WELFARE ECONOMICS AND ENVIRONMENTAL QUALITY

by

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COMMENTS on ALLEN V. KNEESE

"WHAT ARE WE LEARNING FROM ECONOMIC STUDIES OF ENVIRONMENTAL QUALITY?"

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I. Introduction

I share with Roland McKean the sense of being overwhelmed by the size of this audience, and even more so by the distinction of its members. In fact, when I contemplate the collective value of your time which I am about to consume, and contrast it with the honorarium for my services, I detect some basic economic imbalance which may violate Ralph Turvey's principles and call for remedy. However, the hen has been paid, the egg must be laid. So Ridi, Pagliaccio: the show must go on!

The other day I heard a man remark, "The trouble with women is that they take everything personally." To which his wife replied, "I do not!"

I hope I am not being like that woman, but the first thing that struck me about Dr. Kneese's paper was that he quoted me. I am honored to be anointed an expert on welfare economics. I do at least cherish some strong opinions on the subject. Candor compels me to confess, however, that much of the extensive literature on welfare economics and I remain alien. Some of the most indecisive soliloquies in literature have come under that heading. For them I have no heart.

I understand about marginal cost pricing, spillovers, the perils of suboptimizing, and all that. But when the Hamlet School warms to the subject of why we can never decide anything because we can't be sure of everything, and why everything is wrong unless everything else is right, I am quickly sated. I would classify much of that with medieval theology. It only unmans us, and is mainly fun and games for those who would like to see "academic" remain synonymous with "irrelevant."

So I am glad to see Dr. Kneese's concept of the proper coverage of welfare economics coincides with mine. I take it to mean we share the conviction that economics should help with decision, and in that spirit I accept his compliment in good grace.

II. Reprise

The last time I delivered a paper the nature of my discussants' comments was such that I was forced to tell the story of an old Ozark farmer who burst into his cabin one day, all excited, and exclaimed, "Maw, I learned how to write!"

"Land sakes, Paw," said Maw, "what'd ye write?"

"I don't rightly know," said Paw. "I ha'nt learned to read yet."

Not wishing to be guilty of the same oversight, let me begin by paraphrasing Dr. Kneese's paper to prove that I really have read it.

A. Conceptual Studies

Under this heading Dr. Kneese tells us that we should balance the benefits of pollution control against the costs, and that an optimal balance may be found where the marginal benefits of control become equal to the marginal costs.

In benefits and costs he explicitly includes direct effects on human beings, and rejects a narrow concept of economics which would limit its scope to benefits and costs which are measurable through property or explicit transactions (although this does not prevent his later using property values as one indirect indicator of welfare).

He also moves beyond what might be called myopic marginal analysis, with its danger of suboptimization--the danger of choosing the top of a molehill in preference to the shoulder of a mountain--and declares that sometimes we should pass over small-scale measures in favor of large-scale pollution abatement measures like aeration of entire rivers.

B. Empirical Studies

1. He cites empirical studies which disclose that increasing the degree of pollution control meets rising marginal costs and falling marginal benefits. He might have added that most economists would have confidently forecast such findings a priori; but it is comforting to be reassured, and to have specific functional relationships quantified.

2. The cost of treating plant effluents varies from plant to plant, especially in the short run. Again, that comes as no surprise. But Dr. Kneese is right to signalize it because even economists often forget to distinguish marginal from supra-marginal operations, and speak carelessly of the "average industry cost" of doing something-or-other, as though it had any relevancy. (It hardly ever does.)

3. Control and treatment of effluents at the outlets are often costlier than control and treatment either of raw materials before processing, or of water (but not air) after pollution.

4. Two methods of measuring the net social benefits of clean water are:

a. Putting a monetary value on person-days of recreational use, and

b. Measuring the effect of water or air quality on land values.

Method b requires some statistical ingenuity. But so do many other things, such as relating lung cancer to smoking, auto accidents to high speed, poor carburetion to age of automobile, telephone rates to use, insurance rates to risks, etc. The reasoning is based on the concept of land rent as a measure of the net social value of a resource, a concept which he repeats when discussing the social value of mines.

5. Disease is very costly. His data suggest it may be the greatest cost of pollution, but his method of measurement, as expounded, is a little unclear.

6. We do not know the marginal contribution of pollution to death and disease. That is one of the most important things we need to learn. Dr. Kneese gently intimates that M.D.'s could contribute more to guiding public policy on these matters if they would use some of the economists' marginal concepts in framing their research. I would like to shout, where he has whispered, that much medical research and thinking is monumentally irrelevant to public policy decisions because of the profession's inability to submit its findings to the common discipline and comparison that is implicit in marginal analysis. They may have too good a thing going in the traditional deference to the authoritarian M. D., and the wide public susceptibility to thought-choking clichés about the infinite value of a human life. Yet if they did mount a greater effort to communicate in a common tongue it might very well be, as Dr. Kneese suggests, that the relative importance of their discipline would rise.

7. Air pollution does more damage than water pollution. Coming from one who has made a great reputation studying water pollution, that finding testifies as well to Dr. Kneese's objectivity as to the importance of air pollution.

C. Control Systems

By this rubric Dr. Kneese purports region-wide engineering systems, and not systems of social or institutional control as the words might suggest to some readers. His examples are, not unexpectedly, the Ruhrgenossenschaften which he has so effectively expounded to American readers. This picks up and repeats his earlier point that such region-wide control systems may often be cheaper than and superior to treatment and control at effluent outfalls.

D. Institutional Studies

Here he suggests that we need to develop better control institutions. But he leaves an impression that the suggestion is concessive, that engineering or economic studies really should come first, with institutions accommodating themselves to machines in Technocratic fashion.

III. Applause

I find much to applaud in Dr. Kneese's performance, and just as that man whose wife took things personally should have specified in some detail what he found admirable in her, I would like to tell you and Dr. Kneese what I liked about his paper, and in the process reinforce or illustrate a few points.

I applaud his measured, tempered tone.

> "It is easy to fly into passion...but to be angry with the right person and to the right extent and at the right time and with the right object and in the right way--that is not easy and it is not everyone who can do it. This is equally true of giving or spending money. Hence we infer that to do these things properly is rare, laudable and fine." Aristotle, Ethics.

I admire his dogged persistence in carrying the gospel of marginal analysis into the alien territory of pollution evaluation and abatement. He is not willing, like some of our economics textbooks, to limit economic analysis to the market place and the marginal rate of substitution between apples and oranges. He seeks to meld theory and practice in a new area, to the mutual gain of practice and theory.

He applies the economists' incremental approach, based on the postulate--which he establishes--of continuous variation in nature, Marshall's "Natura Non Facit Saltum." There are degrees of pollution; the decision is rarely either-or, but how much.

He points out that the economists' criterion of how much, that is the optimal balance point where marginal costs equal marginal benefits, applies to pollution control as much as it does to producing apples and oranges (not that the Fruit Growers' Exchange will let us apply it to producing oranges, much as we might like to).

A corollary of marginal analysis is that land rents (and land values capitalized therefrom) are useful measurements of the net social benefits of pollution control outlays which are confined within a defined area. One recurrent voice in the Hamlet School of Indecision is the Omelet School of Inscrutability, the School of those who tell us they cannot unscramble production and impute specific credits to specific outlays, and since they cannot they will not let anyone else do it either. Dr. Kneese answers the Omelet School that increments to land rent represent the benefits of pollution control in an area, net of the associated costs of taking advantage of the benefits.

Another implication of marginal analysis which Dr. Kneese carries through is that price, in the form of an effluent charge, may serve to constrain pollution, and the constraint have properties in many ways superior to direct controls. Price lets us impose an incremental control, a penalty which is graduated to the severity of the offense and which compensates society for damage to the extent that damage is done.

Along with this missionary zeal, Dr. Kneese manifests admirable coverage and balance in his approach to control measures. He is a conspicuous advocate of the effluent charge and, as might alas be expected, the lower opposition whispers of his monomania for his "panacea." But he tells us to survey the entire range of control measures. One benefit of the effluent charge approach to pollution

control is that it leaves the choice of control technique to the individual, thus allowing him a wide choice of means to achieve the desired end. Dr. Kneese sees that, in a larger view, the effluent charge approach itself is one of several social techniques to achieve the basic end of pollution control, and he advises us to select the best of the group of control techniques.

He points out that control at the point of effluent discharge may be more costly than control before or after. Another option which he suggests we consider is stream specialization in sewage disposal; that is, letting one stream carry most of the sewage of a city or region so that other streams may be nearly pure. And, I imagine, he would also approve of neighborhood specialization in noisy and smoky industries, and perhaps of regional specialization in crops requiring large use of pesticides, and so on. It would be a travesty of Kneese to say he recommends specialization in all circumstances. If he fails to specify the circumstances it is probably because the marginal rules are straightforward and obvious to his colleagues. Still, it would be useful for him to specify them. It might turn out they have a high locational content--that the lower reaches of streams should specialize in sewage, and the upper in scenery.

I further applaud Dr. Kneese's consistent admixture of fact with theory. He insists on keeping his and our feet on the ground.

He does not impose on our time solving trifling problems for the delectation of those to whom riddles have become a game. De minimis non curat Kneese. He is interested in problems which are quantitatively burdensome.

Many economists seem to enjoy economizing on everything except the time of economists and their students. To them, an interesting problem is an amusement, an end in itself. Dr. Kneese's factually grounded approach guides us to where the marginal value productivity of economists' efforts can be a maximum. He appeals to us therefore not as dilettantes, but as concerned citizens with more real problems to solve than we have the capacity to handle, and who appreciate some index to the relative importance of problems.

The data which he gives us on pesticides, while fragmentary, shed more light and hope on this gloomy problem than is to be detected in all the jeremiads, or the stuffy defenses thereto (I'm not sure which are worse.). But suddenly Dr. Kneese appears ex machina with the good old principle of diminishing returns. We don't have to stop using pesticides; we only need to use less. We don't have to let the bugs win; we can use more alternative methods of control.

His data on the cost of treating municipal drinking water again strike an important note of realism in a field often marked by panic and irrationality. San Francisco years ago insisted on importing water over 178 miles from the Sierras, in preference to the lower Sacremento, allegedly because of quality preference. Yet that same

city not long ago had to be warned by the U. S. Public Health Service that its municipal water was contaminated by leaks in the local distribution system! Millions to grab remote waters, but little concern over quality maintenance at home: can it be that municipal complaints about polluted waters are often a subterfuge for hydro-imperialism? That the imperialists are deluding themselves more than others makes it no less imperialistic--isn't that always the way?

I applaud Dr. Kneese's emphasis on measurement. It shows that he means business. Abstract theorists who fear they might prejudice their scientific purity by empiricism forget, I think, the old aphorism that "Science is measurement." In economics, measurement entails getting out in the brawl, but that need not be less scientific. Gentleman Jim Corbett, after all, made a science of brawling. Modern economists should do no less.

IV. Supplement

This is no criticism, but Dr. Kneese in the space at his disposal could not point to all the gaps that research needs to fill, and I would like to suggest some others.

A. External Pecuniary Economies

Sixteen years ago the question of secondary benefits, or external pecuniary economies, was the least-developed topic in

benefit-cost analysis. It remains so today, It falls to economists to work on this question which involves economic reasoning primarily. The American mind is an engineering mind, and easily grasps the reality of technological spillovers like air and water pollution. It requires some conceptual analysis to see the reality of pecuniary spillovers, and to many Americans what is merely conceptual is imaginary.

Yet if Boeing wins a contract from Lockheed all kinds of secondary benefits move to Seattle along with it, as we and Seattle well know. The matter is closely related to pollution. Communities that accept and even invite polluting industries do so because these also generate secondary benefits. The communities take the pollution in order to get the payroll and the tax base.

Clean physical environment is quite clearly a superior good, that is, one which we do not demand much of until our incomes rise and our bellies are full. As Thor Hultgren puts it, "Cleanliness is next to affluence." This is manifest in the way high-income suburbs zone out industry while blue-collar suburbs and remote towns compete with each other to attract more. Perhaps we could work out better ways of compensating industries for generating secondary benefits. But we need to recognize that sometimes low-income communities, especially if sparsely populated, would rather pay in degraded environment than in money.

Mind you, I am not saying this is the best of all possible worlds; but it is the world, and we need to understand it in order to deal with it.

B. Taxation and the Price System

Policy-makers need more analysis of how tax policy affects the price system if they are to use the price system to control pollution, or anything else. Supposing local or state governments impose effluent charges to constrain polluting emissions. These would surely be deductible from taxable income. The force of the constraint would vary with the income tax position of each company and individual.

Again, if outlays to control pollution are deductible, and if they add nothing to taxable income,[1] then they are already being subsidized. This subsidy, too, varies with the tax position of the firm or individual.

Progressive rates and capricious loopholes in the income tax have distorted the price system as an index of alternatives. To the extent of the distortion, direct controls have some advantage over price-like controls--they may get more directly down to realities. Personally I would prefer to see us perfect the price system as a true

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1. Most costs are incurred to gain increased income. Deductibility reduces the impact of the cost by the tax rate, but it reduces the gain the same, which limits its effect to the nondeductible costs (like the use of fully-owned capital, or family labor.) But deductible costs which add nothing to taxable income receive the benefit of deductibility without the cost of higher taxable income.

index of alternatives. But if my fellow citizens will not permit that, I must not advise them that it can be used as though it were in good working order.

Economists must also remember Cameralism, and include public with private revenues in measuring the effects of public improvements on the general welfare. When we use land-value increments as measures of environmental enhancement we are measuring only part, usually less than half, of the social value of the betterment: because real estate is subject to taxation, and what we call "land value" is capitalized from that portion of income which is privately collected. It does not include the present value of the portion which is publicly collected. In an urban renewal project, for instance, we find the rational city is more concerned with selling to someone who will pay heavy taxes in the future than it is in selling to someone who will bid the most for the title to the land: the present value of future taxes is usually actually greater than the present value of future net ground rent as measured by land value. So if we let land-value increments be the measure of the benefits of pollution control, we understate those benefits by a wide margin. Indeed, ethically, there are those who would regard the private unearned increment as shameful and divisive and count only the public portion as a social benefit, and possibly even count the unearned increment negatively because of its anti-social implications.

6. Distribution

The question of distributive equity needs to be an integral part of the economics of pollution abatement. Dr. Kneese's neglect of this question may not be entirely an oversight, but jibes with his underemphasis on institutions. Institutions exist not only to get things done, but to distribute the benefits and levy the costs without which nothing gets done. The following are some of the distributive questions that economists need to answer:

1. Supposing we choose to use large-scale works like Dr. Kneese's air-injection scheme, which earn no direct revenue from users. Who then is the beneficiary, and who should pay?

2. If we levy an effluent charge, and so earn a surplus, how would we distribute it?

3. If we choose the option of stream specialization and let one stream become a sewer so that others may be pleasant, how shall we then compensate the sewer riparians and other losers from the gains of the clean riparians and other beneficiaries? That problem society has hardly ever solved. That is why we make inadequate use of the principle of stream and area and neighborhood specialization, and instead impose a great gray homogenized mediocrity on all. It is no trick to see the aggregate net benefits of resource specialization; the unresolved problem is the distributive one.

4. Distributive equity also relates to efficiency. We can hardly achieve efficient resource use without some care in distribution of the income from use. Some economists, from John Stuart Mill

to the present, have sought to compartmentalize distribution off from production and allocation economics. But the market mechanism requires a close correspondence between giving and getting. Income is the motive to produce. If favored landowners get something for nothing, for example from water quality betterment financed by outside money, other people (and the same people in different capacities) are probably getting nothing for something. That demotivates both--the one because he gets without working and the other because he works without getting. The successful operation of the price system presupposes that it key income (after taxes!) to output. So we economists need attend to the distribution of income in order to enhance the efficiency with which the market allocates resources.

Beyond that, it is questionable if the income of drones should be counted as part of a social welfare function. It is a sterile materialism that counts our blessings only in what we get and disregards what we do for it--why else is larceny anti-social, unemployment demoralizing, and aid without trade resented? All public spending needs to be adjusted to such distributive considerations.

5. The distribution of benefits of pollution control also affects the political and ethical rationale for control. Water pollution control, for example, benefits downstream riparian landowners primarily. The ownership of downstream riparian lands is often, even usually, concentrated in a few strong hands. In this circumstance, effluent control may benefit the affluent at the expense of the many,

whose numbers give them influence. That is politically unattractive and helps account for the unchecked advance of pollution on many waters.

Similarly, on many lakes a few hold the shoreline closely. A numerous public has access from one or two points to the water surface, so most water users have no pied-à-terre. This inhibits the development of responsible mores among most water users, who remain strangers and sojourners in an alien place. If we look forward to a future in which private responsibility will obviate most policing, we need wide distribution of property to create a feeling of common responsibility.

Concentration of ownership not only means that the distribution of benefits is narrow, it may also lessen the aggregate value. For example, that is the case where concentration of riparian land is due to large tract zoning, or other legal barriers to subdivision, which frustrate the market's demand for smaller lots. Concentration of riparian lands may also be traced to tax-motivated preference for capital gains over ordinary income, which tends to keep land from what otherwise would be the highest bidder. There is a tax-motivated preference for implicit income over explicit income which works in the same direction. Lands that pass through an estate at death acquire as a new basis the appraised value at death, whereby all previous increments escape income taxes entirely, creating a strong locked-in effect. Sometimes inadequate subdivision of riparian lands

is due to imperfections in the credit market which prevent the highest and best users from bidding high enough to get land from an ancient possessor with a low internal rate of time-preference. In all those cases concentrated ownership means that riparian land is not in its highest and best use, and therefore that the benefits of pollution control are a good deal less than they might be if the land were more widely and economically distributed.

6. Finally, there is a distributive question which we may call the Coase Problem in recognition of Professor R. Coase, who has given it his attention. Should we regard polluters always as the guilty parties and receptors as injured? Or would it be equally just to say, in the event that pollution is not allowed, that those who enjoy clean air and water are imposing on those who would like to use air and water for waste disposal? If so, what is the status quo from which we start? Who should pay whom for doing or not doing what?

I do not have the solutions on the tip of my tongue, but I am happy to say that my colleague, Thomas Crocker, is working on this very question and will soon have some interesting results. But let me emphasize the importance of solving the problem rationally, because if we do not I can tell you exactly what will happen. We will settle on the least justifiable solution of all, that is, priority of occupation. We will say that if the polluters were there first, then pollution is ancient and honorable and no later intruder can complain about it even though the area's best use would

be for a TB sanatorium; and contrariwise if a residential use is once established in an area ideally suited by nature as the community's garbage dump, then the community will have to dump its garbage elsewhere at whatever cost to all concerned. To avoid such monstrous results we need some scale of priority other than seniority.

D. Economics of Space

We cannot and should not dissipate our resources enhancing environmental quality equally over all the earth. We need to concentrate our efforts where they will do the most good to people. One important option in pollution control is, for example, not to process wastes but to relocate them. The selection of optimal dump sites becomes an interesting question in pollution control, balancing transportation costs against reduced human exposure to wastes as they are removed from centers of population.

Again, how should effluent charges vary with location of the outfall? Presumably upstream polluters should pay more than downstream polluters since their wastes degrade a longer reach of the stream. Economists and policy makers need to work out formulas for the variation of effluent charges with location.

A more general question has to do with sewer charges levied on users of a common system. Collecting sewage for treatment is on the whole costlier than treating it. The user at the end of the line imposes much higher costs on the collection system than the

user next to the treatment plant. A system of rates graduated with distance from a central treatment plant needs to be applied, not in a punitive spirit, but with the constructive aim of encouraging a closer congregation of economic activity inside a sewer system, and near its center, in order to minimize collection costs. More positively, that means to maximize the number of dischargers who can be located within a system at reasonable cost.

One of the primary reasons why pollution is getting so far out of hand currently is urban sprawl, which locates more and more residences or plants outside the reach of existing sewers, and at densities too low to permit of new systems. To the extent that existing systems do reach the new settlement it is by bleeding and neglecting their own centers. They spend their limited money extending lines to reach as many new settlements as possible, deferring needed replacement and enlargement of lines serving older settled areas, which lines become too small to carry the growing loads imposed on them as the older areas fill in.

This leads to a more general question of spatial economics, settlement density. In order to achieve scale economies in treating effluents before discharge into a river we need to have all polluters located close together to share the cost of a common facility. Dr. Kneese's discussion of large-scale treatment is limited to the treatment of whole rivers after the discharge of pollutants. This is no criticism, he could not discuss everything; but the more relevant

economy of scale is the economy of collective sewage treatment, which only becomes possible when large numbers of waste generators can share the cost of a common treatment plant.

Modern Americans have thoughtlessly tried to escape from the pollution which we rather vaguely associate with the city by running half-way back to the country. Some call exurbia a happy medium, but in pollution matters it is the worst of both worlds. People can get along at low rural density, where they are far enough apart not to pollute each other's water; and again at high urban density where close enough to use common facilities. But on the sprawling urban fringe we are close enough to get in each other's way and too far apart to do anything about it. The Water Well Drillers' Association keeps telling us this is ideal, but they speak ex parte and it is becoming increasingly evident that we are going to have to turn more to the American Water Works Association. The number of contaminated wells found each year is a material and growing percentage of the whole, and if we could or would afford to check each small private well regularly, and if public officials dared to release the results, we might be shocked at what many have been drinking in this modern sanitary age, and we might pinpoint one important cause of impaired human function and health. Septic tanks that seem workable when an area is first sprinkled with a few dwellings come to overload the capacity of the underground as an area fills in, even at large lot minima. The jump to densities high enough to allow public sewerage is a big one, calling for concerted public action more clearcut and decisive than our system of government facilitates.

These remarks barely scratch the surface of a question of infinite fascination and paramount importance. Most questions of environmental quality involve settlement density: the cost of environmental enhancement tends to rise with area, and the value with the population of the area. In general, that means the denser the settlement, the higher quality of physical environment we can afford to maintain.

High density in some areas is also the best guarantee of low density in others, because obviously if a given number of people live here they won't live there. We can let some areas specialize in accommodating large numbers of people at a high level of environmental quality, and others in receiving garbage, pollution, and debris, with very few people. That should leave most of the world more or less "natural," which some, perhaps forgetting about mosquitoes and bandits, regard as the highest-quality environment of all. But we cannot afford to maintain uniform high standards everywhere, and we need to give high priority to analysis and policy-making on the question of where, and where not.

E. Unexplored Alternatives

Some alternative means of pollution control worthy of attention are the following:

1. We can export pollution by importing products whose manufacture or mining pollute the environment. Sugar, which Dr. Kneese

discusses, is something we should be importing anyway from tropical nations because they produce at lower cost, even if we exclude the external (to the firm) cost of polluting water. Add to that, most tropical nations are more willing to accept pollution because of sparser population and lower per capita wealth. The last point may appear invidious, although it makes sense otherwise, and some dare not call it reason for fear of igniting flammable tropical inferiority complexes which would make the people perceive it as condescending. Yet if trade is a "voluntary act between consenting adults," where lies the condescension? It is refusing foreign sugar that really provokes resentment, and to do so on the pretext that we are protecting our little brothers from the consequences of their decisions would add condescension and hypocrisy to injury.

The same argument applies to petroleum. Why not let the Sheik of Kuwait suffer the pollution associated with oil wells? He might appreciate the option, and we should be getting our oil from the lowest cost source anyway.

2. The heavy use of pesticides which we now suffer is, as Dr. Kneese points out, in part a substitution of pesticide for land, and might be alleviated by substituting land for pesticide. Since the U.S.D.A. holds millions of acres idle in various programs of the soil bank type, would it not make more sense, if we insist on limiting farm output, to do so instead by cutting back on pesticides? It makes no sense to hold all that land in cold storage anyway.

Along the same line, we could produce our present domestic output of oil with one-half or less the present number of wells if we let the superior wells produce 30 days a month instead of as now holding them down to 7 or 8 days a month and letting only the marginal stripper wells produce constantly. When we see oil rigs disfiguring the landscape, and marginal mines polluting water, let us not blame it on economics, or laissez-faire, or other conventional scapegoats. A large part of the landscape disfigurement which mineral extraction imposes does not result from economic necessity at all, but from sheer boondoggling inherent in the prorate or allowable system. The economist who would like to rationalize the oil industry needs to join forces with the environmentalist who would like to preserve the landscape. They have a common interest in substituting a few superior wells and mines for many marginal ones.

3. It would be useful to modify our property tax policies and our income tax policies so as to accelerate the replacement of obsolete equipment. Much air and water pollution comes from ancient ineffective plants which enjoy grandfather-clause protection in their polluting activities. Tax policies to accelerate replacement of such historical antiquities would be desirable on other grounds anyway.

F. Market Structure

Economists need to study the effectiveness of effluent charges under conditions of imperfect competition. The rationale as developed so far presupposes competitive markets, and to the extent that markets

are not so, the charge would not work as intended. An effluent charge paid by a monopolist would on the whole have less effect on output than the same charge levied on a competitive firm. Marginal firms would go out of business, and the danger of lessening the degree of competition should be counteracted by other measures if necessary.

G. Institutional Economics

Environmental quality demands more economic research on social institutions. Dr. Kneese has emphasized that economists need to bend their analyses to engineering constraints. But institutional constraints can be equally compelling. The cost of amending the United States or a state constitution, of reversing a common-law rule or a precedent *stare decisis*, or altering established *mores*, may be high enough to prohibit all manner of otherwise useful ideas. The social institutions hammered out through centuries of human trial and error are real facts of the world, every bit as controlling as physical facts.

There is a danger, which Dr. Kneese may be intimating, of institutional idolatry, or of infinite taxonomy. Some institutionalists are guilty of those felonies. Let economists continue to criticize obsolete and ill-conceived institutions which block economic adjustments. But let them do more than remove blocks; they must build channels for positive social action. The development of workable social institutions like California's Irrigation Districts was, as Albert Henley put it, "...of infinitely more value to California than the discovery of gold a generation earlier."

It is a truism, at least since Ogburn, that institutional evolution is behind science and engineering. It seems to follow that the marginal productivity of economists' time would be highest if directed to building institutions. As good marginal economic theorists, should many of us not then become institutional designers?

That certainly was my experience working with water law and economics in California. Why should economists elaborate models of optimal allocation and programming of water and fuss over finer points of theory, when water law may not let one move water across the street from a swamp to a desert? As Professor Boulding has observed, an engineer then becomes someone who figures the best way to do something that shouldn't be done at all.

On the positive side, California is rich in constructive enabling legislation. California law authorizes local citizens to set up special districts that can do everything but stand on their heads. Stephen Smith, Herbert Snyder, Michael Brewer, Albert Henley, and other economists and lawyers have published important studies of these districts and their uses in controlling environment, in particular the level of ground water. California and other states have districts for drainage, flood control, air pollution control, mosquito abatement, sanitation, water conservation, weed control, etc., ad infinitum. These adjudicated precedents bear close study by American economists--more, probably, than German precedents--for they are the institutional mechanism most readily available for environmental control in the

United States without performing major surgery on federal and state constitutions, and without waiting through years or decades of judicial review.

V. Criticism

There is little in Dr. Kneese's excellent paper with which to take direct issue. That, indeed, is my first criticism--the language is often guarded, the meaning open to inference.

Second, I would object to the use of the first person plural in the title and throughout. Mark Twain once ruled that "No one should be allowed to refer to himself in the plural except royalty, editors, and persons with tapeworms." That is too harsh--we all must do it sometimes! But the antecedent of Dr. Kneese's "we" evolves parlously.

Dr. Kneese confesses early that his survey of research is partly biographical but the emphasis evolves from self to Resources for the Future, and as he warms to the topic he increasingly intimates that "we" comprises most people who matter. Quoting Will Rogers now, "We are all ignorant. We are just ignorant about different things." To say that "we" have learned something because an economist learned it from other men and wrote it in an economics journal is something like saying the Indians learned where they were because Columbus found them.

I would not quibble over the stylistic point, but it reflects a state of mind that may mislead one. For example, Dr. Kneese says

that the benefit-cost analysis "used" in water policy is "the most advanced field of applied welfare economics." I think what he means is that a few economists have written good books on the subject; but I see little evidence that those books have stopped the Arkansas or the Feather River Projects. On the contrary, these boondoggles are now dwarfed by the incredible nonsense of a proposal, seriously advanced, to carry water from--may Heaven protect us--Alaska (!) to California. "We" may know better, but another "we" do it anyway.

Again, the idea that the benefits of environmental enhancement show up in increased land values may be news to "us" economists, but it has been preached vigorously from every real estate sales office in the western world from at least the days of the South Sea bubble, and has long been the effective criterion used by many local governments to decide on outlays for school, fire and police protection, street lights, utility extensions, etc.

Again, I think Dr. Kneese overstates the novelty of studies of damage to downstream users of degraded water. The California Department of Water Resources and related agencies have monitored water quality for years. Downstream irrigators have had upstream users in court since, it would seem, the beginning of time, and the constant fussing has generated volumes of information. All of that is known to some people, even if it is not part of that restricted literature which we sometimes refer to as "the" main body of economic knowledge.

A third criticism is that Dr. Kneese overdifferentiates his subject. Most government services are designed to improve the quality of the environment in one way or another. Economic techniques designed to evaluate the benefits of fire protection, garbage collection, pest and contagion control, street lighting, drainage, and even police work are transferable and partially applicable to evaluate pollution control measures. (Indeed, it is essential that comparable methods be used, else how shall governments allocate budget funds among these competing claims?) Thus Dr. Kneese overstates economists' neglect of environmental quality studies. It is the more specific application to pollution control that has languished.

True, economists have far to go in evaluating the benefits of public goods. But Dr. Kneese might have cited a great deal of work on marginal cost pricing, on layout of distribution and collection grids (like sewers), on vertical summation of demand curves for public goods, on pay T.V., on the value of weather information, etc.[1]

Still, there remains a bite in Dr. Kneese's implied criticism. Economists have largely been talking to each other on these matters. We deserve to be faulted for too little effort to reach a consensus, and then to shout it from the housetops. Dr. Kneese deserves high praise for his success in wider communication.

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1. A partial list of such works is given on pages 33-34.

Fourth, I detect hints that Dr. Kneese is too easy on polluters. Concerning pesticides, there is "no evidence of any effect." That phrase implies to me that he puts the burden of proof on the damaged person. I suggest it belongs on the polluter. The Food and Drug Administration requires the seller to prove safeness before distributing a new drug. In the case of polluters the case is even stronger, because their neighbors' exposure is involuntary.

Where measurement and proof are tenuous, as with many pollutants, placing the burden of proof may be a paramount issue. I would not want 100% of the burden on the polluters. Some rule of reason needs to apply--another institutional problem. Making change too burdensome is a tool of blind conservatism. But I do think Dr. Kneese's statement suggests a greater tolerance of those who would use the rest of us as guinea pigs than I find acceptable.

Again, he suggests that imperfect knowledge may inhibit us from controlling pollution. But put the burden of proof on polluters, and imperfect knowledge would prevent our permitting any pollution! In fact, no legislature has ever possessed perfect knowledge. Society must always contrive to act on the basis of what is known. Where reasonable doubt remains about the safety of new pollutants, I would be inclined to check their use tightly until those who profit from their sale and use have managed to demonstrate safety.

Finally, the phrase "quality of the environment" is too comprehensive really to describe the specific concerns covered in Dr. Kneese's paper. The environment of slum dwellers consists largely

of houses and streets, joints and cheap stores, playgrounds and schools, garbage cans, and drop-forge vibrations. Perhaps it would be well to attend more to such intimate urban environmental matters. Ameliorating them can improve the lot of man by a larger factor than cleaning up lakes used by summer sportsmen of the wealthier classes or improving the scenery on which they occasionally gaze with cultivated eyes. Meantime, the present subject is better called "pollution control and aesthetic uplift from the viewpoint of the upper-middle classes."

VI. Envoi

On balance, these criticisms are minor and I strongly applaud Dr. Kneese's paper. He applies economic theory to practical problems, which gives him scarcity, and does it very well, which gives his scarcity a value.

I was struck by his description of control of blow flies in the southern states. Agencies have learned to control the flies, recall, by releasing millions of sterilized males into the population. Somehow that brought to mind the higher education in the United States. Each year sees its horde of sanitary graduates go forth, ill-prepared to infect the world with new ideas, but only to preempt social niches that might better be filled with more virulent specimens.

The sterility of the college product derives in some measure from the segregation of theory and practice. We turn out our

idealists and theoreticians, and then our nuts-and-bolts practitioners, but rarer is the man burning to make practical the ideals of theory. Here is Dr. Kneese's great strength. By blending theory and practice so well, he enhances not just the physical but the intellectual environment of his times.

Important as the physical environment is, the intellectual, social and psychological are more so. The greater gain of improving the physical world is improving the man who does it, the greater gain of achieving harmony of man and nature is achieving, through nature, harmony of man and man. In this case, the means may indeed be the end!

(1) 1. Weisbrod, Burton A., "Collective Consumption Services of Individual Consumption Goods," QJE, August 1964, pp. 471-477.

2. Margolis, Julius, "Metropolitan Finance Problems: Territories, Functions, and Growth," Public Finances: Needs, Sources, and Utilization, NBER (Princeton: Princeton University Press, 1961), pp. 229-270.

3. Shoup, Carl S., "Standards for Distributing a Free Governmental Service: Crime Prevention," Public Finances/Finances Publiques, XIX (4) 1964, pp. 383-392.

4. Holtman, A. G., "Estimating the Demand for Public Health Services: The Alcoholism Case," Public Finances/Finances Publiques, XIX (4) 1964, pp. 351-358.

5. Hirsch, Werner Z., "Cost Functions of an Urban Government Service: Refuse Collection," Rev. of Ec. & Stat., February 1965, pp. 87-92.

6. Tiebout, Charles M., "A Pure Theory of Local Expenditures," JPE, October 1956, pp. 416-424.

7. Buchanan, James M., "Private Ownership and Common Usage: The Road Case Reexamined," SEJ, January 1956, pp. 305-16.

8. Tiebout, Charles M., "An Economic Theory of Fiscal Decentralization," Public Finances: Needs, Sources, and Utilization, NBER (Princeton: Princeton University Press, 1961) pp. 76-96.

9. Tinbergen, J., "The Appraisal of Road Construction: Two Calculation Schemes," Rev. of Ec. & Stat., August 1957, pp. 241-249.

10. Lave, Lester B., "The Value of Better Weather Information for the Raisin Industry," Econometrica, January-April 1963, pp. 151-164.

11. Minasian, Jora, "Television Pricing and the Theory of Public Goods," Journal of Law & Economics, October 1964.

12. Dorfman, R., ed., Measuring Benefits of Government Investments (Washington: The Brookings Institution, 1965).