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David A. Gulley*

Severance Taxes and Market Failure

I. INTRODUCTION

Whenever market imperfections prompt the government to intervene in the economy, the question arises as to what form of intervention to undertake. Two broad categories of intervention exist. Command control procedures supplant the market place, replacing or overseeing it with a bureaucracy. For example, worker safety might be fostered by regulations stipulating equipment standards. In contrast, market-like procedures correct the socially inappropriate market signals (such as price, cost, or output) without otherwise tampering with the marketplace itself. An example is a stiff fine, levied on firms shown to be unsafe. Both approaches have their own appeal,¹ and the superiority of one or the other depends upon the particular circumstances at hand.

Regardless of any conceptual superiority, the vast majority of politically accepted forms of intervention fall within the command control category. The wide acceptance of command control has provided plenty of raw material for case studies and anecdotes concerning conventional regulatory forms. Intervention necessarily requires cumbersome and fallible organizations to address complex situations in an attempt to regulate effectively. These organizations frequently prove to be incapable of meeting the challenges posed by the complexities of the real world. Predictably, critics of command control, armed with an abundance of ready evidence of suboptimal performance, have had a field day.

If we are to effectively evaluate the pros and cons of both regulatory forms, a body of information comparable to that surrounding command control theories must develop around market-like intervention concepts. The theory of market-like intervention is well developed, even elegant.

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1. For a cross-section of the literature and a discussion of the extent of current implementation, consult the following. C. L. SCHULTZE, *THE PUBLIC USE OF PRIVATE INTEREST*, 51 (1977); A. V. KNEESE and B. T. BOWER, *ECONOMICS, TECHNOLOGY, INSTITUTIONS* (1968); Blockman and Baumaol, *Modified Fiscal Incentives in Environmental Policy*, 56 *LAND ECON.* 417 (1980); Tietenberg, *Transferable Discharge Permits and the Control of Stationary Source Air Pollution: A Survey and Synthesis*, 56 *LAND ECON.* 391 (1980); Russell, *What Can We Get From Effluent Charges?* 5 *POLICY ANALYSIS* 2 (1979); Breyer, *Taxes as a Substitution for Regulation*, 10 *GROWTH AND CHANGE* (1979), and A. V. KNEESE and C. L. SCHULTZE, *POLLUTION, PRICES, AND PUBLIC POLICY* (1975).

Implementation of such theories, however, has lagged. This lag has hampered the realistic appraisal of the practical strengths and weaknesses of such policy instruments.

One American institution does exist, though, which represents a significant intervention in the private market and resembles at least superficially a form of market-like intervention. This institution is the severance tax—a selective sales tax on the production of mineral resources. Governments at all levels, it will be shown, have displayed renewed interest in such taxes. Resource development causes socioeconomic and environmental impacts. Accordingly, special resource taxes might be viewed as a form of economic regulation—a device for limiting the production which causes damage, while raising government revenues. This simple idea is by no means the ultimate in market-like regulation, and indeed the greater political acceptability of severance taxes stems more from traditional legislative concerns than from a desire to fine tune economic performance. The state and federal governments tend to adopt severance taxes because they are relatively simple, easy to legislate, easy to administer, and they raise significant revenues. Nevertheless, the tax's resemblance to market-like intervention suffices to prompt the question: does the severance tax effectively ameliorate market failure due to mining? This article pursues this inquiry.

II. THE SEVERANCE TAX AS A CORRECTIVE INSTRUMENT

A. *An Impact Tax?*

Governments levy taxes on the extraction of natural resources. Two types of severance taxes exist: specific taxes levied on the physical quantity of production, and ad valorem taxes levied on the monetary value of production. In principle, the tax is a constant charge per unit of production. In practice, though, states often allow various credits and deductions to be made.² So the tax is in reality more difficult to analyze.

However defined, the severance tax (a production tax) is very similar in form to an excise tax (a single-commodity sales tax). The severance tax differs from the more sophisticated fiscal regulatory instruments proposed by environmental economists. These latter instruments include the effluent disposal charge, which involves monitoring and taxing each unit of pollution discharged into the environment, and the pollution rights quota system,³ which defines a permissible level of environmental deg-

2. For example, a state might allow the company to deduct from its severance tax bill the property tax payments made to local government.

3. Both of those forms are discussed in Blockman and Baumol, *supra* note 1. Also see Tietenberg, and KNEESE and SCHULTZE, *supra* note 1.

radation and allows firms to compete in an auction to purchase a portion of the permissible pollution load.

Even so, authorities have recommended the severance tax as a corrective device to improve society's use of mineral resources. Page offers the most comprehensive development of this argument.⁴ He argues that a number of economic characteristics lead society to over-use its raw materials base. These features are the lack of disposal charge, to reflect the social costs of waste treatment and burial; implicit subsidies such as hidden tax benefits and regulatory gaffes which favor virgin materials over recycled materials; discriminatory pricing; and socially nonoptimal discount rates, which accelerate production and reduce the resource base available to later generations. Page believes that price elasticities of materials are higher than usually assumed, though he offers no real empirical evidence. He also believes modest price changes would create a significant shift away from virgin material usage, toward more intensive use of recycled materials. To accomplish this, Page proposes a severance tax but does not analyze the detailed economic effects he expects the tax to create.

Despite the interest in severance taxation as a market-correcting instrument, a severance or other excise tax cannot be expected, theoretically or practically, to accomplish all that might be possible with more advanced tools. Nevertheless, under some conditions even this basic form of market-like intervention offers important advantages over conventional regulation. Chief among these advantages is the tax is predicated upon the recognition that a complete elimination of impacts is often neither feasible nor even desirable. Compensation for some classes of damages can benefit everyone. A standard economic analysis, shown in Figure 1, displays how the tax offsets one form of market failure.

The tax increases price and reduces production. A lower production level results in a lower level of deleterious effects. Whatever effects remain can be treated, either by government mitigation programs or by compensation, with the revenues received. An additional social benefit arises, subtle but important, from the redirection of overall production and consumption patterns by the higher resource extraction costs. The market system, above all, is a social invention designed to signal information on sacrifice (cost) and benefits (price) for a myriad of goods and

4. R. T. PAGE, *CONSERVATION AND ECONOMIC EFFICIENCY; AN APPROACH TO MATERIALS POLICY* (1977). At some risk of oversimplification, we might contrast Page's contribution with this article. Whereas Page discusses complications which a severance tax might correct, we discuss here the complications inherent within the attempt to formulate and implement an efficient system of charges. Another difference is Page's preoccupation with the competitiveness of primary and secondary sources of supply, and the emphasis here on various mining-related impacts.

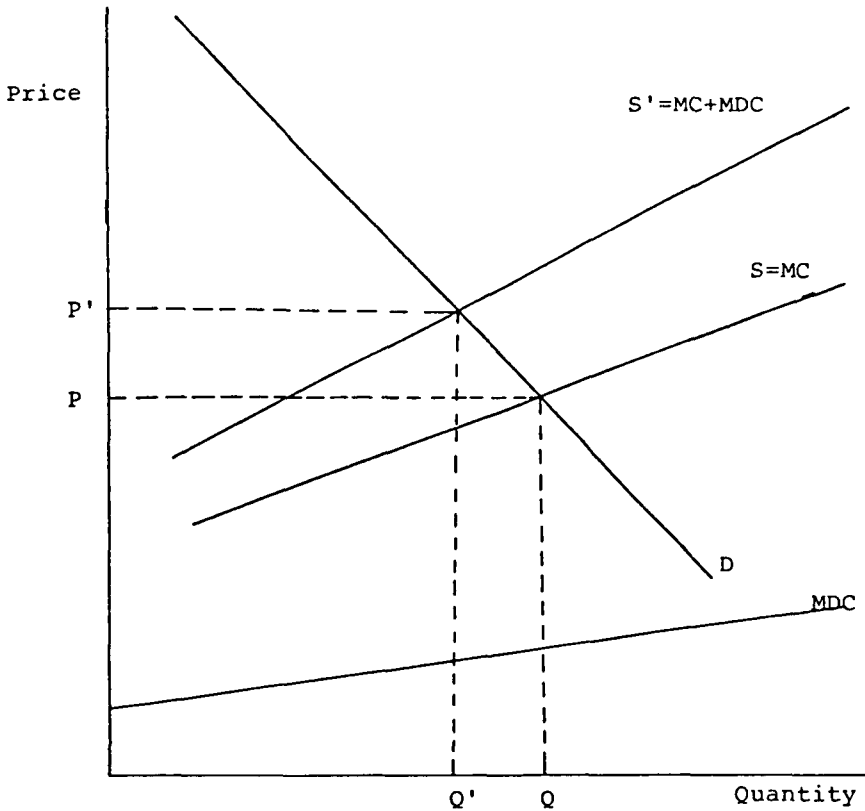


FIGURE 1.

This diagram represents the production of a commodity which creates an external cost. The supply curve, S , represents marginal production costs, and MDC represents the marginal damage costs associated with it. When a tax equal to MDC is added to the product price, fewer units are sold (Q') at a higher price (P'), reflecting all of society's costs. Total damages are reduced by a monetary amount that exceeds the extra payments of consumers, an amount which is also available for compensation.

services. More accurate cost signals better enable society to respond to its problems and opportunities.⁵

When supply and demand are inelastic, as is the case with mineral commodities in the short-run, little change in output (or in damages) will result from the imposition of severance taxes, but rather large revenues will be generated. Thus, the cost-internalizing approach is arguably most effective for a class of impacts characterized by readily quantifiable pecuniary damages to easily identified victims. It is a less satisfactory approach under other conditions,⁶ which is why environmental economists emphasize effluent charges rather than product excises, and under extreme conditions fall back on command-control.

In contrast to this simple sketch, a more detailed evaluation of the economic effects of severance taxation presents some complications. We consider the issues of incidence, welfare changes, differences between specific and ad valorem taxes, and conservation effects.

The incidence of a tax is never easy to demonstrate. The profession still is not sure who pays the property tax.⁷ The great variety of minerals and markets covered by the term "severance tax" further complicates the issue in this case. The following comments are therefore somewhat speculative. At this time, a tax on crude oil is probably largely backward-shifted, onto the original resources owner.⁸ Long-term contracting prevails in the coal industry, but the industry also experiences chronic demand-constraint. Coal taxes appear to be forward-shifted in the short run, but they reduce rents in the long run.⁹ Among metals, market power varies greatly; commodities are sold at many stages of processing, sometimes

5. For example, all resources are scarce. One attempt to better utilize our fossil fuels, due to their scarcity, might take the form of lower-loss electrical transmission lines. Such lines might stretch supplies of fuel, but are themselves the products of other scarce mineral resources (to say nothing of other scarce resources such as labor and capital). At what point does greater use of these other resources no longer pay? The price system is our best single guide to the answers.

6. For example, suppose the toxic discharge of a plant reduces the life of one percent of the population living within ten miles by an average of three years. How does one compute the monetary value of damages and locate the victims? The issue has been an on-going inspiration to some economists to develop new analytical devices, but few are comfortable with a strictly economic solution to this problem.

7. H. J. AARON, WHO PAYS THE PROPERTY TAX? A NEW VIEW (1975).

8. McDonald, *The Incidence of an American Oil Severance Tax Under World Pricing by OPEC*, 20 NAT. RES. J. 547 (1980).

9. Since ad valorem severance taxes are in form virtually identical to royalty payments, some interesting work remains to be done regarding state severance taxes and federal coal royalties. Do these compete for the same rents, and in effect cancel out, or are they additive? A conventional microeconomic, long-term analysis suggests they both tend to be capitalized in part, and in such a case some of the state's gain is illusory, for 50 percent of federal royalties return to the state, and an increase in taxes will reduce royalties. A short-run, more institutional analysis suggests tax cumulation occurs. In this analysis, both royalty and severance taxes are computed on a price that includes the other. The author knows of a coal company that solves a set of simultaneous equations to determine how much to pay in royalties, how much in severance taxes.

locally, sometimes in world markets; interproduct competition can be critical; and so on. These comments do not lead readily to any conclusion and, indeed, suggest instead why careful empirical incidence studies are rare.

Economists generally measure social welfare changes by means of a concept called consumer's surplus.¹⁰ Mineral commodities are sold in intermediate markets. Controversy exists as to how taxes and price distortions in such markets are reflected in final markets and whether consumer's surplus measures in the two markets are equivalent. Under ideal conditions for firms operating in perfectly competitive product and factor markets, the consensus is that tax and price distortions are neither diminished nor expanded as the product moves from stage to stage, and happily, the welfare measure also remains intact.¹¹

The rub, of course, is that we do not know how reassuring these conclusions might be in a less idealized world. Consider, by way of example, the electric utility which burns the coal upon which a severance tax has been added. The extent to which the utility pays the tax may depend on the competitiveness of the coal market, whether the mine is captive or independent, the nature of the contract, and the vagaries of the public utilities commission. The extent to which the tax is passed on is subject to similar influences. Deriving a consumer's surplus measure for the utility is awkward, owing to the peculiar nature of electricity pricing and the corresponding dearth of an ordinary, utility-revealing demand function.¹²

In both static and intertemporal analysis, the effects of ad valorem and specific severance taxes differ slightly. The difference arises from the uniformity of specific severance taxes with respect to output, in contrast to the variability of the ad valorem tax (as supply and hence price increases, so does the unit charge). In a static analysis, ad valorem and specific taxes have identical effects under competitive conditions, since price is constant regardless of the firm's output. Where monopoly power exists, price varies with output, and an ad valorem tax thus varies with output as well. Under such conditions, ad valorem and specific taxes differ in the magnitude of the effect. Even in a competitive market, ad

10. The term refers to the difference between what a person is willing to spend and what he or she actually spends for a product. Since demand curves are downward-sloping, only for the last unit purchased is price equal to what consumers are able and willing to pay. See MANSFIELD, *MICROECONOMICS* (1979).

11. The problem of tax pyramiding is well-discussed in public finance literature. The controversy over benefit measures in alternate markets is relatively new. Carlton, *Valuing Market Benefits and Costs in Related Output and Input Markets*, 69 *AMER. ECON. REV.* 4 (1979).

12. Anderson, *The Social Cost of Input Distortions: A Comment and a Generalization*, 66 *AMER. ECON. REV.* 1 (1976). These complications are not insurmountable, but merely expensive and time-consuming to overcome. In fact, the article by Carlton, *id.* shows how to overcome the last problem above. However, since much of the economics profession's critique of conventional regulation is directed at its cost, it is only proper to mention explicitly the complications here.

valorem taxes can have a distortionary effect if the tax is levied on F.O.B. prices rather than final prices. Coal producers compete in a market which equilibrates the sum of mining and transport costs. Two mines can sell their product at an identical price and yet have very different F.O.B. costs, due to differences in location. A tax on the F.O.B. price of coal discriminates in favor of low-mining-cost, high-transport-cost producers. Such a tax may amount to an indirect subsidy of the railroads.

In a dynamic analysis, using the theory of exhaustion,¹³ the ad valorem tax has a smaller effect. The reasons for this are best discussed in terms of the tax's conservation effect. Two forms of conservation must be distinguished. The better-appreciated form involves deferring current production and use until a later date. The second form involves the physical and economic efficiency of current production, the reduction of wasteful or destructive practices in producing and using resources. To evaluate the severance tax effect on the first type of conservation, economists have employed the intertemporal theory of exhaustible resources, showing that firms will reduce the present value of the tax burden by deferring production to a later date. As mentioned before, this effect is most pronounced for specific severance taxes. A more realistic analysis, however, must account for firms' *expectations* of future changes in tax rates. Depending on the expectation, the severance tax can be either pro- or anti-conservation (in the first sense of the term) or neutral.¹⁴

With regard to the second form of conservation, the efficiency of current production, both types of severance taxation, but especially specific taxes, have an anti-conservation bias. To understand this, one must recognize that mineral deposits are never entirely exhausted. As ore or hydrocarbons are extracted, the marginal production cost increases and/or the unit value of the remaining ore decreases. Production ceases when marginal cost and marginal revenue coincide. Mining engineers formalize this problem in the concept of cutoff grade. The marginal production decision is somewhat less appreciated by economists than the theory of exhaustion, but the mining engineering literature reveals that of the two concepts, the cutoff grade problem more commonly affects daily operations.¹⁵ Sever-

13. The theory of exhaustion evaluates, among other topics, how the price of an exhausting resource behaves over time. In most cases, the price increases and thus over time a tax which is not subject to legislative tinkering or indexing will have a constant burden for the specific tax but an increasing burden for the ad valorem tax.

14. Burness, *On the Taxation of Nonreplenishable Natural Resources*, 3 J. ENV'T'L. ECON & MGMT. (1976). Also see Dasgupta, Heal and Stiglitz, *The Taxation of Exhaustible Resources* in ESSAYS IN PUBLIC FINANCE IN HONOR OF JAMES MEADE, (G. HEAL and G. HUGHES, eds., in press). Vickrey, *Economic Criteria for Optimum Rates of Depletion* in EXTRACTIVE RESOURCES AND TAXATION (M. GAFFNEY, ed., 1967).

15. For economic analyses of the issue, see Lockner, *The Economic Effect of the Severance Tax on Decisions of the Mining Firm*, 4 NAT. RES. J. 468 (1965). Also see Steele, *Natural Resource Taxation: Resource Allocation and Distribution Implications* in EXTRACTIVE RESOURCES AND TAXATION 233, (M. GAFFNEY, ed., 1967).

ance taxes raise operating costs and therefore reduce cumulative production. Where production costs are constant for high and low-grade ores (which occur in the same deposit), a specific severance tax will further discriminate against lower grade ore production. In theory, of course, any unextracted valuable mineral can be mined at a later date, when the material is more valuable. Greater inefficiency may result from this deferred production. First, reopening an old mine generally proves more difficult and expensive than developing a new property because of the redistribution of underground pressure caused by the old workings and related complications. Also, the infrastructure and related markets that existed for the "old" extraction must be duplicated for the "new" extraction. Moreover, conflicting and diffuse claims to ownership, passed down through inheritance, can effectively prevent redevelopment of financially healthy properties. On balance, then, the conservation effects of severance taxation appear ambiguous. Any final judgment would require more information.

B. The Issues

Impact taxation can conceivably address several social issues related to mining. Taxation could improve market allocation by internalizing external diseconomies, by offsetting pricing inefficiencies caused by market power, and/or by offsetting pricing inefficiencies caused by distortions in the rest of the tax system. Impact taxation could also serve as a surrogate for user charges, by generating revenues to fund public programs which are consumed in parallel with mineral production or consumption. Finally, taxation could enhance equity by distributing wealth interregionally, intertemporally, or across income groups.

Severance taxation might offset income distribution, both in subtle and obvious ways. Interregionally, for example, when the tax is forward-shifted there is an unsubtle transfer of wealth from consumer locales to producer locales. For some commodities, however, a regional tax will transfer income *out* of the producing region because marginal production is shifted to other locales unaffected by the tax. The nature of the commodity determines the alternative that arises. Some commodities are plentiful and widespread. The large number of substitute locations results in relatively small consumer impacts (i.e., a small price change), but relatively large production and employment impacts. For other commodities, the reverse would hold. Intertemporally, properly designed and implemented severance taxation can directly increase future generations' wealth, both by forestalling production, and possibly by endowing a resource exhaustion trust fund. More subtle intertemporal effects might have the opposite effect because the tax could cause inefficient results including

burdening the economy, slowing rates of growth and distorting orderly changes in the mix of production inputs and final goods and services. Among income groups, excise and production taxes might appear to have unfair burdens because the tax rate is constant. However, energy and materials demands are probably, though price-inelastic, relatively income-elastic.¹⁶ If the total consumption increases proportionately faster than income, severance taxes would be progressive.

The market allocation and user charge issues warrant detailed treatment because market failure (and hence impact mitigation) is the central concern of the paper. Four specific issues arise in this context: environmental degradation, health and safety, socioeconomic impacts, and exhaustion.

Mining and mineral processing do create some unique environmental damages, and where the impacts are not qualitatively unique they are unusual in magnitude. Severance taxes could promote environmental protection in several ways. First, they could be used to encourage or discourage particular technologies. For example, the typical state tax system taxes underground mining more heavily than surface mining, because deep mining is more capital intensive. A severance tax could be used to reverse this pattern. At present, Montana taxes surface mining more heavily.¹⁷ Second, severance taxes could be graduated with respect to the level of impurities in the mineral product; these impurities often eventually become pollutants. Third, a regional system of severance taxes might be used to make mining unattractive in more sensitive areas. Fourth, a tax could be legislated either to encourage or discourage businesses conducting downstream activities (milling, smelting, combustion, etc.) from locating within the taxing district. It is worth noting that such calibrations of severance tax rates moves the tax beyond a simple excise, one step closer to a true charge on damages.

Health and safety issues are to a degree external to the market place. This is obviously true when such costs are imposed on third parties. Production workers who are not compensated for hazardous conditions also provide an example of the externalization of health and safety costs.¹⁸ The Federal government's present use of a severance tax on coal for black lung benefits demonstrates the potential for internalizing these costs.

Socioeconomic impacts are widely cited as a justification for severance

16. Durable goods tend to be more energy-intensive in use and material-intensive in production than is the case for nondurable goods, and durable goods tend to be much more sensitive to fluctuations in national income. Moreover, some recent econometric results tend to yield income elasticities greater than one, although the evidence probably cannot be regarded as definitive.

17. WESTERN GOVERNORS REGIONAL ENERGY POLICY OFFICE, *TAXATION OF SURFACE AND UNDERGROUND COAL MINING IN WESTERN STATES* (1976).

18. W. RAMSEY, *UNPAID COSTS OF ELECTRICAL ENERGY* (1979). Other research, such as that of Thaler and Rosen, suggests that wage rates incorporate such risks.

taxes.¹⁹ This is only in part due to externality arguments; such taxes are also seen as a form of user charge, in that the industry which creates demand for public services is asked to fund the services. A remark made earlier, about efficiency charges being particularly appropriate when impacts are largely pecuniary and affect an identifiable cohort, is particularly germane here. The external costs associated with boomtown conditions include inadequate social and governmental services, inadequate private services and amenities, and the potential of a bust or decline following the short-lived boom. This issue appears to provide the strongest potential for severance taxation as a cost-internalizing instrument—a fact worth bearing in mind when we turn, in the next section, to an evaluation of some complications that arise in this case.

The boom-to-bust cycle associated with community impact problems has its larger counterpart in the issue of resource exhaustion. The issue of exhaustion should be distinguished from site-specific closings because the threat of the former has never been demonstrated while there are many examples of the latter. If exhaustion is not a problem, of course, there is no need to “correct” it. Still, exhaustion might present a case of market failure, if it is a legitimate threat and if the market fails to find a proper intertemporal allocation. In a market economy, the marginal user cost of production (according to the theory of exhaustion) guides intertemporal allocation. The marginal user cost is essentially the opportunity foregone by not deferring production until the end of the life of the resource. This, in turn, is essentially the present value of future rent, with some adjustments made to account for changing access cost or other complications.²⁰ Exhaustion would present a case of market failure if either an improper discount rate is used, or if the firm ignores the marginal user cost concept. The firm might do this out of ignorance, out of a belief that the resource is essentially unlimited,²¹ because the concept represents a needless complication of what is already an imperfect decision process, or because the world distribution of yet undeveloped resources is a common property, so that the firm cannot be certain it will reap the benefits of its decision to postpone production. Perhaps all of these factors are at play. The severance tax might then conceivably be used to artificially incorporate a socially-correct marginal user cost, providing the form of the marginal

19. For discussions pro and con, see J. KRUTILLA and A. FISHER, *ECONOMIC AND FISCAL IMPACTS OF COAL DEVELOPMENT: NORTHERN GREAT PLAINS* (1979); Gilmore, *Boom Towns May Hinder Energy Development*, 191 *SCIENCE* (1976); Colorado Geological Survey, *TAX LEAD TIME STUDY* (1975); and NEHRING, *COAL DEVELOPMENT AND GOVERNMENT REGULATION IN THE NORTHERN GREAT PLAINS* (1975).

20. P. S. DASGUPTA and G. M. HEAL, *ECONOMIC THEORY AND EXHAUSTIBLE RESOURCES* (1979).

21. Gordon, *A Reinterpretation of the Pure Theory of Exhaustion* 75 *J. OF POLITICAL ECON.* 3 (1967).

user cost is known. The form of this cost varies with the form of the modelled depletion. Therefore, a workable definition of exhaustion-related scarcity is a prerequisite. Economic analysis of resource scarcity remains clouded with uncertainty.

Apart from the existence of external costs, extractive resources could be over- or under-priced because of market power or tax distortions. Market power increases prices above the competitive norm; since elimination of market power may be impractical, excise and production taxes could be used to raise the price of competitive products so that ideal relative prices exist. For practical purposes, the focus here would be on groups of commodities which are fairly close substitutes, such as coal for fuel oil, or aluminum for copper. Given this focus, a tax would be levied on the most competitive among the many distinct mineral commodity markets. Complications abound. Does countervailing power exist? How important is interproduct rivalry, or co- and by-product supply? How does one measure market power in a system of world markets? If these questions can be tentatively answered, then a tax levy could be (tentatively) computed which would enhance market efficiency.

The final allocational case for severance taxes concerns existing improper mineral policies which artificially lower prices.²² According to this argument, the public sector has repeatedly, and mistakenly, provided the extractive industry with a variety of tax and pricing advantages so that a new tax is needed to offset the distortions. The ideal response to the failure of past policies is to discontinue such policies. As economic conditions change and as intellectual fads come and go, evanescent arguments call for this or that special treatment of a particular sector. Citing the dreary history of failures in this regard should hardly encourage public policymakers to undertake additional fine tuning. The proper direction of change is toward a simplification of the tax codes and regulatory procedures, not toward more patches for the existing boiler. On the other hand, one could argue that this call for simplification is unlikely to be heeded. In such a case, if it is conclusively determined that mineral production is undertaxed, a severance tax might be a second-best solution.

C. *The Caveats*

Having described in some detail the efficiency arguments for severance taxation, it is worth noting the obstacles inherent in estimating and levying an efficient charge. Some of these obstacles are merely practical difficulties—"merely" meaning significant real-life challenges to the numerical estimation of the charge, which may, however, become less burdensome as economic science and data evolve. Other obstacles are of a more

22. PAGE, *supra* note 4.

abstract or conceptual nature; these problems are more fundamentally built into our institutions.

These qualifications can be organized into four principal groups: aggregation problems; second-best solutions; x-efficiency aspects; and externality negotiations. A fifth type of challenge, the problem of accurate measurement, is so endemic as to need no further mention. A sixth type of problem, political distortion, is postponed until later in the paper.

Aggregation problems occur when two or more types of inefficiency seem to require opposing types of responses. For example, the domestic coal industry is probably the most competitive of the mineral industries (with the possible exception of sand and gravel quarries). Coal reserves are also far greater than domestic oil and gas reserves. Thus, the market power argument would suggest adding a stiff severance tax. The scarcity issue presumably requires the price of coal to be increased by a tax but not so much as would be the case for the other fossil fuels. If it is difficult to orchestrate simultaneous scarcity taxes on liquid and solid hydrocarbons, the alternative appears to be to keep the coal price as low as possible. Of course other aggregation problems arise in connection with coal: underground mining has a greater health impact; surface mining tends to have greater environmental impacts. Given time and resources, of course, it is not beyond our collective wit to compute a net charge. Each of these factors, however, will acquire a different weight in each particular instance. (Surface mining, for example, only *tends* to have greater environmental impacts than deep mines—it is harder to reclaim areas of subsidence due to underground mining than some surface mineable locales.) The more precise the charge system, the more site-specific it will become, perhaps ultimately acquiring the staff and workload of traditional regulatory requirements. Is an average or net response what economic science is advocating? Two or more social problems may lead to self-cancelling price distortions, but the problems are not self-cancelling.

The qualification which has come to be known as the “theory of the second best” states that incremental “improvements,” which move the economy marginally closer to idealized competitive conditions, may actually decrease workable competition and consumer welfare.²³ Caution is in order, when considering policies which, like the severance tax, single out particular industries. As one illustration, the severance tax is industry-specific, but socioeconomic impacts arise more generally. Less than half of the projected western energy-related population impact is directly at-

23. Lipsey and Lancaster, *The General Theory of the Second Best* 24 REV. OF ECON. STUD. 11 (1956-7).

tributable to mining,²⁴ and in addition to energy impacts, other sectors—manufacturing, recreation facilities, government installations, and agribusiness—can and do create such impacts. Not even the boom-to-bust cycle associated with mining is unique to it. Many one-industry towns decline when aging or obsolescent facilities force a shutdown. A market-power excise tax, also, ought to be levied across sectors, as should any redistributive tax system. Further instances in which severance taxation is a second-best strategy could be cited.

A market transaction involves a buyer, a seller, and other parties affected by the transaction but not directly participating in it. These other parties receive external costs and benefits, but these externalities are by no means entirely unrepresented in the market place. Some externalities, termed pecuniary externalities, are resolved by the process of general equilibrium.²⁵ Other externalities are resolved through negotiations and through the law of torts. Where such social mechanisms exist, Coase has shown that additional tax intervention is superfluous.²⁶ To a degree, the third-party losses involved in boomtowns are already incorporated in the marketplace. Many boomtown studies, for example, indicate that labor productivity declines precipitously.²⁷ While the concomitantly increasing production costs do not eliminate the boomtown syndrome, the social costs are reflected in the product price. The pricing inefficiency will, to a degree, disappear, and the *allocative* case for severance taxation is shaky (equity considerations, of course may still urge a public response). If severance taxes are then used to “internalize” social costs already internalized through the labor market,²⁸ and the severance revenues are not used to ameliorate the harsh conditions (which is in fact the case in some states), then the consumer pays for the impact twice. The point is not that socioeconomic impacts can be ignored. The point, rather, is that such communities represent a complex set of problems and relationships, and that the remedies which are pursued are also numerous and complex. Within this institutional setting of factor market, litigation, and pre-existing taxes, the problem of finding efficient charges and equitable revenue

24. One study concluded that, in the western states, the change in energy-related employment would be: Colorado, 38 percent; Montana, 11 percent; North Dakota, 8 percent; Utah, 55 percent; Wyoming, 34 percent. Department of Labor, ETA, PROJECT EMPLOYMENT REQUIREMENTS FOR ENERGY DEVELOPMENT AND EXPANSION IN FEDERAL REGION VIII (1976).

25. J. F. DUE and A. F. FRIEDLAENDER, GOVERNMENT FINANCE; ECONOMICS OF THE PUBLIC SECTOR 340 (6th ed., 1977).

26. Coase, *The Problem of Social Cost* 3 J. L. & ECON. 1 (1960).

27. Gilmore, *supra* note 19.

28. Cummings and Mehr, *Investments for Urban Infrastructure in Boomtowns*, 17 NAT. RES. J. 223 (1977).

shares is more subtle and elusive than severance tax proponents have recognized.

A closely related problem arises in grafting a system of charges onto a system which is not purely laissez-faire to begin with. For example, the Public Lands Law Review Commission believed that environmental disturbances have already led to an overly restrictive discrimination against mining on federal lands,²⁹ and if that were not the case in the middle 1960s, it may be so in the late 1970s and early 1980s, in an era of less production-oriented land management.³⁰ Such institutional restrictions have an effect similar to taxes—they raise costs and restrict output. Safety and health regulations constitute another example. The existence of other institutional responses to market failure obviously complicates the measurement problem, and if Russell³¹ is correct that a blend of policy instruments is preferable to either one or the other exclusively, the issue will have to be addressed not only by practical policy analysts, but by economists wishing to compute charges in idealized settings.

The attention received in the current literature by externalities and inefficiency suggests that these must be pressing social problems. Actually, this supposition has never been rigorously established. In fact, some have tried to demonstrate the opposite—that the loss of welfare due to allocative inefficiencies is small relative to other economic problems (x-inefficiencies), and thus warrants little attention.³² The obvious retort to this is that pricing inefficiencies lead to other, dynamic economic problems (e.g., low rates of social cost reducing innovation) which *are* serious.³³ Still, the controversy reminds us of the need to ask just how serious the problem may be. A priori, we would expect typical nationwide average social costs due to inefficiency to be small relative to the production cost. At least, it is hard to imagine using a “market solution” to solve allocative problems where the social charge would exceed the initial price by orders of magnitude. Such a price correction would not only be extraordinarily difficult to implement, it would be a powerful demonstration of the need to remove such a commodity from the private marketplace altogether. From time to time, of course, instances arise where

29. MacDonnell, *Public Policy for Hard Rock Minerals Access on Federal Lands* 17 QUART. COLO. SCH. OF MINES 100 (1976).

30. CULHANE, *PUBLIC LANDS POLITICS* (1981). Despite much rhetoric to the contrary, President Reagan's Interior Department is not likely to be very successful at turning back the clock to an earlier, more exploitive attitude, due to legislative and judicial constraints.

31. Russell, *supra* note 1.

32. Among others who have argued the small magnitudes of allocative inefficiency losses are: Harberger, *Monopoly and Resource Allocation*, AMER. ECON. REV. (1954) and Leibenstein, *Allocative Efficiency vs. 'x-Efficiency'*, AMER. ECON. REV. (1966).

33. Schultze, *supra* note 1, has concentrated on non-allocative arguments.

low average social costs are terribly concentrated and cruelly imposed upon a specific community or cohort. Water pollution, for example, may involve relatively modest social costs on the average, but imagine the plight of the rare community which unknowingly ingests toxic chemicals for years. To call such injustice a mere social cost is to leach the reality of its havoc. Neither the language of economics nor the tax instrument is a suitable response to this problem, for which the ordinary concepts and procedures of justice provide a far better solution. The allocative efficiency concept and fiscal instruments can aid in the more mundane, more common cases of social costs. These cases arise on a scale for which economic solutions are reasonable. Their scale also prompts the question: in a many-problem world, are such problems worth our attention?

III. THE SEVERANCE TAX AS A POLITICAL INSTITUTION

A. Mineral Taxes in Practice

The previous section has emphasized the theory of severance taxation and has sought to define a niche for the tax as a potential instrument for internalizing market failure. In this section, we turn to the practical problems in implementing such taxes.

Earlier it was mentioned that the severance tax is a relatively popular levy, certainly more so than effluent charges and other forms of market-like regulation. Resource taxes are also old taxes. Elizabeth I doubled the size of her tax on coal, which was levied upon the vessel used to haul the coal, when she learned that tradesmen had doubled the size of the vessel.³⁴ The belief in windfall resource rents and quasi-rents has been an ongoing inspiration to tax collectors throughout the last several hundred years.³⁵ Nelson has charted the changing political postures of Minnesota and Michigan to the rising and waning fortunes of the Lake Superior iron-ore region.³⁶ More recently, the improved market position of western coal has led most of the affected states to increase and/or consolidate their coal taxes. At present, a new net proceeds mineral tax passed by the Wisconsin legislature in response to renewed mining interest

34. EAVENSON, *COAL THROUGH THE AGES* (1935).

35. As the term is used here, quasi-rents refer to all payments exceeding operating costs, *i.e.*, capital recovery. Pure rents are due to locational or resource quality advantages. We associate land rents with the single-tax proposal of Henry George in the late 1800s. For a discussion of rents and government tax receipts, see J. E. TILTON, *THE FUTURE OF NON-FUEL MINERALS* (1977).

36. Nelson, *Some Broader Lessons from the History of Lake Superior Iron Ore Taxation*, *PROPERTY TAXATION USA* 237 (R. W. LINDHOLM, ed., 1967).

is generating controversy. The precise form and institutional features of such taxes is a large topic, discussed elsewhere.³⁷

In general, states are clearly interested in capturing significant revenues from the production of minerals. The level and form of taxation varies among the states by a very large degree, and there may be several taxes in a particular state that are in fact if not in name severance taxes, yet few are as simple as a per-unit of output levy.

Our examination of severance tax politics will concentrate on the behavior of states, since that is the government level that most often applies such a tax. Most economists who advocate the tax strictly on the grounds of efficiency, however, probably have in mind a national tax. A fair question then is whether the politics of a national tax differ substantially from the politics of a system of state taxes. An obvious reason compels thinking it might. A national tax involves no intergovernmental competition, and regional aggrandizement and beggar-thy-neighbor policies are harder to accomplish when the constituency is national in scope. Congressional votes nevertheless very often follow regional advantage. When general revenue sharing was proposed, the allocation formula and the general goals were quite clear; by the time the House and Senate arrived at a compromise allocation procedure, the original intent had been abandoned and the result catered to regional political and economic interests.³⁸

In adopting any form of resource taxation, the state is making both explicit and implicit statements about the crucial natural resource issues. Explicit statements emerge in the legislative process; implicit statements, which need not be consistent with explicit concerns, arise due to the different economic effects of different forms of taxation.

To an economist, the ideal tax would do more than raise revenues. It would also offset those market distortions which are believed to give rise to negative impacts. To the legislature, however, the ideal tax raises revenues without affecting the status quo. In designing their taxes, states often show genuine concern for the marginal firm. States may sometimes wish to raise taxes to prevent *new* undesired industries from becoming established, but they usually do not want to "discriminate" (as they see it) against the marginally profitable existing firm. And yet it is hard to see how the market correcting aspect of excise types of taxes can be effected without somebody curtailing output, and this ultimately means

37. Church, *Conflicting Federal, State, and Local Interest Trends in State and Local Energy Taxation. Coal and Copper—a Case in Point*, 30 NATIONAL SEVERANCE TAXES AND DISTRIBUTIONS OF REVENUES (1976); Blackstone, *Mineral Severance Taxes in Western States*, 75 QUART. COLO. SCL. OF MINES 3 (1980); and Manvel, *A Survey of the Extent of Unneutrality Toward Energy Under State Excise, Property, and Severance Taxation*, in STUDIES IN ENERGY TAX POLICY (G. M. BRANNON, ed., 1977).

38. CALKINS, MONITORING REVENUE SHARING (1975).

somebody going out of business. Economists seldom pose the problem in such stark terms, no doubt hoping for an industry-wide, finely-calibrated reduction in each firm's output. Yet whether one believes mineral supply is a lumpy collection of firms or a smooth continuum of Ricardian resource producers, reduction in output means reduction in firms.³⁹ The state may minimize economic impact by creating exemptions for small firms from the tax (as in the case of Colorado's metal mining severance tax), by simply keeping the rate quite modest, or by allowing the severance tax to be credited against state corporate or income or other taxes.⁴⁰ However the minimization is approached, the state frequently designs a tax to mitigate some of the reallocative effect.

Such circumspection tends to make taxes more nearly neutral, a desirable outcome under certain circumstances, and only barely objectionable in any event (though there is room to question the efficiency of the approaches taken). However, other political tendencies, discussed next, might lead to charges that perpetuate imperfections rather than remove them. Environmental surcharges, for example, are advocated to influence the choice of technology, and earlier the severance tax was discussed in this context. However, few mineral deposits physically afford a choice between surface or deep mining, and the use of a severance tax to affect mining methods determines whether a particular deposit is mined at all. In general most deposits in any area will be mined by one method, either by surface or underground mining. Consequently, such a use of severance taxes will affect the economics of entire regions. The political tendency, of course, is to preserve the status quo.

A related environmental use of severance taxes involves graduating them so as to penalize the extraction of impure resources, e.g., high-sulfur coal. The absence of impurities however, raises the product price. This price increases the per-ton effective tax rate if an ad valorem tax is used. If a flat rate tax is used, legislators confront the temptation of a greater demand tolerance for higher tax rates. It is no accident that those states which have most raised their coal tax rates have been states with low-sulfur coal.

As already mentioned, a socioeconomic impact charge is probably not efficient unless the revenues go to impact mitigation. Yet, in many states,

39. Skeptics find the "straw that broke the back" argument implausible. But accounting conventions give firms the picture—rightly or wrongly—that their operating costs (average variable and marginal) are flat, a situation that both theory and observation suggest leads to lumpy changes in market supply. On the other hand, in a Ricardian world of smoothly varying cost and supply functions, firms on the extensive margin have no alternative to leaving the industry—even if taxes are fully shifted. In either case, then, the result is similar.

40. One ploy attempted in 1975 by the late Senator Metcalf of Montana was to attempt to levy a federal severance tax, against which existing state severance taxes could be credited. Blackstone, *supra* note 37.

such charges take a rather circuitous route. Colorado mitigates coal boom towns with oil shale bonus payments. Wyoming's coal tax revenues go to a general impact fund, for use in communities that need not be near the mine which generated the dollars. The tears shed by some legislators, for boom towns, are crocodile tears: most or even all revenues go to the state's general fund. This is not entirely reprehensible because other taxes are usually sufficient to cover the community costs.⁴¹ Moreover, earmarking funds often proves to be an unwise approach.⁴² Efficiency nevertheless is not served by levying a charge when social costs are subject to legal or other remedies or other influences, unless the revenues are used to mitigate the impacts. In some states, the link between severance taxation and impact mitigation is indirect and diffuse.

The exhaustion issue displays the political economy of mineral taxation in its most ambiguous form. Increasing scarcity may lead to higher prices and hence to higher taxes; depending on the form of the user cost, this may be all for the good. Threatened exhaustion, however, also improves the market position for substitute minerals. These improvements yield an undesirable result by tending to increase those sectors' taxes. The tax increases related to coal following the OPEC price rise provide an obvious example of such a result. Minnesota's experience with an exhaustion trust fund also reminds us that wasteful use of revenues can reduce the theoretical gain from more efficient pricing.⁴³

B. Another View of State Mineral Taxation

The state, then, is a political animal, sufficiently savvy and sufficiently opportunistic to set tax rates according to a whole agenda of diverse goals and constantly changing conditions. The states' political agendas effectively frustrate any finely-calibrated measure for social cost internalization, but (at least historically) the states have confined themselves to

41. It is well-documented that traditional taxes on mining return more than enough revenues to offset state and local government operating costs and amortized capital costs. The major problems are the front-end financing problem and possibility of a mismatch of local jurisdictions receiving revenues and those which must increase spending. Funds from a special tax are a practical means of overcoming these problems, because they allow legislators to create new impact mitigation mechanisms, rather than to redistribute existing monies, which already are associated with vested interests. Much more material on this point is available.

42. Economists have long been skeptical about ear-marked funds, feeling that such systems are too rigid to be effective. An anecdote, while not conclusive evidence, illustrates the reasons for the economists' skepticism. State tax funds had been set aside in Minnesota to revitalize the iron-ore region, but the fund was not particularly successful. The technological breakthrough that made it feasible to exploit the lower remaining grades was, however, invented in a state-supported university. Research support was the key, but while public support was involved, it did not come from a mineral excise-exhaustion trust fund. The Lake Superior case not only demonstrates the tendency to tailor taxation to specific conditions, it provides an anecdote wherein an impact aspect of the tax fails but other public revenues succeeded. Nelson, *supra* note 36.

43. *Id.*

modest tax rates. Whether the states will use resource taxation to become, in Richard Nehring's phrase, a new coal OPEC⁴⁴ presents another important concern outside the scope of a paper on market failure. Some precedent exists, if only because state petroleum prorationing boards traditionally performed cartel-like activities,⁴⁵ and Montana's coal severance tax rate may be emulated, having been upheld by the Supreme Court.⁴⁶ The scanty empirical literature presently available, however, suggests that no such trend is yet evident.⁴⁷

The federal response to state severance taxes has been characteristically ambivalent. The Congress passed its very own coal excise in 1977, and in 1979 DOE briefly considered another such charge. On the other hand, legislation was proposed to limit state energy tax rates. While representatives scold the states, one coal state has been scolding the Feds. In a letter to the Secretary of the Interior, Utah's Governor Matheson criticized the "institutionalized avarice" of the new approach to federal coal leasing, Interior's pursuit of "the maximization of profits like some nineteenth century Robber Baron."⁴⁸

The net effect of federal-state revenue maneuvers remains to be seen, but such episodes clearly point out the zero-sum-game nature of resource rents and quasi-rents. The landowner, all government levels, the mine workers, the mine operators, and a few others as well, compete for these revenues, and tax rates will tend to reflect that fact.

The traditional purpose of any tax is the creation of revenue, rather than the replacement of regulation. On these grounds the severance tax can be judged a success. The tax is selective because it falls on unpopular industries and presumably on out-of-state consumers. It is also politically acceptable, perhaps the ultimate test. At a crude level, the tax is proportional to the impacts: more mining, more tax revenues.⁴⁹ The severance

44. Nehring, *supra* note 19.

45. Before the OPEC embargo, Texas and Louisiana adopted market demand prorationing as an alternative to other types of petroleum supply regulations (needed to overcome common property effects). This activity, analogous to a monopolist's restriction of output, is described in: Mead, *Petroleum: an Unregulated Industry?*, ENERGY SUPPLY AND GOVERNMENT POLICY (R. J. KALTER and W. A. VOGELY, eds., 1976).

46. See Browde and DuMars, *State Taxation of Natural Resource Extraction and the Commerce Clause: Federalism's Modern Frontier*, 60 ORE. L. REV. 1 (1981).

47. Gully, *The Pattern of State Coal Taxation*, 5 MATERIALS AND SOCIETY (1981).

48. Department of the Interior, FINAL ENVIRONMENTAL STATEMENT, FEDERAL COAL MANAGEMENT PROGRAM K-159 (1979). In fairness to the government, this is somewhat overstated. Both Federal Statute and present government policy is to capture "fair market value." It is correct that the federal government is anxious to increase revenues, but incorrect to assume they wish to maximize economic rents. Department of the Interior, FINANCIAL REPORT OF FAIR MARKET VALUE TASK FORCE (1979).

49. Of course, this article has argued that production level is not by itself an adequate index of impact, and hence a production tax is not an adequate means of internalizing impact. Nevertheless, production levels and impacts are clearly related.

tax, more than other tax forms, has features which are particularly appealing to a legislature. The tax generates predictable revenues, is easily administered, and asserts the priority of state interests. A net proceeds tax, while superior conceptually, would involve fluctuating revenues, additional audit work, and an erosion of the tax base due to the high-cash-flow, low-net-revenue nature of the mineral industries. If the economic or geologic conditions facing the mineral industry change, then the legislature can always pass ad hoc adjustments to existing taxes. The response of western states to the improved relative position of coal amply demonstrates such an adjustment, as do other episodes, such as Minnesota's history of iron-ore taxation, or Colorado's treatment of its incipient oil shale industry. Just as the traditional purpose of a tax is raising revenues, one of the oldest of tax purviews is punitive or sumptuary excise taxation. The clearest perspective on severance taxes is that they are designed to increase the price of a noxious commodity while raising, due to the commodity's inelastic demand, fairly high revenues. Severance taxes are no more innovative a policy than are excises on alcohol or tobacco.

CONCLUSIONS

A great deal of the resource-related economic literature offers a vision of unhampered market forces, operating rather benignly after judicious adjustments in price, and cost. This paper has charted some of the swamp-land awaiting the advocate who wishes to implement such a scheme. While the present contribution qualifies only as exposition, "the validity of welfare theory is so much a matter of judgment, and so little a matter of precise measurement."⁵⁰

The discussion is easily summarized. First, determining the right amount of a severance tax to internalize market failure would be very difficult due both to difficulties in computing damages and to the opposing types of distortions. Second, the tax, in addressing existing problems, would create new distortions. Third, the political process would continue the historical tendency toward perverse taxation, so that the tax would significantly deviate from its ideal form. As a laboratory experiment in market-like intervention, then, the severance tax is not encouraging.

Despite the popularity of the severance tax, it is far from an ideal tax. One of the fascinations of the severance tax issue is that the tax embodies corrective principles aimed at four different problems—exhaustion, rapid growth, environmental decay, and tax nonneutrality—but it does not resolve any of them. Indeed, it probably creates new complications in all four areas. The public probably would be better served by separate

50. I. M. D. LITTLE, *A CRITIQUE OF WELFARE ECONOMICS* 258 (2d ed., 1958).

policy packages, each offering a coherent treatment of one of these problem areas. Severance taxation, however, is popular because it is precisely the opposite of such packages. It is a narrow, rather than comprehensive change in tax policy and it inadequately treats a host of problems rather than adequately treating a single problem. The fact that in two years the majority of western coal states passed severance tax legislation demonstrates that constituency building and incrementalism remain as hallmarks of the legislative process. An earlier writer on resource taxation remarked that "anything worth doing is, of course, 'politically difficult'."⁵¹ Severance taxation presents the contrapositive to this remark.⁵²

The proper role of efficiency-promoting taxes and charges thus remains open to discussion. The traditional purpose of any charge is not as a substitute for regulation, but as a means of raising revenues. Equity issues, long the preoccupation of public policy, require the disbursement of funds. Efficiency arguments can best help when they aid in pinpointing the source of the funds and the balance between compensation of victims and mitigation of impacts. The inability of an efficiency-promoting charge to address natural resource issues more fully does not mean there is no need for the revenues generated by such taxes, but only confirms what we ought already to suspect: that innovative resource management and effective impact mitigation might be better served by innovative policy instruments than by a charge system which is not much different than the ancient sumptuary excise. Innovative policy expressions might include true effluent fees or quota systems, development gains taxation, and publicly-supported inter-generational futures markets—these and more, all considerably more refined than a production tax. Such charges are better viewed as a supplement to regulation than as a substitute for regulation. These innovations, however, no less than severance taxes, no less than conventional regulation, will to some extent fall prey to the complexities of life. That, at least, is the theme of this paper.

51. M. GAFFNEY, *EXTRACTIVE RESOURCES AND TAXATION* 417 (1964).

52. In logic the Law of Contraposition asserts that the statements "if A then B" and "if not B then not A" are exactly equivalent. F. DINKINES, *INTRODUCTION TO MATHEMATICAL LOGIC* (1964).