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POLICY RESEARCH WORKING PAPER 1249

Competitiveness and Environmental Standards

Some Exploratory Results

Piritta Sorsa

Restricting trade to compensate for differences in environmental standards is unlikely to improve competitiveness in environmentally sensitive industries. Higher environmental spending has had no noticeable effect on trade performance, so protection will not solve problems of noncompetitiveness. The reasons for good or poor performance are likely to lie elsewhere.

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Summary findings

Contrary to common perceptions, higher environmental standards in industrial countries have not tended to lower their international competitiveness, Sorsa contends. There has been little systematic relationship between higher environmental standards and competitiveness in environmentally sensitive goods (those that incurred the highest pollution abatement and control costs in the U.S. in 1988).

Among Sorsa's findings about what determines trade flows in environmentally sensitive goods:

- Environmental spending has been a small share of total spending -- so it is unlikely on its own to have caused shifts in comparative advantage in most industries.
- Differences in environmental spending among industrial countries seem to have been minor.
- Environmental spending has been concentrated in a few basic industries under heavy pressure to structurally the international division of labor.
- Energy use and environmental spending are closely linked.
- Positive adjustment and increased comparative advantage in environmentally sensitive goods were more pronounced in countries where environmental policies encouraged investment rather than current spending.

The costs of environmental standards depend not only on physical characteristics but also on the policies chosen. The reductions industrial countries have achieved in the main pollutants differ greatly across countries. In the United States, which has some of the highest private environmental spending (as a share of GDP), investments have been a declining share of spending. The United States also has some of the lowest reductions in abatement, which may mean that it has succeeded less than other countries in internalizing environmental costs.

Compliance with higher environmental standards is not a zero-sum game. Higher environmental standards t reduce the social cost of pollution is a new source of permanent structural change. Countries that adjust early and invest in environmental protection te hnology can maintain and even create comparative advantage in environmentally sensitive industries.

Private costs incurred to reduce the social cost of pollution may, apart from the social benefit of lower pollution, also bring private benefits. Adjustment can mean shifting to producing less pollution-intensive goods. Pressures toward this end are likely to increase a environmental awareness becomes more common.

Instead of lobbying for protection, industries struggling with environmental spending should lobby for better environmental policies -- that is, policies and standards that encourage efficient abatement. Demands for protection because of differences in environmental spending are likely to be counterproductive and to retard adjustment toward a new way of competing. Eco- dumping duties could do little for the environment but much harm to the trading system.

This paper — a product of the International Trade Division, International Economics Department — is part of a larger effo in the department to analyze the links between trade and the environment. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Pauline Kokila, room S7-040, extension 3371 (35 pages). February 1994.

COMPETITIVENESS AND ENVIRONMENTAL STANDARDS -

Some Exploratory Results

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Summary

It is a common perception that higher environmental standards in industrial countries tend to lower their international competitiveness. This argument has frequently been put forward by opponents of NAFTA or other international agreements aiming at liberalizing trade such as the Uruguay Round. A look at data on trade flows and environmental expenditures to date show that there has been little systematic relationship between higher environmental standards and competitiveness in environmentally sensitive goods. In Germany, Japan and the United States correlations coefficients between changes in world export shares in environmentally sensitive goods and changes in environmental expenditures were not significant. For Austria the coefficient was positive.Environmentally sensitive products are defined as those having incurred highest pollution abatement and control costs in the US in 1988. Environmental expenditures are financial outlays both private and public that OECD governments have reported as related to pollution abatement in water, waste, air, noise, and other pollution. The study analyses trade flows in environmental sensitive products and environmental expenditures in seven industrial countries all claiming to adhere to high environmental standards - Austria, Finland, Norway, Sweden, Germany, Japan, and the United States.

Industrial countries have maintained competitiveness in environmentally sensitive goods in general - their index of revealed comparative advantage (RCA) in these goods has remained around one. The index measures comparative advantage within an industry in the context of a country's overall share in world markets. Among the industrial countries, overall performance in exports of the sensitive goods varied greatly among countries despite relatively uniform standards in most industrial countries. Furthermore, among the industrial countries, there are both gains and losses in world market shares of the different sensitive industries. Imports of these goods from lower-standard developing countries have not invaded home or third country markets of industrial countries that have raised environmental standards. Their performance in these goods was in line with their increasing share in total world trade, but was inferior to their performance in manufactures. Product level data shows increases in developing country RCAs in most categories of these sensitive industries. Other factors are likely to have been more important than differences in environmental expenditures in explaining trade patterns in environmentally sensitive industries. Competitiveness is influenced by a complex interaction of a number of macro- and micro-economic factors.

Performance among the industrial countries is diverse. Japan on the one hand, and Austria and Finland on the other are the two extremes. Austria and Finland, with high shares of environmentally sensitive goods in their exports and some of the highest environmental expenditures among industrial countries, have increased their world market shares in these goods. For example, Austria's and to some extent Finland's, environmental policies seem to have encouraged investment and innovation, which is showing especially in higher investment shares in total environmental expenditures. But other factors, including macro-economic management during the 1970's and 1980's, are likely to have been more important for their good performance. Germany, Sweden and the US were successful in maintaining competitiveness of their environmentally sensitive industries, despite increases in environmental expenditures in the 1980s, especially in Germany, and overall losses in total world exports and especially those of

manufactures. Japan has opted out of trade in many environmentally sensitive goods. Its market share in these goods has been halved. Although its environmental expenditures first rose in the 70s, they have declined in the 80s. High cost of energy especially in the 70s is more likely to have contributed to the change in comparative advantage - Japanese electricity costs are among the highest in industrial countries. Japan has also been most successful in reducing pollution. It is competitive in production of machinery for environmentally sensitive industries.

In its analysis of determinants of trade flows in environmentally sensitive goods the study notes that: i) environmental expenditures are a small share of total expenditures and therefore unlikely to cause shifts in comparative advantages in most industries on their own; ii) differences in environmental expenditures among industrial countries seem to be minor; iii) environmental expenditures are concentrated in a few basic industries which are under strong pressures for structural change from the international division of labor; iv) energy use and environmental expenditures are closely linked; and v) positive adjustment and increased revealed comparative advantage in environmentally sensitive goods were more pronounced in countries where environmental policies encouraged investment rather than current expenditures. Apart from physical characteristics the costs of environmental standards also depend on what policies are chosen - the reductions achieved in the main pollutants by the industrial countries have been quite different across countries. The US with one of the highest private environmental expenditures in GDP has a declining share of investments in its expenditures. It also has lowest reductions in abatement which may mean that it has had less success in internalizing environmental costs.

Compliance with higher environmental standards is not a zero-sum game. Higher environmental standards to reduce the social cost of pollution is a new source of permanent structural change - countries adjusting early and investing in environmental protection technology can maintain and even create comparative advantages in environmentally sensitive industries. Private costs incurred to reduce the social cost of pollution may, apart from the social benefit of lower pollution, bring private benefits as well. Adjustment can also mean shifting to producing less pollution-intensive goods. Pressures towards this end are likely to increase as environmental awareness becomes more and more part of the landscape.

Instead of lobbying for protection, industries struggling with environmental expenditures should lobby for better environmental policies, i.e. standards and policies that encourage efficient abatement. Demands for protection on account of differences in environmental expenditures are likely to be counterproductive and retard adjustment to a new way of competing. Protection will not solve problems of non-competitiveness -- the causes of poor performance are likely to lie elsewhere.

1. Introduction

Does compliance with higher environmental standards impair an industry's or a country's competitiveness in world markets? In some countries industry is calling for border protection for differences in environmental standards and expenditures across countries. The paper argues that to date there has been little systematic relationship between trade performance and increases in environmental standards or expenditures. Correlation analysis showed no negative correlation between trade shares and environmental expenditures in Germany, Japan, and the United States. In Austria the correlation was positive. This is because environmental expenditures have been a small share of total costs, net private expenditures are reduced by various private benefits from environmental investments, and competitiveness is a result of an interaction of a complex set of macro- and micro-economic factors. Protection from imports from countries with different standards is not justified, nor would it help competitiveness. It is also argued that higher standards can contribute to improving competitiveness in environmentally sensitive goods[1].

This paper will analyze: i) developments in trade of environmentally sensitive goods over the past two decades; and ii) the links between environmental expenditures and trade in environmentally sensitive goods in a number of countries that claim to have high environmental standards - Austria, Finland, Germany, Japan, Norway, Sweden and the United States. The paper compares world trade shares in the sensitive goods over the past two decades, calculates revealed comparative advantage indexes for the various countries within the sensitive industry. It then discusses past environmental expenditures at the country and industry level.

The analysis in this paper is exploratory and subject to many difficult data problems. The definitions of environmentally sensitive industries can be questioned (it is based on US environmental expenditures), reported environmental expenditures at the country level do not always follow similar definitions making comparisons especially at the industry level difficult,

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[1] These are defined as in Low-Yeats (1991). Annex Table 1 shows the composition of products included in the sample: pulp and paper, petroleum products, organic chemicals, inorganic chemicals, other inorganic chemicals, coal, fertilizers, other chemicals, veneers and plywood, wood manufactures, paper and paperboard, articles in paper, cement, iron and steel, non-ferrous metals, metal manufactures. The environmentally sensitive industries are those that in 1988 incurred the highest pollution control expenditures in the US in 1988.

or the countries' present and past environmental policies can be deemed deficient. Country comparisons are also made difficult by the lack of comparable data for some indicators.

2. World trade in environmentally sensitive goods

Competition for world markets has been keen over the past twenty years. While industrial countries seem to have more or less maintained their share in total exports, a major change has happened in manufactures. Developing countries'[2] share in world exports of manufactures rose from 8 to 18% between 1970 and 1990 (Annex table 2). The role of lower environmental standards and expenditures in developing countries than in industrial countries in this is likely to be small. The average share of environmental expenditure[3] in industrial countries has been a modest share of GDP, around 1-1.5%. Differences in labor, capital and other resource endowments are more likely to have contributed to the international division of labor between industrial and developing countries. Policy reforms in developing countries have also increased productivity and efficiency. Total trade shares and those of the sensitive categories during the past twenty years were also influenced by changes in commodity and especially in oil prices.[4] Only about half of the environmentally sensitive goods belong to the manufactures category as traditionally defined in international trade statistics.

The share of environmentally sensitive goods in total exports varies greatly among countries (Table 1). High shares of sensitive goods in exports can make a country's overall export performance more sensitive to changes in environmental standards at home and abroad. In the Nordic countries environmentally sensitive goods are a very high share of total exports -

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[2] Developing countries in the paper refer to all countries not included in the industrial country category.

[3] Environmental expenditure indicates all public and private expenditure for pollution abatement and control as reported to the OECD Secretariat by its member countries. It is defined as the first-order, out-of pocket expenditure of those economic entities that implement control measures and undertake compliance activities. The reporting is done according to guidelines provided by the OECD to help comparability. Categories included are water, waste, air, noise, other pollution. The data excludes expenditure on nature protection. For more detail on definitions see OECD(1990, 1993). Despite the efforts at OECD for comparability of data cross-country definitions and reporting vary a great deal and therefore cross-country comparisons of data should be done with much caution.

[4] Data for 1980 is distorted by the oil price increases in the 70's and is therefore left out. The share of petroleum products in the sensitive category was 11% in 1970, 24% in 1980 and 16% in 1990 based on data on world imports of the goods.

up to a half of total in Finland. In Austria, a quarter of total exports are in environmentally sensitive products. The lowest shares among the seven countries are in Japan and the US - about one tenth of their total exports.

Overall export performance among industrial countries is diverse (Annex Table 2). Given the endowments of natural resources, competitiveness is influenced by many other factors such as productivity growth, and macro-economic stability. These are likely to matter more for total export performance than increases in environmental expenditures. Finland and Austria with high environmental standards and shares of sensitive goods in total exports have increased or maintained their world shares both in total and manufactures exports over the past decade. The fact that Germany, Sweden, Norway and the United States have lost world markets in manufactures is unlikely to be due to excessive environmental expenditures. Germany and Norway increased their shares in total world trade.

Table 1: Share of environmentally sensitive goods in total merchandise exports and imports in 1970 and 1990

Regions/Countries	Exports: 1970	1990	Imports: 1970	1990
	(percent)			
World	22	18	21	18
Industrial	23	18	21	18
Austria	28	25	19	14
Finland	54	47	22	22
Norway	47	26	22	25
Sweden	35	31	26	23
Germany	21	18	23	20
Japan	25	11	14	17
US	16	14	22	18
Developing	18	19	n.a.	n.a.

Source: Derived from United Nations COMTRADE database.

Trade flows in sensitive goods. The share of environmentally sensitive goods in total exports declined in all the sample countries, and in industrial countries as a whole (Table 1). In

developing countries the share of environmentally sensitive goods increased slightly from 18 to 19% in total exports. The uniform decline in industrial countries suggests that this is likely to be due to expansion of non-sensitive goods in world trade, and increased specialization rather than a loss of advantage in these goods. The most substantial decline in the share of environmentally sensitive goods in total exports occurred in Japan and Norway. In Norway this reflects the increase of oil in total exports. As many of the environmentally sensitive goods are resource-intensive, it would be natural for the resource-poor Japan to specialize in other goods. With the exception of Japan and Norway the share in imports of these products also declined. In Japan and Norway the share of the sensitive goods in total imports increased slightly during the twenty-year period.

World market shares in environmentally sensitive goods have not changed dramatically over the past two decades, despite the introduction of higher environmental standards in most industrial countries. The trends in trade shares (see Table 2) indicate that there has been no across-the-board decline in the market shares of environmentally sensitive goods in the higher standard industrial countries. Measured as shares in world exports the share of industrial countries share was about the same in 1970 as in 1990. Measured by world imports the share of industrial countries declined slightly between 1970 and 1990.[5] The bulk of world exports of environmentally sensitive goods continue to originate in industrial countries - over 70%. [6]

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[5] Data on world imports of environmentally sensitive goods captures better the share of developing countries in world trade. This is because many developing countries have not reported data to the UN trade data bank, which underestimates their share in world exports. Compared to earlier versions of the study based on world export data, this paper uses world imports for the world and developing country totals in the calculations. Export data underestimates the share of developing countries by about 5-10%.

[6] As a large part of the sample of environmentally sensitive goods especially from developing countries are commodities, especially oil, the trade shares are likely to be very sensitive to developments in commodity prices. Further research on the impact of price changes in these trade flows would be useful.

Table 2: Share in world trade of environmentally sensitive goods, 1970-90

Regions/countries	Share in world imports		For reference: Share in world exports	
	1970	1990	1970	1990
	(%)			
Industrial	**78.2**	**72.9**	**8.3**	**81.1**
Austria	1.3	1.3	1.3	2.0
Finland	2.0	2.1	2.1	2.4
Norway	1.9	1.5	1.9	1.7
Sweden	3.9	3.0	4.0	3.4
Germany	11.7	12.1	12.1	13.8
Japan	7.8	5.3	8.0	6.0
US	11.2	8.9	11.6	10.1

Source: United Nations COMTRADE data base.

Changes in trade shares among industrial countries in the sensitive goods are diverse. There are both gainers and losers among them. Given that most industrial countries introduced higher environmental standards over the past two decades, the diversity in trade performance in the sensitive goods indicates that other factors are likely to have been more important than environmental standards. Austria, Finland, and Germany have increased their market share in the sensitive goods Austria nearly doubled its share between 1970 and 1990 (Table 2). As mentioned earlier Austria and Finland also had a good overall performance of competitiveness measured by their increased/maintained world market share in world exports of manufactures or total trade (Annex table 2). In both countries, overall competitiveness and that in the sensitive goods improved more than the average for industrial countries despite the high shares of the sensitive goods in total exports and increasing environmental expenditures in Austria (see below). Germany increased its market share of sensitive goods, despite losses in world markets for manufactures and increases in environmental expenditures (see below) during the 80s.

Japan, Norway, Sweden and the US lost markets in the environmentally sensitive goods between 1970-90. Norway, Sweden and the United States have also lost market shares in both total exports (except Norway because of oil) and in manufactures suggesting poor overall

competitiveness in world markets. Curiously, in these countries, expenditures on the environment were generally among the lowest of the industrial countries and even declined in the 80s (see table 9 below). This would suggest no systematic link between trade performance in the sensitive goods and environmental expenditures. The reason for changes in market shares is likely to lie outside the changes in environmental standards. Japan switched away from environmentally sensitive goods and specialized in other products with impressive gains. Its environmental costs were the highest of all industrial countries in 1980, but have since declined considerably as share of GDP (Table 9).

The lack of negative impact of higher environmental expenditures on trade performance in environmentally sensitive goods is confirmed by correlation coefficients between changes in world trade shares of the sensitive goods and changes in environmental expenditure. While cross-country comparisons are unreliable because of the considerable differences in the measurement of environmental expenditures, reasonable time series data for the trade and expenditure variables are available for Austria, Germany, Japan and the United States. Correlation coefficients were calculated for both total and private environmental expenditure in GDP, when available (Table 3). The correlation coefficient for Austria and Germany was positive, 0.7 and 0.12 respectively. For Germany it was not statistically significant, but for Austria the positive correlation was very significant at 2.5% level. The US coefficient was negative, but statistically insignificant. For Japan the coefficient was negative, failed to be statistically significant. This means that only in the case of Austria was there any correlation between environmental expenditures and trade performance.

Table 3: Correlation of Share in World Trade of Environmentally Sensitive Goods with the Share of Environmental Expenditures in GDP for Selected Industrial Countries

	Correlation Coefficient (total env.exp.)	Confidence test (2.5%)***)	Correlation coefficient (private env.exp.)	Confidence test (2.5%)
Austria	n.a	n.a	0.7	10.56
Germany	0.12	1.63	0.14	2.24
Japan	-0.33*	3.91	n.a.	n.a.
United States	-0.05	0.90	-0.07(0.05)**	1.33(0.89)

*) For Japan the data refers to public expenditures only. **) For the United States numbers in parenthesis refer to data on private expenditure reported by the US national sources and the other number is based on OECD definition. ***) If the number below is larger than 5.02 the coefficient is significant at the 3% level.

The increase in the share of developing countries in world exports of the sensitive goods reflects their increased overall participation in world trade. Their exports of environmentally sensitive goods increased much less than those of manufactures. Export growth from developing countries in the sensitive goods may have been influenced by trade barriers. As many of the products of industries included in the sample of sensitive goods are experiencing structural difficulties in the industrial countries (iron and steel, some chemicals) from over-capacity or from lower labor-costs in developing countries, protection from imports in some sectors may have influenced import growth. Although tariff barriers in the sensitive goods are low, a large share of imports of environmentally sensitive goods is subject to non-tariff barriers (Table 4). Developing countries face lower duties than industrial countries, but more of their imports are subject to non-tariff measures especially in the United States and Japan. However, the measure gives little indication on the protective impact of the non-tariff barriers. Estimates of their tariff equivalents are not available. A more likely explanation for the slower export growth of developing countries in the sensitive goods is the low income elasticity of many of these goods compared to other manufactures and the declining material intensity of production. This is particularly true of the metals, steel, nickel, manganese etc. Also energy intensity of production has declined substantially since the oil price hikes of the 1970's.

Table 4. Level of Protection in Environmentally Sensitive Goods in Main Industrial Country Markets (1988)

Country	Tariffs(weighted average) World	Developing	Non-tariff barriers(% of imports covered) World	Developing
EEC	1.5	0.7	9.0	9.0
Japan	2.8	2.3	43.5	48.1
United States	2.7	2.7	16.2	32.7

Source: World Bank SMART data base.

Revealed comparative advantage (RCA) indexes. Another way to analyze changes in comparative advantages or trade patterns in specific products is through calculating indexes of revealed comparative advantage[7]. Traditionally it has been used to analyze a specific country's revealed comparative advantage in different industries. In this study it is used to measure different countries' RCA's within a specific industry. The RCA measures changes in the share of a country's exports of a product in world exports of the product compared to changes in the country's total share in world exports, i.e, relative to the size of the country. The index allows taking account of the impact of changes in a country's or countries' overall importance in world trade on changes in trade shares in a specific industry. If the index is above one, a country is deemed to have a comparative advantage in a product, i.e. its share in the market of a product was larger than its overall share in world trade. Calculated RCA indexes are presented in Table 5.

The indexes confirm many of the results of the analysis of trade shares. Industrial countries as a whole have maintained their comparative advantage in environmentally sensitive goods (index around 1.0), while that for developing countries has remained below one at 0.9. The aggregate data hide large differences between countries. Austria, Finland and Sweden have

[7] The formulae used for calculating the RCA index is RCAji = (xji/Xjt)/(xit/Xtw) where j is industry, i country, w world and t total. The index goes up, for example, when the country increases its share in the world market of the product; it can go down if the country's other exports go up or if the country share in world trade declines. The RCA ignores the impact of some protectionist barriers in distorting trade patterns between alternative source of supply, or trade not taking place because of protectionist barriers. This study used total trade in the denominator versus manufactures, because many of the environmentally sensitive goods are outside the traditional definition for manufactures (SITC 5-9 less 68, 67). The share of manufactures in the sensitive goods was 40% in 1970, which increased to 54% in 1990. The use of manufactures as total has been justified in other studies due to the distorted nature of world trade in agriculture.

a comparative advantage in environmentally sensitive industries, which was increased/maintained over the period. Sweden maintained its comparative advantage in the sensitive industries while losing markets in total and manufactured goods. The US has never had a comparative advantage in these products. The index for the US and Germany remained stable. The sensitive industries did better in world markets than total or manufactured exports in these countries. Japan has clearly lost its comparative advantage in environmentally sensitive goods, with its index falling from 1.2 to 0.6 during the period. The larger relative decline in the RCA compared to its market share suggests that the increase of other exports in Japan is responsible for much of the decline. Norway is still competitive, but has lost markets since 1970. For Norway this is likely to reflect the increase in oil revenues in total exports (denominator).

Table 5: Revealed comparative advantage indexes in environmentally sensitive goods, 1970-90

Regions/Countries	1970	1990
Industrial	**1.1**	**1.0**
Austria	1.3	1.4
Finland	2.7	2.9
Norway	2.3	1.5
Sweden	1.7	1.7
Germany	1.0	1.0
Japan	1.2	0.6
US	0.8	0.8
Developing	**0.8**	**0.9**

Source: Derived from United Nations COMTRADE database. World exports based on world import data.

At the product level there are gains and losses in comparative advantage. This, in itself, suggests that factors other than environmental standards have been more important for trade performance in environmentally sensitive goods. As the goods in the sample are assumed to have been subject to high environmental standards, if these were to have an effect on trade performance one would expect a more uniform pattern. It is notable that in many countries certain sensitive industries lost competitiveness, while others gained it (Table 6).

Among the European countries, Austria maintained the number of industries with an RCA index above one in 22 from a total of 38 three-digit SITC industries. Competitiveness improved in 27 categories. It has done best in industries such as paper and wood, metal manufactures, and iron and steel. Chemicals and metals industries have the highest environmental control expenditures within manufacturing in Germany yet it has maintained its comparative advantage in these industries and it has lost markets in others. Germany is strong in various chemical products, metals, iron and steel and refined paper articles. Its losses have been in fertilizers. Finland is particularly competitive in several wood-based industries, but has also become competitive in iron and steel. It has lost its comparative advantage in chemicals. The changes among industries reflects moves to a higher degree of transformation and diversification within the industrial sector. Sweden is competitive in processed wood and paper products, some chemicals, and iron and steel. Despite its losses in manufactures, Sweden managed to improve competitiveness in several of the sensitive categories despite environmental regulations. For Norway, wood and paper, non-ferrous metals (aluminum), fertilizers and petroleum products are among the industries with comparative advantages. Its losses have been in paper products and construction materials such as cement. Norway also has clearly more losses (RCA decreased in 26 categories) than gains. The explanation is more likely to lie in the appreciating real exchange rate from the oil boom than in higher environmental costs.

In the US the number of industries with a revealed comparative advantage declined from 14 to 10. It has lost comparative advantage in most metal products, and wood and paper products while improving its position in pulp production. In Japan the data again show a clear shift away from the sensitive industries. Japan lost comparative advantage in ten sensitive industries and maintained it in eight in 1990, mostly in iron and steel. The largest declines have been in basic wood industries like veneers and plywood and wood manufactures. Other losses were in chemical industries and metal manufactures.

Table 6: Changes in RCA indexes in environmentally sensitive goods, 1970-90

Regions/Countries	RCAs above 1		Goods in which RCAs	
	1970	1990	Increased 1970-90	Decreased 1970-90
	(no.)			
Industrial	**28**	**23**	**8**	**30**
Austria	21	22	27	10
Finland	13	14	24	13
Norway	20	16	11	26
Sweden	15	16	23	14
Germany	18	18	16	21
Japan	18	8	8	30
US	14	10	17	21
Developing	10	15	30	7

Source: Derived from United nations COMTRADE database. Includes a total of 38 three-digit SITC categories as defined in footnote 1 and annex table 1.

Product level analysis gives some indication of a shift in trade towards developing countries in a number of products included in the category of sensitive goods. Although industrial countries continue to have a comparative advantage in more of the categories of sensitive goods studied (23), the index declined in 30 categories. This means that developing countries increased their index in most categories. Between 1970 and 1990 the number of industries in developing countries with indexes above one increased by half (Table 6). Developing countries are gaining market share in industries like iron and steel, fertilizers, wood products, and chemicals. This is likely to reflect both their increasing participation in world trade and increasing production in the developing countries of many of the basic industries that belong to the sensitive category. As mentioned the share of non-industrial countries in world exports of manufactures, for example, increased from about 8 % in 1970 to over 18 % in 1990. The role of lower environmental costs in this is likely to be negligible. Many of these industries, such as iron and steel, tend to be part of early stages of industrialization.

Data on foreign direct investment (FDI) flows of environment-sensitive industries do not suggest any systematic trend towards an increasing pollution intensity of foreign direct

investment in developing countries. [8] For example in Japan, Germany and Sweden the share of environmentally sensitive industries in total outward FDI declined between mid-70s and late 80s. In the US it first increased in the 70s but declined slightly in the 80s. Data for many developing countries shows that in a number of countries the share of environment-sensitive industries in inward foreign direct investment has decreased somewhat in the 80s (UN 1992).

Direction of Trade. Industrial countries continue to export environmentally sensitive goods to other high standard countries suggesting that, overall, the industrial countries have been able to meet the higher standards in their export markets. Successful exporters, such as Austria and Germany have increased the share of other industrial countries in their exports of environmentally sensitive goods (Table 7). Only Japan and the United States have increased the share of developing countries in their total exports. This could mean that the Europeans have better adjusted to the changed product market conditions. Or it could just be a reflection of the growth in importance of the Asian market to the United States and Japan.

Changes in the developing countries' share in industrial country imports of environmentally sensitive goods was mixed in the sample countries. Among the European countries developing country share in imports of environmentally sensitive goods went down in most countries. Curiously, developing country share was substantially up only in Japan and the United States despite the higher share of non-tariff barriers than in Europe, and lower levels of environmental costs than many European countries.

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[8] For a discussion of a number of studies and recent data see World Investment Report (1992).

Table 7: Share of developing countries in industrial country exports and imports of environmentally sensitive goods,1970-90

Regions/Countries	In exports		In imports	
	1970	1990	1970	1990
of:	(percent)			
Industrial	**22**	**20**	**15**	**17**
Austria	25	14	12	10
Finland	13	9	6	9
Norway	7	6	11	10
Sweden	10	9	11	7
Germany	19	15	13	11
Japan	45	61	34	40
US	34	39	22	33

Source: Derived from United nations COMTRADE database.

4. Environmental expenditures and competitiveness

The trade patterns in environmentally sensitive goods suggest that the factors explaining the trade flows are diverse. The level and changes in environmental control expenditure incurred is only one factor among many. For policy analysis it is also important to underline that costs of environmental policies also depends on the type of measures chosen. Good policies can achieve abatement targets at lower cost than bad policies. Available data indicate, for example, that there are substantial differences in results in abatement of main pollutants among industrial countries for relatively similar levels of costs incurred. In comparing the expenditure data, one also has to keep in mind that differences in environmental standards and expenditures can reflect differences in environmental endowments. A country may have a comparative advantage in environmentally sensitive goods due to the fact that its natural conditions permit a greater ability to absorb pollution.

This section will explore the nature and extent of environmental expenditures in general and by industry. The impact of environmental expenditures on competitiveness can depend on the level of environmental standards across countries. High shares of investment in total expenditures can be an indicator of the internalization of environmental costs, or the

development of new products and processes. A high share of public funding of environmental costs can indicate a lower impact on industry competitiveness, although the cost will ultimately be more widely shared via higher taxes.

As environmental policies and related expenditures are not new to most industrial countries, the use of data starting in 1970 is justified. In many OECD countries, environmental policy making started in earnest in the early 1970s with a main focus on national problems. It reached a new peak in the late 1980s and early 1990s with greater emphasis on global problems. Available data on the costs of these policies to industry or to the economy at large is patchy and subject to many definitional and measurement problems. The following expenditure estimates, nevertheless, show a number of interesting features among countries on how the policies may or may not have affected competitiveness (see Table 8).

Table 8: Environmental expenditures as a share of GDP, industrial countries, 1980-90

	1980	1990
(%)		
Industrial*	0.9-1.8	0.9-1.9
Austria	1.2	1.9
Finland	1.3	1.1
Norway	1.3	0.6
Sweden	1.0	0.9
Germany	1.5	1.7
Japan	1.8	1.0
US	1.6	1.4

* Range in mid-1985, as total industrial country estimates are not available for 1980 or 1990.
Source: OECD (1990), Blazejczak (1993).

The overall level of environmental expenditures in industrial countries is moderate and, from country to country, not radically different. Although, as mentioned, considerable caution has to be exercised in making cross-country comparisons with the available data. Existing data suggests that higher standards are not forcing industries to much higher costs than their competitors in other countries. Estimates of expenditures range between 1 and 2% of GDP. Over the past ten years these expenditures have increased in some countries and decreased in others as share of GDP, reflecting differences in timing and types of policies. Some of the

differences may reflect different physical conditions, or differences in the demand for a cleaner environment. Population densities, for example, tend to increase the severity of environmental problems. The sparsely populated Nordic countries may have a much higher pollution absorptive capacity than densely populated Japan. This may explain their lower level of expenditure despite high shares of the sensitive goods in total exports and in economic activity.

Data on environmental expenditures in developing countries is sparse. Their present expenditures can be assumed to be lower than those in industrial countries, because of lower demand for a cleaner environment. One available estimate (World Bank, World Development Report, 1992) calculated that to do away with the main pollutants and to reach the present level of environmental technology in industrial countries, developing countries would have to invest annually 0.6 to 0.8 % of their GDP over the next ten years. This gives a rough yardstick on how their present costs and standards compare with those in industrial countries.

The impact of environmental standards and expenditures on competitiveness can also depend on who bears the financial costs. By absorbing part of the cost, government can reduce the static impact of higher standards. Table 9 shows that many governments have borne a large part of total environmental expenditures. The public[9] share of total environmental expenditure in the mid-1980s was highest in Japan, over 90%. In other industrial countries the government's share fluctuated around 50% - with the US having the lowest share at 40%. In the Nordic countries a large share of environmental expenditures, nearly two-thirds in Sweden and Norway - has been incurred by the government.

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[9] Public expenditure in the OECD(1990) survey include all budgetary and extra-budgetary expenditure by all levels of government (central, local, state or provincial). Public enterprises whose main function is to provide pollution control services such as waste water management etc. are included in the public sector. For more detailed definition see OECD(1990).

Table 9: Share of public expenditures in total environmental expenditures, selected industrial countries, mid-1980's

	-(percent)-
Austria	50
Finland	45
Norway	67
Sweden	72
Germany	51
Japan	94
US	41

Source: OECD (1990).

The exact amount of actual subsidies in this expenditure is difficult to assess. In countries where utilities, for example, are owned and run by governments their expenditures on pollution control would count on the public side, whereas the opposite would hold in countries with privately run utilities. The actual existence of subsidies would depend on whether these entities operate under market principles and how the costs are included in prices to users etc. General subsidies are included in the data only to the extent that governments classify them as "environment-related".

Depending on how potential subsidies are implemented, they may carry the risk of reducing the incentives for internalization of pollution-control expenditures and the incentives to innovate. This hypothesis does not seem to hold for Japan. In Japan, much of the public money was spent on supporting joint research projects with industry to develop new processes and technologies (Fukasaku, 1992). The measures appeared to have reduced pollution drastically (Annex Table 3) as Japan now has one of the lowest levels of major pollutants among the industrial countries. But despite the fact that the government bore the bulk of the environmental expenditures, Japan lost markets in most of the environmentally sensitive industries during the past two decades.

Despite the difficulties in extracting subsidies from the data, it suggests that private costs of abatement have been highest in the United States. Lower private costs in Europe than in the United States can reflect different laws, differences in absorptive capacities, or the higher share of public expenditures in total expenditure. For Japan, complete industry-level data for private

costs is not available, but the high public share would suggest that private industry costs have been lower than those in the United States and Europe. These numbers should be treated with caution, however, as existing statistics make it difficult to compare industry level data across countries, because of differences in coverage or definitions of industry.[10] How much of the total private costs are borne by industry or the manufacturing part of it, depends on country circumstances. One study on the United States (Low 1991) indicated that in 1988 0.5% of manufacturing output was spent on pollution abatement. German data suggests that 0.7% of manufacturing output in 1990 was devoted to environmental expenditures. These and other estimates (see Table 10, Ugelow 1985) show that environmental expenditures are a small share of total industry costs - compared to costs of energy or labor, for example.

Table 10: Levels of private environmental expenditure, selected industrial countries, mid 1980s

	Private environmental exp. in GDP	For reference: Shares in manufacturing costs of: Energy(1990)	Labor(1990)
	percent		
Finland	0.8	3	20
Norway	0.3	n.a.	19
Sweden	0.3	n.a.	n.a.
Germany	0.7	2	25
US	0.9	n.a.	n.a.

Source: OECD (1990), National statistics.

Most environmental costs are concentrated in a few basic industries. In Germany, for which complete data is available (Annex Table 4), the industries with the highest environmental expenditures are either in mining and utilities (10% of industrial output in 1990) or in basic industries like iron and steel, chemicals, petroleum and metals (24 % of industrial output). In mining and utilities, environmental expenditures were over 4% of the value of output, while the

[10] Comparisons of environmental costs are made difficult by uneven coverage across countries or differences in classifications. Some countries equal private costs to those of industry (Japan), while others report a much more comprehensive coverage (US). As utilities account for a large share of environmental expenditures, definition of industry can be important proper accounting of expenditures. Nordic countries do not include utilities in industry costs, whereas Japan, the US and Germany do. Mining is sometimes included in definitions of industry. This makes any comparative assessments especially at the industry level difficult.

manufacturing average was only 0.7%. In the basic manufacturing industries the expenditures ranged between 1% and 2.2% of output in 1988. These have increased in Germany in recent years where many basic industries have allocated 10-16% of their investment to environmental protection. Nevertheless, their overall of expenditures remain moderate. Despite the higher than average environmental expenditures in the sensitive industries and the overall increases in recent years the trade data and correlation analysis (see above) show little impact on export performance. Germany maintained competitiveness in the sensitive goods (Table 2) over the past two decades.

In other countries as well trade data shows little impact of these costs on trade performance in these sensitive industries (see above). As private environmental expenditures seem to be lowest in Japan and total expenditures have declined, the fact that Japan has lost comparative advantage in many environmentally sensitive industries is unlikely to have been due to higher environmental costs. A more likely explanation could be that Japan decided to move out of energy-intensive smelting and refining industries. These were also the most polluting.

In the United States there has been no major shift in comparative advantage in the sensitive industries (RCA index remained at 0.8), despite the relatively high private environmental costs. Despite an increase in total environmental costs in Austria during the 1980s, it increased competitiveness in environmentally sensitive industries. The correlation between environmental costs and competitiveness was even positive. In the Nordic countries the public share is relatively high and environmental costs declined overall during the 80s. But this is unlikely to explain the increased market shares in these products.

The Japanese case suggests that pollution-intensity and **energy-intensity** are highly correlated. The link can be direct or indirect. environmental expenditures can have an indirect impact on energy costs, and vice versa. In Japan and Germany, for example, in the mid-1980s electricity and utilities accounted for over half of total environmental investments in industry. In Germany, the electricity and mining sectors devoted nearly 20% of their investment to environmental protection in 1990. As utilities tend to have the highest environmental

expenditures (Annex Table 4), part of this can feed into higher electricity prices: during the 1980s the real price of electricity in Europe rose by 3% while most other energy prices declined by 10-27%.

In Japan the sharp increase in energy costs especially after the oil shocks in the 1970s is likely to have contributed to the decline in environmentally sensitive exports through the general shift to less energy intensive production. For example, in 1990 the price of electricity for industry in Japan was three times higher than that in the United States, and five times higher than in Norway (see Table 11). Although the costs estimates can be greatly influenced by yearly changes in exchange rates. the table gives some indication of the relative price levels of energy in different countries. The differences reflect relative endowments in addition to differences in efficiency, structure of energy production (nuclear or hydro-power) etc. that influence average costs of production. Differences in taxes on electricity for industry are minor. Norway has ample hydro energy resources while Japan has very few. It would be more efficient for Japan to specialize in less energy intensive production than for Norway to do so.

This also shows how irrational it would be to require equalization of expenditures across countries. Equalization of taxes would not result in equalization of prices and should not. The low price of electricity in Norway coupled with lower environmental expenditures have not resulted in its invasion of world markets in environmentally sensitive goods. Its comparative advantage index in these goods declined from 2.3 to 1.5 between 1970 and 1990. The appreciating exchange rate from the oil boom is likely to have influenced the competitiveness of other sectors and their exports more than any change in environmental standards.

The level of energy costs can also help identify industries that could be vulnerable to future increases in environmental expenditures especially in terms of carbon taxes. Their impact on competitiveness will depend on industry characteristics and whether other countries apply similar measures. If energy costs on average are 2% of manufacturing costs - as they were in German manufacturing for instance in 1990 - a 25% tax would amount to one-half of one percent of the value of total output, assuming nothing else changes. Most industries would be

able to absorb this without difficulty, while the impact in some industries such as iron and steel or paper would be higher ceteris paribus, 2 to 3% of output price in Germany. Such an increase could aggravate their existing structural problems. At present in many countries real energy prices are also about 30% below their levels ten years ago.

Table 11: Prices of electricity for industry in selected OECD countries, 1990

	Electricity UScents/1000kWh
OECD	71
Austria	65
Finland	63
Norway	23
Sweden	56
Germany	91
Japan	126
USA	48

Source: OECD

The OECD data indicates that European countries and Japan devote more of their environmental expenditures to **investment** than the United States (Figure 1 and Table 12).[11] Despite the difficulties related to its classification and measurement (see footnote 8), the share of investment spending on environmental-control expenditures can be one indicator of internalization of pollution-control costs, and of promoting the positive impact of higher standards through technological change and innovation. It can also help generate private benefits that reduce the net impact of expenditures on competitiveness. In the United States in the early 1980's the share of investment in total industrial pollution expenditures was above 50%, but declined steadily thereafter and in the mid-1980s accounted for less than 30%. Austrian investment on environmental control was high in the 1970's and has increased further since the

[11] In the OECD classification investment expenditure covers construction or acquisition of plant and equipment, construction or acquisition of buildings, improvements, acquisition of land. They refer to actual costs incurred in the year in question. Running costs include operation and maintenance on labor, energy, materials other than energy, services, rents, repairs. See OECD (1990) for further details. The dividing line between the two types of expenditure is often blurred. For example, investments in human capital in training, preparation of new guidelines, new ways of disposing waste etc., which are likely to be included in running costs could be considered capital expenditures.

mid-80s. Germany's share has been 35 to 45% over the past two decades. Japanese data on private operating costs are not available. Investment expenditure is likely to dominate, however, as most public environmental expenditure was in the form of investments (91%). In the Nordic countries, estimates of the share of investment in total expenditure are poor. The share of investment in total expenditure in manufacturing in Finland has been around 40% in the 1980s. For Sweden and Norway, few estimates are available. In the mid-1980s the share in Sweden would have been above 50% and in Norway around 30%.

Table 12: Share of investment in public and private environmental expenditure, selected industrial countries, mid-1980's

	Public	Private
	(%)	
Austria	n.a	56
Finland	44	48
Norway	32	33
Sweden	32	53
Germany	47	42
Japan	96	n.a
US	38	38

Source: OECD (1990).

The higher share of investment in total environmental expenditure in European countries in recent years as compared to the United States can explain their increased competitiveness in many environmentally sensitive goods and machinery. In Austria, which showed positive correlation between trade performance and environmental expenditures, the share of investments in total has also increased. Better trade performance in environmentally sensitive goods in Europe coupled with success in reducing major pollutants (see below) suggest that the European countries may have been more successful in internalizing environmental costs and promoting technological change in environmentally sensitive products. But the high public investment in Japan did not improve its comparative advantage in environmentally sensitive industries. They can, however, explain Japan's success in developing appropriate technologies and exporting machinery to the sensitive industries (see below).

Success in pollution abatement. Success in reducing the major pollutants can be another indicator of internalization of environmental costs and the efficiency of policies. Among the sample countries, Japan has been most successful in reducing pollution despite having the lowest total and private costs of environmental protection. Measured by the reduction in the level of the four main pollutants (Annex Table 3) Japan is first both in terms of the largest reductions achieved over the past 20 years and having the lowest present level of emissions. The United States had, and continues to have, the highest levels of each pollutant per unit of GDP. Germany is in between. For Austria, no data are available. The Nordic countries have managed to achieve considerable reductions in the main pollutants - especially in sulfur-based pollutants - at relatively modest cost to their economies. Its present levels of most pollutants are among the lowest in most of the sample countries.

The United States seems to have had the highest private costs of abatement with the poorest results in reducing pollution. High-cost policies do not equate with most efficient policies. Most of the US expenditure would have gone to pay for operating costs (or legal suits as exemplified in the Superfund Case) and less to developing new products or processes. The share of investment in total US pollution control expenditure has declined and is now lower than in many European countries or Japan. Low levels of investment expenditure may suggest poor results in internalizing costs. Japan invested heavily with public support in pollution control in the 1970s. Being a small area, Japan has less absorptive capacity than the United States. However, its comparatively modest total expenditure has had the most impressive results in terms of abatement. Western European countries began to invest heavily only in the 1980s, perhaps explaining the slower results in abatement of pollutants.

Despite the high share of environmentally sensitive goods in total exports and production in the Nordic countries, expenditures on the environment have been moderate. Nevertheless, their success in reducing emissions of the main pollutants has been better than that of the United States or Germany. This may suggest that the relatively lower environmental expenditures in the Nordic countries do not reflect lower standards but their better absorptive capacities as sparsely populated countries.

4. Private benefits from higher standards and competitiveness

Higher environmental standards can bring private benefits having a positive impact on competitiveness. Environmental standards are aimed at reducing the social cost of pollution. The private costs incurred in complying with environmental standards bring social benefits to society in terms of lower pollution. But in addition many of these expenditures also bring private benefits which reduce the net private expenditure to industry. Apart from the social benefit of lower pollution from higher standards, the process of reducing the initial social costs can create new products and new sub-sectors of industry. These reduce the potential impact of private environmental expenditures on competitiveness.

Too often the discussion of environmental policy and competitiveness has portrayed a static, gloomy image of higher private environmental expenditures leading to market losses by enterprises. Compliance with higher environmental standards to reduce the social cost of pollution is presumed only to increase private costs of production or costs of doing business in general, increase prices and reduce demand at home and abroad. The only assumed gain is the social benefit of lower pollution or lessened environmental degradation. Unless other countries follow similar policies to correct similar distortions, international competitiveness of the high-standard country is assumed to be seriously impaired. Protection from imports from lower-standard countries is thought to be necessary for survival.

The above may be true in a very static context and under strict assumptions, but the situation can be quite different in a dynamic world with continuous change and innovation. Positive dynamic effects can go a long way towards canceling the initial static costs. First, higher costs tend to bring about resource-saving innovation. Cost savings arise from more efficient use of polluting materials or processes. Second, in the environmentally-aware 90s the environmental record of a company can become an asset or a liability. This can have an important impact on costs. As environmental clean-ups or law-suits are costly, the probability of environmental damage will influence insurance premiums. The likelihood of environmental

disasters affects expected earnings and asset values of companies. Investment in cleaner technologies will pay off in lower risk-premiums or higher asset values. Third, increased environmental awareness has and will continue to influence demand towards cleaner and higher quality products for which consumers are willing to pay a premium. This allows companies to cover environmental expenditures.

Fourth, innovations can improve or even create comparative advantages when rivals either fail to perceive the new way of competing or are unwilling or unable to respond. Innovators not only respond to possibilities for change, but force it to proceed faster. The early adopters' advantages and the new market opportunities are multiplied, if higher environmental standards are perceived as a permanent source of structural change. Increased environmental awareness in most OECD countries is already shaping how products are packaged, produced, etc., and the trend is likely to continue. Countries are also increasingly committing themselves to international agreements on the environment with various consequences for production processes. Early adopters can gain an edge against competitors in a world where all eventually have to adapt[12].

Fifth, higher environmental standards can also contribute to the development of new markets. These can be markets for secondary materials like metal scrap, waste paper, consulting services, and new types of equipment. In Germany, environment related investments now account for close to 10% of total industrial investment in many sectors. In Japan, the share ranges from 4 to 7 %. The International Finance Corporation (1992) has estimated that the world-wide market for environmental goods and services is expected to double from the present US$ 300 billion to US$ 600 billion by the year 2000. The OECD(1992) estimated the present market as US$ 200 billion and growing to US$ 300 billion by the year 2000. According to the European Commission (1992) the environmental goods and services industry already employs 1.7 million in the OECD countries.

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[12] Innovators and early adopters gain advantages such as being first to reap economies of scale, reducing costs through cumulative learning, establishing brand names and customer relationships without competition, getting their pick of distribution channels, and obtaining the best locations for facilities or the best sources of raw materials or other inputs (Porter, 1990 p.47)

The net impact of the positive and negative private costs and benefits of higher environmental standards on competitiveness is also influenced by a number of external or structural factors. These can be the nature of the industry, the size of the domestic market, or the overall economic climate. The static view is more likely to prevail in declining industries that have little scope for price differentiation, or work at the edge of profitability. Higher environmental costs, although modest, may aggravate an existing situation of poor competitiveness. Innovation as a response to change is more likely in growing industries, in industries able to price differentiate and those with a tradition of investing in technological change. The introduction of higher standards is also easier in a cyclical upturn than in a recession.

The role of the government in making and enforcing environmental standards is important because of the public good nature of environmental quality. For industry, government regulations can contribute to creating and upgrading of comparative advantages. Particularly beneficial are policies that anticipate standards that will spread internationally. It is also important that regulations are rapidly, efficiently and consistently applied. Transparency and certainty in their introduction is also important. Policies that encourage internalization of costs tend to promote innovation and technological progress. Regulations can also undermine competitiveness; for example, if a nation's regulations lag behind those of other nations. Industry costs depend also on the level of standards chosen, the time path for reaching them, how the costs are financed, and the policy instruments used. The World Bank 1992 World Development Report concluded that environmental expenditures can be reduced by: i) choosing standards appropriately and concentrating on options with the highest net benefits; ii) choosing instruments that encourage flexibility and cost-effectiveness (market-based versus command and control instruments); iii) preventing damage from the outset and avoiding clean-up costs later; and iv) building them into new equipment.

New industries. To get some indication on whether higher environmental standards have created new comparative advantages in industries that are the suppliers of equipment incorporating environmentally-friendly technology this part computes revealed comparative

advantage indexes for a number of supplier industries. Other likely beneficiaries are service industries such as consulting. A recent OECD study pointed out that various forms of technology licensing are likely to form a large part of the trade in environmentally sensitive goods (OECD, 1992). For example, a Japanese enterprise having developed an environment-friendly process sells the license abroad. Data for the non-merchandise trade flows are difficult to obtain, however.

To get some insight into supplier industries, RCA indexes were calculated for industries that can be assumed to supply machinery to environmentally-sensitive production. Table 13 identifies nine categories of machinery used in industries like pulp and paper (2), metals (3), power generation, heating and cooling equipment, cleaning machinery, and non-electrical machinery[13].

From Table 13, industrial countries clearly have revealed comparative advantage in a larger number of industries which are suppliers of machinery to environmentally-sensitive industries. Among the developed countries, Austria and Japan have improved their comparative advantage in five and three categories, respectively. Although Japan is exporting less of environmentally sensitive goods, it has gained markets in machines that are used by these industries. This would indicate that investments to reduce social costs of environmental damage would have brought private benefits in terms of development of new technologies and industries. Germany has maintained its traditionally strong position with some minor market declines. Finland maintained its competitiveness during the period in five industries, and RCAs increased in five categories. Norway shows as being non-competitive in machinery exports. Sweden was an important supplier of all categories covered, but has lost its comparative advantage in two industries. The US has lost comparative advantage in some industries. As with exports of environmentally sensitive goods, developing countries are slowly increasing their shares in all categories of machinery exports.

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[13] These are SITC (Rev2) 725, 726, 728, 736, 737, 741, 745, 749, 773.

Table 13: Changes in RCA indexes in machinery supplied to environmentally sensitive industries, 1980-90

	RCAs above 1 1980	1990	RCAs increased in 1980-90
	number		
Industrial	9	9	0
Austria	8	9	5
Finland	5	5	5
Norway	0	0	2
Sweden	9	7	1
Germany	9	9	0
Japan	6	7	3
US	7	5	1
Developing	0	1	8

Source: United Nations COMTRADE database.

The likely positive impact of higher standards on competitiveness of supplier industries in Japan and in Europe is also confirmed by the direction of exports. High shares of exports to industrial countries suggest that the machines comply with their higher environmental standards. The share of industrial countries in the machine exports of Austria and Germany has increased from two-thirds to four-fifths over the past ten years. Japan also exports more environmentally sensitive machines to other industrial countries, contrary to its pattern in the sensitive goods. The US has maintained an export share of about 40% to developing countries with no major change over the period. Developing countries increasingly supply each other with machinery for environmentally sensitive industries.

5. Policy implications.

The lack of a systematic relationship between environmental standards/expenditures and trade performance in environmentally sensitive goods suggests that restricting trade to compensate for differences in environmental standards would do little to improve competitiveness in environmentally sensitive industries. As higher environmental expenditures

have had no noticeable effect on trade performance, the reasons for poor or good performance are likely to lie elsewhere. Furthermore, the observation that there is no systematic link between the level of environmental expenditures and success in reducing pollution reinforces the importance of good least-cost environmental policies for competitiveness rather than trade measures.

The above also suggests that high environmental expenditures may not necessarily be reflection of high environmental quality. If countries with inefficient and costly policies were allowed to impose the costs of their poor policies on outsiders through trade restrictions or compensatory duties, a likely result would be the export of bad policies and little environmental improvement. A better option is competition among countries adopting standards that are appropriate to their circumstances and that minimize costs of compliance. In some cases coordination of country policies, especially of those that cope with global environmental issues help flexible adjustments.

Eco-dumping duties could do little for the environment, but much harm to the trading system. The most likely impact of compensatory duties is more protection for domestic producers. There is no a priori reason why environmental standards or costs should be the same across countries. Furthermore, there is also no reason why environmental expenditures should be the same across companies facing the same environmental standards in the same country. Differences in costs reflect differences in efficiency, innovativeness, etc. One company is likely to be more efficient or innovative than another - that is human nature. In this context arguments for cost equalization seem untenable.

Most vulnerable to such actions will be developing countries where environmental issues have received less attention. However, a closer look at the tax proposals reveals that their introduction could be a shot in the foot for the industrial countries themselves. At present, differences in taxes or prices of energy, for example, across industrial countries are notable. Gasoline taxes in the US are a fraction of those in Europe or Japan. Given the revealed reluctance of the US Congress to agree to any increases in energy taxes, setting them at a level

equal with Europe, meaning a near doubling of the price of gasoline in the US, seems utterly impossible. US trade partners would have an easy target for trade harassment. What is the appropriate price or tax on energy anyway? Such issues are likely to be better resolved in a cooperative setting, rather than by obscure trade rules.

6. Conclusions

The essentially exploratory analysis in the paper shows that there is little systematic relationship between higher environmental standards and competitiveness in environmentally sensitive goods. Correlation analysis between changes in world market shares and changes in environmental expenditure show no correlation in Germany, Japan and the United States. In Austria the correlation was positive. Industrial countries have maintained their comparative advantage in environmentally sensitive goods in general. Imports of environmentally sensitive goods from lower-standard developing countries have not invaded home or third markets of industrial countries that have increased environmental standards over the past two decades. There share in the sensitive goods has moved in line with their overall increase in world trade. Other factors are likely to have been more important than differences in environmental expenditures in explaining trade patterns in environmentally sensitive goods.

Industrial countries with high environmental standards have both gained and lost competitiveness in environmentally sensitive industries. Japan on the one hand, and Austria and Finland on the other are the two extremes. Austria and Finland, with high shares of environmentally sensitive goods in their exports and one of the highest environmental expenditures among industrial countries in Austria, have increased their world market shares in these goods. Germany, Sweden and the US have maintained competitiveness in environmentally sensitive exports despite increases in environmental expenditures in the 1980s, especially in Germany, and against overall declines in world markets shares in manufactures and total exports in all three countries. In Norway the growth of petroleum production and exports reduced comparative advantages in environmentally sensitive goods. Japan is the clearest case of lost comparative advantage in the sensitive goods. But Japan is competitive in production of

machinery for environmentally sensitive industries.

In its analysis of determinants of trade flows in environmentally sensitive goods the study noted that: i) environmental expenditures have been a small share of total expenditures and therefore unlikely to have caused shifts in comparative advantages in most industries on their own; ii) differences in environmental expenditures among industrial countries seem to be minor; iii) environmental expenditures are concentrated in a few basic industries that are under strong pressures for structural change from the international division of labor; iv) energy use and environmental expenditures are closely linked; and v) there is some indication that success in abatement and increased comparative advantage in environmentally sensitive goods can be more pronounced in countries where environmental policies encouraged investment rather than current expenditures. Apart from physical characteristics the private costs of environmental standards also depend on what policies are chosen - the reductions achieved in the main pollutants by the industrial countries have been quite different across countries. In the end competitiveness is determined by a complex set of macro- and micro-economic factors.

Compliance with higher environmental standards is not a zero-sum game. Higher environmental standards is a new source of permanent structural change - countries adjusting early to internalize costs of pollution and investing in environmental protection technology can maintain and enhance comparative advantages in environmentally sensitive industries. Adjustment can also mean shifting to producing less environmentally sensitive goods. Pressures towards this end are likely to increase as environmental awareness becomes more and more part of the landscape.

Instead of lobbying for protection, industries struggling with environmental expenditures should lobby for better environmental policies. Demands for protection on account of differences in environmental expenditures are likely to be counterproductive and retard adjustment to a new source of structural change. Protection will not solve problems of non-competitiveness -- the causes of poor performance are likely to lie elsewhere. Instead, adjustment can be aided by appropriate timing and design of environmental policies.

Annex Table 1. Product composition of environmentally sensitive goods, in 1970 and 1990

SITC		1970	1980	1990
		(%)		
251	Pulp and paper	4.3	2.9	3.2
332	Petroleum products	11.1	23.7	15.8
512	Organic chemicals	7.4	9.2	12.5
513	Inorganic chemicals	2.8	2.8	2.7
514	Other inorganic chemicals	1.5	1.5	1.5
515	Radioactive materials	0.3	1.5	0.9
521	Coal	0.2	0.5	0.5
561	Fertilizers	2.2	2.7	2.3
599	Other chemicals	4.4	4.3	5.8
631	Veneers, plywood	1.9	1.7	1.9
632	Wood manufactures	0.7	0.9	1.2
641	Paper and paperboard	7.3	5.8	8.[illegible]
642	Articles in paper	1.3	1.4	2.1
661	Cement, etc.	1.0	1.5	1.3
67	Iron and steel	23.9	18.3	17.4
68	Non ferrous metals	15.6	10.6	8.2
69	Metal manufactures	14.3	10.8	14.3
		100.0	100.0	100.0

Source: UN COMTRADE data base.

Annex Table 2. Share in total world exports and in manufactures, selected industrial countries, 1970-90

	Total		Manufactures	
Regions/countries	1970	1990	1970	1990
	(%)			
Industrial	74.3	72.7	91.3	81.3
Austria	1.0	1.3	1.3	1.6
Finland	0.8	0.8	0.9	0.9
Norway	0.8	1.0	0.8	0.5
Sweden	2.3	1.8	2.9	2.0
Germany	11.7	12.2	17.2	15.2
Japan	6.6	8.8	10.2	11.8
United States	14.5	11.4	16.9	12.3

Source: United nations COMTRADE data base.

Annex Table 3. Pollution indicators per Unit of GDP, in 1970 and 1989, at 1985 prices and exchange rates

	1970	1989	Δ
	Sulfur (SO_2) Emissions (kg/1000 US$)		
Finland	15.5	4.2	-69
Germany	8.3	2.2	-73
Japan	7.2	0.5	-93
Norway	5.5	1.0	-82
Sweden	12.2	1.8	-85
U.S.	10.8	4.6	-57
OECD	11.4	4.0	-65
	Nitrogen (NO_2) Emissions (kg/1000 US$)		
Finland	4.8	4.2	-13
Germany	5.3	4.3	-19
Japan	2.4	0.8	-67
Norway	5.1	3.7	-27
Sweden	4.0	2.9	-28
U.S.	7.0	4.4	-37
OECD	5.7	3.6	-37
	Carbon dioxide (CO_2) Emissions from Energy Use (kg/US$)		
Finland	0.45	0.28	-38
Germany	0.46	0.29	-37
Japan	0.31	0.18	-42
Norway	0.22	0.14	-36
Sweden	0.36	0.19	-47
U.S.	0.46	0.32	-30
OECD	0.43	0.29	-33
	Energy Intensity*		
Finland	0.58	0.49	-16
Germany	0.53	0.41	-22
Japan	0.38	0.27	-30
Norway	0.57	0.44	-22
Sweden	0.58	0.52	-10
U.S.	0.60	0.44	-27
OECD	0.54	0.41	-24

* TOE per 1000 US$, primary energy requirements per unit of GDP.

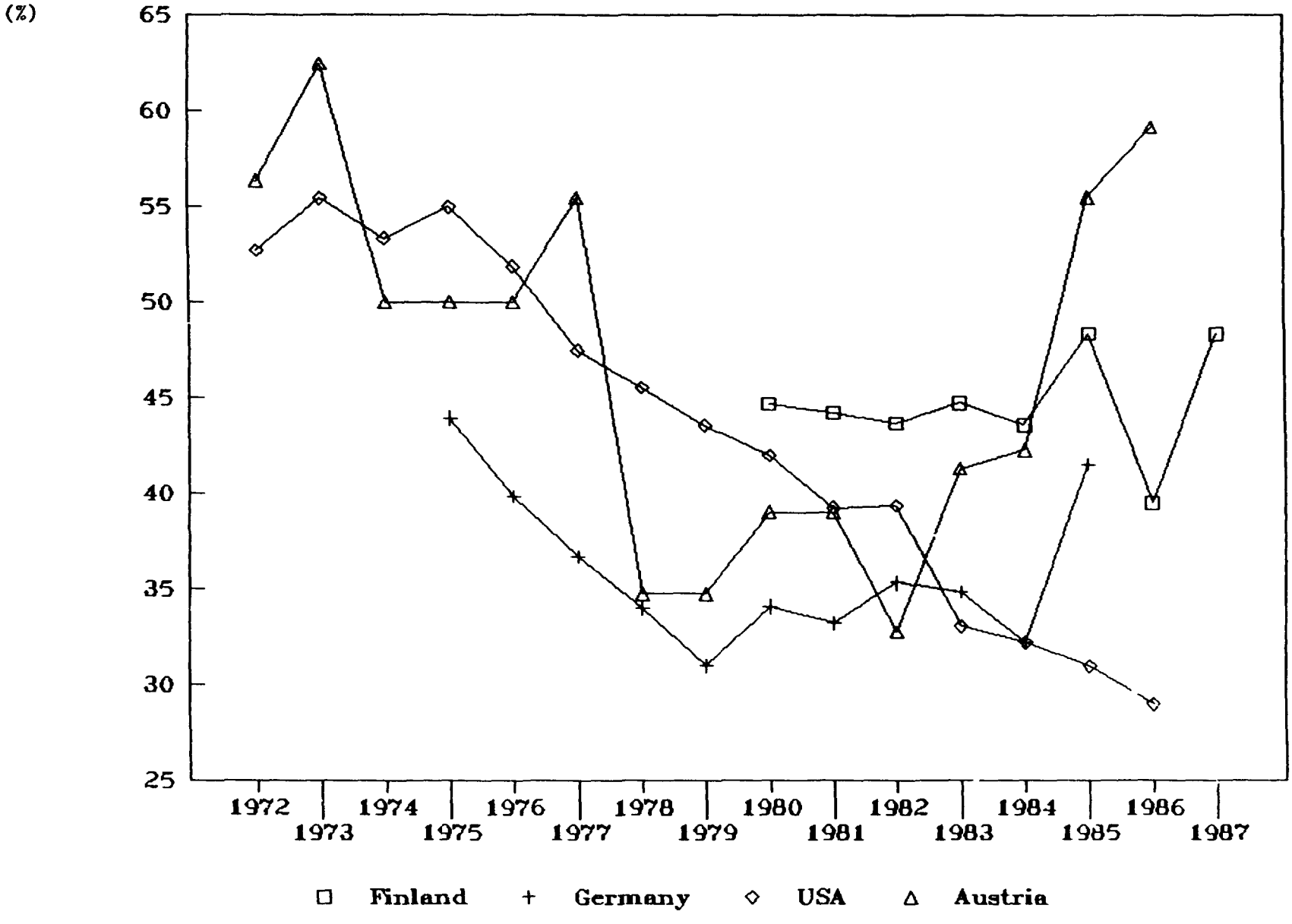
Source: OECD (1991)

Annex Table 4. Cost Structure in German Industry (1990)

Sector	Costs	Labor Costs	Energy investments	in total *	Openness	Share of env. Environmental costs(1988)
	(%)					
* Manufactures	25.2	2.2	4.8		29	0.7
Raw Materials and Production Goods	20.4	4.4	11.3		28	n.a.
Iron & Steel	24.7	10.1	13.7		34	n.a.
Chemicals	24.5	3.8	12.9		42	2.2
Petroleum	3.2	1.1	15.8		4	1.1
Paper	18.0	8.6	10.3			n.a.
Metals (incl. iron, basic metals)	16.0	5.1	12.8		29	1.6
Investment Goods	30.1	1.1	1.9		38	n.a.
Machinery	32.5	1.1	1.4		44	0.3
Consumption Goods	27.2	2.2	2.7		20	
Ceramics	43.7	4.9	3.1		33	n.a
Glass	29.6	6.2	5.2		30	n.a
Paper	23.2	2.2	2.4		18	)
Clothing	23.0	0.7	2.4		20	) 0.7
Textiles	24.7	2.9	0.6		29	)
Food	12.8	1.6	2.7		9	0.4
* Mining	44.8	10.4	20.7			3.9
* Electricity etc.	13.4	–	18.1			4.2

Source: Statistisches Jahrbuch, Germany various issues, Ausgewahlte Ergebnisse zur Umweltokonomischen Gesamtrechnung 1975 bis 1990, Statisches Bundesamt. * openness is defined as the share of exports in total sales (%).

Figure 1. Investment shares in total private environmental costs



Source: OECD (1990).

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