GLOBAL DEVELOPMENT AND ENVIRONMENT INSTITUTE

WORKING PAPER 00-03

Trade Liberalization and Pollution Intensive Industry in Developing Countries

A Partial Equilibrium Approach

Kevin Gallagher and Frank Ackerman

October 2000

Tufts University
Medford MA 02155, USA
http://ase.tufts.edu/gdae

Trade Liberalization and Pollution Intensive Industry in Developing Countries: A Partial Equilibrium Approach[1]

Kevin Gallagher and Frank Ackerman

ABSTRACT

Economic theory suggests that liberalization of trade between countries with differing levels of environmental protection could lead pollution-intensive industry to concentrate in the nations where regulations are lax. This effect, often referred to as the "pollution haven" hypothesis, is much discussed in theory, but finds only ambiguous support in empirical research to date. Methodologies used for research on trade and environment differ widely; many are difficult to apply to practical policy questions.

We develop a simple, partial equilibrium model explicitly designed to analyze the effects of a change in trade policy. Our model analyzes the relative concentrations of "clean" and "dirty" industries in two nations or regions, before and after the policy change. While lacking the theoretical rigor and mathematical intricacy of other modeling methods, our approach has the advantages of transparency and accessibility to a broad range of analysts and policy makers.

[1] This paper was published in *Methodologies for Assessing the Environmental Impacts of Trade Liberalization Agreements.* Dale Andrews, ed. (Paris: OECD, 2000). It has been reprinted with permission.

I. INTRODUCTION

The dominant trend in the world economy in the 1990s was toward liberalized trade. At the global level the decade witnessed a new round of negotiation under the General Agreement on Tariffs and Trade (GATT) that resulted in the creation of the World Trade Organization (WTO). At the regional level, free trade agreements were initiated or strengthened in Europe, Asia, Africa, Latin America, and North America.

What happens to the environment when international trade is liberalized? Economic theory suggests that trade between countries with differing levels of environmental protection could lead pollution-intensive industry to concentrate in the nations where regulations are lax. Developing countries frequently have less stringent environmental regulations than developed countries. Thus free trade might give developing countries a comparative advantage in industries that are associated with relatively large environmental externalities (Baumol 1988; Seibert 1988). Evoking this theory, nations that are attractive to industry due to their looser pollution controls are often referred to as "pollution havens."

As part of the ongoing WTO negotiation process, many OECD member countries have agreed to undertake an environmental assessment of their trade liberalization policies. In addition, a number of nations are or soon will be engaged in regional free trade agreements. In each case, policy makers, NGOs, and concerned citizens will want to evaluate the likelihood and the severity of the problems potentially associated with pollution havens.

This paper provides a methodology for modeling the effects of trade policy on the balance of “clean” and “dirty” industries between countries at different levels of industrial development. Such an approach could prove to be invaluable in assessing the environmental effects of trade liberalization between the EU and Eastern Europe, between Japan and Southeast Asia, between Canada, Mexico, and the United States, and in many other international trade agreements.

The next section of this paper briefly presents a general framework for analysis of the environmental effects of trade liberalization. Section III reviews three relevant bodies of literature, followed by a discussion of limitations of the existing research in Section IV. We present our model in Section V, and contrast it with other modeling strategies in Section VI.

II. TRADE AND THE ENVIRONMENT: A GENERAL FRAMEWORK

A useful framework for thinking about trade and the environment has been proposed by Gene Grossman and Alan Krueger (1993). They identify three mechanisms by which trade and investment liberalization affect the environment: scale, composition, and technique effects. Scale effects occur when liberalization causes an expansion of economic activity. If the nature of that activity is unchanged but the scale is growing, then pollution and resource depletion will increase along with output.

Composition effects occur when increased trade leads nations to specialize in the sectors where they enjoy a comparative advantage. When comparative advantage is derived from differences in environmental stringency (i.e., the pollution haven effect), then the composition effect of trade will exacerbate existing environmental problems in the countries with relatively lax regulations.

Technique effects, or changes in resource extraction and production technologies, can potentially lead to a decline in pollution per unit of output for two reasons. First, the liberalization of trade and investment may encourage multinational corporations to transfer cleaner technologies to developing countries. Second, if economic liberalization increases income levels, the newly affluent citizens may demand a cleaner environment.

Of the three effects, the scale effect is a straightforward consequence of economic growth; the technique effect leads to interesting questions of technology transfer that will not be pursued here. Most of the literature on trade and the environment concentrates on the composition effect, as does the remainder of this paper. The model developed in Section V is designed to test the composition effects of specific trade policy changes between two countries or groups of countries. While several economists have embarked on studies of overall composition effects in the world economy, few have looked at specific agreements and other trade policies between a small number of trading partners.

III. LITERATURE REVIEW

The revitalization of trade liberalization policies has been accompanied by a growing literature on the effects of international trade patterns on the environment. The methodologies employed to test this relationship are widely varied, as are the results. While such efforts have shed a great deal of light on historic patterns of trade liberalization and pollution intensity, none have been able to test the environmental effects of specific trade agreements.

The empirical work on this topic through the early 1990s has been thoroughly reviewed by Judith Dean in 1992 and by Adam Jaffe and his colleagues in 1995. This section draws on their work in discussing early research, as well as addressing important studies that have appeared more recently. There are three major areas to review: research on the effects of state regulation within the United States; global analyses of comparative advantage and pollution intensity; and studies of bilateral trade and pollution.

A. Environmental Regulations and Plant Location Within the United States

From an economic perspective, the United States can be viewed as a conglomeration of states that have partially independent environmental regulations, while engaging in exceptionally free trade with each other. Thus the literature on the effects of regulation on domestic plant location may be relevant to the problems of international trade and the environment.

It is common in American politics to make the casual assumption that environmental regulations have a significant effect on the siting of new plants in the United States. The empirical literature, however, suggests otherwise. Early studies by Timothy Bartik showed that business location decisions are sensitive to interstate variations in taxes, public services, and rates of unionization, but relatively insensitive to variation in environmental regulations. Examining the manufacturing plants of Fortune 500 companies in the United States from 1972 to 1978, Bartik found that state air and water pollution control measures, average cost of compliance, and levels of particulate emissions all had small, statistically insignificant effects on plant locations (Bartik 1988). Looking at 19 manufacturing industries from 1967 to 1982, Bartik found a significant, but quite small, negative effect of state environmental regulations on the rate of small business start-ups (Bartik 1989).

A study by Arik Levinson is fairly consistent with the work of Bartik. In a study of U.S. manufacturing plants from 1982 to 1987, using detailed establishment-level data on plant pollution abatement costs, Levinson found that interstate differences in environmental regulations do not affect the location choices of most manufacturing plants (Levinson 1996).

Another study looked at the determinants of new plant location within the U.S. by foreign multinational corporations. In this case the effect of environmental stringency was negative but not statistically significant (Freidman et al. 1992). Finally, on a related topic, Eban Goodstein has argued at length that there is virtually no evidence that substantial numbers of jobs have ever been lost due to state or federal environmental regulation (Goodstein 1999).

This literature suggests that, contrary to public opinion, environmental stringency has had little impact on plant location decisions within the United States.

B. Comparative Advantage and Pollution Intensity in the Global Economy

There have been a number of widely cited studies on international trade flows and environmental regulations. Many have identified and studied a set of “dirty” industries, where regulations might be expected to have the greatest effect. Although the definitions of dirty industries vary, many of the same industries tend to show up on everyone's lists.

James Tobey looked at the behavior of 23 nations in 1977, testing whether environmental policy affected the patterns of trade in commodities produced by dirty industries (Tobey 1990). He defined a dirty, or pollution intensive, industry as one where pollution abatement costs in the United States were 1.85% or more of total costs. Industries meeting this standard were pulp and paper, mining, iron and steel, primary nonferrous metals, and chemicals. For international comparisons Tobey created an ordinal variable ranging from 1 to 7 to measure the level of stringency of a country's environmental policies. He then regressed net exports of each country's dirty industries on their factor inputs (land, labor, capital, and natural resources) and on environmental stringency. In no case did he find that environmental stringency was a statistically significant determinant of net exports.

World Bank researchers Patrick Low and Alexander Yeats tested whether developing countries gained a comparative advantage in pollution-intensive products during the period 1965-1988 (Low and Yeats 1992). Their model relies on calculation of Revealed Comparative Advantage (RCA), defined as the share of an industry in a country's total exports, relative to the industry's share of total world exports of manufactures. Low and Yeats looked at RCAs of 109 countries for pollution-intensive industries. Their list of pollution-intensive industries, selected on the basis of pollution abatement costs in the U.S., consists of iron and steel, nonferrous metals, petroleum refining, metal manufacturing, and pulp and paper. Low and Yeats found that for these industries the RCAs of developing countries were growing relative to those of industrial countries. They observed decreases in dirty industry RCAs in the developed world and increases in Eastern Europe, Latin America, and West Asia.

Results along the same lines were found in a recent study by Mani and Wheeler (1998). They found that from 1960 to 1995, pollution intensive output as a percentage of total manufacturing fell in the OECD and rose steadily in the developing world as a whole. However, the location of pollution havens has changed over time because economic growth in any one country brings "countervailing pressure to bear on polluters through increased regulation, technical expertise, and clean sector production" (Mani and Wheeler 1998, 244).

Another article, focusing on trade between the United States, Japan, Australia, and the Association of Southeast Asian Nations (ASEAN), also used an RCA model to find that dirty industry expansion was faster in developing countries. However, it concluded that differences in environmental standards between developing and developed countries were not a significant cause of the movement of dirty industries (Abimanyu 1996).

Using a different methodology, another World Bank team looked at trade liberalization and the toxic intensity of manufacturing in 80 countries between 1960 and 1988 (Lucas, Wheeler, and Hettige 1992). Analyzing aggregate toxic releases per unit of output, they identified metals, cement, pulp and paper, and chemicals as the dirtiest industries. Lucas et al. found that the dirty (toxic-intensive) industries grew faster in the developing countries as a whole, but this growth was concentrated in relatively closed, fast growing economies, rather than in the countries that were most open to trade. Regional work on Latin America has generated similar results (Birdsall and Wheeler 1993).

A later article, by Michael Rock (1996), criticizes the work of Lucas et al. for their classification of dirty industries and their narrow definition of openness. Rock found that a measure of the toxic intensity of GDP (toxic pollution loads per dollar of GDP) for a country as a whole was positively correlated with measures of openness to trade during 1973-1985. That is, the more open the trade policy, the greater the pollution intensity.

C. Bilateral Trade, Investment, and Pollution Intensity

A few studies have looked at the environmental effects of liberalization of bilateral trade and investment. Two will be discussed here.

The earlier of the two studies, by Grossman and Krueger (1993), was widely cited during debates around the passage of NAFTA. Grossman and Krueger tested whether pollution abatement costs in U.S. industries affected imports from Mexico. That is, they asked whether dirtier U.S. industries relied more heavily on imports from Mexico, as would be expected if Mexico was functioning as a pollution haven relative to the U.S. They found traditional economic determinants of trade and investment, such as factor prices and tariffs, to be very important. In contrast, they found the impact of cross-industry differences in pollution abatement costs on U.S. imports from Mexico to be small and statistically insignificant.

A more recent study looked at the patterns of U.S. foreign investment in Mexico, Venezuela, Morocco, and Cote d'Ivoire between 1982 and 1994, to see whether it is influenced by U.S. pollution abatement costs (Eskelund and Harrison 1998). This study also finds traditional economic variables to be important, but rejects the hypothesis that the pattern of U.S. foreign investment in any of the recipient countries is skewed toward industries with high costs of pollution abatement.

IV. LIMITATIONS OF THE EXISTING RESEARCH

While much can be learned from the existing research on trade liberalization and the environment, there are at least four important limitations to the body of work reviewed in the previous section.

The most obvious problem is the extent to which the conclusion depends on the methodology and scope of the research. There appears to be a pollution haven effect in analyses of global patterns of comparative advantage, but not in studies of bilateral trade or of business location within the U.S. Even the extent of the global pattern is uncertain; when the analysis of revealed comparative advantage is coupled with controls for other economic factors that influence trade, the relationship between trade liberalization and the location of dirty industry becomes weaker (Abimanyu 1996). In any case, it is not clear how to apply the results of an analysis of many countries over long time periods to the effects of a specific nation's trade policies – which is the most important practical application of this line of research.

A second limitation stems from the first. Quantitative international comparisons require that complex information about national policy, such as the degree of environmental stringency or openness to trade, must be represented by numerical variables. This gives rise to inevitable problems of arbitrariness in definition, as in the ordinal scale for environmental stringency mentioned in the literature review in Section III. (Though mentioned only once, similar problems affect other studies as well.)

A third limitation is more technical. Many studies have focused solely on plant migration. However, it is the amount of production in a country that should be measured, not the number of plants. Expansion of old plants and opening of new ones both have the effect of increasing production, and both should be counted equally in tracking the location of industrial activity.

The last problem has already been mentioned. The definition of dirty industries is crucial to the analysis, but varies from one study to another. This problem is perhaps the least serious, as several different definitions seem to yield similar lists of dirty industries. However, the definitions used in most studies rely on pollution data from developed countries. It remains to be seen whether pollution data from developing countries will show that the same industries are the dirtiest ones everywhere.

The model presented in the next section attempts to circumvent the first three of these problems by examining pollution intensity in two nations before and after specific changes in trade policy.

V. MODELING THE ENVIRONMENTAL IMPACT OF BILATERAL TRADE

Not all studies of trade and the environment are asking the same question. The question our model asks is: what is the effect of a specific change in trade policy on the location of clean and dirty industry? We assume that there are two trading partners affected by the policy change, one more developed and the other a developing nation; either or both could be trading blocs rather than single nations. For example, the model could be applied to trade between the U.S. and Mexico, between Japan and Southeast Asian nations (singly or as a group), or between the EU and trading partners in Eastern Europe or elsewhere.

The model begins by identifying sets of clean and dirty industries. As mentioned above, there are some uncertainties in this process, but many standards based on developed country data produce similar sets of industries. Judging by emissions intensity (actual emissions per unit of output, rather than abatement costs), the five most pollution intensive industries are iron and steel, non-ferrous metals, industrial chemicals, pulp and paper, and non-metallic minerals. The five cleanest industries, by the same standard, are textiles, non-electrical machinery, electrical machinery, transport equipment, and instruments.

The basic data for the model consists of measures of annual activity in each industry in each of the trading partners, for several years before and after the change in trade policy. Output is the preferred measure of activity, though employment could be used as a proxy if necessary. (Data on value added, which is less widely available, may also be less appropriate; the pollution caused by dirty industries frequently is directly related to the use of purchased inputs, not simply to value-added activity.) The number of establishments in the industry is a very poor proxy for activity, as explained above. Other data needs include conventional economic variables that might affect trade, such as exchange rates, factor prices, etc.

The model then applies regression analysis to isolate the effect of the change in trade policy on the relative levels of economic activity in clean and dirty industries. That is, it relates the level of activity in each industry to the conventional economic variables, and simultaneously tests for the effects of dummy variables reflecting policy-relevant classifications. The equation to be estimated is:

$Y(\text{country, industry, year}) = A_0 + \Sigma A(i)\, X(i) + \Sigma B(j, k, m)\, D(j, k, m)$

where

A(i) and B(j, k, m) are coefficients to be estimated

Y is the activity measure (such as natural logarithm of output)

X(i) are the economic variables such as exchange rates, wages, interest rates, etc.

j, k, and m are binary indices, given verbal values here for clarity of exposition:

j = IND (industrialized country) or DEV (developing country)

k = CLEAN or DIRTY industry

m = PRE (years before or during policy change) or POST (years after change)

D(j, k, m) are dummy variables for the corresponding categories of observations -- e.g., D(DEV, CLEAN, POST) = 1 for observations on developing country clean industry after the policy change, and 0 for all other observations; similarly for other D(j, k, m)

There are eight possible dummy variables, of which one must be omitted from the regression analysis to avoid the statistical problem of collinearity. That is, one of the eight categories is picked, arbitrarily, as the baseline; the estimates of the remaining seven coefficients measure differences from the baseline.

If a trade policy has had an effect on the relative levels of activity in clean and dirty industries in either country, some or all of the coefficients B(j, k, POST) should be significantly different from the corresponding coefficients B(j, k, PRE) -- recalling that one of the coefficients is zero by definition. The strongest form of the pollution haven hypothesis would assert that after trade liberalization, the concentration of dirty industry increases in the developing country and decreases in the developed country, while the opposite is true for clean industry. In other words, the hypothesis is that the following differences would all be significant:

B(DEV, DIRTY, POST) > B(DEV, DIRTY, PRE)

B(IND, DIRTY, POST) < B(IND, DIRTY, PRE)

B(DEV, CLEAN, POST) < B(DEV, CLEAN, PRE)

B(IND, CLEAN, POST) > B(IND, CLEAN, PRE)

The policy relevance of the model results is immediately clear. For example, a preliminary application of this model (Gallagher 1999), now undergoing further testing and refinement, suggests that the enactment of NAFTA had no statistically significant effect on the location of clean or dirty industry in the U.S. vs. Mexico.

In summary, our model rests on a simple, partial equilibrium framework. It develops a basic analysis of the relationships that determine activity levels in the clean and dirty industries of two trading partners, and then looks for breaks or "jumps" in those relationships at the time of a change in trade policy. This is, of course, in sharp contrast to the far more intricate modeling techniques that have been adopted by many economists. We view the simplicity of our approach as a valuable asset for policy analysis, as we explain in the next section.

VI. MODELS, THEORIES, AND TRANSPARENCY

Economists analyzing international trade frequently rely on computable general equilibrium (CGE) models, derived from economic theory and presented with great mathematical sophistication. The contribution of these models, beyond their theoretical rigor, is their explicit representation of the interactions between all sectors of an economy. Changes in trade policy or environmental policy may have a direct effect on only a few industries, but changes in production and prices in those industries have indirect effects that ripple throughout the rest of the economic system.

However, the benefits of CGE models are obtained only at substantial cost. Most obvious is the loss of transparency. The model proposed in Section V is accessible to large numbers of policy makers and analysts; the meaning of its relationships and the interpretation of its results are straightforward. In contrast, CGE models are often developed and presented in the context of formal, highly mathematical economic theories, which are in practice accessible only to other economists. Most policy makers and analysts can make use of such models only by asking economists to operate the models and to interpret the results -- a cumbersome, expensive, and time-consuming process.

The loss of transparency and the resulting dependence on specialists might conceivably be justified if the models were based on widely accepted, exact relationships that have proven to be empirically successful in forecasting. That is roughly the situation in many areas of physical sciences and engineering. In economics, however, there is nothing like a commonly accepted, empirically tested set of CGE relationships. The estimated indirect effects of trade policies in a CGE model inevitably rest on assumptions about the exact shape of numerous relationships, such as the price elasticities of supply in other industries, or the speed with which the labor market adjusts to shocks. Those assumptions differ from one model to the next, precisely because there is no one model that has proved to be reliably more accurate than others in practice.

Even the theoretical rigor of general equilibrium analysis becomes problematical when examined more closely. Economic theorists have known since the 1970s that general equilibrium is seriously flawed as a model of economic dynamics, with the apparently inescapable potential for unstable or chaotic outcomes. Ironically, many advanced theorists have moved away from the general equilibrium framework at the same time that it has become the norm in applied economics (Ackerman 1999). In a simpler, static context, the well-known optimality properties of competitive general equilibrium theory clearly do not apply to the real world with its oligopolies, externalities, and market failures. (In raising these theoretical issues, we do not mean to suggest that most applied CGE models explicitly claim to rest on the complex theories of general equilibrium. Rather, through their shared name they implicitly draw on the prestige that is still associated, mistakenly in our view, with general equilibrium as a foundation of economic theory.)

Despite these limitations, there is a potential role for careful application of CGE models. We recommend that simple partial equilibrium models, such as the one presented in Section V, be used for the first stage of policy analyses. The lower cost and greater transparency of such models allows them to be used far more widely, to examine many possible impacts of policy changes. If strong effects are found in a partial equilibrium context, and if the issue is of great concern to policy markets and their constituents, a more elaborate, second stage of analysis may be called for. That stage could employ more sophisticated techniques, such as CGE modeling, to elaborate, refine, and validate the partial equilibrium results.

Kevin Gallagher is a Research Associate on G-DAE's "Sustainable Hemispheric Integration Project." He is a doctoral candidate in International Political Economy at Tufts University, and holds a Masters Degree in International Environmental Policy from Tufts.

Frank Ackerman is Director of the Research and Policy Program of the Global Development And Environment Institute and Research Associate Professor at Tufts University's Urban and Environmental Policy Program.

REFERENCES

Ackerman, Frank. "Still Dead After All These Years: Interpreting the Failure of General Equilibrium Theory." G-DAE Working Paper No. 00-01. (Medford MA: Tufts University, Global Development and Environment Institute, 1999).

Abimayu, Anggito. "Impact of Free Trade on Industrial Pollution: Do Pollution Havens Exist?" *ASEAN Economic Bulletin*, v13, n1, (July 1996).

Bartik, Timothy. "The Effects of Environmental Regulation on Business Location in the United States." *Growth and Change,* Summer 1988, 19, 3, 22-44.

Bartik, Timothy. "Small Business Start-ups in the United States: Estimates of the Effects of Characteristics of States," *Southern Economic Journal*, April 1989, 55, 4, 1004-18.

Baumol, W. and W. Oates. *The Theory of Environmental Policy*. (New York: Cambridge University Press, 1988).

Birdsall, Nancy, and David Wheeler. “Trade Policy and Industrial Pollution in Latin America: Where are the Pollution Havens?” *Journal of Environment and Development*, 2, 1, (Winter 1993).

Dean, Judith. “Trade and the Environment: A Survey of the Literature,” *International Trade and the Environment*. Ed. Patrick Low. (Washington DC: World Bank, 1992).

Eskelund, Gunnar and Ann Harrison. “Moving to Greener Pastures: Multinationals and the Pollution Haven Hypothesis.” *World Bank Policy Research Paper #1744*. (Washington DC: World Bank, 1998).

Freidman, Joseph, Gerlowski, Daniel, and Jonathan Silberman. “What Attracts Foreign Multinational Corporations?” *Journal of Regional Science*, November 1992, 32, 4, 403-18.

Gallagher, Kevin. “Pollution Intensive Industry Under NAFTA: Model and Empirical Evidence.” *Praxis: The Fletcher Journal of Development Studies*, 1999.

Goodstein, Eban. *The Trade Off Myth.* (Washington: Island Press, 1999).

Grossman, Gene, and Alan Krueger. “Environmental Impacts of a North American Free Trade Agreement,” in *The US - Mexico Free Trade Agreement*. Ed. Peter Garber. (Cambridge: MIT Press, 1993).

Jaffe, Adam, Steven Peterson, Paul Portney, and Robert Stavins. “Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?” *Journal of Economic Literature*, vXXXIII (March 1995), 132-163.

Leonard, Jeffrey. *Pollution and the Struggle for World Product*. (Cambridge: Cambridge University Press, 1988).

Levinson, Arik. “Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufactures,” *Journal of Public Economics*; v62 n1-2 October 1996, pp. 5-29.

Low, Patrick and Alexander Yeats. “Do ‘Dirty’ Industries Migrate?” *International Trade and the Environment*. Ed. Patrick Low. (Washington DC: World Bank, 1992).

Lucas, Robert, David Wheeler, and Hemamala Hettige. “Economic Development, Environmental Regulation, and the International Migration of Toxic Industrial Pollution, 1960-1988,” *International Trade and the Environment*. Ed. Patrick Low. (Washington DC: World Bank, 1992).

Mani, Muthukumara, and David Wheeler. “In Search of Pollution Havens? Dirty Industry in the World Economy, 1960-1995.” *Journal of Environment and Development*, v7, n3, September 1998, 215-247.

Rock, Michael. “Pollution Intensity of GDP and Trade Policy: Can the World Bank Be Wrong?” *World Development*, v24, No 3, 471-479.

Seibert, Horst. “International Dimension.” *Economics of the Environment*. (Lexington: Heath, 1981), 131-142.

Tobey, James. “The Effects of Domestic Environmental Policies on Patterns of World Trade.” *Kyklos*, 43, 2, 1990, 191-209.

The Global Development And Environment Institute (G-DAE) is a research institute at Tufts University dedicated to promoting a better understanding of how societies can pursue their economic goals in an environmentally and socially sustainable manner. G-DAE pursues its mission through original research, policy work, publication projects, curriculum development, conferences, and other activities. The "G-DAE Working Papers" series presents substantive work-in-progress by G-DAE-affiliated researchers. We welcome your comments, either by e-mail directly to the author or to G-DAE, Cabot Center, Fletcher School, Tufts University, Medford, MA 02155 USA; tel: 617-627-3530; fax: 617-627-2409; e-mail: gdae@tufts.edu; web: http://ase.tufts.edu/gdae.

Papers in this Series:

00-01 Still Dead After All These Years: Interpreting the Failure of General Equilibrium Theory (Frank Ackerman, November 1999)

00-02 Economics in Context: The Need for a New Textbook (Neva R. Goodwin, Oleg I. Ananyin, Frank Ackerman and Thomas E. Weisskopf, February 1997)

00-03 Trade Liberalization and Pollution Intensive Industries in Developing Countries: A Partial Equilibrium Approach (Kevin Gallagher and Frank Ackerman, January 2000)

00-04 Basic Principles of Sustainable Development (Jonathan M. Harris, June 2000)

00-05 Getting the Prices Wrong: The Limits of Market-Based Environmental Policy (Frank Ackerman and Kevin Gallagher, September 2000)

00-06 Telling Other Stories: Heterodox Critiques of Neoclassical Micro Principles Texts (Steve Cohn, August 2000)