it is still precious; it is the only tool we have with such property. Until a better alternative appears, or we manage to implement a substantial part of the improvements outlined above, governments, national and international organisations, if desiring to use the technique, should do it along the lines in section 3. Organisms like ECLAC, the IADB or the World Bank can play a major role supporting and encouraging such efforts. They are also uniquely positioned to enhance information and data sharing, as well as putting people from various origins and countries together, to share their experiences.

Different groups and different models, conceived in different units, either in government, or universities or the private sector, are a plus. A serious and complex homework is however before us, if we want to correct, at least, the most dangerous present shortcomings of the technique.

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