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On the Political Economy
of Transferable Discharge Permits

Holger | Bonus

Serie B - Nr. 13

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On the Political Economy
of Transferable Discharge Permits

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On the Political Economy
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1. The Environment Syndrome

To the economist, environmental policy means that new, and "artificial", constraints must be added to those already in existence. This is by no means peculiar to environmental economics. Every law regulating land use; every restriction on working conditions agreed upon by employers and unions; and even the politeness of motorists who stop as a lady crosses the road -- all of these constitute "artificial" constraints to the range of economic activities. There are probably just as many "artificial" (i.e., man-made) constraints as are natural ones in economics.

What, then, makes environmental economics a field of its own? Several aspects of environmental problems interact to form a syndrome that is quite difficult to cope with.

First, a basic asymmetry is involved. Suppose a motorist passes through some village at midnight. He disturbs sleepers as the noise spreads along streets. Two alternative uses of the local air mantle compete against each other: the motorist needs a carrier of the noise waves that he must discharge if he is to drive at all; and the sleepers need quietness (absence of noise waves), if they are to sleep well.

Coase [1960] made the point that in a situation like this it is by no means clear that the sleepers' demand for quietness should be given priority over the motorist's demand for noisiness. It may well be, for instance, that the motorist's trip serves to protect the sleepers themselves: he may be a police-

* Paper presented at the Oxford International Symposium 1980, "Environment and the Use of Resources", held in Christ Church, Oxford from September 22 to 27, 1980.

man on duty, or a fire warden. Thus to see whether or not the motorist should proceed, one would have to account for the social significance of both alternative uses.

However, this just won't happen in practice. The reason is that it is so much easier to any motorist to impose noisiness upon sleepers than it is to sleepers, to impose quietness upon a motorist. By the very act of turning on his engine, the motorist is able to devote the air mantle to his own purpose; but sleepers cannot turn off the noise by simply going to bed. As the motorist's claim is quite strong in practice and the sleepers' claim so weak, institutions are needed to make sure that the sleepers get a fair deal.

Second, the situation is not simply one where some majority exploits a minority, or vice versa. Rather, it is often everybody who exploits everybody else. How come? As the motorist arrives at home by one o'clock in the morning, he needs some sleep, but cannot get it because other motorists keep cruising by. Thus all those noisy motorists become themselves quite vulnerable to the noise made by their fellow motorists, as soon as they get home or to their workplace. It is therefore probably to their own mutual advantage if they see to it that the general noise level gets significantly reduced.

But again, that just won't happen. Suppose for instance a noise-abating equipment became available that would cut the noise discharged through cars by one-half. Costs would be £ 250 per car, say; and let us assume that every motorist would be glad to spend that amount of money if he could only make sure that he would get, in return, a reduction of the general noise level as indicated. Unfortunately, that would only be the case if every single motorist would outfit his own car with the same equipment. But each must face the sad truth that if he proceeds, he could as well throw £ 250 out of his window. The general noise will by no means level off just because he installed the equipment. His own contribution is all but insignificant; it is the sum of all individual contributions that counts.

In that situation, it is clear that very few will take the risk. The reason is that the benefits of each outfit spread over the community while the investor alone is to bear all cost. To each and every would-be investor, that sort of investment is quite unattractive. Yet by not installing the device, all of them forego those quiet nights they all long for. As they are unable to get what they are in fact willing to pay for, some institutions are needed to assist them in satisfying their demand.

Third, the institutions called for must be provided through government, i.e., the political process¹. Politicians, however, being up for reelection, are subject to yet another sort of benefit-cost calculus. The required institutions will restrict the range of admissible economic decisions; in other words, they will be costly. And while total benefits stemming from environmental restrictions will in general exceed total costs, those hit by the costs (e.g., motorists, employers and employees in the automotive industry) will be much better organized than are those benefiting (e.g., the sleepers). The noisemakers are thus in a position to put pressure on legislators, to the avail that the restrictions eventually turned out should be toothless; and as a result, the very same people will find it difficult to sleep as the noise stays on².

The political dilemma gets much worse when it comes to ecological constraints, i.e., those institutions designed to keep the ecological system balanced. The benefits of any single measure serving this purpose are widely spread among present and future populations and cannot be felt; the costs, however, must be borne by some small groups who will resist them. Any politician sticking out his head when it comes to endorse such legislation will find it rough to explain to his constituency why they should pay so much hard cash, when the benefits go to no one in particular.

The result of the environment syndrome is that while most people want a clean and viable environment, it is difficult to provide what they want.

¹When numbers are small, agreements can be worked out by the concerned themselves; see Coase [1960], Buchanan [1965a, 1965b, 1973]. The point is, of course, that numbers are not small.

²Needless to say, if those responsible can manage to live in areas where the noise cannot be heard, then even weaker restrictions may result; but such features are not necessary to establish the general result sketched above.

Before turning to specific instruments of environmental policy, let us inspect somewhat more closely the mechanics of the syndrome.

2. The Prisoners' Dilemma

In our examples we ran into situations where people acted against their own interest. They were caught within a "rationality trap" that would make it attractive to the individual, to violate the conditions that must be collectively met if common demands are to be satisfied.

This kind of trap is well-known in the theory of games, and may best be depicted by the "Prisoners' Dilemma" game³. Suppose a series of crimes have been committed, and two suspects been jailed. There is no proof yet; so if neither confesses, both must be set free after serving a month for carrying a gun without permit. If both confess, both get jailed for 10 years. But if one confesses while the other denies, the former is set free immediately and the latter imprisoned for 25 years. Communication between the prisoners is ruled out, as each is held in isolation..

Obviously, it is the common interest of both to deny. But to each prisoner alone, it is rational to confess. If A confesses and B doesn't, A may walk out a free man, while having to stay around for a month if he had denied. If A confesses and so does B, then A gets away with 10 years, while stuck for 25 years if having denied. Thus whatever B does, it is safer for A to deny; and the same holds for B. Unfortunately, that line of thinking puts both prisoners right to jail for 10 years, even if both are perfectly innocent.

The way out of this trap so prominently present in the environment syndrome is, of course, to make sure that the concerned can rely on each other. If both prisoners are certain that the other fellow won't confess, then both get away with one month in jail each. If each motorist can be sure that all others install the noise-abating device, then each buys a healthy quietness

³See, for instance, Intriligator [1971], pp. 120-23; van den Doel [1979], pp. 47-50.

for £250, which all are quite willing to spend for that purpose. And if all legislators can be satisfied that none of their fellow legislators (or future competitors) will yield to those pressures and arguments, then they may go ahead and legislate institutions that enable polluters to quit or cut pollution. But while the institutions to be legislated can be readily designed, no political arrangement is known as yet that would free legislators themselves from the prisoners' dilemma.

Therefore, whatever instruments of environmental policy one may consider, one must bear in mind that governments cannot simply apply the instruments that economists tell them to apply, and that they will not utilize them quite the way economists prescribed them. There will always exist a political bias in the utilization of economic policies designed for protecting the environment; and the resulting constraints will work out a little different from what one would expect without considering the politicians' dilemma.

In this paper the key instruments⁴ - government regulations, subsidies, pollution taxes, and transferable discharge permits (TDP's) - will be treated as designs to be handled by politicians, and the results compared. Special attention will be given to the group mentioned last, as TDP's look most promising in the long run; certain modifications of the concept will be in order in view of the political bias to be anticipated.

3. Government Regulation

Returning to the prisoners' dilemma that keeps the population from meeting their own demand for a cleaner (and less noisy) environment, it is perfectly clear that direct government control, or government regulation, is a way out of the rationality trap outlined above. If all motorists know that their fellow motorists will install that noise-abating device, as the government instructs them to do so, then they will happily comply as they get their money's worth in terms of quietness. Government regulation, as long as

⁴The literature on this field abounds. See Baumol and Oates [1975, 1979], Siebert and Antal [1979] for systematical treatments and references.

properly enforced, provides the reliability needed if common action must occur and if individual agents must be satisfied that they will not be left alone: due to the nature of the prisoners' dilemma, elements of coercion are necessary to meet the common demand for environmental quality.

While this certainly speaks in favor of direct controls, and while no environmental policy can do without them, the great trouble with this instrument is that it ignores the economic dimension of the problem. As the environment's capacity to absorb wastes is strictly limited, any right to pollute is a scarce and valuable asset that should be carefully allocated to such uses where its contribution towards social welfare is maximal. Governments -- acting through bureaucracies -- just aren't capable to achieve that; and they don't even care to try. What happens in this field is that the traditional way of allocating rights among diverse applicants is at variance with the requirements of efficient allocation.

Consider, for instance, a densely populated and heavily industrialized region. By all possible standards, overall discharge of waste materials must not exceed present levels within such region. Government regulation, then, invariably tends to freeze the quota that individual polluters presently hold; those who discharge a lot may continue to do so, on the grounds that they must be granted the possibility to continue their present operations. If the overall level of pollution is to be reduced in the region, then all polluters are told to reduce their levels by some given percentage. This appears a just solution to bureaucrats and polluters alike.

But, of course, it isn't. Suppose some of the companies in the region are quite successful and want to scale up operations. They then find that additional rights to pollute are unavailable, and that their investment plans must be abandoned. Or think of some companies seeking to settle in the region. They must soon recognize the impossibility of so doing, as no permission to pollute will be granted. When this goes on some time (as it does in the West German Ruhrgebiet), then it is the dynamic industries who leave for lack of discharge permits, while newcomers cannot settle; what is left, are "aging" industries that won't expand anyway. An economic decline of the whole region is the result.

What the bureaucrats thus do is to give away free of charge valuable pollution rights as long as they last, shrugging away applicants thereafter. This is comparable to rent-control in areas where apartments are in short supply; we soon find old ladies living alone in huge flats while, unfortunately, young couples with kids cannot find anything adequate.

So far what we have seen is that government regulations are economically inefficient: as a means to achieve a clean environment they are quite expensive. In a way they resemble emergency breaks: they work fast, but should not be used for routine operations in cases where better devices are available.

Things are much worse, however. When placed within a dynamic world, government regulations turn also out to be ecologically inefficient: they won't warrant ecological standards, but will rather work to the effect that such standards are violated through economic activities.

4. Macro vs. Micro Standards

To see this, a distinction must be made as between regional macro and micro standards. A macro standard would require that the total discharge of wastes within a given region must not be in excess of certain limits, x tons of sulphur dioxide per day, say⁵. It is clearly macro standards that are relevant to the ecology. - A micro standard, on the other hand, is addressed towards individual polluters. It would require some company, for instance, not to discharge more than y ounces of SO₂ (say) per ton of output, or it would prescribe a certain technical equipment; it could also decree that gasoline must not contain more than a certain amount of lead per gallon. It is micro standards that government regulations must work with; but it is macro standards that they must aim at.

Now suppose that a certain set of micro standards was somehow so ingeniously imposed that as a result, the regional macro standard was indeed observed -- because all regulated individual discharges did add up to target values. Even then, the macro standard will soon be violated, unless micro standards are continuously adjusted to changing outputs, technologies, and consumption

⁵Strictly speaking, also pollutants from elsewhere must be counted when transported into the region, by wind, say. This is ignored here for convenience, as the exposition gets a bit complicated otherwise. See, e.g., Tietenberg [1980]

patterns. If a certain lead content of gasoline was alright last year, it won't be today anymore, as today there is more (or less) traffic, and hence more (or less) gasoline consumed. In a dynamic world, micro standards must be kept variable if fixed macro standards are to be maintained. Thus what is required -- if one is to use micro standards for protecting the environment -- is that those micro standards are reconsidered on a monthly basis (say), and shifted whenever necessary, in order to keep them consistent with regional macro target values.

While to do so would be tedious if technically possible, it is absolutely out of reach for political reasons. As every standard imposes heavy cost on polluters, the political process required to issue -- and alter -- standards is quite complicated and time-consuming. It takes years until just one round is completed and one set of micro standards agreed upon. Such set is then politically well-balanced and based upon a lot of compromising and horse-trading. Once arrived at, it just cannot be abandoned the next month, leave alone the time it would take to renegotiate a new set of micro standards. Thus, micro standards cannot but lag far behind actual requirements; and hence they cannot but violate macro standards.

5. Indirect Controls and Shadow Pricing

Rather than prescribing individual polluters in detail how to proceed, one may use economic incentives to tell the message⁶. The idea then is to make it profitable to meet standards; this leaves individual polluters free to use their own judgements (which are generally superior to those of outside bureaucrats), while still giving the general direction through price signals. The problem, of course, is to determine just which price signals should be used to secure observance of macro standards.

⁶See, for instance, Anderson et al. [1977].

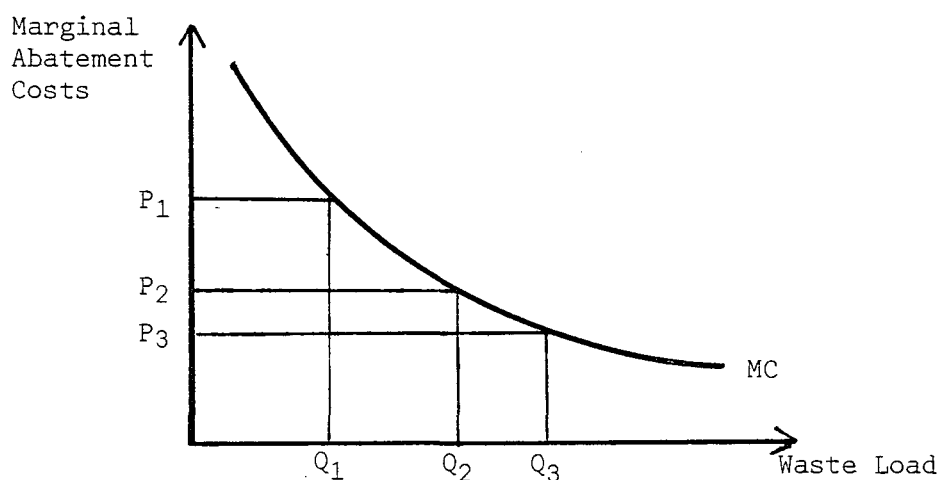


Fig. 1: Marginal Costs of Macro Standards

To see what is required to get the job done, consider Fig. 1. Plotted against the horizontal axis is the total amount of waste discharged within a given region per day (SO_2 say). To the right, the waste load gets heavier; to the left, the environmental quality improves. Q_2 , then, indicates a macro-standard, i.e., some prescribed quality index that is to be met. - Marginal abatement costs are plotted along the vertical axis. If the quality Q_2 is to be marginally improved, some more discharge must be withheld, which requires an investment. As there are many polluters and production processes involved, there are many locations where that could be placed; and if we choose the very cheapest among all possible, marginal abatement costs will be P_2 . Tighter standards require more abatement, and since the low-cost opportunities are then exhausted, more expensive devices must be installed. Marginal costs will, therefore, be up to P_1 if Q_1 is the new standard. On the other hand, if the standard is loose at Q_3 , marginal abatement costs will be down to P_3 .

P_2 is called the shadow price of a macro standard Q_2 ; shadow prices reflect the marginal cost that the community must bear in view of a given scarcity of some resource (or commodity)⁷. A macro standard of Q_2 in Fig. 1 means that

⁷See, e.g., Margolis [1969], Bonus [1972].

polluters in the region are legally entitled to discharge an overall load of Q_2 , which amounts to a (legally defined) capacity of the local environment to take that much. Given the total of Q_2 , any discharge permit granted to individual polluters is indeed a valuable resource that saves the holder an abatement device as he would otherwise have needed. Such scarce resource commands a shadow price, but not necessarily a market price if there is no market on which discharge permits can be traded.

Interestingly, if shadow prices are actually charged to those using the scarce resource, then this will have the effect that all individual users will restrict their demands to precisely what is available in total⁸. Thus, if P_2 is charged per unit of pollutant emitted, then the quantity Q_2 will result in Fig. 1; and this will be brought about at least-cost. Why? Because with charges at P_2 , those emissions will continue that would cost more than P_2 to abate, while those with abatement costs of less than P_2 per unit, will be withheld.

If economic incentives are to be used as a means to maintain macro standards within the region, then it is shadow prices that must be charged, which also means that social costs of emission control are minimized. While this sounds easy, it isn't quite so as shadow prices are unknown.

A further complication emerges as we face a dynamic world. Suppose production levels go up; then the curve of marginal abatement costs (MC in Fig. 1) shifts to the right, as it now costs more to meet the old standard. Consider Fig. 2. Given the shift from MC to MC*, the shadow price corresponding to Q_1 is up to P_1^* . If the charge is left at P_1 , on the other hand, then the target value Q_1 is no longer met as the total waste load moves up to Q_1^* .

⁸See, e.g., Samuelson [1947], p. 231; Lancaster [1968], p. 69.

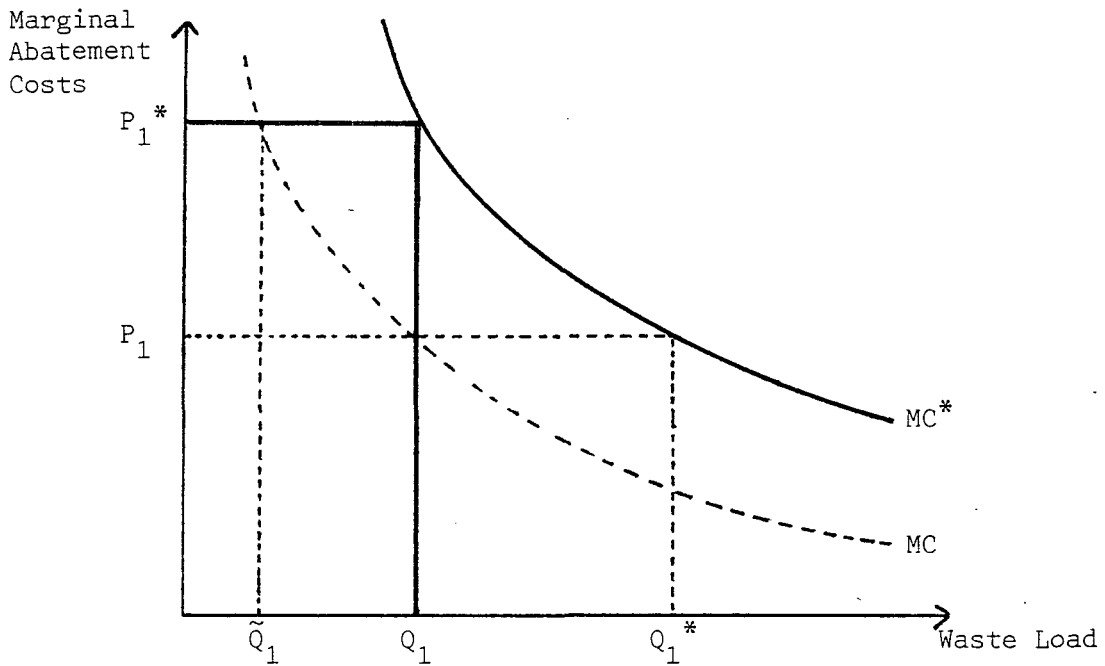


Fig. 2: Shift in Shadow Price or Waste Load

The situation underlying Fig. 2 could be quite different, though. MC^* may show the original values; technical progress may then shift the MC^* curve to the left. In that case, the shadow price corresponding to Q_1 moves down from P_1^* to P_1 ; and if the charge remains at P_1^* , then this results in a much tighter quality index \tilde{Q}_1 than the original value Q_1 .

6. Subsidies, Taxes, and the Political Market

Given that shadow prices are needed to achieve macro immission targets via indirect controls, the tax-subsidy scheme may be viewed as an approximation: lacking information about actual shadow prices, a flat rate is imposed instead, and it is hoped that such rate is somewhere close enough to the "true" value to yield macro loads not too far away from target loads.

In a way it is irrelevant whether taxes or subsidies are chosen. If a tax is used whose rate equals the shadow price, then the macro standard will be

met as a result. A subsidy for not polluting, on the other hand, creates opportunity costs, as emitters now forego subsidies and must weigh that loss against abatement costs.

But, of course, to the individual firm it makes a hell of a difference whether pollution is taxed or nonpollution subsidized; and it may therefore be politically feasible to legislate a subsidy scheme in cases where tax schemes would face unsurmountable difficulties. As any environmental policy boils down to imposing additional costs where environmental resources used to be taken free of costs before, many hardships are generated until firms have adjusted their capital equipments and locations to the new set of prices; and quite often it may therefore be deemed legitimate to alleviate such difficulties by means of subsidies. Even so, some second thought is always appropriate before actually using this instrument. The reasons are both of economic and of political nature.

Economically, the trouble with subsidies is that incentives are set false in the long run. If you are compensated for incurring abatement costs, why should you search for new technologies to bring down those costs? Quite to the contrary: chances are that you will deliberately design polluting equipments, just to become eligible for even more subsidies.

Politically, subsidies resemble drugs in that they are nice in the short run, detrimental in the long run, and that one invariably gets addicted. Any groups lucky enough to receive some will never concede that their cause has submerged and that payments should be terminated. Rather they will feel entitled to receive payments forever, just because they did so before; and to get off the scheme, a political deal must be made by which the privileged receive other privileges. Thus the instrument is politically irreversible and should be handled with extreme caution.

That leaves us with taxes. They differ from government regulations through their economic efficiency but share with them the ecologic inefficiency, as it results from their rigidity due to properties of the political process. Why? Because the "true" tax rates (i.e., shadow prices) keep shifting around as do all prices; the unknown "true" rates that one could search for in

theory by means of iterative procedures⁹ are thus moving targets themselves; and therefore one would have to adjust tax rates rather frequently. That in turn would have to be accomplished through the political machinery which needs years -- if not decades -- for each adjustment, while considerations would have to be made on a day-to-day basis.

It is frequently overlooked that taxes, viewed as prices, emerge from political markets. While it is customary to study the properties of monopolistic or oligopolistic markets before predicting price responses on them, the political market tends to be taken as "perfect" in the sense that all price changes required in given situations will indeed occur. But political markets are quite restricted and slow. They are certainly better equipped for medium-range decisions (covering one electoral cycle or so) than for such daily business as the determination of shadow prices. Quite clearly, "economic markets" are a better suited institution to handle the latter; and it is therefore in order to search for economic markets properly designed for the task. If indirect controls are exerted via political instead of economic markets, then macro immission targets will be missed. Pollution will be much heavier than adequate, because political prices tend to be much too low; and the system will be unfit to adapt to new requirements because political prices are far too rigid.

7. Transferable Discharge Permits (TDP's)

The approach underlying Transferable Discharge Permits is straightforward. Starting point is a given regional macro standard; this is split up into a set of individual discharge permits such that the sum corresponds to the macro target. The bearer of one permit is entitled to emit a certain quantity of one pollutant within a given period. This guarantees ecologic efficiency¹⁰,

⁹ Baumol and Oates [1971].

¹⁰ The concept is to be modified if diffusion of pollutants beyond the region occurs, or critical concentrations within the region must be avoided. See FN 5, and Tietenberg [1980].

given that the target is properly set¹⁰. -- The point is that individual permits may be transferred among those interested; and that means they will command a price which turns out to be the shadow price, or something close to it, depending on the type of competition. Thus the political business -- to determine target values -- is left to the political process, while the economic business -- determination of shadow prices -- to ordinary markets. Note, however, that ecologic efficiency itself does not depend on perfect markets within this scheme, as the number of permits and hence the overall load is not determined on the market, but through politicians. As the number of permits is fixed, one need not worry about adjusting charges to their new shadow values every other month; this is done by supply and demand on the market¹¹.

So far, TDP's just appear to be an ideal instrument, combining as they do ecologic and economic efficiency¹². Before turning to the flaws, however, let us briefly inspect the relative merits of all instruments and see how this translates into political practice: are the best instruments also the ones most preferred in politics?

¹⁰The target is set through the political process, which may result in a downward political bias. Still, target values are medium-term parameters, as they should be up for revision after a couple of years; and the political process is better suited to determine targets, than it is to determine shadow prices.

¹¹The scheme itself was originally designed by Dales [1968a, 1968b] and has rapidly developed into a standard textbook case; adoption through governments is another matter, of course.

¹²Siebert [1979, p. 119] derives a Pareto optimal standard from benefit-cost considerations and concludes that standards set through political decisions may yield "suboptimal" pollution levels, as such standards may only by chance coincide with Pareto optimal levels of environmental quality. Yet this holds only so long as environmental quality is treated as a public good, of which a Pareto optimal level should be supplied (see also Siebert [1981, this volume]). It is more realistic, however, to think of the environment as a system whose assimilative capacity is strictly limited; then there exists a tolerable load independently of what consumers prefer, and this must be treated as a constraint to be imposed in a similar way as technological constraints are. The level of environmental quality to be approached is then determined, not by means of supply and demand considerations, but through properties of the ecologic system. It is quite another matter, of course, whether or not political standards will coincide with the values compatible with the ecologic system!

Obviously not. A rough rank-ordering based on ecologic and economic efficiency considerations would turn out TDP's first, taxes second, and government regulations competing with subsidies for a poor third grade; while in politics government regulation is a clear winner, followed by subsidies, taxes trailing far behind and TDP's plainly being off-limits. How come?

The political experience suggests that markets are not well-understood by electors, and that somewhere in the collective subconscious mind, associations lurk around that money is dirty and hence unfit to clean up the environment.

8. Market Imperfections: The Alternatives

One of the most used arguments against TDP's is that they won't work vis-a-vis market imperfections, or that they may be misused to aggravate existing imperfections, by crowding-out competitors (say).

In a way, this argument is trivial: whenever new markets are created, they may also be misused.

But to judge whether or not this should be held against markets as determinators of effluent charges, the alternatives must be viewed as critically as markets are; and in the end, the results must be weighed against each other. Let us, therefore, inspect a little closer the market imperfections that result from all instruments under review here, i.e. government regulations, tax-subsidy schemes, and transferable discharge permits.

a. Government Regulation

What must be seen is that government regulations don't fall from heaven like manna, but result from lengthy bargaining, parties to which are the administration on one hand, and industries on the other. There is a strong bias involved when it comes to selecting among firms to be consulted in the process. Big firms command much expertise that the administration cannot bypass if

emerging regulations are to be sound; and of course, they also have the power to pull strings that small business cannot reach.

The bias continues when regulations are implemented. In the Federal Republic, a Vollzugsdefizit is to be observed: once a rule is put forth, it doesn't necessarily follow that it is rigidly executed. A wide discretionary margin is at the administration's disposal, and it is heavily used in favor of large firms. Why? Because the local tax base appears at stake when large firms threaten to close down, or to move elsewhere. Ironically, the silent disease of many small businesses may hurt the community much more after all; but in each single case the impact is negligible, and hence the local officials do not see why they should not strictly follow the rule.

Another factor discriminating against small business is the internal cost of carrying out regulations. A lot of paperwork must be done, and an ever-growing set of rulings be registered. It has been estimated for West Germany¹⁴ that this costs .7 percent of total turnover to firms with 100 employees or more, but 3.5 percent to firms with less than 10 employees¹⁵.

Quite obviously government regulation is not at all a neutral instrument with regard to competition. It favors concentration and discriminates against small business to such a degree that this is in itself one of the most powerful arguments why governments should discontinue their present way of relying entirely on this one instrument.

b. Taxes and Subsidies

In our context it is difficult to distinguish taxes and subsidies from government regulation, as exemptions from regulation are subsidies, and insistence upon regulation taxes, when it comes to the burden that a firm is subjected to. Therefore, much of what has been said in the previous section carries over to taxes and subsidies. Whenever subsidies are considered, large firms will be the first to get hold of them; and where a tax scheme is

¹⁴Industrie- und Handelskammer Koblenz [1977, p. 5].

¹⁵See Bonus [1980] for more details and some court ruling to the same effect.

designed, big business will have expert co-designers on the spot. It is precisely the prospected failure of TDP's to grant large firms a word in all steps of the process that makes the business world so reluctant to try TDP's for a change.

One frequent argument that covers both taxes and TDP's should be treated here. Taxes as well as a need to purchase TDP's constitute additional costs, and therefore they should be abandoned from consideration, as additional costs hurt the national firms' competitive situation vis-a-vis foreign firms.

That line of thinking confuses the cost of environment protection with the sum to be paid-out in cash for emission charges of whatever type. Given a certain macro standard, total cost to the industry as a whole depends on the economic efficiency of the instrument adopted to implement the standard; and that puts government regulation squarely on the worst position among all instruments. They are the most expensive means one could dream of, and it is them who would hurt the business world most -- provided the standard is really met.

There, however, is the point. Given discretionary margins, the standard will not be met; or at least this is what may be in the minds of businessmen, who may themselves be caught in a prisoners' dilemma. Each may reasonably hope that he will be able to get exemptions, or meet a friendly official who will somehow view the firm's special situation with more comprehension than anonyne market forces will. But all together face, as a consequence, severe restrictions and heavy cost burdens as regulations get tighter and more rigid. - Taxes are favored over TDP's clearly for this reason: it is much easier to water down tax rates, as nobody is in a position to prove that this implies a lowered macro standard; but it is tough business to water down explicitly the macro standard itself, as one would have to in case of TDP's.

9. Market Imperfections: The Permits

If a firm cannot manage to purchase discharge permits on a TDP market, it must close down operations, as it will be generally impossible to go on without polluting at all. Withholding permits from a firm thus amounts to a strike: key factors of production are turned off. Arguments that such an enormous potential to destroy potential competitors could be used to do just that must be taken very seriously.

To avoid a popular error: the issue is not a presumed failure of TDP's to guarantee the macro standard. Even the monopsonist on a local TDP market -- who would simply take over all TDP's without paying a dime -- could not circumvent the standard; the permits would still tell him to submit to the standard. The issue is whether TDP's may be instrumental to firms on their pursuit of market power.

a. Output Markets

The argument is usually applied to competitors on output markets: a steel company may want to hurt another steel company by purchasing all available permits, or by driving their price high enough to force substantial losses upon the other steel company.

As a rule, however, competing companies are not situated entirely within one region, but will operate on different locations. Even if all their plants are indeed located close enough to share one regional TDP market, they won't be the only firms there; coal mining, breweries and the like will also bid for regional TDP's. If you want to hurt your competitor, you must hit all other firms in the region, and that will prove extremely costly. You will soon find that it is better to hit your competitor in a more efficient way, by hitting him alone and not everybody else who happens to be around; for instance, it will be much cheaper to force losses upon competing firms (and only them) by cutting output prices below cost.

Prospects are even bleaker with regard to long-run policies of crowding-out competitors via TDP's: competitors will simply move elsewhere, or scatter

their plant locations, thereby fully evading all pressure.

It is simply not a promising strategy for would-be monopolists on output markets to crowd competitors out of regional factor markets that are shared by other business branches as well; there are much better alternatives among the conventional strategies.

Special cases may exist though where the strategy might work; and TDP markets should be designed to cope with these. For instance, markets should not be too narrow, but broad enough to make crowding-out costly. In general, however, the possibility is not a very serious one and shall be abandoned in the following.

b. Input Markets: Durable Permits

As TDP's are immobile factors of production, it is perhaps more promising to establish some market power on factor markets by means of permits -- not to hurt competitors on output markets, but to draw profits from holding a key position on some local factor market. If somebody owns all local permits for sulphur dioxide, say, he may lease them to local firms and charge Cournot prices. That would make the location an expensive one; and the monopolist would find it difficult to keep up permit prices, as his customers would install abatement devices and return permits to the owner, or move elsewhere. There is a healthy lot of competition left; in other words, the monopoly one might be able to establish is rather short-lived. Given the high cost of crowding out all other bidders from a regional TDP market in the first place, few people will want to invest the substantial capital needed to establish such monopoly.

Another market imperfection might be created by bidders who collude to keep permit prices down. If they manage to agree upon the quotas each is to purchase, they can refrain from overbidding each other and thereby realize gains that would put them in a better position vis-a-vis their respective competitors in other regions. However, such advantages are short-lived again. Inefficiencies resulting from the quotas will drive regional abatement costs up beyond comparable levels in other regions, eating away and then reversing

relative gains: As the quotas must be bargained and will be rather inflexible over time, some firms will draw rents from the permits they hold, by polluting even where abatement costs are low; while others must abate even where they should not because abatement costs are high. Such cartel would lose all attractiveness for the latter firms, and fall apart.

A more serious case of market distortion might be hoarding: a firm may wish to purchase more permits than it normally would, just to make sure that it can scale up operations later. Such firm would then accept current losses, by holding permits for machinery that could be easily equipped with abatement devices, thereby forcing other firms to abate where costs are much higher.

While these imperfections do not seem earthshaking altogether, especially when compared to those presently in operation due to abounding government regulation, one might still feel a bit uneasy about the durable permit type which amounts to private ownership of the environment's assimilative capacity. One reason is that such capacity isn't really known as yet, and that legal macro standards are likely to be up for revision every now and then. As damages to the environment tend to be creeping below visibility for quite a time, and as they accumulate before emerging to sight, one must expect that macro standards will have to be tightened again and again; and it might therefore be preferable to issue temporary rather than durable permits, that is, to lease assimilative capacities instead of selling them. This has also the advantage that hoarding is no longer a realistic option.

c. Input Markets: Annual Permits

In this scheme, then, polluters must buy permits at regular intervals, annually say. If one competitor would like to crowd out others, he would have to hit hard and fast: the other bidders must be forced to close down before the year is over and the next auction starts, because he would otherwise have to repeat the costly exercise anew. Having succeeded, he would then sadly watch others moving into the region; his monopoly would have to be reestablished year after year. This does not seem an attractive strategy.

One should make sure though that no narrow submarkets exist for pollutants that are jointly produced with others, such that it would suffice to buy up, strategically, a few key permits in order to close down other firms.

An allocative mishap that might occur is pointed out by Pearce [1976, pp. 105-6]: when bidders are few on a local permit market, each feels that his marginal bid drives up the permit price; that is, his marginal outlay exceeds the permit price. As he will quit bidding when his marginal outlay equals marginal abatement costs, he will quit before the permit price is up to marginal abatement costs; and that means that too much money is spent on abatement, while the permit price falls short of the shadow price.

Pearce concludes that this distortion is a serious one and "will render the scheme inferior to the tax scheme discussed in previous sections" (p. 105). This is a very typical way of focusing upon "conventional market failure" while completely overlooking even the gravest failures of political markets: Pearce doesn't account for the possibility that politicians might fail to adjust tax rates properly and timely; and such failure must then be weighed against any failure of TDP markets. - Is the defect just depicted really that serious, anyway? Of course it is not: Given that permit prices are quite substantially below marginal abatement costs, new polluters will move into the region and drive the price up again. If the difference is not so substantial, on the other hand, then the distortion cannot be too serious after all.

There is a truly serious setback to the scheme, however. Hoarding doesn't pay anymore, as the permits expire annually; but speculative behaviour may now turn out rewarding. If you can get hold of the permits that some companies just need to keep going, then you can blackmail them nicely, and try to do the same every year. If that works, you will not be the only one to try: speculation might swamp local permit markets. Something must be done to rule out that possibility.

An obvious way to achieve more security for the single investor is to sell permits that last as long as the depreciation period of the machinery for

which they are acquired. A would-be investor would thus be able to make sure that he could not be expelled from the market once he decided to obtain a permit, and safely install the technology he had in mind. He may find later that new techniques become available which make it profitable to abate some of the pollution and sell off permits accordingly; there would be used-permit markets similar to used-car markets.

Speculators might still enter the picture, installing phony machinery with the sole purpose of getting as many long-term permits as possible, and selling them to firms really in need of permits later. There appears to be an uneasy choice between hoarding on one hand (durable permits), and speculating on the other (temporary permits). To get out of this, a modification of the institutional setup may be required, one that resembles the way monetary problems are attacked.

10. Open Market Operations and Environmental Banking

In case of money, the difficult task is to provide the necessary currency while at the same time keeping stable the price level. To achieve the former, the government must be able to change the supply of money; but to achieve the latter, the government must be barred from doing precisely that. Why? Because any government finds itself caught squarely within a prisoners' dilemma if it can modify the supply of money. There are so many useful purposes to which some extra currency could be devoted; and while each politician will readily confirm that the price level should be stabilized, no one will be able to resist the pressure of his own constituency with regard to one useful purpose. It is just not possible to identify any particular project as the cause of inflation; it is the sum of all projects what over-taxes the economy.

To make sure that the prisoners' dilemma can be avoided, it is necessary that politicians can rely on each other when it comes to turn down the financing of extra projects through the printing press; and this is what a central bank is needed for. By making the central bank independent and as-

signing it the explicit task to provide the due money and guard the price level, every single politician can tell his constituency that the central bank will not provide the extra money needed for some project, and that he is unfortunately not in a position to influence the bank's ruling. This doesn't always work as it should; but it certainly prevents a lot of overspending through politicians.

The situation on TDP markets is quite similar. To cope with both, hoarding and speculating, some regional authority should be able to perform open market operations with discharge permits. There must be a possibility to avoid undue hardships from speculative hoarding through other parties; and the very possibility of such intervention renders speculation against some firm unattractive. On the other hand, macro standards are to be kept. Local politicians would find it irresistible to violate standards, by selling-off permits beyond any standard on the open market, as they can hope to lure investors into a region where discharge permits are plentiful and cheap. When the necessity arises to reduce the number of permits because tighter standards are called for, then again local politicians would be unable to enforce the reduction, because it would hurt their local tax base.

Suppose regional Banks For the Environment were in charge of TDP supply. They would be responsible for keeping regional standards the same way as are central banks for guarding the price level. They would buy (used) permits as the waste load approaches a ceiling, and sell permits as the load falls short of what is permitted. At the same time, they would keep an eye on permit prices, intervening with some caution when they feel that prices rise (or fall) excessively. One might say that one task conflicts with the other; and that will indeed occur at times -- as it does happen in case of Central Banking within the money sector. But as Central Banks do have quite a few instruments at their disposal which they try to combine, that would have to be true for Environmental Banking, too. For instance, the Bank might tell regional polluters to use not more than 80 percent of their respective TDP's face values.

Undoubtedly that brings elements of government regulation, and of taxes, back into environmental politics. And indeed, it would be unwise to rely entirely

upon one or the other pure strategy alone; all instruments must be combined in real life. But that is precisely what the present policy fails to realize when refusing to consider anything else than direct controls.

11. Summary

Environmental politics rely on Direct Controls rather heavily; it is shown that this instrument is not only economically inefficient, but fails also to meet ecologic standards within a dynamic setup. Pollution Taxes turn out to share ecologic inefficiency with Direct Controls; in both cases the reason is a basic rigidity which results from properties of the political process. Transferable Discharge Permits are ecologically efficient but to some degree open to hoarding and speculation. It is proposed that Environmental Banks be in charge of issuing regional permits, and performing open market operations.

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