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THE ECONOMIC PROBLEM OF COAL SURFACE MINING

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At the present time, committees in both houses of Congress are considering proposed legislation for the control of surface mining, particularly surface mining for coal. The degree of concern over this problem is suggested not only by the number of published accounts of the adverse effects of surface mining,[1] but also by the success of anti-strip mining candidates in recent primary elections. That the control of surface mining should now be of national concern comes as no surprise to most persons, for surely the issue is consistent with the pattern of rising environmental awareness of recent years.

To the economist, it should come as no surprise that the issue is being debated and will no doubt be partially resolved in the absence of firm quantitative economic assessments of the dimensions of the problem. The same pattern of events occurred in the earlier controversies over the control of air and water pollution. At most, the role of the economist appears to be that of helping to predict what the repercussions or impacts of the proposed legislation will be on local or regional economies. But the primary issue of whether or not scarce resources should be devoted to the control of surface mining and, if so, to what extent and by what means or instruments of control, seems somehow to escape applied economic analysis. This state of affairs often tends to suggest, in turn, that perhaps surface mining is not really an "economic" problem, and that criteria for action other than efficiency in the use of scarce resources (e.g., that it is "fair" or "equitable" that surface mining be controlled) should be employed in resolving this issue.

It is the purpose of this article to analyze the economic aspects of the problem of surface mining and to discuss the implications of that analysis in terms of the economist's conventional recommenda-

tions for corrective action. Such a review suggests that it has been the inability of economists to supply empirical or quantitative substance to their theoretical analyses which necessarily has led to a discussion and proposed resolution of the issue according to other criteria.

One theoretical aspect of the problem of surface mining is well understood by economists and is probably more or less obvious also also to others. In general, the problem is one of external effects or spillovers: the act of surface mining results in environmental impacts and costs that are imposed on persons living downstream or downslope of the mining site but which are not accounted for in market transactions in that those imposing the costs are not required to pay for them. For example, downstream persons or firms must bear the costs (e.g., increased treatment expenses) associated with using water the quality of which has deteriorated due to acid drainage or sedimentation.[2] As a result, there is a discrepancy between the private and social costs of mining, and mine operators, by responding to private costs only, produce too large an output at too low a price. There occurs not only a misallocation or inefficiency in the use of resources—some of the resources devoted to mining could have been employed elsewhere to obtain a product of higher value—but also a problem of equity, for those persons suffering the environmental costs of mining are in fact unfairly subsidizing others who are able to enjoy lower prices on products produced from the commodity being mined.[3] The economist's suggested remedy in such a situation involves a justified intervention of government in the market economy, by corrective taxes or mining regulations, so that the external costs are "internalized" to the mining firm.[4] Economic principles can even be employed to define the preferred extent or degree of mining control and mined-area reclamation: society should continue to employ resources for the prevention and control of environmental impacts only up to the point where the value of the resources so employed just equals the value of external costs avoided.[5] Implementation of this analysis involves primarily the complex and difficult task of evaluating (by assigning dollar costs) the environmental or external impacts that occur under various degrees of surface mining control.

It is fair to question, however, whether the situation that would result following the introduction of such controls would really be acceptable, particularly in the case of coal contour surface mining in such mountainous areas as are found in Appalachia. Since many

of the areas currently being mined are relatively uninhabited, and since the environmental impacts (other than perhaps the destruction of scenic views) often do not occur more than a few miles downstream or downslope, the magnitude of the external costs being suffered in the absence of control might not be sufficient to justify very extensive or complete mining regulation.[6] On the other hand, many persons would feel, at least intuitively, that society could devote still more resources to the control of surface mining and be better off. Such an intuitive feeling would be correct, for there are other aspects to the problem than the control of external effects.

Internalizing external costs amounts to making a correction to the market cost of mining some commodity. Presumably, the market cost of mining already includes some measure of the time stream of returns that could have been obtained from some alternative use of the land if it had not been mined. That is, the mining firm has had to pay some amount for the land it mines, either through direct purchase or lease of the site or through a royalty payment to the owner of the surface rights. The amount paid represents the market's evaluation (a discounted present value) of the stream of net returns that the land could yield.[7] It is necessary, however, to examine just what alternative uses and returns the market has considered.

For example, many areas of the Appalachian region underlaid by coal seams offer a wide variety of alternative and not mutually exclusive benefits to society. Some relatively uninhabited or primitive areas possess rare natural habitats and scenic views of potential value for various types of outdoor recreation. Less obviously, such areas also have value as pollution sinks and as genetic "banks."[8] A legitimate question is whether or not the market price of such land adequately reflects the value to society of these alternative uses. Unfortunately, the answer is that it does not, because of the particular nature of many of the services that land can provide that are "public goods."

A public good is a good of the type that, once it is supplied to one person, it is not possible or desirable to exclude others from its enjoyment.[9] For example, it is not possible to deny the benefits of a genetic "bank" to one person while providing them to others, and neither is it possible to assess him fairly for the benefit he gains. Up to a point, the additional costs of allowing one more person to make use of a recreation area are zero. Since efficiency in the

use of resources requires that the price of an additional unit of some good or service be set equal to the additional cost of providing it, the price to be charged for an additional use of a recreation area should be set at zero; thus use should not be rationed by positive prices.[10] Many members of society would no doubt be willing to pay some amount for the preservation of natural habitats and scenic views regardless of whether they might ever actually visit and enjoy them.[11] But again, since the cost of providing such options to an additional person are zero, no price should be charged for their provision.

In all of these cases, where it is impossible to exclude users or where the efficient allocation of resources requires the charging of zero price, no private person or firm would provide such goods and services voluntarily, for it would be unable to gain sufficient revenue to cover the cost of provision. Thus, while the preservation of the land and natural habitats may provide a wide range of valuable alterative goods and services, the private market economy has no incentive to assure their availability. The market price of land reflects only the value of those services which a private firm can capture.[12] The efficient allocation of resources again requires the intervention of government, not in this case to internalize external costs, but to prevent an unwarranted conversion of natural habitats into mining sites.

Whether private land values accurately reflect social opportunity costs must be investigated on a case by case basis. The techniques which can be employed are again applications of cost-benefit analysis; in this instance, they involve explicit comparisons of the value of the goods and services flowing from alternative land uses.[13] If the analysis indicates that preservation of the natural environment is justified, then such preservation should be provided for through the public budget and paid for out of general revenues.[14]

It is important to realize the considerable difficulties involved when attempting to implement this decision-making framework. In particular, it is exceedingly difficult to evaluate the benefits that would accrue to society from the provision of a genetic "bank" or from the use (or option to use) a wilderness recreation area.[15] The desired measure of benefit is the individual's willingness to pay, but since no markets exist where such goods and services can be exchanged at equilibrium prices, methods other than the use of market prices for imputing benefits must be devised. Procedures

must be found not only for estimating the demand for such goods and services but also for determining the appropriate dollar benefits that would be obtained from their provision. Although considerable progress has recently been made in the case of outdoor recreation,[16] much needed research remains. While in times past economists can perhaps be justifiably accused of having ignored this area of applied analysis, much of the lack of progress and development is directly related to the intractable nature of the problem.

Meanwhile, environmental awareness has continued to grow and demands for solutions to these problems have increased. Thus, it has been necessary to debate the issues and propose legislative solutions in the absence of the valuable cost-benefit information the economist might provide. Of necessity, then, criteria other than the efficient use of scarce resources have been applied to the problem. In this study, it is important to consider the implications of resolving these problems according to these other criteria.

Currently, much of the discussion concerning coal surface mining involves not whether some control might be justified, but rather what the resulting economic repercussions on employment, income, and regional economic development would be if surface mining were so strictly controlled as to make it unprofitable. This is also an economic problem, but one of income distribution or equity rather than resource allocation. Interestingly, concern over the possible adverse employment effects of the control of surface mining continues despite the fact that reclamation programs would require the use of additional labor and that, where surface mining is eliminated, the effect of a shift to deep mining would be an increase in total regional employment.[17] Thus, only in those areas where surface mining would be eliminated and deep mining would not be a feasible production alternative is concern over employment justified. In such areas, surface mining is presently providing employment while, on the other hand, preserving natural habitats and related public goods and services often are not types of economic activities which result in immediate local employment and economic development in the traditional sense of the word. Such is not necessarily the case in the long run, however. For example, the Appalachian Regional Commission has spent huge sums on the construction of highways designed to link the Appalachian states more closely to national markets and to remove the transportation handicap of the past. Since a major feature of several

of these states is their wilderness appeal, various types of amenity-oriented economic activities will be attracted once these highways are completed. Continued surface mining will almost certainly prevent this development.[18]

It is important to recognize that it is not necessary to sacrifice the preservation of natural habitats and efficiency in resource allocation in the interest of providing a fair or just distribution of income. The two goals need not be at odds. If inequity in income distribution is the problem at hand—and surely it is in the depressed regions of Appalachia—then there are preferable means of meeting this problem. Employment dislocations can be met more effectively and efficiently through such devices as job re-training, improved educational systems, and the like.[19] Public funds are required for programs to solve this problem. We need not also sacrifice our natural environment and the irreplaceable services it can provide.

Another element entering the discussion is the possible effect on the energy supply if surface mining is too strictly controlled or eliminated. While the issues surrounding the current energy "crisis" are complex, objectivity is required to put this particular aspect into perspective. Thus, the forecasts by mine operators and electric utilities of widespread fuel shortages if mountain surface mining were eliminated should be compared with the fact that of all fuels burned in the U.S. for electric power generation, only eleven percent comes from contour stripped coal, and much of this could easily be absorbed by increased deep mining.[20] Any resulting increase in coal prices will be paid by coal users, which is desirable in the interests of both resource allocation and equity.

In conclusion, while several issues cloud the discussion of surface mining, the basic problem is one of efficiency in the use of scarce resources. Since the private market fails to take into account the external costs of surface mining and the full opportunity costs of land use, scarce resources are currently not being used efficiently; therefore, governmental intervention to promote surface mining regulation and mined-area reclamation is justified. While economic analysis can provide important guidelines to aid government decision-making, much necessary research, particularly in the area of the valuation of public goods, must first be performed. Without this research, any surface mining controls that are implemented will be in accordance with other criteria, with no guarantee that the social welfare will in fact be improved.

FOOTNOTES

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[1] *See,* U.S. Department of the Interior, SURFACE MINING AND OUR ENVIRONMENT (Washington, D.C.: U.S. Government Printing Office, 1967); D. Brooks, *Strip Mining Reclamation and Economic Activity,* 6 NATURAL RESOURCES J. 13–44 (1966).

[2] Other possible external effects include: landslides, increased flooding, destruction of scenic views, and deterioration of public roads by overweight coal trucks. D. Brooks, *supra* n.1, at 22–25.

[3] The allocation and distribution repercussions mentioned are those that generally accompany production with external effects. *See,* E. J. Mishan, *The Postwar Literature on Externalities: An Interpretative Essay,* 9 J. OF ECONOMIC LITERATURE 1–28 (1971). Such repercussions will in fact occur, however, only in those markets for the specific commodity, surface-mined coal. On the other hand, if the supply to a market consists of both surface- and deep-mined coal, if the average cost of surface-mined coal is lower than that of deep-mined coal, and if price equals minimum average cost of the deep mining producers, then the distribution consequences of external effects will be higher profits to the surface mining operators rather than lower coal prices (and, thus, lower prices on products produced from coal). Evidence of the relatively high net returns that can accompany coal surface mining is presented in S. Brock, and D. Brooks, THE MYLES JOB MINE—A STUDY OF BENEFITS AND COSTS OF SURFACE MINING FOR COAL IN NORTHERN WEST VIRGINIA (Morgantown, W. Va.: Office of Research and Development, West Virginia University, 1968).

[4] For an analysis of various alternative solutions to the problem of external effects, *see,* O. Davis and M. Kamien, *Externalities, Information, and Alternative Collective Action,* in Joint Economic Committee, U.S. Congress, THE ANALYSIS AND EVALUATION OF PUBLIC EXPENDITURES: THE PPB SYSTEM, Vol. I (Washington, D.C.: U.S. Government Printing Office, 1969) 67–85.

It is appropriate to note that the effect of governmental intervention is to circumscribe somewhat the rights of property owners. Under differing institutional arrangements, e.g., where the rights to environmental quality are by law explicitly placed with the public, the imposition

of government controls would not be as necessary. *See,* R. Coase, *The Problem of Social Cost,* J. OF LAW AND ECONOMICS 1–44 (October, 1960).

[5] An example of this analysis as applied to the similar problem of air pollution control can be found in A. Freeman, THE ECONOMICS OF POLLUTION CONTROL AND ENVIRONMENTAL QUALITY (New York: General Learning Press, 1971) 9–10. If at the optimal level of control, damages still remain, they should be compensated for directly by the mining firm.

[6] D. Brooks, supra n.1, at 27, estimates that it would require an expenditure of $50/acre to avoid the worst effects of surface mining, while a more complete restoration of mined land could cost $1800/acre to $3000/acre.

[7] Net returns are represented by land rents. Economics possesses differing theories of the determination of land rent. For example, rent may be conceptualized as representing a marginal revenue product or a differential between product revenues and factor payments (other than for land) for goods produced per acre. *See,* R. Clower and J. Due, MICROECONOMICS (Homewood, Ill.: Richard D. Irwin, Inc., 1972) 327–336.

[8] Pollution sinks can be defined as areas over which the atmosphere is able to cleanse itself of pollutant loadings through settling and dispersion, and where the proportions of normal atmospheric constituents (such as oxygen) can be re-established. Genetic banks can be defined as areas where the wide diversity of genetic evolution is allowed to continue uninterrupted so that these areas might provide a possible source of (1) natural enemies when biological rather than chemical control of obnoxious or detrimental species (e.g. insect pests) is desired, and (2) new genetic material to aid in the development of disease resistant strains of species (e.g. for agricultural crops). For a discussion of the various potential benefits of preserving natural habitats, *see,* J. V. Krutilla, *Conservation Reconsidered,* 57 AMERICAN ECONOMIC REV. 777–786.

[9] *See,* R. Musgrave, THE THEORY OF PUBLIC FINANCE (New York: McGraw-Hill, 1959) 6–14 for a classical discussion of public goods.

[10] Bator, F., THE QUESTION OF GOVERNMENT SPENDING (New York: Macmillan, 1960) 97–102.

[11] Such so-called "option" demands are discussed in Krutilla, J., *et al., Observations on the Economics of Irreplaceable Assets,* in A. Kneese and B. Bower, ENVIRONMENTAL QUALITY ANALYSIS (Baltimore: The Johns Hopkins Press, 1972) 95–111.

[12] In addition to the inability to take account of public goods and services, there are other instances where the private market can fail to consider the full opportunity costs of alternative land use. For

example, scientific forestry can be profitable only when practiced on a rather large scale, and such economies cannot be realized when land ownership is divided into many small holdings. In other instances, the division of land into arbitrary political jurisdictions, together with other similar institutional restraints, can limit the range of land use alternatives the private market can consider.

[13] For example, *see* J. V. Krutilla and C. J. Cicchetti, *Evaluating Benefits of Environmental Resources with Special Application to the Hells Canyon,* 12 NATURAL RESOURCES J. 1–19 (Jan. 1972); R. L. Spore and E. A. Nephew, *Opportunity Costs of Land Use: The Case of Coal Surface Mining,* presented to the Conference on Energy: Demand, Conservation and Institutional Problems, Massachusetts Institute of Technology, February 12–14, 1973.

[14] R. Musgrave, *supra* n.9, at 14–15.

[15] Particularly troublesome are the difficulties of estimating the assumed future benefits. Not only can the value of benefits change over time, but the definition of society must be made clear. The question of what collection of persons, present and future, should be considered when scarce resources are being allocated is discussed by J. de V. Graaff, THEORETICAL WELFARE ECONOMICS (Cambridge, England: Cambridge University Press, 1967) Ch. VI.

[16] *See,* survey in M. Clawson, METHODS OF MEASURING THE DEMAND FOR AND VALUE OF OUTDOOR RECREATION (Washington, D.C.: Resources for the Future, Inc., 1959).

[17] *See,* W. Miernyk, *Environmental Management and Regional Economic Development,* presented to the Southern Economic Association meeting, Miami Beach, Florida, Nov. 6, 1971.

[18] I am indebted to Professor William Miernyk for suggesting this point.

[19] R. Musgrave, *supra* n.9, at 18, suggests that, in general, it is preferable to meet objectives concerning the distribution of income through the tax and transfer mechanisms that exist, and to avoid interference in the allocation of resources as otherwise determined.

[20] Environmental Policy Center Newsletter, August 31, 1972; R. C. Austin and P. Borrelli, THE STRIP MINING OF AMERICA (New York: Sierra Club, 1971) 54–58.