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MODEL SPECIFICATION, DATA AND STRUCTURAL PARAMETERS: A NARRATIVE SUMMARY OF CONFERENCE CONTRIBUTIONS

David Roland-Holst[1]

This paper provides a synthetic narrative of conference sessions devoted to CGE methodology. The three primary drivers of results from models of this kind are functional forms (equation specification), share parameters (calibration data), and structural parameters (elasticities, etc.). In each of these areas, the conference provided interesting and useful insights and discussion. It was clear from these sessions that the challenges before us are substantial but, looking back on the last two decades of CGE modeling, however, we have seen dramatic progress in computational capacity, theoretical insight, data availability and standards, and even a little more econometric support for this kind of work. This gives one hope that GE simulation models will continue their steady evolution, increasing explanatory power and policy relevance.

The narrative follows the order of the original conference agenda. Although I have tried to be faithful to the content of the presentations and discussion, for the sake of expository continuity and context I have chosen to paraphrase extensively rather than edit and publish a fractious transcript. Next to each heading below is the name of the lead speaker in that session and a footnote reference is made to the text supporting their presentation if it is available. This attribution is intended only to recognize the speaker's contribution to the conference, and confers no responsibility for errors or omissions in the narrative. Although many people contributed to the discussions, no one else is mentioned by name. A complete list of participants is published elsewhere[2].

DYNAMICS IN THE MODELS (SHANTAYANAN DEVARAJAN)

While comparative static models can elucidate much about underlying economic structure, they remain unsatisfying to forward looking policy analysts for several reasons. Researchers have turned to dynamic specifications to better capture the details of structural adjustment, incorporate a wide variety of growth and sustainability considerations, and capture essential intertemporal characteristics of decision making and behavior.

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2. See "Présentation" (NDLR).

More specifically, there are three salient reasons to insist on a dynamic specification. The first is analytical consistency. If one is going to build a general equilibrium model, reflecting agents making optimal decisions in contemporaneous markets, one also needs to have the savings and investment decisions, inter-temporal decisions, based on the same type of optimizing behavior as the intra-temporal decisions. Secondly, and perhaps more obviously, there are a lot of important policy questions we want to ask that are essentially dynamic in nature. Questions about capital market behavior, taxation, and growth trajectories. You can't ask a question about the relative tariffs on capital versus consumer goods in a static model where investment is exogenous. This has been tried, but the answers are really quite misleading. For example, models trying to calculate optimal tariffs find that a static model calls for a huge tariff on capital goods. Since investment is exogenous, this has no effect on investment. Other limitations of static models are evident in research on Dutch disease, allocation of rents over time, some remittance questions, as well as questions of borrowing and investment strategies.

The third reason might be called the "small number syndrome" or the hunt for large numbers. In the class of static models that looked at trade liberalization and calculated welfare gains, the results were relatively small. On a good day you might get half or one percent increases in real GDP from extensive trade liberalization and this is, at least to some people, profoundly embarrassing. This usually led to an apologetic paragraph at the end of the paper saying, "Well, but of course in a dynamic model, the gains would be much larger."

Some authors have tried to extend the static framework to overcome some or all of these shortcomings, e.g. imputing TFP growth and using this to simply scale up the welfare gains. These approaches are sometimes ingenious, but generally very ad hoc and in any case not consistent dynamic modeling. To do this requires several necessary components. First, you take a static general equilibrium model and now index everything with time as well sectors. Then agents need an objective function both within periods and across periods, usually a standard additively separable utility function accounting for consumption behavior and (most importantly) an inter-temporal budget constraint. So the consumer has an inter-temporal objective function, subject to an inter-temporal budget constraint. This can then be broken down in to the different commodities so that you also have the intra-temporal welfare, intra-temporal utility and consumption demand. Similarly on the production side, you would have some sort of Tobin q theory for investment, so that the producers would maximize the value of the firm, giving rise to an investment function. Thus savings behavior and investment behavior come out of their respective inter-temporal objective functions.

After the basic specification, attention must be given to terminal conditions and adjustment characteristics. Traditionally, dynamic models have exhibited a problematic tendency to jump to steady state trajectories very quickly, thus failing to capture the intertemporal realities of structural adjustment and being unduly dependent upon terminal conditions, however distant (the so-called bang-bang problem). The most effective means of dealing with has gene-

rally been to specify adjustment costs or other structural rigidities that can more finely delineate the transition path of the economy.[3] Other models take a more endogenous approach by incorporating expectations and discounting to smooth the adjustment process.[4]

Discussion on this topic emphasized the importance of modeling the adjustment process, and doing do in as much detail as possible, arguing that steady state solutions are beyond the interest and even the ken of most policy makers. Other discussants cautioned that models generally predict large adjustment costs, while ex post studies show economies adjusting quite rapidly to, e.g. trade liberalization. In terms of timing adjustments, dynamic models also have not fulfilled much of their promise. Perhaps a better emphasis would be upon delineating changing patterns of demand, supply, and employment that will ensue, rather that upon the transition path or incidental adjustment costs. One area where the dynamic framework is especially attractive is modeling strategic interactions. In the context of trade policy, for example, such issues as first-mover advantage and precedence can be quite important.

Scale economies and imperfect competition

(David Roland-Holst)

The constant returns, perfectly competition paradigm is endemic to neoclassical economy-wide modeling. While this is a natural consequence of the latter's origins, a narrow structural and behavioral framework can limit the applicability of these models. This is particularly true in applications to economies replete with market imperfections and institutional failure such as those in the developing world, but it is also clear that in OECD countries a large proportion of economic activity is governed by less than perfectly competitive market forces. There is also persuasive evidence that a large part of both OECD and non-OECD trade is animated in significant part by the realization of scale economies.

As researchers have adapted classical CGE models to increase their policy relevance, economies of scale and imperfect competition have attracted interest for two reasons. Firstly, evidence from established and newly industrialized countries indicates that the realization of scale economies can accelerate progress toward external competitiveness and domestic growth. Second, in the late 1980's and early 1990's trade economists re-discovered many ideas from industrial organization and applied them in thought provoking ways.

Before discussing how these ideas have been applied by empirical modelers, it is worthwhile to remind ourselves about their practical significance. Trade theorists have been predicting for some time that such factors could exert significant influences on trade and development[5], and these arguments have since been supported by an ever-expanding body of evidence out-

3. See e.g. Harrison, Rutherford, and Tarr (2001) and Devarajan and Go (2000).
4. See McKibbon and Vines (2000).
5. See e.g. Brander and Spencer (1984), Cox and Harris (1985), Eastman and Stykholt (1960), Ethier (1982), Helpman and Krugman (1989), Hunter *et al.* (1995), Rodrik (1988), Smith and Venables (1991).

side and inside the CGE literature.[6] Thus we know these issues are policy relevant and empirically significant, but can we agree on standards for modeling them?

The best general entry point for the literature on scale economies and imperfect competition for GE modeling is probably still de Melo and Tarr (1992), who made extensive efforts to specify and calibrate both economies of scale and imperfect competition. Since then, a very diverse set of approaches has arisen, and these are itemized with references below:

- Scale Economies[7];
- Product Differentiation[8];
- Price Setting[9];
- Market Entry/Exit[10];
- Regulation[11];
- Other Issues for Future Research/Discussion:

– Market conduct
– Productivity growth
– Infrastructure
– Transactions costs
– Externalities.

During the discussion it was pointed out that there are essentially three sources of welfare gains from such model extensions: economies of scale, productivity gains, and "rationalization gains" where the pricing rule changes to achieve more competitive consumer surplus conditions. The work of Harrison, Rutherford, and Tarr (2001) emphasizes the importance of identifying and decomposing these three sources.

Another challenging area is product variety. Variety has been part of CGE models since the Armington assumption was incorporated in the earliest specifications. Only recently, however, have authors begun to examine the implications of differentiated products for efficiency, welfare, and domestic market outcomes. Two special challenges pointed out in the discussion are biases arising from calibrated demand patterns (sometimes called home-bias) and overestimating the implicit utility of variety because of the desire to limit substitution possibilities.

Among other salient discussion points, the issue of the "small number" (welfare gain) syndrome was raised, particularly as it masks some very important realities about the adjustment

6. Outside references include Antweiler and Trefler (2000), Feenstra (1995), and Harrigan (1997).
7. See Abayasiri-Silva and Horridge (1996), Devarajan and Rodrik (1988), Lopez de Silanes *et al.* (1994), Francois and Roland-Holst (1997), Harris (1984), Krugman (1980), de Melo and Roland-Holst (1991), Roberts and Tybout (1996).
8. See Abayasiri-Silva and Horridge (1996), Antweiler and Trefler (2000), Francois and Roland-Holst (1997), and Harrison *et al.* (1993).
9. See Brown (1992),), Lopez de Silanes *et al.* (1994), Markusen and Rutherford (1994), de Melo and Tarr (1992), Roberts and Tybout (1996), Willenbockel (1994).
10. *Op. cit.*
11. See Gortz and Hansen (1999) and Willenbockel (1994).

process. Given the resource constraints that we often impose on these models, one can't expect to see very big aggregate movements. Yet beneath the smooth veneer of the social welfare function, very dramatic adjustments are taking place, and for political economy reasons these are of essential interest to policy makers. To expound and elucidate macro results is important, but the bottom up nature of trade policy means that the sectoral adjustments are very important. The issue of scope for scale economies (industry, national, or international), was also raised, and this is a very interesting area of research with multi-country models. To try to identify exactly what network externalities arise from trade linkages is an important challenge.

A number of discussants mentioned the lack of hindsight in the CGE literature, i.e. the relative absence of empirical studies comparing model projections with eventual outcomes. It was observed that there is very little institutional support or publication opportunity for this kind of historical research and this deprives the literature of an important source of model selection criteria.

Finally, concern was expressed about the lack of integration between market structure, conduct, and dynamic effects. In particular, there is the potential in a dynamic setting to turn "triangle" welfare results into "rectangles," and this has known since the work of Balassa almost half a century ago to be one of the primary drivers of gains from economic integration. The challenge for modelers is to be explicit about the mechanism of this dynamic linkage and how to calibrate it.

International capital mobility and accumulation, including FDI (David Roland-Holst)

Financial flows generally, and foreign capital flows in particular, have been one of the more challenging areas for CGE modelers. These flows are important to the underlying economies, particularly developing ones where FDI and other external inflows can exert significant leverage on the growth process and domestic institutions. Despite general agreement about what kind of phenomena deserve primary attention and a wide variety of strategies to capture them, however, modelers have failed to achieve consensus about empirically robust specifications. There are substantive reasons for this failure, but perhaps a more modest agenda and greater dialogue can improve this situation.

Why is this difficult? Like most other components of our models, a structural specification of financial behavior is only as credible as the economic theory it represents. We know money is important in economics, but it has defied conclusive integration into general equilibrium theory. Money and finance at the micro and macro levels encompass a vast range of phenomena and behavior, but for present discussion it makes sense to set priorities. Since the main emphasis of most CGE applications has been trade and development, consider the following two groups of issues:

High priority

• Foreign Direct Investment – This really refers to long term real investment, which is important because of its real growth effects and which, being linked to real rates of return, might be more amenable to neoclassical specification.

• Remittances – a very important emergent issue in multilateral capital flows, particularly in the Americas. This phenomenon is also driven by real economic variables, but of a very different kind.

Lesser priority

• Debt and Debt Service – This is not insignificant, particularly in the sovereign case, but less amenable to market forces and endogeniety.

• Hot Money – probably a waste of time for long term growth modeling.

• Monetary and financial variables – each interesting in its own right, but unlikely to be endogenized convincingly with our existing repertoire.

• Monetary aggregates.

• Nominal anything, especially the exchange rate, is relatively intractable with current methodologies.

• Interest rates and other market yields.

• Technology transfer/productivity.

• Ownership patterns.

Alternative approaches

While every model is different, a limited set of alternative specifications that have been applied to modeling capital flows. For discussion they can be divided into four generic categories (references in brackets):

Ad hoc[12]

• Fix something[13].

• Use closure rules that determine capital flows and other financial balances residually[14].

Static and sequential static multilateral capital allocation

• Usually the above with capital accumulation[15].

• International real rental rate arbitrage[16].

• Portfolio models with segmented expectations[17].

12. In terms of international capital flows, this category includes nearly all one country models.
13. By far the most common approach – scores of references.
14. Also common, see e.g. Dewatripont and Michel (1987) and Francois *et al.* (1997).
15. See Lewis (1994), Robinson (1991), and Yeldan (1997).
16. Lee *et al.* (2001).
17. Easterly (1990), Feltenstein and Shah (1995), Souissi and Decaluwe (1997), and Vos (1998).

Dynamic

- Forward-looking sequential[18].
- Closed-form and Steady-state[19].

Combined micro and macro

- GE micro-macro[20].
- Mixed GE and macroeconometric[21].

A moderate recommendation

Given the theoretical ambiguities of modeling pure financial behavior, it is probably more reasonable to decide on a reasonable definition of real capital and real rate of return, modeling these with neoclassical factor demand and supply models. This approach avoids nominal/real macro and wealth effect issues, which many practitioners agree are mooted by neoclassical closure (the numeraire) in any case. An example of this approach would be to handle FDI with an international, real rental rate arbitrage condition, driven by real exchange rates and wage rental ratios across all countries. This approach does not explicitly account for risk, but that is a separate issue.

Discussants mentioned that FDI is the subject of extensive trade negotiation and has statutory support rivaling trade in most multilateral settings. Modeling investment like commodity or service flows, with a multilateral Armington specification, was advocated.[22] Other discussants observed that better accounting for flow of funds might permit inclusion of an accommodating monetary authority in a dynamic ("cash in advance") setting. This might also help explain an essential financial issue raised by other discussants, the co evolution of trade liberalization and foreign capital inflows. Several discussants felt it was essential to model this linkage more convincingly, particularly in the Latin American context.

Decomposing factors of production and distributional effects (Sherman Robinson)

When representing domestic income and, by extension, welfare, by far the most common convention in CGE modeling is the aggregate domestic household. This expedient facilitates most of the practical aspects of modeling, but does little to elucidate the political economy relevant consequences of policies, external shocks, or other issues addressed with these models. In order to really capture the complexities of incidence and policy trade-offs, income linkages must really be decomposed by source and destination. This means more clearly delineating patterns of factor entitlement and household income distribution.

18. Diao and Somwaru (2000), Fargeix and Sadoulet (1994), Feltenstein and Shah (1995), McKibbin and Wilcoxin (1998), and Thissen and Lensink (forthcoming).
19. Werin (1990).
20. Bourguignon *et al.* (1992) and Robinson (1991).
21. Azis (2001).
22. An example of this approach is Lee, Roland-Holst, and van der Mensbrugghe (1999).

Fortunately, this kind of distributional analysis is as old as economywide modeling itself and the challenge facing us is not really methodological, but one of more extensive and intensive data development and model calibration. This can be seen in one of the principal tools of economywide distribution analysis, the Social Accounting Matrix (SAM), which is an ideal tool for calibrating CGE models, but is still underutilized in this field. In its most aggregate form, a Macro SAM simply represents Keynesian national income accounts in double-entry or tabular form, including the popular but entirely fictional nationally representative household. To fulfill their potential for distributional analysis (using either multiplier or modeling methods), SAMs are generally much more disaggregated, particularly on the factor and household sides.[23] A detailed SAM traces income and expenditure cycles through the "iron triangle" of household consumption patterns, production activities, factor employment, and accrued income. Detailed accounting and calibration of activities, factors, and households enables models to capture the complex incidence of economic effects upon different stakeholders and more clearly reveals political implications.

While disaggregation of this kind is an essential step toward greater insight and policy relevance, most SAM based studies still only capture a significant fraction of the compositional adjustments. Lacking longitudinal sampling, they reveal no information about true individual welfare transitions, and in any case most are not detailed enough to capture more than half the total variation in individual incomes arising from a given policy or shock. This fact has given impetus to a more radical recent approach of micro-simulation, a data and computation intensive attempt to model something more like individual behavior and welfare in a consistent, economywide framework.[24] Given the proliferation, under World Bank and other auspices, of nationally representative household surveys, one can expect to see more developments in this direction.

Discussion focused on sampling and data development issues, including under-reporting of profits, eligible labor force, and other components. It was also emphasized that the value of micro simulation (in many cases with more than 10,000 individuals) comes at a price in terms of new demands for econometric estimation of behavioral relationships and new demands for sampling discipline. This is a relatively new area, but one with great promise if the practical obstacles can be overcome.

SERVICES (PHILIPPA DEE)[25]

Services represent a serious paradox in modern economics, where they constitute a comfortable majority of economic activity but a residual category in economic theory. Globally, services represent about 60 percent of GDP (closer to 70 percent in OECD countries) and an estimated 30 percent of trade. Despite its practical significance, however, this realm of eco-

23. For a recent and detailed example, including 97 activities, 14 factors, 16 household types, and 94 trading partners, see Rand, Roland-Holst, and Tarp (2002).
24. See e.g. Bourguignon *et al.* (2001).
25. See Dee (2001).

nomic activity has humbled microeconomic theorists as well as national income and trade accountants for two generations. Generally, we are still using production and supply models from the manufacturing sector to capture the subtleties of producing intangibles with often arcane value added relationships. At the same time, measurement issues abound for statistics on production, trade, and final demand in detailed service sectors. For these reasons, services are both an essential priority and a mighty challenge to empirical economists.

The significance of these issues for trade research and policy cannot be overstated. By even the most heuristic measures, protection levels in services can reach levels that would instigate open disputes in manufacturing trade, and the magnitude of service trade is large enough to make these a serious impediment to open multilateralism. Fortunately, the current Doha round of the WTO is bringing service trade to the fore with explicit negotiating recognition and an assertion of standards for measurement of service trade and barriers thereto. There is real hope that opening this negotiating agenda will renew interest in more definitive behavioral specification, measurement, and empirical analysis of service sector activity.

To understand service sector trade, it is necessary to consider the modalities of service delivery. For present discussion, we focus on four: transport services, communication services, temporary services (effected by a visitor), and financial services (primarily FDI). Other service sector trade, such as software and media content, is more amenable to traditional neoclassical modeling. The first two of the four are essentially trade and transport margins, and can be modeled without difficulty. The third is more complicated, including tourism and visiting expert services. The last represents a case of special significance and difficulty. Financial flows are obviously a critical component of global economic interaction, and modeling them convincingly is a big challenge. Firstly, it is usually necessary to keep track of both origin and destination of financial flows, and beyond this we are usually with the complexity of multinational firm decisions regarding foreign affiliates and/or joint ventures. Secondly, the theory surrounding this behavior still awaits definitive theoretical treatment (see the section on capital flows in the present paper). Beyond this, it is clear that market imperfections, including scale economies, product differentiation, and noncompetitive price setting, are very prevalent in service markets and service trade. Many indeed are the challenges, but a significant payoff to greater explanatory power in this component of trade modeling, particularly as we enter the new WTO Round.

Discussants emphasized the importance of consistent aggregation and the risk of aggregation bias in a sector with such diverse modalities of production and supply. This is just as much the case with trade barriers, which are risky to aggregate in commodity categories but very ambiguous when dealing with the plethora of market access restrictions that influence service trade. Add to this the distinction between barriers to establishment and barriers to ongoing operation and we are left with very diverse constituent protection and correspondingly high risk of aggregation bias.[26]

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26. A great deal of Australian work on quantifying service barriers illustrated both the issues and challenges. See Dee (2001) for an overview of these contributions and more details on all services issue.

TRADE AND EMPLOYMENT (SÉBASTIEN JEAN)

There is an established literature applying CGE methods to trade and employment issues, and this kind of work has informed the policy debate with some authority at least since the NAFTA was under negotiation. The present work reiterates a theme that pervaded the methodology sessions, the so-called small number syndrome. Neoclassical simulation models, for a variety of reasons, calculate relatively small adjustments by comparison to expectations and historical experience about structural changes induced by trade liberalization. Here we focus on labor market adjustments, and attempt to better describe the extensive shifts in allocative and aggregate employment. The emphasis of present discussion is the impact of expanding North/South trade on employment in the North (essentially the OECD countries).

To evaluate both specification and scenario alternatives, four of each are considered. The models are all three sector and three factor, with capital and unskilled and capital-complementary skilled labor, and all are calibrated to GTAP 5. The first model is a kind of new trade theory model with increasing returns to scale, imperfect competition, and horizontal product differentiation a la Dixit-Stiglitz. The second model specifies perfect competition, homogenous products, and Armington trade, just to elucidate the effects ot imperfect competition and horizontal product differentiation. Then we consider a variation of benchmark model, assuming unskilled labor is sector-specific, as this may be responsible for large impacts in developing countries. Finally, we consider a model including capital accumulation, assuming the real interest rate is fixed and the capital stock of each economy is endogenous. Four scenarios consist of tariff reduction, enlargement of the Southern economic region resulting from superior growth rates, and two scenarios that reduce transactions costs with and without skill bias. The last two are intended to show how labor market rigidities can affect the adjustment process and net effects.

The basic findings of this work are that capital accumulation significantly amplifies the adjustment impacts and labor market adjustment biases even more so. Clearly, leverage from nonlabor factors and structural rigidities can combine in a liberalization scenario to intensify the adjustment process, increasing its short term costs and longer term allocative effects.

Directions for future research include more sectoral disaggregation. It is not clear what effect this will have on the results, since disaggregation will to some extent smooth the skill discrepancies across sectors and facilitate labor market re-allocation. It may also reduce the extent of trade specialization for similar reasons, leading to smaller discrepancies between counterfactuals. The role of capital accumulation will still be to amplify effects, but there will be less leverage against intersectoral discrepancies in factor intensity.

During discussion, some questioned the robustness of results based on such aggregate data. There was also skepticism about the idea of "de-constructing" a CGE specification to find which assumptions were necessary to generate results of a given magnitude, while the norm

is to simply run counterfactuals to establish sufficiency of initial conditions for the results obtained. The implied reversal of logic in this case appears to lead to non-uniqueness of necessary conditions, and the benefits of such an exercise are ambiguous at best.

Non-tariff barriers and tariff equivalents
(Antoine Bouët)[27]

A very large component of the CGE research agenda addresses trade policy issues, and for this reason data on prior protection levels is indispensable. While data resources are much more extensive and standards for comparability and accuracy higher, than a decade ago, there remain many shortcomings. This presentation introduces a very significant and original joint effort of CEPII and the International Trade Centre (ITC), Geneva. Called Market Access Maps (MAcMaps), this database is intended to detail highly disaggregated bilateral protection patterns, encompassing both tariff and non-tariff barriers. Of particular interest in this work are detailed treatment of emergent NTB instruments such as SPS, anti-dumping measures, and trade preferences. Perhaps most challenging but most important for the modeling community, the database strives for an *ad valorem* tariff equivalent reporting standard.

The database can be visualized in four dimensions: importer, exporter, instrument, and commodity/service. Detail is an essential priority, to facilitate consideration of very specific and complex negotiating positions and agreements, with an attendant cost of developing and maintaining a relatively huge database. Information is retained for 137 markets, 220 exporting countries, and ten digit harmonized customs lines. The first complete year for the database is 1999. Great care has also been taken to aggregate consistently, since the objective is to define counterfactuals at the detailed level, but implement models at a higher level without aggregation bias. This bias is minimized by aggregated with import weights from reference group partitioned by GDP per capita.

A number of examples suffice to demonstrate the special advantages of this database. In the case of a very detailed commodity, White Chocolate, it is apparent that the database reveals protection patterns by destination, origin, and even product quality. For a given importer, preferences and other NTBs can lead to differential protection for different exporters. For different grades of the product, observed price differentials imply different *ad valorem* price distortions. Most of these features are absent from more widely available protection databases. The four dimensional layout of the data also permit ranking of importers by commotidy-specific and aggregate average protection rates, taking into account complex combinations of instruments and preferences. These lead to some counterintuitive outcomes. For example, average *ad valorem* European protection is lower than the US in some commodity categories, but the former's systems of preference are so complex that they may bind easily (or even seasonally) and overshoot US protection rates.

27. See Bouët *et al.* (2001).

Another innovative component of MAcMaps is an inventory of Environment Trade Barriers (ETB), which encompass any trade restraints concerning protection of: environment, flora and fauna, human health, and human security. These data are generally not estimated on an *ad valorem*, but on an incidence or coverage basis like the traditional UNCTAD NTB data. Nevertheless, these data form the template for later imputation of induced price distortions.

Discussion was generally very laudatory of this ambitious data development effort, and several people suggested a synthesis with the GTAP database be achieved. This would require considerable effort, but could promote development of flexible and user-friendly data access and aggregation software and rapidly increase the implementation of MAcMaps.

Discussants also emphasized the importance of more research on the problem of aggregation bias. The MAcMaps approach is more extensive and intensive, but import weighting has been around for some time and is not free of bias. Given that the nature of induced bias depends critically on the details of a given aggregation, it is suggested that some constrained optimization procedure be developed with bias in the objective function. In reference to ETBs, it was mentioned that, even without measures of restrictiveness, very diverse patterns of use for this instrument emerge geographically. This in itself can inform the negotiating agenda.

Concern was expressed by one discussant about gaps in the MAcMaps data sources, including flows not recorded by GSP. This might be a small fraction of total trade, but could significantly undermine the precision of detailed protection estimates.

DATABASES (THOMAS HERTEL)[28]

Since the advent of GTAP a decade ago the network externalities of international databases and data sharing have emerged dramatically. In the early days, there were relatively few stakeholders in this enterprise, but as the scope of the data has increased, more and more experts have stepped in to share their resources and experience. The result is a new standard for collaborative information development and dissemination, and we are all the beneficiaries of this. With the geographic extension, desegregation, and further standardization of the database, more and more sophisticated and diverse analysis can be supported, and the IDB/CEPII conference contributions make obvious. From a strong foundation then, where might we expect this work to evolve?

In some areas, progress has been enormous. Significant reservations about bilateral merchandise trade data, for example, have largely been put to rest. On the other hand some areas, such as services, remain very substantial challenges for data development and standards. Also, each step in desegregation of the global database creates new demands for consistency at the national and bilateral level, instigating a reassessment of standards in each constituent data source. This is true at the sectoral level, but even more so at the level of

28. See Hertel (1997).

factor and household desegregation, where there can be vast differences in national data resources and accounting standards. Another challenging area is protection and other price distortions, where there is a bewildering diversity of interventions, data standards, and measurement problems. To mention a few, account must be taken of a myriad of bilateral and multilateral trade preferences, statutory and de facto exemptions, hybrid price and quantity restraints, binding content standards (SPS, TRIPS) and the entire realm of services regulation. In all these areas, significant distortions are being exerted on the international price system.

Apart from trade, there are other areas where much progress could be made in accuracy, currency, and standardization. Input/output tables and SAMs for example, are still very diverse in the GTAP sample in by all three criteria. Recently, the new agenda for detailed household surveys has animated interest for global standardization and dissemination in GTAP fashion. This would be very desirable for the research and policy community – it is precisely this kind of reconciliation between trade and detailed household data that is needed to answer the most pressing questions about globalization and welfare. Such an initiative, whoever, would require ambitious financial and institutional initiative. This is beginning to emerge in the World Bank and a few other places, but decisive commitment and leadership are still needed.

Discussion emphasized the importance of more uniformly up-to-date structural accounts, especially input/output tables. There were also reservations expressed about measurement and data gathering on informal sector activity, which is very significant to the poor. Another intervention mentioned measurement problems in value added accounts, where attributions to different factor types could be partially or completely misleading. An example was given of the Turkish locomotive sector, which registered no capital value added. Clearly, data standards will be an impediment to research until they can be raised substantially and harmonized. It was observed that further development of household data resources will provide a convenient consistency check on production base income and expenditure accounts, helping to reconcile diverse accounting sources through balancing checks as is done with SAMs.

TRADE ELASTICITIES (EDWARD BALISTRERI)[29]

While most of the methodological discussion above has dealt with data and model specification, the essential role played by structural parameters cannot be ignored, either by CGE modelers or those who must interpret and act upon their findings. Not only are these parameters necessary to complete the model information set, but they determine the responsiveness of behavioral relations and therefore the results in any counterfactual experiment. While great progress has been made in establishing and implementing higher standards for model specification and data, however, parameter estimation is still in its infancy. There are many reasons for this, but the main ones appear to be lack of involvement by the econome-

29. See Hillberry *et al.* (2001).

tric community and limited resources in the modeling community. The orientation of the econometric literature is such that researchers have little or no incentive to dedicate themselves to estimating parameters for simulation models, especially other people's models. For their part, CGE modelers usually require so much time to assemble data and develop model software that original econometric estimation is infeasible.

Despite an emergent interest in micro-econometrics, it is not reasonable to expect the econometric community to turn its attention to the needs of modelers anytime soon, except on an individual collaborative basis. In some ways, this is understandable since, as Jorgensen and others have pointed out, each CGE model is a different specification and thus calls for unique parameter estimates. While this view is extreme, econometricians are stricter in their sensibilities about identification than CGE modelers. The latter tend to be more pragmatic. Consider for example the issue of degrees of freedom. Calibrated models have been ridiculed by some econometricians for having none, but what is their true significance in the context of forward looking simulation modeling. One could have data back to the time of the Pharaohs, without shedding any light whatsoever on structural adjustments in the Egyptian economy over the next decade. From a modeler's perspective, if the criterion for empirical credibility were policy relevance, one might ask what the majority of econometricians have been doing with their lives. In any case, the two groups are far apart in their empirical perspectives (often for the wrong reasons), and thus we must be largely self-reliant.

Because the mere creation of these models is so data and software intensive, most researchers adapt parameter estimates from other sources. From this experience, norms have emerged in the literature about plausible ranges for parameter values, and these ranges are often further tested with sensitivity analysis. This is an important and necessary exercise in validation, and most who undertake it obtain new insights from the process. Generalizing rules for parameter use is not a simple matter. Not only are actual parameters specific to a given model, but there are important differences between parameter standards that depend upon time interval and level of aggregation. The main challenge regarding parameter choice is really to recognize the commons nature of the available estimates and the importance of sharing research results and experience about them. Meetings like this one, organizations like GTAP, referee and citation reciprocity – all these propagate the network externalities needed to advance standards for estimation, implementation, and interpretation of structural parameters.

Discussion emphasized the incentive problems for fostering research in this area, as well as the many ways in which more empirical support is needed. Even in the case of sensitivity analysis, the moments of distributions for the underlying parameters are very uncertain. It was also observed that limited availability of parameter information creates a bias for parsimonious structural equations, like CES, which are less flexible. It was also observed that help may be on the way from macroeconomics, whose long march from Keynesian determinism is leading it in the direction of simple dynamic GE specifications. This could inspire collabora-

tive opportunities that might break down some of the barriers with the econometric community. Finally, hope was expressed that greater automation, including online task sharing, might advance more intensive sensitivity methods and improve our understanding of robustness.

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