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BENEFIT COST ANALYSIS—A NECESSARY PART OF ENVIRONMENTAL DECISIONING

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ABSTRACT

Society may use benefit cost analysis to set priorities in determining the level of environmental pollution they wish to tolerate. The benefits of pollution are derived from the production and consumption of goods and services necessary to life. The estimated social costs of this productive activity are the costs necessary to reduce or eliminate the wastes from the effluents discharged into the environment. Therefore, BCA is appropriate in environmental decisioning since its proper use ensures that society can reach the ecological stability level without violating the economic optimum. However, ecological stability may not always be a rational choice, particularly when dealing with ecological sub regions rather than the global ecosphere.

This article is written in response to an article written by Professor Frank G. Müller entitled, "Benefit-Cost Analysis—a Questionable Part of Environmental Decisioning [1]." Professor Müller's main conclusion is that Benefit Cost Analysis (BCA) is not a useful part of environmental decision making because BCA does not lead to environmentally optimum decisions. His article stresses that Benefit Cost Analysis, BCA, is faced with serious measurement problems which even when solved would only lead to the environmentally optimum solution. He states that BCA is at best redundant and society would be better off making all environmental decisions based on technical environmental data. These conclusions rest on his implicit assumption that social costs of pollution discharged

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into the environment begin only after the waste carrying capacity of the environment is reached.

In this article, I will assume that social costs are measured directly by environmental impact of waste discharged into the ecosphere. These social costs are measureable when environmental resources such as clean air and water are considered valuable rather than free. For simplicity, I shall assume also that society has perfect knowledge of the environmental impacts of waste discharge and the social costs these discharges impart. This assumption may be relaxed and the conclusions of my analysis will still hold.

The analysis begins with the same general understanding of the ecosystem suggested by Professor Müller. A stable ecosystem which guaranties the continuous services of the natural resources provided by the ecosphere is a valuable commodity which man should protect. Every ecosystem changes over time due to internal factors (e.g., the impact of the present inhabitants on their own habitat) and external forces. However, human beings are a part of the ecosystem and have changed much of the system already. Some ecological systems have been vastly altered by man's presence. These ecosystems include cities and their surrounding regions. Pollution, as result of man's economic activity, must be regarded as a disturbance to his and surrounding ecosystems. This pollution is continuous and increasing in intensity. In many instances human activity and pollution have impaired major segments of the ecosystem causing apparent breakdown in the existing ecological cycles. Consequently, the environment is less suitable for life and leads to the elimination of some species. Since each specie exercises a function in the ecosystem, the removal of any specie reduces the checks, balances, diversity and stability of the ecosystem. Some ecological studies have suggested that the dominant species may be the most endangered one by pollution. Thus, some ecologists and Professor Müller imply that the human race is risking survival, or at least the quality of life for both present and future generations if mankind continues to tolerate the present level of pollution [1-5].

From this discussion Professor Müller concludes that BCA is irrelevant by suggesting that money criteria are not applicable if the objectives are not commensurable. He suggests that BCA does not possess any method at present to assess and evaluate the benefits, if any, and costs of the elimination of some plants or animal life or the liquidation of mankind [1, p. 304]. According to these considerations he supports ecologists' requests that ecosphere instability should be minimized and pollution be prevented. He tried to show that BCA will always lead to a rate of production and pollution which exceeds the waste capacity of the ecosystem. It is at this point in Professor Müller's article that I take exception. In fact, I believe that BCA can lead to a more ordered pollution abatement policy than is currently being advocated by many ecologists.

My above contentions will be demonstrated using a reconstructed Figure 1 adopted from Professor Müller's text. Part (a) of Figure 1 depicts the environment as a waste receptor. The horizontal line EE represents the absorptive capacity of a particular environment, (for example a river) to transform and/or disperse waste products into usable substances valuable to the ecosystem [1, Figure 2a, p. 305]. The curve OR shows the residuals dumped into the environment. This curve represents the physical wastes generated from the productive process Y according to the scale of operation. In the economist's terminology this is the total waste discharge per unit of time associated with Y_E output. The level of discharge from Y is $R = bY$ where "b" is the slope of OR. Part (b) of this reconstructed graph relates the waste residual OR and absorption capacity EE to the amount of marginal social costs, MSC, of the environmental disruption caused by OR. Unlike Professor Müller's Figure, this figure shows MSC to be directly related to the rate of waste disposal introduced into the system. This analysis treats the environment as a valuable resource and the cleansing capacity of the environment as a useful service for which the polluter should pay. Thus, the shadow price, P, estimated here is based on either an average cost of preventing the pollutant from entering the environment or the average cost of removing the pollutant from the environment once there. The price also may include the shadow price estimated by what people are willing and able to pay to avoid a polluted environment. In any event, $MSC = P \cdot \frac{\partial R}{\partial Y}$ where $\frac{\partial R}{\partial Y} = b$ and is called marginal rate of waste discharged per unit of Y, MRW. Since Professor Müller postulates a linear function for OR, the MSC is a linear function and constant dependent on the values of b and P.[1]

While the firm would like to maximize its profits at an output level OY_o the socially optimum rate of output is achieved at the level OY_E where the $MPB = MSC_B$. This level of output depends on the value that society places on a clean environment as estimated by P and the MRW as shown through the MSC. The firm is producing at the socially optimum rate which in this case also

[1] This function could be curvilinear rather than linear and the results would still obtain.

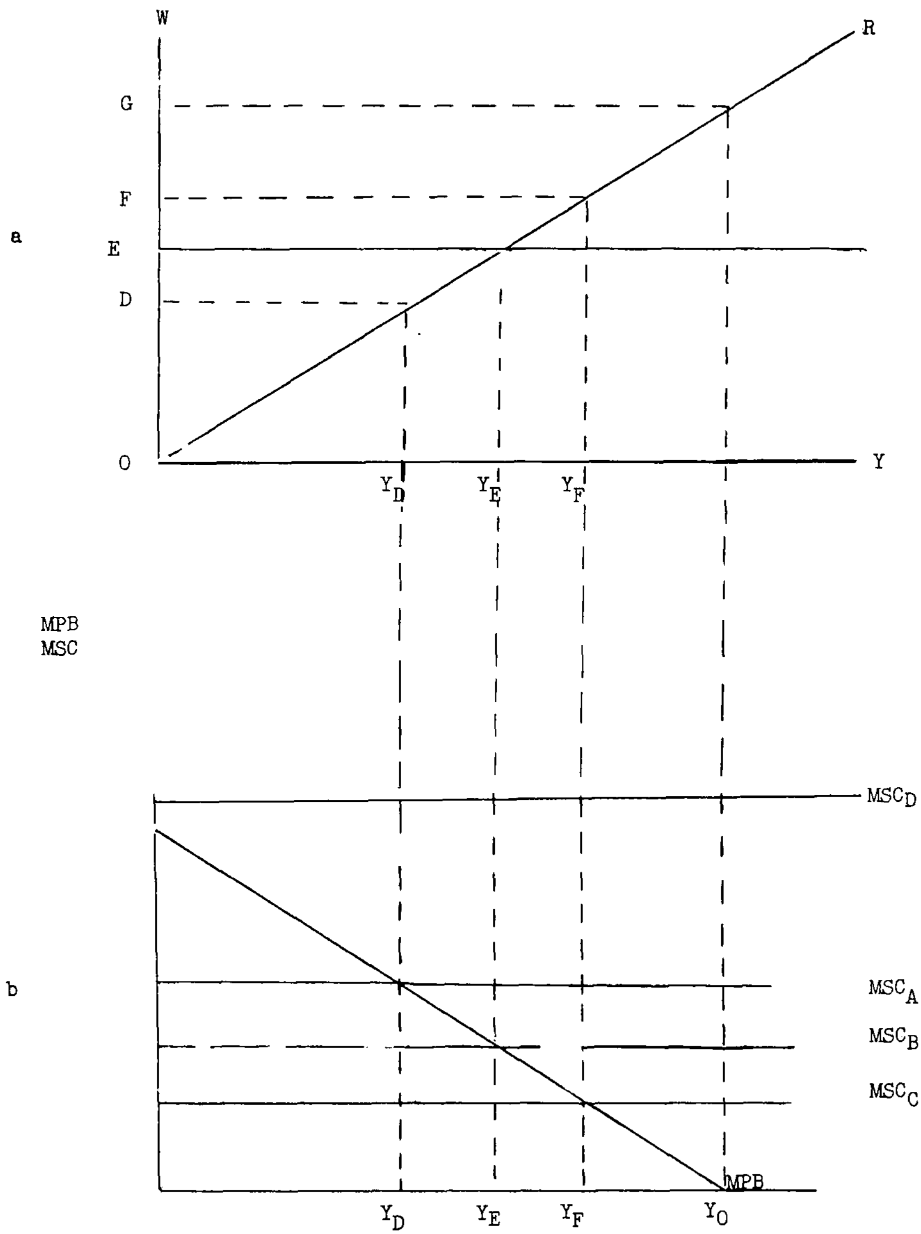

Figure 1.

coincides to the ecological optimum rate. This coincidence does not make the BCA analysis redundant since it allows society to set priorities concerning environmental and economic objectives. If the society values the waste absorption capacity of the environment, they may wish to set a higher price on the discharge of some pollutants in some areas. This is shown as P_A and $MSC_A = P_A \cdot b$. Thus, $MSC_A > MSC_B$ since $P_A > P_B$. Under these conditions, society optimum output is Y_D which is below the absorption capacity of the environment shown as D in part a of Figure 1. On the other hand, society may set a low price on the discharge of some pollutants in other areas. If society feels some streams or lakes, or ponds are useful as waste disposal areas, they may set a low price say P_C where $P_C < P_B$ so $MSC_C < MSC_B$. In this case society chooses an output level Y_F which is above the absorbtion level of the ecosystem at F in Part a of Figure 1.

The three cases demonstrated above illustrates the priority setting capabilities of BCA which the simple technological analysis cannot provide. In many geographic areas we may want to over use or abuse the regional environment. This situation is illustrated as Case C and represents the solution which Professor Müller and environmentalists fear. In this solution society sets a low value on the environment and man's activity burdens the ecosystem with more pollutants than can be assimulated without altering or destroying the balance of the system. Under these conditions man produces at Y_F and discharges OF wastes into the environment. While the pollutant has been reduced from OG the pure private discharge, environmentalist still have reason to be upset since the balance of the existing ecology will be destroyed. In many regional situations, society may not worry that much about losing a lake or river to pollution. In Chicago, most people are not agitating for reclamation of the Chicago sanitation canal and designating it as a wild river. Moreover, the city land cannot be returned to the ecological system of prairie and swamp land from which it came. Many of the regional areas surrounding our major cities and probably many of our rivers fall into Case C. Some of these ecological areas are being altered by choice but most of these are being altered because we continue to price the environmental resources at zero and our waste discharges range up to OG.

In most of our cities and for most of our rivers, lakes, and air space, society would probably opt for Case B where the price of the environmental resources are set high enough so that man's activity does not overburden the environmental waste carrying capacity. We have already seen indirectly that major segments of our population would like to live in areas with less pollution. People tend to move away from areas of heavy pollution and congestion when they can afford to. Therefore, BCA can set the environmentally optimum rate of discharge if given the proper pricing information from society.

Finally, in some geographic areas society may want to severely restrict, if not completely eliminate, man's productive activity and discharge of effluents. In this situation society's wish to restrict economic activity in these areas can be reflected in the price set by BCA for effluent discharges. By setting a high price of P_A for each unit of discharge BCA will generate a high MSC_A. Private production will be restricted to Y_D and discharges to OD. Society would probably set a high price for discharges in areas such as Minnesota's Boundary Water Canoe Area, California's Lake Tahoe, most of the national parks and many other places of scenic or ecological interest. In fact, society may set its price for certain geographic areas so high as to generate MSC_D. In this situation, society would in effect be banning any discharge into the environment.

Conclusion

Society, therefore, may use benefit cost analysis to set priorities in determining the level of environmental pollution they wish to tolerate. The benefits of pollution are derived from the production and consumption of goods and services necessary to human life. The estimated social costs of this productive activity are the costs necessary to reduce or eliminate the wastes from the effluents discharged into the environment. Therefore, BCA is appropriate in environmental decisioning since its proper use ensures that society can reach both an ecologically stable and economically optimum level of discharge. However, ecological stability may not always be a rational choice particularly when dealing with ecological sub regions rather than the global ecosphere. Society may wish to over burden certain areas of the environment to provide for an adequate standard of life for its citizens. Finally, the environmentalists solution of zero discharge is illustrated nicely in Figure 1 as zero output. This solution in the global ecosphere substitutes a certain human catastrophe, now, for a possible environmentally generated human catastrophe in the future. I, for one, prefer the latter possibility to the former certainty.

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