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What Can The Developing Countries Infer From The Uruguay Round Models For The Millennium Round Positions?

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Abstract:

This paper discusses the results from general equilibrium trade models executed towards the end of the Uruguay Round, reporting both aggregate and regional gains. These results were generated some 5 years ago, and were important to the debates at the end of the Uruguay Round as to what would be the foregone gains were the Round not to conclude. The paper argues that there are substantial, and at times hard to explain inconsistencies across model results. One model shows most of the gains come from agricultural liberalization, another from textiles, and yet another from tariff cuts. One model shows developing countries account for around 10% of the total gain, another shows them to gain over 50%. One model shows developing countries losing from elimination of the MFA, another shows them as large gainers. One model shows that imperfectly competitive and scale economy effects double global gains, another shows almost no impact. These differences occur even where similar data sets, and benchmark years are used, and are hard to explain on the basis of parametric specifications for models seemingly used though these are frequently poorly exposited. The paper also discusses the verification of models relative to behaviour since the Round concluded, expressing skepticism as to its feasibility for reasons set out in the paper. It also attempts to discuss what, if any, are the implications for the developing countries, and the possible ways forward in making these models more useable in the Millennium Round.

Keywords: Trade, Uruguay Round, General Equilibrium.
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1. INTRODUCTION

In the period overlapping with the conclusion of the Uruguay Round (say, between 1993 and 1996), at least eight global multi-commodity multi-region equilibrium models (by my count) were constructed to analyze the potential impacts of the Round. Such models had been built on a smaller scale during the Tokyo Round, but this represented a major enlargement of previous activity of this type. New (and large) model admissible data sets were assembled; the major institutional players (the WTO (GATT), the World Bank, and the OECD) all housed and supported in various ways one or more of these modelling efforts and with enhanced computing power and software, models were in place that could be quickly solved and resolved for sensitivity and other analyses.

This piece looks back at these efforts with a new Round still under discussion after Seattle, and asks what developing country negotiators can infer from the results from the models by way of pointers for their negotiating positions for a new Round. The conclusion is that at first sight, the picture is one of substantial confusion. Some model results suggest that the gains to developing countries from the Uruguay Round might have been only small (say 10% of the total global gain) while some have them as much larger (over 60% of the total). One can also find model results that seemingly indicate that developing countries either lost from an elimination of the MFA or gained a lot; that the largest sources of gain in the Uruguay Round lay in agriculture, in textiles, or even in tariff cuts. One can become further confused by seeing model results that suggested that, potentially, liberalization in services could dominate everything else in the Round; or results that suggest only small impacts from services.

If this is not enough, one can get into more technical aspects of the modeling work and find results showing that introducing scale economies and market structure considerations into models doubles the gains, and counter claims and results that they will not. One can read discussions of

sensitivity analyses showing that model results are robust to significant variations in elasticities, and other discussion of how results are, in fact, substantially elasticity dependent. And if one cares to descend into results reported for individual countries and regions, one can find changes of sign and size across models and regions for particular results, and claimed positive country impacts as large as 20% of GDP. If as a developing country negotiator, one wanted to draw upon the model results to support or help frame a negotiating position for the Millennium Round, seemingly there is support for almost anything one wanted to argue. The gains to developing countries could be large or small; agriculture could be the most important issue, or it could be services. Impacts on individual countries could positive or negative, large or small.

These may strike negotiators as somewhat strange and overly negative conclusions to draw from this modeling work. Quantification of trade policy impacts is usually thought of as good and bringing important factual material to bear on policy. If model results differ in some way, surely they must be able to be reconciled, and we can see what the differences in model design and execution are that account for them. Data, model parameter values, estimates of trade distortions, and theoretical structures are the ones that come most readily to mind. And given that the models were built some five years ago, equally surely with hindsight and data generated since the Round we should be able to readily see which model predictions were right and which were wrong.

Some of the modelers have made (often heroic) efforts to reconcile their results with others, and these help a little in sorting things out. But at the same time, it is unfortunately the case that the differences I list above remain as largely unreconciled and hence a source of confusion for possible Millennium Round negotiators. Also, Uruguay Round model predictions are difficult to verify expost from 2000 for a number of reasons. Key predictions relate to things not directly measured

(like welfare); the decisions of the Uruguay Round remain (in 1999) only partially implemented, in contrast to the full implementation assumed in the models; and all manner of developments outside the Uruguay Round decisions have influenced the actual behaviour of the global economy (and probably more so that the Round's decisions).

In the paper I first describe key differences in model results, and ask what can account for them. I also speculate why these differences have remained so relatively unnoticed for so long, and what this implies for how model results are used more widely in the policy process. I then discuss what all of this may mean both for the formulation of negotiating positions in the new Round, and for any associated new modeling efforts parallel to it. Specifically, I ask how modellers might be able to work more effectively together so as to improve the value of their joint work for negotiators.

2. DIFFERENCES IN RESULTS FROM URUGUAY ROUND MODELS

For the purposes of the present discussion I will focus on 8 models, each of which sought in various ways to analyze the impacts of the Uruguay Round during the early - mid 1990's. Their focus was on welfare impacts, trade flows, production and consumption; both in aggregate and individually for key regions and economies. The early versions of these models looked prospectively at what a package of liberalization in the Round might be, along with its implications; the later models sought to analyze the impacts of the actual package which resulted as negotiations concluded. The focus of modeling was on those elements which more easily lent themselves to quantification (tariff cuts, agriculture, textiles) rather than hard to quantify elements (dispute settlement, TRIMs, TRIPs). Some of the more difficult to model elements, such as services, received partial quantification. I discuss both the model results and the underlying structures and data used, stressing a comparative approach and emphasizing the results giving estimated impacts on the developing countries.

The 8 models at issue are all numerical general equilibrium models. I view them as fairly conventional in structure relative to previous literature, and in the spirit of Hecksher-Ohlin models which dominated trade theory from the 1940's until the mid 1970's, with the key difference being the incorporation of product heterogeneity across countries (the Armington treatment). They treat the global economy as a series of regions (or countries), each of which have demands and supplies for a series of country specific goods, and engage in international trade. Demands reflect utility maximizing behaviour, typically by an assumed representative consumer for each region. Supplies reflect the outcome of sectoral profit maximizing behaviour in which there are production functions with inputs (capital and labour) and outputs, as well as intermediate products. Exports are given by

sales abroad of country specific goods, and imports as purchases from all other regions. In such an Armington structure, all pairwise trade flows of goods between regions are identified.

Trade barriers in the model regions operate against the various traded goods; and they restrict trade and change trade patterns, demands, and supplies. Changes in trade barriers, as occurred under Uruguay Round liberalization, alter trade, consumption and production across regions, and prices of products across regions adjust to clear markets. Constant elasticity of substitution (CES) functional forms are nearly uniformly used in these models. Welfare impacts are evaluated by comparing regional welfare before and after liberalization, with changes in welfare converted into an equivalent monetary measures (so called money metric welfare measures).[2]

A few further points should be noted about these models. One is that they typically assume perfect competition and constant returns to scale, although in some cases model variants embodying increasing returns to scale and imperfect competition are used (there is disagreement among modelers as to how important this is for results). Another is that models are typically single period, although some use various multiplier devices to adjust results for what they call dynamic effects. These adjustments can more than double the estimated impacts of Uruguay Round liberalization in some models.

Another is that these models are typically benchmarked, or calibrated, to a base year data set, around which counterfactual experiments are conducted to simulate the effects of Uruguay Round liberalization. Many of the models draw on a data compilation for 1992, known as the GTAP data set. This data compilation, initiated by Tom Hertel of Perdue University, draws together data on trade, consumption, production and trade barriers for each of a number of countries and regions.

[2]See the discussion of this in Shoven and Whalley (1992).

Since its initiation in the early 1990's, it has grown substantially in product and regional coverage. One of the strengths of the Uruguay Round modeling efforts has been both the assembly and availability of data in this form. This largely common use of data (along with the equally common use of CES functions), other things being equal, should also make the model results more similar than otherwise. Typical levels of disaggregation in models are 10-20 commodities, and 10 or so regions.

The models[3] I have chosen[4] for this exercise[5] are

1. *Francois, McDonald, and Nordström* (1993,1994) [*FMN1*] This is an early 10 sector, 7 region general equilibrium model which when used in increasing returns to scale, monopolistic competition format, and with added accumulation effects, produced a $510 billion global gain estimate for the Uruguay Round decisions. This was the basis for $500 billion figure subsequently repeatedly cited by Peter Sutherland, the then Director General of GATT. It was benchmarked to 1990 data, and was used in a range of formats (constant returns/increasing returns; with and without steady state analysis) producing a range of estimates of global gains from less than $100 billion to the $510 billion estimate. It captured

[3]Two of the original working papers, one by Yang (1994), and the first Francois, MacDonald and Nordström paper (FNM (1993)) are unpublished and not accessible through the library facilities available to me. I have relied on the secondary descriptions of these in Perroni (1998) and Francois, MacDonald, and Nordström (1996)). I have also assumed FNM (1993) to be close to FNM (1994).

[4]I have excluded other models, such as the partial equilibrium model of Page and Davenport (1994), since the structures are different from those in the general equilibrium models.

[5]Two earlier survey pieces on Uruguay Round models provide helpful details on model structures, data, and results across models (Perroni (1998), and Francois, McDonald, and Nordström (1996a)) and I draw on these here. These surveys results lay out model results in a matter of fact way, with less commentary than offered here across model results.

a global liberalization package including MFA removal, tariff cuts on industrial goods, agricultural liberalization, and NTB removal. The $510 billion of gains involved a projection out to 2005 with assumed interim growth rates for the global economy, although the gains were still measured in 1992 prices. Liberalization of services, TRIPs, TRIMs and other elements of the Uruguay Round liberalization package (such as dispute settlement) were excluded.

2. *Francois, McDonald, and Nordström* (1995, 1996a) [*FMN2*]. These are later versions of the original *FMN1* model of 1993, which expanded on the number of sectors and regions (up to 19 and 12 respectively). Later versions analyzed actual agreed to liberalization from the Round, rather than the conjectural liberalization packages of earlier. Various projections over time of estimated gains were produced. The basic model structures remained the same as in the earlier piece, but the estimates of size of gains fell significantly; typically from $510 billion annually in the 1993 and 1994 papers to the $40 - $215 billion range.

3. *Harrison, Rutherford, and Tarr* (1995, 1996, 1997) [*HRT*]. These 3 related papers report results of Uruguay Round liberalization from a 22 sector, 11 region global general equilibrium model calibrated to 1992 data and projected forward to 2005. The liberalization covered MFA removal, agricultural liberalization, and tariff cuts. They produced annual static welfare gains of $96 billion in 1992 dollars, with an upper bound steady state increasing returns to scale estimate of $171 billion. Their results showed developing country losses from MFA removal (due to reduced rent transfers), and little difference in results with and without market structure/scale economy features, although their steady state modifications do significantly affect results.

4. *Goldin, Knudsen (1995 only) and van der Mensbrugghe* (1993, 1995) [*GM*]. This is a 22 region, 20 sector model with an urban rural structure and endogenous employment in regions (in some model variants). Benchmarked to 1985-93 data, the model considers changes in NTB equivalents due to Uruguay Round liberalization. In its 1995 version, projected annual gains out to 2002 were $235 billion, while in its 1993 version the annual gains were projected to be $511 billion (also in 2002).

5. *Hertel, Martin, Yangashima, and Dimaranan* (1995, 1996) [*HMYD*]. This is a constant returns to scale, perfectly competitive model, covering 15 regions and 10 sectors. It considers Uruguay Round cuts in industrial tariffs, agricultural liberalization, and MFA elimination, showing global gains of $258 billion in 1992 prices by the year 2005. A feature of this model is the seemingly more prominent role for industrial tariff cuts in model results compared to other models.[6]

6. *Yang* (1994). This is similar in structure to *HMYD*, also using 1992 data for its benchmark year. It examines cuts in industrial tariffs, agricultural liberalization, and MFA removal, and examines various model variants, including with external scale economies. It concludes that annual global gains from the Uruguay Round lie in a range of $69-146 billion based on 1992 data, with no forward projection of gains.

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[6]*HMYD* project forward to 2005 taking into account differential rates of growth in capital, labour, and human capital, as well as productivity growth by country so as to match World Bank GDP projections. In most developing countries, these projections increase capital in manufacturing relative to labour. Projections for export tax equivalents of MFA quotas also increase under these projections, leading to a greater role for industrial tariffs. I am grateful to Will Martin for bringing these points to my attention.

7. *Nguyen, Perroni, and Wigle* (1991, 1993, 1995) [*NPW*]. This is again similar in structure to *HMYD* and also to Yang, covering 9 sectors and 10 regions, but is based on a data set separately assembled by the authors for 1986. They also consider industrial tariffs, textiles and clothing, and agriculture; but add to this liberalization of services. They show annual global gains from global liberalization thought at the time of their 1993 paper to reflect the likely Uruguay Round decisions of $212 billion in 1986 dollars; but this estimate is revised downward to $69 billion in their 1995 paper evaluating the actual agreement.

8. *Brown, Deardorff, Fox and Stern* (1995) [*BFDS*]. This piece deals with liberalization of trade in both services and industrial products in the Round using a 29 sector, 8 region model using 1990 base case data, and embodying product differentiation and monopolistic competition. The paper begins by suggesting that little liberalization was actually achieved in services in the Round, and argues that its main contribution is to quantify what the benefits of services liberalization could be when they eventually occur. They seem to show gains from services liberalization significantly larger than Uruguay Round liberalization in goods in their tables, but their text appears to indicate a less significant role for services.

The findings from these models were important both in the period leading up to the conclusion of the Round in April 1994 and subsequently, in evaluating the impacts of both prospective and actual Uruguay Round decisions. The main focus in the initial discussion of model results was the aggregate size of gains; whether they were really as large as had been claimed in the early work (some $500 bill.) and projected by Peter Sutherland. The details in the results were less fully discussed, in part because the political process did not seem to focus on them.

In evaluating these results, my approach here is to take their results as a combined set, and ask what negotiators can conclude from them today, relevant to their concerns. The focus is on the outputs (results) from the modeling work, more so than on the inputs (data, model structure) emphasizing three groups of results; (a) the size of aggregate gains to the global economy from Uruguay Round liberalization (b) similarities and differences by region, country and area of liberalization (tariffs, agriculture, textiles) using more detailed results, and (c) the seeming implications of these model results for the developing countries and their possible positions in a Millennium Round. *FMN* (1996a), and Perroni (1998) in discussing these models provide helpful comparative material, on which I draw, but they tend to focus more on differences in model structure and data, and offer relatively little commentary on results, instead largely simply setting them out in tabular form.

Global Gains From The Uruguay Round

How large the aggregate gains to the global economy from Uruguay Round liberalization could be became a topic of intense discussion when Peter Sutherland, then Director General of GATT in the closing stages of the Round, picked up on early model studies of the impacts of the Round executed at the WTO (then GATT).[7] His portrayal of gains in the region of $500 billion per year; and his emphasis on the lost opportunity if the Round were not concluded proved central

[7]Prior to this work the GATT was not known as an agency with particular expertise in the modelling area. There is little of a peer review process being used to evaluate these results, prior to Sutherland using them in 1993 to underscore his arguments in favour of concluding the Round.

factors in persuading then GATT contracting parties to successfully conclude the Round in 1994.[8] It was also widely believed at this time that model results showed gains from the Round for nearly all countries, including most developing countries.[9]

In assessing aggregate estimates of gain such as these, it helps first to clarify a few points. First, modelers measure gains in terms of welfare, or real income; not in terms of GDP. A number of elements of improved economic performance from trade liberalization are captured in such a measure, but not all relate to the production side of the economy. Consumer benefits accrue from lowered domestic prices as trade barriers fall. Improvements in resource allocation within economies occur as internationally distorting policies are removed. Improved access to a wider variety of products as trade increases is a factor in market structure models, as is increased specialization in production which occurs as trade expands and benefits of economies of scale are realized. All these elements show up as part of the global gains from Uruguay Round trade liberalization.

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[8]For instance, a later October 5th 1994 story in the Times "Sutherland confident WTO is on schedule" states "GATT's secretariat has calculated the impact of enhanced international competition and economies of scale associated with access to wider markets. They suggest global income in 2005 would be more than a further $500 billion higher than it would have been without the Uruguay Round".

A related story in the *Journal of Commerce* around the same time quotes Sutherland as saying that "the GATT is preparing to release.....updated figures on the worldwide economic benefits that will accrue as a result of the Round's completion. Previous studies had estimated a $200 billion annual boost to global economic output resulting from the deal.....Sutherland said that by products of the accord, including enhanced competition and the economies of scale enabling producers to spread fixed costs over larger export markets would produce far greater benefits than had previously been calculated.....(the) study showed the benefits to increase to more than $500 bill. in 2005".

[9]The impacts on African economies, and also on net food importing countries who believed they lost from a reduction in agricultural supports in food exporting countries, were subsequently to become a subject of further debate.

However, country gains need not, and typically will not, follow this pattern. As export subsidies are removed in various countries, importers elsewhere may suffer. As commodity prices rise, exporters of these commodities gain and importers lose. The global gain only reflects the aggregate effect and country gains and losses will criss cross country borders. It is also important to flag that these welfare gains are also not directly measurable. Available data show changes in production, consumption, trade, and other value based measures of economic activity. Welfare is not directly measured since it is not directly observable.[10] This is a major difficulty with any expost validation of model predictions of gain or loss.

Table 1 reports estimates of global gains produced by the model studies referred to above. Its striking feature is the sharp difference between the results of the early and later studies. Gains from the early studies are, in 2 cases, over $500 billion/year (the estimate repeatedly cited by Peter Sutherland). Later estimates are considerably lower and with some variation, being in the range of $40 billion - $258 billion. Table 1 also reports welfare gains as percentage of global income for the relevant year. The range is from 0.17% of global product on the low side to 1.36% on the high side. The early estimates (taking a 1.36% figure for the $510 billion estimate in *FMN1*) average to perhaps 1.2%; the later estimates to perhaps 0.5or 0.6%. The range in later estimates from 0.17% to 0.89% involves a factor of nearly 5.

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[10]The issue of the direct measurability of welfare is a longstanding issue in economic research, which has never been adequately resolved. Irving Fisher argued that welfare change was measurable if there was a commodity with constant marginal utility (he thought this was food). Edgeworth proposed directly applying measuring devices for utility to human subjects. But in the data available from Statistical Offices around the world on trade patterns, production and consumption, welfare remains not directly measured, and inferring welfare changes from revealed behaviour depends on the parameters of the model of behaviour used.

This is one area where results have received substantial comment from the modelers, placing their own results on aggregate effects in comparison with those of others. In aligning these estimates, as *FMN* (1996a) point out, one has to be careful in taking account both of different dollars (valuations in different year prices) and different time reference points (these vary between 1986 and 2005), and *FNM* indicate that their evaluation is that when "expressed as percentages of baseline (*status quo*) GDP, the numbers are surprisingly comparable" (p.8). This is not quite the conclusion suggested by the range in % terms in Table 1 varying by a factor of 5.

HRT (1996, p. 243) highlight the different growth factors involved in producing various results, and indicate that the *FMN1* $510 billion estimate with their extrapolation removed is $291 billion. They suggest the reduced $193 billion estimate of *FMN*2 (with increasing returns to scale) is comparable to the *HRT* increasing returns to scale estimate of $171 billion. *HRT* attribute the differences between their constant returns estimate ($93 billion) and *HMYD* ($258 billion) to the influence of a forward projection to 2005 in *HMYD* (which doubles the estimate), to lower MFA quota growth rates in *HMYD*,[11] and to the use of higher elasticities in *HMYD*.

[11]I am grateful to Will Martin for correcting an earlier draft on this point.

Table 1

Estimated Global Gains from the Uruguay Round Decisions

Early Studies	*Estimated Global Gain in $*	*Gains as % of GDP*
Francois, McDonald, Nordström (1993, 1994)	$510 billion/year based on 1990 prices and projected to 2005	0.31-1.36%
Goldin, Knudsen, and van der Mensbrugghe (1993)	$511 billion/year based on 1990 prices and projected to 2002	n.a.
Nguyen, Perroni, and Wigle (1993)	$212 billion/year based on 1986 data	1.1%
Later Studies		
Yang (1994)	$69 - $196 billion in 1992 (1992 prices)	0.3-0.63%
Francois, McDonald, Nordström (1995, 1996b)	$40 billion - $214 billion in 2005 (in 1992 prices)	0.17%-0.44%
Harrison, Rutherford, Tarr (1995, 1996, 1998)	$96 billion - $171 billion (1992 prices)	0.405%-0.712%
Goldin, Knudsen, and van der Mensbrugghe (1995)	$235 billion in 2002 (in 1992 prices)	n.a.
Hertel, Martin, Yangashima, and Dimaran (1996)	$258 billion in 2005 (in 1992 prices)	0.89%[12]
Brown, Deardorff, Fox, and Stern (1995)	services liberalization yields gains larger than for liberalization of goods (no specific global estimate reported)[13]	n.a.
Nguyen, Perroni, and Wigle (1995)	$69 billion/year based on 1986 data	

[12]As *FMN* (1996b) note, the reported 0.42% for this estimate in *HMYD* (1995) is in error, and is not reported in *HMYD* (1996).

[13]*BDFS* report no global estimate directly. On p.292 in their introduction, they report "the effects of liberalization in services trade are of the same order of magnitude as for liberalization in industrial products", but in their table 10.2 (p.301) which reports welfare effects by region (but not globally) most of the welfare effect seems accounted for by services rather than goods liberalization.

HRT conclude (p.243) that "...we do not regard.....differences between our estimates and the WTO and GTAP teams as significant. The broad themes....are quite similar across the models. In particular, all the models indicate that those countries that liberalized the most gained the most; and this was the European Union, the United States, and Japan".[14] Here again, there is the issue of whether a range of 5 for estimates as a % of gross world product is significant; but also a statement that seems to be at odds with some of the results presented for other models elsewhere in the same volume. *FMN* (1996a), for instance, show (Table 9.11, pp. 283-284) that for their increasing returns to scale cases the majority of gains accrue to non OECD (effectively developing countries), and in % terms these gains can be as large as 5% of income for economies such as China, while gains do not exceed 0.5% of GDP for OECD countries.

Most attention was placed on the estimates of aggregate global gain when these results appeared, since at political level this was the feature of results (and seemingly, the only feature) that figured prominently in debate. *HRT* (1995, 1996, 1998) devoted the most attention to reconciling the various model estimates to allow for different (or no) extrapolations, differences in model features, and other factors. They also offer reconciliations in other areas discussed below, such as agriculture and textiles, clearly a sensible way to proceed and these modelers deserve credit for setting out their reconciliations clearly.

The (to me convincing) argument offered by modellers as to why lower estimates of gain occur in the later studies is that the early studies based themselves on various conjectures as to what the Uruguay Round liberalization package would look like, and were generally too optimistic about

[14]See, in clear contrast, the results reported in the later Table 3 and the discussion around the table.

the extent of the actual liberalization which eventually resulted. This point is emphasized by Perroni (1998) in his survey of Uruguay Round model results. Particularly striking is the downward revision by a factor of 3 in the results between early and later versions of the Perroni, Nguyen, and Wigle studies. Perroni attributes all of the revision to reduced estimates of barrier change due to the Round. Francois (1999) makes a similar argument. As such, this argues that the use of early and larger estimates of gain by Peter Sutherland in his advocacy of potentially foregone gains should the Round not succeed was defensible, since the precise contours of the final package were still unknown at that point.

Detailed Impacts From The Round

It is, however, when the results from the models listed above are analyzed at a more detailed level in an attempt to see what can be learned for negotiating positions for developing countries in a new Round that difficulties arise. Simply put, there seem to be multiple and significant inconsistencies across model results. Somewhat surprisingly, these seem not to have been previously noted (including by modelers), nor discussed in published papers commenting on the various model pieces.

Table 2 reports estimates of the global welfare impacts of liberalization from the component parts of the Uruguay Round results analyzed in these models (agriculture, tariffs, and textiles and clothing) for a subset of the models listed in Table 1. There are striking differences between these model results. For instance, HRT show agriculture to be unambiguously the largest area of gain in their constant

Table 2

Estimated Global Gains From Components of Liberalization in the Uruguay Round Models displaying such results

		Agricultural Reform	*Industrial Tariffs*	*Textiles and Clothing (MFA)*
1. *FMD2* (1996)	CRS	9.34 ($bill, 1992 prices)	54.31 ($bill, 1992 prices)	35.71 ($bill, 1992 prices)
	IRS	7.08 ($bill, 1992 prices)	84.57 ($bill, 1992 prices)	107.68 ($bill, 1992 prices)
2. *HRT*(1996)	CRS	58.6 ($bill, 1992 prices)	21.7 ($bill, 1992 prices)	16.4 ($bill, 1992 prices)
	IRS - Steady State	63.7 ($bill, 1992 prices)	86.8 ($bill, 1992 prices)	20.3 ($bill, 1992 prices)
3. *HMYD* (1996)	CRS	207.6 ($bill, 1992 prices)		50.1 ($bill, 1992 prices)
4. *NPW* (1995)	CRS	36.9 ($bill, 1986 prices)	17.0 ($bill, 1986 prices)	10.1 ($bill, 1986 prices)

returns to scale case. It remains important, but less dominant, in their increasing returns to scale - steady state case. In contrast, *FMN2* show agriculture to be of minor importance in both sets of their results. *HRT* show textiles to be of relatively minor importance, while in their increasing returns case *FMN2* show it to be the dominant component. *HMYD* show tariffs (and seemingly predominantly industrial tariffs) to be the largest source of gain, a theme missing in *NPW*, who place most weight on agriculture.

Table 3 reports results on the regional composition of gains and loss, both by component of liberalization and in total; again showing large differences in results across models. Here, I have taken results only for those models showing this level of detail, and have chosen only one set of results for each model, even where multiple results are displayed. Two of these are for increasing

returns cases (*HRT*, *FMN2*) and two for constant returns cases (*HMYD* and *PNW*). In these results, *HRT* show gains from agricultural liberalization to the EU of $28.3 billion, while *FMN2* show gains of only $0.5 bill. *HRT* show gains to Japan in agriculture of $15.1 billion; *FMN2* show losses of 0.2 billion. Impacts on developing countries differ by sign and size; see the startling gains for Malaysia in the *HMYD* results, for instance.

Table 3

Model Estimates of Uruguay Round Gains by Component by Region ($bill)

	HRT (IRS)			***FMN2 (IRS, Fixed Capital)***			***HMYD (CRS)***			***PNW (CRS)***		
Developed World	***Ag***	***Tex***	***Total***	***Ag***	***Tex***	***Total***	***Ag***	***Tex***	***Total***	***Ag***	***Tex***	**Total**
US/Canada	2.1	10.9	14.6	-0.02	11.5	17.2	n.a.	29.4	32.2	4.6	0.3	10.8
EU	28.3	7.6	39.3	0.5	10.3	17.1	n.a.	27.5	58.4	12.7	3.5	19.0
Japan	15.1	-0.6	16.9	-0.2	2.0	5.7	n.a.	1.1	43.0	14.5	1.8	19.0
Developing World												
Asia												
China	-0.5	1.0	1.3	0.3	9.4	12.4	n.a.	5.3	19.9			
Malaysia	1.2	0.1	1.8				n.a.	-0.6	34.2			
Thailand	0.8	0.1	2.5	0.4	15.2	19.7	n.a.	1.5	10.4	-0.6	1.1	0.1
Indonesia	0.2	0.6	1.3				n.a.	3.0	11.1			
Africa	-0.2	0.0	-0.3	1.3	0.4	6.2	n.a.	-0.7	-1.3			
L.America	2.2	-0.1	3.6	1.0	0.07	3.9	n.a.	-3.7	-1.3			

HRT show results which indicate that, under most model specifications developing countries lose from the elimination of the MFA[15], a result they suggest is generated by the loss in transferred quota rents to the exporting countries. In contrast, *FMN2* (1996a) (in Tables 9.10, 9.11 and associated model results) show large and (except for non China transition economies) unambiguous gains for all developing countries from MFA elimination. Indeed, the gains to China, Asia, and South Asia are approximately 2% of GDP from this one source; they also show gains to Africa and Latin America from MFA elimination. Beyond blockwide results, results by country have even wider variance attached to them. Table 3 highlights some of these; differences of a factor of 20 in certain country results (Malaysia between *HRT* and *HMYD*), and differences in sign for Africa (*FMN2* versus *HRT* and *HMYD*).

Results in Table 4 relate to the claim that the majority of the global gains from Uruguay Round liberalization accrue to developed rather than developing countries, a feature that has been claimed for these model results.[16] Perroni (1998) in his survey of model results concludes, for instance, that "the fraction of total gains accruing to developing countries is relatively small". *HRT*, as noted earlier, make the same claim as common to their results, those of *FMN*, and *HMYD*.

Results in Table 4 suggest that these claims are only partly borne out by model results. The theme is strongly there in *PNW* and *HRT*; less strongly there in *GM*, and missing or reversed in

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[15]See Tables 8.4 and 8.6 in *HRT* (1996).

[16]The intuition behind such a belief is that the majority of the gains emerging from these models occur from the liberalization of agriculture and textiles, and these are areas with (pre Uruguay Round) high barriers in the industrial countries. The argument is that most of the gains from liberalization in these areas would likely accrue on the demand side, as demand elasticities are lower than model supply elasticities because there are typically many alternative sources of supply for these restricted products, and from economies in which factors are mobile across all production sectors.

HMYD and *FMN2*. Indeed, in *FMN2*, as results proceed across model variants with higher aggregate global gains (endogenous capital stock - fixed savings rate; endogenous capital stock - endogenous savings rate) the proportion of gains accruing to the developing countries increases further.

Table 4

Developed and Developing Country Breakdown of Gains From The Uruguay Round Decisions in Model Results

($bill, 1992 prices except where indicated)

Model	Developed Country Gains	Developing Country Gains	Global Gains
FMN2 (IRS, fixed cap. stock case)	40.1	59.3	99.4
HMYD	131.6	126.1	257.7
PNW (1986 prices)	50.6	19.3	69.9
HRT (IRS, non steady state)	76.6	19.4	96.0
GM	178.6	56.5	235.1

Turning to other areas, only two of the models, *BDFS* and *PNW*, attempt quantification of liberalization in services. Both flag that their efforts are inevitably somewhat rudimentary, since there is neither reliable information available for the representation of barriers to service trade, nor analytical frameworks which fully capture the characteristics of individual service items (such as banking, transportation and other policy forms of intermediation through time and space). In addition, data on service trade flows is notoriously poor.

BDKS assign tariff equivalents to service trade flows using Hoekman's (1995) guesstimates of service trade restrictiveness. Hoekman classifies each of 155 service sectors and 4 modes of supply for 97 countries using a subjective 3 way no restriction, some restriction, unbound

classification. *BDKS* assign tariff equivalents as prohibitive (200%) for a range of sectors (maritime and air transport, life insurance, some telecommunications), and use *ad valorem* equivalents of 20-50% for other sectors. These are then multiplied by a restrictiveness index based on Hoekman's assignments. *PNW* somewhat arbitrarily assign tariff equivalents to service flows treated as a single category.

Table 5 reports the resulting model estimates of gains from services trade liberalization. *PNW*'s results suggest that services liberalization will produce gains which are small compared to total gains; while *BDFS* suggest that services account for the dominant portion of total gains from the liberalization they consider. Both groups of modelers are, however, careful to emphasize that their results relate to potential gains from liberalization in services not actual gains. They both emphasize that the liberalization actually achieved in this sector in the Round was substantially more limited that they model, but provide no guidance as to how to quantify actual as against potential liberalization.

Table 5

Estimates of the Gains from Services Liberalization related to and beyond the Uruguay Round

***BDFS* (1996)**	**Gains as % of Income from**	
	Services Liberalization	**Services Liberalization and Industrial Products**
US	0.7	0.9
Europe	0.6	0.9
Japan	0.8	1.4
Asian Newly Industrialized	1.1	3.6
Others	1.0	1.0
***PNW* (1995)**	**Gain in 1986 Prices, $bill**	
	Services Liberalization	**Services Liberalization, Agriculture, Textiles & Tariffs**
US	0.5	9.6
Europe	1.5	19.0
Japan	0.2	17.8
Rest of the World	0.1	2.7
World	5.9	69.9

The modellers all emphasize that their results only provide a partial picture of the implications of the Uruguay Round decisions. This is so for a number of reasons, including the limited coverage of the various elements that make up the Uruguay Round decisions, as well as the benchmark used for the evaluation of the agreement. This is typically the *status quo* rather than a threat point, such as that characterizing a further weakening of the trading system had the Uruguay Round not concluded.

On the coverage front, the major omissions are in the new issues areas of intellectual property, and investment. Economywide models of impact of these factors are not well developed, and data is a major problem. In intellectual property, it is widely thought that potential losses to developing countries will occur as they raise levels of protection and transfer resources to intellectual property developers[17]; and in trade related investment measures new disciplines on domestic trade related policy measures are thought to limit developing country policy flexibility, although if this limits country abilities to impose trade restricting measures, some economists suggest this may yield country gains.

[17]But see the recent paper by Watal (1999) which attempts to quantify the welfare impactions for India of new disciplines under TRIPs.

3. WHY DO THE DIFFERENCES IN RESULTS OCCUR?

The differences in model results at a detailed level noted above occur for a number of reasons, although unearthing the single or dominant reason can be difficult, especially for non-modellers. First, there are differences in data, although for the key models in the set referred to above, the extensive use of GTAP data would seem to minimize this source of discrepancy. Second come differences in key parameter values, and especially elasticity parameters. Third come differences in estimates of trade distortions, already highlighted above as a source of major difference between earlier and later studies of the impact of the Round. Finally come differences in the theoretical structures used. One way to attempt a reconciliation of results would be for each modeller/model to try to replicate the results of all other models by gradual replacement of others data, parameters, distortion estimates, and structure, but the resource requirements of such an effort across different software, code, and computer systems make this difficult.

The modelling group who have gone the farthest in attempting to reconcile various model results are *HRT* (1998) who deserve substantial credit for their efforts. Table 6 reports on their suggested reconciliations. However, while these are helpful and welcome efforts at reconciliation, they are unfortunately still not comprehensive enough for the differences highlighted above to be resolved in ways which would allow negotiators to use model results for the formulation of negotiating positions.

Thus, for example, in agriculture *HRT* provide a helpful reconciliation of their results with those of *GM* and others using the OECD RUNS model structure. The issue they focus on is why *GM*

obtain somewhat larger impacts from agricultural reform than they do. In agriculture, seemingly the bigger issue is why *FMN* obtain such small numbers for agriculture.[18]

Table 6

Reconciliations among model results offered by *HRT* (1998)

1. Overall evaluations of impact

Difference between *HRT* (1995, 1996, 1998) and *FMN* (1996a) in terms of dollar size of the gain reflects the projection forward to 2005 in *FMR* (not made in *HRT*). As a % of GWP, *HRT* claim their results and *FMR's* are comparable. The differences between *HRT* and *HYMD* are attributed again to projection forward to 2005. They (*HRT*) rerun their model with factor endowments in the model scaled in the same proportions as *HMYD*, and obtain a slightly lower estimate than *HYMD*, which they attribute to elasticity differences.

2. MFA reform

Claimed difference between *HRT* (1995, 1996, 1998), who show about 17% of the gains coming from the UR, and *FMN* (1996a), who show about 50% of the gain coming from the UR, is that *HRT* employ updated estimates of the tariff-equivalents of MFA quotas from the GTAP data base, while *FMN* do not.[19] *HRT* claim their estimates of gain are roughly comparable to those of *HYMD*, who estimate about 20% of the gain from this source.

3. Agriculture

HRT (1995, 1996, 1998) compare their model to *GM* (1995, 1996) and other models using the so-called "RUNS" structure (models largely used at OECD). These models show somewhat larger gains from agricultural reform (some nearly 90% of total gains) than *HRT* (some 63% of total gains). Introducing the RUNS structure into the *HRT* model format increases the gains to 87% of the total gain.

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[18]In private communication, Joseph Francois has suggested that the source of the difference lies in *FMN* excluding agricultural tariff cuts from the modelled liberalization package on the grounds that dirty tariffication in agriculture implied little liberalization from this source.

[19]In private communication, Joseph Francois has indicated that in his view the major differences between *FMN* and *HRT* in this area lay in the modelling of imperfect competition, rather than the explanation offered by *HRT*.

In textiles and MFA reform, the difficulty with the *HRT* explanation is that while *HRT* and *FMN* do use different estimates of tariff equivalents of MFA quotas (Table 3, p. 1413, *HRT* (1998); Table 9.4, *FMN* (1996a), p. 263) from the published tabes *FMN* have significantly lower (rather than higher) tariff equivalents for quotas. From the size of the price distortion, one would expect significantly larger not smaller impacts in *HRT* from MFA quota removal. And *FMN* (1996a, p. 284) are both clear and explicit in indicating that they capture the removal of quota rents with MFA elimination that *HRT* use to explain their result. The losses from MFA removal are even more pronounced in *HYMD* who show Asia, Latin America, and sub Saharan Africa all losing from MFA removal (*HYMD* (1996) Table 7.9), in part because *HYMD* both point out and model MFA quotas as growing in severity as they become more binding before being phased out in 2004. [20]

The *HRT* discussion of differences in total gains focuses on the role of extrapolations to 2005, as against the use of a 1992 base year calculation. As noted earlier, this seems convincing, but other model results without extrapolation, such as *PNW*, remain as having lower estimates.

Thus from the list of differences in model results from a developing country point of view, the key ones noted above remain, although the issues at stake are narrowed by the *HRT* reconciliations. Developing countries gain a large or small amount from the Round as the gains from textiles and apparel liberalization are large or small (MFA), and agricultural liberalization yields large or small effects. Individual country or region gains or losses reflect the same factors. The ranking of issues across models reflect similar considerations. The issue of the size of gains from services is not touched on by these reconciliations.

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[20]See *HYMD*, p. 195 and following.

At this point, the conclusion would seem to be that the *HRT* reconciliations are inconclusive in both agriculture (*FMN* results not discussed), and textiles and apparel (explanation not fully convincing). On the other hand, one is tempted to argue that the weight of other modelling results seem to side more heavily with *HRT* on these two central issues of agriculture and textiles and apparel than they do with *FMN*. As such, a working null hypothesis might be that the position that developing countries gain a large amount from MFA removal, and that MFA removal yields considerably larger aggregate gains then agricultural liberalization seems a minority modelling position.

In the elasticity area their role in contributing to model result differences is also unclear. *HRT* set out their elasticities, assuming all demand elasticities for goods aggregated across country sources of supply are one; substitution elasticities between imports are everywhere and for all products 8, and between domestic and imported goods everywhere and for products 4. In their scale economy variant; elasticities of substitution in preferences between varieties are 15. The rationale offered for using these estimates is "a priori beliefs about the plausible values of these elasticities" (p.218). Elasticity values are not discussed in *FMN2* (1996b), and in (1995) are given in a table in an Appendix with "Armington" "substitution in value added" and "inverse scale" as the column headers and various hard to read computer generated row headers with the reader left to infer that these are presumably the same for all countries. Armington elasticity values vary from 1.9 to 5.2 with literature sources only given for value added and scale elasticity values. *HMYD* (1996) seemingly provide no discussion of elasticities in their text (nor eve of model structure); *HMYD* (1995) has a reference to an Appendix to the paper containing details on model parameters which was not published, and a reference (p.82) to "elasticities of substitution twice as high as standard

GTAP elasticities were.....used in the projections and tariff liberalizations", but with neither the standard GTAP elasticities or the values used reported.[21]

Beyond the clarity of presentation of elasticity parameters in the model papers, the equally central issue is what is their role in accounting for differences between model results. *HRT* (1996) report on systematic sensitivity analyses of their model results, which for space reasons, is somewhat compact (*HRT* (1995) gives a fuller discussion). Their conclusion is that "...to the extent that our major conclusions are robust to perturbations (of plausible bounds on elasticities) we do not believe that our uncertainty about specific values of these elasticities is a major weakness of the model".

In contrast, Bach, Dimaranan, Hertel and Martin (forthcoming) in a piece building on *HYMD* (1996) present results which they interpret as showing that the size of trade elasticities is the main source of difference between their Uruguay Round results and those of others. Their sense is that trade elasticities should be larger than (perhaps double) those used in the earlier work, and this modification will significantly increase estimates of gains.

FMN (1996a) offer no discussion of sensitivity analysis, but in their 1995 paper do report cases where Armington trade parameters (effectively trade elasticities) are varied by plus and minus 25%, and scale parameters (in their scale economy variant) also vary by plus and minus 25%. For the former, (Table 18, Appendix) they show substantial variation in welfare affects across developing countries (with some changes of sign), but small to little variation across developed countries. The reasons for this could lie in the differential size of impacts by region in their base case. For the latter

[21]These elasticities and discussion of their values has since been given in a CUP volume. I am grateful to Will Martin and Tom Hertel for bringing this to my attention.

they show larger gains with seemingly smaller scale economy effects, which at first sight seems counterintuitive.

It is also worth flagging that there are other issues of results sensitivity, beyond elasticities. One is the choice of reference point. All the model results take as their point of reference the *status quo* that prevailed before the Uruguay Round in evaluating gains and losses, either in aggregate or for particular regions or countries. The issue from the point of view of quantifying gains and losses from the Uruguay Round is that this ignores one of the major factors driving developing country participation in the Round, namely the desire to strengthen the trading system. If the developing country concern in the 1980's was a spreading erosion in the basic principles of the trading system, such as MFN, and the need to strengthen the application of these rules, results from models referred to above based on the *status quo* may only shed limited light on the value of the Uruguay Round decisions to them. Crucial also here is the value of strengthened dispute settlement procedures to the smaller countries.

A recent modelling piece by Ghosh, Perroni, and Whalley (1998) highlights the value to smaller developing countries of preserving non-discrimination in trade rules. They use a 7 region global model benchmarked to 1986 data, and show that the gains from preserving non discrimination substantially outweigh the gains from incremental trade liberalization such as occurred in the Uruguay Round, and modelled in the pieces discussed above. While the probability of these two events (liberalization, and reversion to complete trade discrimination) are not equal, the possibility that the value of system strengthening not covered by the available models might outweigh that of conventional *status quo* evaluated liberalization (as in the Uruguay Round) seems worth further consideration.

In conclusion, the implications for the developing countries from all the model results would thus seem to be that while there were probably global gains from the liberalization achieved in the Uruguay Round, their precise dimensions are somewhat hazy, and the country (or region) and area composition of these gains is equally cloudy. Whether particular components, such as textiles or agriculture were more important to them is unclear. Why particular models produce results which are higher or lower than others is also still not clear, and modellers sometimes have competing theories to explain differences in results. How far negotiators should either accept or act on any one set of model results is also not clear

4. EXPOST VALIDATION OF MODEL RESULTS

In thinking through the differences in Uruguay Round model results highlighted in the previous section, a natural question to ask is whether it is possible to use expost validation of these model results as a way of distinguishing between them. The argument is that the Round concluded in 1994, and data on how the global economy has performed since then is now available and should surely be able to be utilized to evaluate whether the predictions of impacts made by the models have turned out to be correct.

While seemingly a natural approach to take to model validation, my view is that expost validation is virtually unimplementable in the case of the Uruguay Round models, and that this is so for a variety of reasons. In my opinion, these results, as for other general equilibrium and simulation model predictions, are inherently untestable.[22] The first reason for this is that the liberalization seemingly assumed in the model experiments discussed here (see Francois (1999)), and largely based on the final Uruguay Round text, remains still not fully implemented some five years later. Liberalization in textiles and agriculture has yet to arrive in any substantive way, and available trade data certainly do not reflect the impacts of the full liberalization agreed to in the Round. The liberalization experiments in the models and the liberalization generating the data are different.

The second is that, even were the announced liberalization now complete, many other things have happened in the world economy since 1994, and these as well as the decisions of the Uruguay Round affect the data generated since. These effects include real growth at different rates by country (and underlying productivity growth), changes in transportation costs between economies, shifts in

[22]See an earlier version of this same argument I made in Whalley (1986); but see the counter argument presented in Kehoe et al (1995) which uses a model of Spain to analyze VAT changes and argues that model predictions conform with real world behaviour.

preferences for goods both within and across countries, changes in market structure, changes in commodity prices (including oil), and many other factors. Despite the efforts made in 1994 to convince (the then GATT) contracting parties of the benefits of concluding the Uruguay Round, the likelihood is that all these other factors have had more influence on trade patterns and global economic performance since than the decisions of the Round themselves.

A third reason is that the key results from the models, namely estimates of gain and loss both globally and by country (or region) refer to variables which are inherently unmeasurable. Economic welfare is a concept that relates to levels of consumer satisfaction (or happiness) from the consumption of bundles of commodities. Changes in economic welfare attributed to the Uruguay Round decisions relate to measures of utility, converted into what economists label a money metric measure of the welfare change. This refers to the monetary equivalent of the change in consumer satisfaction due to the increased trade and consumption stemming from the decisions agreed to in the Round. Available data measures the value of trade, production, consumption, and employment by commodity or sector. Such data are available by region, and on a pre and post Round basis. These data, however, yield no direct measure of the monetary equivalent of a welfare change. To do this functional forms for preferences must be assumed, parameter values determined in some way (by calibration or estimation). Even given observed data, money measures of welfare changes remain parameter sensitive (to elasticities, for instance).

Separating out the influences of the decisions of the Round on available data from these other factors is thus no easy matter. What is needed is decompositional analysis of a total change that has occurred, into constituent parts. This contrasts with the model work on the Uruguay Round, which is inherently counterfactual in nature; i.e. analysis of the future potential impacts of a change which

is yet to occur. The modelling literature is only recently turning itself to the development of procedures for decompositional analysis (see Abrego and Whalley (1999)), and these techniques were not available at the time these exercises were undertaken. Such analyses are also complicated by many factors, including the non additive nature of the components to be analyzed; and the sensitivity of decompositions to key model parameters, such as elasticities. Put another way, if told that exante models predicted welfare gains globally of $500 billion from the Uruguay Round, and if asked where these gains are in the data, the honest response is to say that welfare is not directly measured and such a predicted gain cannot be either verified or disproven by data.

Despite these difficulties, I have taken projected changes in world trade from model results in Table 7 and compared these to actual trade changes. Somewhat surprisingly, only three of the models appear to report projected impacts on world trade, and among the three there is again substantial variance in model estimates. *HMYD* report the largest estimate of nearly 60%; the lowest estimate in *FMD2* is around 6%. None of the estimates have any time frame attached to them; the period of adjustment to the new trade regime is unspecified, as is the period over which trade growth is to occur. This makes any comparison between predicted and actual trade changes difficult if not impossible.

Table 7 indicates an actual change in world trade between 1994 and 1997 in volume terms of 20%. This figure, however, needs to be qualified by the observations that with a 10 year phase in for major decisions from the Round, actual growth will be considerably larger; and that little substantive liberalization occurred in key areas covered by the Round between 1994 and 1997

Table 7

Comparison of Model Projections of Changes in

World Trade Volumes and Actual Changes

Model Projected Changes in World Trade Volumes Due to the Uruguay Round	Actual Changes in World Trade Volumes 1994-1997
NPW (1993) 20.2%	
FMN2 (1995) 5.7-14.5%	20%[20]
HMYD (1995) 58.8%	
GM (1996) n.a.	
HRT (1996) n.a.	

(textiles, for instance), and so the elements of decisions driving actual trade growth for this period remain largely non implemented.

In closing this section, I should perhaps highlight again that for non modelers seeking to use these model results to inform their future WTO negotiating positions what I set out here must seem a perplexing state of affairs; seemingly non verifiable results with sharp differences across them, and with degrees of inconsistency that seemingly grow with higher levels of disaggregation. The comment I would offer is that judging model results against an absolute standard of performance and consistency generates an unattainable, unrealistic, and perhaps ultimately unhelpful standard. If model results could be reconciled, and users had more confidence in the logic driving individual results, then their fresh insights on previously unexplored issues would provide food for thought. Relative to the next best alternative of pure conjecture they are an improvement. The key is to understand their behaviour, and hence the importance of a comprehensive model comparisons exercise to move clearly localize the sources of result differences.

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[20] *WTO Annual Report 1998*, International Trade Statistics, Table 11.1, p.11.

The other issue that also needs to be faced is that in the policy process model results are often not used in the same way as in the research community. Because the roles played by model structure, parameters and other factors are less well understood, and because the modelling process may seem non-transparent, numerical results can either be seized on as ammunition supporting a prior position or castigated as worthless, frequently with little concrete underpinning the allegation. The balanced position in my view is that if results are used as a selective guide to intuition and the source of null hypotheses to challenge models are simultaneously unreliable, inconsistent, and highly informative. In the present case, the inconsistencies across model results, in my view, unfortunately compromise both their receptivity and the process of sensibly using their results; and differences in model results are in need of resolution.

5. MODELLING AND THE MILLENNIUM ROUND

Given this evaluation of the model results from the Uruguay Round, what should be the approach adopted towards any modelling work used in a future WTO Round? Should existing models be rejected on the grounds their results are unreliable, or is there some other way forward? From my remarks at the end of the previous section, it should be clear that my own position is that model analyses for a future Round should definitely not be rejected; but at the same time we need to improve upon what we now have.

At the end of the Round, with little understanding of how numbers were generated a large estimate of global gains was used to persuade contracting parties to conclude the Round. Many of the participants in the negotiations lacked an appreciation of what these gains were, or how these estimates had been arrived at. Modelers, the WTO Secretariat, the World Bank and other agencies in which the studies had been conducted made significant efforts to help with understanding; but the gap was large and expectations were built up as to what the eventual impacts might be. Five years on, the question posed (and to some delegations quite naturally so) is where are the $500 billion of gains; and for individual countries what has happened to their share? This sense of unfulfilled promise fuelled by expectations stemming, in part, from model results was one factor behind the cautious approach to a new Round by the developing countries in Seattle.

For a new Round, in my view, the first step towards constructive use of modelling work is a clear acknowledgment on all sides of the communication difficulties of the past. Receivers of model results need to be much more aware of how results are generated, what the key assumptions are, what the key parameters are, and what the margins of error are. Producers of model results need to be able to better communicate, and, especially, to mutually reconcile both their results and their

model structures and parameter values used. This ideally should not be left as a task for researchers such as myself, not directly involved in the immediate modelling work, who some five years on find myself going through tables in published papers which sometimes report only part of results, not always on consistent bases, and with at times incomplete parameter descriptions. An explicit model comparisons exercise in which models and results were achieved and differences across models explored would help greatly. It would also help to build up wider trust in the worth of the modelling exercises.

Reconciliation of model results needs to be an ongoing task, with such a model comparisons forum convened at the start of any new Round. Weaknesses in both data and key parameter estimates need to be centrally acknowledged, and improvements sought. The ways in which different model structures can influence results needs to be systematically studied. Modelers also need to accept that at the end of the day their numbers, even if, at times, inevitably produced using assumptions and approximations, carry substantial potential weight in the policy process and they need to explain, communicate, and reconcile.

Let me also add that at the time of writing, a new Round if it ever emerges is yet to be concretely defined, but is beginning to emerge as a more narrowly targeted Round than the Uruguay Round; focussed on agriculture, services, and industrial tariffs; and with a much shorter time frame (3 years). If this is the case the time for developing new models may be short. In already evaluating these areas the Uruguay Round models already contain the right ingredients. Agriculture and industrial tariffs are already fully modelled (even if results are not consistent), and attempts have been made to model services. Better data on services, and work on alternative analytic structures

for services may be needed, but the dovetailing between current model coverage and issues for the Millennium Round could hardly be better.

What is needed, as I have emphasized above, is to reconcile existing model results, agree the weaknesses in key parameter estimates, data, and model structures, and use the resulting reconciled structures to better inform the policy process, and through this the developing countries as to their negotiating positions in the Millennium Round.

6. CONCLUSIONS

This paper discusses model based evaluations of the impact of the Uruguay Round undertaken both in the later stages of the Round, and in the Round's immediate aftermath. It focuses on the oft cited estimates of global gains of $500 billion annually, and associated impacts by country, region, and for individual components of the Uruguay Round package. It asks how reliable these estimates are, and what the implications are both for the developing countries and for a new Round.

The picture that emerges is one of inconsistency across model results, even where seemingly similar base data is used. These inconsistencies seem to be a problem that intensifies as more disaggregated results are examined. The early estimates of global gains of $500 billion fall substantially in later models; estimates of gain and loss by region vary substantially; the estimates of the relative importance of various components of the Uruguay Round package (tariffs, agriculture, textiles) also vary substantially.

This may seem a perplexing state of affairs to non-modelers, but with uncertain values for key parameters, differences in model structure, variations in the way experiments are set up, and other factors, such differences inevitably arise. An absolute standard of performance clearly casts doubt on these model results taken as combined set; a standard of the next best alternative is more sympathetic. Explicit model comparisons and reconciliations of results are what is needed to better understand them, and build confidence in their future use.

For a new Round, I suggest that despite these discrepancies in results the Uruguay Round models could not be better suited to the task if, as expected, it is a time limited Round and one focussed on agriculture, tariffs, and services. Two of these areas provide the core of the existing

Uruguay Round models, and a start has been made on services. Where work is needed in better reconciling the results from existing models, and in sorting out why results seem to differ so much.

Developing countries have clear interests in agriculture in a new Round, and the size of potential gains and the segments to focus on can be informed by these models. Developing countries have the higher tariffs, and the adjustment and other implications of a further multilateral reduction can be usefully analyzed. Services is an area where many remain confused exactly what is in their national interest, and models can help here. The key is communication, transparency, better understanding, and ultimately improved confidence in their usefulness. The step needed is a more comprehensive model comparisons exercise than undertaken thus far.

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