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International Trade in Hazardous Waste

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Working Paper No. 19

International Trade in Hazardous Waste

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International Trade in Hazardous Waste

Michael Rauscher

1 Introduction

In an internal memo, which was later published by the Economist magazine (Economist, 1992), the chief economist of the World Bank, Lawrence Summers, posed the question whether it would be advisable to dump toxic waste in countries with low wages and low population densities. Low population density implies that the number of people affected by environmental risks is small. Low incomes result in a low willingness to pay for environmental quality or - to put it the other way around - high degree of tolerance to environmental hazard. Moreover, low wages are said to indicate a low economic value of human life and health and, therefore, relatively small costs of health-impairing pollution. The intention of this memo was to make the implicit value judgements contained in the neoclassical view on comparative advantage more explicit. According to the law of comparative advantage, toxic waste should be stored or treated where the environmental costs are low, i.e. *ceteris paribus* in low-income under-populated countries. Free trade is said to be beneficial for all parties involved. First, it is based on voluntary exchange. Thus, if a country did not benefit from trade, it would not trade. Second, the international division of labour improves the efficiency of allocation since it makes factors of production move into their most productive utilisations. Applying these arguments to hazardous waste, one would come to the conclusion that international trade in this commodity is a good thing.

Environmentalists have a completely different view on international trade in hazardous waste. They argue that much of this trade involves an

unequal exchange between the North and the South. Industrialised countries export their domestic environmental problems to the developing world, which faces huge problems with the disposal and processing of hazardous substances. A ban of trade in hazardous waste would bring relief to the South and would coerce the North to either avoid the generation of this waste or develop environmentally sound methods for its disposal.

In reality, however, trade in hazardous waste is neither completely liberalised nor completely prohibited. Transboundary movements of hazardous substances are possible but they are highly regulated and restricted. The most important international agreement in this respect is the Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Its Disposal (hereafter: Basel Convention). It prohibits purely private transactions in hazardous waste and exports to non-parties and it requires re-imports of exported toxic substance in special cases.

This paper intends to give an overview of the economics of international trade in hazardous waste. It is organised as follows. The next section briefly discuss the extent of trade in hazardous waste and it will present the institutional framework as given by the Basel Convention. Then we will deal with determinates of the patterns of trade. Who is an exporter and who is an importer of toxic waste? Afterwards, we will deal with welfare effects of trade in hazardous waste. It will be seen that in a first-best world, trade is indeed beneficial to all parties involved although the object of the trade consists of dangerous substances. However, if there are distortions such as insufficient environmental policies, then international trade may be harmful. After a short section on the effects of trade liberalisation on environmental regulation, we will consider the impact of hazardous-waste regulation on trade. Are there good reasons to modify environmental regulation in order to achieve trade-related objectives? And will this result in a harmful deregulation. In a next step, I will introduce imperfections such as regulatory and enforcement deficits and asymmetric information. Afterwards, international externalities will be considered in an

interjurisdictional-competition framework. Section 7 deals with imperfect competition, i.e. with the question whether a monopolistic supplier of hazardous waste can exploit importing countries. In section 8, trade barriers will be considered and the final section will summarise the results.

2 Trade in Hazardous Waste: Some Stylised Facts and the Institutional Framework

Hazardous waste is waste that poses a threat to human health or the environment and, therefore, requires special care during transportation, storage, treatment, and disposal. (Asante-Duah/Nagy, 1998, pp. 1-2). The statistical records on generation and, particularly, trade of hazardous waste are often incomplete and sometimes inconsistent. Thus, it is difficult to provide reliable numbers. However, what is known is that hazardous waste has become a large-scale problem only in the recent past. The generation of hazardous waste in the US, for instance, has increased by a factor of ten from 1980 to 1990. The most important producer of hazardous waste is the US, which alone accounts for some 75 per cent of OECD waste output. OECD countries on average import and export some one per cent of their hazardous- waste output. Countries with export shares above ten per cent are the Netherlands, Switzerland, Austria, Australia. Countries importing more than ten per cent of their domestic outputs are again Netherlands and Austria, and Denmark. (Asante-Duah/Nagy, 1998, pp.70-73). There appears to be some intra-industry trade in hazardous waste in Europe. Records on North-South trade are even less reliable than those for industrialised countries. In many cases, transports have been illegal or they have never been recorded by official authorities. Asante-Duah/Nagy (1998, pp. 75-80) present some anecdotal evidence concerning imports of hazardous waste by developing and transition countries. It is seen that these importing countries in many cases lack the capability of environmentally sound treatment or disposal. Nevertheless, they are willing to accept these substances for rather

low compensation payments, that save the exporters a substantial amount of money.

International trade in hazardous waste is regulated by the Basel Convention. For surveys see Douma (1991), Rauscher (1997, pp. 300-301), and Asante-Duah/Nagy (1998, pp. 98-103). This Convention is an international environmental agreement, which came in to force in 1992 and to which most industrialised and many developing countries are signatory parties. It requires them to minimise the generation of hazardous waste, to ensure that adequate disposal facilities are available, to control and reduce international movements of hazardous substances, and to prevent illegal traffic. The particular rights and obligations of the signatory parties are specified in Article 6 of the Convention. International trade in hazardous waste is to be supervised by the authorities of the states involved with a transboundary shipment. The exporter of hazardous waste is required to notify the authorities of the exporting, importing, and transit states and written letters of consent by the latter two are necessary for the transactions to take place. This means that purely private shipments of toxic waste without an involvement of government authorities are prohibited. Moreover, every country has the right to refuse imports of hazardous waste. Another restriction of trade is contained in Article 4 (5) of the Basel Convention: Exports of toxic waste to non-parties are prohibited. However, this constraint is mitigated by Article 11, which allows signatory parties to export toxic waste to countries with which they have agreements that are at least as stringent as the Basel Convention. An additional rule that the hazardous-waste trade is subject to concerns re-imports. If the movement of toxic waste is not completed in accordance with the terms of the contract and possibilities for an environmentally sound disposal in the transit or importing country do not exist, the exporting country is held responsible for re-importing the waste. Besides simply limiting the volume of trade in toxic waste, the Convention has an incentive effect. Due to the threat of re-imports, the exporters care about sound environmental regulation in the

importing countries, and countries wanting to exploit their comparative advantage in the disposal and processing of toxic substances tend to implement stricter standards in these industries.

From the point of view of a free-trade advocate, the regulations contained in the Basel Convention are severe trade restrictions that prevent an efficient and welfare-enhancing division of labour between potential exporters and importers of hazardous waste. The mandatory involvement of government authorities subjects the hazardous-waste trade to bureaucratic discretion. The obligation to re-import shifts the risk of insufficiency of storage or processing facilities from the importer to the exporter. The right of a country to ban hazardous waste imports is a severe trade impediment. Finally, the prohibition of trade with non-parties is an obvious discrimination. These features of the Basel Convention do not only contradict the view of dogmatic free-traders, they are also inconsistent with the spirit of General Agreement on Tariffs and Trade (GATT). The GATT defines circumstances under which trade interventions are justified. In such cases, trade restrictions must be non-discriminatory, domestic like-products must be treated in a similar way as foreign goods and no other instruments that are less trade-distorting should be available.¹ The measures taken by the Basel Convention do not satisfy these criteria.

Environmentalists in contrast complain about too-low strictness of the Basel Convention. The principle of trade only among parties is diluted by Article 11. Moreover the definition of what constitutes hazardous waste which is to be regulated by the Convention is considered to be insufficient or too vague.

Besides the Basel Convention, there are numerous other multilateral and bilateral international agreements on hazardous waste trade, e.g. on the

¹ On environmental aspects of the GATT, see Rege (1994), Esty (1994, 46-52), and Rauscher (1997, 301-303).

EC and the OECD levels but also by groups of developing countries, such as the OAU. See Asante-Duah/Nagy (1998, ch. 5).

3 Factor Abundance and the Patterns of Trade

International trade in toxic waste is trade in a commodity with particular characteristics and it is often performed between countries that are rather dissimilar. These stylised facts suggest that trade in hazardous waste is to be explained by Heckscher-Ohlin theory. International differences in endowments with factors of production are then viewed as being the reason of specialisation and trade. We will present an intuitive version of this theory based mainly on a diagrammatic approach. For a more formal approach, see Rauscher (1997, ch. 4).

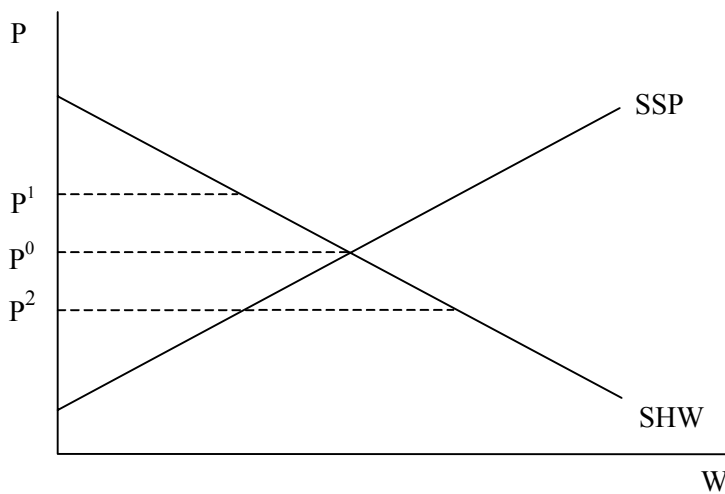


Figure 1: *Supply and Demand of Hazardous Waste*

First of all, it should be noted that hazardous waste is a commodity with a negative value; it is a bad rather than a good. The corresponding good with a positive value is the importer's service to help the exporter to get rid of the hazardous waste. This is depicted in the following diagram, Figure 1. It represents a country's market for hazardous waste. W denotes the quantity

of hazardous waste and P the price to be paid by the producers of the waste to the waste-management sector. SSP denotes the supply of storage and/or processing services and SHW is the supply of hazardous waste or the demand for storage and processing services. The SSP curve is positively sloped because the treatment of waste utilises scarce resources. The SHW curve is negatively sloped since a high cost of waste disposal is an incentive to avoid waste in the production process. The equilibrium price is P^0 . If the price on the world market larger than the domestic autarky price, e.g. P^1 , then the country will be an importer of toxic waste. If it is lower, e.g. P^2 , it will be an exporter.

It follows that the patterns of trade are determined by the shapes of the SPP and SHW curves in different countries. An upward shift in the SPP curve is explained by tighter regulation of the waste treatment industry, in particular by tighter environmental standards. An upward shift in the SHW curve may be due to lax environmental standards in the waste-generating production sectors and by the size of these industries.

From the effects of these shifts on the domestic price, it follows immediately that a country is an exporter of toxic waste if, *ceteris paribus*,

- the waste management sector is subject to tight standards,
- the waste-generating sector is subject to lax standards,
- the waste-generating sector is large.

In Rauscher (1997, p. 95) the size of the waste generating sector is positively related to the economy's capital stock. Thus, capital-rich countries such as industrialised countries tend to export hazardous by-products of their manufacturing output.

What determines the strictness of environmental regulation? In the context of our model, all environmental externalities can be internalised by

an appropriate regulation of the waste management sector.² The strictness of this regulation depends on variables such as availability of safe deposit sites and on the willingness of the voter to pay for environmental quality. This in turn is influenced by the degree of environmental concern and by the ability to pay, i.e. on per capita income. This implies that, everything else being equal, low-income countries with low ability to pay tend to accept toxic waste at lower compensation payments and, therefore, to become waste importers. Finally, a Ricardian element determines the price of toxic waste. Technological progress shifts the *SSP* curve downwards and increases domestic wage processing.

4 Gains and Losses from Trade

In mainstream economic theory, international trade is in general advantageous to all parties involved. The reason is that transactions would not be made if people acting in their self-interest did not benefit from them. The exception to this rule is second-best theory. If there are distortions in the economy, it is possible that these are partially corrected by barriers to trade. The removal of trade barriers then leads to welfare losses. In the context of environmental economics, distortions are omnipresent. Let us assume that there are un-internalised environmental externalities, e.g. in the case of insufficient environmental regulation. In our model framework, we will assume that the waste-treatment sector of the economy is not appropriately regulated. Thus, the marginal social cost of waste disposal exceeds the marginal private costs.

In Figure 2, this is depicted for the waste-exporting country. Again *SHW* is the hazardous-waste supply curve, *SSP* is the supply curve of the waste disposal industry under perfect regulation, and *SSP'* is the same curve if this industry is insufficiently regulated and can shift some of its cost to the

² Sources of environmental disruption other than hazardous waste are assumed to be exogenous and constant.

rest of society. P^w is the resulting world market price after trade liberalisation. In the case of optimal environmental regulation, the gains from trade consist of an increase in the production sector's surplus and a reduction in the waste processing industry's surplus. The net effect is a welfare gain of $a+b+c$. In the case of insufficient regulation, the autarky level of hazardous waste output is larger. Thus, the private gain due to trade expansion is reduced to c . In addition to this gain, however, there is an environmental benefit of magnitude $b+d$. It is seen that the total welfare gain, $b+c+d$, may turn out to be larger than in the case of perfect environmental regulation.

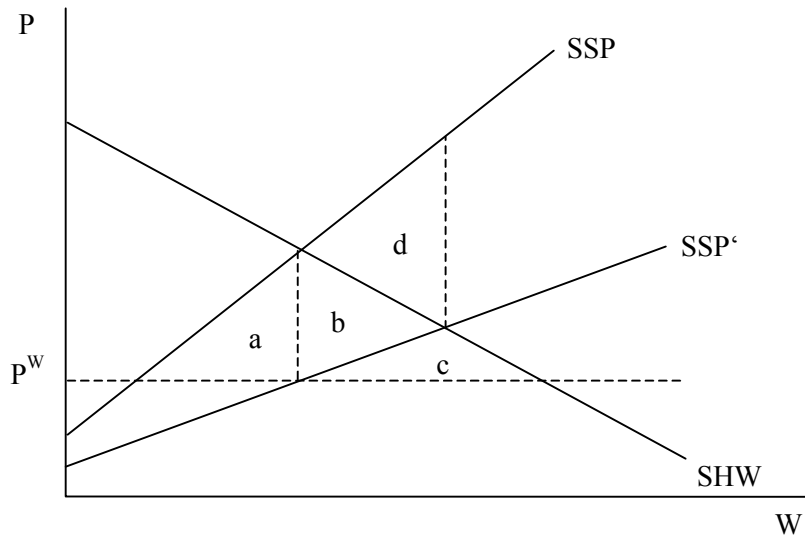


Figure 2: *Gains from Trade in the Exporting Country*

Next consider the importing country. The difference in Figure 3 compared to the previous diagram is that the world market price is above the autarky price level. The variables are indicated by asterisks now. In the case of a perfectly internalising environmental policy (SSP curve), the gains from trade are measured by area a . If the environmental regulation is insufficient (SSP' curve), the private gains from trade are larger: $a+b+c$. However, there is a non-internalised environmental effect $-c-d$. The net welfare effect is $a+b-d$, and this may well be negative. The likelihood of welfare losses

becomes even larger if the deviation of environmental regulation from its optimal level is so large that a potential exporter of hazardous waste is turned into an importer.

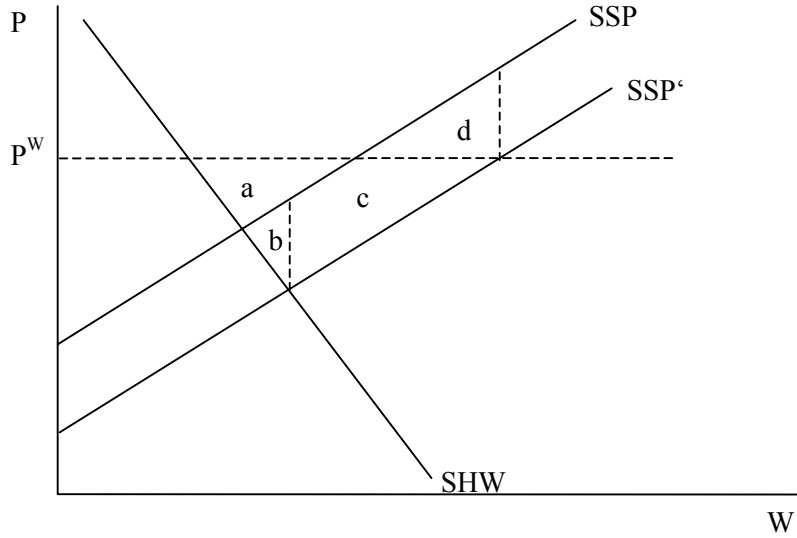


Figure 3: *Gains from Trade in the Importing Country*

In a next step, let us consider the interaction of a group of industrialised countries with adequate, that is strict, environmental laws and a group of developing countries that do not generate toxic waste themselves but act only as recipients of waste shippings. We will consider the effect of a regulatory deficit in the developing countries. *EHW* is the export supply of hazardous waste, and *SSP** and *SSP*'* are the import demand functions of the developing countries in the cases of adequate and inadequate policies, respectively. See Figure 4. P^0 is the world market price in the case of perfect regulation, P^1 is the price if developing countries have insufficient environmental policies. The move from *SSP** to *SSP*'* reduces the world market price. This is an improvement of the terms of trade of the waste-exporting countries and results in an increase in the gains from trade by $a+b$. Trade is beneficial to the waste exporters and the benefits are increased by environmental laxity in the importing countries. The importing countries experience

a welfare gain of $a+d$ if they correctly internalise the environmental costs of waste disposal. In the case of insufficient internalisation, however, the private sector's gain is $d+e$ whereas society as a whole experiences a loss of environmental quality of $-e-b-c$. The total effect of international trade from the importers' point of view is negative. The global welfare effect of international trade is $o+a+d-c$, which may well be negative.

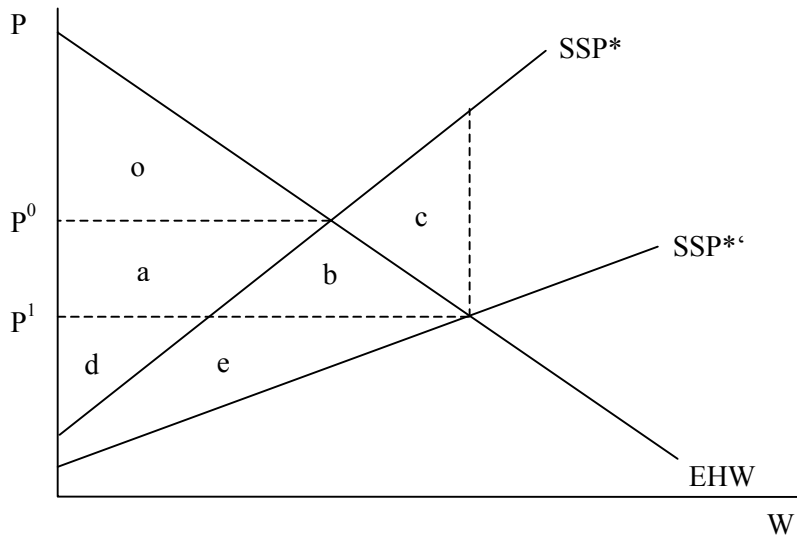


Figure 4: *Gains from Trade in a North-South Model*

The results can now be summarised as follows:

- A regulatory deficit in the waste disposal and processing industries of the importing countries is beneficial to the exporters of toxic waste.
- It is harmful to the importers and may cause welfare losses from trade liberalisation for them.
- The gains from trade may be negative for the world as a whole.

It should be noted that these results have been obtained under two implicit assumptions. First, we have neglected transport externalities. Second, we have neglected transfrontier pollution spill-overs. When environmental costs of the transportation of toxic waste are taken into account, then the gains from trade may become negative for all parties

involved unless these costs are adequately internalised. With the internalisation of these costs, however, transportation may become so expensive that trade in hazardous waste is not profitable any more. Transfrontier spill-overs of pollution imply that the exporting country has to bear some of the environmental cost of storage and processing of hazardous waste even if these activities are taking place in another country. A historical example for this is the trade in toxic waste between the Federal Republic of Germany and the German Democratic Republic in the 1970s and 1980s. Much of this waste was disposed of under rather dubious conditions on a site called Schönberg in the north-west of the GDR right at the border between East and West Germany. In a case of leakage, West Germany would probably have suffered severe environmental harm. Thus, it is not always true that exporting toxic waste really means exporting the problem.

5 Changes in Environmental Policy Following Trade Liberalisation

The possibility to trade toxic waste should affect the design of environmental policy. Usually, environmental economists make the assumption that marginal environmental damage is increasing in pollution, i.e. the environmental cost of pollution is rising more than proportionally than the level of pollution. This is sensible because in most cases the assimilative capacity of ecosystems is a declining function of pollution.³ Since trade in toxic waste exports a part of the pollution from the country where it has been generated to the country where the waste is stored or processed, the marginal environmental costs in the two countries are changed. Since these costs equal optimal environmental taxes, this should have an impact on environmental policy. One can expect that (explicit or implicit) environmental taxes are increased in the exporting and reduced in the importing country. In reality, however, it is difficult to observe such changes in environmental policy since (i) real-world environmental regulation is often

governed by political rather than economic objectives and (ii) there are various variables influencing environmental regulation and in practice it is difficult to isolate the effects of trade liberalisation.

Moreover, transportation externalities must be taken into account. An environmental policy aiming at internalising environmental externalities should introduce trade taxes or otherwise regulate the transportation of hazardous substances.

6 Effects of Changes in Environmental Regulation and the Design of Optimal Environmental Policies

The literature on international trade and the environment has established that environmental policies in open economies may under certain circumstances differ from policies in closed economies. The underlying reason is that environmental policies can be used to achieve trade-related objectives. This is not the case if the country under consideration is small and, thus, cannot influence the world market. Then tighter environmental regulation in the waste sector leads to an increase in exports or a reduction in imports. Optimal regulation is governed by the rule that the tax to be charged for the polluting activity should equal the marginal environmental damage.

Matters are different if we consider a large country with market power in the market for hazardous waste. Tighter environmental regulation of the waste sector leads to an increase in the price for waste disposal. This is good for the waste-importing country and bad for the waste-exporting country. Tighter environmental policy in the exporting country and laxer environmental policy in the importing country increase the volume of waste traded and, therefore, the environmental cost of transportation. Moreover, in the case of transfrontier pollution, a leakage effect has to be considered. With tighter environmental regulation in one country, the quantity of waste to be

3 An exception is the case of hot spots, i.e. areas that are polluted so much that additional pollution does not matter any more.

disposed of in the rest of the world is increased. If this country is an importer, its imports are reduced. If it is an exporter, its exports are increased. In both cases the risk of transfrontier pollution rises.

From these considerations, it follows that an optimal environmental tax to which the waste sector is subject consists of four parts.

- The first part is the domestic marginal environmental damage.
- The second part is a terms-of-trade term. It is positive if the country is an importer and negative if it is an exporter of toxic waste.
- The third part is a term covering the transportation problem (provided that the transportation externality affects the country under consideration). As the terms-of-trade term, it is positive for the importing and negative for the exporting country.
- Finally, there is a leakage part. It is negative for both countries since laxer environmental policies at home reduce the transfrontier spill-over from abroad.

These trade-driven changes in environmental policy in one country have external effects on the rest of the world. Terms-of-trade improvement for one country means terms-of-trade deterioration for its trade partner. Reduction of trade for reasons of transport externalities is beneficial for other countries that suffer from these externalities as well. And a laxer domestic regulation increases the transfrontier pollution problem faced by other countries. These externalities lead to deviations of national policies from the co-operative first-best optimum. We can distinguish three cases:

- Terms-of-trade effects dominate. In this case the importing country chooses a tighter-than-optimal level of regulation. The exporter's environmental regulation is too lax.
- Transfrontier pollution dominates. Both countries choose too-lax regulation of their waste sectors.

- Transport externalities dominate. The importing country's regulation is too strict, the exporting country's regulation is too lax.

7 Imperfectly Competitive Markets

It is often argued that the laxity of environmental regulation in developing countries is to be explained by their dependence on large multi-nationally operating firms. These multinationals can exploit their market power vis-a-vis small countries that compete against each other. A scenario showing such a situation is depicted in Figure 5. As in Figure 4, the *EHW* and *SSP* curves denote the export supply of hazardous waste and the supply of storage and processing, respectively. To a monopolist, however, the cost of buying waste-management services is larger than the market price. An additional unit of waste leads to a price increase which makes the existing exports more expensive. This is denoted by the marginal-cost-of-exports (*MCE*) curve. The monopolist's optimum is to restrict exports until the marginal cost of export equals the willingness to pay for waste disposal. This reduction in waste exports leads to a price reduction. The price, P^M , is less than the competitive price, P^C . This implies that the regulation of the waste sector in the developing country has indeed been relaxed. Monopoly power on the hazardous-waste supply side of the market leads to deregulation by the importers.

The effect of this deregulation on the environment is ambiguous. The monopolist restricts its waste exports and this is beneficial to the environment. On the other hand, domestic waste is supplied in increased quantities and this may reverse the original effect.

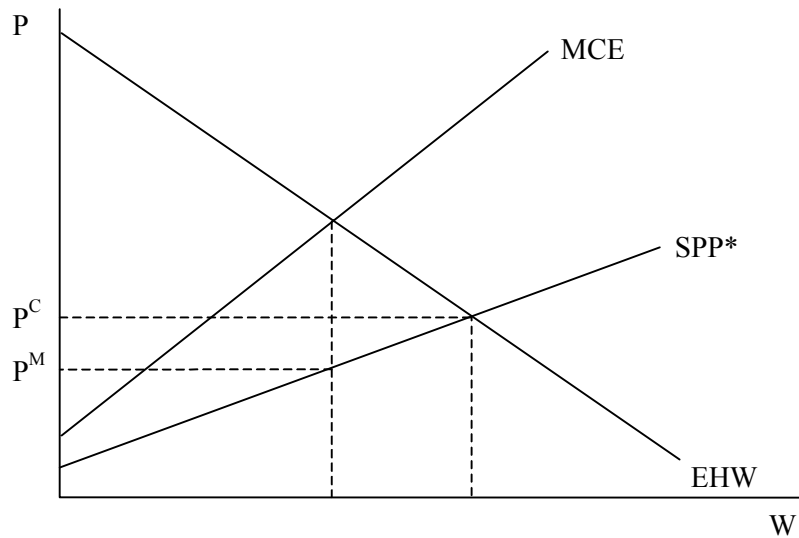


Figure 5: *Monopolistic Supply of Hazardous Waste*

8. Restrictions on Trade in Hazardous Waste

It has been seen that trade in hazardous waste may be beneficial in some situations and welfare-reducing in others. Moreover, it was shown that the regulation of the waste treatment and disposal sectors can be used to achieve trade-related objectives. The question now is whether environmentally motivated objectives justify trade restrictions. Three kinds of arguments can be made on theoretical grounds in favour of such measures. The first one is the internalisation of transport externalities. If transport is environmentally disruptive, this activity should be restricted, either by means of taxation or by other environmental-policy instruments. Since this is rather obvious, we will not dwell on this any further. The other two problem areas require more attention. On the one hand, environmental regulation may be insufficient, and trade restrictions may be used as a second-best policy to correct the distortion at least partially. On the other hand, large countries can influence trade and, therefore, may be interested to use trade-policy measures. However, the question arises as to where the environmental motivation is to be sought in such cases.

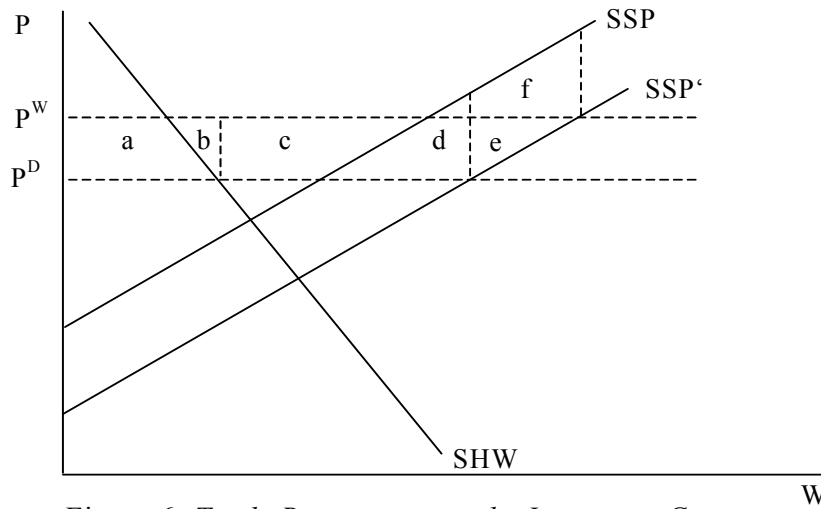


Figure 6: *Trade Restrictions in the Importing Country*

I wish to start by looking at the issue of insufficient environmental regulation. In the public, this is often discussed as a typical importing-country problem. Thus, most of the analysis is devoted to the case of a waste importer. Consider Figure 6. It shows a situation where, as in Figure 3, a waste-importing country is insufficiently regulated. The SSP' curve represents the distorted supply of storage and processing services. In the free-trade situation, the domestic price in the hazardous-waste market equals the world market price, P^W . If a tax on waste imports is levied, the domestic price must be reduced. Foreign producers of toxic waste are still willing to pay no more than the world market price. This means, that domestic suppliers of waste treatment and disposal have to offer their service at a lower price. As a result, domestic producers of hazardous waste will experience a gain of a . The waste disposal sector will lose $a+b+c+d+e$. The government's tax revenue is $b+c+d$. Finally, the gain in environmental quality is $e+f$. The net welfare effect turns out to be $f-b$ and this is positive. Of course, as already mentioned, this is only a second-best policy. The first best would be to eliminate the original distortion, i.e. to internalise the environmental externality completely by moving the supply function of the storage and processing industry to SSP . An import quota would have the

same effect as a tariff. Domestic supply of hazardous waste would be reduced and this would generate an excess supply of storage and processing services. The domestic price would be reduced and rents would be generated. Since the foreigners' willingness to pay is unchanged, this rent accrues to domestic citizens. However, there may be problems of rent seeking that reduce the rent.

In a waste exporting country with insufficient regulation of the waste treatment sector, it is also advisable to reduce domestic disposal and processing of toxic substances. This is done by an export subsidy as a second-best policy.

In the large-country case, trade interventions are desirable even in the case of perfect internalisation of the environmental cost. This result is based on the well-known terms-of-trade argument of optimum-tariff theory. The waste importer benefits if the compensation payment made by the exporter is high, the exporter benefits from low payments. Thus, the importer is interested in increasing the scarcity of her services and the exporter is interested in reducing the supply of hazardous waste. Thus, it is optimal for the exporter to restrict her exports and for the importer to impose a restriction on imports. See Levinson (1997) for similar results based on a tax-competition model. The empirical evidence derived by him from a data set on inter-state waste movements in the US shows that waste-importing states indeed have an incentive to introduce a surcharge for imported waste.

Of course, this standard optimum-tariff argument has nothing to do with ecological goals of trade policy. Green objectives enter the arena if there is transfrontier pollution. Then the optimum tariff has an anti-leakage component. Consider a waste-exporting country which fears that it will be negatively affected by hazardous waste being treated or disposed of on the other side of the border. An optimal trade policy takes account of this. An export restriction reduces the waste treated or disposed of in the neighbouring country and, thus, the transfrontier externality. See Figure 7, which

depicts the international waste market from the point of view of the exporting country. EHW represents the desired exports of waste, SSP^* is the foreign country's supply of storage and processing, and SSP^*+TFP is the total cost of exporting if transfrontier pollution is taken into account. The free-trade situation is characterised by a relatively large volume of trade and a low price, P^0 . The country can then restrict its exports of waste by taxing them, for example. The effect on the domestic waste generating and disposal sectors is $-a-b-c$. The tax revenue is $a+b+d+e$. Finally, the environmental dividend is $c+f+g$. The total welfare effect turns out to be $d+e+f+g$, which is unambiguously positive. Part of this is a terms-of-trade gain, the other part an increase in environmental quality.

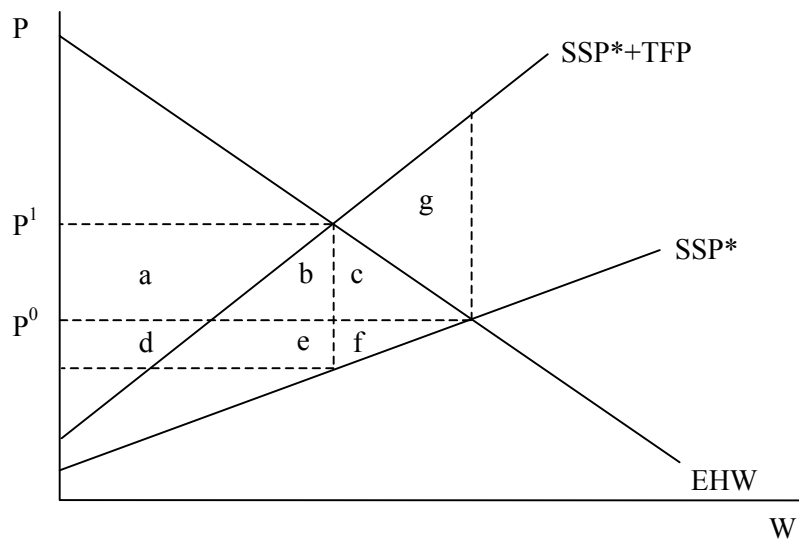


Figure 7: *Optimal Tariff and Transfrontier Pollution*

The importing country should subsidise waste imports if it suffers from transfrontier pollution and leakage. An import subsidy reduces the quantity of the waste on the other side of the border.

Summarising the results derived up to now, we can state that trade restrictions may be explained by regulatory deficits in the downstream

waste sector in the importing country, by transfrontier pollution and leakage in the exporting sector and by terms-of-trade objectives in both countries. The first link probably explains much of the trade barriers raised by developing (but also by developed) countries against imports of hazardous substances. If the capabilities to deal with hazardous waste are insufficient and these deficiencies cannot be repaired, e.g. because of lacking access to new technologies, it is indeed advisable to control the waste at the border and refuse to accept major proportions of it. The transfrontier pollution problem is of practical relevance only in border regions. Finally, I regard the real-world role of the terms-of-trade motive as rather limited and unimportant. So, what explains export restraints by industrialised countries?

The first explanation is a political-economy argument. If one wants to explain an economic policy, one has to find out who gains from it. Two groups of people should be considered: the domestic waste disposal sector and the environmentalists. The waste industry benefits from trade restrictions since waste that cannot be exported must be treated or disposed of domestically. This increases the demand for the services this industry has to offer and, therefore, its producers' surplus. Most environmentalists are concerned about the environment on a global scale. For them, pollution in a distant Third-World country is not much different from pollution at home. Thus, they will exert political pressure in favour of export restraints or even bans. The green view can also be visualised by means of Figure 7. Now the SSP^*+TFP curve does not represent the real cost of exporting toxic waste but the psychic cost due to the fact that the altruist suffers from environmental disruption abroad. Since an altruist is not interested in improving the terms of trade at the expense of the trading partner, the terms-of-trade deteriorating effect for the other country would be taken into account. Then the welfare gain from the implementing the trade restriction is only g .⁴

⁴ See Maestad (1998), for a formal elaboration of this argument in a slightly different model with trade and the environment.

Thus it is seen that there exist good economic reasons to regulate and restrict international hazardous-waste movements. Of course this is not the first-best policy. The first best would be to have strict regulations everywhere and free trade. Strict regulations guarantee that the true costs of environmental hazard are taken into account and that the generation of waste is reduced to an optimal level. Free trade then improves the allocation of factors of production and allows countries to obtain welfare gains from a beneficial international division of labour. However, the world we are living in is not first best in many respects and almost certainly not so in the international hazardous waste business. On these grounds, trade restrictions are often justified.

9. Conclusions

This paper has dealt with the issue of trade in hazardous waste. It has been seen that standard economic theory and diagrammatical approaches can be utilised fruitfully to derive interesting results. From a purely economic-theory point of view, hazardous waste is not a particular commodity. Of course do waste movements offer the possibility to separate pollution geographically from the location where it has been generated but this does not add additional complications to the economic analysis.

It has been seen that the possibility to trade does not guarantee that there will be positive gains from trade. Waste importers may lose if they have internalised the environmental cost of treatment and disposal only incompletely. Moreover, it is rather unlikely that there will be a race towards the bottom in the regulation of the waste industry. There are substantial environmental costs involved for an importer of hazardous substances and there is no reason not to take them into account. However, it can be useful to soften environmental standards if leakage effects are substantial. Finally trade restrictions are desirable in situations where other irremovable distortions are present. It is likely that this is true for the

international market for treatment and disposal of hazardous waste. Thus, restrictive regulations like that of the Basel Convention appear to be justified on ecological grounds.

This paper was concerned with legal movements of hazardous waste only. The issue of illegal dumping has not been discussed. It is likely that increasing restrictiveness of regulations and agreements governing the trade in hazardous waste generate additional incentives to dump toxic substances illegally. From a theoretical point of view, the interesting question is how environmental and trade policies are affected by this possibility. The practical problem is to cope with illegal international waste movements.

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