Environmental Control and Patterns of International Trade and Investment: An Emerging Policy Issue (*)

Public concern for the "quality of life" is hardly a new phenomenon. Indeed, it underlies the very fundamental desire to improve the human condition and motivates the pervasive drive for economic growth, social change and political adaptation. In its essence, the concept is a highly personal one, governed by a wide variety of criteria forming unique and widely divergent individual preference patterns that are subject to constant evolutionary change. Economists have long recognized that the establishment of a collective or social preference function purporting to characterize a particular group of individuals is most uncertain, both conceptually and empirically. Revealed social preference is instead the product of collective decision-making through rather imperfect political processes, which themselves contribute additional uncertainty.[1] While the precise definition of a society's preferences and valuations regarding the quality of life may represent an inherently futile endeavor, it is nevertheless relatively safe to predict the emergence of important differences in this respect among political collectivities over time: interregionally and internationally, between collectivities subject to different political decision processes, between collectivities at different

* This paper is based on a larger, policy-oriented study on the multinational corporation for the Center for Multinational Studies, Washington, D.C., and on current research supported by the Ford Foundation. Helpful comments on earlier drafts by Robert G. Hawkins are gratefully acknowledged.

1 Cf. James M. Buchanan, "Individual Choice in Voting and the Market", *Journal of Political Economy*, August 1954, and Anthony Downs, "An Economic Theory of Political Action in a Democracy", *Journal of Political Economy*, April 1957. For a different view, see J. von Neumann and O. Morgenstern, *The Theory of Games and Economic Behavior* (Princeton: Princeton University Press, 1944).

levels of economic development, and so forth. So long as these differences obtain — in substance, in intensity, and in timing — both economic and political relations between these groups will be affected, often in rather dramatic ways.

Environmental despoilation is one aspect of the quality of life that has always entered into the determination of social welfare.[2] But it has generally been subordinated in individual as well as in collective decision-making to other elements, in particular to the more tangible and immediate requisites of improved levels of living (defined conventionally) and real per capita incomes. Over time however, the incremental social costs of environmental degradation have risen as an inevitable consequence of rapidly advancing levels of economic activity and population-expansion in the face of steadily more apparent limits in the absorptive capacity of the biosphere. At each political level, there is thus the growing realization that severe problems of environmental disruption are closely related to the imprudent pursuit of economic growth — that the intersectoral and intertemporal cost-transfers and negative social spillovers inherent in the conventional growth process may at various points become sufficiently powerful to outweigh the expected economic gains. This process has been both gradual and uneven, gaining in intensity and social impact particularly during the past decade and varying widely among municipalities, regions and national states.

This lack of homogeneity, in the severity of environmental despoilation *and* in its political perception, is attributable in large part to the fact that a threshold normally exists below which the environment is able to absorb noxious effluents on a continuing basis, but beyond which incremental pollution becomes highly apparent. The threshold varies widely, both among different forms of pollution and among geographic regions. When added to the aforementioned differences in the social valuation of environmental degradation this insight helps to explain the observed variations in environment-control (E-C) policies and techniques, interregionally, intertemporally and internationally.[3]

2 For an excellent review of the issues, see Sir Solly Zuckerman, "Background Report on the Congress Theme", in *The Vienna Papers, Technology and Society: A Challenge to Private Enterprise,* XXIII Congress of the International Chamber of Commerce (Washington, D.C.: The United States Council of the ICC, 1971).

3 A useful survey of the problems is provided in S. V. Ciriacy-Wantrup, "The Economics of Environmental Policy", *Land Economics*, February 1971.

It is also true that international movements of common-property and natural resources have themselves helped to obscure emerging environmental crises at the national level, and have thereby delayed effective measures to deal with them. Air and water resources move globally in a natural manner, dispersing noxious effluents and reducing the social costs of environmental degradation from a national point of view. At the same time, international trade permits the acquisition of scarce or environmentally-costly natural resources and pollution-intensive manufactures from abroad, again diminishing the urgency of dealing with common-property resource management problems arising in these sectors. International trade and resource flows can be counted upon to continue to ameliorate environmental problems for individual countries in the foreseeable future, probably in substantially intensified form. At the same time, global pressure on these resources will continue to grow, and the scope for additional international reallocations of this nature will become successively more limited.[4]

The purpose of this paper is to indicate the probable direction and magnitude of environmental control in its effects on international economic relations, focusing on the prospective impact on economic structure, production processes and efficiency, patterns of trade, commercial-policy responses, industrial location and capital flows, as well as intra-firm logistics and managerial decision-making on a multinational scale.[5]

I. Industrial Structure, Competitive Advantage, and Control of the Environment

Three functional sources of environmental despoilation can be identified:

Type A: Final goods, intermediates and raw materials which, when used as intended, cause serious despoilation of the environment. Examples include automobiles, aircraft, construction equipment, certain advertising materials, pesticides, fungicides, fuels, detergents, and so forth.

Type B: Residuals of the consumption process — products which, having served their purpose and, possessing no effective market value, are discarded in a manner harmful to the environment. Closely related and evidencing similar attributes is the environmental impact of human and animal waste-disposal.

Type C: Residuals of the production process — environmentally deleterious side-effects of the production of virtually all goods and services.[6]

Within a modern conceptual framework, these undesirable by-products of the production-distribution-consumption cycle are considered social costs, which must be deducted from social product in order to develop a valid guide to aggregate welfare and changes therein. Economic activity generates a wide range of "externalities", including the economic and social costs of environmental despoilation, which may not be reflected in product costs and hence may fail to enter both into the economic and resource-allocation process and into measures of economic welfare.[7] Once acknowledged as real social costs, such externalities must be considered explicitly, and this can materially alter economic decisions and priorities.[8]

The market generally fails to distribute the cost of environmental despoilation and other externalities — i.e., they are not "internalized" in the production process — to the ultimate consumers and users in the form of prices. Consequently, public policy together with an increased and perhaps anticipatory social awareness on the part of management must be relied upon to secure an internalization of existing environmental externalities or an apportionment of these costs on some other agreed-upon basis. Enforced

4 Cf. *United Nations Conference on Trade and Development*, "The Implications of Environmental Measures for International Trade and Development", Research Division Memorandum, No. 42, 15 September 1971 (mimeograph).

5 The sources of environmental despoilation may conveniently be grouped as follows: (a) atmospheric pollution, (b) water pollution, (c) thermal discharges, (d) acoustical pollution, (e) radiation, f) solid wastes, (g) visual despoilation, (h) recreational safeguards, wildlife and the natural terrain, and (i) congestion, as well as the closely-related issue of natural-resource management.

6 Cf. General Agreement on Tariffs and Trade, *Industrial Pollution Control and Industrial Trade* (Geneva: GATT, 1971).

7 For a good review of externalities theory, see E. J. Mishan, "The Postwar Literature on Externalities: An Interpretative Essay", in *Journal of Economic Literature*, March 1971.

8 A very useful analytical technique is provided by the general theory of the "second best". See R. E. Lipsey and K. Lancaster, "The General Theory of Second Best", *Review of Economic Studies*, Vol. XXIV (L), No. 63 (1956-57), and O. A. Davis and A. B. Whinston, "Welfare Economics and the Theory of Second Best", *Review of Economic Studies*, January 1965.

internalization of E-C costs will clearly affect the competitive position of the producing units involved, depending upon the degree of national and international uniformity applied. Distribution of the E-C burdens in other ways may also affect competitive relations, although the impact depends fundamentally on the nature of the measures employed.[9]

Consider, for example, the standards imposed under the United States Clean Air Act of 1967, and their prospective effects on *all* prices in the U.S. if the 20 industries responsible for most of the emissions of sulphur dioxide, hydrocarbons, carbon monoxide and particulates satisfy fully these norms. As seen in Table 1, adherence to these standards by the primary non-ferrous metals industry, for example, is estimated to increase the U.S. price level by 16.8 per cent, electric utilities by 7.3 per cent, iron and steel foundries by 3.5 per cent, primary steel by 2.2 per cent, secondary non-ferrous metals by 3.0 per cent and miscellaneous non-ferrous metals by 6.0 per cent, to cite only the most dramatic cases. Column 2 of Table 1 indicates correspondingly the degree to which all prices in the U.S. are likely to rise if, as a partial air-pollution control measure, high-sulphur fuels are replaced by low-sulphur fuels in domestic and industrial applications. Note that the sensitivity of prices is highest if this substitution is forced upon producers of industrial chemicals, coal mining, plastics and synthetic materials, fertilizers, pulp and paper, iron and steel foundries, iron and steel forgings, non-ferrous metals, petroleum refining and metal containers.

If environmental controls such as this go forward systematically, and if such estimates are even reasonably close to the mark, the overall international competitive impact could be very substantial indeed.[10] Taken in isolation, it would for example indicate the need for a downward adjustment in the value of the national currency

9 For an excellent survey of the issue, see Robert U. Ayres and Allen V. Kneese, "Production, Consumption, and Externalities", *American Economic Review*, June 1969.

10 This is at variance with tentative findings by Pearson and Takacs to the effect that "... preliminary studies indicate that the rise in prices will be under one percent for most industries". Charles Pearson and Wendy Takacs, "International Economic Implications of Environmental Control and Pollution Abatement Programs", in the Williams Commission report on *United States International Economic Policy in an Interdependent World* (Washington, D.C.: U.S. Government Printing Office, July 1971), pp. 777-790. And quite the opposite conclusion is derived in a paper by Ralph C. D'Arge in Allen V. Kneese, Sidney E. Rolfe and Joseph W. Harned, *Managing the Environment: International Economic Cooperation and Pollution Control* (New York: Frederick A. Praeger, 1971).

Table 1

ESTIMATED PRICE INCREASES OF ALL GOODS AND SERVICES RESULTING FROM COMPLIANCE WITH CERTAIN ANTI-POLLUTION MEASURES

(*in per cent*)

Sector[1]	Price increase if major air-polluting industries met the standards of the U.S. Clean Air Act, 1967 [2]	Price increase resulting from an overall substitution of low sulphur fuels for high sulphur fuels [3]
2 Electric utilities	7.3	2.9
87 Gas utilities	0.1	1.1
4 Iron and steel foundries	3.5	2.9
5 Primary steel	2.2	1.5
22 Iron and ferro-alloy mining	0.4	2.3
13 Coal mining	0.5	6.1
26 Chemical and ferrous mineral mining	0.4	1.9
52 Iron and steel forgings	1.9	2.4
3 Pulp mills	0.7	3.2
40 Paper and allied products	0.4	2.8
41 Paper containers	0.3	2.5
6 Primary non-ferrous metals	16.8	3.4
17 Secondary non-ferrous metals	3.0	1.9
23 Misc. non-ferrous metals	0.5	1.8
9 Petroleum refining	6.0	2.1
24 Crude petroleum and natural gas	0.2	8.3
7 Industrial chemicals	0.2	1.2
44 Plastics and synthetic materials	0.6	10.3
8 Fertilizers	0.4	6.2
54 Metal containers	0.8	4.7
57 Other fabricated metal products	1.6	2.0
61 Metal handling machinery and equipment	1.4	1.7
62 Metal working machinery and equipment	0.8	1.5
63 Specific industrial machinery and equipment	0.7	1.3
64 General industrial machinery and equipment	0.8	1.7
65 Machine shop products	0.8	1.1
68 Electric equipment and appliances	0.9	1.6
73 Electric machinery and equipment	1.6	1.4
58 Engines and turbines	0.9	1.5

1 Industry grouping aggregated from OBE 370-order matrix for 1963 published in "Input-Output Structure of the U.S. Economy: 1963, Vol. 1 - Detailed Transactions", Washington, 1969.

2 This column shows by how much all prices would have to increase if the 20 industries mainly responsible for generating the four principal pollutants (particulates, SO_2, hydrocarbons and CO) actually complied with the standards of the U.S. Clean Air Act, 1967.

3 This column shows by how much the prices of all goods and services would have to increase if, in industries as well as in domestic uses, high-sulphur content fuels were eliminated.

Source: General Agreement on Tariffs and Trade, *Industrial Pollution Control and International Trade* (Geneva: GATT, 1971), as taken from W. Leontief and A. Ford, "Air Pollution and Economic Structure: Empirical Result of Input-Output Computations" (mimeo.).

in order to avoid serious adverse shifts in the trade balance. Simultaneous progress in this area by main competitor countries would, of course, reduce the need for such action in the monetary sector, but certain currency readjustments may be required in the absence of a considerable degree of transnational uniformity in E-C standards.

General price-level sensitivity to pollution control in other countries may of course be greater or lower than in the U.S., depending on the availability of substitute fuels, comparative efficiency in applying environmental-control techniques, and differences in economic structure. The impact on aggregate trade flows depends also on the distribution of control measures among competitive national economies and the range of affected products competing on world markets. Nevertheless, it is evident from this example that the impact of environmental controls on aggregate price and cost levels — and hence on imports and exports — may be substantial indeed.

In addition to affecting broad-gauge industrial *competitiveness* of the nation as a whole and necessitating possible countermeasures in the monetary sector, E-C policies will also influence *comparative advantage* in the traditional sense, as a result of variations in impact as between different industries. Suppose we classify all of the goods and services produced by a nation into those in which an international competitive advantage may exist (exportables), those which appear to be characterized by an international competitive disadvantage (importables), and those which are non-traded. In international commerce a country exchanges exportables abroad in return for importables under (assumed constant) terms of trade which render it materially better off — in terms of real income per capita — than if it did not engage in trade. Its economic structure is thus biased toward the production of exportables, in which it specializes more than it otherwise would as a result of its particular factor endowments and factor productivities. Let us further hypothesize that the country decides to deal with environmental degradation in a serious manner by diverting substantial productive resources to environmental control, either by forcing this upon existing producers or by undertaking direct pollution-abatement operations through the public sector.

The initial outcome is the production of fewer exportables *and* fewer importables, i.e., fewer tradeable consumption goods, investment goods, and services as a result of the government-induced diversion of resources to (non-traded) environmental control: The quality of life may well improve, but the quantity of exportable and importable goods and services produced by the economy declines.[11]

If this resource-transfer reduces the potential output of *both* exportables and importables symmetrically in favor of intensified E-C activities, the country's international *comparative advantage* remains unaffected. Assuming balanced trade, it continues to export and import the same products as before, only in smaller volume, and its gains from international trade shrink accordingly. The reduction in the gains from trade, when added to the domestic resource-diversion costs, represents the economic burden upon the society of environment-control in the form of reduced real disposable income.

Quite different are the E-C effects on international trade if the incidence is not neutral or symmetrical as between exporting and import-competing industries. Suppose, for example, the country's exportable production is clearly capital-intensive; that is, it has an international comparative advantage in the production of goods and services which demand substantial capital inputs (however defined) relative to labor and other cooperant inputs per unit of output. Suppose, further, that E-C activities likewise turn out to be capital-intensive. The diversion of productive resources from tradeable products to the E-C sector thus bears more heavily on potential output of exportables than it does on importables. Hence the country's comparative advantage in that product-group is reduced, and its production mix of tradeable goods and services becomes less specialized in the export sector. Again assuming balanced trade, the volume of trade declines significantly *more* than in the case of equivalent neutral-incidence environmental control, as does the country's gain from international commerce and its corresponding loss in real income.

At the other extreme, suppose the country specializes in the production of labor-intensive goods, and pollution-control techniques again happen to be fundamentally capital-intensive. The result now is quite different. Potential output in the import-competing sector is reduced substantially more than that of labor-intensive exportables. The volume of (balanced) trade may again decline, but less than in the earlier case, and the reduction in the gains from international

11 For a general discussion, see Orris C. Herfindahl and Allen V. Kneese, *Quality of the Environment* (Washington, D.C.: Resources for the Future, Inc., 1965).

commerce may also be materially less serious. Indeed, in terms of economic structure the country actually may specialize to a greater degree in the production of exportables than it did before the E-C measures were imposed.

From the standpoint of international comparative advantage, therefore, it would appear that the factor-intensity of environment-control techniques will in part determine its impact on the structure of a nation's trade: The more this factor-intensity coincides with the factor-intensity of a nation's exports, the greater will be the effects on the structure and volume of its international trade and the benefits it derives therefrom. So, for example, in trade between a capital-abundant nation and the rest of the world, relative to that of a labor-abundant country, we might well expect the net impact of an identical measure of environmental control applied in both countries to work a substantially greater hardship on the former.

The existence of major inter-industry variations in the effects of E-C policies appear to be borne out by the facts. In terms of primary impact on selected industries, the bearing of environmental control measures may be gauged by their respective expenditures on E-C plant and equipment, both in absolute terms and relative to total new expenditures for plant and equipment.[12] In 1969, United States durables manufacturing industries invested $15.96 billion in new plant and equipment, of which $630 million, or 3.9 per cent was for air and water pollution control. During that same year, non-durables manufacturing industries invested $15.72 billion in plant and equipment, of which $651 million, or 4.1 per cent, was for pollution control.

The iron and steel sector devoted the highest proportion of new capital investment (9.8 per cent) to environmental control, followed by pulp and paper (9.1 per cent), stone, clay and glass (5.9 per cent), mining (5.6 per cent), gas utilities (4.9 per cent), fabricated metals, instruments, other durables, and petroleum (4.6 per cent) and chemicals (4.5 per cent). Among other industry groups that made E-C investments in 1969, rubber (0.1 per cent), non-electrical machinery (1.5 per cent), electrical machinery (1.6 per cent), and electric utilities (1.7 per cent) devoted the smallest proportion of new capital formation to environmental control. In the intermediate range are non-ferrous metals (3.7 per cent), motor vehicles, aerospace and other transportation (3.3 per cent), food and beverages (2.2 per cent) and textiles (1.6 per cent). A set of alternative estimates for the years 1966, 1967 and 1968 are given in Table 2. It should be noted that values do not reflect the presumed net burden on product prices of environmental control because the annual cost of the total capital *stock* thus utilized needs to be considered (not only the increments to that stock), as well as any operating inefficiencies that may be induced by pollution-control measures.[13] Nevertheless, they do indicate an order of magnitude, and more particularly the inter-industry differences that may materialize in the effects of E-C policies on international competition.

The foregoing discussion has implied that the impact of environmental control on international competitive conditions inevitably tends to be biased against countries leading in E-C efforts. This is based on the assumption that E-C products and services are not traded internationally. But the need for ecological balance will eventually influence all national economies, even if its incidence at any point in time may be vastly different among individual countries — depending on the specific seriousness of environmental problems at the national and sub-national level, and on political perceptions and policy reactions. Lead countries will develop E-C technology, which becomes highly exportable in the form of consulting services, licensing and other arrangements, to countries less advanced in this respect. Furthermore, certain types of E-C hardware embodying this technology will evolve into competitive products on world markets. Examples include catalytic converters, electrostatic precipitators, solid-waste recycling equipment, cooling towers, sewage treatment plants and components, and so forth. The wider the gap between leading and lagging nations in E-C policies, the more pronounced will be the competitive advantages of the leaders as environmental control equipment and technology moves through the early stages of the product cycle.

Several additional trade implications may be of particular concern to the less-developed countries. For example, since many synthetic materials are produced in a manner that is relatively damag-

12 Data on total investment expenditures by industry from *Sourvey of Current Business*, September 1970; E-C expenditures levels from Subcommittee on Air and Water Pollution, Committee on Public Works, U.S. Senate, 91st Congress, 2nd Session, *Hearings* (Washington, D.C.: U.S. Government Printing Office, 1970).

13 For a comprehensive discussion, see W.L. Faith, *Air Pollution Control* (New York: John Wiley, 1959).

TABLE 2

RATIO OF POLLUTION CONTROL EXPENDITURES TO TOTAL CAPITAL EXPENDITURES, BY INDUSTRY 1966-1968

Industry	Total			Air		Water	
	1968 %	1967 %	1966 %	1968 %	1967 %	1968 %	1967 %
Durable goods industries							
Primary iron and steel	5.83	4.76	3.23	3.02	2.81	2.81	1.95
Primary non-ferrous metal	2.37	—	3.76	2.18	—	0.19	—
Electrical machinery & equipment	1.08	1.21	0.35	0.32	0.34	0.76	0.87
Machinery, except electrical	1.51	1.31	0.35	0.83	0.85	0.68	0.46
Motor vehicles & equipment	2.08	3.39	2.38	1.92	2.09	0.16	1.30
Transportation equipment, except motor vehicles	1.65	1.03	1.49	0.98	0.83	0.67	0.20
Stone, clay & glass	2.35	2.68	1.91	1.42	1.99	0.93	0.69
Fabricated metal products	1.02	1.49	0.40	0.73	0.81	0.29	0.68
Instruments & photographic eqt.	1.36	0.93	0.25	0.56	0.66	0.80	0.27
Other durable	1.49	—	0.49	0.77	—	0.72	—
Nondurable goods industries							
Food and beverages	1.36	3.68	1.33	0.65	1.27	0.71	2.41
Textile mill products	2.24	5.70	0.49	0.85	0.45	1.39	5.25
Paper & allied products	9.45	4.51	2.42	2.73	1.40	6.72	3.11
Chemical & allied products	2.41	2.33	1.56	1.41	1.02	1.00	1.31
Petroleum & coal products	4.38	4.71	1.41	2.16	2.19	2.22	2.52
Rubber products	1.18	0.63	0.18	0.31	0.16	0.87	0.47
Other nondurable goods	0.50	—	0.20	—	—	0.50	—

Source: *The Conference Board Record*, February 1970, September 1968 and September 1967.

ing to the environment, the unit cost of synthetics tends to be rather sensitive to E-C standards. This may well favor the use of natural substitutes for the affected synthetics, especially in pesticides, food products, detergents, and oils and fats, all of which are of major export interest to the developing countries. Both from a cost and demand standpoint, there may thus evolve a partial offset to the long-term tendency in the substitution of synthetics for natural products, which may be of some benefit to the less-developed economies. Conversely, the problem of solid-waste disposal and the generation of useful by-products from pollution-control activities will lead to increasingly efficient recycling and the extensive use of secondary raw

materials, and can thus be expected to work *against* the export interests of the developing countries. Both effects will however make themselves felt very gradually over a long period of time.[14]

II. Industrial Location and International Capital Flows

While perhaps a transitory phenomenon, a number of semi-autonomous political jurisdictions within various national states have begun to discourage the location of industry, following an implicit cost-benefit assessment at the political level that the negative environmental consequences outweigh the expected static and dynamic economic gains, and involving frequently bitter confrontations between interest groups falling at various points on the spectrum between total concern with economic expansion and total concern with environmental despoilation.[15]

Regions in the United States adopting anti-development policies for environmental reasons tend to be characterized by relatively high-incomes and favorable historical growth patterns. The political balance in other regions of the U.S., particularly in the South, is quite different and represents a fundamentally different assessment of the growth-vs.- environment tradeoff. The result is a major increase in the importance of environmental considerations in decisions regarding industrial location and interregional capital flows and a shift in development and commercial trends within the national economy.

Locational implications of environment-control for the international economy are no less straightforward, and will tend to be felt initially at a specific industry level and progressively spread to broader ranges of economic activity. Firms which find preferred sites excluded for environmental reasons find available alternatives that encompass *both* domestic and foreign locations.[16] There will thus evolve certain international spillovers attributable to local or regional environmental control. As domestic environmental awareness and cost-assessments increase in leading countries, these spillovers will tend to grow, with foreign sites appearing progressively more advantageous relative to domestic locations, and environmental considerations increasing in

14 See UNCTAD, *op. cit., supra.*

15 Some recent developments are reviewed in "Fellow Americans, Keep Out!", *Forbes*, June 15, 1971.

16 Cf. Tax Foundation, *Pollution Control: Perspectives on the Government Role* (New York: Tax Foundation, Inc., 1971).

importance relative to such factors as labor costs and efficiency, availability of raw materials and intermediates, proximity to markets, and so forth. Access of offshore production to the domestic market will also affect locational decisions, in particular the level and structure of tariffs and the existence of other barriers to international trade, as will the investment climate in host countries.

Since inter-country variations in environmental awareness are always likely to exceed corresponding domestic variations, and since the imposition of homogeneous E-C standards internationally is likely to lag well behind domestic harmonization, the scope for international locational spillovers will tend to be rather durable.[17] In a dynamic context, therefore, one would expect environmental pressures to promote a gradual shift of pollution-intensive forms of economic activity from higher-income to lower-income regions domestically and from higher-income to lower-income countries internationally, with the range of affected industrial activities gradually widening over time. This will have notable implications for the development process, international trade and commercial policy, and patterns of international investment.

Multinational firms — seeking to optimize supply logistics on a global scale — must likewise take environmental controls into account in the internal planning process, and the resultant capital flows may differ substantially from what would be expected in the absence of environment-induced locational policy shifts. Both the flow of investment and the return flow of earnings will undergo change, as will the financing of new capital investments.

Relations between multinational firms and host governments may also be affected. Although less rigorous E-C standards may have induced investment in a given host country, a point will eventually be reached when ecological balance will become a major concern there as well, and the same kinds of conflicts may arise as prompted the initial location decision. There may well be, however, considerably greater tensions between foreign-owned polluting firms and host governments than between governmental units and offending firms within a single nation.[18]

17 Cf. Michael L. Hoffman, "Development Finance and the Environment", *Finance and Development*, September 1970.

18 For a useful discussion of the general issue, see Judd Polk, "Social Costs of Economic Growth", in *The Vienna Papers, loc. cit.*, pp. 31-38.

One can extend this reasoning yet another step, and envision locational spread-effects increasingly in favor of developing countries. This is nothing more than a counterpart of the redistribution of new investment particularly in naturally pollution-intensive industries between rich and poor regions nationally, where ecology-growth perceptions and priorities differ markedly.

In most developing countries the threshold beyond which the eco-system can no longer absorb industrial effluents is still far removed, and the effects of environmental degradation are frequently less marked. Hot or dry climates tend to minimize the impact of certain effluents of production processes. High rainfall levels reduce the impact on air quality of certain types of emissions. Low population densities reduce the effects of other types of pollution, and large undeveloped tracts of land render marginal encroachment by industry of minor significance. Since the causative conditions and perceptions are likely to differ far more drastically between developed and developing countries — and are likely to converge much slowly — than between regions within a developed country itself, such directional effects on investment flows may make themselves felt strongly over extended periods of time. The reactions of the political leaders of developing countries to pressures for environmental protection is predictable: within the social-welfare function that faces them, ecological questions invariably play a subordinate role. Under present conditions, they simply cannot afford to forego maximum possible economic growth and generally must reject out of hand anything which may interfere materially with this objective. They cannot concern themselves with the fine points of industrial location, water pollution or despoilation of the land, when a certain degree of environmental degradation is an integral cost of the otherwise efficient achievement of their primary objectives.

On the basis of such dramatic differences in priorities, one would expect environmental control policies in the developing countries to differ fundamentally from those applied in the more advanced economies, with a general lack of concern with all but the most immediate environmental consequences of industrial development. This would manifest itself in basic differences in any environmental standards that may be applied, and a substantial lag in any such standards vis-à-vis the industrial countries. As a result, with the marginal social benefit even of pollution-intensive industries exceeding their marginal social cost in the developing countries, one would

expect them to welcome investment in these sectors, even at some cost to the environment. This may indeed prove to be generally beneficial by promoting a convergence of marginal social benefits and costs on a global scale, and we would expect — given this cost-benefit relationship — to find the developing countries courting certain types of pollution-intensive manufacturing activities to the general benefit of the international economy as a whole, at least in the intermediate term.

III. Implications for International Commercial and Financial Policy

The impact of E-C measures on international trade and capital flows depends in large part on precisely how these policies are carried out, and what countermeasures may simultaneously be taken by governments to soften their adverse effects.[19]

First, numerous proposals have centered around the use of punitive or incentive tax measures designed to reduce or eliminate environmental degradation. Generally, proposals for punitive taxation involve the establishment of pollution norms appropriate to the society or region and the application of a tax which may be in direct proportion to the amount of noxious effluent expelled or may be fixed at a constant level for the duration of the environmental despoilation. In the United States, various governmental levels presently apply tax incentives to the problem of pollution control. The Federal government and several States offer industry an accelerated depreciation for a small category of qualifying E-C facilities, for example, and they are also exempt from property taxes and various other indirect fiscal levies in certain States.

When applied to production processes, punitive taxes must be regarded as operating costs facing producers and, if they are to be effective, must exceed the operating cost-equivalent of applied E-C measures. Hence the imposition of such taxes in principle *accelerates* the impact of costs associated with environmental control upon product prices by taking effect instantaneously instead of over a prolonged period of time. With the gradual abatement of pollution, then, the tax would be lessened proportionally and direct pollution-control costs would increase as components of overall product cost.[20] Presumably, total costs would decline somewhat, assuming that the tax initially exceeded the pollution-abatement cost-equivalent as an incentive for the implementation of E-C procedures.

Taxes imposed on pollution-causing industrial processes would almost certainly give rise to demands for generally equivalent countervailing charges on imports, whether or not produced under similar conditions of environmental stringency. Such charges would be fully consistent with the concept of non-discrimination embodied in the GATT (Article III: 1) which is concerned only with the principle that imported goods should be taxed no more heavily than domestically-produced goods. They would also require rebate of the tax on exports, in order to preclude double taxation of home-produced goods in other countries applying a similar system.

The problem becomes more complex when pollution-abatement measures applied by domestic industry result in a reduction in the punitive E-C tax. Logically any import surcharges and export rebates should be reduced along with the degree of conformity with E-C standards and the concomitant reduction of the associated punitive taxes. But in the international competitive environment this would place at a relative disadvantage precisely those suppliers progressing with environmental control and work in favor of laggards or those producing under less rigorous standards. Retention of E-C equalization-duties under such conditions would be undesirable and clearly inconsistent with the GATT, thereby inviting possibly deleterious foreign commercial-policy reactions.

One alternative having potentially fewer international ramifications would be a tax-subsidy scheme, whereby an E-C tax would be combined with E-C subsidies financed out of the proceeds. Whereas the tax would indeed raise immediate cost levels, the subsidies would reduce them, either immediately or over the intermediate term. Hence any countervailing charges on imports and rebates on exports could be substantially lower and still compensate for international differences in the net incidence of E-C costs on product prices.[21]

19 It has already been pointed out that a serious attack on environmental control will have a major effect on cost structures and price levels in the national economies involved and that, to the extent that there are wide differences in intensity or timing in E-C policies internationally, equilibrium exchange rates will be affected. Appropriate adjustments in exchange rates will thus be required or, alternatively, these adjustments will occur automatically under a monetary system permitting substantial flexibility. Timely compensation in the monetary sector will minimize the emergence of many of the non-tariff trade distortions discussed below.

20 Cf. Tax Foundation, *op. cit.*, Chapter III.

21 Cf. GATT, *op. cit., supra.*

Moreover, there would be far fewer problems connected with phasing out such a program, once standards had been achieved, than in the case of purely punitive E-C taxes alone.

A second approach for dealing with inter-country differences in the cost-incidence of E-C measures, however implemented, consists of the application of border adjustments, employing the "destination principle" of adjustment for international differences in indirect business taxation, currently in widespread use.[22] This type of arrangement would demand a complete schedule of ad-valorem equivalent (A.V.E.) compensatory adjustments paralleling the national tariff schedules for affected products, and the incidence of these charges would vary widely as between different types of goods. It would also be exceedingly complex and difficult to administer in an equitable manner. For example, a domestic firm which succeeds in reducing the incidence of E-C costs falling on its products as a result of existing norms would benefit substantially in the face of a continuation of equalization charges on competitive imports and rebates on its exports. Furthermore, elaborate investigative machinery would be required to set compensatory rates, including appeals procedures for the affected industries, and changes in these rates might require significant policy responses on the part of foreign governments. The system would also have to be adopted by all of the major countries applying E-C measures in order to avoid inequities, and hence its establishment would be complex indeed.

Aside from the industries most directly affected by pollution-abatement standards, their cost-incidence would be felt in a wide variety of user-industries as well. As a practical matter, therefore, compensatory surcharges and rebates would take the form of rough approximations or flat rates covering a variety of different manufacturing activities, and would involve the danger of serious overcompensation or undercompensation with respect to specific industries and products.

Not least important, compensatory arrangements of this nature can easily evolve into *de facto* non-tariff distortions of international trade and lead to falsification of international competitiveness, if the surcharge/rebate rates are deliberately increased beyond justified

22 For a brief review of this principle, see Robert E. Baldwin, *Nontariff Distortions of International Trade* (Washington, D.C.: The Brookings Institution, 1970), Chapter 4.

levels to favor domestic industry.[23] Moreover, there is sufficient room for misinterpretation on the part of trading partners, particularly those favoring other solutions to the international competitive aspects of environmental control and those less concerned with the entire issue. Hence there is a danger of retaliation which cannot be entirely discounted.

Third, use of *direct subsidies* for environmental control will clearly represent a major policy alternative in the restoration and maintenance of ecological balance in the industrial countries. Such subsidies may be geared to matching effort on the part of a specific industry — in order to provide the incentives necessary for a serious and sustained attack on the problem — or may be applied on a broad scale in particular to the development of new production-control technology and hardware, and benefiting a wide range of firms and industries. Alternatively, they may be applied directly to production processes, by supporting the capital cost of pollution abatement or by substituting less harmful production techniques and inputs for existing ones.

Subsidies tend to be inherently self-limiting as a result of fiscal constraints facing national governments.[24] Public expenditures on pollution control in the industrial sector must compete not only with necessary environmental expenditures in other sectors, but also with a wide variety of other expenditure priorities in the areas of defense, social welfare, public works, education and so forth. Nevertheless, the greater the degree of public financial support in this form, the fewer will be the immediate spillover effects onto international trade and investment flows for the domestic industry. Since the direct burden to an industry and its reflection in product cost is less, so too is the degree to which its international competitive position is compromised and production-location decisions are affected. The results would appear to be a reduction in the likelihood of pressure for compensatory charges or other restrictions on imports produced under less rigorous standards and a diminution of the need to transfer

23 For some recent studies on non-tariff distortions, see Ingo Walter, "Non-Tariff Barriers and the Free Trade Area Option", this *Review*, March 1969, and "Non-Tariff Barriers and the Export Performance of Developing Countries", *American Economic Review*, Papers and Proceedings, May 1971; also Ingo Walter and Jae W. Chung, "Non-Tariff Obstacles and Trade Preferences for Developing Countries", *Kyklos*, Fasc. IV, 1971 and "The Pattern of Non-Tariff Ostacles to International Market Access", *Weltwirtschaftliches Archiv*, Bd. 108 (1972).

24 See Tax Foundation, *op. cit.*, pp. 22-24.

production abroad in order to take advantage of less rigorous E-C standards.

Moreover, they are likely to run into fewer internationl legal difficulties as well. Article XVI:4 of the GATT prohibits direct subsidies to exports of non-primary products. Retaliatory action based on this Article will be the probable response to direct subsidization of exports, and action under the GATT articles would also be a significant possibility in the case of compensatory import surcharges.[25] On the other hand, direct subsidization of environmental control activities need only be notified to the GATT under the terms of Article XVI:1 if there is some evidence that incidental effects on international trade may develop. Upon request by other Contracting Parties, the country applying subsidies may then be asked to discuss the possibility of limiting such subsidization — an extremely unlikely contingency in the case of E-C activities — with little danger of retaliatory response from abroad. In any event, exposure to the risk of foreign retaliation to pollution-control subsidization is directly proportional to the degree of export-orientation and significance of the industries most directly affected.

A complementary range of policy issues relates to international trade in products which may themselves despoil the environment, either in their intended use or after the termination of their useful lives. Problems may be caused by the use of products within the national territory and standards may regulate their character from a waste-disposal standpoint.

A number of studies have shown that significant trade-distortive effects may be traced to the existence of such standards, although few would argue that countries should refrain from regulatory activities in this area.[26] Nevertheless, standards may sometimes be used for explicitly protective purposes in order to impede imports, and this has led to their frequent identification as non-tariff barriers to international trade. The other difficulty relates to inter-country *variations* in standards, which compound the problem of effective supply to different regional or national markets.

There are little or no conceptual differences between national health, safety and related standards and their effects on international

25 GATT, *op. cit., supra.*

26 See, for example, International Chamber of Commerce, *Non-Tariff Obstacles to International Trade* (Paris: ICC, 1969).

trade, and those of standards regarding the environmental attributes of various products. Certain goods may be considered pollutants, such as disposable aluminum, plastic, or glass containers in the area of solid-waste disposal, non-biodegradable detergents in the area of water pollution, and high sulphur coal and oil in the area of air pollution. In the case of each E-C standards may be set which may prohibit imports not fulfilling these requirements, or which tax them in order to discourage their use and/or defray the cost of pollution-abatement measures.

In addition to requirements targeted on products themselves causing pollution, similar standards may be applied to products which are *proximate* causes of environmental despoilation. Exhaust emissions and noise standards for motor vehicles represent the most obvious case in point. Similar standards may affect trade in construction machinery, aircraft and other transport equipment, certain types of industrial mahinery, and so forth.

There is little controversy about the sovereign right of nations set standards concerning the environmental impact of products put to use within the national boundaries — so long as standards applied to imported products are no more severe than those applied to domestically-produced goods. Indeed non-discriminatory trade restrictions of this nature are allowed under Article XX of the GATT, which permits the application of barriers to trade in products considered harmful to the public health and safety.[27]

Embargoes, which generally play a minor role in international commercial policy, may assume substantial importance in connection with environmental control. Following the demise of the U. S. supersonic transport aircraft, for example, a great deal of discussion centered around barring foreign-built SST aircraft from major American airports, thereby potentially restricting travel or forbidding imports of supersonic transports themselves.[28] Automobiles that do not adhere to U. S. emission-control standards are already embargoed. It is not difficult to visualize extension of embargoes to such products as plastic and aluminum packaging materials — or even products packaged in this manner — certain types of plastics, products con-

27 General Agreement on Tariffs and Trade, *Articles and Selected Documents* (Geneva: GATT, 1969).

28 Cf. Christian A. Herter, Jr., "Preserving the Environment: The International Front", *Business Economics*, January 1971.

taining certain chemicals, and even products (such as newsprint) which are not composed to a specified degree of recycled wastes.

Customs procedures may also be applied in a manner restrictive of trade, particularly when imposed in conjunction with licensing and other certification measures. It may well be, for instance, that certain products considered environmentally sensitive will be subject to automatic import licensing, with the license accorded only after all of the requirements of the importing country have been satisfied. So long as the degree of rigor applied to imports does not exceed that applied to home-produced goods, one cannot object to this procedure. Nevertheless, there is substantial scope for misuse in any licensing and certification scheme, and it may easily be applied in a highly protectionist manner — either as a matter of policy or on a discretionary basis.

Similarly, *consular formalities* may also be employed in this context. Environmentally sensitive imports may be required to obtain consular clearance and compliance certification, which may include inspection of manufacturing facilities. This system, as well as licensing, tends to induce additional costs, delays and uncertainties, and provides ample scope for misuse in a protectionist manner.

Problems currently encountered in *state trading* and *discriminatory government procurement* may be aggravated when the requisites of environmental control are added. Public procurement, which already discriminates heavily in favor of domestic suppliers in most industrial countries, may be limited in large measure to domestic goods in the case of products that are deemed environmentally damaging. In public procurement the discriminatory element frequently derives not from codified policies, but is based on understandings, specifications and supplier relationships that evolve over time, in addition to restricted bidding procedures. A larger government role in the form of E-C activities will considerably widen the scope for discriminatory procurement, both by government at various levels and by state-trading agencies.

Even if E-C standards for imported goods are no more stringent than for home-produced goods, the enforcement of such regulations can lead to substantial costs and uncertainties on the part of foreign suppliers. Unless there is clear-cut mutual acceptance of certifications concerning the salient environmental characteristics, as well as mutual acceptance of inspection and other procedures, serious trade distortions may result.

A number of other international competitive distortions may arise out of environmental protection efforts as well, although in-depth analysis lies will beyond the scope of the present survey.[29] These include:

(a) *Selective import prohibitions,* aimed at specifically pollution-intensive products produced under considerably more lenient or non-existent environmental controls.

(b) *Export restrictions,* to safeguard natural resources and discourage depletion of coal, oil, natural gas, timber and mineral reserves, or to prevent environmentally-damaging practices associated with the exploitation of these resources for export.

(c) *Variable import charges,* under which levies might be adjusted to the degree of conformity of imported products or foreign suppliers to E-C standards obtaining at home.

(d) *Advance deposit requirements,* related to the eventual disposal-costs of the imported product or compliance with other domestic requirements.

(e) *Tax benefits,* related to environmental control for import-competing suppliers not available to foreign suppliers of imports.

(f) *Government subsidization* of research and development and the adjustment of environmental standards according to the resulting pollution characteristics, with similar assistance being unavailable to foreign suppliers.

(g) *Communications-media and other marketing restrictions,* preventing effective merchandizing of imported goods alleged to be environmentally damaging.

(h) *Alteration of tariff structures* for environmental-control reasons, and introduction of potentially distortive customs valuation and classification practices.

Governments might also rely on indirect taxes for controlling environmental disruption by polluting products. Such taxes would

29 For an inventory of non-tariff trade barriers which might be applicable to the environmental control issue, see Ingo Walter, "Non-Tariff Barriers and the Free Trade Area Option", *loc. cit.*, as well as H. H. Glismann and A. Neu, "Towards New Agreements on International Trade Liberalization: Methods and Examples of Measuring Non-Tariff Trade Barriers", *Weltwirtschaftliches Archiv*, Bd. 107, Heft 2, 1971 and Ingo Walter, "Nontariff Protection Among Industrial Countries: Some Preliminary Evidence", *Economia Internazionale*, 1972 (forthcoming).

increase prices to the consumer, resulting in reduced quantities demanded. From the producers' point of view, such a reduction in demand would necessitate corporate policy changes in favor of products on which no tax is imposed. If, however, the polluting product is exported it might be exempted from this tax and the importing country, guided by its own policies and objectives with respect to environmental control, might or might not impose a pollution tax on the product. Unfortunately, in the real world it may be difficult to draw a line between the polluting and non-polluting products in accordance with a consistent set of norms. Furthermore, the indirect tax approach leaves a wide range of discretion open to producers. If the demand for a polluting product is highly inelastic, indirect taxes applied in this manner will only serve as a source of revenue and there will be no incentive for the producers to alter the nature of the product.

A final question relates to international effects of pollution-causing economic activities. This includes pollution of rivers traversing more than one nation, despoilation of lakes and other bodies of water bounded by several countries, radiation and other atmospheric pollution. Such trans-national environmental effects are generally of greater concern, the more geographically contiguous are the countries involved.[30]

With respect to transport, the accidental discharge of oil, petroleum products, chemicals or certain bulk products from ships into international waters has already been the source of considerable difficulty. Now generally held liable even for accidental spillage, insurance charges and other costs of transport are increased, while operating costs may rise in other ways as well due to modification of shipboard procedures. An analogous situation may develop in air freight, particularly with respect to the suppression of noise and particulate emissions of aircraft engines, both of which may have a significant effect on costs.[31]

Up to the present time the major non-transport-related instance of inter-country environmental spillovers has been in the area of water pollution. This includes municipal sewage and industrial

30 See Michael Connolly, "Public Goods, Externalities, and International Relations", *Journal of Political Economy*, April 1970.

31 See statement by Knut Hammerskjöld, Vienna Congress *Proceedings*, Document No. 137, (Vienna: International Chamber of Commerce, 1971).

pollution of major bodies of water, as well as accidental discharges in offshore oil exploration and recovery. Pressure for environmental control in such instances may eventually become especially acute, and channels of protest are open in the case of such inter-country externalities which are not available at the national level. On the other hand, the kinds of standards necessary for effective environmental control are most difficult to agree upon on an international level, while problems in establishing enforcement machinery may likewise be considerably more severe.[32] What might be expected in the case of international water pollution, therefore, is a considerable lag both in standards and enforcement, with environmental crises calling forth potentially harsher remedies once the relevant ecological thresholds are encountered.

Industries likely to be affected in matters of inter-country environmental despoilation include utilities, iron and steel, non-ferrous metals, chemicals, petroleum recovery and refining, transportation, and certain kinds of agricultural, mining and manufacturing activity.[33] A similar case of international spillovers may arise on occasion in the case of air pollution, particularly in Western Europe, but the problems encountered here are still considerably less serious than in the case of water pollution.

IV. Summary and Conclusions

The foregoing discussion focused on the potential effects of measures intended to deal with environmental protection upon the international economy. It was pointed out that such measures can have a substantial effect on international competitive relations: while their impact will vary widely as between different industrial sectors, the effects of some of the most important E-C measures will be felt in virtually every area of the economy. International competitive effects will depend in the first instance upon inter-country differences in the degree of stringency of standards applied, induced uncertainties, and timing. It was determined that a national commitment to ecological balance may fundamentally affect economic structure

32 See Gerard Eldin, "The Need for Intergovernmental Cooperation and Coordination Regarding the Environment", *OECD Observer*, February 1971.

33 Cf. Richard A. Carpenter, "Information for Decisions in Environmental Policy", *Research Management*, March 1971.

and hence the basis of competitive advantage in the inernational economy.

Given environmental-control-induced competitive shifts, which may be more or less abrupt, it is clear that policy countermeasures may be undertaken by national governments designed to soften or neutralize the potential impact on domestic exporting and import-competing industries. A number of techniques are discussed whereby this may be accomplished, emphasizing the possible trade-distortive effects of such devices. At the same time, it was indicated that a variety of exportable products and services may arise from E-C activities as well, and that this may to some extent offset competitive disadvantages encountered by suppliers in countries in the forefront of environmental control. Moreover, it was pointed out that E-C activities may also have an impact on international industrial location and hence on the pattern of inter-country capital flows.

Environmental control remains primarily a normative concept, subject to a great deal of engineering and economic uncertainty. What is a "clean" environment? How can it be achieved? How soon? And at what cost? No one knows the answers to these questions. It is certain, however, that the answers will differ materially between countries for a long period of time — even though the ultimate outcomes may be very similar — and that in the interim these differences will have a marked impact on international trade, investment and economic policy.

Implications for the international economy will be reduced to the extent that the uncertainties can be mitigated at an early stage, and in accordance with the degree of international coordination and harmonization that occurs. It is of utmost importance that realistic standards and targets be established. Unachievable standards and time schedules will impose unnecessary burdens on producers. While there is a need for flexibility, haphazard policies and continuous revisions of regulations and standards will inevitably entail an element of uncertainty and make multinational business planning and investment extremely difficult.

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