The Economics of Trade and the Environment: Redefining the Research Agenda

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Abstract

In the 1990s, a burgeoning literature in economics emerged concerning the relationship between trade liberalization and the environment in the world economy. While this work is still in its infancy, it has already produced a number of important insights. On the whole however, this literature has been limited to a set of broad questions about the trade and environment relationship. How does economic growth affect the environment? How does trade liberalization affect environmental quality? And, how do environmental regulations affect trade and competitiveness? The profession has not approached a consensus on these three questions. However, policy lessons can be drawn from our inconclusiveness. This paper proposes a second wave of research surrounding a narrower set of more answerable questions that can better guide the policy-making process.

I. Introduction

The last decade of the twentieth century was similar to the end of the nineteenth century in that the world’s economies were vigorously opening themselves to international trade. One aspect of trade
liberalization that did not concern society at the turn of the last century was how such openness might affect the earth’s environment. Discussions in the 1990s however, were saturated with questions regarding the environmental impact of trade liberalization.

Economists played a key role in these discussions. This paper will provide an assessment of how economists have approached the trade-environment debate and will be divided into five parts. The first will briefly outline the sub-fields within economics that contemporary economists have drawn from in order to assess trade and environment interactions. Second, it will be demonstrated how these sub-fields are manifest in current theoretical discussions. This will be followed by a brief look at the methodological approaches that are used to test these theories. Fourth, the empirical evidence on three different aspects of the trade and environment debate will be presented. Finally, key outstanding and policy relevant research questions for a second wave of research are presented.

II. Antecedents in Economic Theory

Not only were ecological concerns absent from the international political arena for almost three quarters of the twentieth century, they were largely absent from economic thinking as well. The reason for this is that many environmental problems that are now major concerns were either not problems at all or not recognized to be problems at the time. Thus, the economic rationale for the multitude of trade liberalization agreements that have been forged in the post-war period stem from two branches of economics: growth theory and trade theory.
The foremost question that has concerned economists since Adam Smith has been: what
creates the wealth of nations? Smith’s contribution gave rise to classical growth theory, and treated the
increase in the wealth of nations as a function of: growth in the labor force and stock of capital; and
improvements in efficiency through greater division of labor and technological progress (Smith 1776).
Variations of Smith’s theory became staples in economic theory for years to come. Smith’s views were
elaborated upon into the nineteenth century by other classical economists such as Thomas Malthus,
David Ricardo, and John Stuart Mill. Indeed, in his 1955 classic, *The Theory of Economic Growth*,
the economist W. Arthur Lewis stated that “no comprehensive treatise on the subject has been
published for about a century.”

One year after Lewis’ proclamation however, Robert Solow founded what became known as
neoclassical growth theory, for which he eventually won the Nobel Prize. Solow argued that growth
resulted from one or more of three factors: increases in labor quantity and quality (through population
growth and education); increases in capital (through savings and investment); and improvements in
technology (Solow 1956). Where the classical growth theorists stressed that increasing returns were
endogenous explanations for economic growth, for Solow technology became a residual factor that
was determined independently (exogenously) of the other two factors. More recent attention has
focused on the tacit nature of technology and argues that Solow’s residual can to a large part be
explained by endogenous factors (Romer 1990).

For classical and neo-classical economists alike, international trade is seen as a mechanism to
utilize capital, labor, and technology more efficiently - and therefore increase growth in the manner
conceived by growth theorists. Classical arguments for trade liberalization are based on David
Ricardo's theory of comparative advantage. Because different countries will have different technologies,
customs and resources, Ricardo showed how these countries would face different costs to produce the
same product. His contribution was the argument that if each country produces and exports the goods
for which it has comparatively lower costs, then all parties will benefit. Not only would benefits
accrue to the parties directly involved in such a transaction, Ricardo added that the benefits from trade
would extend to include greater efficiency in production and higher world-wide rates of consumption.
While he acknowledges that this approach may cause some groups to “lose” as a result of free trade,
Ricardo argued that the net gains would exceed those losses (Ricardo 1817).

The effects of comparative advantage on factors of production are dealt with in the
"Heckscher-Ohlin" model. This model assumes that all countries have perfectly competitive economies,
where the same diversified mix of goods and services can be produced, and where the factors of
production can move between industries. (Heckscher 1919; Ohlin 1933). From this perspective, the
Stolper-Samuelson theorem adds that international trade increases the prices of products in which a
country has a comparative advantage. If demand and prices rise for those factors in which a country is
relatively abundant the theory predicts that a country will specialize in such factors. This model has
served as a prevailing explanation as to why rich countries have traditionally specialized in capital- and
skill-intensive industries, while poor countries have specialize in unskilled, labor-intensive ones (Stolper
and Samuelson 1941).
Awareness of the problems associated with environmental pollution and natural resource degradation did not become widespread until the 1960s and the 1970s. It was against this backdrop that the sub-field of environmental economics emerged. These economists surmised that environmental problems were prevalent because the market was not valuing the environment properly, sending mixed signals that gave firms the perverse incentive to pollute (Pearce and Turner 1990). Environmental economists borrowed the concept of externalities from earlier welfare economists. An externality exists when an activity by one economic agent causes an uncompensated gain or (more typically in the environmental arena) loss of welfare to another economic agent. In the environmental context, environmental economists began seeing producers and consumers as not incorporating the full environmental costs (or externalities) of economic exchange into their transactions.

More recently, a related sub-field has emerged called ecological economics that views the economy as seminally intertwined with ecological processes. Drawing on the natural sciences, these economists assert that the earth’s ecology is inherently limited in its ability to both supply the economy with matter and energy and absorb the waste products created in the economic process. At some point, economic activity could cause catastrophic and irreversible ecological damage. Traditional environmental economics assumptions regarding marginal environmental costs and benefits of economic activity do not square neatly with this approach (Harris et al, 1995).

Returning to growth and trade theories, since its inception in the 1970s environmental economics had largely focused on providing incentives for individual firms to ‘internalize’ environmental
externalities through such instruments as regulation, bargaining, and taxation. However, a small group of economists began asking the question: what are the environmental costs of economic growth? Could the microeconomic framework of environmental externalities be applied to entire economies?

In 1972 William Nordhaus and James Tobin constructed a Measure of Economic Welfare (MEW) that adjusted conventional measures of GNP for environmental and other costs. Their calculations revealed that while the U.S. economy had still grown from 1929 to 1965, it had grown at a slower rate than GNP figures suggested (Nordhaus and Tobin 1972). In the late 1980s, economists at the World Resources Institute, the World Bank, and ecological economists revived and expanded attempts to account for the environmental impacts of growth, and in some cases it has been shown that the net costs of economic growth have been negative (Harris and England 1997). A recent study, for example, estimated that air and water pollution in China cost the country between 3.5 and 7.7 percent of its annual GDP during the 1990s (World Bank 1997).

While these economists have linked growth economics and the environment, the next section shows how development, trade, and environmental economists have used similar tools to examine the relationships between trade and the environment.

II. Manifestations in the Trade and Environment Literature

These three sub-fields in economics have been drawn from to address the interrelationships between international trade and environment. In the 1990s tempers flared when it was suggested that if
the benefits (surplus) of trade liberalization where not derived from transactions where the externalities related to trade had not been internalized, then perhaps the environmental costs of trade liberalization could outstrip those benefits.

Trade and environment discussions in economics date as far back as the early to mid-1970s (d’Arge and Kneese 1972; Grubel 1975; Pethig 1976) but attracted only scant attention. It was not until the early 1990s, in the midst of international negotiations on the General Agreement on Tariffs and Trade (GATT) and the North American Free Trade Agreement (NAFTA) that these issues came to a head. The most well-known forum for this debate occurred in the pages of *Scientific American* in 1993, where prominent trade economist Jhagdish Bhagwati and ecological economist Herman Daly presented opposing views on the relationships between trade and environment in economics.

Combing growth and trade theory, Bhagwati argued that trade liberalization is an efficient route to economic growth for nations. Economic growth, he added, enables governments to raise the taxes necessary for environmental protection. Indeed, such rising incomes and freer trade could enable countries to import pollution-control technologies from countries that would be closed off from them without trade.

Daly believed that the environmental costs of economic growth were outpacing its benefits and therefore trade-led growth was undesirable. Evoking environmental economics, Daly added that trade liberalization leads to inefficient allocation of resources because it encourages trade between nations
that do not internalize their costs. This could cause ‘pollution havens’ where companies move into nations with lower pollution-control standards. Daly went on to argue that nations that did internalize their costs should impose tariffs on those who do not.

Their seemingly opposed views can, in fact, be reconciled in a broader theoretical perspective. While the *Scientific American* exchange was quite heated, neither Bhagwati nor Daly was necessarily wrong. This was revealed in another groundbreaking 1993 article that synthesized these views into a framework that has largely characterized the trade and environment literature since then. Economists Gene Grossman and Alan Krueger identified 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 the transfer of cleaner technologies to developing countries.
Second, if economic liberalization increases income levels, the newly affluent citizens may demand a
cleaner environment.

Framing the interaction in this light shows that neither Bhagwati nor Daly was entirely wrong (or
right!). Bhagwati was essentially arguing that trade could cause the technique effect to occur, while
Daly feared the possibility of negative scale and composition effects. Grossman and Krueger’s
framework is now considered to be the “standard way for thinking about the problem and a helpful tool
for analyzing the issues involved.” (Fredriksson 1999, 1) The devil however, is in the details. From
this group of articles to the present, a growing literature has emerged that analyzes and tests these three
effects.

III. Note on Methodological Approaches

Before delving into the dearth of empirical investigations on the trade and environment
relationship, it is important to note the methodologies that economists have used in their analyses.
Methodologies for assessing the trade and environment relationship in economics can be grouped into
two categories: general equilibrium and, by default, partial equilibrium approaches. General equilibrium
approaches are most commonly used in forecasting the possible environmental impacts of trade
liberalization; partial equilibrium approaches are more often used to analyze the effects of trade policies
already in affect.
The core hypothesis in neo-classical economics is that as markets become more perfect they will move toward a general equilibrium where all resources are being put toward their highest value use. While this has remained controversial even among the most prominent economists (Debreau 1974; summarized in Ackerman 2000) it serves as the basis for computable general equilibrium (CGE) approaches to policy questions. In the trade context, because trade liberalization is assumed to be “liberating” markets from distortions, markets are therefore moving closer to general equilibrium. CGE models then, can be useful in forecasting the effects of a proposed trade liberalization agreement on the environment (Martin 2000).

Essentially, CGE models are exercises in comparative statics that are helpful in asking “what if?” questions related to the impacts of proposed policies. That is, CGE models forecast what an economy would look like after a trade agreement based on a benchmark of what an economy looked liked before the agreement. The “picture” of what the economy looks like in the base case is represented by a series of complex equations and base line data for a year before the trade agreement. In a CGE model, that picture is essentially redrawn by omitting or correcting the equations that represented pre-trade agreement distortions in the economy. After such an exercise the CGE model will report the forecasted changes in sectoral composition or environmental quality in the economy.

Partial equilibrium approaches are the tool of choice for retrospective policy analysis, or questions of “what happened?” as a result of policies that have already taken place. These are econometric models that often rely on ordinary least-squares regression techniques. Such an approach
allows policy analysts to isolate the effect of trade liberalization on particular sectors, commodities, or pollutants in an economy and to test the significance of the relationship between trade policy and the examined variable.

Each approach has a number of strengths and weaknesses, and neither should be used as the sole basis for decision making. CGE models have a great deal of theoretical rigor, but their greatest strength lies in their ability to represent the interaction between all sectors of an economy. Changes in trade or environmental policy may have a direct effect on only a few industries, but changes in production or prices in such industries have indirect effects that ripple through the rest of the economic system. Only CGE models can analyze many of the relevant linkages in an economy (Martin 2000).

In their comprehensiveness, however, CGE approaches lose their ability to pinpoint the causation between a small number of isolated variables. Moreover, while CGE models are reaching ever increasing levels of mathematical sophistication, they continue to rely on questionable assumptions in order to simplify an economy into a series of equations. More practically, CGE models are not transparent. CGE models are often developed and presented in the context of formal, highly mathematical 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 (Gallagher and Ackerman 2000).
The majority of the literature in the discussion that follows relies on these approaches in economics. This understanding of such methods used in the literature can now help decipher the empirical literature analyzing the relationships between international trade and the environment.

**IV. International Trade and the Environment: Issues and Evidence**

What is the relationship between trade liberalization and the environment? Over the past ten years, alongside the myriad of trade agreements in the policy arena, a sizable economic literature has grown around three questions regarding the relationship between trade and the environment:

1. How does economic growth affect the environment?
2. How does trade liberalization affect environmental quality?
3. How do environmental regulations affect trade and competitiveness?

This literature is still in its infancy, and most, if not all of these questions still lack definitive answers. These three controversial trade and environmental relationships can be referred to as the Environmental Kuznets Curve, Pollution Haven, and Porter effects. As will be pointed out, these three effects also translate into the scale, composition, and technique framework outlined earlier.

**A. Effects on Economic Growth and the Environment: The Environmental Kuznets Curve**

There has been a great deal of discussion that attempts to link trade and environmental quality through a number of growth and developmental parameters. Such discussions revolve around the so-
called Environmental Kuznets Curve (EKC). The original Kuznets curve (1955) suggested an inverted U shaped relationship between income inequality and national income, saying that income inequality increases at lower income levels, reaches a maximum, and then declines thereafter. While this ultimately did not hold up to empirical scrutiny, it served as a backdrop for policy makers to advise governments to “grow now, worry about equality later.” (Gallagher 1999).

In the past decade, an EKC hypothesis has arisen. Another article by Grossman and Krueger (1995) argues that environmental conditions worsen during the early stages of industrial development, then improve as income levels rise. Using a partial equilibrium approach, they found that the peak or “turning point” for sulphur dioxide and smoke pollution was around $5,000 per capita. The relationship is seen as a function of either improvements in technology or as a result of newly affluent citizens demanding a cleaner environment. Such observed relationships have formed the basis for policy-makers to advise governments to raise incomes by developing their economies now through trade liberalization, and worry about the environment later.

In a comprehensive survey of the literature since the initial work of Grossman and Krueger, David Stern (1998) reveals that an EKC relationship can only be observed under a limited set of conditions. Moreover, he argues that a country’s level of pollution is often a function of other factors unrelated to rising incomes.
Of the articles that do show an EKC, some have found turning points higher than the $5,000 point that Grossman and Krueger found. This is of critical importance because it suggests that many of the world’s poorest nations would have to endure high levels of pollution far into the future, even if they do eventually reach a turning point. (Selden and Song 1994; Hilton and Levinson 1998). Setting the turning point aside, while a number of studies have found an EKC for sulphur dioxide and for smoke (Panayatou 1996), other pollutants have been found to grow continuously with income, such as urban wastes and carbon dioxide (Shafik and Bandyopadhyay 1992).

A small but growing segment of this literature focuses on factors other than income levels that determine levels of environmental degradation. One study found that the oil-price shocks of the 1970s, not income changes, were the triggering factor leading to changes in per capita CO2 emission trends (Moomaw and Unruh, 1997). Another looked at the relationship between income, inequality, power, and levels of pollution (Torras and Boyce 1996). The authors argue that greater inequality of power will be associated with higher levels of pollution. Those who benefit from pollution will be better able to prevail against those who bear the costs of pollution. While some of their methodologies are questionable (see Gallagher 1999), the article is a pioneering first attempt to introduce power and inequality into the EKC debates.

The preponderance of the empirical evidence shows that, like the original Kuznets curve hypothesis prescriptions to “grow now, worry later” can be erroneous. Based on the literature, five important factors should limit optimism about the policy relevance of the EKC literature:
1) Much of the environmental degradation that occurs before a nation might reach its turning point could be very large and irreversible (Arrow et al, 1995).

2) Ambient concentrations of pollution, rather than annual flows of emissions (the measure most used in EKC calculations), will remain quite large and can contribute to irreversible affects.

3) Decreases in pollution in one country could be due to increases in others. For example, trade liberalization between a developing country and a developed one could lead pollution-intensive activity to concentrate in the developing country and make a developed country look cleaner (Rothman, 1998).

4) Looking at the EKC relationship through the lens of median incomes reveals that global pollution to be increasing for decades. While many of the studies find comfort in the possibility that the turning point may be around the current world mean per capita income, there are many more people below this level than above it.

5) There is not a linear relationship between economic growth and democratic progress. The levels of democracy and political power in an economy may limit the ability of newly affluent citizens to demand a cleaner environment.

B. Effects of Trade Liberalization on Environmental Quality: The Pollution Haven Effect

Perhaps the most politically charged element of the trade and environment debate involves the so-called pollution haven hypothesis. There is no consensus on the pollution haven effect in the
economics literature. Both CGE and partial equilibrium approaches have shown that such an effect is possible in theory, but the empirical work on this subject reveals conflicting evidence regarding the effects of trade on environmental quality (Jaydevappa and Chhatre 2000).

Combining trade and environmental economics suggests that liberalization of trade between two countries with differing levels of environmental protection could lead pollution-intensive industry to concentrate in the nation where regulations are lax (Baumol and Oates 1988). If one nation embarks on an effort to internalize environmental and social costs, and enters into trade with a nation that does not, the latter nation can enjoy an advantage in goods that incur high amounts of such costs (Daly 1996). General equilibrium analysis yields this result as well. Copeland and Taylor (1994) have shown that free trade can induce international specialization in “dirty” manufacturing. In this case, the difference in the relative price of environmental inputs in Northern countries and in the South implies that the South specializes in dirtier activities than the North.

The empirical evidence, however, is conflicting. A World Bank team looked at trade liberalization and the toxic intensity of manufacturing in 80 countries between 1960 and 1988 (Lucas et al., 1992). Analyzing aggregate toxic releases per unit of output, they identified metals, cement, pulp and paper, and chemicals as the dirtiest industries. They found that the dirty industries grew faster in developing countries as a whole, but that growth was concentrated in relatively closed, fast-growing economies, rather than in the countries that were most open to trade. However, Rock (1996) contradicted this by showing that open-trading policies were more pollution intensive compared with inward-trading policies (see also Mani and Wheeler 1998).
These arguments have a flip side. Some argue that even if trade liberalization will cause an expansion of dirty industry in a developing economy, such expansion could be cleaner than it would have been otherwise. This is due to the possibility that the expansion could involve large amounts of foreign direct investment (FDI). In 1990 foreign direct investment (FDI) flowing to the developing world was 44 billion dollars, but reached over 650 billion dollars in 1998 while official development assistance continued to hover at close to 50 billion dollars annually (UNCTAD 2000). It is argued that these foreign investors often set up operations with modern, less polluting, new technologies and management systems that are more advanced than those that exist locally (Esty and Gentry 1997).

This possibility promises intriguing “win-win” solutions but falls far short in a number of areas. Of all FDI flows in 1998 - 657 billion dollars- only 25 percent was located in the developing world. Moreover, three nations, China, Mexico, and Brazil -receive almost half of the developing world’s share (UNCTAD, 2000). These figures reveal that many of the world’s poorer nations will not be able to benefit from the possible transfer of cleaner technologies through FDI. Moreover, massive capital flows to the developing countries are not a sustained guarantee; such flows have proven to be erratic and volatile over time. In addition, there is evidence that sometimes FDI comes in the form of outdated, environmentally deterious technology (Esty and Medelsohn, 1995).

The existing literature on the relationship between FDI and the environment is perhaps the least developed aspect of these debates, however some new work is beginning to outline the conditions under which FDI can improve the environment. A recent study analyzing Mexico found that in some
industries Mexican firms were on average cleaner per unit of output than their US counterparts. In such industries (such as iron and steel), pollution is in large part a function of plant vintage, or, put another way, core technology. In these industries, FDI, among other factors, has led to newer, cleaner vintages and therefore less pollution. However, in those industries where pollution is a function of end-of-pipe technologies, FDI was positively associated with increasing pollution (Gallagher 2001).

It is important to note that practically all of the pollution haven literature assumes that a handful of the dirtiest industries in the developed world are the dirtiest industries worldwide. Indeed, the definition of dirty industries is crucial to all analyses in the pollution haven literature. While several different definitions seem to yield similar lists of dirty industries, the definitions used in most studies rely on pollution data from developed countries. Pollution data from developing countries shows that the same industries are not the dirtiest ones everywhere (Aguayo et al, 2001). Developed country environmental problems and successes are not a mirror of the entire world.

This points to a deeper and more fundamental northern bias in the pollution haven literature. Most of the discussion surrounding the environmental effects of trade liberalization between developed and developing countries assumes that liberalization may threaten strong environmental standards in developed countries. A minority holds a less Western-centric view, focusing on how liberalization can undercut more sustainable practices in developing countries by inducing them to import goods from developed countries that have not internalized the negative externalities associated with those goods.
This has been shown to hold true in the context of genetic diversity. Genetic diversity in crop plants is widely recognized to be essential for long-term world food security. James Boyce has pointed out that such diversity is sustained “in the field” by poor farmers in developing countries. Such preservation of this diversity is subtly accounted for in the higher, more labor intensive costs of agricultural work. Agricultural imports from developed countries without such diversity, and with implicit subsidies for more capital intensive agricultural production, do not include the internalization of externalities (in this case negative) in their prices in the manner that such costs are captured by the work of the poor farmers. Boyce argues that the result can come in the form of displaced local production in centers of genetic diversity. Such a displacement can threaten both rural livelihoods and the continued provision of crop genetic diversity. Two papers have shown how the North American Free Trade Agreement (NAFTA) has impacted Mexican maize farming in this manner. Such changes in Mexico have resulted in higher levels of migration from rural areas and increased pressure on land, aquifers, and forests (Boyce 1996; Nadal 2000).

Like the EKC debates, this work has remained inconclusive because the level of analysis has been too broad. However, one can now pull out a set of findings from this literature that shows how the “win-win” and “lose-lose” scenarios presented in many political circles are limited at best. Indeed such findings point toward a set of narrower questions that can better inform future policy:

1) On the whole, the literature has suggested that dirty industries don’t move from developed to developing countries in pursuit of weaker environmental regulations, although there are certainly cases
where this has occurred.

2) On the other hand, while dirty industries may not move, but they have expanded more in developing countries than in developed countries in recent decades. This leads to an important and less researched empirical question: to what extent has relatively weak environmental policy lead to such expansion?

3) The work of Boyce, Nadal and others hints that developed countries can be pollution-havens too! Ironically, the most clear example of the relative expansion of a dirty industry as a result of trade liberalization has been the case of pollution intensive corn production in the United States.

4) The literature also suggests that FDI has a limited ability to transfer clean technologies to developing countries, and can therefore not be seen as the solution. The lion’s share of FDI flows only to a handful of developing countries, in some cases FDI can be in the form of dirtier technology, in some cases it just doesn’t matter. What are the broad set of conditions under which the positive and negative effects of FDI occur?

C. The Effects of Environmental Regulation on Trade: The Porter Hypothesis

The third series of discussions in the trade and environment literature is as inconclusive and controversial as the first two. This literature centered around the work of Michael Porter who argues that strong environmental regulations can be a source of dynamic comparative advantage. Whereas the pollution haven literature focuses on how weak environmental regulations can give nations a comparative advantage in international trade, Porter argues that strong regulations can do the same. What is central to this part of the literature is the role of technological change.
The crux of Porter’s hypothesis is that innovation to decrease environmental degradation can lead to reduced costs and therefore increased competitiveness. Environmental regulation can lure firms to seek ways of increasing resource productivity and therefore reduce the costs of inputs (for earlier discussions see Ashford et al. 1985). Such “innovation offsets” can exceed the costs of environmental compliance. Therefore, the firm that leads in introducing cleaner technologies into the production process may enjoy a “first mover advantage” over those industries in the world economy that continue to use more traditional, dirtier production methods (Porter and van der Linde 1995). A related way in which more stringent environmental regulation can enhance competitiveness is through the establishment of new industries that produce pollution control and monitoring technologies (OECD 1996). Such notions are critical of the static nature of trade theory by arguing that firms and countries can move to comparative advantage dynamically.

Such statements have raised the eyebrows of more than one economist. The Porter hypothesis has been criticized as being a predetermined outcome of a series of case studies:

With literally hundreds of thousands of firms subject to environmental regulation in the United States alone, it would be hard not to find instances where regulation has seemingly worked to a polluting firm’s advantage. But collecting cases where this has happened in no way establishes a general presumption in favor of this outcome. It would be an easy matter for us to assemble a matching list where firms have found their costs increased and profits reduced as a result of (even enlightened) environmental regulations, not to mention cases where regulation has pushed firms over the brink into bankruptcy. (Palmer et al 1995, 120-121).
Fortunately, this debate is becoming less polarized. While there is still insufficient evidence regarding a general pattern for the Porter hypothesis, recent studies have pointed the way for further empirical work. A study of 127 large US firms determined that there was a positive relationship between emissions reduction and subsequent profitability (Hart and Ahuja 1996). Another econometric study found a positive relationship between strict environmental regulations and research and development expenditures in a cross-section of US manufacturing industries (Jaffe and Palmer 96). In addition, partial equilibrium modeling techniques have been developed to test this hypothesis in the developing country context (Larson 2000).

Rhys Jenkins (1998) has offered a synthesis of the Porter hypothesis, arguing that regulation is more likely to lead to “innovation offsets” under three conditions. Note that each condition requires that a firm has substantial market power:

1) In industries where there is substantial innovative activity. Considering the fact that cost reductions are more likely to occur where new clean technologies are developed rather than in industries which adopt end-of-pipe solutions, the level of R&D is likely to be a factor in determining the impact on competitiveness.

2) In industries or firms that have the ability to absorb environmental costs, which is most often determined by profit margins and firm size (Alanen 1996).

3) In firms that have the ability to pass those costs to consumers in the form of higher prices.
V. An Emerging Synthesis

Although the economics profession was a latecomer in incorporating environmental problems into its calculus, it was well equipped to meet such a challenge. The emergence of environmental and ecological economics allowed for reformulation of basic growth and trade theories on the basis of externalities. In addition, the conventional tools of general and partial equilibrium analysis served as ample instruments to test reformulated theory.

That was the easy part. With these tools in hand economists have engaged in often heated and polarized debates on the empirical effects of trade and environmental interactions. These debates can be grouped into three categories: the relationship between economic growth and the environment (EKC); the relationship between trade and environmental quality (pollution haven hypothesis); and the relationship between environmental regulation and competitiveness (Porter effect).

While the debates on each of these three topics continue to rage, they are nearing at least conceptual synthesis. The framework developed by Grossman and Krueger discussed earlier deserves the utmost credit for making sense of these interactions. Looked at through this lens, it is revealed that the three debates are each only looking at a particular slice of the trade and environmental relationship. They are less right or wrong as they are incomplete.

The EKC literature empirically picks up all three effects, but it is difficult to determine which of the three effects is dominant. Remember that 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. The EKC literature is essentially saying that at a certain point the nature of activity does change as a result of trade liberalization, either in terms of the composition of output; the transfer or development of cleaner technologies to (or by) developing countries; or increasing income levels leading the newly affluent citizens to demand a cleaner environment. However, at this point the EKC literature does not shed light on which of these effects is driving change. For this the discussion shifts to the pollution haven and Porter effects.

Arguments surrounding the pollution haven hypothesis are looking at the scale and composition effects but are not considering the technique effect. When comparative advantage is derived from differences in environmental stringency the composition effect of trade will exacerbate existing environmental problems in the countries with relatively lax regulations and increase the overall scale of pollution. Notice though, the literature on the pollution haven effect rarely discusses technological change.

Technique effects, or changes in resource extraction and production technologies, are the key to determining the net impacts of trade and environmental interactions. The literature that centers most on this effect is that concerning the Porter hypothesis. However, this literature has thus far focused on individual sectors and firms, and has not concentrated on overall scale and industrial composition in or across nations.
To date, there has not been a study that attempts to assess these effects jointly to determine the net effects of trade liberalization on environmental degradation. Indeed, such a task is a tall order. However, thinking about these relationships in this manner can help policy makers make better sense of these relationships.

VI. Research and Policy

A number of proposed trade agreements are on the horizon. Globally, a new round of WTO negotiations, while currently stalled, is inevitable. Regionally, estimates for the completion of a Free Trade Area of the Americas (FTAA), which would create the world’s largest trading block, range from 2003 to 2005. Similar arrangements are planned for Asia, Africa, and for the expansion of the European Union. Economists will continue to be called upon to inform the policy process related to these events -and should be. However, the existing literature can not be easily packaged for policy audiences.

There are two clear policy conclusions that come out of the literature assessed in this paper. First, the work on the EKC confirms that trade-led growth will not automatically improve the environment. In addition, the pollution haven and Porter hypothesis literatures indicate that environmental policy, at least in the developed economies, is not a deterrent to trade and competitiveness. Indeed, threads of these literatures show that stronger environmental policies can enhance trade and competitiveness. This has led to an emerging consensus among economists that “increased trade and growth without appropriate environmental policies in place may have unwanted
effects on the environment.” (Fredriksson 1, 1999).

These conclusions provide some guidance but by and large are too vague for the policy-making process. The three broad categories of research discussed here need to be narrowed and refined in order to provide clear advice to policy makers. Research questions in this context include:

**Environmental Kuznets Curve**

1) What are the conditions, or non-growth related aspects, that spur the development of environmental policy in developing countries? How can they be replicated and accelerated through the trade process?
2) What are the growth-environment trajectories for post-industrial societies, for developing countries? How do they compare and contrast?

**Pollution Haven hypothesis:**

1) To what extent has environmental policy, or lack thereof, contributed to the relative expansion of pollution intensive industries in the developing world in past decades?
2) In what respects do environmentally unsafe practices in developed countries jeopardize more environmentally friendly practices in the developing world through the process of trade liberalization?
3) To what extent does trade liberalization exacerbate problems associated with overexploitation of natural resources in developing countries?
4) Under what specific conditions can trade liberalization agreements enhance environmental protection,
when does trade degrade the environment? Are there specific categories of industries or economic activity that are more likely to environmentally benefit from trade liberalization?

5) Related to the second point, to what extent does FDI bring the transfer of cleaner technologies to the developing world? Are there only a few countries and a few industries where this is possible?

**Porter Hypothesis:**

1) To what extent does the Porter hypothesis only pertain to large industries in the developed economies with extraordinary market power? Can innovation offsets occur in large industries in the developing world. Does the Porter effect pertain to smaller, more competitive industries?

2) There is a large and controversial literature on economic instruments for environmental policy what kinds of environmental policy spur innovation offsets when they do occur?

A research agenda based on these and similar questions can better inform upcoming debates on trade and environment. However, while many policy-makers will certainly welcome more concrete lessons drawn from past trade agreements, many will want to know the potential impacts of *proposed* policies. In addition to analyses drawing lessons based on methodologies that determine what happened in the past, in cases where lessons are not easily transferred to current policy proposals, policy-makers will want to consider analyses of “what if” scenarios under proposed agreements. In this context, economists can play a role in the shaping of national environmental policy and international trade policy.
In political circles, the crux of the trade and environment debate has surrounded clashes between the rules of the international trade regime and national environmental policy. In the much publicized tuna/dolphin, CAFÉ standard, and shrimp/turtle decisions before the WTO, national environmental policies were seen to be in conflict with the global trade regime for two reasons. First, national environmental policy was determined to be discriminatory - being levied on foreign producers more than on domestic ones. Second, in these and similar cases the kind of environmental policy utilized was not considered to be the “least trade restrictive.” One of the largest literatures in environmental economics is termed the “instrument choice” literature. However, most of this literature focuses solely on which economic instruments are the most economically efficient ones (see Stavins 2000). Other work has focused on the limits of such a focus, but both are guilty of not focusing on economic instruments for environmental policy in a trade context (Gallagher and Ackerman 2000). An unresearched question for economists is how economic instruments for environmental policy can be designed to maximize environmental protection and economic efficiency in the “least trade restrictive manner?”

A second area for research pertains to international trade policies. A number of international meetings have been convened to discuss “Sustainability Assessments” of proposed agreements (OECD, 2000; World Wide Fund for Nature, 2000). Indeed, the United States government has issued an executive order requiring environmental reviews of proposed trade agreements. Economists can play a key role in developing methodologies for these assessments.
To date, economists have offered CGE approaches to this process. As mentioned earlier in this essay however, CGE models are inaccessible to non-economists, expensive and difficult to operate. Even within the profession, they do not have an established track record of empirical success from which a set of agreed upon prerequisites for such an approach can come. This can lead to erroneous conclusions (Ackerman et al. 2001). Again, perhaps the most insurmountable problem with the CGE approach is that the economic theory underlying CGE models is controversial, and even advocates of CGE modeling state that such an approach is extremely limited for dynamic analysis (see Ackerman 2000).

Strengthening CGE approaches and supplementing them with the development of more realistic tools is of utmost importance for upcoming trade and environment debates. Many of the relationships that CGE analyses seek to represent can be examined in simpler, more transparent models. In particular, input-output relationships and econometric techniques have, to a limited extent, been used in the past to examine trade and environment relationships (Gale 1995; Uno 2000). Building on this early work to establish a core set of partial equilibrium techniques to examine the intricate relationships between trade and the environment should be central to the economics research agenda in the coming years. To take the case of input-output analysis, it already benefits from a well established theoretical basis and years of empirical testing. And, like CGE approaches, input output analysis can examine secondary effects of policy changes.

This paper has shown that international trade and the environment are inextricably linked in
theory, practice, and policy. In addition to synthesizing the current literature in economics on this subject, a set of more concrete questions have been offered to elevate and refine future discussion on these issues.

References


Gallagher, Kevin, and Frank Ackerman, (2000). “Trade Liberalisation and Pollution-Intensive
Industry in Developing Countries: A Partial Equilibrium Approach.” *Assessing the Environmental Effects of Trade Liberalisation Agreements.* Paris, OECD.


