REPORT OF THE

QUANTITATIVE ANALYSIS WORKING GROUP

To

THE FTAA INTERAGENCY ENVIRONMENT GROUP

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Foreword

Executive Order 13141 calls for the assessment and consideration of environmental impacts of trade agreements during the negotiating process. These environmental reviews will help identify potential environmental effects (both positive and negative) resulting from the proposed agreement, and facilitate the development of appropriate policy responses. As lead agency for this activity, USTR started an interagency process in February 2000 to analyze the environmental effects of the Free Trade Area of the Americas (FTAA). This review will be the first application of Executive Order 13141 to a major multilateral trade negotiation, and results of this analysis are intended to inform our negotiating positions throughout the FTAA negotiations. Ultimately, the review will include an analysis of environmental effects resulting from changes in economic activity, and potential impacts on domestic environmental laws and regulations. USTR will formally initiate the environmental review of the FTAA through the Federal Register (FR). The FR Notice will seek public input on the proposed scope of the FTAA review, as provided for in the USTR-CEQ draft environmental review guidelines. That work is being conducted by an interagency committee; the FTAA Interagency Environment Group (Environment Group).

Given the FTAA environmental review's importance, the Environment Group created an interagency Quantitative Analysis Working Group (Working Group), composed of experts from relevant agencies. This Group was charged with developing an analytical methodology for quantifying the environmental effects of hemispheric tariff liberalization. The Working Group, after having invested a considerable amount of time and energy in this project, recently presented the results of its work in a report to the Environment Group.

In summary, the Working Group recommends a two-pronged approach consisting of a *core (quantitative) analysis* of the FTAA, accompanied by a *supplemental analysis* of specific economic sectors, geographic areas within the United States, and other relevant issues not covered in the core analysis. In addition, the Working Group has presented: 1) existing methods to quantify the potential economic and environmental effects and complete the *core analysis*, 2) identification of and some recommendations for dealing with the challenges presented by the *core analysis*, 3) recommendations for a process to help identify priority issues and appropriate methodologies for a *supplemental analysis* of issues not treated in the *core analysis*, and 4) estimates of the resources necessary to perform the quantitative aspects of the review.

By itself, the proposed quantitative methodology will not constitute a comprehensive analysis of environmental effects; rather the outcome of this effort is intended to feed into the larger environmental review process. Other components of the review, including a concurrent analysis of potential impacts on domestic environmental laws and regulations, and possibly qualitative economic/environmental analysis where quantitative analysis will not be feasible, will be combined with the quantitative assessment to complete the final environmental assessment.

The challenge represented by quantitative analysis of the potential environmental effects of the FTAA is partly one of scope. Because the President's Order covers all potential environmental effects, including those related to health and human safety, and because the FTAA will potentially leave no sector of the U.S. economy unaffected – though effects may be slight for many or most sectors – the universe of potential analysis is very large. In addition, the Working Group was asked to bear in mind the need for the quantitative analysis to proceed expeditiously. These considerations resulted in recommendations for separate *core* and *supplemental* analyses. The *core analysis*, while fraught with analytical challenges to be addressed, nevertheless would rely on existing economic and environmental modeling capabilities at the U.S. International Trade Commission, the Economic Research Service of the Department of Agriculture and the Environmental Protection Agency. It would address core environmental issues related to various media and could be launched quickly.

Despite these advantages, the *core analysis* is not comprehensive. The *supplemental* analysis is meant to address remaining issues, with these additional analyses to be conducted as soon as feasible. Since it would be impossible and unnecessary to quantitatively analyze every detailed effect of the FTAA for environmental implications, a key element of the *supplemental* analysis will be the selection of priority issues to be addressed quantitatively in the environmental review. The Working Group's discussion of the scoping aspects of the *supplemental* analysis are an elaboration of and consistent with current draft Guidelines for Environmental Reviews. As envisaged by the Working Group, once the additional issues have been identified in the *supplemental* analysis, specific recommendations can be developed for analysis, using methods that may differ from the approach used in the *core analysis*.

The Environment Group anticipates adoption of the Working Group's proposed methodology, and USTR intends to initiate work soon on the quantitative portion of the analysis to ensure the timely introduction of analytical results to the negotiating process.

REPORT OF THE QUANTITATIVE ANALYSIS WORKING GROUP

I. Summary and Recommendations:

A. ***Introduction:*** Executive Order 13141 (the EO) commits the United States Government to "factor environmental considerations into the development of its trade negotiating objectives." The proposed Free Trade Area of the Americas (FTAA) is the first major negotiation to fall within the guidelines of this directive. Since a trade agreement, especially a comprehensive agreement like the FTAA, potentially touches every sector in the economy through the primary and secondary effects of tariff changes, removal of non-tariff trade barriers and rules changes, the breadth and complexity of an environmental assessment of such policy changes are overwhelming.

We do not pretend that all of the intricacies of the analysis of this issue have been sorted out, although we have come a great distance. As a comparable analysis has never been done before, unknowns exist with implementing this analytical plan. As the plan is implemented problems will arise that will need to be addressed. These uncertainties may affect the outcomes and estimated time frames to complete the core analysis.

B. ***Recommendations:*** In order to best encompass the breadth and the complexity of this challenge, the Working Group (Advisory Working Group on Quantitative Analysis) recommends a two-pronged approach encompassing a "core analysis" of the issue, supplemented by specific sectoral and issue analyses, as the best procedure for the quantitative component of the environmental review.

1. ***Core Analysis:*** The "core analysis"can be divided into two components: first, the economic effects, such as changes in trade, production and consumption, of the FTAA are estimated; and, second, the economic effects are then used to estimate changes in some environmental variables.

The environmental effects of this analysis include:

- estimating selected environmental effects (e.g., changes in effluents) in the United States.
- estimating changes in land and water resources relating to agricultural liberalization, and
- estimating regional agriculture-related environmental effects in the United States.

2. ***"Supplemental" analyses:*** While the existing and available models that are proposed for use in the core analysis are very comprehensive in terms of the economic effects of trade, geographic areas, and products that will be analyzed, the product and geographic sectors within these models may be too aggregated to detect or fully assess important trade and environmental impacts at a detailed product level. Also, the core analysis only covers a subset of possible environmental and human health concerns. There are therefore trade, environmental, global and

extra-territorial effects that are outside the scope of the aggregate models used in the core analysis. For these reasons it is anticipated that "supplemental" analyses will be required.

C. ***The Core Analysis:*** Given the requirements of the EO and the absence of a comprehensive environmental model with the capacity for analyzing the full range of effects generated by the proposed hemispheric trade agreement, it is envisioned that the core analysis will focus on U.S. domestic effects and will be centered around the use of two existing economic models and three existing environmental models. These models have been built independently and for different purposes, and they were not designed to work together. The Working Group believes that the necessary adjustments can be made to complete the analysis described below.

1. ***Economic Models:*** To estimate the changes in the trade and output of domestic and foreign industries resulting from the trade agreement (the trade effects), Computable General Equilibrium (CGE) models will be used. Currently the ITC has experience with two such models, each with its own advantages and shortcomings:

The Global Trade Analysis Project (GTAP) model: The GTAP model is a multi-country, multi-sector CGE model representing the global economy capable of representing 50 economic sectors. Some advantages of the GTAP model are: it is a multi-country model (economic effects are estimated for the United States and other FTAA countries, generated simultaneously and in a mutually consistent way); second, it is a multi-sector model; third, the USG has experience using this model and there is a large international consortium that supports this model and that provides guidance and expertise. But drawbacks include the fact that the model's 50 sectors are too aggregated to be used directly in the second stage environmental analysis. Furthermore, the sectoral disaggregation that does exist within the model tends to be in the agricultural products area.

***The U.S. Model*:** The U.S. CGE model can be used to analyze the effects of trade liberalization on the U.S. economy. This model has been employed in a series of studies on the economic effects of significant U.S. import restraints that the ITC has undertaken for The Office of the United States Trade Representative (USTR). Its potential product detail is much more dis-aggregated than the GTAP model -- up to 485 sectors. Among its limitations are that it reports results for the United States only. In principle, in the second stage of the analysis, the economic effects arising from runs of the U.S. model could be directly input into the EPA TEAM model described below since the sector basis of both models is that of the U.S. industry input-output structure developed by the Bureau of Economic Analysis (BEA).

2. ***Environmental Models:*** Once the economic effects of the trade agreement have been estimated, these effects would then be fed into three environmental models to estimate the (mainly) domestic environmental impacts of the FTAA. The three models are:

The Future Agricultural Resources Model (FARM) of the ERS: This USDA model combines a geographical information system with a computable general equilibrium economic model (using GTAP) that simulates production, trade, and consumption of 13 goods and services. A comparative static version of FARM divides the world into eight regions. (A dynamic version of the model identifies six additional regions.) The model simulates changes in the use of land and water resources for the United States and the Western Hemisphere that include land-use shifts between cropland, grassland, forestland, and other land for up to six classes or "agroecological zones"; changes in crop yields, stocking rates, and timber harvest rates; and transfers of water between irrigation and other uses, and changes in water prices. The inputs for this model include the GTAP database and trade changes estimated by the ITC. A major limitation is that while the United States and Canada are separate regions, Latin America is included in a rest-of-the-world sector, except in the dynamic version of the model. Also, sectoral breakouts are not extensive.

The United States Regional Agricultural Model (USRAM) of the ERS: This USDA model is a mathematical programming model of the U.S. agricultural sector. It provides coverage for the contiguous 48 states, which are dis-aggregated into 45 regions. Commodity coverage includes 10 crops and several dozen processed and retail products. USRAM provides estimated changes in the following environmental indicators: embodied energy, soil loss from water erosion, soil loss from wind erosion, offsite cost of soil erosion (e.g., annualized value of lost productivity due to soil depreciation and offsite clean-up costs associated with maintaining water quality), nitrogen losses, phosphorus losses, carbon flux, and greenhouse gases. The strengths of USRAM are its extensive sectoral and regional coverage and estimated impacts for eight environmental variables of interest. Its major limitation is that it is for the U.S. only and is not comprehensive, dealing only with the agricultural sector of the economy.

The Trade Environment Analysis Models (TEAM) of the EPA: The TEAM suite of models has the potential to become what is believed to be the best surrogate for a comprehensive model. The major limitation, however, is that TEAM is under development. The core model, based on the 485-sector DOC/BEA input/output table, could be refined and updated and used to estimate the "first-order" impacts on pollutant emissions from changes in economic activity. Using emission factors derived from EPA databases and other sources for selected pollutants, the total pollutant emissions (direct and indirect) can be tracked for all sectors of the economy. This core model combines emission factors (expressed primarily in terms of mass of pollutant emission per dollar of output) with changes in output by sector to generate estimates of total, nationwide changes in emissions of certain pollutants. EPA anticipates being able to have emissions factors for: (1) criteria air pollutants, (2) pollutants covered by the Toxics Release Inventory, and (3) certain water pollutants in the United States. Among areas *not* covered by the EPA assessment are issues of land use, invasive species, protected species and depletable natural resources.

D. ***Supplemental Analysis:*** Owing to the aggregation of the sectors in the core analysis, the possible need to further illuminate some issues raised in the core analysis, and the coverage of only a subset of environmental effects in this part of the effort, "supplemental" analyses likely will be necessary.

1. ***Introduction:*** The sectoral and geographic aggregation within the models used in the core analysis may mask environmentally sensitive trade and production changes. Also, the models in the core analysis address a limited number of environmental indicators. The core analysis may identify issues (e.g., a potentially large increase in emissions that may be concentrated in one specific region) that merit further investigation in a follow-on analysis (as part of the supplemental analysis). Outside of the core environmental analysis there exists a very large number of pairs of economic effects and their related environmental impacts that could be addressed. These additional micro-sector issues, together with a myriad of trans-boundary, global, and extraterritorial effects, present the FTAA Interagency Environment Group with an almost endless list of environmental impacts from which it must identify those impacts that are of significance.

The Importance of "Scoping": There are potentially a very large number of intersections between the trade effects of the FTAA and possible environmental effects that will not require any detailed review. Also, the resources do not exist to formally analyze every possible intersection. Determining which of such intersections should, however, have further analysis does require some sense of the whole universe and a process of paring down to the few that truly matter. The supplemental analysis, in other words, begins with a substantial "scoping" exercise. In the context of this work, "scoping" refers both to defining the range of potential environmental issues subject to the President's Executive Order as well as to the range of effects of the FTAA that could affect the environment or the health of U.S. citizens.

a. ***Quantitative Indicators:*** The development of quantitative indicators for detailed sector analysis is envisioned as an important part of the supplemental work to provide information about which, if any, sectors require a more detailed analysis. In this effort it is advised that USTR ask the ITC to assemble the tariff schedules for each of the major countries in the FTAA negotiations (this exercise may be done as an input to the model simulations at any rate) and to determine the products for which the tariff reductions are particularly large. Since the changes in domestic production and trade are, in the first place, conditional on the changes in tariffs, this procedure highlights those sectors where the more significant changes are likely to take place, and that might usefully be selected for more careful analysis on the basis of environmental impacts. It should be said, of course, that this indicator will only be suggestive since many areas of relatively large trade/production changes are unlikely to raise environmental concerns, while some areas where trade/production changes are modest may be environmentally sensitive.

b. ***Participation of Federal Agencies and the Interested Public (e.g., NGOs, business, and academics) Involved in Environmentally-Related Issues:*** In conjunction with this detailed quantitative work, reliance on the expertise of federal agencies with environmental responsibilities and on the public will help to determine which pairs of economic effects and their related environmental impacts should be subjected to further review. The quantitative indicators, in and of themselves, are not sufficient to make this determination. Additional non-quantitative information will have to be brought to bear in this selection process. To determine which detailed sectors may require a more thorough partial equilibrium analysis, the expert knowledge of the various agencies with environmental responsibilities is vital, both for trade effects-environmental issue parings to be addressed as well as for identifying parts of the core analysis requiring further assessments. In addition, input from the public resulting from Federal Register Notices and input from other private sector entities (e.g., advisory committees, academic, research community and literature) will also play an important part in this effort.

2. ***Analysis to Address Issues Not Included in the Core Analysis:*** In addition to, and perhaps more important than, the supplemental analysis of the detailed sectors within the aggregations of the core model analysis are those issues that lie outside the parameters of the core analysis models. Outside of the core environmental analysis exists a large number of economic effects and their related environmental impacts that could be addressed. These additional subjects for analysis could include any trans-boundary, global, or extraterritorial effects (as well as additional domestic effects) chosen for review by the FTAA Interagency Environment Group. The suggested core analysis concentrates mostly, but not entirely, on U.S. domestic effects (some of the suggested models for the core analysis include foreign trade flows and environmental effects). In general these extra-core analysis issues lie within the following two subsets:

a. ***FTAA Negotiated Rules Changes and Non-quantifiable Changes in Non-tariff Barriers:*** Besides its focus on tariffs, quotas and other quantifiable trade barriers, the FTAA negotiations, like most trade agreements, will encompass non-tariff barriers, rule changes and other non-quantifiable aspects of international trade that cannot be analyzed using existing trade models. For these issues a qualitative economic analysis of potential environmental and health effects must be used. As in the case of dis-aggregated product sectors, the range of issues within this category is broad, and the issues must be "scoped" to identify those issues with important environmental ramifications.

b. ***Global, Trans-boundary, and Extra-territorial Environmental Effects*****:** Although the focus of the executive order that has initiated this effort clearly is on those environmental effects that occur within the United States, the directive does state that:

"As appropriate and prudent, reviews may also examine global and trans-boundary impacts." With only a few notable exceptions, the environmental responsibilities of U.S. government agencies lie within the confines of the United States and its territories, and the capacity to perform even a superficial quantitative analysis of these extra-territorial effects is limited. Nevertheless, to be consistent with the Executive Order, any trans-border, global or foreign country environmental issues to be addressed are likely to be identified through a less formal process of scoping than could be envisaged for the domestic effects analysis. Private sector views, agency expertise, and the existing literature on trade and the environment may highlight specific potential concerns beyond the strictly domestic. In such a case the FTAA Interagency Environment Group could ask for a quantitative analysis, tailored to non-domestic environmental issues. Such analysis would not be part of the core analysis, but rather fall in the area of supplemental analysis.

E. ***Time and Resource Requirements:*** The resources, both staff time and contract funds, required to conduct the core analysis are substantial. The three agencies with the principal analytical tools and personnel have estimated that the types of quantitative environmental analyses described would take about 8 -13 months, requiring approximately 104 person-months of staff time and $750,000 for contractors. Responsible agencies are in the process of identifying and securing the personnel and financial resources that would be required.

II The Task: To Identify Quantitative Tools Available to Measure the Environmental Effects of Free Trade Agreements

A. The Question

The FTAA Interagency Environment Group created the Advisory Working Group on Quantitative Analysis (the Working Group) in response to Executive Order 13141 (the EO) of November 16, 1999. The EO commits the United States Government to "factor environmental considerations into the development of its trade negotiating objectives. Responsible agencies will accomplish these goals through a process of ongoing assessment and evaluation, and, in certain instances, written environmental reviews." The EO states that comprehensive multilateral trade rounds, bilateral or multilateral free trade agreements, and major new trade liberalizations agreements in natural resource sectors require an environmental review. The EO further states that "[a]s a general matter, the focus of environmental reviews will be impacts in the United States. As appropriate and prudent, reviews may also examine global and trans-boundary impacts."

To meet the requirements of the EO, the FTAA Interagency Environment Group has constituted this Working Group to advise on the feasibility of conducting a quantitative assessment of the environmental impacts of the proposed FTAA. A quantitative analysis is just one component of the environmental review. The EO implementing Guidelines provide that the environmental review shall contain both an economic impact section and a regulatory review section. Even within the economic impact component of the review, formal modeling will not be applicable and/or available for certain environmental issues and a qualitative approach will be necessary as has been the case in earlier environmental reviews of trade agreements.

The Working Group was asked to address the following questions:

1. Trade Effects of Tariff Elimination:

   What type(s) of formal quantitative analysis should be employed to estimate changes in U.S. macroeconomic variables as well as sectoral trade, production, consumption and investment arising from FTAA tariff elimination? What is the appropriate level of sector disaggregation for such analysis (e.g. narrowly or broadly defined goods/service sectors)? To what extent and at what effort can such information be generated for effects in other FTAA countries? What resources (e.g., human, financial; within, outside the Executive Branch) would be necessary to conduct each type of analysis? What resources are available? Are there potential constraints other than resources on the feasibility of formal technical analysis? What is the best feasible analysis? How much time would such analyses require?

2. Trade Effects of Non-Tariff Barrier Elimination:

To what extent can the effects of changes in various non-tariff measures by the FTAA on trade, production and consumption be estimated? What are the resources necessary and the time required to conduct such analysis? What resources are available?

3. Environmental Effects Resulting from the Trade Effects

What formal quantitative models are available, or could be developed, to estimate the impact of changes in trade, production, consumption or investment resulting from the FTAA on quantitative measures relevant to human health and environmental standards, objectives, and performance in the United States? What resources and how much time would be necessary to conduct such analysis? What resources are available? To what extent and at what effort can such information be generated for global and trans-boundary impacts?

In light of the necessary sequencing of the two stages of the quantitative analysis (estimates of trade effects needing to precede estimation of environmental effects), what would be the total time required to complete formal quantitative estimates of the impact of the FTAA on environmental parameters?

In order to address the questions asked by the FTAA Interagency Environment Group, it is necessary to define the potential universe of issues that may need to be addressed in the environmental review. In a typical project for which an environmental impact assessment is required, the environmental impacts are often relatively contained and the types of effects generally known. A trade agreement, especially a comprehensive agreement like the FTAA, potentially touches every sector in the economy through the primary and secondary effects of tariff changes, removal of non-tariff trade barriers and rules changes. Any one of these sectoral trade, production, or consumption effects could affect multiple environmental indicators as well. This situation clearly demonstrates the importance of a well thought-out procedure to identify and to focus on the areas to be addressed in the review. (See discussion on scoping in Section VII.)

A simple analytical paradigm illustrates the importance of the scoping issue in the FTAA environmental review. Consider a table with perhaps 200 rows, one for each product to be liberalized by the FTAA, and 40 columns, one for each type of environmental or human health concern. The number of product/environmental concerns for which data, an analytical framework and results are required tallies to 8,000 for this example, and even at 8,000, the tally may be too low. Environmentally sensitive trade/production changes may only be visible in more finally disaggregated data than the 200 sector level and 40 may be an insufficient number of environmental or health concerns. In addition, environmental changes may only be visible at a regional level rather than a national level. Because of the lack of comprehensive tools and data sets to reflect the entire universe of product/environmental concern pairings in a single unified framework, the Working Group believes that neither the time nor

resources exist to analyze the full universe of such issues. As noted previously in the recommendations (Section I.B.), the Working Group has suggested an approach to this problem.

B. Challenges

Measuring the impact of trade agreements on the environment is a relatively new, and an analytically complex, area of study. To date, there have been relatively few attempts to comprehensively analyze the quantitative effects of a comprehensive agreement. Some of the complex issues include:

The Dimensions of Such Analysis. Some significant trade or environmental effects may be visible at only the most detailed level of consideration, while impacts on trade or the environment as measured through broader, economy-wide trade analysis may be understated due to product and geographic aggregation problems. For a comprehensive environmental analysis of a general trade agreement, an economy-wide trade model with highly detailed sector disaggregation, closely integrated with detailed predictive models covering all areas of environmental concerns, would be ideal. Clearly, such tools do not exist, neither for the trade effects analysis alone, nor for the environmental analysis, nor with respect to the integration between the two (though progress is being made all the time).

The Isolation of the Trade Agreement Effects from other Factors: It is also difficult to separate out those effects resulting from the trade agreement from other factors such as economic growth and trade expansion that would occur even without the trade agreement, particularly if such isolation of trade effects is attempted through the context of a forecasting model.

The Ability to Measure All Components of the Trade Agreement: Typically, a trade agreement will focus on tariff reductions, quotas, tariff-rate quotas, other non-tariff trade barriers and rules changes. However, not all of these components or their effects can be quantitatively measured (especially with some non-tariff trade barriers and rules changes). The currently available models for trade analysis make it relatively easy to address tariff reductions. Quotas can be modeled in most circumstances, with the quantitative restrictions typically translated into price changes and then fed into the models. However, the data for many FTAA countries may not be available. Tariff rate quotas can also be modeled by expressing them as tariff equivalents, although data and methodological issues sometimes preclude comprehensive treatment. Modeling other policy changes presents additional measurement and methodological challenges. Furthermore, before entering into full scale estimation of the impacts of quotas and tariff rate quotas, it would be important to examine the relative importance of tariffs vs. quotas in the trade regimes of these countries to determine if such an analysis is a wise expenditure of scarce resources.

Linkage Between Trade Liberalization Models and Environmental Models: As will be discussed, there are linking issues between the economic and environmental models that need

to be addressed, i.e., outputs of the trade models are not necessarily defined or estimated in a manner to serve directly as inputs into existing environmental models. Commodities, for example, are more aggregated in global trade models than in most environmental models, and so some sectors in the environmental models may need to be aggregated. Also, environmental data is often not organized in the same way as economic data.

Scarcity of Environmental Models of Trade Liberalization: There are currently only a few existing examples of attempts to model the effects of trade liberalization on the environment, and these generally only cover a limited number of environmental impacts. There is no one model that comprehensively covers all environmental concerns. Therefore, different environmental models will need to be utilized to look at as many potentially significant environmental impacts, as possible.

Environmental Data Limitations: Finally, environmental data are limited, especially for developing countries. EPA anticipates examining pollutants beyond those listed in this report (see page 34). Also, environmental effects are likely to be most apparent at the local level; this is below the geographic resolution of most environmental models. Finally, marginal (new) emissions factors may differ from average/current emissions factors.

C. Ways in which Trade Liberalization affects the Environment

A categorization of the ways in which trade liberalization can affect the environment appears in the 1994 OECD document, "Methodologies for Environmental and Trade Reviews" (OECD (1994)). This categorization has been adopted by many analysts and is a convenient way of discussing what is and is not reasonable to expect of quantitative modeling efforts in this area. The five categories are scale effects, structural effects, technology effects, product effects, and regulatory effects.

Scale effects are those associated with the overall level of economic activity or macroeconomic effects arising from a trade agreement. If economic growth takes place without the relationship of pollution to output changing, scale effects have a negative environmental impact.

Structural effects (also known as *composition effects)* arise from changes in the pattern of economic activity among industries or sectors arising from trade liberalization. If a country begins to export relatively "clean" products in exchange for relatively "dirty" products, structural effects can have a positive impact; if the reverse happens, there may be a negative impact.

Technology effects are associated with changes in the way products are made (the technology of production). Positive technology effects come about if trade liberalization reduces emissions per unit of output, and may be associated with technology transfer from foreign direct investment (FDI) associated with a liberalization. In principle, there can also be negative technology effects.

Product effects arise from increased trade in specific products. Positive product effects come about from trade facilitating the diffusion of more environmentally-friendly products such as fuel-efficient cars and machinery. Negative product effects may come about from increased trade in hazardous waste, toxic chemicals, endangered species, or invasive species.

Regulatory effects are associated with the legal and policy effects of a trade agreement on environmental regulations, standards, or other measures, and can also be positive or negative.

The analytical tools discussed below, particularly CGE modeling, primarily provide information on *scale* and *structural effects* of trade liberalization. With appropriate modifications, they may provide some limited information on *technology effects.* Analysis of *product effects* is more likely to emerge in the context of specific analyses of sensitive products (e.g. partial equilibrium analysis) should any such be undertaken. Analysis of *regulatory effects* may best be undertaken in the non-quantitative portion of the environmental review.

III. The Aggregate ("Core") Analysis

Given the complexity of the issues to be addressed and the methodological and data challenges of the quantitative portion of an environmental review, the Working Group has structured its recommendation to the FTAA Interagency Environment Group in terms of a "core" analysis, supplemented by specific sectoral or issue analyses for the quantitative portion of the environmental review of the FTAA. The base of this "core" analysis on trade effects are the current economic analytical tools that have been utilized in prior analyses of trade agreements. While some empirical studies of the impact of the FTAA are available in the literature, the existing studies are inadequate for the purposes of the environmental review. In addition, the conduct of a quantitative analysis by USG would provide flexibility in structuring the trade effects analysis to support the follow on modeling of environmental effects.

A. Literature Review

Any quantitative analysis of the effects of the FTAA should be preceded by a review of the literature more extensive than that conducted by the Working Group. This review should cover existing attempts to model the economic effects of the FTAA and analyses of possible environmental effects of trade liberalization in the region. Such a literature review should also discuss the current state of analysis on whether, and under what circumstances, trade liberalization, and economic growth associated with such liberalization, tends to be positive or negative for the environment. Such a review should also examine the literature on investment and environmental policy issues associated with trade liberalization.

With respects to the aspects of the agreement that can be analyzed and the type of and extent to which effects can be captured, existing static economic analyses of the FTAA project that the economic impact of such an agreement on the U.S. economy, and on most particular sectors in the economy, is likely to be modest due to the small size of the trade flows to be liberalized relative to the overall size of the U.S. economy. Bilateral trade flows between North American Free Trade Agreement (NAFTA) on the one hand, and the Common Market of the South (MERCOSUR), the Andean Community, the Central American Common Market (CACM) and the Caribbean Common Market (CARICOM) on the other amounted to about $90 billion in 1999, and the increase in such trade flows potentially induced by liberalization (perhaps $5-$30 billion, at a back-of-the envelope guess) amounts to less than ½ of 1% of a U.S. GDP exceeding $9 trillion dollars.With respect to solely U.S. effects, there exists the option of foregoing the expense and time of CGE modeling and arguing based on logic and existing economic studies that the effects are de minimis, recognizing that some effects may be suppressed in model results due to product aggregation, non-quantifiable aspects of the agreement, and the non-capture of dynamic growth effects. There would also be the possibility of identifying some such exceptions with respect to specific products and sectors for detailed analysis.

The Working Group reviewed several analyses of FTAA-type liberalization scenarios using CGE methods existing in the literature. These analyses vary according to the degree of regional and sectoral detail, the assumed nature of the liberalization, and the date of the baseline. The Working Group was

able to obtain a rough idea of the nature of the results which would be obtained from a new modeling exercise, as well as the ways in which a new exercise could add value to already existing results.

Results in the literature focusing on manufacturing indicate likely output changes ranging between an increase of 0.5% and a decrease of 0.5% for U.S. industries as a result of the FTAA, when analyzed at a level of detail including, single categories for all chemicals, products of all metals, all electronic equipment and all machinery and equipment. For countries elsewhere in the FTAA, larger changes ranging between an increase of 10% and a decrease of 10% were observed, with the larger changes for smaller countries. These results are consistent both with the fact that the changes in trade induced by the FTAA are large relative to the smaller trading partners and with the fact that the United States is already closer to free trade than other FTAA members.

Results in the literature which focus on agriculture indicate larger percentage changes for agriculture than for manufacturing as a result of the FTAA. Such results are consistent with the fact that current levels of protection are on average higher for agriculture than for manufacturing in most countries. This suggests that, as related to changes in production, environmental impacts of the FTAA, either positive or negative, are more likely to be found for environmental indicators such as land use (e.g. deforestation or reforestation), biodiversity, water use, etc., with links to agriculture than for indicators linked primarily to manufacturing. The largest estimated percentage increases in agricultural production are for the small Central American and Caribbean countries, followed by the Andean countries.

B. Shortcomings of Existing Analysis

Currently existing estimates in the literature tend to use base periods ranging from about 1990 to 1995, depending on the study. New quantitative estimates could potentially improve on those existing in the literature in a number of significant respects, including the following:

More accurate representation of the FTAA. Studies using older base periods may not include the full effect of MERCOSUR and the many other new bilateral or regional arrangements in the hemisphere in the baseline, as well as unilateral policy changes. Thus, they can mistakenly attribute the effects of these already agreed-to liberalizations to the FTAA.

More careful measurement of existing levels of protection in agriculture. A significant portion of current protection in agriculture takes the form of tariff-rate quotas (TRQs). Though the economic effects of these can in principle be measured, the process of quantifying TRQs is resource-intensive. Although it is probably not possible to provide a definitive measure of the tariff equivalent of all TRQs in all countries, resources devoted to such measurement would likely add significantly to the accuracy of both the economic estimates and the follow-on environmental estimates.

Taking into account structural change in the economies in question. The relative importance of different sectors and industries changes over time. While even results using a 1995 base period can

provide useful information for policy purposes, any feasible updating of the base period would move both the economic and environmental estimates in the direction of greater realism.

C. The Core Analysis

The core analysis involves an economy wide assessment of selected environmental effects of tariff reductions in the FTAA. There are two aspects to this work: (1) estimating the economic effects of the FTAA (changes in the trade and output of domestic industries); and (2) translating these outputs changes into changes in selected environmental effects such as changes in land and water resources relating to agricultural liberalization, regional agriculture-related environmental effects and other selected environmental effects in the United States regarding pollutants (many potential areas of environment or health issues are not covered in currently available models).

Due to the lack of a comprehensive environmental model, follow-on or supplemental sectoral/ issues analysis would be required to address any additional areas that are uncovered through the scoping exercise. For example, such supplemental analyses may also be required to address issues that are identified as a result of the core analysis. It is anticipated that supplemental analyses will use either quantitative or qualitative methods.

For the first part of the work, the basic inputs into the model are the tariff reductions and tariff rate quota changes, which fall to zero within some specified time frame, and possibly some non-tariff barrier changes. The outputs of the model are the changes in domestic production and trade that would occur in the United States. There are several models within the Government that could be used to make these assessments, including a) GTAP (the multi-country CGE model) maintained at the ITC, and b) the U.S. Model (the U.S.-only CGE model) also maintained by the ITC. (See Appendix A for a detailed discussion of these models.)

The second part of the core analysis could be completed primarily by the Environmental Protection Agency and the Economic Research Service (ERS) of the U.S. Department of Agriculture. The EPA would use its TEAM models. The ERS would use its FARM and USRAM Models. The final results would be estimates of changes in various categories of pollution in the United States that could be expected from the trade agreement. (See Appendix A for a detailed discussion of these models.)

The economic effects of the FTAA would be estimated in a comparative static analysis with the ITC's GTAP model. Before undertaking the analysis, the current GTAP database needs to be modified and updated to: a) reflect economic growth and changes in industrial structure since the last version of the GTAP database[1], b) reflect the current complex pattern of regional and bilateral trade liberalizations

[1]For GTAP 4, the base year is 1995. GTAP 5, with a 1997 baseline, is soon to be released. The decision on which version of GTAP to use for the analysis will be based on technical consultations between ITC and ERS.

already under effect or agreed to by the FTAA countries, and c) measure the tariff equivalents of non-tariff measures where feasible, particularly tariff-rate quotas (TRQs) in agriculture. ERS would provide data to update the base data and protection levels for the agricultural products in the ITC's GTAP model. The updated database and FTAA trade shocks would be used as inputs by ERS to estimate changes in land and water resources and to estimate regional agriculture-related environmental effects in the United States. Estimated changes in U.S. production of non-agricultural goods and services will be used as inputs by EPA to estimate other environmental effects in the United States.

Changes in land and water use would be estimated in a comparative static analysis with ERS's FARM modeling framework using the updated database and trade shocks provided by ITC. Before conducting the analysis, FARM's land and water resources database needs to be updated to conform to the regional and sectoral composition of current GTAP databases. In addition, FARM's database and computable general equilibrium economic model would simultaneously be modified in order to expand the number of agricultural commodities for which economic impacts can be obtained. Environmental indicators provided by this analysis for the United States and other regions in the Western Hemisphere include: a) land-use shifts between cropland, grassland, forestland, and other land for up to six land classes or "agro-ecological zones"; b) changes in crop yields, livestock stocking rates, and timber harvest rates; c) transfers of water between irrigation and other uses; and d) changes in water prices. Estimated changes in the demand for U.S. agricultural exports, the supply of agricultural imports into the United States, and U.S. production in some agriculture-related sectors would be used as inputs by ERS's USRAM and EPA's TEAM models.

Regional agriculture-related environmental effects in the United States would be estimated in a comparative static analysis with ERS's USRAM model using the trade impacts obtained by the FARM modeling framework to modify the export demand and import supply of USRAM's agricultural commodities. Modifying export demands and import supplies for commodities with a one-to-one mapping from FARM to USRAM (e.g., rice, wheat, and raw milk) is straightforward. Modifying export demands and import supplies of other commodities will involve isolating the trade impacts of specific commodities from FARM's commodity aggregates (e.g., separating corn, soybean, and cotton from FARM's other grains n.e.c., oil seeds, and plant-based fiber commodities, respectively). Once the appropriate shifts have been obtained, USRAM will simultaneously estimate changes in production and environmental indicators. Changes in environmental indicators include: embodied energy, soil loss from water erosion, soil loss from wind erosion, offsite cost of soil erosion (e.g., annualized value of lost productivity due to soil depreciation and offsite clean-up costs associated with maintaining water quality), nitrogen losses, phosphorus losses, carbon flux, and greenhouse gases. Estimated changes in U.S. production in some agriculture-related sectors will be used as inputs by EPA's TEAM model.

Other environmental effects in the United States would be estimated by EPA's TEAM, using changes in production obtained by the ITC's GTAP model, ITC's U.S. Model and ERS's FARM and USRAM models. Some of these production changes will have a one-to-one mapping to the sectors in TEAM. Other production changes will have to be re-aggregated in order to conform to the existing sectors in

TEAM, or the sectors in TEAM will have to be aggregated in order to conform to the production changes estimated by the economic models.

IV. Sector ("Supplemental") Analysis

In addition to issues identified from the core analysis, supplemental analysis will likely be necessary owing to the aggregation of the sectors in the core analysis models (possibly masking environmentally sensitive trade and production changes), the core analysis results being for a limited number of environmental indicators, and the core analysis itself may highlight topics (i.e., regional issues) for additional analysis. Outside of the core environmental analysis will exist a very large number of product effect/environmental issue intersections that could be addressed. These additional subjects for analysis could include any transboundary, global, or extraterritorial effects (as well as additional domestic effects) chosen for review by the FTAA Interagency Environment Group. The suggested core analysis concentrates mostly, but not entirely, on U.S. domestic effects. Most such intersections will not require any review, and the resources do not exist to formally analyze every possible such intersection. Determining which of such intersections should, however, have further analysis does require some sense of the whole universe and a process of paring down to the few that truly matter. The supplemental analysis, in other words, begins with a substantial scoping exercise.

To assist the FTAA Interagency Environment Group in determining which of these issues to address in the supplemental analysis, two methods to narrow the scope should be considered. First, the development of quantitative indicators for detailed sector analysis could be part of the supplemental work to provide information on which, if any, sectors require a more detailed analysis. Second, and in conjunction with this detailed quantitative work, reliance on the expertise of federal agencies with environmental responsibilities and the public could be utilized to help determine which product effect/environmental issue pairings outside those of the core analysis should be subjected to further review.

It would be possible for USTR to ask the ITC to assemble the tariff schedules for each of the major countries in the FTAA negotiations (this may be done as an input to the model simulations) and determine the products for which the tariff reductions are particularly large. Since the changes in domestic production and trade are, in the first place, conditional on the changes in tariffs, this procedure highlights those sectors where the more significant changes are likely to take place. This quantitative indicator could be used to help identify detailed sectors that one might want to select for partial equilibrium (single-sector) analysis on the basis of suspected environmental impacts. It should be said, of course, that this indicator would only be suggestive as many areas of relatively large trade/production changes are unlikely to raise environmental concerns, while some areas where trade/production changes are modest may be environmentally sensitive.

Because it will be up to the FTAA Interagency Environment Group or its designee to determine which additional areas require formal analysis, the issue of what tools to utilize and what resources would be needed will depend on the analyses requested, and will have to be determined at a later date.

V. Estimates of time and resource costs.

The resources, both staff time and contract funds, required to conduct the core analysis are substantial. The three agencies with the principal analytical tools and personnel have estimated that the types of quantitative economic and environmental analyses described will take about 8 -13 months, requiring approximately 104 person-months of staff time and $750,000 for contractors. Responsible agencies are in the process of identifying and securing personnel and financial resources that would be required.

The ITC can carry out an analysis of the economic effects of the FTAA using the GTAP model and can be asked by USTR to assist in the development of sectoral data for input into the EPA pollution emission model via the U.S. Model. It is expected to take 8 months to update the base data (i.e., tariffs, structural changes, NTBs to the extent feasible) and run the standard comparative static GTAP model. The ITC would concurrently begin to update and adjust the U.S. Model and define the sectors and sector aggregations. It is expected to take a total of 9 months to produce final results using the U.S. Model, assuming the specific sectors can be defined within the first 4 months.

ERS can analyze the impacts of the FTAA on land and water use with the FARM model, but not before the current version is updated to conform to the regional and sectoral resolution of the current GTAP database. These revisions would proceed simultaneously and necessitate interaction with the ITC. It is expected that revisions would take 6 months and could run concurrently with the work of the ITC on the GTAP model. An additional 2 months would be required to complete the FARM-based analysis. After changes in U.S. exports and imports are provided for the relevant commodities, ERS can analyze the agriculturally related environmental impacts of the FTAA with the USRAM model. It is expected to take 2 months (1.5 months running concurrently with the FARM-based environmental analysis) to complete the USRAM-based analysis.

EPA anticipates it would take 6 to 8 months to implement desired enhancements to its TEAM model. This effort would be undertaken while ITC and ERS are conducting their analyses, and the three agencies are addressing the sectoral aggregation issues. An additional 2 to 4 months following the completion of the ITC's runs of the U.S. Model would be required to complete the actual core analysis of environmental impacts, including initial identification of possible areas for supplemental analyses (i.e., regional and sectoral issues).

As noted previously, the ITC, ERS, and EPA can also conduct follow on activities such as extensions of the general equilibrium based "core analysis" for either specific economic sectors or specific environmental issues. In addition, the ITC, USDA, EPA, and the Department of Commerce (as well as other agencies with environmental responsibilities) have the capability to conduct a partial equilibrium analysis of individual sectors/environmental issues. It should be noted however, that the time and resource estimates above do not include such analyses. Estimates of the time and resources required for the specific types of analysis can be made at the time the topic to be studied is identified by the scoping process.

The milestones specified below envision that the resources for all three agencies would be available at the start of the review project:

Month 4	Completion of definition of sectoral aggregations.
Month 8	Completion of ITC comparative-statics analysis using GTAP
Month 9	Completion of ITC comparative-static analysis based on U.S. model
Month 10	Completion of ERS core environment analyses using FARM and USRAM and ITC GTAP results
Month 11-13	Completion of EPA core environment analyses based on ITC/ERS results

VI. Further Considerations of Global, Trans-Border & Trade Partner Effects

The President's EO mandates an assessment of domestic environmental effects and permits the consideration of global or trans-border effects of trade agreements, as appropriate. The request to the Working Group asked for advice on formal quantitative analysis of the effects of tariff and non-tariff barrier changes from an FTAA on measures relevant to human health and environmental standards, objectives and performance in the United States. The core analysis suggested above looks at multi-country economic effects of an FTAA but primarily at U.S. domestic environmental effects. However, some estimates of changes in land and water use outside the United States will be generated as a by-product of the FARM model. The "follow on" analysis suggested above is intended to supplement the core analysis with respect to economic effects of the FTAA and related environmental concerns.

While the complexity associated with a comprehensive review of FTAA effects and environmental outcomes for the United States alone provides significant challenges, similar analytical aspirations with respect to global, transboundary, or foreign country effects appear to be beyond the range of currently available tools. In addition to methodological difficulties, the paucity of measurements of environmental indicators and other essential data outside the United States would hamper such quantitative analyses.

Consistent with the EO, any trans-border, global or foreign country environmental issues to be addressed are likely to be identified through a less formal process of scoping than could be envisaged for the domestic effects analysis. Private sector views, agency expertise, the existing literature on trade and the environment may highlight specific potential concerns beyond the strictly domestic. In such a case the FTAA Interagency Environment Group could ask for a quantitative analysis, tailored to non-domestic environmental issues. Such analysis would not be part of the core analysis, but rather fall in the area of "supplemental" analysis. Since specific trans-border, global or foreign country environmental issues that might be considered in the environmental review of the FTAA have not yet been identified, no advice as to tools, resources or timing is provided here.

VII. Executive Agency Survey ("Scoping")

A. Introduction: The Critical Importance of Scoping.

Scoping refers both to defining the range of potential environmental issues subject to the President's Executive Order as well as to the range of effects of the FTAA that could affect the environment or human health. Scoping is an important activity in the environmental review process for two reasons.

First, the EO does not call for the examination of selected topics, but the study of any significant environmental effect likely arising from a trade agreement. This argues for identifying the entire universe of potential environmental concerns covered by the EO and then following some reasonable process for identifying those areas where one might expect the possibility of significant environmental effects. Second, the breadth of potential environmental issues falling within the scope of the EO appears to be very broad, including a multitude of issues from air and water quality to human health issues.

The core analysis described in this paper is valuable not just for its analytical results, but also as an important step in the scoping process, by which the universe of potential trade effects and environmental issues is reduced to a significant degree. The core analysis should therefore be supplemented to pick up legitimate potential areas of environmental concern for additional study. The selection of these additional issues for formal analysis will most likely have to depend on informed qualitative methods of selection. The FTAA Interagency Environment Group would want to take into account, in tasking formal quantitative analysis beyond that of the core analysis, all such sources of information, such as public responses to Federal Register notices, the views of and opinions of knowledgeable experts in and out of government, and the relevant literature. This report assumes that, on the basis of such sources of information, as well as the core analysis, the FTAA Interagency Environment Group will selectively identify, for tailored analysis, more detailed areas of trade effects from an FTAA because they are judged the most likely to raise environmental concerns.

B. Agency Contacts

Because the FTAA is one of the first reviews under the President's EO to be undertaken, there is not yet an established universe of environmental concerns that define the potential universe of such concerns covered by the EO. Although the Working Group on Quantitative Analysis was not directly charged with a scoping exercise, coming to grips with the scoping issue was nevertheless viewed as a prerequisite for completion of the Group's work. To that end, the Group decided to undertake a series of meetings with the various agencies of the U.S. government charged with environmental responsibilities. The purpose of these meetings was actually two-fold: to scope out the range of environmental issues potentially affected by the FTAA as well as to ascertain resources available to the agencies capable of conducting formal quantitative analysis on areas falling within the agency's responsibilities.

The Working Group has met with every federal agency that has been identified as having an environmental responsibility, the Army Corps of Engineers excepted. This includes the Department of Commerce's National Oceanic and Atmospheric Administration, the Department of Energy, the Department of Transportation, the Department of Interior, the Food and Drug Administration, the Forest Service of the Department of Agriculture, and the Animal and Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture. The Environmental Protection Agency was not included in this process because of its instrumental role in the design of the core analysis.

C. Conclusions

From its meetings with agencies with environmental responsibilities, the members of the Working Group drew several conclusions:

(1) The universe of covered environmental issues is wide and linkages of such issues to effects of the FTAA complex. There is no one methodology that can easily assure that the whole universe of potential environmental issues has been examined and all relevant issues identified and carefully assessed. Clearly, the greatest expertise within the federal government on the range of environmental issues potentially covered by the President's EO resides with EPA and other federal agencies with environmental mandates. It also appears clear that doing as thorough a job as possible on the quantitative analytical side would require the active participation of these agencies.

(2) Even with this active participation, however, the task will be difficult. Many agencies do not have environmental offices but treat various environmental issues on a decentralized basis among the various organizational units of the agency. In some instances the agencies' involvement with domestic environmental regulation is limited to the monitoring of actions taken under the jurisdiction of states or localities. Furthermore, some of the relevant agencies have little active involvement in international trade issues and would have difficulty knowing where to begin, or who within the agency should have the responsibility for relating changes resulting from the FTAA to various areas of their environmental responsibilities or concerns. In this regard, "outreach" materials in the form of detailed descriptions of the FTAA and expected economic effects may have to be provided to these agencies to help begin the process of considering whether any of the agency's environmental concerns are likely to be affected by the FTAA and whether further detailed analysis is therefore warranted. In some cases, finite resources and competing priorities may limit what agency staffs perceive to be their ability to devote resources to the environmental review of the FTAA.

(3) Despite these complexities, the involvement of the environmentally-related federal agencies in the analytical aspects of the review appears essential to its completion and meeting the spirit of the EO. In the core analysis suggested above, the environmental issues that will be addressed by EPA, while considerable, will not be comprehensive. For the FTAA Interagency Environment Group to be assured that the fullest effort has been made in considering the broad range of potentially significant issues, the

resources, internal expertise, and relationships with academic and private sector research communities that each of the environmentally-related agencies possesses will have to be brought to bear.

APPENDIX A Identification of Quantitative Tools Available:

A. Overview

The analytical framework for measuring the environmental effects resulting from a trade agreement involve two aspects. The first involves the estimation of the changes in the trade and output of domestic industries resulting from the trade agreement (trade effects), and uses such quantitative tools such as computable general equilibrium (CGE) models or partial equilibrium models. The second aspect involves the translation of those output changes into changes in environmental effects (taking these trade effects and plugging them into environment models to show any environmental effects). The U.S. Government currently has at its disposal trade effect models, environment models, and integrated trade and environment models, though none of these models are comprehensive.

B. Trade Effects:

1. CGE Models

General equilibrium models analyze market interactions within an economy between producers and consumers for goods, services, labor, and physical capital. The distinguishing feature of a general equilibrium model is its economy-wide coverage and multi-sectoral nature. General equilibrium models can be either single country or multi-country. A general equilibrium model explicitly accounts for upstream and downstream production linkages and competition between sectors for labor and capital. In addition, the general equilibrium approach considers the balance of trade, income transfers associated with quotas and tariffs, and economy-wide resource constraints for labor and capital. These additional features of general equilibrium models provide a more complete or comprehensive assessment of employment, output, and trade effects of policy changes.

Trade analyses simulate reduction in import costs by removing tariffs, tariff rate quotas (TRQs), and non-tariff barriers (NTBs) in protected sectors. The resulting decline in the price of imports in the protected sector induces an increase in the quantity of imports demanded and simultaneously induces a reduction in the demand for the competing domestic product (in a comparative static framework, that is to say, ignoring any effects of future growth). The primary effects of removing the import restraints are a decline in the output of the domestic import competing products.

There are secondary effects of liberalization that are realized in sectors that are upstream and downstream to the liberalized sector. The CGE model allows the estimation of both primary and secondary effects. These secondary, or indirect, effects are important since they can enhance or diminish the direct effects of liberalization in the protected sectors. In the model, these secondary effects occur mainly through changes to the real exchange rate and the reallocation of production inputs (labor and capital) to export goods and services and non-traded goods and services.

The most common form of CGE analysis is "comparative statics" analysis, which takes base data for a given year and compares scenarios with or without a given policy change (e.g., what would the global economy have looked like in 1995 if the FTAA had already been fully implemented, as compared to what it actually did look like? Would trade flows, production of specific goods, etc., be larger or smaller?). The strength of the comparative static approach is that it clearly isolates the effect of the policy change under consideration and is well established methodologically. Its limitations are that it does not capture important dynamic effects of trade agreements nor describe how the effects of trade agreements will act upon the economy under future economic conditions.

There are two reasons why policymakers might be interested in a dynamic analysis. The first is that trade agreements are often phased in over a period of time. It may be useful to see an estimated "glide path" of effects for a phased-in liberalization (comparative-static analyses usually analyze a full liberalization as compared to zero liberalization), or to see an estimate of the effects of liberalization simulated against a future baseline (e.g. the economy in 2010 as opposed to 1995). Either of these needs can be met by estimating dynamics against a moving baseline, which is similar to in some ways to estimating a sequence of comparative-statics models for different points in time. Even in this case, comparative-statics analyses will usually give the flavor of the dynamic analysis.

The second reason is that trade liberalization may have, in fact, effects on economic growth over and above the efficiency effects which are captured in comparative-static analysis. Methods exist for estimating some of the dynamic (growth) effects of trade liberalization. Such estimates are both more complex and less standardized than simple moving-baseline dynamics, and there are methodological controversies surrounding them. Dynamic models are likely to produce larger estimates of both the economic benefits of trade liberalization, and its potential environmental impacts (both positive or negative), than comparative-static models - modestly larger for moving-baseline estimates, and potentially substantially larger for estimates incorporating dynamic growth effects.

U.S. government agencies have a significant body of experience in estimating the quantitative effects of trade agreements. CGE analysis – comparative static and moving baseline dynamics, but not dynamic growth versions of CGE analysis – has become the primary tool of such policy analysis. This framework, developed in the late 1970s, began to be applied in USG policy analysis in the 1990s. By 1991, the U.S. International Trade Commission (ITC) had developed a CGE model of the United States for trade policy analysis (the "U.S. Model") which has been used in a number of investigations. The diffusion of CGE modeling in government accelerated due to intensified demands for analysis by both the Executive Branch and Congress while the NAFTA and Uruguay Round agreements were under consideration during 1992-94.

There are two types of CGE models that USG currently uses that measure the effects of trade policy changes: The Global Trade Analysis Project (GTAP) model[2] and the U.S. Model. The U.S. International Trade Commission (ITC) has experience with both of these CGE models, and the U.S. Department of Agriculture (USDA) has experience with the GTAP model and a different U.S. model.

a. The Global Trade Analysis Project (GTAP)

The GTAP model is a multi-country, multi-sector CGE model representing the global economy. The GTAP model is capable of representing 50 economic sectors (though it remains largely aggregated with respect to traded goods, e.g. "Machinery and Equipment" and 12 regions within the FTAA, as well as an arbitrary number of non-FTAA regions (table A-1).

The strengths of GTAP are that (1) it is a CGE model whose main benefit is that the solutions are simultaneous; (2) it is a multi-country global model (economic effects estimated for the United States and other FTAA countries are generated simultaneously and in a mutually consistent way); (3) it is a multi-sector model; (4) the USG has a lot of experience in using this model, and there is a large consortium supporting this model and providing guidance and expertise, and therefore timing considerations may be more minimal than other types of modeling exercises; (5) as with other CGE models, some forms of dynamic effects could be measured; and (6) it feeds into USDA's FARM model that measures land use, etc., and may with modifications feed into EPA's environmental models, though not completely.

The limitations of GTAP deal primarily with the specific sectors of the model: (1) there are only 50 sectors which are fewer than would be optimal for directly linking with EPA's model for environmental effects which contains 485 sectors); and (2) the sectors being so aggregated, the model may underestimate the trade effects from a policy change such as a trade agreement. Furthermore, the base year from which the analysis is to be conducted is 1995 for Version 4 or 1997 for Version 5.

Product aggregation bias may result in which a sub-sector may actually have a large positive or negative impact but these negative impacts are offsetting in such a way that the overall reported

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[2]A significant portion of CGE analysis in the U.S. government is facilitated by the work of the Global Trade Analysis Project (GTAP) at Purdue University. The work of GTAP is supported by an international consortium in which the U.S. government is represented by the U.S. Department of Agriculture Economic Research Service (ERS), the U.S. International Trade Commission, and the Environmental Protection Agency's Economy and Environment Division. The consortium members advise and influence on future development of the database and modeling. USG CGE modeling is also enriched by ongoing interactions with researchers elsewhere in the GTAP consortium (e.g. the World Bank, OECD, Australian Productivity Commission, International Food Policy Research Institute (IFPRI)) and with modelers at research institutions adopting non-GTAP CGE modeling frameworks, some of which rely on the GTAP database.

Table A-1
Aggregation for GTAP Version 4, by sector or region

Sectors			
pdr	Paddy rice	b_t	Beverages and tobacco
wht	Wheat	tex	Textiles
gro	Cereal grains nec	wap	Wearing apparel
v_f	Vegetables, fruit, and nuts	lea	Leather products
osd	Oil seeds	lum	Wood products
c_b	Sugar cane, sugar beet	ppp	Paper, pulp, and publishing
pfb	Plant-based fibers	p_c	Petroleum and coal products
ocr	Crops nec	crp	Chemicals, rubber, plastics
ctl	Cattle, sheep, goats, horses	nmm	Non-metallic minerals
oap	Animal products nec	i_s	Ferrous metals
rmk	Raw milk	mfn	Metals nec
wol	Wool, silkworm cocoons	fmp	Metal products
for	Forestry	mvh	Motor vehicles and parts
fsh	Fishing	otn	Transport equipment nec
col	Coal	ele	Electronic equipment
oil	Oil	ome	Machinery and equipment nec
gas	Gas	omf	Manufactures nec
omn	Minerals nec	ely	Electricity
cmt	Meat: cattle, sheep, goat, horse	gdt	Gas manufacture, distribution
omt	Meat: other products nec	wtr	Water
vol	Vegetable oils and fat	cns	Construction
mil	Dairy products	t_t	Trade, transport
pcr	Processed rice	osp	Finance, business, rec services
sgr	Sugar	osg	PubAdmin, defense, educ, health
ofd	Other food products	dwe	Dwellings

Regions			
CAN	Canada	BRA	Brazil
USA	United States	CHL	Chile
MEX	Mexico	URY	Uruguay
CAM	Central America and Caribbean	RSM	Rest of South America
VEN	Venezuela	JPN	Japan
COL	Colombia	EU	European Union (6 subregions)
EPB	Rest of Andean Pact (Ecu,Per,Bol)	ROW	Rest of world (24 subregions)
ARG	Argentina		

sector shows little change. At present, the technical experts on the Working Group do not know the empirical importance of such effects for the environmental review, though they could be significant given highly aggregated trade sectors, such as "machinery and equipment," "electronic equipment," and "chemicals."

b. The ITC U.S. Model

The "U.S. Model" is another CGE model that is available at the ITC that can be used to analyze the effects of trade liberalization on the U.S. economy. This model has been employed in a series of studies on the economic effects of significant U.S. import restraints that ITC has undertaken for USTR, and is based on the same U.S. input-output table underlying the EPA's damage-function analysis (see appendix B for a list of these sectors). Its potential product detail is much more disaggregated than the GTAP model -- up to 485 sectors -- though all of these sectors cannot be run simultaneously. Among its limitations are that it reports results for the United States only. In principle, economic effects arising from runs of the U.S. Model could be directly input into the EPA damage-function model as the sector basis of both reflects the U.S. industry input-output structure.

The U.S. Model was constructed and is normally used to examine the effects of U.S. policy changes, taken simultaneously with respect to the whole world, rather than simultaneous U.S. and foreign policy changes with respect to a subset of U.S. trade such as the FTAA. An extension of the U.S. Model which can handle both subsets of U.S. trade, and simultaneous U.S. and foreign policy changes, which would be required for an FTAA analysis.

The strengths of using the U.S. Model are that (1) it is a CGE model whose main benefit is that the solutions are simultaneous; (2) it is a multi-sector model; (3) the USG has a lot of experience in using this model for policy changes affecting the United States; and (4) it appears to feed into EPA's environmental model.

The limitations of using the U.S. Model include: (1) it requires development of tariff inputs for the FTAA countries; (2) it has not been thoroughly tested/implemented in measuring policy changes resulting from regional trade agreements; and (3) the base year from which the analysis is conducted is1996.

2. Partial Equilibrium Models

An additional method for modeling the economic effects of trade policies is partial equilibrium modeling. Partial equilibrium models consider the behavior of one product or sector at a time (e.g. wheat, or steel), by isolating that sector from the activity in other sectors or in the economy as a whole, which is assumed to remain constant. In partial equilibrium trade models, domestic varieties of a product coexist with imported varieties from one or more sources. Changes in tariffs or other trade policies cause consumers to shift a part of their purchases away from varieties which become relatively more

expensive toward cheaper varieties. Changes in domestic production volumes, employment, and relative prices can be inferred from these models, as well as changes in consumer and producer surplus, tariff revenue accruing to the government, and economic welfare as a whole.

The fact that the prospective FTAA liberalizations affect all products simultaneously, and that effects on one product or sector spill over into other sectors generally makes CGE analysis more appropriate than partial equilibrium modeling for the first stages of an environmental analysis of the trade agreement. However, partial equilibrium analysis has the significant advantage over CGE that it can be conducted for narrowly defined products which are not distinguished in the aggregated data used for CGE analysis. This makes partial equilibrium analysis a potential candidate for "drilling down" to get more detailed information of environmental effects related to particular products of special concern.

One drawback to using partial equilibrium analysis is that it does not incorporate important impacts between sectors. To overcome this drawback, it is recommended that any partial equilibrium analysis include the major upstream links and the major downstream links. By including the major upstream and downstream links, the more important cross-sectorial impacts should be uncovered. A second drawback is that tariff/tax equivalents would need to be developed for sectors with TRQs, quotas, etc.

C. Environmental Effects

USDA has two models, the Future Agricultural Resources Model (FARM) and the U.S. Regional Agricultural Model (USRAM, but also known as USMP), and the Environmental Protection Agency (EPA) has one model, the Emissions and Damage Functions Model (EDFM), that report some environmental effects resulting from trade effects that are useful in this project. There are also a variety of single use models that have been developed to treat specific environmental issues.

1. The FARM Model

This USDA model combines a geographical information system with a computable general equilibrium economic model (derived from the first version of GTAP) that simulates production, trade, and consumption of 13 goods and services. A comparative static version of FARM divides the world into eight regions: the United States, Canada, the European Community, Japan, Other East Asia (China, including Hong Kong and Taiwan plus South Korea), Southeast Asia (Indonesia, Malaysia, Philippines, Singapore, and Thailand), Australia and New Zealand, and the Rest-of-World. A dynamic version further divides the Rest-of-World region into the Former Soviet Union and Mongolia, Other Europe, Other Asia, Latin America, and Africa. The model simulates changes in the use of land and water resources (table A-2). Land-use changes

Table A-2
Environmental Indicators Provided by FARM

Environmental Indicator	Geographic Resolution
Cropland	Agro-ecological zone or region
Grassland	Agro-ecological zone or region
Forestland	Agro-ecological zone or region
Other land	Agro-ecological zone or region
Aggregate crop yields	Agro-ecological zone or region
Stocking rates	Agro-ecological zone or region
Timber harvest rates	Agro-ecological zone or region
Irrigation water	Region
Water price	Region

Note.--The FARM model will use the same sectoral and regional aggregation as the ITC GTAP model, based on either GTAP Version 4 or GTAP Version 5.

include shifts between crop land, grassland, forest land, and other land. Such changes are provided for in up to six land classes or "agro-ecological zones" within each region (see figure A-1). Changes in land-use intensity are provided by changes in aggregate crop yields, livestock stocking rates, and timber harvest rates. Changes in water resources are limited to transfers between irrigation and other uses and to changes in water prices.

The strengths of using FARM are that (1) it explicitly estimates changes in land and water resources in the U.S. and other areas of the Western Hemisphere and (2) these changes are estimated for different zones within countries or multi-country regions. This will provide some initial information about the potential effects of the FTAA on natural habitats throughout the Western Hemisphere and the extent to which such effects may generate potential global and trans-boundary impacts.

The limitations of using FARM are that (1) it is highly aggregated both with respect to sectors and regions; (2) the model has been used primarily for analyses of global climate change (Darwin and others, 1995) rather than for analyses of trade liberalization, so experience is limited (Darwin and others, 1996); and (3) the current base year is 1990.

2. The USRAM Model

This USDA model is a mathematical programming model of the U.S. agricultural sector (see House and others, 1999). It provides coverage for the contiguous 48 states, which are disaggregated into 45 regions (figure A-2). Commodity coverage includes ten crops (corn, sorghum, oats, barley, wheat, rice, cotton, soybeans, hay, and silage), 16 primary livestock enterprises (the principal ones being dairy, swine, beef cattle, and poultry), and several

Figure A-1

Global Distribution of Agro-Ecological Zones in the Future Agricultural Resources Model

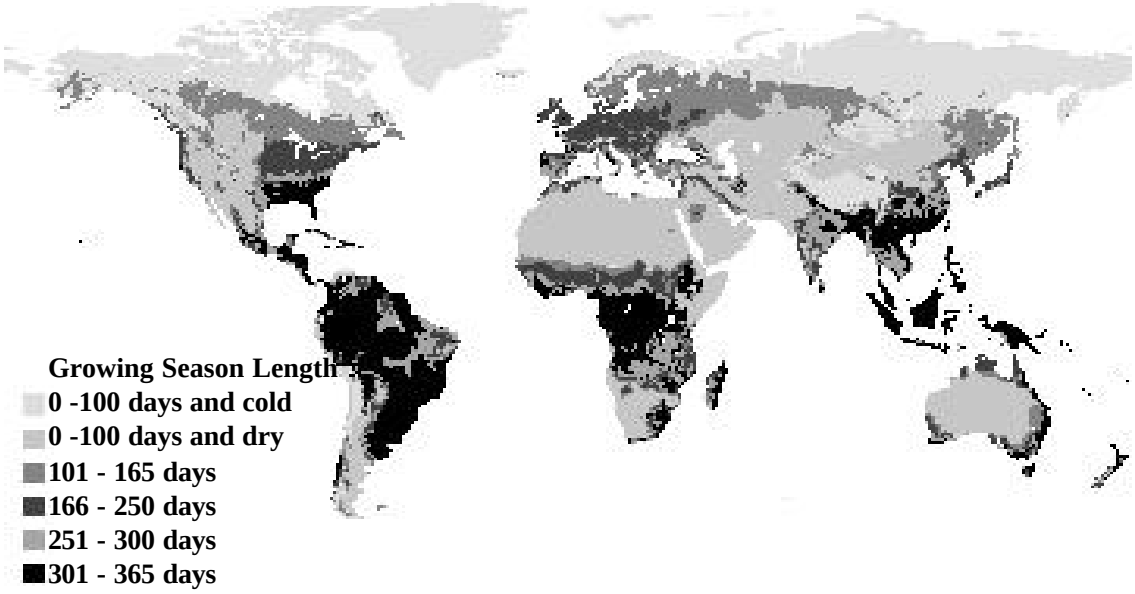
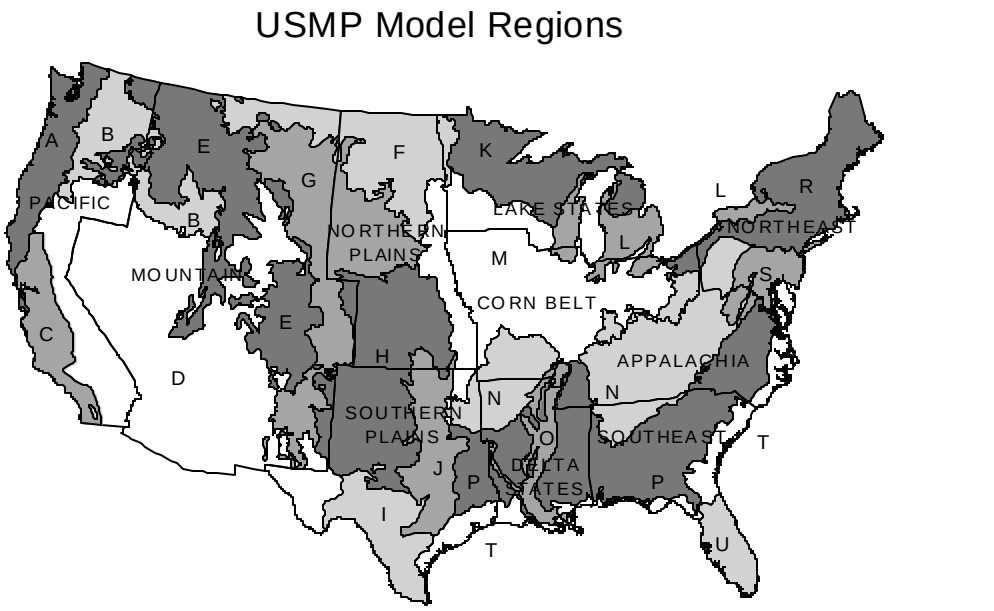


Figure A-2



Farm Production and Land Resource Regions

NT - Northeast	A - NW Forest, Forage, and Spec. Crops	K - N. Lake States Forest and Range
LA - Lake States	B - NW Wheat and Range	L - Lake States Fruit, Truck, and Dairy
CB - Corn Belt	C - Cal. Subtrop. Fruit, Truck, and Spec. Crops	M - Central Feed Grains and Livestock
NP - Northern Plains	D - Western Range and Irrigated	N - East and Central Farming and Forest
AP - Appalachia	E - Rocky Mountain Range and Forest	O - Mississippi Delta Cotton and Feed Grains
SE - Southeast	F - N. Great Plains Spring Wheat	P - S. Atl. & Gulf Slope Cash Crops, Forest, Lvst.
DL - Delta States	G - W. Great Plains Range and Irrigated	R - Northeast Forage and Forest
SP -Southern Plains	H - W. Great Plains Winter Wheat and Range	S - North Atlantic Slope Diversified Farming
MN - Mountain	I - SW. Plateaus and Plains Range and Cotton	T - Atlantic & Gulf Coast Lowland Forest and Crop
PA - Pacific	J - SW. Prairies Cotton and Forage	U - Fla. Subtropical Fruit, Truck Crop, Range

USMP model region nomenclature is the concatenation of abbreviations for farm production and land resource region, e.g. CBM is Corn Belt M, LAM is Lake States M, etc.

dozen processed and retail products. USRAM provides estimated changes in the following environmental indicators: embodied energy, soil loss from water erosion, soil loss from wind erosion, offsite cost of soil erosion (e.g., annualized value of lost productivity due to soil depreciation and offsite clean-up costs associated with maintaining water quality), nitrogen losses, phosphorus losses, carbon flux, and greenhouse gases (table A-3).

The strengths of using USRAM are that (1) it provides information on environmental variables, some of which are unavailable from other models, (2) this information is regional as well as national, (3) the crop and livestock commodities covered are not highly aggregated, and (4) possibilities for base year range from 2000 to 2010.

Table A-3
USRAM Environmental Indicators

Indicator	Description	Activity Units	Report Units
Total	Total All Commodities--Used For Sums	Na	Na
Emenergy	Embodied Energy	Units	Million Units
Soildep	Soil Depreciation Allowance	Us$	Million Us$
Erosion	Soil Loss From Water Erosion	Tons	Million Tons
Ersncost	Off-Site Soil Erosion Cost	Us$	Million Us$
Windersn	Soil Loss From Wind Erosion	Tons	Million Tons
Nsoln	Nitrogen Loss In Solution (Surface Runoff)	Lbs	Million Lbs
Nsedmnt	Nitrogen Loss With Sediments	Lbs	Million Lbs
Nleach	Nitrogen Leaching Potential	Lbs	Million Lbs
Ndenite	Nitrogen Loss By Denitrification	Lbs	Million Lbs
Nloss	Total Nitrogen Loss To The Environment	Lbs	Million Lbs
Nflux	Nitrogen Flux	Tons	Million Tons
Nfluxval	Nitrogen Flux Value	Us$	Million Us$
Psoln	Phosphorus Loss In Solution (Surface Runoff)	Lbs	Million Lbs
Psedmnt	Phosphorus Loss With Sediments	Lbs	Million Lbs
Pleach	Phosphorus Leached	Lbs	Million Lbs
Ploss	Total Phosphorus Loss To The Environment	Lbs	Million Lbs
Cflux	Carbon Flux	Tons	Million Tons
Cfluxval	Carbon Flux Value	Us$	Million Us$
Embodied Energy	Barrels Diesel Fuel Equiv. In Inputs	Tons	Million Tons
Greenhouse Gases	Carbon Equiv. Of Nvol, Cflux, Embodied Energy	Tons	Million Tons

The limitations of using USRAM are that (1) it provides information about environmental impacts only for the U.S., (2) it only deals with environmental impacts associated with the agriculture sector, (3) coverage of the agriculture sector is not comprehensive, and (4) experience analyzing trade liberalization with the model is limited.

3. The TEAM Model

EPA could employ and further develop what is believed to be the best surrogate for a comprehensive model, the TEAM suite of models, though it covers only some, not all, areas of potential environmental and health and safety concerns. Ideally, a comprehensive analysis would be able to fully employ what is termed the "damage-function" approach in carrying out this analysis. That is, changes in economic activity, as provided by the ITC and USDA, would be translated into changes in pollutant emissions, possibly expressed as an increment in emissions per increment in trade. These would then be translated into changes in environmental quality (e.g., changes in ambient concentrations of an air pollutant), that would be translated into changes in human health or welfare (e.g., change in number of pollution-related

hospitalizations), which would then be expressed as a monetary value. No such comprehensive model exists. Further, carrying out a complete "damage-function" analysis, even for a single pollutant for a single sector, generally requires considerable amounts of time and resources. Usually separate analyses are also required for each pollutant in each medium (e.g., land, air or water) as well as separate analyses for each relevant location (e.g., air shed or ecosystem). Since the FTAA could have effects (however small) on every pollutant in every part of the United States, such thoroughness will not be feasible for this analysis. EPA anticipates focusing instead on estimating the selected first order emission-type indicators, in the core analysis.

EPA could refine and update its core Trade and Environment Analysis Model (TEAM), based on the 485-sector DOC/BEA input/output table, for estimating the "first-order" impacts on pollutant emissions from changes in economic activity. TEAM's core model uses the total requirements coefficients from the 1992 US input-output accounts to measure the quantity (measured in dollars) of every input needed to produce every commodity that final consumers buy. Using emission factors derived from EPA databases and other sources for selected pollutants, the total pollutant emissions (direct and indirect) can be tracked for all sectors of the economy. This model combines emission factors (expressed primarily in terms of mass of pollutant emission per dollar of output) with changes in output by sector to generate estimates of total, nationwide changes in emissions of certain pollutants. EPA anticipates being able to have emissions factors for at least: (1) the criteria air pollutants–tropospheric ozone precursors, particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead; (2) selected pollutants of the approximately 600 chemicals covered by the Toxics Release Inventory, and (3) certain water pollutants (biological oxygen demand(BOD), total suspended solids (TSS), and heavy metals) in the United States. Among areas not covered by the EPA assessment would be issues of land use, invasive species, protected species and depletable natural resources.

If the FTAA causes changes for specific pollutant emissions that are essentially environmentally insignificant, the analysis would not proceed further to estimate changes in environmental quality, impacts, etc. On the other hand, should the FTAA be estimated to cause a significant change, e.g., in a particular pollutant in a sensitive location, then EPA could carry the assessment further or propose the issue for follow-on analyses (as part of the supplemental analysis) as described below.

Problems of Linkage between Trade Models and the EPA Model

At present, the GTAP model is too aggregated for use directly as an input to the first step in the damage function approach outlined above. The GTAP model used for the analysis of the economic effects aggregates the economy into 50 sectors (in which manufacturing activity is under represented for purposes of EPA analyses) while the environmental analysis will utilize a 485 sector model. With a 50 sector model, the effect on sub-sectors can be moving in different directions resulting in the need for greater disaggregation for environmental analysis. Therefore, some means for disaggregating these results would have to be developed. One possibility is matching the 485-sector aggregation of the EPA damage-function model directly to estimates of the impact of the FTAA on the United States

economy using the ITC's U.S. Model. A second option, is to use the U.S. Model to develop estimates for some number of sectors that is larger than the 50 now present in the GTAP model. Other, less desirable, options include developing a "back-of-the-envelope" analysis that considers the heterogeneity of the sectors, etc., or utilizing available government, industry and environmental experts to advise on non-homogeneities that they anticipate and how they think they can be dealt with. Unresolved technical issues remain for each of these approaches.

Even the first order analysis detailed above will require substantial amounts of time and resources, both to refine existing tools to use and for the actual execution of the analysis. Should more detailed damage function analyses be required for particular pollutants/locations, additional time and resources will be required. Further, the single emission factor employed in the TEAM described above is necessarily a gross simplification of the widely varying source-level emission factors that exist in the 485 sectors. Consider, for example, electric power as both an input and a final demand. Large variations exist in U.S. power plant emission factors, due to the age of the facility (since older facilities have typically been 'grandfathered in' when new standards are set), fuel (e.g., natural gas vs. coal vs hydro power), etc. Also, different parts of the country have different environmental standards, depending on local circumstances, which creates differences in emission factors. Therefore, the estimated impacts of the FTAA on emissions within the United States that arise from this analysis will have to be considered rough estimates.

TEAM's main strengths are its breadth of coverage of pollution emissions and its consistency with the best theory on how to assess environmental impacts. Nevertheless, as discussed elsewhere, the approach is still under development, will be resource intensive to refine and expand, can not be utilized fully, and entails a number of significant technical issues that must be resolved.

4. Discrete Single Use Models

There are a variety of discrete single use models developed to deal with individual environmental issues. Some of these models may be relevant, once the scoping has occurred for areas outside the core analysis. Once those particular areas of product/environmental concerns are identified, a thorough search should be made for available tools to translate trade and production effects of the FTAA into effects on the particular environmental parameter. In fact, if the various federal agencies and sub-agencies with environmental responsibilities play a principal role in the scoping of issues outside the core analysis, as the Working Group recommends, they will be best placed to know the formal analytical tools applicable to environmental issues in their respective areas of responsibility and may in fact use such tools as part of the scoping process.

Appendix B
Industry Classification of the 1992 Benchmark Input-Output Accounts

I-O industry number and title		Related 1987 SIC codes
1 Livestock and livestock products:		
1.0100	Dairy farm products	024,*019, *0259, *029
1.0200	Poultry and eggs	0251-3, *0259, *019, *0219, *029
1.0301	Meat animals	0211-4, *0219, *019, *0259, *029
1.0302	Miscellaneous livestock	0271-3, *0279, *019, *0219, *0259, *029
2 Other agricultural products:		
2.0100	Cotton	0131, *019, *0219, *0259, *029
2.0201	Food grains	*011, *019, *0219,*0259, *029
2.0202	Feed grains	*011, *0139, *019,*0219, *0259, *029
2.0203	Grass seeds	*0139, *019, *0219, *0259, *029
2.0300	Tobacco	0132, *019, *0219, *0259, *029
2.0401	Fruits	0171-2, 0174-5, *0179, *019, *0219, *0259, *029
2.0402	Tree nuts	0173, *0179, *019, *0219,*0259, *029
2.0501	Vegetables	0134, *0139, 016, *019, *0219, *0259, *029, *0119
2.0502	Sugar crops	0133, *019, *0219, *0259, *029
2.0503	Miscellaneous crops	*0119, *0139, *019, *0219, *0259, *029
2.0600	Oil bearing crops	0116, *0119, *0139, *0219, *0259, *029
2.0701	Forest products	*018, *019, *0219, *0259, *029
2.0702	Greenhouse and nursery products	*018, *019,* 0219, *0259, *029
3 Forestry and fishery products:		
3.0001	Forestry products	081, 083, 097
3.0002	Commercial fishing	091
4 Agricultural, forestry, and fishery services:		
4.0001	Agricultural, forestry, and fishery services	0254, *0279, 071-2, 075-6, 085, 092
4.0002	Landscape and horticultural services	078
MINING		
5+6 Metallic ores mining:		
5.0001	Iron and ferro alloy ores, and miscellaneous metal ores, n.e.c.	101, 106, 1099
6.0100	Copper ore	102
6.0200	Nonferrous metal ores, except copper	103-4, 1094, *108
7 Coal mining:		
7.0000	Coal	122-3, *124
8 Crude petroleum and natural gas:		
8.0001	Crude petroleum and natural gas	131-2, *138
9+10 Nonmetallic minerals mining:		
9.0001	Dimension, crushed and broken stone	141-2
9.0002	Sand and gravel	144
9.0003	Clay, ceramic, and refractory minerals	145
9.0004	Nonmetallic mineral services and miscellaneous minerals	*148, 149
10.0000	Chemical and fertilizer minerals	147
CONSTRUCTION		
11 New construction:		

I-O industry number and title		Related 1987 SIC codes
11.0101	New residential 1-unit structures, nonfarm	*15, *17, *6552
11.0102	New residential 2-4 unit structures, nonfarm	*15, *17
11.0105	New residential additions and alterations, nonfarm	*15, *17
11.0108	New residential garden and high-rise apartments	*15, *17, *6552
11.0400	Highways and streets	*16-17
11.0501	New farm housing units and additions and alterations	*15, *17
11.0601	Petroleum and natural gas well drilling	*138
11.0602	Petroleum, natural gas, and solid mineral exploration	*138, *108, *124, *148
11.0603	Access structures for solid mineral development	*108, *124, *148
11.0800	Office, industrial, and commercial buildings	*15, *17
11.0900	Other new construction	*15-17
12 Maintenance and repair construction:		
12.0101	Maintenance and repair of farm and nonfarm residential structures	*15, *17
12.0214	Maintenance and repair of highways and streets	*16-17
12.0215	Maintenance and repair of petro- leum and natural gas wells	*138
12.0300	Other maintenance and repair	*15-17
MANUFACTURING		
13 Ordnance and accessories:		
13.0100	Guided missiles and space vehicles	3716
13.0200	Ammunition, except for small arms, n.e.c.	3483
13.0300	Tanks and tank components	3795
13.0500	Small arms	3484
13.0600	Small arms ammunition	3482
13.0700	Ordnance and accessories, n.e.c.	3489
14 Food and kindred products:		
14.0101	Meat packing plants	2011
14.0102	Sausages and other prepared meat products	2013
14.0105	Poultry slaughtering and processing	2015
14.0200	Creamery butter	2021
14.0300	Natural, processed, and imitation cheese	2022
14.0400	Dry, condensed, and evaporated dairy products	2023
14.0500	Ice cream and frozen desserts	2024
14.0600	Fluid milk	2026

I-O industry number and title		Related 1987 SIC codes
14.0700	Canned and cured fish and seafoods	2091
14.0800	Canned specialties	2032
14.0900	Canned fruits, vegetables, preserves, jams, and jellies	2033
14.1000	Dehydrated fruits, vegetables, and soups	2034
14.1100	Pickles, sauces, and salad dressings	2035
14.1200	Prepared fresh or frozen fish and seafoods	2092
14.1301	Frozen fruits, fruit juices, and vegetables	2037
14.1302	Frozen specialties, n.e.c.	2038
14.1401	Flour and other grain mill products	2041
14.1402	Cereal breakfast foods	2043
14.1403	Prepared flour mixes and doughs	2045
14.1501	Dog and cat food	2047
14.1502	Prepared feeds, n.e.c.	2048
14.1600	Rice milling	2044
14.1700	Wet corn milling	2046
14.1801	Bread, cake, and related products	2051
14.1802	Cookies and crackers	2052
14.1803	Frozen bakery products, except bread	2053
14.1900	Sugar	2061-3
14.2002	Chocolate and cocoa products	2066
14.2004	Salted and roasted nuts and seeds	2068
14.2005	Candy and other confectionery products, including chewing gum	2064, 2067
14.2101	Malt beverages	2082
14.2102	Malt	2083
14.2103	Wines, brandy, and brandy spirits	2084
14.2104	Distilled and blended liquors	2085
14.2200	Bottled and canned soft drinks	2086
14.2300	Flavoring extracts and flavoring syrups, n.e.c.	2087
14.2400	Cottonseed oil mills	2074
14.2500	Soybean oil mills	2075
14.2600	Vegetable oil mills, n.e.c.	2076
14.2700	Animal and marine fats and oils	2077
14.2800	Roasted coffee	2095
14.2900	Edible fats and oils, n.e.c.	2079
14.3000	Manufactured ice	2097
14.3100	Macaroni, spaghetti, vermicelli, and noodles	2098

I-O industry number and title		Related 1987 SIC codes
14.3201	Potato chips and similar snacks	2096
14.3202	Food preparations, n.e.c.	2099
15 Tobacco products:		
15.0101	Cigarettes	211
15.0102	Cigars	212
15.0103	Chewing and smoking tobacco and snuff	213
15.0200	Tobacco stemming and redrying	214
16 Broad and narrow fabrics, yarn and thread mills:		
16.0100	Broadwoven fabric mills and fabric finishing plants	221-3, 2261-2
16.0200	Narrow fabric mills	224
16.0300	Yarn mills and finishing of textiles, n.e.c.	2269, 2281-2
16.0400	Thread mills	2284
17 Miscellaneous textile goods and floor coverings:		
17.0100	Carpets and rugs	227
17.0600	Coated fabrics, not rubberized	2295
17.0700	Tire cord and fabrics	2296
17.0900	Cordage and twine	2298
17.1001	Nonwoven fabrics	2297
17.1100	Textile goods, n.e.c.	2299
18 Apparel:		
18.0101	Women's hosiery, except socks	2251
18.0102	Hosiery, n.e.c.	2252
18.0201	Knit outerwear mills	2253
18.0202	Knit underwear and nightwear mills	2254
18.0203	Knitting mills, n.e.c.	2259
18.0300	Knit fabric mills	2257-8
18.0400	Apparel made from purchased materials	231-8
19 Miscellaneous fabricated textile products:		
19.0100	Curtains and draperies	2391
19.0200	Housefurnishings, n.e.c.	2392
19.0301	Textile bags	2393
19.0302	Canvas and related products	2394
19.0303	Pleating and stitching	2395
19.0304	Automotive and apparel trimmings	2396
19.0305	Schiffli machine embroideries	2397
19.0306	Fabricated textile products, n.e.c.	2399
20+21	**Lumber and wood products:**	
20.0100	Logging	241
20.0200	Sawmills and planing mills, general	2421
20.0300	Hardwood dimension and flooring mills	2426
20.0400	Special product sawmills, n.e.c.	2429
20.0501	Millwork	2431
20.0502	Wood kitchen cabinets	2434
20.0600	Veneer and plywood	2435-6

I-O industry number and title		Related 1987 SIC codes
20.0701	Structural wood members, n.e.c.	2439
20.0702	Prefabricated wood buildings and components	2452
20.0703	Mobile homes	2451
20.0800	Wood preserving	2491
20.0901	Wood pallets and skids	2448
20.0903	Wood products, n.e.c.	2499
20.0904	Reconstituted wood products	2493
21.0000	Wood containers, n.e.c.	2441, 2449
22+23	Furniture and fixtures:	
22.0101	Wood household furniture, except upholstered	2511
22.0102	Household furniture, n.e.c.	2519
22.0103	Wood television and radio cabinets	2517
22.0200	Upholstered household furniture	2512
22.0300	Metal household furniture	2514
22.0400	Mattresses and bedsprings	2515
23.0100	Wood office furniture	2521
23.0200	Office furniture, except wood	2522
23.0300	Public building and related furniture	253
23.0400	Wood partitions and fixtures	2541
23.0500	Partitions and fixtures, except wood	2542
23.0600	Drapery hardware and window blinds and shades	2591
23.0700	Furniture and fixtures, n.e.c.	2599
24 Paper and allied products, except containers:		
24.0100	Pulp mills	261
24.0400	Envelopes	2677
24.0500	Sanitary paper products	2676
24.0701	Paper coating and glazing	2671-2
24.0702	Bags, except textile	2673-4
24.0703	Die-cut paper and paperboard and cardboard	2675
24.0705	Stationery, tablets, and related products	2678
24.0706	Converted paper products, n.e.c.	2679
24.0800	Paper and paperboard mills	262-3
25 Paperboard containers and boxes:		
25.0000	Paperboard containers and boxes	265
26A Newspapers and periodicals:		
26.0100	Newspapers	271
26.0200	Periodicals	272
26B Other printing and publishing:		
26.0301	Book publishing	2731
26.0302	Book printing	2732

I-O industry number and title		Related 1987 SIC codes
26.0400	Miscellaneous publishing	274
26.0501	Commercial printing	275
26.0601	Manifold business forms	276
26.0602	Blankbooks, looseleaf binders and devices	2782
26.0700	Greeting cards	277
26.0802	Bookbinding and related work	2789
26.0803	Typesetting	2791
26.0806	Platemaking and related services	2796
27A Industrial and other chemicals:		
27.0100	Industrial inorganic and organic chemicals	281, 2865, 2869
27.0401	Gum and wood chemicals	2861
27.0402	Adhesives and sealants	2891
27.0403	Explosives	2892
27.0404	Printing ink	2893
27.0405	Carbon black	2895
27.0406	Chemicals and chemical preparations, n.e.c.	2899
27B Agricultural fertilizers and chemicals:		
27.0201	Nitrogenous and phosphatic fertilizers	2873-4
27.0202	Fertilizers, mixing only	2875
27.0300	Pesticides and agricultural chemicals, n.e.c.	2879
28 Plastics and synthetic materials:		
28.0100	Plastics materials and resins	2821
28.0200	Synthetic rubber	2822
28.0300	Cellulosic manmade fibers	2823
28.0400	Manmade organic fibers, except cellulosic	2824
29A Drugs:		
29.0100	Drugs	283
29B Cleaning and toilet preparations:		
29.0201	Soap and other detergents	2841
29.0202	Polishes and sanitation goods	2842
29.0203	Surface active agents	2843
29.0300	Toilet preparations	2844
30 Paints and allied products:		
30.0000	Paints and allied products	285
31 Petroleum refining and related products:		
31.0101	Petroleum refining	291
31.0102	Lubricating oils and greases	2992
31.0103	Products of petroleum and coal, n.e.c.	2999
31.0200	Asphalt paving mixtures and blocks	2951
31.0300	Asphalt felts and coatings	2952
32 Rubber and miscellaneous plastics products:		
32.0100	Tires and inner tubes	301

I-O industry number and title		Related 1987 SIC codes
32.0200	Rubber and plastics footwear	302
32.0300	Fabricated rubber products, n.e.c.	306
32.0400	Miscellaneous plastics products, n.e.c.	308
32.0500	Rubber and plastics hose and belting	3052
32.0600	Gaskets, packing, and sealing devices	3053
33+34	**Footwear, leather, and leather products:**	
33.0001	Leather tanning and finishing	311
34.0100	Boot and shoe cut stock and findings	313
34.0201	Shoes, except rubber	3143-4, 3149
34.0202	House slippers	3142
34.0301	Leather gloves and mittens	315
34.0302	Luggage	316
34.0303	Women's handbags and purses	3171
34.0304	Personal leather goods, n.e.c.	3172
34.0305	Leather goods, n.e.c.	319
35	**Glass and glass products:**	
35.0100	Glass and glass products, except containers	321, 3229, 323
35.0200	Glass containers	3221
36	**Stone and clay products:**	
36.0100	Cement, hydraulic	324
36.0200	Brick and structural clay tile	3251
36.0300	Ceramic wall and floor tile	3253
36.0400	Clay refractories	3255
36.0500	Structural clay products, n.e.c.	3259
36.0600	Vitreous china plumbing fixtures	3261
36.0701	Vitreous china table and kitchenware	3262
36.0702	Fine earthenware table and kitchenware	3263
36.0800	Porcelain electrical supplies	3264
36.0900	Pottery products, n.e.c.	3269
36.1000	Concrete block and brick	3271
36.1100	Concrete products, except block and brick	3272
36.1200	Ready-mixed concrete	3273
36.1300	Lime	3274
36.1400	Gypsum products	3275
36.1500	Cut stone and stone products	328
36.1600	Abrasive products	3291
36.1700	Asbestos products	3292
36.1900	Minerals, ground or treated	3295
36.2000	Mineral wool	3296
36.2100	Nonclay refractories	3297
36.2200	Nonmetallic mineral products, n.e.c.	3299
37	**Primary iron and steel manufacturing:**	

I-O industry number and title		Related 1987 SIC codes
37.0101	Blast furnaces and steel mills	3312
37.0102	Electrometallurgical products, except steel	3313
37.0103	Steel wiredrawing and steel nails and spikes	3315
37.0104	Cold-rolled steel sheet, strip, and bars	3316
37.0105	Steel pipe and tubes	3317
37.0200	Iron and steel foundries	332
37.0300	Iron and steel forgings	3462
37.0401	Metal heat treating	3398
37.0402	Primary metal products, n.e.c.	3399
38 Primary nonferrous metals manufacturing:		
38.0100	Primary smelting and refining of copper	3331
38.0400	Primary aluminum	3334
38.0501	Primary nonferrous metals, n.e.c.	3339
38.0600	Secondary nonferrous metals	334
38.0700	Rolling, drawing, and extruding of copper	3351
38.0800	Aluminum rolling and drawing	3353-5
38.0900	Nonferrous rolling and drawing, n.e.c.	3356
38.1000	Nonferrous wiredrawing and insulating	3357
38.1100	Aluminum castings	3363, 3365
38.1200	Copper foundries	3366
38.1300	Nonferrous castings, n.e.c.	3364, 3369
38.1400	Nonferrous forgings	3463
39 Metal containers:		
39.0100	Metal cans	3411
39.0200	Metal shipping barrels, drums, kegs, and pails	3412
40 Heating, plumbing, and fabricated structural metal products:		
40.0100	Enameled iron and metal sanitary ware	3431
40.0200	Plumbing fixture fittings and trim	3432
40.0300	Heating equipment, except electric and warm air furnaces	3433
40.0400	Fabricated structural metal	3441
40.0500	Metal doors, sash, frames, molding, and trim	3442
40.0600	Fabricated plate work (boiler shops)	3443
40.0700	Sheet metal work	3444
40.0800	Architectural and ornamental metal work	3446
40.090	Prefabricated metal buildings and components	3448
40.0902	Miscellaneous structural metal work	3449
41 Screw machine products and stampings:		

I-O industry number and title		Related 1987 SIC codes
41.0100	Screw machine products, bolts, etc.	345
41.0201	Automotive stampings	3465
41.0202	Crowns and closures	3466
41.0203	Metal stampings, n.e.c.	3469
42	Other fabricated metal products:	
42.0100	Cutlery	3421
42.0201	Hand and edge tools, except machine tools and handsaws	3423
42.0202	Saw blades and handsaws	3425
42.0300	Hardware, n.e.c.	3429
42.0401	Plating and polishing	3471
42.0402	Coating, engraving, and allied services, n.e.c.	3479
42.0500	Miscellaneous fabricated wire products	3495-6
42.0700	Steel springs, except wire	3493
42.0800	Pipe, valves, and pipe fittings	3491-2, 3494, 3498
42.1000	Metal foil and leaf	3497
42.1100	Fabricated metal products, n.e.c.	3499
43	Engines and turbines:	
43.0100	Turbines and turbine generator sets	3511
43.0200	Internal combustion engines, n.e.c.	3519
44+45	Farm, construction, and mining machinery:	
44.0001	Farm machinery and equipment	3523
44.0002	Lawn and garden equipment	3524
45.0100	Construction machinery and equipment	3531
45.0200	Mining machinery, except oil field	3532
45.0300	Oil and gas field machinery and equipment	3533
46	**Materials handling machinery and equipment:**	
46.0100	Elevators and moving stairways	3534
46.0200	Conveyors and conveying equipment	3535
46.0300	Hoists, cranes, and monorails	3536
46.0400	Industrial trucks and tractors	3537
47	**Metalworking machinery and equipment:**	
47.0100	Machine tools, metal cutting types	3541
47.0200	Machine tools, metal forming types	3542
47.0300	Special dies and tools and machine tool accessories	3544-5
47.0401	Power-driven handtools	3546
47.0402	Rolling mill machinery and equipment	3547

I-O industry number and title		Related 1987 SIC codes
47.0404	Electric and gas welding and soldering equipment	3548
47.0405	Industrial patterns	3543
47.0500	Metalworking machinery, n.e.c.	3549
48	Special industry machinery and equipment:	
48.0100	Food products machinery	3556
48.0200	Textile machinery	3552
48.0300	Woodworking machinery	3553
48.0400	Paper industries machinery	3554
48.0500	Printing trades machinery and equipment	3555
48.0600	Special industry machinery, n.e.c.	3559
49	**General industrial machinery and equipment:**	
49.0100	Pumps and compressors	3561, 3563
49.0200	Ball and roller bearings	3562
49.0300	Blowers and fans	3564
49.0500	Mechanical power transmission equipment	3566, 3568
49.0600	Industrial process furnaces and ovens	3567
49.0700	General industrial machinery and equipment, n.e.c.	3569
49.0800	Packaging machinery	3565
50	Miscellaneous machinery, except electrical:	
50.0100	Carburetors, pistons, rings, and valves	3592
50.0200	Fluid power equipment	3593-4
50.0300	Scales and balances, except laboratory	3596
50.0400	Industrial and commercial machinery and equipment, n.e.c.	3599
51	**Computer and office equipment:**	
51.0102	Calculating and accounting machines	3578
51.0103	Electronic computers	3571
51.0104	Computer peripheral equipment	3572, 3575, 3577
51.0400	Office machines, n.e.c.	3579
52	**Service industry machinery:**	
52.0100	Automatic vending machines	3581
52.0200	Commercial laundry equipment	3582
52.0300	Refrigeration and heating equipment	3585
52.0400	Measuring and dispensing pumps	3586
52.0500	Service industry machinery, n.e.c.	3589
53	**Electrical industrial equipment and apparatus:**	
53.0200	Power, distribution, and specialty transformers	3612

I-O industry number and title		Related 1987 SIC codes
53.0300	Switchgear and switchboard apparatus	3613
53.0400	Motors and generators	3621
53.0500	Relays and industrial controls	3625
53.0700	Carbon and graphite products	3624
53.0800	Electrical industrial apparatus, n.e.c.	3629
54	Household appliances:	
54.0100	Household cooking equipment	3631
54.0200	Household refrigerators and freezers	3632
54.0300	Household laundry equipment	3633
54.0400	Electric housewares and fans	3634
54.0500	Household vacuum cleaners	3635
54.0700	Household appliances, n.e.c.	3639
55	Electric lighting and wiring equipment:	
55.0100	Electric lamp bulbs and tubes	3641
55.0200	Lighting fixtures and equipment	3645-8
55.0300	Wiring devices	3643-4
56	Audio, video, and communication equipment:	
56.0100	Household audio and video equipment	3651
56.0200	Prerecorded records and tapes	3652
56.0300	Telephone and telegraph apparatus	3661
56.0500	Communication equipment	3663, 3669
57	Electronic components and accessories:	
57.0100	Electron tubes	3671
57.0200	Semiconductors and related devices	3674
57.0300	Other electronic components	3672, 3675-9
58	Miscellaneous electrical machinery and supplies:	
58.0100	Storage batteries	3691
58.0200	Primary batteries, dry and wet	3692
58.0400	Electrical equipment for internal combustion engines	3694
58.0600	Magnetic and optical recording media	3695
58.0700	Electrical machinery, equipment, and supplies, n.e.c.	3699
59A	**Motor vehicles (passenger cars and trucks):**	
59.0301	Motor vehicles and passenger car bodies	3711
59B	**Truck and bus bodies, trailers, and motor vehicles parts:**	
59.0100	Truck and bus bodies	3713
59.0200	Truck trailers	3715
59.0302	Motor vehicle parts and accessories	3714
60	**Aircraft and parts:**	

I-O industry number and title		Related 1987 SIC codes
60.0100	Aircraft	3721
60.0200	Aircraft and missile engines and engine parts	3724, 3764
60.0400	Aircraft and missile equipment, n.e.c.	3728, 3769
61 Other transportation equipment:		
61.0100	Ship building and repairing	3731
61.0200	Boat building and repairing	3732
61.0300	Railroad equipment	374
61.0500	Motorcycles, bicycles, and parts	375
61.0601	Travel trailers and campers	3792
61.0603	Motor homes	3716
61.0700	Transportation equipment, n.e.c.	3799
62 Scientific and controlling instruments:		
62.0101	Search and navigation equipment	381
62.0102	Laboratory apparatus and furniture	3821
62.0200	Mechanical measuring devices	3823-4, 3829
62.0300	Environmental controls	3822
62.0400	Surgical and medical instruments and apparatus	3841
62.0500	Surgical appliances and supplies	3842
62.0600	Dental equipment and supplies	3843
62.0700	Watches, clocks, watchcases, and parts	387
62.0800	X-ray apparatus and tubes	3844
62.0900	Electromedical and electro- therapeutic apparatus	3845
62.1000	Laboratory and optical instruments	3826-7
62.1100	Instruments to measure electricity	3825
63 Ophthalmic and photographic equipment:		
63.0200	Ophthalmic goods	385
63.0300	Photographic equipment and supplies	386
64 Miscellaneous manufacturing:		
64.0101	Jewelry, precious metal	3911
64.0102	Jewelers' materials and lapidary work	3915
64.0104	Silverware and plated ware	3914
64.0105	Costume jewelry	3961
64.0200	Musical instruments	393
64.0301	Games, toys, and children's vehicles	3944
64.0302	Dolls and stuffed toys	3942
64.0400	Sporting and athletic goods, n.e.c.	3949

I-O industry number and title		Related 1987 SIC codes
64.0501	Pens, mechanical pencils, and parts	3951
64.0502	Lead pencils and art goods	3952
64.0503	Marking devices	3953
64.0504	Carbon paper and inked ribbons	3955
64.0700	Fasteners, buttons, needles, and pins	3965
64.0800	Brooms and brushes	3991
64.0900	Hard surface floor coverings, n.e.c.	3996
64.1000	Burial caskets	3995
64.1100	Signs and advertising specialties	3993
64.1200	Manufacturing industries, n.e.c.	3999

TRANSPORTATION, COMMUNICATIONS, AND UTILITIES

65A Railroads and related services; passenger ground transportation:

65.0100	Railroads and related services	40, 474
65.0200	Local and suburban transit and interurban highway passenger transportation	41

65B Motor freight transportation and warehousing:

65.0301	Trucking and courier services, except air	421, 423
65.0302	Warehousing and storage	422

65C Water transportation:

65.0400	Water transportation	44

65D Air transportation:

65.0500	Air transportation	45

65E Pipelines, freight forwarders, and related services:

65.0600	Pipelines, except natural gas	46
65.0701	Freight forwarders and other transportation services	473, 478
65.0702	Arrangement of passenger transportation	472

66 Communications, except radio and TV:

66.0100	Telephone and telegraph communications, and communications services, n.e.c.	481-2, 489
66.0200	Cable and other pay television services	484

67 Radio and TV broadcasting:

67.0000	Radio and TV broadcasting	483

68A Electric services (utilities):

68.0100	Electric services (utilities)	491, 4931

68B Gas production and distribution (utilities):

68.0201	Natural gas transportation	4922, *4923
68.0202	Natural gas distribution	*4923, 4924, 4925, 4932, 4939

68C Water and sanitary services:

68.0301	Water supply and sewerage systems	494, 4952
68.0302	Sanitary services, steam supply, and Irrigation systems	4953, 4959, 496-7

WHOLESALE AND RETAIL TRADE

I-O industry number and title		Related 1987 SIC codes
69A Wholesale trade:		
69.0100	Wholesale trade	50, 51
69B Retail trade:		
69.0200	Retail trade, except eating and drinking	52-7, 59
FINANCE, INSURANCE, AND REAL ESTATE		
70A Finance:		
70.0100	Banking	60
70.0200	Credit agencies other than banks	61, 67 (excl. 6732)
70.0300	Security and commodity brokers	62
70B Insurance:		
70.0400	Insurance carriers	63
70.0500	Insurance agents, brokers, and services	64
71A Owner-occupied dwellings:		
71.0100	Owner-occupied dwellings	--
71B Real estate and royalties:		
71.0201	Real estate agents, managers, operators, and lessors	65 (excl. 6552)
71.0202	Royalties	--
SERVICES		
72A Hotels and lodging places:		
72.0101	Hotels	701
72.0102	Other lodging places	702-4
72B Personal and repair services (except auto):		
72.0201	Laundry, cleaning, garment services, and shoe repair	721, 725
72.0202	Funeral service and crematories	726
72.0203	Portrait photographic studios, and other miscell- aneous personal services	722, 729
72.0204	Electrical repair shops	762
72.0205	Watch, clock, jewelry, and furniture repair	763-4
72.0300	Beauty and barber shops	723-4
73A Computer and data processing services:		
73.0104	Computer and data processing services	737
73B Legal, engineering, accounting, and related services:		
73.0301	Legal services	81
73.0302	Engineering, architectural, and surveying services	871
73.0303	Accounting, auditing and book- keeping, and miscellaneous services, n.e.c.	872, 89
73C Other business and professional services, except medical:		
73.0101	Miscellaneous repair shops	769
73.0102	Services to dwellings and other buildings	734
73.0103	Personnel supply services	736
73.0106	Detective and protective services	7381-2
73.0107	Miscellaneous equipment rental and leasing	735

I-O industry number and title		Related 1987 SIC codes
73.0108	Photofinishing labs and commercial photography	7335-6, 7384
73.0109	Other business services	732, 7331, 7334, 7338, 7383, 7389
73.0111	Management and consulting services	874
73.0112	Testing and research labs	8731-2, 8734
73D Advertising:		
73.0200	Advertising	731
74 Eating and drinking places:		
74.0000	Eating and drinking places	58
75 Automotive repair and services:		
75.0001	Automotive rental and leasing, without drivers	751
75.0002	Automotive repair shops and services	753, 7549
75.0003	Automobile parking and car washes	752, 7542
76 Amusements:		
76.0101	Motion picture services and theaters	781-3
76.0102	Video tape rental	784
76.0201	Theatrical producers (except motion picture), bands, orchestras and entertainers	792
76.0202	Bowling centers	793
76.0203	Professional sports clubs and promoters	7941
76.0204	Racing, including track operation	7948
76.0205	Physical fitness facilities and membership sports and recreation clubs	7991, 7997
76.0206	Other amusement and recreation services	791, 7992-3, 7996, 7999
77A Health services:		
77.0100	Doctors and dentists	801-3, 8041
77.0200	Hospitals	806
77.0301	Nursing and personal care facilities	805
77.0303	Home health care services	808
77.0304	Veterinary services	074
77.0305	Other medical and health services	8042, 8043, 8049, 807, 809
77B Educational and social services, and membership organizations:		
77.0401	Elementary and secondary schools	821
77.0402	Colleges, universities, and professional schools	822
77.0403	Private libraries, vocational schools, and educational services, n.e.c.	823-4, 829

I-O industry number and title		Related 1987 SIC codes
77.0501	Business associations and professional membership organizations	861-2
77.0502	Labor organizations, civic, social, and fraternal associations	863-4
77.0503	Religious organizations	866
77.0504	Other membership organizations	84, 865, 869, 8733, 6732
77.0600	Job training and related services	833
77.0700	Child day care services	835
77.0800	Residential care	836
77.0900	Social services, n.e.c.	832, 839
SPECIAL INDUSTRIES		
78 Federal Government enterprises:		
78.0100	U.S. Postal Service	43
78.0200	Federal electric utilities	(1)
78.0500	Other Federal Government enterprises	(1)
79 State and local government enterprises:		
79.0100	State and local government passenger transit	(1)
79.0200	State and local government electric utilities	(1)
79.0300	Other State and local government enterprises	(1)
80 Noncomparable imports:		
80.0000	Noncomparable imports	(2)
81 Scrap, used and secondhand goods:		
81.0001	Scrap	(3)
81.0002	Used and secondhand goods	(3)
82 General government industry:		
82.0000	General government industry	(4)
83 Rest of the world adjustment to final uses:		
83.0000	Rest of the world adjustment to final uses	(5)
84 Household industry:		
84.0000	Household industry	(6)
85 Inventory valuation adjustment		
85.0000	Inventory valuation adjustment	(7)

Notes.

1. The SIC assigns the same codes to the activities of both private firms and government agencies, but the SIC codes in the I-O accounts are only used for classifying private activities.

2. Noncomparable imports include imported services that are not commercially produced in the United States, and goods and services that are produced abroad and used abroad by U.S. residents--for example, U.S. Federal Government defense spending abroad.

3. Industry output is zero because there is no primary producing industry. Scrap is a secondary product of many industries, and used goods are sales and purchases typically between final uses. The sales are shown as negative values in the use table.

4. Industry output is defined as the compensation of employees and consumption of fixed capital of general government agencies. The compensation of employees engaged in construction work is included in the

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construction industry.

5. The commodity entries include adjustments among PCE and government expenditures to eliminate counting the expenditures by foreign residents in both exports and PCE or government expenditures.

6. Industry output is defined as the compensation of domestic household workers.

7. The inventory valuation adjustment is an adjustment needed to eliminate inventory profits or losses from the change in inventory component of gross output.

An asterisk preceding a Standard Industrial Classification (SIC) code indicates that the SIC industry is included in more than one I-O industry. For a description of the systems used in the I-O accounts, see the section "Definitions and conventions for classification" in the November 1997 Survey of Current Business article dealing with the 1992 benchmark.