Environmental Reviews of Trade Agreements:

Assessing the North American Experience

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Summary

Beginning in the late 1990s, Canada and the United States began requiring "Environmental Reviews (ERs)" of all trade agreements to be negotiated by each government. The purpose of these reviews is to help identify potential environmental effects of trade agreements, both positive and negative, in order to facilitate responses to such effects throughout the negotiation and implementation processes. This paper outlines how ERs have evolved in North America, and evaluates the different methodological approaches that have been employed in ERs thus far.

We show that the ERs conducted to date have an encouraging number of strengths that can be built upon. In both countries, ERs are becoming increasingly sophisticated in their analyses. Compared to earlier efforts, they have begun to apply rigorous quantitative and qualitative techniques in the attempt to identify the potential environmental impacts of a trade agreement. In addition, ERs have brought unprecedented levels of public participation into the trade policy-making process.

This paper also establishes that the art of conducting ERs reviews is still in its infancy. We identify four limitations with the methodological approaches that have been employed in the most recent ERs.

1. Environmental Reviews for trade agreements that will involve relatively small amounts of economic activity pay too little attention to analyzing the agreement's potential marginal environmental costs.
2. Environmental Reviews for trade agreements that are predicted to have "economy-wide effects" base the core of their environmental assessments on estimates derived from controversial economic modeling techniques.
3. Environmental assessments that are based on estimates from economic modeling are only as good as the economic models themselves.
4. Many environmental issues do not lend themselves to quantitative analysis, and are therefore largely ignored in the ER process.

Based on an analysis of these limitations, we propose four ways to improve how ERs are conducted in the future:

1. Broaden the scope of Environmental Reviews
The scope of ERs should be broadened to address two of the limitations discussed in this paper: the problem of the "moving target," and the exclusive focus on domestic impacts.

2. Expand the set of methodologies used to estimate economic impacts.
Comprehensive ERs should draw from a variety of methods to estimate the economic impacts of proposed trade agreements. For trade agreements that have potentially substantial economy-wide effects, rather than relying solely on intricate CGE models to form the "core" of their analyses, ERs should make use of simpler, more transparent partial equilibrium, input-output analyses, and similar techniques to estimate the primary and secondary effects of a proposed agreement.

3. Increase the number of environmental variables that are assessed.
Environmental Reviews should expand the categories of environmental problems that they seek to examine. Where ex-ante estimates of potential environmental effects are impossible to consider, ex-post analyses, both quantitative and qualitative, should be employed to fill in these gaps.

4. Enhance existing levels of inter-governmental and public participation.
There should be a built-in response mechanism whereby final drafts of ERs discuss the extent to which earlier public commentary has been incorporated into the final draft.

Environmental Reviews of Trade Agreements:

Assessing the North American Experience[1]

I. Introduction

We have entered a new era of trade policy-making in North America. Whether in the form of a new round of global trade negotiations, the proposed Free Trade Area of the Americas (FTAA), or the numerous ongoing bilateral talks with individual countries around the world, all three North American countries are involved in multilateral, regional, and bilateral trade negotiations. A newcomer at the table is the emergence of concern regarding trade policy's social and environmental ramifications. In response to that concern, North American governments have begun to formally require their ministries to conduct "Environmental Reviews" or "Environmental Assessments" (ERs) of proposed trade agreements.

This paper will outline how the process of ERs have evolved in North America, and evaluate the different methodological approaches that have been employed in ERs thus far. The paper is organized into four parts. After this short introduction, the second section provides an overview of the origins and current form of ERs in North America. In the third part, we analyze the strengths and weakness of current ER approaches. Based on that analysis, the concluding section offers recommendations for improvement in future ERs.

II. Environmental Reviews in North America

Environmental reviews of proposed trade agreements have a ten-year history in North America. What started out as somewhat ad-hoc responses to public pressure have since developed into systematic mandates from the highest levels of authority. While the United States and Canada have conducted a number of ERs, at this writing, the government of Mexico is not engaged in the ER process. This section traces the origin of ERs in North America and outlines the evolution and current state of ER methodologies.

The Process of Environmental Reviews

In response to pressure from non-governmental organizations (NGOs), the US and Canadian governments conducted their first environmental reviews in the early 1990s (Montgomery, 2000; Beale, 2000). These first reviews were of the (then proposed) North American Free Trade Agreement (NAFTA), and the Uruguay Round.

In 1999, leading up to the Third Ministerial Meeting of the World Trade Organization (WTO) held in Seattle, Washington, high-level officials from the US and

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Canada issued decrees mandating that ERs become a regularly mandated component of trade policy-making in each country. In the United States, this took the form of Executive Order number 13141, issued by President Clinton. Canada issued the 1999 *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. These mandates commit each government to conduct ERs of trade agreements and provide policy-makers with the general guidelines from which to proceed.

Table 1. The Inter-Agency Process for Environmental Reviews of Trade Agreements in the USA and Canada

	USA	CANADA
Directive Legal Mandate	Executive Order 13141 Nov 16, 1999 – Clinton	Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals, 1999
Lead Agency	United States Trade Representative (USTR) Council on Environmental Quality (CEQ)	Department of Foreign Affairs and International Trade (DFAIT)
Advisory Committee	Trade and Environmental Policy Advisory Committee (TEPAC)	Sector Advisory Groups (SAGITS)
Interagency Process	Trade Policy Staff Committee (TPSC) Environmental Protection Agency Department of Energy Department of Agriculture Department of Labor	Environmental Assessment Committee for Trade Negotiations Interdepartmental Steering Committee chaired by DFAIT includes representatives from: Environment Canada Environmental Assessment Agency Industry Canada
Public Input Process	1. Federal Register Notices of intent to conduct ER and request for comments on the scope of ER (45 day public comment period) 2. Notice of availability of the draft ER document and request for comments 3. Notice of availability of the final environmental review document 4. Final draft made public.	1. Canada Gazette Notices (45 day public comment period) requesting for comments on the scope of ER (coinciding with electronic, face to face consultations, and regional multi-stakeholder meetings) 2. Notice of availability of draft ER and request for public comment. 3.Notice of availability of final document 4.Final draft made available to public. Final document summarizes previous comments and how they were responded to.

Source: USTR, 2000; DFAIT, 2001.

In many ways ERs in the two countries are conducted in a similar manner. Each country puts together an inter-agency group to conduct an ER, holds a public comment

period to consider the scope that an ER should take, develops a methodology, conducts the review, and releases it to the public. Table 1 compares the ER process in the US and Canada. Both countries have high-level mandates, are led by ministries of trade but involve other relevant agencies, and have elements of public participation. The key differences involve levels of participation. Regarding governmental participation, on the US side, the United States Trade Representative (USTR), in addition to the Council on Environmental Quality (CEQ) "oversee" the ER process. For Canada, the Department of Foreign Affairs and International Trade (DFAIT) is the sole leader. Both nations involve the public in the ER process. Each country calls for public commentary on the scope of the ER and commentary on a first draft.

Both the United States and Canada conducted reviews for the North American Free Trade Agreement, and the Uruguay Round of world trade negotiations. While these early efforts were pioneering in their own right, recent attempts at analyzing the potential impacts of a trade agreement have become much more sophisticated. In Canada, ERs that have more recently been conducted, or that are scheduled for completion in the near future, are reviews for the Canada-Chile FTA, Canada-Singapore FTA, Canada-Central America FTA, Canada-Costa Rica FTA, the Free Area of the Americas (FTAA), and the new round of global trade negotiations agreed to in Doha, Qatar. For the US, recent and forthcoming reviews are for the US-Jordan FTA, the US-Chile FTA, the FTAA, and the built-in agenda on agriculture and services at the WTO.

Methodologies for Environmental Reviews

ERs are *ex ante* evaluations, occurring before the proposed changes have occurred. Thus they are inherently different in methodology from *ex post* analyses. After the fact, it is possible to ask, “What did happen when a trade agreement was adopted?” That is, actual historical data can be used in *ex post* analyses. However, ERs clearly cannot use historical data on the results of future trade agreements. In place of historical data, what is needed is the best possible projection of what might happen in the future. For this reason, the intricacies of economic modeling techniques necessarily play a large role in our discussion of ERs.

The methodologies employed to conduct ERs in the two countries are coming to look increasingly similar. There are typically four stages of an ER:

- "scoping" of the relevant categories of environmental outcomes that should be included in the ER;
- assessment of the potential economic impacts of the proposed trade agreement;
- evaluation of the subsequent potential environmental ramifications of those economic changes; and
- (in the US) an analysis of the potential effects on the US regulatory system that may be triggered by the FTA.

Scoping

Most environmental reviews begin by “scoping out” the main environmental issues likely to arise as a result of the proposed negotiations (DFAIT, 2001). The scoping process usually includes three principal components:

(i) evaluation of the likely outcome of trade negotiations;
(ii) identification of potential resulting environmental impacts; and
(iii) selection and prioritization of identified environmental impacts for review.

Therefore, the first step of the scoping process involves determining what the probable outcome of the trade negotiation may be. Such an estimate serves as the core of projections for future economic and environmental assessment. The second step focuses on soliciting interagency and public input to determine the types of economic and environmental impacts (both positive and negative) that could result from the proposed trade agreement. Some of these impacts are more serious than others, and budget, data, and time constraints usually prohibit analysis of every impact; thus it is not normally possible to analyze all the issues identified in the ER. The final step of scoping then selects and prioritizes the significant issues that should be analyzed to determine the environmental consequences of the trade agreement. (USTR, 2000; DFAIT, 2001).

Assessing the economic effects

The level of methodological sophistication that is involved in predicting the potential economic effects of a trade agreement depends on the scale of economic activity between the proposed trading partners. For smaller bilateral (and some regional) agreements such as the Canada-Chile FTA or the US-Jordan agreement, fairly simple economic techniques are often sufficient. Larger agreements that have potential economy-wide effects, such as the proposed FTAA and the new round of world trade talks, are more likely to involve more complex economic modeling techniques.

When proposed agreements are relatively small in scale, analysts often only consider what are sometimes referred to as the "primary" effects of the agreement, or changes in sectors directly affected by the terms of the agreement. Such an approach is justified because the level of activity between the potential trading partners will not be large. Analyses of the primary effects essentially ask how exports and imports in key sectors will expand or contract as a result of the proposed agreement. Such estimates can be a derived from simple examinations of historical trends and tariff rates, or by more sophisticated partial equilibrium models. An example of the former approach is the draft ER for the proposed US-Chile FTA that was conducted by the USTR. To examine the potential effects of that agreement analysts simply examined the historical record of the top 25 imports and exports and their respective tariff rates between the US and Chile (USTR, 2001). From such an examination it became fairly easy to predict which sectors might enjoy expansion and contraction from trade liberalization between the two nations.

A partial equilibrium model focuses on certain sectors of the economy, but does not attempt to represent the full range of interaction among all sectors. Such an approach allows policy analysts to isolate the effect of trade liberalization on particular sectors, commodities, or pollutants in an economy and to test the significance of the relationship between trade policy and the examined variable. Partial equilibrium assessments have been used, for example, to examine the potential economic impacts of the US-Jordan agreement. These models assume, in effect, that the interactions between certain sectors and the overall economy can be ignored in order to focus greater attention on the workings of a particular sector itself.

When a proposed trade agreement, such as the FTAA or a new round of world trade negotiations, has the potential for substantial effects throughout the economy, ERs are beginning to rely on estimates from computational general equilibrium (CGE) models. In contrast to the partial equilibrium approach that looks at changes in one or a small family of sectors, a CGE model attempts to present a quantitative picture, at a point in time, of the interaction of the full range of markets and industries throughout an economy. Like partial equilibrium models, the CGE approach involves an analysis of the primary effects of the proposed agreement, but then adds two other layers of analysis.

We will refer to the three stages of effects as "primary," "secondary," and "tertiary." The secondary effects are the indirect, inter-industry consequences of the primary effects, as calculated by input-output models. The tertiary effects are the economic equilibrium effects resulting from the primary and secondary effects. For example, when Mexico opens its markets to US corn under NAFTA, the primary effect on the US is the increase in corn exports; the secondary effects include increased purchases of farm inputs by corn growers; the tertiary effects include shifts in consumer spending and employment patterns throughout the economy as a result of the changes in incomes and prices in the farm and farm input sectors.

These stages are conceptually distinct, even if in practice somewhat collapsed into each other. First, as discussed earlier there is the estimate of the primary economic effects of trade liberalization. What exports and imports expand, by how much, in each country? What changes in production technology, organization, and ownership will occur? Second, there are input-output (I-O) effects, as changes in final demand ripple through supply chains and intermediate goods producers. If a policy change leads to the production of fewer cars, I-O analysis can calculate the resulting decrease in auto industry inputs from other sectors of the economy. Finally, there are equilibrating changes, as markets readjust to changed conditions, prices rise and fall, and labor (hopefully) moves from declining industries to expanding ones.

For use in an ER the CGE model is run twice: once as a benchmark, representing actual conditions in a recent “base year” without the proposed agreement; and again for that same year, making the counterfactual assumption that the agreement was in effect but other conditions remained unchanged. In other words, the only difference between the two model runs is that the proposed agreement is assumed to be in effect in the second one. The difference between the output of the two model runs is then taken to be the impact of the proposed agreement. Note that this is what economists call a “comparative statics” analysis, contrasting two snapshots of economies in equilibrium. It does not attempt to describe the time path of adjustment following adoption of a trade agreement. Table 2 shows recent trade agreements where specific models have been employed in *ex ante* analyses. It is interesting to note that several models used for analyses of NAFTA are now being adapted to estimate the effects of the FTAA. Of these models, GTAP, Michigan, Berkeley (IADB), Baylor, and the U.S. model, GTAP is one that is slated to be part of an ER (USTR, 2000).

Table 2. Models used in recent ex ante assessments of trade agreements

Models	NAFTA	Uruguay Round	Jordan – U.S.	FTAA
Computable General Equilibrium Models				
GTAP		●		●
Berkeley	●			●
Michigan	●			●
Baylor	●			
U.S. Model	●			●
RUNS		●		
Partial equilibrium models				
COMPASS			●	
SWOPSIM		●		
Mandate		●		
IMPACT		●		
WFM		●		
Tyers/ Anderson		●		

Formal economic modeling is a relatively recent methodological addition to environmental reviews. Previously, most environmental reviews were largely qualitative in nature. For example, the Canadian and U.S. environmental reviews of NAFTA and the Uruguay Round focused on the expected economic outcomes using comparative language, without relying on quantitative tools to estimate the economic changes from pre-agreement conditions. However, this strategy has been changing over the past decade. One of the first environmental reviews to employ quantitative methods was the 1990 EC evaluation of the EU, which linked the economic model HERMES to different environmental impacts. Later, the United States used COMPAS (Commercial Policy Analysis System), a partial equilibrium model designed by the U.S. ITC, in its environmental review of the U.S.-Jordan free trade agreement. Today, the USTR proposes using one of two models for the environmental review of the FTAA, including GTAP and the U.S. Model.

Estimating environmental and regulatory effects

The final stages of an ER involve estimating the environmental and regulatory effects of the anticipated economic changes triggered by the trade agreement. In estimating the subsequent environmental impacts of a trade policy change, early ERs were largely qualitative in nature. However, ERs are increasingly employing a range of quantitative methodologies as well.

The environmental stage of an ER is performed at two levels. First, commonly called "sectoral" analyses, is an examination of the environmental effects of the economic changes estimated in the economic stage of the ER. Second is a regulatory assessment that often seeks to identify text in the proposed agreement that could potentially affect the ability of a country to enact, maintain, or enforce its regulations pertaining to the environment.

A range of approaches is used for the sectoral analyses. In general, the key sectors that are thought likely to undergo significant economic changes as a result of the agreement are analyzed for their potential environmental effects. For example, if it was predicted that a nation's mining sector might significantly expand as a result of an agreement, an ER might assess the amount and location of increased water use and pollution in that sector. Alternatively, economic analyses could determine that an expansion of a nation's pulp and paper industry would occur. ER analysts would then look at the changes and location of industrial air pollution as a result of those changes as well. Subsequently, an assessment of a nation's regulatory capacity to absorb these effects is conducted. In other words, it is asked whether the nation is equipped with the necessary laws and incentives to abate the anticipated environmental effects. In the USTR's draft ER of the proposed US-Chile FTA, for instance, it was determined that the US-Chile FTA would lead to small changes in the production in hazardous wastes. It was then determined that the US Resource, Conservation, and Recovery Act (RCRA) had the capacity to address those small changes (USTR, 2001).

Sectoral analyses are beginning to be conducted at higher levels of quantitative sophistication. In Canada and the US alike, there are growing amounts of quantitative data on levels of environmental degradation in specific sectors of the economy. For example, estimates are available for the amount of air pollution per unit of output in specific industrial sectors. Such data are increasingly used as coefficients that are linked to the economic results performed earlier in ERs. Later in this paper we will show how economic estimates derived from a CGE model were used to predict increases in sulfur dioxide pollution in the North American metals sector.

Building on this approach, a number of models that can derive environmental predictions based on inputs from economic analyses have been proposed for use in future ERs in North America. The Economic Research Service of the USDA has created another model, called the Future Agricultural Resources Model, or FARM. This model combines a geographical information system with a computable general equilibrium economic model (using GTAP) that simulates changes in the use of land and water resources for the United States and the Western Hemisphere. This model has been proposed by the USTR for analyzing potential impacts from an FTAA, along with the United States Regional

Agricultural Model (USRAM) of the ERS and the Trade Environment Analysis Models (TEAM) of the EPA (USTR, 2000). What will also be very useful in the future will be the assessment of an environmental baseline for the United States. Such an analysis can serve as a control, representing what would have happened without a trade policy change.

The other environmental component of an ER is often referred to as the Regulatory Review. Regulatory analyses in earlier ERs primarily focused on responding to trade and environmental regulatory hypothesis such as the pollution haven hypothesis. This has changed in more recent reviews, which look at proposed text in the agreement being negotiated in an attempt to identify language that could possible affect a nation's ability to develop, enforce, or maintain its levels of environmental regulation.

Contemporary trade agreements now often include provisions that extend well beyond changes in tariffs. Indeed, it is likely that a trade agreement will also have chapters on financial services, intellectual property, investment, competition policy, government procurement, and other matters. For this reason, the regulatory review portion of an ER can be rather lengthy. Legal experts conduct a thorough examination of the language of the text to determine the potential conflicts between the two legal regimes. Past reviews, such as the Canadian and US ERs for NAFTA, examined regulatory, trade, and environmental hypothesis. In each of these reviews, a literature review of the empirical evidence regarding the pollution-haven hypothesis determined that the US and Canada did not have to be concerned about the possibility of a race to the bottom in North American environmental standards.

III. Strengths and Weaknesses of Recent Reviews

The state of the art of ERs in North America has evolved a great deal in the past decade. However, a number of improvements still need to be made in order for ERs to be of optimal use to policy-makers. This section of the paper identifies the stronger aspects of the most recent reviews, and also highlights areas that continue to be relatively weak. There are two major parts to this section. First, we outline the strengths and weaknesses of current ER approaches to estimate the economic impacts of a trade agreement; then we evaluate the relative merits of the subsequent environmental assessment techniques.

Economic Modeling for *ex ante* Environmental Reviews

As trade agreements become more complex, involving many countries and sectors of an economy, efforts to predict their economic outcome become more controversial. In contrast, the modeling techniques used in ERs for smaller trade agreements that will not entail major changes in economic activity are non-controversial. Indeed, for ERs that concerned trade deals with countries like Jordan and Chile, the level of economic analysis that was conducted was adequate and appropriate. The major limitation of economic models for ERs comes in the analysis of larger trade agreements. Such reviews inherit the many controversies surrounding the predictive capability of CGE models, and therefore their utility for policy-makers is more limited.

Because North American governments will be involved in conducting ERs for proposed agreements with potentially large economy-wide effects, particularly for the FTAA and a new round of world trade negotiations, we will spend the majority of our attention here on the weaknesses of the economy-wide modeling efforts that will form the core of those ERs. In the last section of this report, we propose alternative, less controversial, ways to capture these effects.

As discussed above, the most common modeling technique for estimating the economic impacts of a trade agreement with suspected economy-wide effects involves CGE models. While this technique has strengths that other models fail to offer, it also suffers from several weaknesses. For these reasons, the results from CGE analyses should be taken with caution and should not be relied on as the sole source of information from which to base an ER.

The strengths of CGE models include their theoretical rigor, their ability to represent the direct and indirect interactions among all sectors of the economy, and their precise, detailed quantitative results. CGE models are rigorously derived from economic theory, assuming that markets respond to prices in the expected manner – excess demand pushes prices up, excess supply pushes prices down. Changes in one market affect other markets as well; the general equilibrium, for which the model is named, occurs when a set of prices is reached at which supply equals demand in all markets at the same time.

CGE models incorporate the interactions among all sectors of the economy. Some interactions result from supply chains: more demand for automobiles implies more purchases of tires and window glass by auto companies. Others result from price and income effects: higher prices for cars imply that fewer people will buy them, while higher wages for autoworkers imply more spending on consumer goods. CGE models provide consistent sets of equations to analyze all such interrelationships. Once constructed, these powerful tools can run different simulations to consider alternative policies. They incorporate multiple markets (for factors of production, final goods and services, or even marketed environmental instruments), and are able to quantify efficiency and distributive impacts of economic and/or environmental policies (de Miguel and Nuñez, 2001).

Another contribution of CGE models to environmental reviews is that they respond to the need for quantitative tools (Waverman, 1992). Trade agreements can potentially affect all economic sectors, and create a mix of positive and negative effects on labor markets, consumer welfare, and environmental media including air, water, land, and biodiversity. It is important to improve the understanding of the linkages between trade policy reform and the environment, and quantifying their significance is an important part of the analysis. Quantification improves the possibility of correctly anticipating the size of predicted environmental impacts, and facilitates the scoping stage in assigning their relative importance. It also allows a more meaningful debate about the potential costs and benefits of a proposed trade-related reform (Anderson and Strutt, 1996).

CGE models, while offering the ability to demonstrate potential economic effects *ex ante* of a proposed trade agreement, also have a number of less familiar but important limitations. We can group these limits into three categories: high information costs and

lack of transparency; controversial assumptions regarding model relationships; and the inability to capture "non-trade" aspects of trade liberalization.

1. High information costs and lack of transparency

At its core, building a CGE model is a cumbersome and expensive task, requiring a great deal of time, substantial effort from a team of specialists, and considerable resources, especially with respect to data. Given the large data requirements, disaggregated models become problematic because for every sector it is necessary to examine its direct relationship with every other sector. Even in a highly aggregated, 25-sector model there are 300 distinct pairs of sectors whose relationships must be considered; with 50 sectors there are more than 1,000 pairs to consider; with 100 sectors there are nearly 5,000 pairs.[2] Adding a level of disaggregation causes a more than proportional increase in data and parameter requirements (Munk, 1990).

The expense of building adequate data sets means that they can only be infrequently updated; the resulting reliance on aged data puts policy analyses at risk of being outdated before they are even completed. For example, as of 2001 the most recent version of the GTAP data set (GTAP 5) uses 1997 as a base year. Other models have been known to use base years as much as ten years out of date; GTAP is probably as current as possible given the size of its data set. However, analyses that use this data can only tell policymakers what would have happened if the policy change had occurred in 1997, not in the present or future. That is, an *ex ante* analysis of the effects of the FTAA using such a data set does not actually project what will happen, in 2005 or later, if the FTAA is adopted. Rather, it is examining what would have happened if the FTAA had somehow been transported back in time, and dropped into the economy of 1997 (Ackerman et al. 2001).

This inescapable obsolescence can be a serious problem. In an *ex ante* situation, proposals during trade negotiations are always changing, as are the base conditions for creating the model. As a result, any economic assessment is in constant danger of being rendered irrelevant should the direction of negotiations or economic conditions change (UNEP, 2001). This was an issue for early NAFTA modelers, because in the late 1980s and early 1990s the Mexican economy was changing so rapidly that models calibrated to any fixed base year soon became inaccurate (Waverman, 1992).

A modeler's analysis is only as good as the quality and quantity of data available. However, due to the large data requirements it has become commonplace to synthesize data from multiple published data sources. Although these data sets are assembled carefully by skilled technicians, there is always a risk that some of the data sources employ assumptions or definitions that are incompatible with the model scenarios. Use of incompatible or biased data sources can create a host of problems, potentially even undermining model calibration and the relevance of the model results (Laird, 1997; Waverman, 1992).

[2] With n sectors there are n(n-1)/2 distinct pairs of sectors in the model.

High information costs lead to a lack of transparency in CGE models; ironically the problem can arise from either too little detail or too much. On the one hand, cost constraints and the desire to keep models simple can lead to highly aggregated models with relatively few sectors, relying on numerous simplifying assumptions. Models of this variety can be difficult to interpret since their results are shaped by the degree of aggregation and the nature of the simplifying assumptions (Gallagher and Ackerman, 2000). Moreover, a simple, highly aggregated model often lacks the detailed forecasts that policy makers need.

On the other hand, a more disaggregated model, with sufficient detail for policy analyses, can be difficult for anyone but an expert in the field to follow. The number of intersectoral relationships, as we have seen, grows much faster than the number of sectors. Comprehending and evaluating a model with hundreds of sectors and thousands of potential interactions is a challenge even for another expert on CGE models, and essentially impossible for non-specialists.[3]

It is not obvious that there is any happy medium between too little disaggregation and too much; instead, there is some danger that both problems could occur at once in a medium-sized model.

2. Controversial assumptions regarding model relationships.

While CGE models pride themselves on their rigorous grounding in economic theory, this does not mean that they have escaped from controversy about their economic assumptions and relationships. Economic theory unfortunately does not provide clear, unambiguous guidance on how to model a complex, modern economy; on the contrary, theory suggests several reasons to question standard CGE approaches. Questions that will be addressed here include the limitations of the static framework, the reliance on textbook-style "perfect competition", and the lack of established empirical estimates for key relationships.

a) Limitations of static analysis

As we have seen, most CGE models rely on comparative-static analysis, contrasting a scenario representing a hypothetical policy change to actual conditions in a fixed base year. Both the base year and the policy scenario are represented as static "snapshots," with no provision for gradual adjustment or change over time. When the new policy is introduced, the model jumps directly to the resulting new equilibrium.

In practice, however, we are often extremely interested in the process of adjustment following introduction of a new policy. If labor, for example, is eventually going to end up in new industries (in a new "general equilibrium"), it makes a great deal of difference to know whether it takes 10 weeks, 10 months, or 10 years for workers to change occupations following a shift in economic structure. Lacking the ability to model the pace of change, in labor markets or elsewhere, comparative static analyses have proved most useful for examining short-term issues (Munk 1990; see also Tims 1990).

[3] It is important to note that much of the data in the US that derives from the ITC is classified by an act of Congress and can not be examined by the public (and in some cases other agencies).

To address such questions, a dynamic model would be needed. Unfortunately, CGE models are poorly suited for dynamic analysis. The data requirements are significantly greater for a dynamic analysis, and dynamic models are much more unstable and difficult to solve (i.e., iterative solutions do not always converge), even for the best computers.

The issue goes beyond the practical limitations of existing computers. The abstract theoretical rigor of general equilibrium is limited to static analysis, and is silent on questions of adjustment over time. Economic theorists have known since the 1970s that general equilibrium is seriously flawed as a model of economic dynamics, with the apparently inescapable potential for unstable or chaotic outcomes.[4] Ironically, many advanced theorists have moved away from the general equilibrium framework at the same time that it has become the norm in applied economics.

b) Reliance on perfect competition

Economists have a strange relationship with the familiar theory of "perfect competition," in which markets are populated exclusively by very competitive firms, all of whom are too small to exert any independent power over prices. On the one hand, the theory is easy to analyze; in perfect competition the market leads to ideal outcomes, which cannot be improved on by government intervention. On the other hand, it is obvious that the theory does not describe the market economy as it actually exists; perfect competition among small, powerless firms does not characterize the likes of Microsoft, General Motors, AOL Time Warner, and ExxonMobil.

In building CGE models, the mathematical convenience of familiar theories such as perfect competition has often won out over realism about market imperfections. A study of the CGE models used for economic analysis of NAFTA found that many were arguably erroneous and easily challenged when compared to the real world (Stanford, 1993). The models' debatable assumptions include the idea that factor markets, including labor markets, are perfectly competitive and will always clear (i.e., markets always return to equilibrium, or full employment, after an external shock). The models tend to ignore the impacts on income distribution of socio-economic institutions such as trade unions, minimum wages, and social programs. Conversely, they assume that the distribution of income has no effect on aggregate economic performance. A common assumption is that the aggregate economy is supply-constrained, so that output is limited only by the availability of productive factors; this makes it impossible to model unemployment and recessions. Some NAFTA models even assumed that there is no capital mobility between North American countries, only within a country; no country in such a model can be threatened with a loss of capital, and all gains in foreign investment come from outside of the region.

[4] The extensive technical literature on this question, based on the so-called Sonnenschein-Mantel-Debreu Theorem (proved in 1974) and subsequent related research, is well-known to economic theorists but almost no one else. For a summary from an economist's point of view see Kirman 1989; for a summary by a mathematician who has been active in this area see Saari 1995. For a literature review with more complete citations see Ackerman 2002.

The literature on critiques of perfect competition is itself extensive, raising many reasons why these theories are inappropriate or inaccurate representations of real economies. Among the most important recent contributions is the analysis of the economics of limited information. Three economists who have worked in this area shared the Nobel Prize in economics for 2001. The best known of the three is Joseph Stiglitz, formerly the chief economist for the World Bank, and the chair of the President's Council of Economic Advisors in the Clinton administration. Stiglitz argues that the fatal flaw of traditional economic theory is its assumption that everyone has perfect information about all goods and services (see Stiglitz 2000 and numerous sources cited there). No one could possibly have that much information, Stiglitz points out, let alone update it as the market changes. An economy of limited information behaves very differently from the traditional theoretical model; Stiglitz demonstrates that the theory of perfect competition and perfect information (the standard basis for CGE models) is not even a good approximation to the behavior of a realistic, limited-information economy.

c) Lack of established empirical relationships

One of the important strengths of CGE models is their explicit treatment of the interactions between different economic sectors. It is this feature that allows analysis of indirect, intersectoral effects of trade policies. However, the models' estimates of indirect effects inevitably rest on assumptions about the exact shape and strength of numerous relationships, such as the price elasticities of supply and demand in various industries, or the speed and completeness with which markets adjust to external shocks. The economics literature does not provide a single set of widely accepted estimates of these parameters; CGE model relationships cannot be based on a professional consensus about the empirical strength of price elasticities and market responses, because there is no such consensus. Indeed, many of the models that predicted the effects of NAFTA used elasticities estimated on the basis of U.S. trade with the whole world in the 1980s (not with Mexico and Canada in the 1990s), averaged across separate industries where necessary due to mismatched SIC code lists, etc., and arbitrarily rounded upward in some cases because the model is unstable with low elasticities (Hinajosa-Ojeda, 2000).

This is the opposite of the situation in many areas of physical sciences and engineering, where physical relationships are based upon well-established natural laws and have withstood repeated empirical tests. Everyone doing rocket science uses exactly the same model of gravity – but economics is not rocket science, and every CGE model has its own picture of labor and product markets. The key assumptions differ in detail from one model to the next, precisely because there is no one model that has proved to be reliably more accurate than others in practice.

3. Inability to capture "non-trade" aspects of trade liberalization.

Recent trends in multilateral trade agreements have been to move beyond tariff reductions and dismantling non-tariff barriers. The new trade agenda focuses on building trade regimes that include trade related issues such as international property rights, investment, government procurement, and services. Although the economic impacts of these provisions will be significant, it is difficult to model them in a CGE framework. This is especially problematic for environmental reviews if these "non-trade" provisions will create environmental impacts.

Most important in this respect is the inability of CGE models to capture investment effects (CEPAL, 2001). Proposed changes in investment rules could have a significant impact on economic activity throughout the hemisphere. According to the World Bank, annual net foreign direct investment (FDI) inflows into Mexico more than tripled after NAFTA was passed, reaching over $10 billion in 1998. In addition to altering the composition and output of different sectors in Mexico, such inflows have altered the trade orientation of many sectors as well. Changes in investment rules under NAFTA have reshaped intra and inter industry trade in North America, and changes in future investment regimes are likely to do the same. Increases in FDI have direct impacts on technology choice and environmental quality. Investment-related changes to trade patterns of this kind are of potentially great importance, but are beyond the scope of CGE models.

One of the dangers in using CGE models for economic analyses is that they are "oversold" as definitive predictors of how the *entire* economy may change after a trade agreement. In fact, the accomplishments of such models are much more modest. A CGE model is only analyzing how a proposed agreement might affect an economy via changes in trade barriers, while holding everything else, including policy toward investment and services, constant. If the limitations of the modeling exercise are kept in mind, it may provide useful information; if it is presented as the beginning and end of economic analysis of a trade agreement, it may prove misleading.

Scott (2000) notes that in many of the *ex ante* analyses of NAFTA, the authors pointed to the growth in U.S. exports without adequately highlighting the concurrent growth in imports. In a 1992 study designed to highlight some of the expected economic benefits from NAFTA, the Michigan model predicted that U.S. exporters would benefit more than their Mexican counterparts. Exports from the U.S. to Mexico were forecast to increase by $4.2 billion per year, while imports from Mexico would grow only $3.5 billion per year (Brown et al. 1992). A later *ex post* assessment showed that these forecasts were gross underestimates, and wrong about the balance of trade as well. U.S. exports to Mexico grew by an average of $8.3 billion per year, while imports from Mexico grew by $13.5 billion per year. The result was that the U.S. trade deficit with Mexico almost quadrupled, jumping from $16.6 billion in 1993 to $62.8 billion in 2000 (Scott, 2000). Although NAFTA was not solely responsible for these changes, the results dramatize the extent to which CGE model output can provide misleading forecasts.

The impact on labor in the U.S. from Mexican imports was another highly charged pre-NAFTA debate, which even today generates ongoing controversy among economists. For example, one *ex ante* model showed that U.S. employment would fall by 234,000 workers after NAFTA; most of this was assumed to be a return flow of illegal immigrants to Mexico since Mexican employment was predicted to increase by 273,000 (Hinojosa-Ojeda 1992). At first glance this looks close to some views of what actually happened: a later *ex post* model by the same author showed that in the U.S. 259,000 jobs were lost as a result of increased Mexican imports, and the U.S. Department of Labor reported that 238,051 workers were certified under the NAFTA-TAA to have lost their jobs due to trade with Mexico (Hinojosa-Ojeda 2000).

However, these *ex post* results refer to different workers than the *ex ante* model: illegal immigrants who returned to Mexico did not get certified under NAFTA-TAA for job loss in the U.S. If, in addition to 238,000 certified job losses by U.S. workers, there were other U.S. job losers who did not get certified, and a large number of undocumented Mexican immigrants who lost their U.S. jobs and returned to Mexico, then the true employment impact must have been much greater (and surprisingly hard to measure). A different *ex post* analysis of U.S.-Mexican trade since NAFTA found that what we have called the primary and secondary effects of that trade caused the loss of 766,030 U.S. jobs, though the impact was of course offset by the growth of the U.S. economy in the late 1990s (Scott 2000).

The disparity between these numbers shows that even after NAFTA, there is no agreement on the full effects, both due to methodological issues of the studies, and the other economic factors that impacted U.S. employment. Before future economic analyses are conducted with the same models that were used to predict the outcomes of NAFTA, a thorough evaluation of their NAFTA predictions should be undertaken.

Environmental modeling: analysis or afterthougtht?

Once the economic forecasts have been made, the predicted changes must be matched up with environmental indicators, to see how the economic changes might directly affect environmental quality. In many ways, this is the most important part of the process, but it is not always treated with the same level of effort and sophistication as the economic component. In some of the simple cases marginal environmental impacts are ignored, especially in ERs for relatively small FTAs; in some of the more elaborate studies, environmental analysis is in danger of being treated as an afterthought tacked onto the results of CGE models.

The central limitation of the environmental component of ERs for relatively small trade agreements is that they largely ignore the potential marginal environmental costs of the proposed agreement. What drives a large country's interest in negotiating trade agreements with smaller countries are the marginal benefits that will accrue to the economy. The methodologies used to estimate marginal economic benefits in many reviews have been thorough and detailed. However, much less attention has been paid to the agreements' possible marginal environmental costs. Too often ERs claim that since changes in economic activity will be small, the resulting environmental changes will be insignificant.

In ERs for big trade agreements, typically, environmental analysis is based on identifying and measuring the impact of economic changes on environmental media. Coefficients are established for pollution emitted per unit of output for a particular economic sector. These coefficients can then be applied to the economic output of the CGE models to determine how changes in patterns of production due to the proposed trade agreement might impact the environment. The technique is most successful with quantifiable, readily measured impacts, such as the levels of air pollutants associated with particular manufacturing industries, or with transportation. Water quality and water use is another area where this technique has been widely used. It is easy to link levels of

water pollution to industrial output in certain sectors (e.g., chemicals, paper, or intensive agriculture) or water use to acreage of irrigated agricultural production.

Agriculture plays a prominent role in assessments of trade agreements, and some (not all) environmental models used in ERs focus solely on the agricultural sector. The United States Regional Agricultural Model (USRAM), from the USDA, provides estimated changes in embodied energy, soil loss from wind and water erosion, offsite cost of soil erosion, nitrogen and phosphorus losses, carbon flux and greenhouse gas emissions. The Trade Environment Analysis Models (TEAM) from the USEPA can track the total pollutant emissions for the entire United States (USTR, 2000).

When environmental models contain sufficient spatial detail, it is possible to use geographical information systems (GIS) technology to estimate the location as well as the magnitude of environmental impacts. For example, the Future Agricultural Resources Model (FARM) of the USDA uses GIS to simulate changes in the use of land and water resources for the United States and the Western Hemisphere, including land-use shifts between cropland, grassland, forestland, and other land; changes in crop yields, stocking rates, and timber harvest rates; and transfers of water between irrigation and other uses.

Other models that attempt to link economic output to pollution emissions at the intermediate and final consumption level is the Trade and Environment Equilibrium Analysis (TEQUILA) model, from the OECD. This model was adapted to Mexico from the OECD Development Center's prototype CGE model (NACEC, 1999).

However, despite these promising tools there are three ways in which the environmental modeling phase of an ER can go wrong. First, if it relies solely or directly on an economic forecast that proves to be incorrect, then the environmental projections will be incorrect as well. Second, there may be technical flaws in the calculation of the model's environmental coefficients. Finally, current environmental modeling approaches have the ability to capture only a limited set of environmental problems. Both the problems of aggregation and the obstacles to quantification lead to slighting or excluding important categories of impacts.

The first problem is illustrated by a study that used a version of the Michigan model to estimate the potential impacts of NAFTA on industrial pollution in Canada, Mexico, and the US. The study multiplied CGE estimates of employment growth in industrial sectors in the three countries by a variety of pollution intensity coefficients. Table 3 presents the study's *ex ante* estimates for post-NAFTA changes in SO_2 emissions in the base metals sector (including iron, steel, and nonferrous primary metals), compared to actual or *ex post* changes.[5] The model predicted large increases in SO_2 emissions, because it predicted large increases in the sector's output and employment in all three countries. However, employment in the base metals sector actually declined in Canada and Mexico, and increased by about two-thirds of the predicted amount in the U.S. To obtain the "actual" data shown in Table 3 we multiplied the levels of employment growth that actually occurred in the sector by the same pollution coefficients used in the study.

[5] The study used a 1991 base year, and estimated changes due to NAFTA, without specifying a specific post-NAFTA year. We calculated the *ex post* change between 1991 and 1998.

Table 3. Conflicting Estimates on Environment and Trade: Base Metals in North America

Change in SO_2 Emissions from Base Metals Industry after NAFTA (1000 pounds)		
	Ex ante forecast	*Ex post* actual
Canada	10,786	-102,121
Mexico	40,248	-244,003
US	99,301	63,321
Sources: Forecast is from Reinert and Roland-Holst, 2000; actual is authors' calculations from UNIDO, 2001 (explained in text).		

The second problem, indirectly present in the same study, is subtler, and the details are beyond the scope of this paper. The study used the same coefficients for all three countries, calculated by the World Bank based on pollution per employee in US industry in 1987. Briefly, the use of employment as an indicator of economic activity and calculation of pollution per employee are problematic, since employment does not have a direct causal relationship to emissions. Also, rapid technological change and environmental improvement in all three countries in the last 14 years makes the coefficients based on 1987 emissions particularly inappropriate (Gallagher, 2002; Repellin-Hill, 1999). Better industrial pollution coefficients for Mexico, expressing pollution per unit of value added in 1997, have recently been published, making it possible to overcome this problem (Aguayo et al., 2001).

The third problem in the environmental modeling phase of ERs is the tendency to minimize or overlook important categories of impacts. This occurs for two different reasons. First, the aggregation of economic data may bury an environmentally sensitive activity in a larger sector. Emissions that result only from aluminum production (to take a strictly hypothetical example) would be easy to see and to analyze in a model that disaggregates different metal industries. Now consider the treatment of the same emissions in a model that aggregates all primary metal producers into a single sector. Most metal production is not aluminum (iron and steel is a much larger industry), so the relationship between the emissions and metal production in general would look quite weak. The model results would not provide guidance about the causes of emissions or the strategies for reduction, due to excessive aggregation.

This problem is endemic: establishing clear linkages between economic trade-related changes and the resulting direct and indirect environmental effects is complicated by the mismatch of the optimal scale for studying the two subjects. In a review of economic and environmental model methodologies for the OECD, Dale Ervin observes,

> "Economic analyses conducted at the local/watershed level may omit important forces that are determined in the larger market context; for example, product and input price changes that alter land rents, or shifts in output mix that alter processing patterns. In contrast, environmental analyses have more integrity if they are conducted in disaggregated fashion, usually for the watershed or ecosystem that shares common environmental processes" (Ervin, 1999, 121).

Paraphrasing Ervin, he argues that economic analyses are best performed at a level that is too aggregated to capture many important environmental impacts.

Impacts may also be missed because they are excluded from the scope of assessment. Some of the limitations on the scope of ERs are intentional, as in the decision to restrict some U.S. analyses to impacts within the country. This prevents analysis of the "pollution haven" hypothesis, i.e. the possibility that polluting activities are relocating to countries that have less strict regulation. Since the argument for trade agreements is usually that they benefit all parties together, it seems appropriate to analyze their environmental impacts on all participating countries.

Some of the limitations on scope of assessments may simply reflect limited resources for modeling. In the suite of U.S. models discussed above, although FARM, RAM and TEAM each covers multiple economic sectors and a variety of environmental issues, the fact remains that none is comprehensive enough to include all areas. Of these three models, two are designed to assess land and resource use and degradation within a specific sector, agriculture. The third, while a bit more comprehensive in scope, does not cover issues of land use, invasive species, protected species and depletable natural resources. The fact that no model includes all sectors underscores the need for use of multiple methodologies in the assessment of environmental impacts, as well as continuing development of more comprehensive approaches (USTR, 2000).

The most challenging limitations on the scope of environmental assessment reflect the difficulty of quantifying some important impacts, such as nature conservation and biodiversity (Beghin *et al.* 1997). This can be contrasted with the discussion of sulfur emissions from industry associated with Table 3 above, one of the best cases for quantification. Whatever the merits of any specific coefficient, it is clearly meaningful to talk about a numerical value for quantity of emissions per unit of production. Common sense suggests that, with twice as much production and unchanged technology, there will be twice as much sulfur emissions.

Now consider the different situation that arises with unquantifiable impacts, such as loss of biodiversity. In a recent study of the corn trade under NAFTA, Alejandro Nadal argues that U.S. exports, which are displacing traditional Mexican producers, threatens the survival of ancestral genetic stocks of maize, which originated in Mexico and Central America (Nadal 2000). Without arguing the merits of this question, one can conclude that, *if* Nadal's argument is correct, he has identified an important but unquantifiable impact. There is no way to attach a "biodiversity loss coefficient" to

Mexico's imports of corn; but loss of biodiversity could nonetheless be a crucial impact of trade.

In addition to the lack of attention to certain sets of environmental problems, many NGOs have commented that ERs should address a broader range of social concerns such as social displacement, income inequality, and so forth (DFAIT, 2000; NGO letter, 2001). The problems that arise in evaluating these broader questions of sustainability are parallel to those for biodiversity – the impacts are important, but they cannot be attached to economic model results with a simple coefficient, as in the case of sulfur emissions.

The difficulties in linking CGE and environmental models that have been highlighted here do not mean that this exercise is invalid. Rather, it is meant to show that this is an evolving science, that there are limits inherent in the nature of the models, and that these limits have created formidable methodological obstacles to overcome. Nevertheless, progress has been made in recent years. One activity that would help promote this recent progress would be to conduct more *ex post* assessments of the environmental effects of earlier trade agreements, and compare the outcomes to the *ex ante* environmental reviews in order to determine which models worked well, and for which sectors and environmental issues.

IV. Toward More Comprehensive Environmental Reviews for North America

Environmental Reviews of proposed trade agreements form an essential new component of trade policy-making in North America. This paper has established that the art of conducting such reviews is still in its infancy. However, we have also shown that the ERs conducted to date have an encouraging number of strengths that can be built upon. This section of the paper suggests specific steps that policy-makers can take to enable the environmental review process to become more comprehensive and useful for trade negotiations.

The overarching framework that has been used in past reviews is a useful one that provides a good starting point. We have noted that virtually all past ERs in North America have had three major components: a determination of the scope that the ER will take; an estimation of the economic impact of proposed trade policy changes; and estimates of the subsequent environmental ramifications induced by such economic impacts. In addition, most ERs have included maintained a commitment to inter-governmental and public participation throughout the review process. In this section we propose ways in which each of these areas – scoping, economic analysis, environmental analysis, and public participation – can be improved upon. Finally, it is important for Mexico, a country engaged in a flurry of trade negotiations, to start conducting ERs of those negotiations.

1. Broaden the scope of Environmental Reviews

Environmental reviews should encompass the broadest possible scope within time and feasibility constraints. The scope of ERs should be broadened to address two of the

limitations that have been discussed earlier in this paper: the problem of the "moving target," and the exclusive focus on domestic impacts.

The "moving target" problem is crucial to the validity of the analysis. If an ER is based on an estimated outcome of a trade negotiation that proves to be erroneous or incomplete, the entire effort will have little applicability to the policy process. Taking the lead from other aspects of Canada's 1992 NAFTA report, we recommend that a scenario approach be taken. Conducting ERs based on a range of possibilities would grant trade policy-makers the flexibility to consider the environmental impacts of various proposals, both before and during the negotiation process.

Of course, the construction of scenarios for an ER would take different forms for different agreements. To provide a framework then, we propose the following. Through discussions with informed trade negotiators and experts both within and outside of the nations conducting ERs, a range of possible or probable outcomes could be constructed. For example, a hypothesized ER of a new round of WTO negotiations, including China's accession, could include a scenario with the introduction of investment provisions, another with significant progress made on negotiations for agricultural subsides, and the default case of no major new policy changes accompanying China's accession.

In addition to addressing the "moving target" problem, it is also in the interest of North American nations to consider the potential environmental impacts on proposed trading partners. This is important for four reasons. First, because trade liberalization can change the composition of production between trading partners, estimations of "cleaner" outcomes in one country could indeed be a direct result of "dirtier" outcomes in another country. Second, a trade agreement may cause trans-boundary environmental effects that could spill over into North American territories and therefore increase environmental problems domestically. Third, a trade agreement could alter the impact of trading partners on global environmental problems such as global warming, biodiversity loss, and so forth. Fourth, identifying more localized effects in partner countries can help pinpoint where appropriate policy responses might be targeted to alleviate the negative costs of trade liberalization in those countries.

2. Expand the set of methodologies used to estimate economic impacts.

Comprehensive ERs should draw from a variety of methods to estimate the economic impacts of proposed trade agreements. For the trade agreements that have potential economy-wide effects, rather than relying solely on results from controversial CGE models to form the "core" of their analyses, practitioners of ERs should make use of partial equilibrium, input-output analyses, and similar techniques to estimate the primary and secondary effects of a proposed agreement. Isolating these important, non-controversial areas from the more speculative and debatable equilibrating effects can provide policy-makers with a range of economic estimates from which to base their decisions on.

Standard CGE approaches involve three layers of analysis, which are conceptually distinct even if in practice somewhat collapsed into each other. First, there is the estimate of the direct economic effects of trade liberalization, such as increased

trade in sectors where tariffs are reduced. Second, there are input-output (I-O) effects, as changes in final demand ripple through supply chains and intermediate goods producers. Finally, there are equilibrating changes, as markets readjust to changed conditions, prices rise and fall, and labor moves from declining industries to expanding ones.

There is a strong tendency for studies to publish and focus on the combined results of all three stages, including the more controversial, equilibrating effects. Analyses of the primary and secondary effects are often embedded in the larger CGE models – but receive far too little analytical attention on their own, and are rarely even separately discussed in the presentation of CGE results. Simpler, more standardized partial equilibrium and I-O analyses can estimate these primary and secondary effects. I-O analysis is a well-established, straightforward process, resting on nothing more theoretically complex than matrix multiplication (yet still rigorous and very data-intensive).

I-O analysis was initially developed, and can easily be used, in a partial equilibrium framework. For instance, if analysis of the primary effects of a tariff change in the automotive sector provides estimates that indicate that there will be the production of fewer cars, I-O analysis can calculate the resulting decrease in auto industry inputs from other sectors of the economy After such analyses are carried out, it can be determined if CGE modeling is necessary to provide necessary supplementary information. In the ER of the US-Jordan trade agreement, CGE analysis was not needed because the composition and scale of US-Jordan trade was relatively small and straightforward.

If CGE work is conducted, the results should be published with full disclosure of the embedded assumptions, and alongside the results from analyses of the primary and secondary effects. It is important for policy-makers and for analysts evaluating the models to know the answers to questions like: How large are the relevant price elasticities? How rapidly do labor, capital, and product markets move back toward equilibrium when perturbed in the model? How is government assumed to respond to changing economic conditions, and how does the government response affect the economy?

It is important to stress that estimates of the potential economic impacts of a trade agreement should include an examination of effects triggered by events beyond changes in trade and tariffs. Increasingly, "trade" agreements deal with capital flows and investment, intellectual property rights, government procurement, and a host of other issues. Capital flows and investment alone account for billions of dollars of transactions in the hemisphere, and are seen by many to be a key rationale for an agreement. However, the dominant modeling techniques are not constructed to predict the outcomes related to these issues.

3. *Increase the number of environmental variables that are assessed.*

Environmental Reviews should expand the kinds of environmental problems that they seek to identify. The level of quantitative sophistication in environmental modeling has made impressive progress, but even more needs to be done. Earlier ERs had to rely

solely on reviews of literature and educated guesses regarding the possible environmental ramifications of different economic changes. The most recent ERs promise to incorporate environmental modeling techniques to estimate those impacts. At this writing, many of the available quantitative techniques for *ex-ante* analysis of proposed trade agreements fall far short of being able to identify some key environmental problems; as a result, they need to be supplemented. Indeed, there is a growing family of environmental models that rely on CGE results, such as the TEAM, US-RAM, and FARM models discussed earlier. If the CGE results end up being erroneous, efforts to model the environmental ramifications of those predictions will also be of little use.

A valuable initiative should be noted in this context: the US has begun efforts to put together an "environmental baseline" scenario that will guide future ERs. This will allow them to determine what economic changes will affect the environment. Other North American governments should follow this lead.

ERs should focus on a wider range of environmental issues, including both natural resource and pollution related problems. NGOs and the EU reviews also seek to identify potential socio-environmental impacts, and offer insight regarding how such variables could also be included (WWF, 2000; Lee, 2000). For some environmental issues, such as air and water pollution, existing data is enough to make reliable estimates of how such problems would be affected by trade-led economic change. However, a number of other problems, such as changes in land use patterns and in biodiversity, are more difficult to quantify, especially at an aggregate level. For these problems we recommend conducting *ex-post* analyses of similar trade measures to draw out *ex-ante* lessons. Here, the methodology conducted by NACEC serves as a great guidebook for conducting ex-post analyses, as does the terms of reference for the World Wildlife Fund's growing array of sustainability assessments.

In addition to assessing how trade policy may affect the environment, ERs should continue to provide more targeted insight regarding whether a proposed trade agreement will affect environmental regulations. Provisions in NAFTA's controversial Chapter 11 have caused concern about the potential for "regulatory chill" that might prompt environmental policy-makers to water down or stagnate existing regulations, in fear that environmental standards will be challenged in investment tribunals (IISD, 2000; Neumayer, 2001). In addition, concerns regarding a potential "race to the bottom" due to competitiveness and degree of environmental regulation have also resurfaced given new evidence. It has been suggested that Canadian's lax hazardous waste legislation has resulted in Canada becoming a "pollution haven" for North American hazardous waste. Similar to the empirical environmental baseline work that the US is conducting, perhaps a regulatory baseline could be drafted that would outline environmentally friendly and unfriendly language in potential trade agreements. This would enable negotiators to identify and avoid harmful language in the negotiation process.

4. Enhance existing levels of inter-governmental and public participation.

Public participation should be built into each stage of the ER process. In recent years, the Canadian and US government have each begun to open the trade policy-making process to government entities, such as environment ministries, that have not

traditionally been part of trade policy. In addition, trade policy has begun to be more open to the public, and have a built-in response mechanism to public commentary. These developments should be extended to the realm of environmental reviews.

Trade policy in the US and Canada, especially as it pertains to the environment, now involves a number of agencies and civil society representatives that have not traditionally participated in policy-making. Regarding inter-agency process, the US serves as a model; in the realm of public participation, Canada does. According to the Executive Order governing the process in the United States, USTR *and* the Chair of the Council on Environmental Quality both oversee the implementation of ERs. In Canada, DFAIT serves as the lead agency. Specifically, the ER process should put environmental ministries on equal footing with trade ministries, allow public advisory committees to participate in the development of an ER, release drafts of ERs for public and expert review prior to final publication (as Canada does and the US has done recently), and then respond to the latter commentary in final drafts.

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