BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

# Assessing The Impact Of Federal And State Taxes On The Domestic Minerals Industry

Federal and State tax codes contain significant special considerations for the minerals industry. In light of current concerns over budgetary resources and the continued availability of domestic mineral supplies, it is important that the impact of pertinent tax provisions be understood.

This report explores one quantitative method for assessing the effects of Federal and State taxation on the profitability of domestic mineral operations. Recommendation is made regarding a new institutional mechanism to assure that the effects of taxation are consistent with our national minerals policies.




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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report presents a quantitative method to assess the effects of Federal and State taxes on the profitability of domestic mines and mineral deposits and the attendant implications for domestic mineral production. The report encompasses three Federal tax provisions and three State tax provisions for four minerals produced in nine States. In all, 80 domestic mines and deposits are included.

This is the first time that such a broad, yet specific, quantitative assessment of mineral tax policy has been available. Better understanding the effects of both Federal and State tax actions is especially important given heightening congressional interest in increasing the self-sufficiency of U.S. minerals supplies and in view of the growing attention towards State taxation of energy and mineral resources in relation to Federal policies and objectives. The results of this report can be used, as well as further developed, to assist critical tax policy judgements.

Copies of the report are being sent to the Secretaries of the Interior and the Treasury, the Director of the Office of Management and Budget, the Governor of each State, the Advisory Commission on Intergovernmental Operations, and the chairmen of various congressional committees and subcommittees.

Milton J. Socolar

Acting Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

# ASSESSING THE IMPACT OF FEDERAL AND STATE TAXES ON THE DOMESTIC MINERALS INDUSTRY

## D I G E S T

### BACKGROUND

During the 1970s the domestic minerals industry experienced a severe and prolonged downturn leading to concern about its financial health. Contributing factors included the cost of implementing environmental programs, the increase in debt for many firms that previously had relied primarily on equity financing, and competition from foreign producers, often subsidized by their governments, that led to depressed world mineral prices. Industry experts and others in Government believed that the poor financial condition of U.S. mineral producers could have serious implications for domestic mineral supply, which in turn has implications for the Nation's security and economic well-being. (See p. 1.)

One means by which the Federal Government and the States affect the economic and financial condition of the domestic industry is through the tax system. GAO found that sufficient analysis has not been undertaken to determine the effect that various Federal and State tax provisions, even those specific to the mineral industry, might have on domestic mineral supply. (See pp. 1 and 2.)

Understanding these effects is especially important given heightening congressional interest in increasing the self-sufficiency of U.S. minerals supplies, and in view of the growing attention toward State taxation of energy and mineral resources in relation to Federal policies and objectives. GAO's work in this report represents an initial effort to develop a method to quantitatively assess the effects that Federal and State taxes might have on the profitability of domestic mines and deposits and their influence on domestic mineral production, investment, and exploration. These results can be used, as well as further developed, to provide information for critical policy

judgments relative to resource tax policy. (See p. 4.)

On the Federal level, GAO analyzed the depletion allowance, the investment tax credit, and the provision for expensing exploration and development costs. (See chapter 2.) Property, severance, and income taxes were analyzed on the State level. (See chapter 3.)

In seeking to develop a method for measuring the impact of Federal and State taxes on domestic mineral profitability, production, and investment, GAO used, with modifications, a computer model developed by the Bureau of Mines. The model calculates net present values and discounted cash-flow rates of return for currently producing mines and for undeveloped deposits. (See p. 3 and appendix II.)

GAO's analysis was performed on four mineral commodities. Copper, lead, zinc, and molybdenum were selected because the United States is a competitive producer of these minerals. These minerals are also important to the Nation's economy; they contribute $2.6 billion toward the gross national product and provide employment for 65,000 people. (See p. 3.)

A total of 80 mining properties in nine States were involved in the analysis. Of the total properties, 51 are producing and 29 are potential mineral producers. (See appendix I.) The producing mines accounted for 95 percent of domestic copper production during 1978. The producing molybdenum mines, together with by-product production (usually from copper), accounted for all 1978 domestic production. The lead and zinc mines analyzed represent 81 percent of 1978 domestic lead production and 48 percent of domestic zinc production.

GAO believes that the model development and analysis described in this report is a substantial step forward in terms of improving the tools and information available to the Congress and to State legislatures in mineral and tax policy deliberations. However, the work is by no means complete. The model has significant uses but it also has substantial limitations. The limitations are recognized, as appropriate,

throughout the report and are summarized in chapter 4 and appendices I and II. Because of these limitations, GAO cautions explicitly against any attempt to use this initial work as a basis for definitive policy judgments. At the same time, however, the report explains why further refinement of data bases and methodology are warranted.

FEDERAL TAXES

Many provisions of the Federal tax code affect the domestic minerals industry. Among the more important are the depletion allowance, the investment tax credit, and the expensing privilege for exploration and development expenditures. (See p. 5.)

Percentage depletion is the most basic Federal mineral tax provision. Its development was evolutionary and complex. (See p. 5.) Initially, most of the arguments surrounding percentage depletion were based on ideas of tax equity or tax simplicity. Since the 1950s, however, percentage depletion has been viewed by both supporters and opponents more in terms of achieving mineral policy rather than tax policy. (See pp. 5 and 6.) Percentage depletion is viewed by an official of the Department of the Treasury as an inefficient subsidy to domestic mineral production (see p. 12), by the Department of the Interior as a part of the market system that works adequately in meeting our Nation's mineral supply needs (see p. 13), and by the American Mining Congress as a time-proven tax incentive for capital funds for the industry. (See p. 12.) GAO accepts the view that percentage depletion should be an incentive to mineral production and investment. As such, GAO believes that percentage depletion should be considered from the perspective of mineral policy rather than tax policy.

Sufficient quantitative studies have not been performed to analyze the effectiveness of percentage depletion as an incentive for mineral production, investment, and exploration. Nor has there been significant analysis on the investment tax credit or on the tax benefits to the minerals industry through the expensing

of exploration and development costs. (See pp. 13 and 14.)

The National Materials and Minerals Policy, Research and Development Act of 1980 (P.L. 96-479) establishes the Executive Office of the President as the locus for, among other things, materials (including minerals) policy decisions and analysis and assigns it certain responsibilities, such as assessing Federal policies, including tax policies, on all stages of the materials (minerals) cycle. Even though the Congress recognized that the Department of the Interior has played a traditional leadership role in mineral policy issues, it went on to designate the Executive Office of the President as the focal point for policy development and coordination. By October 21, 1981, the President must develop a program plan indicating which entity within the Executive Office is responsible for policy analysis and decisionmaking. (See pp. 13 and 14.)

GAO is unaware of any formal Presidential assignment of responsibility for implementing the 1980 Act to any particular organization in the Executive Office. Because the assessment recommended in this report is important, GAO does not believe it should be delayed until the institutional structure for implementing the 1980 Act is in place. Given its traditional role in the minerals policy area, GAO believes the Department of the Interior, building upon the analysis presented in this report, should take the lead in assessing the effect of various tax provisions in encouraging domestic mineral production, investment, and exploration. As soon as the President has made clear which Executive Office organization has responsibility for the 1980 Act, the Secretary of the Interior should inform the head of that organization of the progress and nature of the study and invite any assistance in its completion and evaluation. (See pp. 13 and 14.)

GAO's analysis indicates that, for the 51 producing facilities, 97 percent of depletion allowance-tax expenditure benefits accrue to mines which would be profitable even in the absence of this incentive. Only a small percentage of the benefits go to marginal mines

which might not produce otherwise. (See pp. 21 to 23.) By profitability category such changes in the depletion allowance as increasing or removing the net income limit or lowering the statutory rates do not alter the distribution of benefits in favor of marginal mines, primarily because of the manner in which the allowance is computed. GAO's analysis does show, however, that modifications could be applied which would increase the benefits of the allowance to marginal mines and could result in increased production. (See p. 37 and 38.)

The investment tax credit also provides tax expenditure benefits to the mineral industry. While not an industry-specific tax provision, the credit does increase the present value of profitable mines and some deposits according to the analysis. It has little or an insignificant effect on unprofitable ones because they have no Federal tax liability against which the credit might be applied. (See p. 45.) The model results show that 34 percent of the available investment tax credit cannot be used by domestic copper, lead/zinc, and molybdenum mines. If this unused portion were refunded, most of it would benefit marginal and unprofitable mines. (See pp. 47 and 48.)

The present model is not capable of determining whether the credit rewards production that would have occurred regardless or whether it encourages new investment. While the credit may not be large enough to encourage investment in new capacity, it may alter the mix of labor and capital used at a specific mine and hence lead to more or less efficient production. Changes in various provisions of the credit, such as the carry-over period, had little effect on domestic mines and deposits. (See pp. 45 and 46.)

Some exploration and development costs may be deducted as current expenses instead of being capitalized and deducted over the life of a mine. Exploration costs that are deducted currently must be recaptured when the mine begins production. Most deposits benefit from this expensing provision for

exploration costs. (See pp. 50 and 51.) Only the economically profitable deposits would benefit if they were required to expense from the development costs. (See pp. 52 and 53.) The tax expenditure costs of these provisions are low relative to those of percentage depletion and the investment tax credit.

STATE TAXES

State tax actions can have a significant effect on the profitability of the domestic mineral industry and on the level of domestic mineral production. The State tax burden is a substantial portion--40 percent--of the total taxes paid by all mines in this study. (See p. 54.) In order to obtain stable revenue streams or for other purposes, States sometimes enact taxes that may discourage efficient mineral production. (See p. 62.)

Adequate analysis has not previously been undertaken to determine the effects that State taxes have on mineral production and investment decisions. (See pp. 62 and 63.) In this analysis, GAO found that changes in the bases, rates, and timing of State taxes can significantly affect the present value of producing mines and the investment potential of nonproducing deposits. (See pp. 63 and 64.)

Given the critical interaction of Federal mineral policy, State tax policy, and the profitability of domestic mining, GAO believes that new institutional means should be considered to assure that tax policies are compatible with national mineral production objectives without obstructing the rights of various governmental levels to levy and collect taxes. (See p. 80.)

GAO believes the Federal Government could assist the States in their formulation of appropriately sensitive mineral tax policy by providing information to them on Federal mineral policies and providing analytical capabilities to the States for their use in assessing the effect that

proposed tax changes would have on mineral production, development, and exploration. (See p. 80.) There are several possibilities as to who might take the lead in this regard, including

--the Department of the Interior with assistance from the Treasury Department;

--the Advisory Commission on Intergovernmental Relations; or

--a new, appropriately designed institutional mechanism. (See p. 80.)

GAO has not assessed these institutional alternatives, and believes that the States should first have an opportunity to review the content of this report and express themselves regarding the suggested continuing liaison function. GAO plans to invite each State, through its Governor, to comment on the final report. (See p. 80.)

RECOMMENDATIONS

Because (1) the President has not yet formally designated an organization within the Executive Office of the President to implement the 1980 Act (P.L. 96-479), (2) the study is important to the development and implementation of Federal minerals policy, and (3) the Department of the Interior has been the traditional leader in the area of minerals policy, we believe it is appropriate that the Secretary of the Interior now take the lead in developing and refining a framework to quantitatively analyze the link between taxes and mineral policy, and report to the Congress on his findings. At such time as the President formally designates an organization within the Executive Office to be responsible for policy assessments under the 1980 Act, the Secretary of the Interior should inform the head of that organization of the progress and nature of the Interior study and invite any assistance in its completion. When completed, the study could be used by such an organization in its policy analysis and decisionmaking functions. (See p. 86.) Interior's studies should include:

--A broadening and sharpening of the analysis of percentage depletion presented herein. The analysis should be broadened to include the 23 critical minerals included in the Bureau of Mines Minerals Availability System data base and eligible for percentage depletion. It should be sharpened to reduce the uncertainty in the major assumptions, especially those relative to cost, price, and the treatment of each mine as a separate taxpayer. Sensitivity analysis should be performed to determine the importance of the assumptions to the results. This analysis should be neither an opposition to nor support of percentage depletion, but rather, it should objectively examine the effectiveness of percentage depletion as a tax incentive for production, investment, and exploration.

--A more refined analysis to determine the effects of the proposal to refund the unused portion of the investment tax credit. Given that a substantial portion of the investment tax credit is unused, and the beneficiaries of refunding unused credit would be marginal and unprofitable mines, further attention should be paid to this type of refund as a way to stimulate production at marginal mines and to provide a source of funds for mineral exploration and development.

--Further work on the provisions for expensing exploration and development costs. This should include an analysis of the effect of the recapture provision for exploration costs on the profitability of domestic deposits. (See pp. 85 and 86.)

The Secretary of the Interior, in making this assessment, should consult with the Secretary of the Treasury, so that Treasury's Office of Tax Analysis can contribute its knowledge of the tax code and its expertise in tax analysis. The review should also include an examination of alternative tax policy approaches which might be more effective than those currently in place. (See p. 86.)

## MATTERS FOR CONSIDERATION BY THE CONGRESS

### Federal taxes

The analysis reflected in this report is the first step in determining the effectiveness of percentage depletion and other tax provisions for exploration and production. More work needs to be done to examine the effects that various provisions have on the incentive and source of funds for increasing domestic reserves and supplies.

GAO is recommending to the Secretary of the Interior that this initial work be broadened and sharpened to assist in congressional decisionmaking on national self-sufficiency and other critical minerals policy issues. The Congress should exercise close oversight of Interior's effort on the recommended study. (See p. 86.)

### State taxes

Given the critical interaction of Federal mineral policy, State tax policy, and the profitability of domestic mines, GAO believes that institutional means should be considered for better harmonizing tax policy with national mineral production objectives.

GAO will be ready to assist the Congress in further examination of the issue at an appropriate future date and following consideration by State governments of this report. (See p. 86.)

## AGENCY COMMENTS

### Department of the Interior

The Interior Department agrees that there are elements of the existing U.S. tax code that have particular bearing on minerals productivity and hence minerals policy. Some tax provisions, such as depletion allowance, are unique to the mineral industry; others, such as the investment tax credit, not restricted to the minerals industry, are also of particular importance.

Interior recognizes the responsibility for its involvement in more detailed examination of the relation of minerals and tax policies. (See p. 87.)

The Department of the Interior also made several comments on report detail. (See p. 87.) A complete copy of Interior's comments is included in appendix IV.

Department of the Treasury

Although the minerals-specific provisions of the tax code involve primarily mineral policy questions and, as such, are under the purview of the Interior Department, GAO provided the Department of the Treasury an opportunity to comment on the draft report. (See p. 87.)

The Treasury Department agrees with GAO's conclusion that the impact on mineral policy is the key consideration and that Federal tax laws have been used to influence domestic mineral production in significant ways. It also agrees that the report is aimed toward the right set of questions, namely, how have the tax subsidies provided through the Federal tax system increased the domestic output of minerals and at what budgetary costs. However, although the Treasury Department would endorse and enthusiastically support the recommendation that the Interior Department take the lead in organizing the systematic analysis and empirical estimation of the output effects and budgetary costs of the mineral tax subsidy program, it questioned the utility of GAO's analytical framework and empirical methodology as a model for such a study effort. (See pp. 87 to 90 and appendix V.)

GAO disagrees with Treasury's position and believes its approach is a useful starting point for examining the impact of taxes on the minerals industry. (See pp. 87 to 90.)

| | |
|---|---|
| Percentage depletion | Statutory allowance expressed as a specified percentage of gross income from mining but limited to 50 percent of net income. |
| Producing property | An operating mine. |
| Unprofitable | A measure of profitability when the internal rate of return equals zero percent. |

## GLOSSARY

| | |
|---|---|
| Allowable depletion | The tax deduction which is the larger of percentage or cost depletion. |
| Cash flow | Net income after taxes plus depreciation and depletion minus capital expenditures. |
| Cash flow analysis | A method used to determine the potential economic viability of a proposed venture by relating the annual expenditures associated with the investment to the subsequent annual revenues or benefits generated from the investment. |
| Constant dollars | Actual dollar amounts not affected by price level changes and maintained at their base-year level. |
| Cost depletion | A deduction to recover the investment in a mine in relation to the production and sale of minerals from the mine. |
| Current dollars | Actual dollar amounts not corrected for changes in the price level. |
| Discounted cash-flow rate of return | A rate that equates the present value of costs and the present value of benefits. Synonomous with internal rate of return. |
| Discounting | Process of finding the present value of a series of future cash flows. |
| Discount rate | The rate at which future cash flows are discounted to calculate present value. |

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|---|---|
| Economically profitable | A measure of profitability when the internal rate of return is above 18 percent. |
| Financially profitable or marginal | A measure of profitability when the internal rate of return is between 0 and 18 percent. |
| Hurdle rate | The minimum rate of return at which a nonproducing deposit would start operations. In this we assumed an 18 percent real after-tax rate of return as a hurdle rate. |
| Impact analysis | A method of making a before-and-after comparison of information to obtain a discrete measure of a change by allowing one variable to change and keeping all others constant. |
| Internal rate of return | The rate of return on an asset investment. It is calculated by finding the discount rate that equates the sum of the present value of future cash inflows (benefits) to the sum of present values of future cash outflows (investment) for an investment opportunity. |
| Net income | Total revenues less mining expenses and taxes. |
| Net present value | Difference between present value of benefits and present value of costs. This statistic is a dollar figure which will be positive when actual return on investment exceeds the discount rate and negative when it does not. |
| Nonproducing deposit | Tracts of land with a known mineral deposit but no mine in place. They are potential producers. |
| Opportunity cost | Rate of return on the best alternative investment that is available. |

# Contents

## ABBREVIATIONS

| | |
|---|---|
| GAO | General Accounting Office |
| NPV | Net Present Value |
| OMB | Office of Management and Budget |

# CHAPTER 1

## INTRODUCTION

This report attempts to develop a method of analyzing the effects that Federal and State taxes have on the profitability of domestic mines and deposits and their influence on domestic production.

This study was initiated at a time when there was widespread concern about the financial health of the minerals industry. Like most industries, the minerals industry goes through periods of high and low profitability. In 1975 industry profits decreased dramatically from the high levels achieved in 1973 and 1974 and remained at low levels through 1978. This downturn was more severe and more prolonged than any the industry had experienced in the past 50 years. Some of the major factors contributing to this profitability problem were the cost of implementing environmental programs and the increase in debt as a percentage of total capitalization. Also, competition from foreign producers, who are often subsidized by their governments, led to depressed world mineral prices.

The profits of mineral-producing firms increased sharply in 1979 and the first quarter of 1980. This increase was due primarily to increases in the price of base metals and their attendant by-products. Much of these price increases are attributed to speculative reaction to world political affairs, and industry officials and investment analysts do not expect the high prices to remain.

Previous GAO reports 1/ have identified a wide range of problems related to future materials availability, and a stable minerals supply is of growing concern. One means available to the Federal Government and to the States to achieve specific mineral policy goals is the tax system. Although the Treasury Department has questioned the use of taxes, specifically tax expenditures, as a policy instrument, taxes are nonetheless part of the business environment faced by mineral producers. A 1975 study by Coopers and Lybrand, a major accounting firm, disclosed that taxes in the United States on mining operations were higher than those in most other industrial countries. For the most part, sufficiently detailed information has not been available to the Congress and to the States to assess the impacts that Federal and State tax provisions, even those specific to the minerals industry, have had on domestic mineral supply.

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1/ "Need to Develop a National Non-Fuel-Minerals Policy" (RED-76-86, July 2, 1976); "Learning to Look Ahead: The Need for a National Minerals Policy and Planning Process" (EMD-79-30, April 19, 1979); and "The U.S. Mining and Mineral Processing Industry: An Analysis of Trends and Implications" (ID-80-04, October 31, 1979).

We recognize that tax incentives are not the answer to all domestic mineral supply problems. For example, tax benefits for domestic production would do little to encourage production of such minerals as cobalt and chromium for which the United States has few and relatively high cost reserves. But we believe that tax policy can have an important impact on the domestic supply of such minerals as copper, lead, zinc, and molybdenum for which the United States is a competitive producer. For minerals such as these, changes in U.S. production costs due to our tax policy could significantly affect the profitability of U.S. mining ventures and could result in increased production. Neither tax nor mineral policymakers have as yet, however, analyzed the effects of taxes on mineral profitability and production.

## CRITICAL FEDERAL TAXES

The most important Federal taxes relative to the mining industry are depletion allowances and the treatment of the difference between percentage and cost depletion as a tax preference item in minimum tax calculations, the investment tax credit, and the expensing and recapture provisions for exploration and development costs. One purpose of this report is to examine the relative importance of these Federal tax provisions to the mineral industry, and to determine what needs to be done to provide the Congress with improved information for formulating appropriately sensitive tax and mineral policy. As shown in the record of previous congressional tax policy debates concerning the depletion allowance, for example, and in the conflicting recommendations of materials policy study groups, such information, although sorely needed, was not available.

## CRITICAL STATE TAXES

On the State-level, severance, property, and income taxes impact on mineral production and investment decisions. A State tax policy that includes high tax rates, high taxes early in the life of a project, or otherwise discourages the full extraction of minerals could curtail mineral production and investment. State taxes could also reduce exploration efforts. For such a mineral as copper where one State--Arizona--produces 65 percent of the primary domestic supply, State tax actions could have a significant impact on its availability.

State tax policy is important in its own right and, to date, no comprehensive study has been undertaken to examine the effects of various State tax policies on different financial classes of mineral producers. In addition, many States have not been adequately informed about Federal minerals policy as expressed in the Mining and Minerals Policy Act of 1970 (30 U.S.C. 21a), the National Materials and Minerals Policy, Research and Development Act of 1980 (P.L. 96-479), and other legislation. State tax policy and its effect on mineral production was totally disregarded in the Nonfuel Minerals Policy Review recently accomplished

by the Executive Branch. Adequate information and analytical capability have not been available to the States to assist them in evaluating the effects of alternative taxing schemes on mineral production, development, and exploration. Another purpose of this report is to provide information to help fill this gap.

## OBJECTIVES, SCOPE, AND METHODOLOGY

We performed our analysis on four commodities in order to determine the effect that tax provisions have on different sectors of the mining industry. We selected copper, lead, zinc, and molybdenum because the United States is a competitive producer of these minerals. These minerals are also important to the Nation's economy, contributing $2.6 billion towards the gross national product and providing employment for 65,000 people.

After discussions with individuals having a variety of expertise related to mining, investment modeling, and tax policy from industry, academia, and economic and computer modeling organizations, we found no one model currently available that would enable us to measure all the impacts that Federal and State taxes have on these four industries. In order to develop a complete industry model for each commodity which included primary and secondary markets, imports and exports, and international pricing mechanisms, it would require the combined efforts of a team, probably including tax and investment specialists, geologists, metallurgists, mining engineers, production engineers, economists, and environmentalists. We were unable to obtain firm estimates as to the length of time or the cost of developing a fully detailed model. However, the consensus was that the time required for such an endeavor could be in the neighborhood of 6 months to 1 year for each mineral and could conservatively cost in excess of $1 million.

The Bureau of Mines Minerals Availability Field Office in Denver, Colorado, had developed a MINSIM 4 model for evaluating mineral deposits financially. Although not a complete market model, this model could be used to help examine the effects of taxes on profitability and investment. The Bureau of Mines agreed to allow GAO use of the model and helped modify it to meet our needs. With this model, we were able to take the initial step in quantitatively assessing the impact of taxes on the mineral industry.

This review entailed a high degree of collaboration between GAO and the Bureau of Mines. The Bureau provided us with its knowledge and support throughout our modeling effort. The Bureau's Denver office spent considerable time modifying the model so that we could use it without compromising the proprietary nature of the Bureau's data base. The Bureau incorporated State tax routines and the Federal minimum tax calculation in the model to meet our requirements and provided us training and computer access. The Bureau also worked on the

lead, zinc, and molybdenum data bases so that the information would be available for our study. In short, the Bureau of Mines' cooperation and assistance were outstanding.

We believe that the model development and analysis described in this report is a substantial step forward in terms of improving the tools and information available to the Congress and to the State legislatures in mineral and tax policy deliberations. However, this work is by no means complete. The model has significant uses but it also has substantial limitations. The methodologies employed for assessing the impacts of various taxes are discussed in the following chapters. The model structure, the data base, and their limitations are discussed in appendixes I and II.

The chapters of this report are structured to discuss the many facets and interrelationships of Federal and State taxes and their effect on mining profitability. The chapters focus on:

--Federal taxes including the depletion allowance, the investment tax credit, and expensing exploration and development costs.

--State taxes including property, severance, and income taxes.

We performed our work at the central offices of the Departments of the Interior and the Treasury in Washington, D.C., and at the Interior Department's Bureau of Mines in Denver, Colorado. We also performed work in Arizona, Colorado, Montana, Missouri, New Mexico, New York, Nevada, Tennessee, Utah, and Wisconsin so we could learn about their tax provisions and incorporate them into the model. We met with investment bankers and corporate mining officials and reviewed congressional hearings, reports, testimony, and trade publications that pertained to mineral issues.

While this review was in progress, Montana enacted legislation and has other legislation under consideration which could impact on the feasibility of future minerals development. During the same period, some State tax actions relative to energy resources also came to command prominent attention. The Supreme Court has taken two such cases under consideration, one involving the impact of State severance taxes on interstate commerce of coal. Similarly, the Senate is deliberating legislation which would place a ceiling on State severance taxes imposed on coal mined on Federal lands. In the past, the Bureau of Mines has used a discounted cash flow methodology to evaluate the economic potential of coal properties on Indian lands. With some modifications and refinements and with the inclusion of relevant data, the model used in this report could be applied to determine the economic or financial effects of increases or changes in State taxes on existing and potential domestic coal mines. The results would aid deliberations on energy resource taxation issues.

# CHAPTER 2

# FEDERAL TAXES: THEIR IMPACT ON THE MINERAL INDUSTRY

Many provisions of the Federal tax code affect the domestic minerals industry. Among the most important are the depletion allowance, the investment tax credit, and the expensing privileges for exploration and development expenditures. Percentage depletion is the most debated Federal tax provision relative to minerals. In addition, it is widely thought to be the most important incentive the tax system provides for mineral investment and production.

The investment tax credit, while not specifically a mineral tax provision, is also important to the industry. Changes in the tax credit are cited by mining officials as a means to increase profitability.

Expensing privileges for exploration and development costs are less important to producing mines than to nonproducing deposits. Nonproducing deposits can take advantage of these privileges to minimize the Federal tax bill when the deposit is brought into production.

This chapter reviews the history of these provisions and examines current perceptions of their objectives. The results of a discounted cash flow model are used to analyze the effect of these provisions on the profitability of selected domestic mines and deposits and the potential implications for domestic production.

## HISTORY OF THE DEPLETION ALLOWANCE

Since 1913, the Congress has provided some type of tax deduction for the depletion of natural resources. Under the Revenue Acts of 1913 and 1916, a depletion allowance was provided that, according to some sources, amounted to a form of accelerated depreciation since total deductions could be used before a mine ceased production. Discovery depletion, based on "discovery value," was enacted in 1918 and, by allowing the taxpayer to adjust the original basis, allowed deductions in excess of actual investment.

Many difficulties arose in the administration of discovery depletion. In 1926, a Senate Select Committee reported that the depletion allowances were generally excessive and often arrived at by bargaining with individual taxpayers, and grossly discriminated against individual taxpayers and against different minerals. Another objection raised in the Committee report was that the allowance was not limited to new discoveries, hence large companies rather than small wildcatters were primarily

benefiting from the deduction. To eliminate the problems inherent with discovery depletion, percentage depletion was introduced in 1926. The Senate proposed adoption of percentage depletion for oil and gas wells at a 30-percent gross income rate. In conference, the rate was reduced to 27.5 percent. This amount was enacted into law and remained in effect until 1969.

Adoption of percentage depletion for minerals was urged in congressional hearings beginning in 1928. At these hearings, the American Mining Congress testified that a 15-percent rate represented an actual average of depletion deductions that had been allowed under the discovery depletion. In 1932, percentage depletion was extended to all metals at a rate of 15 percent, to sulfur at 23 percent, and to coal at 5 percent. Percentage depletion was extended to 4 other nonmetallics in 1942 and 10 additional nonmetallics in 1943. The 1943 extensions were granted with the understanding that these additions were strictly for the purpose of aiding the war effort and would expire at the end of the war. In 1947, however, the temporary allowances were made permanent and percentage depletion was extended to other minerals.

An extensive list of minerals was proposed for percentage depletion allowances in 1949 and 1950, but legislation was temporarily halted by the need to raise revenue for the Korean War. In 1951, the allowance for coal was raised to 10 percent and a 5 percent allowance was granted to minerals including sand, gravel, slate, and oyster and clam shells; allowances of 10 and 15 percent were granted to other minerals. In 1954, when the entire tax code was revised, percentage depletion was granted to "all minerals" except those from such "inexhaustible sources" as the air.

The first reduction in depletion allowances occurred with the Tax Reform Act of 1969. The maximum rate was lowered from 27.5 to 22 percent for lead, zinc, sulfur, uranium, and other U.S. deposits. Minerals previously allowed 15 percent were lowered to 14 percent except for gold, silver, copper, iron ore, and oil shale which remained at 15 percent. The allowance for molybdenum was increased from 15 to 22 percent. Percentage depletion was eliminated for most oil and gas production in 1975. Current statutory rates for minerals are given in appendix III.

The minimum tax was introduced in the Tax Reform Act of 1969. The House version of the bill called for a provision to reduce the ability of individuals to escape payment of taxes by providing a limit on tax preferences. Percentage depletion was not considered a tax preference item. The Senate bill, however, applied a minimum tax to individuals and corporations alike and included excess depletion as a tax preference item. The law as enacted provided for a 10-percent tax for individuals and corporations alike on preference items. An amount equal to $30,000 plus the taxpayer's regular income tax for the year was exempt from the minimum tax. The excess of percentage depletion over the cost basis of the property was included as a tax pre-

ference item. The Tax Reform Act of 1976 raised the minimum tax rate to 15-percent and decreased the exemption for corporate taxpayers to an amount equal to the greater of $10,000 or the regular income taxes.

## CONFLICTING CONTENTIONS ABOUT THE OBJECTIVES OF PERCENTAGE DEPLETION

From its inception in 1926 through the 1940s, percentage depletion was viewed primarily as a "tax policy" device. Initially, most of the arguments surrounding percentage depletion were based on ideas of tax equity or tax simplicity. During the 1950s, percentage depletion began to be viewed by both supporters and opponents more as a mineral policy instrument--an incentive for mineral investment and production--than as part of tax policy.

Percentage depletion for metals was initially supported on the grounds that it provided a simple, equitable, and definite method of computing the depletion allowance that permitted prompt and final payment of tax liability. In addition, proponents of percentage depletion testified that discovery depletion had discriminated against small operators.

The Treasury Department opposed percentage depletion and so testified in 1933, 1937, and 1942. Treasury's opposition was on the grounds that those entitled to percentage depletion were recovering more than the full cost of their properties. During the 1942 hearings, Tresury recommended complete elimination of percentage depletion, but realizing that this would not be done, suggested alternative proposals. Treasury's reasoning was as follows:

> "***Tax incentives for stimulating desirable industrial developments can be justified only if they are effective in terms of their cost to the public. Accordingly, if it is desired to continue tax incentives to encourage discoveries in mining properties, such incentives should be denied properties that will be developed in the ordinary course of extending the recovery of known commercially profitable mineral deposits.***"

The Treasury proposals were rejected.

President Harry S. Truman also opposed percentage depletion. In a message to the Congress in 1950, he stated:

> "I know of no loophole in the tax law so inequitable as the excessive depletion exemptions now enjoyed by oil and mining interests.* * * I am well aware that these tax privileges are sometimes defended on the grounds that they encourage the production of strategic minerals. It is true that we wish to encourage such production. But the tax bounties distributed under present law bear only a haphazard relationship

> to our real need for proper incentives to encourage the exploration, development, and conservation of our mineral resources."

Concern over the adequacy of U.S. mineral supply led to the establishment by President Truman of the Materials Policy or Paley Commission in 1951. Among other things, the Paley Commission examined the question of minerals tax policy. In this regard, the Commission's focus was on the effects that existing tax arrangements had on encouraging private business to explore, develop, and produce in response to the Nation's mineral needs, and what changes in the tax structure would make it more effective.

The Commission considered percentage depletion as a device that provided a special incentive for the minerals industry. Although previous proponents had mentioned one attribute of percentage depletion to be encouragement of production from U.S. mineral resources, and Treasury had suggested that percentage depletion be judged on its effectiveness as a mineral production incentive, this was the first time that percentage depletion was examined as part of a system of mineral incentives rather than as part of the tax system.

A study done for the Commission addressed the nature and evolution of percentage depletion, the revenue effects, and nature of the incentive it provided. The study concluded that:

> "* * * the tax benefits tend to concentrate very heavily in the hands of the relatively successful members of the industries in which percentage depletion is used.
>
> The increased profits after taxes which remain in the hands of such relatively successful producers increase the attractiveness of the industry to new investment."

The implication here, that percentage depletion can be justified on this basis, conflicts with Treasury's view that to be effective in terms of cost to the public, percentage depletion should be denied to properties that would be developed without this incentive.

The Commission was persuaded that percentage depletion was a forceful incentive for exploration and development of minerals; however, the Commission thought that the role of percentage depletion as an incentive implied a need for being highly selective in its application to various minerals. The Commission was impressed by the extreme difficulties of adjusting this tax device with appropriate precision to individual mineral situations. It felt that the incentive rate for any mineral should be set in relation to other minerals and to nonmineral industries to bring about the "***desired balance between investment in that domestic industry and others, along with the desired balance between domestic output and the imports of this mineral." The Commission was also aware

of the strong tendency of special tax incentive devices to spread far beyond the area of original intent and justification, particularly in such instances as this one, where it is difficult to assess the precise economic needs for, and consequences of, the incentive. The Commission believed that application of the percentage depletion allowance should be confined to those minerals for which the hazards of exploration were great. The Commission recommended:

> "That percentage depletion be retained because of its strong inducement to risk capital to enter the mineral industries but that the rates now provided in the Internal Revenue Code be raised no further."
>
> * * * *
>
> "That Congress reconsider recent additions to the list of materials now subject to percentage depletion in light of the principles stated above."

In the early 1950s, several other studies examined percentage depletion in terms of its importance for mineral supply. The depletion allowance was seen as an important incentive for mineral production, but there was no consensus about the magnitude of the incentive needed or its effectiveness. No quantitative work was done to address these issues.

Unlike their predecessors, the Secretaries of the Treasury during the Eisenhower administration supported percentage depletion and, hence, some of the controversy was quieted. In 1959, the house Ways and Means Committee held panel discussions on mineral taxation. Supporters of percentage depletion defended it as an incentive to mineral production.

President John F. Kennedy spoke favorably about the depletion allowance during the 1960 campaign:

> "***The depletion allowances *** should be considered primarily as a matters of resource policy and only secondarily as a tax issue. Its purpose and its value are first of all to provide a rate of exploration development, and production adequate to our national security and the requirements of our economy***."

When percentage depletion was reduced in 1969, the House Report contained justification for these changes:

> "* * * even if percentage depletion rates are viewed as a needed stimulant at the present time they are higher than is needed to achieve the desired beneficial effect on reserves.

The retention of the 15 percent rate for gold, silver, copper, iron ore, and oil shale was also explained as providing "*** a proper balance between the need to encourage exploration and the discovery

of the new reserves on one hand and the revenue cost involved on the other hand." There is no evidence in the legislative history of the 1969 act that any quantitative information was available to the Congress to balance the benefits and costs of percentage depletion as a mining incentive.

The National Commission on Materials Policy was established by the National Materials Policy Act of 1970 to develop a national materials policy. In its 1973 report, the Commission recommended that:

> "* * * the Congress continue the percentage depletion provisions of our tax laws as a time-tested major incentive to discovery and development of mineral resources. These provisions should not be further reduced unless and until a better incentive system can be developed."

The Commission's report contained no evidence of any work done to determine the effectiveness of percentage depletion. The report merely stated that:

> "The traditional means of providing this stimulation [for exploration] has been through the substitution of percentage depletion for cost depreciation [sic] in the tax structure * * *."

The National Commission on Supplies and Shortages was created by the Congress in 1974 in response to concerns about resource exhaustion, growing U.S. dependence on imported materials, the adequacy of Government mechanisms for dealing with materials problems, and the ability of market mechanisms to deal with shortages. In its 1976 report, the Commission recommended elimination of percentage depletion. The report stated that:

> "In absence of compelling evidence for its continuation, the Commission recommends the repeal of the percentage depletion allowance for minerals; the Commission opposes the creation of new tax subsidies for the consumption of recycled materials."

Several members of the Commission qualified this recommendation by stating that:

> "Repeal of the percentage depletion allowance would improve economic efficiency by eliminating an artificial bias toward virgin material use, but would raise the effective corporate tax rate. Repeal of percentage depletion should be accompanied by a compensating reduction in general corporation income tax rates sufficient to offset the revenue effect of removing the depletion allowance * * *."

This Commission examined percentage depletion and the role it had in promoting the use of virgin rather than recycled materials. Although the Commission believed that not enough evidence supported the contention that repealing percentage depletion would increase recycling, it believed that the evidence supporting its continuation was even weaker. With regard to the mineral industry's argument that the continuation of percentage depletion protects the national interest in an assured supply of minerals, the Commission believed that this cost, which it termed, "substantial," should be measured against the costs of other methods of preventing the disruption of supply. Although the Commission did not perform any independent studies of depletion, it did seek quantitive answers elsewhere. In a letter to the Assistant Secretary of the Interior for Energy and Minerals, the Commission asked:

> "What is the country getting in exchange for an annual revenue loss to the Treasury of $850 million and a modest disincentive to recycling? Specifically, if * * * a principal impact of the depletion allowance is a reduction in dependence on foreign sources, how large is this reduction? If, * * * future supply would be reduced by repeal of the depletion allowance, how big would that reduction be? * * *."

The Department of the Interior made an effort to answer these questions but found that the available data was insufficient to make the quantitative estimates. Although Interior stated that it was initiating analytical work on these questions, and a report would be forthcoming, to date no such report has been issued. Notwithstanding the difficulty in quantitative justification, it was the firm judgment of the Assistant Secretary that the depletion allowance was fully justified.

In 1978, a Nonfuel Minerals Policy Review was initiated by the Executive Branch. One of the problem areas to be studied was, "financing, capital formation and tax policies." The Treasury Department was the lead agency in this problem area. The draft "Report on the Issues Identified in the Nonfuel Minerals Policy Review," makes little mention of mineral tax policies. Regarding taxes, the report states:

> "In the United States, exploration and development cost expensing and the percentage depletion allowance are considered to be essential by the industry, but are seen as inefficient subsidies by critics."

The report also pointed out that:

> " * * * there is no ongoing coordinating mechanism for assuring the routine and effective involvement of Federal officials with minerals policy responsibility and expertise in the formulation and implementation of tax policy * * *."

No further work related to mineral taxes is planned in conjunction with this review.

The American Mining Congress supports percentage depletion. In its November 1979 testimony before the House Subcommittee on Mines and Mining, a Mining Congress official stated:

> "The percentage depletion allowance constitutes a singular example of a time-proven incentive provided by the tax laws for capital investment in the minerals industry. The cash flow resulting from the allowance has provided an important source of capital funds for the mining industry. The percentage depletion allowance recognizes the vital importance of minerals to our economy and industrial activity."

Treasury concurs in part. Currently, it believes that percentage depletion has nothing to do with tax policy but is a part of minerals policy. A Treasury official stated that percentage depletion is a subsidy to the mineral industry and, as such, it is irrational and inefficient. A Treasury document contends:

> "In effect, the structure of percentage depletion wastes resources as compared with an efficient production subsidy: it discourages exploitation of low-grade minerals."

The effectiveness of percentage depletion as a tax subsidy is heavily influenced by the net income limitation. Percentage depletion is calculated as a specific percentage of gross income from the mine, but it is limited to 50 percent of the net income from the property. Because of this limitation, a marginal mine with lower grade ore and higher production costs, hence a lower net income, gets less of a benefit than does a superior mine with below average extraction costs. Treasury argues that if the mineral industry is to be subsidized, a better way would be to give a subsidy through a direct method, such as on a per-pound basis.

The Department of the Treasury also believes that industry-specific taxes should be the responsibility of the agency with oversight for that industry. A Treasury official stated that the Department of the Interior does not have a handle on the producers who are actually benefiting from percentage depletion. He said that Interior must start to look at the subsidies given the industry, the cost of these subsidies, and whether such subsidies could be given through direct expenditures. He believed that Interior was not concerned with the effects of percentage depletion, because it viewed depletion as a tax issue and Interior was not responsible for tax issues. He said that if any study of depletion were undertaken, Interior should contribute its knowledge of the industry and Treasury its knowledge of the tax code.

## FEDERAL RESPONSIBILITIES FOR MINERALS POLICY

The National Materials and Minerals Policy, Research and Development Act of 1980 (the 1980 Act), P.L. 96-479, aims to establish a coherent national materials policy and coordinated programs to assure the availability of materials critical to the economic well-being, national defense, and industrial production of the United States. It defines the term "materials" to include non-fuel materials and minerals. The Congress considers that notwithstanding the Mining and Minerals Policy Act of 1970 (the 1970 Act), 30 U.S.C. 21a, the United States did not have a coherent national minerals policy.

The 1980 Act mandates that the President, through the Executive Office of the President, (a) coordinate the activities of responsible departments and agencies in the materials area and (b) assume certain specific responsibilities, including assessing Federal policies at all stages of the materials (minerals) cycle, including tax policies. It also assigns several Federal departments and agencies specific responsibilities. Within one year of the date of enactment (Oct. 21, 1980), the President must submit to the Congress a program plan setting forth, among other things, the institutional changes within the Executive Branch necessary to fully implement the Act. One of the minimum elements to be included in the plan is the location of policy analysis and decisionmaking within the Executive Office.

The legislative history of the 1980 Act indicates that the Congress aimed to make the Executive Office of the President the locus of responsibility for coordinating and developing Federal materials policies, rather than to assign it to a particular Federal department or agency. "Elevating the leadership role to the Executive Office of the President should assure that departments and agencies will be permitted to exercise their responsibilities with an oversight of decision and policy coordination provided by the President." 1/

We are unaware of any formal Presidential assignment of responsibility for implementing the 1980 Act to a particular organization in the Executive Office. The Executive Office includes the following: Office of Management and Budget, Domestic Policy Staff, National Security Council, Council of Economic Advisors, Office of Science and Technology Policy, Council on Environmental Quality, Office of Administration, Council on Wage and Price Stability, Office of the Special Representative for Trade Negotiations, and the Intelligence Oversight Board.

Even though the Congress recognized that "the Department of the Interior has been the traditional leader on minerals policy

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1/ Report no. 96-937, U. S. Senate, Sep. 12, 1980, p. 6.

issues," 1/ it went on to designate the Executive Office of the President as the focal point for policy development and coordination. The 1980 Act specifically directs the Secretary of the Interior to act immediately within the Department's statutory authority to attain the goals of the 1970 Act, and the Executive Office of the President to promote the goals of the 1970 Act among the various departments. The 1970 Act made it continuing Federal policy to foster private enterprise in developing mineral resources and industries. The Secretary had the responsibility to (1) implement such a policy in the Department's programs, and (2) include in his annual report to the Congress a report on the state of these private sector activities and recommendations for legislative changes.

Interior's position under the previous administration was that non-fuel minerals policy was best implemented with little or no Government action or intervention in the marketplace. Interior believed that tax incentives such as percentage depletion are consistent with the free market. The former Director of Interior's Office of Minerals Policy and Research Analysis stated that every tax is a distortion and that it is the prerogative of the Congress to grant tax subsidies. He believed that once things like percentage depletion have been around for a long time, they are no longer viewed as subsidies but as rights. He stated further that the former Secretary of the Interior supported percentage depletion, and in absence of information to show otherwise, believed it should be retained.

In 1977, a suggestion was made within the Carter Administration to eliminate percentage depletion for all minerals except some oil and gas production still eligible for percentage depletion. At the time, Interior argued that percentage depletion was not a tax policy issue per se but should be looked at in the context of minerals policy, and hence should be dealt with in the Nonfuel Minerals Policy Review. As noted previously, no study of percentage depletion resulted from that review.

An Interior official stated that a study of percentage depletion would have to be initiated within Treasury or perhaps within the Bureau of Mines. He said that Interior would get involved in such a study but that such a study was not a high priority item in Interior's Office of Minerals Policy Research and Analysis. This office may examine tax incentives in the context of policy options to deal with a specific problem, but no study of depletion is planned.

A Bureau of Mines official told us that it was impossible to assess the impact of percentage depletion; otherwise, either Treasury would have done it to prove its point, or the Bureau would have done it to show that percentage depletion is needed. As the analysis below shows, we believe that much can be done, with relative objectivity, to evaluate the impacts of various taxes, including percentage depletion, on mineral production.

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1/ Report no. 96-937, U.S. Senate, Sep. 12, 1980, p. 6.

## MODEL USED TO MEASURE THE EFFECTS OF TAXATION ON THE PROFITABILITY OF DOMESTIC MINES

We believe that Federal tax policy has an important influence on domestic mineral production, the profitability of mining properties, and the financial health of the domestic industry. We also believe that sufficient analytical work has not been done to quantify the impact of various tax provisions on profitability and production and that such information is needed by the Congress and the administration to aid in developing sensible minerals policies.

Although studies have been performed of percentage depletion and much debate has taken place both in academic journals and before congressional committees, many important questions remain to be answered. The majority of the studies and most of the debate were undertaken before 1975 and concentrated on depletion for oil and gas production. In addition, most of this work examined depletion as part of the tax system instead of viewing depletion as an incentive for mineral production. A few studies did address the effectiveness of depletion as a mineral production incentive. In those studies quantitative work was based either on theoretical considerations or on assumptions about a typical mine. We found no study that addressed the depletion question for nonfuel minerals which was based on characteristics of actual domestic operations. In addition, we found no study that considered the interaction of depletion and other tax provisions including the investment tax credit and expensing of exploration and development costs. We sought to fill this gap by using a discounted cash flow model to measure the effects of tax action on profitability and production.

The financial analysis model we used, MINSIM 4, was developed by the Bureau of Mines to aid in estimating United States and world mineral availability. The model enables an evaluator to perform discounted cash flow rate-of-return analysis on each deposit of a specific mineral. Associated with the model is a data base 1/ containing production and cost estimates for producing mines and nonproducing deposits. While the model has the capability of analyzing both domestic and foreign deposits, at the time our work was performed the data base was complete only for domestic copper, lead/zinc, and molybdenum properties.

We used the model to measure the effect of Federal and State taxes on the profitability of domestic mines and deposits. For each property, we determined the net present value and the discounted cash flow of return under the 1978 tax law. We refer to this as the "as is" case. Both the present value and the discounted cash flow rate of return are measures of relative profitability. To determine the effect of taxes or changes in taxes on profitability, we removed or changed a particular tax

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1/ The data base is described in appendix I.

provision and compared the resulting present value or rate of return with the "as is" case.

We also used the model to determine the tax expenditure costs of various Federal tax provisions. To accomplish this we compared various Federal tax scenarios with the "tax-neutral" situation. 1/ Before examining the model results, it is necessary to understand the major assumptions behind the model and the model's limitations. 2/

The major assumptions behind the model concern

--the discount rate,

--the corporate structure,

-- the future path of costs and prices,

--the level of prices, and

--the shape of the cost curves.

A real after-tax discount rate of 18 percent was used in the analysis. We discussed discount rates with various mineral industry experts who agreed that this was appropriate. The Office of Management and Budget recommends that a real, before tax discount rate of 10 percent be used in evaluating Federal projects. Without adjustments for risk, but considering that the effective corporate tax rate for the industry is 28 percent, this 10 percent rate roughly translates to a 7.2 percent real, after-tax rate of return. Therefore, for the purpose of this analysis, our assumption of 18 percent is a conservative one. Mines with rates of return between 7.2 and 18 percent would be judged profitable using the Office of Management and Budget criterion, but only marginal using our criterion. At a 10-percent rate of inflation, an 18-percent real rate, is equivalent to a nominal rate of 30 percent; at a 12-percent inflation rate, it is equivalent to a 32-percent nominal rate.

Each mine in the model operates and pays taxes as a single corporate entity. This is not completely unrealistic, because such tax provisions, as percentage depletion and expensing of exploration and development costs, are administered on a per mine basis. On the other hand most operating mines are a part

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1/ We used tax expenditure costs and the "tax-neutral" case as defined in Tax Expenditures, Committee Print, U.S. Senate, Committee on the Budget, September, 1978. The concepts are discussed later in this chapter.

2/ These are discussed in detail in appendix II. The major assumptions and limitations are summarized below to aid the reader in interpreting the results.

of a larger corporate structure, which allows greater accounting flexibility for such provisions as the investment tax credit and expensing of exploration and development costs, providing additional tax benefits to the firm. Total taxes paid depends on the total income of corporations not mines. Because of the model's assumption, the sum of effects on all the mines we looked at, even if they represent most of the mines in the industry, are not the same as the actual effect on the industry.

In our analysis we used constant dollars, meaning all future costs and prices are assumed to increase at the same rate. While this will probably not happen, it was not clear that assuming future rates of change for prices and for each component of cost would improve the analysis. Inherent in this assumption is that technology will also remain constant.

The level of costs was part of the data base, however, we assumed price levels for the various minerals. For copper, lead, zinc, and molybdenum, we used the 1958-1978 average price in constant 1978 dollars. By-product mineral commodity prices furnished by the Bureau of Mines were maintained for the analysis. The prices used in the model are shown in appendix I.

In the data base, the Bureau of Mines assumed that each property generates all its production at a single cost per ton. In economic terms, this assumes that the marginal costs are constant and equal to average costs and that the marginal cost curve for each mine is linear and horizontal. This assumption means that the model can detect changes in supply only when a mine comes into production or shuts down. The model cannot take into account the variance of output with price at existing mines.

The scope of the model imposes limitations on the use of the analytical results. The model addresses only one criterion of an investment decision. From the results, only limited judgments can be made about the effects of taxes on supply/demand interactions and expected prices. The model includes only primary U.S. (domestic) properties, limiting judgments about the effects of such foreign tax provisions, as the depletion allowance for foreign properties. In addition, the model includes only four metals. Care should be taken in generalizing the results to other metals and non-metallics.

## PERCENTAGE DEPLETION AND THE PROFITABILITY OF DOMESTIC MINES

Despite the limitations, the model enabled us to look at many of the contentions previous groups have made about percentage depletion.

The issues addressed in this section are

--the tax expenditure costs and the distribution of benefits for existing mines,

--the effects on the profitability and production from domestic mines and deposits,

--the 50-percent and no net income limitation,

--lowering the statutory rates, and

--repeal of the minimum tax.

Cost and benefits

One means by which the Federal Government pursues public policy objectives is through the tax system. The dedication of money to an activity by allowing a special reduction in taxes rather than a direct payment is called a "tax expenditure." Looking at provisions of the tax law this way emphasizes their similarity to direct expenditures and suggests that the Federal revenue losses they create could be "budgeted" the way direct expenditures are. By implication, they must be taken into account in the budget process if the total Government effort in a program area is to be known. This is the concept of the "tax expenditure budget," which was added to the budgetmaking process by the Congressional Budget and Impoundment Control Act of 1974 (88 Stat. 297).

The value of the percentage depletion provision to the taxpayer is the amount of tax savings on the excess of the percentage depletion over cost depletion. The latter is considered the "normal" deduction and the extra deduction that percentage depletion produces is considered a tax expenditure. The budget estimates of tax expenditure costs for percentage depletion are shown in the following table.

Table 1

Budget Estimates of Tax Expenditure Costs for Percentage Depletion

| Fiscal year | Estimated cost |
|---|---|
| | (millions of current dollars) |
| 1978 | $1,460 |
| 1979 | $1,580 |
| 1980 | $1,715 |

A problem with these estimates is that they are not broken out by type of mineral. These totals include oil and gas as well as the nonfuel minerals.

Using the model we were able to estimate the present value of copper, lead/zinc, and molybdenum mines with only cost depletion allowed and with percentage depletion as provided by the current law. As the model could be run with all other variables held constant and only the depletion provision allowed to vary, this change represents the present value of the percentage depletion to the taxpaper, and conversely the present value tax expenditure cost to the Government. These costs are given in the table below.

Table 2

Present Value Tax Expenditures Costs of Percentage Depletion for Producing Mines

| | Present value cost (millions of discounted 1978 dollars) |
|---|---|
| Copper | $532 |
| Lead/Zinc | 91 |
| Molybdenum | 141 |
| Total | $764 |

These costs are different than those published in the budget in three respects.

--The budget figures are yearly estimates whereas our numbers are cumulative over the lives of all mines.

--Our figures are the sum of all mines considered as single taxpaying entities and do not correspond directly with the actual taxes paid by firms in the industry.

--Our figures are present value costs, discounted to take account of the time value of money.

The corresponding cumulative undiscounted tax expenditure costs to Federal and State Governments are given in the table below:

Table 3

Federal and State Income Taxes Foregone--When Cost Only Depletion Rather Than Percentage Depletion is Required

| | Federal | State |
|---|---|---|
| | (millions of undiscounted 1978 dollars) | |
| Copper | $2,157 | $251 |
| Lead/Zinc | 570 | 44 |
| Molybdenum | 652 | 94 |
| Total | $3,379 | $389 |

One of the reasons that percentage depletion is considered a tax expenditure and one of the arguments put forth against it is that with percentage depletion, mines are able to recover more than their full investment costs. In addition, mines are able to recover costs more quickly than capital is depleted. Using the model, we were able to determine the amount by which allowable deductions under current depletion law exceed the investment costs. Figure 1 on p. 21 shows the difference between allowable depletion under current law, the "as is" case, and if the deduction were limited to the cost basis of the property, the "cost only" case.

Effects on profitability and production

One of the questions about percentage depletion raised by the Treasury Department is, who is being subsidized, i.e., who is getting the benefits of these tax expenditures. To determine this, we grouped the mines according to three profitability categories. Economically profitable mines are those that have a positive net present value at a real discount rate of 18 percent. These mines are recovering all their opportunity costs and are making "economic" profits. Financially profitable mines are those that have negative net present values at 18 percent, but have positive cash flows. They are not recovering all their opportunity costs but are making financial or accounting profits. Their internal rate of return is between zero and 18 percent. They are considered the marginal producers. The third category is unprofitable mines. These mines have negative present values and negative cash flows. Their costs are greater than their revenues. Table 4 on p. 22 shows the yearly tonnage produced by profitability category.

The present value tax expenditure costs of percentage depletion are distributed among profitability categories as shown in table 5 on p. 23.

FIGURE 1

**CUMULATIVE DEPLETION USED OVER THE LIVES OF PRODUCING MINES UNDER CURRENT LAW AND IF ONLY COST DEPLETION WAS AVAILABLE**

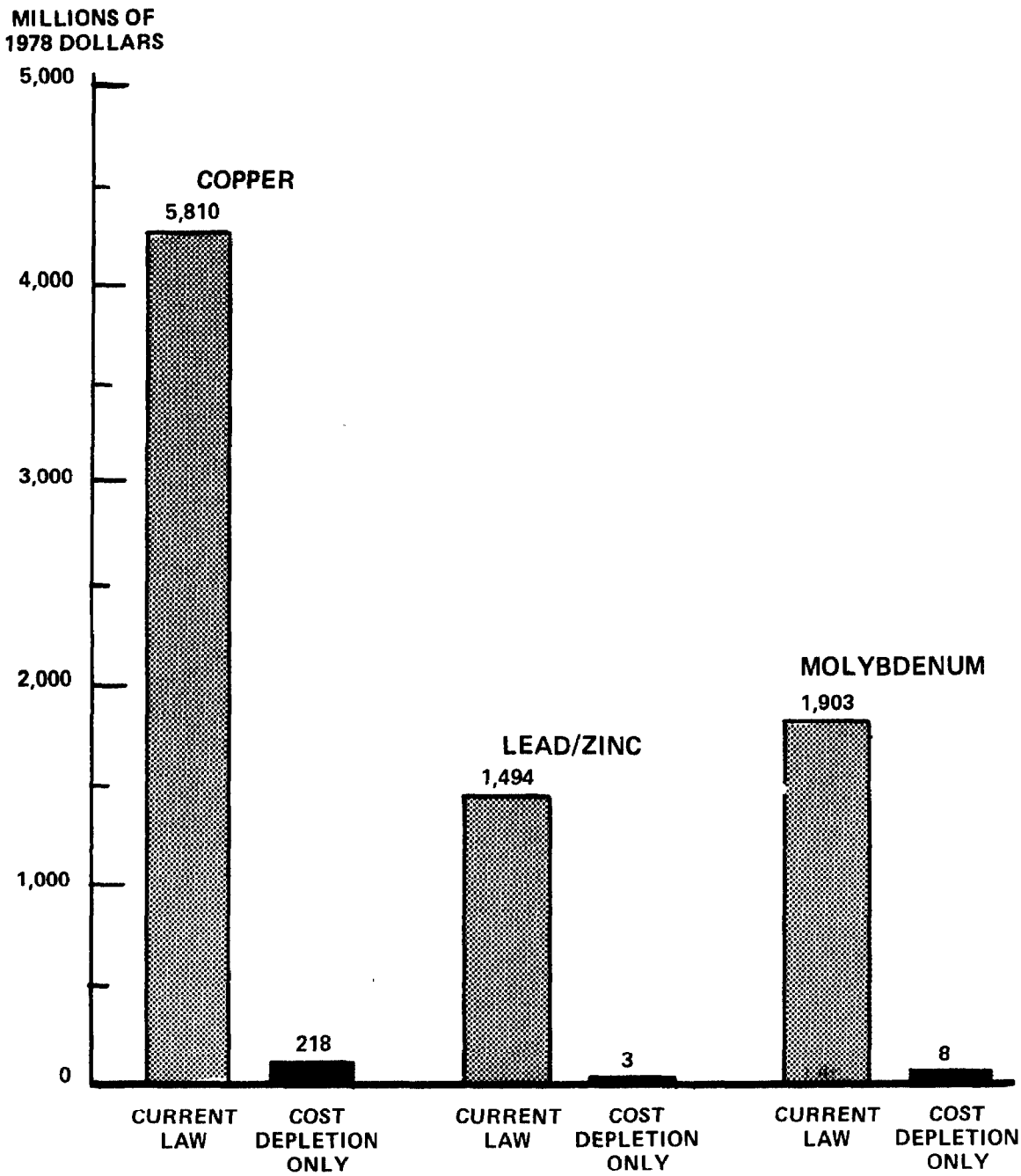

Table 4

Characteristics of Producing Mines by Profitability Category

| | Economically profitable | Financially profitable | Unprofitable | Total |
|---|---|---|---|---|
| | Yearly Tonnage (metric tons) | | | |
| Copper | 1,063,323 (67%) | 269,992 (17%) | 265,115 ( 6%) | 1,598,430 (100%) |
| Lead/Zinc | 447,886-L (97%) | | 13,879-L( 3%) | 461,765-L(100%) |
| | 67,209-Z (27%) a/ | 85,986-Z(35%) | 93,750-Z(38%) | 246,945-Z(100%) |
| Molybdenum | W | W | W | 46,368 (100%) |

a/ Part of economically profitable lead mines.

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

Table 5

Present Value Tax Expenditures Costs of Percentage Depletion for Producing Mines--by Profitability Category (millions of discounted 1978 dollars)

| | Economically profitable | | Financially profitable | | Unprofitable | Total | |
|---|---|---|---|---|---|---|---|
| | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (dollars) | (percent) |
| Copper | $ 507 | 95 | $ 25 | 5 | $ 0 | $ 532 | 100 |
| Lead/Zinc | W | | 0 | | 0 | 89 | 100 |
| Molybdenum | W | | 0 | | 0 | 141 | 100 |
| Total | $ 739 | 97 | $ 25 | 3 | $ 0 | $ 764 | 100 |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

As seen in table 5, the economically profitable producers, those who would be profitable regardless of the depletion allowance, get 97 percent of the tax expenditures benefits. There are two reasons for this. The first simply has to do with size. Twenty-five of 51 mines are economically profitable and these mines produce the majority of the domestic output for copper, lead, and molybdenum. The second is due to the way the depletion allowance is calculated. The economically profitable producers have the lowest cost to revenue ratios and only they can take full advantage of the statutory rates. 1/ The table below shows the type of depletion taken by profitability category.

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1/ For full depletion to be taken, the statutory rate times the gross revenue must be less than or equal to one-half the net income from the mine. The net income is the revenue minus costs, therefore:

depletion rate * gross revenue $\leq$ 1/2 (gross revenue minus cost) and:

$$\frac{\text{cost}}{\text{gross revenue}} \leq 1 - (2 * \text{depletion rate})$$

For copper producers to take full advantage of the 15 percent statutory depletion rate, the ratio of cost to revenue must be less than or equal to 0.70. Similarly, for lead/zinc and molybdenum with depletion rates of 22-percent, the cost to revenue ratio must be less than 0.56.

Table 6

Number of Producing Mines Taking Various Kinds of Depletion--by Profitability Category 1/

| | Economically profitable | Financially profitable | Unprofitable | Total |
|---|---|---|---|---|
| Copper | | | | |
| Full statutory | 4 | 0 | 0 | 4 |
| 50 percent limit | 13 | 7 | 5 | 25 |
| Cost depletion | 0 | 0 | 3 | 3 |
| Lead/Zinc | | | | |
| Full statutory | W | W | W | 3 |
| 50 Percent limit | W | W | W | 12 |
| Cost depletion | W | W | W | 1 |
| Molybdenum | | | | |
| Full statutory | W | W | W | 0 |
| 50 percent limit | W | W | W | 3 |
| Cost depletion | W | W | W | 0 |
| Total | | | | |
| Full statutory | 7 | 0 | 0 | 7 |
| 50 percent limit | 18 | 10 | 12 | 40 |
| Cost depletion | 0 | 0 | 4 | 4 |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

The four copper producers taking depletion at the statutory rate account for 44 percent of the total tax expenditure for all producers. According to the model, all four of these mines have an internal rate of return greater than 110 percent under current law. 2/ Under cost-only depletion, two have an internal rate of return greater than 110 percent and the rates for the others are 74 percent and 83 percent, all in constant dollar terms. These four mines represent 26 percent of domestic primary copper production.

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1/ The evaluation of the type of depletion taken is based on cumulative amounts of depletion used over the life of the mine and not on the depletion deduction taken in each year.

2/ The rate of return is calculated based on the undepreciated values of investments in 1978. For a further explanation see appendix II.

If percentage depletion is viewed as a means of capital recovery for mineral producers, then the idea that the most profitable producers are getting most of the benefits is not troublesome. Those who view percentage depletion in this manner 1/ argue that this is the desired distribution of benefits. They argue that as more ore is mined, bonanza deposits become harder to find and the tax savings of percentage depletion that accrue to current owners of these deposits provide the capital needed to discover tomorrow's bonanza deposits. We did not examine the effect of the depletion allowance on future reserves. However, if percentage depletion is viewed as an incentive for mineral production, this distribution of benefits raises questions of the cost effectiveness of providing the largest amount of this tax subsidy to those who would be profitable even without the subsidy. Thus to analyze the effects the tax subsidy has on production, we must look at the marginal mines and deposits.

There are seven financially profitable or marginal copper mines currently in production. The table below shows the increase in the internal rates of return for these mines because of percentage depletion.

Table 7

Increase in Internal Rates of Return for Financially Profitable Producing Copper Mines Due to Percentage Depletion

| Mine number | Internal rates of return | | |
|---|---|---|---|
| | Cost only | As is | Change |
| 1 | 1.633 | 2.803 | 1.170 |
| 2 | 3.116 | 3.840 | 0.724 |
| 3 | 3.207 | 4.061 | 0.854 |
| 4 | 8.175 | 10.985 | 2.810 |
| 5 | 8.345 | 10.191 | 1.846 |
| 6 | 11.556 | 15.111 | 3.555 |
| 7 | 12.633 | 16.289 | 3.656 |
| Average | 6.952 | 9.040 | 2.088 |

1/ See, for example, Thomas J. O'Neill, "Proposed Federal and Western States Mineral Tax Revisions," in Non-Renewable Resource Taxation in the Western States: A Conference on Tax Policy, sponsored by Lincoln Institute of Land Policy, Cambridge, MA, and College of Mines, University of Arizona, Tucson, AZ, 1977, p. 25.

It is evident from this table that percentage depletion has the largest effect on those marginal producers closest to the financially profitable/economically profitable margin (see definitions in Glossary). However, none of these producers is pushed over the hurdle rate of 18 percent by percentage depletion. Of a total tax expenditure cost for copper production of $532 million, $507 million goes to mines that would be profitable without the subsidy, and the other $25 million goes to increase the internal rate of return of marginal mines.

The table below shows the financially and economically profitable nonproducing copper deposits and their internal rates for the cost only and percentage depletion cases.

Table 8

Increase in Internal Rates of Return
for Financially and Economically Profitable
NonProducing Copper Deposits Due to Percentage Depletion

| Deposit Number | Internal rates of return | | |
|---|---|---|---|
| | Cost only | As is | Change |
| Financially profitable | | | |
| 1 | 1.487 | 1.999 | 0.512 |
| 2 | 2.588 | 3.026 | 0.438 |
| 3 | 2.681 | 3.169 | 0.488 |
| 4 | 2.918 | 3.459 | 0.541 |
| 5 | 5.359 | 7.063 | 1.704 |
| 6 | 7.080 | 8.384 | 1.304 |
| 7 | 8.892 | 10.824 | 1.932 |
| 8 | 9.681 | 11.625 | 1.944 |
| 9 | 11.252 | 13.939 | 2.687 |
| 10 | 13.593 | 17.064 | 3.471 |
| Average | 6.553 | 8.055 | 1.502 |
| Economically profitable | | | |
| 11 | 17.354 | 20.930 | 3.576 |
| 12 | 26.705 | 31.299 | 4.594 |
| Average | 22.03 | 26.11 | 4.08 |

According to the model results, percentage depletion does result in one financially profitable nonproducing copper deposit, number 11, becoming economically profitable. When percentage depletion rather than cost depletion is used, the internal rate of return goes above the 18 percent hurdle rate, increasing from 17.354 to 20.930 percent, and the present value becomes positive. According to the Bureau of Mines, this mine is currently being developed. This does not imply that the depletion allowance alone is responsible for development of this mine. For example,

the ore from this mine has a high byproduct content and recent changes in byproduct prices, which the model does not take into account, may be a factor in the decision to proceed with mining.

Making additional production profitable from already producing mines is another effect that a tax subsidy can have on the level of production. For example in an economically profitable mine there might be an area of high cost production, such as a fringe of low grade ore, which is worth exploiting only because the increase in production, hence gross revenue, brings an increase in allowable depletion. This would be the case for the four economically profitable mines where depletion could be taken at the full statutory rate. The model assumes that all production at a given mine is produced at the same cost. In economic terms, the mines have constant marginal costs, and therefore, cannot be used to examine these effects quantitatively.

Because of the net income limit, an unprofitable mine cannot possibly benefit from percentage depletion. This is because allowable depletion is the lesser of percentage depletion at the statutory rate or 50 percent of net income before depletion. If a mine is unprofitable, it has no net income and, as table 5 shows, receives no benefits from percentage depletion. 1/ Therefore, the depletion allowance cannot make an unprofitable mine profitable.

Raising the 50-percent net income limit

As the Treasury Department contends, and as the model results have shown, the 50-percent net-income limit plays an important role in determining both the tax expenditure cost of percentage depletion and the effect of percentage depletion on the profitability of domestic mines. Using the model, we were able to examine the impacts that result from changes to the 50-percent limit. Two changes were considered:

--raising the net-income limit to 65 percent as it currently is for some independent oil and gas producers; and

--removing the limit entirely.

The model results show that with a 65-percent limit, the present value tax expenditure cost increases to $689 million, $36 million more than under current depletion law. The distribution

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1/ This is not strictly true; the table shows no effect, but in some cases very small effects were seen. This is because a mine may be profitable during 1 or 2 years of its life and benefit from percentage depletion but still be unprofitable over its whole life.

of these tax expenditure benefits is similar to that under the current law. 1/ When the net income limit is removed entirely, the present-value, tax-expenditure cost decreases by $20 million to $744 million and the distribution of benefits changes. The economically profitable mines receive more than 100 percent of the tax expenditure benefits. 2/ Table 9 indicates the distribution of tax-expenditure benefits under the current law, with a 65-percent, net-income limit, and with no net-income limit.

The reason for the hypothetical decrease in the tax expenditure cost and for the economically profitable mines receiving a disproportionate amount of the tax-expenditure benefits when the limit is removed is the interaction of depletion with the minimum tax. Under current depletion law, mines must compute both percentage and cost depletion and then, if they claim depletion, must claim the larger as the allowable depletion deduction. When percentage depletion is limited to 50 percent of net income, as it is for most financially profitable and unprofitable mines (see table 6), a financially profitable mine will have a percentage depletion deduction that will always be less than the net income of the mine. An unprofitable mine will have no percentage depletion deduction. The allowable deduction will either be percentage or cost depletion for the financially profitable mine and will always be cost depletion for the unprofitable mine. The financially profitable mine will pay minimum tax on the excess of percentage depletion, which was used to reduce taxable income, over the cost basis.

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1/ With the increase in the net income limit, the cost to revenue ratio at which producers can take full advantage of the statutory rates increases for copper from 0.70 to 0.77 and for lead/zinc from 0.56 to 0.66. However, the cost structure of the producing mines is such that none previously limited by 50 percent of net income is able to take advantage of statutory rates when the limit is raised.

2/ This analysis is a hypothetical example that demonstrates the interaction of depletion and the minimum tax. It ignores the fact that corporations (in our case, mines) are not required to take a depletion deduction, and in some cases where taking a deduction would not be advantageous would probably choose not to take the deduction. According to the Internal Revenue Service, even if corporations choose not to take the deduction they still must reduce the cost basis of the property by the allowable deduction.

Table 9
Present Value Tax Expenditure Costs of Percentage Depletion for Producing Mines--by Profitability Category
(millions of discounted 1978 dollars)

| | Economically profitable ($) | Economically profitable (%) | Financially profitable ($) | Financially profitable (%) | Unprofitable ($) | Unprofitable (%) | Total ($) |
|---|---|---|---|---|---|---|---|
| Copper | | | | | | | |
| Current law | $ 507 | 95 | $25 | 5 | $ 0 | | $ 532 |
| 65 percent limit | 538 | 95 | 27 | 5 | 0 | | 565 |
| No net limit | 546 | 106 | 7 | 1 | (37) | (7) | 516 |
| Lead/Zinc | | | | | | | |
| Current law | W | | W | | W | | 91 |
| 65 percent limit | W | | W | | W | | 91 |
| No net limit | W | | W | | W | | 84 |
| Molybdenum | | | | | | | |
| Current law | W | | W | | W | | 141 |
| 65 percent limit | W | | W | | W | | 147 |
| No net limit | W | | W | | W | | 144 |
| Total | | | | | | | |
| Current law | $ 739 | 97 | $25 | 3 | $ 0 | | $ 764 |
| 65 percent limit | 778 | 97 | 26 | 3 | (1) | | 803 |
| No net limit | 788 | 106 | 4 | 0 | 48 | (6) | 744 |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

When the net income limit is removed, percentage depletion will be gross revenue times the statutory rate and, as the model shows, will always be greater than cost depletion. The financially profitable mine will be forced to claim and to pay minimum tax on a percentage-depletion deduction which may be greater than their net income before depletion. The unprofitable mine which has no net income before depletion, and under current law does not claim percentage depletion nor pay minimum tax, will now, hypothetically, have to pay a minimum tax on a deduction that they cannot use to reduce their taxable income since it is already zero. The table below shows that while the economically profitable mines would, hypothetically, pay lower Federal taxes if the net income limit were removed, the financially profitable and unprofitable mines would pay higher taxes.

Table 10

Federal Income Taxes Paid by Producing Mines Under Various Depletion Options--by Profitability Categories (millions of undiscounted 1978 dollars)

| | Economically Profitable | | Financially Profitable | | Unprofitable | | Total |
|---|---|---|---|---|---|---|---|
| | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (percent) | (dollars) |
| Copper | | | | | | | |
| Cost only | $ 5,826 | 96 | $ 259 | 4 | $ 0 | | $ 6,085 |
| Current law | 3,776 | 96 | 152 | 4 | 0 | | 3,928 |
| 65 percent limit | 3,708 | 96 | 137 | 4 | 0 | | 3,845 |
| No limit | 3,700 | 90 | 163 | 4 | 235 | 6 | 4,098 |
| Lead/Zinc | | | | | | | |
| Cost only | W | | W | | W | | 1,570 |
| Current law | W | | W | | W | | 1,000 |
| 65 percent limit | W | | W | | W | | 1,008 |
| No limit | W | | W | | W | | 1,116 |
| Molybdenum | | | | | | | |
| Cost only | W | | W | | W | | 1,691 |
| Current law | W | | W | | W | | 1,025 |
| 65 percent limit | W | | W | | W | | 954 |
| No limit | W | | W | | W | | 931 |
| Total | | | | | | | |
| Cost only | $ 9,021 | 97 | $ 282 | 3 | $ 43 | 0 | $ 9,346 |
| Current law | 5,757 | 97 | 168 | 3 | 28 | 0 | 5,953 |
| 65 percent limit | 5,615 | 97 | 152 | 3 | 40 | 0 | 5,807 |
| No limit | 5,567 | 91 | 186 | 3 | 392 | 6 | 6,145 |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

The average internal rate of return for financially profitable copper producers is 9.174 percent with the 65 percent limit compared to 9.040 percent under current law. When the net income limit is removed the average internal rate of return drops to 7.513 percent, only 0.561 percentage points higher than the cost only case, again this is a hypothetical example. The table below shows the internal rates of return for financially profitable copper mines.

Table 11

Internal Rates of Return for Financially Profitable Producing Copper Mines

| Mine number | Internal Rate of Return | | | |
|---|---|---|---|---|
| | Cost only | Current law | 65 percent limit | No limit |
| 1 | 1.633 | 2.803 | 2.594 | 1.549 |
| 2 | 3.116 | 3.840 | 3.835 | 0 |
| 3 | 3.207 | 4.061 | 4.226 | 3.462 |
| 4 | 8.175 | 10.985 | 11.175 | 7.193 |
| 5 | 8.345 | 10.191 | 10.469 | 10.571 |
| 6 | 11.556 | 15.111 | 14.835 | 13.593 |
| 7 | 12.633 | 16.289 | 17.084 | 16.229 |
| Average | 6.952 | 9.040 | 9.174 | 7.513 |

When the net income limit is removed the internal rates of return for three of these mines are lower than they would be if only cost depletion were available. This indicates that removing the net income limit would, hypothetically, penalize these marginal mines. One mine (number 2) would, hypothetically, change from being financially profitable to unprofitable if the net income limit were removed.

The manner in which the minimum tax is calculated further contributes to the disproportionate distribution of benefits. The minimum tax is 15 percent of the excess of percentage depletion over the depletable cost basis of the property. The greater of $10,000 or the regular tax liability of the corporation can be deducted before the minimum tax is applied. Unprofitable mines seldom have any regular tax liability so the maximum amount of excess depletion that they can shield from the minimum tax is $10,000. The more profitable mines have a higher regular tax liability and can shield more of their depletion benefits. 1/

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1/These generalizations are unrealistic because of the assumption that each mine operates as a separate corporate entity. In reality, most mines are part of a larger corporation and the tax liability from the corporation can be used to shield excess depletion from the minimum tax. This analysis does, however, reveal the extent to which the preferential tax treatment given the mining industry may affect corporate organization and the industry structure.

In this hypothetical example, when the net income limit is removed, the tax-expenditure costs of percentage depletion would decrease. The distribution of tax expenditure benefits, however, would also change. Because of the minimum tax, the unprofitable and financially profitable producers would pay more taxes if the net income limit were removed than they do under current depletion law. The economically profitable producers would pay less. Because the "benefits" of removing the net income limitation are negative for unprofitable and financially profitable producers, the economically profitable producers would, hypothetically, receive more than 100 percent of the total tax expenditure.

Reduction of statutory rates

Since percentage depletion became part of the tax code in 1926, several changes have been made to the statutory rates. Using the model, we tested the effects of reducing the current rates by 50 percent to 7.5 percent for copper and to 11 percent for lead/zinc and molybdenum. As the table below shows, the tax expenditure costs would be reduced $193 million by this rate reduction.

Table 12

Present Value Tax Expenditure Costs of Percentage Depletion "as is" and at One-Half the Present Statutory Rates for Producing Mines

| | Present value cost "as is" | Present value cost "low rate" |
|---|---|---|
| | (millions of discounted 1978 dollars) | |
| Copper | $ 532 | $ 425 |
| Lead/Zinc | 91 | 53 |
| Molybdenum | 141 | 93 |
| Total | $ 764 | $ 571 |

At a lower depletion rate more producers can take advantage of depletion at the full statutory rate. 1/ The table below shows that when the rates are halved, 18 producers can take depletion at the full rate. Table 6 showed that only seven producers could do so under current depletion law.

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1/ With the lowering of the statutory rates the cost to revenue ratio at which producers can take full advantage of statutory rates increases. For copper it increases from 0.70 under current depletion law to 0.86 and for lead/zinc and molybdenum it increases from 0.56 to 0.78. The cost structure of the mines is such that with lower rates 11 more producers can take advantage of the full statutory rates.

Table 13

Number of Mines by Profitability Category
Taking Various Kinds of Depletion at Lower Rates a/

| | Economically profitable | Financially profitable | Unprofitable | Total |
|---|---|---|---|---|
| Copper | | | | |
| Statutory at 7.5 percent | 11 | 0 | 0 | 11 |
| 50 percent limit | 6 | 7 | 5 | 18 |
| Cost depletion | 0 | 0 | 3 | 3 |
| Lead/Zinc | | | | |
| Statutory at 11 percent | W | W | W | 6 |
| 50 percent limit | W | W | W | 9 |
| Cost depletion | W | W | W | 1 |
| Molybdenum | | | | |
| Statutory at 11 percent | W | W | W | 1 |
| 50 percent limit | W | W | W | 2 |
| Cost depletion | W | W | W | 0 |
| Total | | | | |
| Statutory to lower rates | 18 | 0 | 0 | 18 |
| 50 percent limit | 7 | 10 | 12 | 29 |
| Cost depletion | 0 | 0 | 4 | 4 |

a/ The evaluation of the type of depletion taken is based on cumulative amounts of depletion used over the life of the mine and not on the depletion deduction taken in each year.

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

Still however, only the economically profitable producers receive the full advantage of the rate reduction. The next table reinforces this; it shows that the distribution of the benefits of percentage depletion is similar under current law and in the lower cases.

Table 14

Comparison of Tax Expenditure Costs for Percentage Depletion Under Current Law and at One-Half of the Current Statutory Rates for Producing Mines by Profitability Category (millions of discounted 1978 dollars)

| | Economically profitable | | Financially profitable | | Unprofitable | Total |
|---|---|---|---|---|---|---|
| | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (dollars) |
| Copper | | | | | | |
| Current law | $ 507 | 95 | $ 25 | 5 | 0 | $ 532 |
| Low rate | 405 | 95 | 20 | 5 | 0 | 425 |
| Lead/Zinc | | | | | | |
| Current law | W | | W | | 0 | 91 |
| Low rate | W | | W | | 0 | 53 |
| Molybdenum | | | | | | |
| Current law | W | | W | | 0 | 141 |
| Low rate | W | | W | | 0 | 93 |
| Total | | | | | | |
| Current law | $ 739 | 97 | $ 25 | 3 | 0 | $ 764 |
| Low rate | $ 551 | 96 | $ 20 | 4 | 0 | $ 571 |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

The 11 economically profitable copper producers taking full percentage depletion at the lower statutory rate account for 64 percent of the total tax expenditure for all copper producers. These mines represent 46 percent of primary domestic copper production. Six of the economically profitable and all of the financially profitable producers still are constrained by the net-income limit. For the most part, the internal rates of return of the financially profitable mines are greater than they would be if only cost depletion were available but are less than under current depletion law.

This is shown in the table below. 1/

Table 15

Comparison of Internal Rates of Return for Financially Profitable Producing Copper Mines Under Different Depletion Rates

| Mine number | Internal rates of return | | |
|---|---|---|---|
| | Cost only | Lower rate | Current law |
| 1 | 1.633 | 1.532 | 2.803 |
| 2 | 3.116 | 3.840 | 3.840 |
| 3 | 3.207 | 4.045 | 4.061 |
| 4 | 8.175 | 10.985 | 10.985 |
| 5 | 8.345 | 9.647 | 10.191 |
| 6 | 11.556 | 14.760 | 15.111 |
| 7 | 12.633 | 16.272 | 16.289 |
| Average | 6.952 | 8.726 | 9.040 |

Similarly, as the next table indicates, the internal rate of return for nonproducing deposits falls between the cost only and current law cases. Deposit Number 11 changes from financially to economically profitable in both the current law and lower rate situations.

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1/ If, in any one year, the depletion deduction for the financially profitable mines is limited to 50 percent of net income in both the current law and lower rate cases, then when the statutory rate is changed the allowable depletion deduction and the discounted cash flow rate of return should not change. The change in the rate of return seen in table 15 results because the evaluation of the type of depletion used (i.e. full statutory, 50 percent limit, or cost) is based on cumulative cash flow figures over the life of the mine and not what happens in each year. When the statutory depletion rate is lowered, the mine may still appear to be limited to 50 percent of the net income over its life, but in some years may take full statutory depletion. The availability of full statutory depletion in some years would increase the discounted rate of return over the life of the mine and the amount of the increase depends on the statutory rate, i.e., the higher the rate the greater the increase. Hence the difference in rates of return between the current law and lower rate cases.

The same reasoning applies to the change in tax expenditure costs between the current law and lower rate cases shown in table 14.

Table 16

Changes in Internal Rates of Return for Financially and Economically Profitable Nonproducing Copper Deposits Under Different Depletion Rates

| Deposit number | Internal rates of return | | |
|---|---|---|---|
| | Cost only | Lower rate | Current law |
| Financially Profitable | | | |
| 1 | 1.487 | 1.976 | 1.999 |
| 2 | 2.588 | 2.913 | 3.026 |
| 3 | 2.681 | 3.147 | 3.169 |
| 4 | 2.918 | 3.370 | 3.459 |
| 5 | 5.359 | 6.906 | 7.063 |
| 6 | 7.080 | 8.215 | 8.384 |
| 7 | 8.892 | 10.425 | 10.824 |
| 8 | 9.681 | 10.180 | 11.625 |
| 9 | 11.252 | 12.986 | 13.939 |
| 10 | 13.593 | 15.953 | 17.064 |
| Average | 6.553 | 7.607 | 8.055 |
| Economically Profitable | | | |
| 11 | 17.354 | 19.331 | 20.930 |
| 12 | 26.705 | 29.490 | 31.299 |
| Average | 22.029 | 24.410 | 26.115 |

Reducing the statutory rates by one-half lowers the present-value, tax-expenditure cost by $193 million or 26 percent. The distribution of tax expenditure benefits is unchanged. Those producers who would be profitable even in the absence of percentage depletion still get most of the benefit. The average internal rate of return for financially profitable or marginal copper producers decreases by 0.314 percentage points from the average return under current depletion law and the average rate of return for financially profitable nonproducing deposits decreases by 0.448 percentage points.

Repeal of the minimum tax

We compared percentage depletion under the current law with and without the minimum tax to determine the effect minimum tax has on the size of the tax incentive provided by percentage depletion and the distribution of the benefits. We found that repeal of the minimum tax would increase the tax expenditure cost of percentage depletion by $126 million and would alter the distribution of benefits in favor of the financially profitable and unprofitable mines. 1/

1/ As discussed in appendix II, this analysis is somewhat unrealistic because it assumes that each mine is a separate corporate entity.

In most cases, the minimum tax does not change the allowable depletion deduction taken by producers, 1/ but simply taxes the excess of percentage depletion over the cost basis and increases the Federal taxes each mine must pay. With the minimum tax, the present value tax expenditures cost for copper, lead/zinc, and molybdenum is $764 million, without the tax this amount increases to $890 million. A breakdown by mineral is shown in the table below.

Table 17

Present value Tax Expenditure Costs of Percentage Depletion for Producing Mines-- With and Without the Minimum Tax

| | With the minimum tax | Without the minimum tax |
|---|---|---|
| | (millions of undiscounted dollars) | |
| Copper | $ 532 | $ 604 |
| Lead/Zinc | 91 | 118 |
| Molybdenum | 141 | 168 |
| Total | $ 764 | $ 890 |

Without the minimum tax the financially profitable and unprofitable producers get a larger amount of the tax expenditure benefits. This can be seen in table 18, which shows the distribution of benefits under current depletion with and without the minimum tax.

1/ The exceptions are some mines in Arizona and Missouri. In these States interactions between State and Federal taxes affect the net income limitations and hence allowable depletion. These effects are small.

Table 18

Present Value Tax Expenditure Costs of Percentage Depletion for Producing Mines--With and Without the Minimum Tax by Profitability Category (millions of undiscounted 1978 dollars)

| | Economically Profitable | | Financially Profitable | | Unprofitable | | Total | |
|---|---|---|---|---|---|---|---|---|
| | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (percent) |
| Copper | | | | | | | | |
| with tax | $ 507 | 95 | $ 25 | 5 | $ 0 | | $ 532 | 100 |
| without tax | $ 568 | 94 | | 6 | $ 0 | | $ 604 | 100 |
| Lead/Zinc | | | | | | | | |
| with tax | W | | W | | W | | 91 | 100 |
| without tax | W | | W | | W | | 118 | 100 |
| Molybdenum | | | | | | | | |
| with tax | W | | W | | W | | 141 | 100 |
| without tax | W | | W | | W | | 168 | 100 |
| Total | | | | | | | | |
| with tax | $ 739 | 97 | $ 25 | 3 | $ 0 | | $ 764 | 100 |
| without tax | $ 839 | 94 | $ 37 | 4 | $14 | 2 | $ 890 | 100 |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

The internal rates of return for financially profitable copper mines increase slightly when the minimum tax is removed. The table below shows that the average rate of return for these producers increases by 0.836 percentage points.

Table 19

Comparison of Internal Rates of Return for Financially Profitable Copper Mines With and Without Minimum Tax

| Mine number | Internal rate of return | | |
|---|---|---|---|
| | With the minimum tax | Without the minimum tax | Change |
| 1 | 2.803 | (a) | (a) |
| 2 | 3.840 | 4.440 | 0.600 |
| 3 | 4.061 | 4.382 | 0.321 |
| 4 | 10.985 | 12.069 | 1.084 |
| 5 | 10.191 | 10.461 | 0.270 |
| 6 | 15.111 | 16.755 | 1.644 |
| 7 | 16.289 | 17.387 | 1.098 |
| Average | 10.080 | 10.916 | 0.836 |

a/ The results for this mine for this test were inconsistent. This is a result of an error in the data rather than an indication of actual effects.

Table 20

Comparison of Internal Rates of Return for Financially and Economically Profitable Copper Deposits With and Without the Minimum Tax

| Deposit number | Internal rate of return | | |
|---|---|---|---|
| | With minimum tax | Without minimum tax | Change |
| Financially profitable | | | |
| 1 | 1.999 | 2.188 | 0.189 |
| 2 | 3.026 | 3.661 | 0.635 |
| 3 | 3.169 | 3.263 | 0.094 |
| 4 | 3.459 | 3.459 | .0 |
| 5 | 7.063 | 7.391 | 0.328 |
| 6 | 8.384 | 8.922 | 0.538 |
| 7 | 10.824 | 11.331 | 0.507 |
| 8 | 11.625 | 11.812 | 0.187 |
| 9 | 13.939 | 14.637 | 0.698 |
| 10 | 17.064 | 17.797 | 0.733 |
| Average | 8.055 | 8.446 | 0.391 |
| Economically profitable | | | |
| 11 | 20.930 | 21.385 | 0.455 |
| 12 | 31.299 | 32.310 | 1.011 |
| Average | 26.115 | 26.848 | 0.733 |

The model indicates that repeal of the minimum tax would increase the tax expenditure cost of percentage depletion for copper, lead/zinc and molybdenum by $126 million. Of this amount, $26 million, or 21 percent, goes to the financially profitable and unprofitable producers. The average rate of return for financially profitable mines increases by 0.836 percentage points.

## DEVELOPMENT OF THE INVESTMENT TAX CREDIT

The investment tax credit provision of the Internal Revenue Code provides a credit against Federal tax liability for 10 percent of the cost of acquiring such depreciable assets as equipment and machinery. The largest beneficiaries of the tax credit are capital intensive industries with equipment having a long life. For the year ending in 1980, the tax credit cannot exceed $25,000 plus 70 percent of the tax liability above this amount. Under the present law, this percentage figure increases 10 percent

per year until 1982, when it will reach 90 percent. Any credits that cannot be used in the current period due to the limitation may be carried back and used to offset taxes in the three preceding years; they then may be carried forward the following 7 years, if necessary. Only qualified properties with estimated useful lives of 7 or more years are fully eligible for the credit. Properties with less useful lives qualify as shown below:

| If the Useful Life Is | The Applicable Percentage Is |
|---|---|
| Less than 3 years | 0 |
| Three years or more but less than 5 years | 33-1/3 |
| Five years or more but less than 7 years | 66-2/3 |

The investment tax credit was originally adopted in the Revenue Act of 1962 at a rate of 7 percent. The credit was intended to stimulate investment by reducing the cost of acquiring depreciable assets and hence increasing the funds available for investment. The House Ways and Means Committee believed that since the credit applied only to newly acquired assets, the incentive effect was concentrated on new investment and no revenue was lost in raising the profitability of assets already held by business firms.

The credit was a permanent part of the tax code until October 1966. At that time, the credit was temporarily suspended as an anti-inflationary measure. In March 1967, the inflationary pressure had abated and the credit was restored. However, the credit was repealed 2 years later by the Tax Reform Act of 1969. Again, inflationary pressure was cited as a reason for removing the credit. The Congress also concluded that the 1969 level of investment could not be maintained for more than a short period of time, and that it was important for the long-run vitality of the economy to keep the level of investment on a steady growth path.

The investment tax credit was reenacted in the Revenue Act of 1971. The reasons again appeared to be primarily to stimulate economic growth through capital goods expenditures in order to combat unsatisfactory levels of production, employment, and inflation. The Revenue Act of 1975 temporarily increased the credit from 7 to 10 percent in an additional attempt to stimulate the economy.

The Revenue Act of 1978 made the 10-percent credit permanent. Also, it increased by ten percent per year, until 1982, the portion of the tax liability over $25,000 that can be offset by the credit. Expenditures made on rehabilitating certain industrial and commercial buildings were made eligible for the credit.

## CHANGES IN THE INVESTMENT TAX CREDIT HAVE LITTLE IMPACT ON DOMESTIC MINES

The effectiveness of the investment tax credit in promoting capital formation and long-term economic growth is reviewed in a previous GAO report. 1/ That study revealed that since the credit was originally enacted, gross private domestic investment as a percentage of the Nation's economic output had not changed appreciably. A large portion of the credit goes to reward investment that would have been made regardless of the provision since the credit may not be significant enough to actually lower the hurdle rate for investing in capital goods.

A Treasury Department official stated that the investment tax credit may not be significant to the mining industry because it was not a specific industry tax provision. He said that although the mining industry is capital intensive, the capital is tied up in mineral reserves and not in property that qualified for the investment tax credit. Therefore, the credit may be more significant to the manufacturing than to the mining industry.

Mining officials believe that the investment tax credit is an important incentive for capital investment and a source of funds for the minerals industry. One official suggested that to aid the industry in improving profitability and cash flow, the Government could extend the investment tax credit carryforward period, or provide tax refunds for unused investment tax credits at the end of the current 7 year carryforward period.

We tested these contentions with the model. To determine the significance of the investment tax credit, we removed it entirely and compared the present value of the producing mines and nonproducing deposits with and without the investment tax credit. The following table summarizes the results.

Removing the investment tax credit decreases the present value of the producing mines by $72 million. The figure represents the present value of additional tax receipts the Treasury would collect over the lives of those mines, if the investment tax credit were removed. This tax change would affect 35 of the 51 producing mines; it would decrease the present value of the affected mines by an average of 7.4 percent. It would affect over half of the nonproducing deposits. It would lower the value of these deposits an average of 19.4 percent with potential savings to the taxpayer of $12 million.

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1/ "Investment Tax Credit: Unresolved Issues," PAD-78-40, May 8, 1978.

Table 21

Change in Present Value When The Investment Tax Credit Is Removed

| | Total change for all mines (discounted 1978 dollars) | Total number of properties | Number of properties affected | Average Percent Change b/ Total properties | Average Percent Change b/ Affected properties |
|---|---|---|---|---|---|
| Copper | | | | | |
| producers | $57,261,000 | 32 | 23 | 7.4 | 10.3 |
| nonproducers | $11,154,000 | 24 | 12 | 4.9 | 9.8 |
| Lead/Zinc | | | | | |
| producers | 4,981,000 | 16 | 9 | 0.9 | 1.6 |
| nonproducers a/ | 924,000 | 4 | 2 | 43.2 | 86.4 |
| Molybdenum | | | | | |
| producers | 9,953,000 | 3 | 3 | 2.4 | 2.4 |
| nonproducers a/ | 161,000 | 1 | 1 | 0.04 | 0.04 |
| Total | | | | | |
| producers | $72,195,000 | 51 | 35 | 5.07 | 7.39 |
| nonproducers | $12,239,000 | 29 | 15 | 10.02 | 19.36 |

a/The large disparity in the average percent change figures for nonproducers is due to the small number of affected properties and the uncertainty in the nonproducer data (see appendix I).

b/The totals are weighted averages.

The table below shows the tax expenditure cost of the investment tax credit by profitability category.

Table 22

Present Value Tax Expenditure Cost of the Investment Tax Credit--by Profitability Category Investment Tax Credit is Removed by Profitability Category

| | Economically Profitable | Financially Profitable | Unprofitable | Total |
|---|---|---|---|---|
| | (discounted 1978 dollars) | | | |
| Copper | | | | |
| producers | $41,064,000 | $16,197,000 | -0- | $57,261,000 |
| nonproducers | $ 4,240,000 | $ 6,909,000 | $ 5,000 | $11,154,000 |
| Lead/Zinc | | | | |
| producers | W | W | W | 4,981,000 |
| nonproducers | W | W | W | 924,000 |
| Molybdenum | | | | |
| producers | W | W | W | 9,953,000 |
| nonproducers | W | W | W | 161,000 |
| Total | | | | |
| producers | $55,172,000 | $16,803,000 | $220,000 | $72,195,000 |
| nonproducers | $ 5,164,000 | $ 6,909,000 | $166,000 | $12,239,000 |

The W signifies that the data is withheld to avoid disclosure of propietary information.

Table 23

Average Percentage Decrease in Present Value When the Investment Tax Credit is Removed-- by Profitability Category

| | Economically Profitable | Financially Profitable | Unprofitable |
|---|---|---|---|
| Copper | | | |
| producer | 4.7 | 22.3 | -0- |
| nonproducer | 17.0 | 8.3 | -0- |
| Lead/Zinc | | | |
| producer | W | W | W |
| nonproducer | W | W | W |
| Molybdenum | | | |
| producer | W | W | W |
| nonproducer | W | W | W |
| Total | | | |
| producer | 3.8 | 16.1 | 0.3 |
| nonproducer | 51.7 | 8.3 | 0.4 |

The W signifies that the data is withheld to avoid disclosure of proprietary information.

From the model results, it is not possible to determine whether the investment tax credit simply rewards investment that would have occurred regardless of the provision or encourages new investment. Removing the investment tax credit has no effect or an insignificant effect on the unprofitable mines and deposits. This indicates that the credit does not increase the investment potential of unprofitable ventures. However, the results of the model show that the credit does affect financially and economically profitable mines and deposits. While the existence of the credit does not make any financially profitable mines or deposits become economically profitable and thus encourage investment in new capacity, i.e., it does not put any property over our assumed hurdle rate of 18 percent, it does increase the present value of all profitable deposits. The credit may also alter the mix of labor and capital used at a specific mine and hence may lead to more or less efficient production. This is an issue the model cannot address.

The largest dollar benefit of the investment tax credit, 76.4 percent of the total benefit, accrues to economically profitable

producers, but as table 23 shows, the average percent change in present value with and without the credit is greatest for the financially profitable producers. This is partially a result of the measurement technique but does reflect the fact that small changes in cash flow have the most effect on the financially profitable or marginal mines. In this case, all the financially profitable mines are affected and removing the investment tax credit decreases their present value by an average of 16.1 percent, at a present value cost to the taxpayer of $17 million. Twenty-four of the 25 economically profitable producers are affected and their present value decreases by an average of 3.8 percent at a cost of $55 million.

Nonproducing deposits that are economically profitable are affected the most by the investment tax credit. There are four deposits in this category and their present value is decreased by 51.7 percent at a cost of $5.2 million. According to the Bureau of Mines, three of these nonproducing deposits are currently being developed. The present value of financially profitable deposits decreases by 8.3 percent as a result of the investment tax credit at a potential cost of $6.9 million. The effect of the credit on unprofitable deposits is insignificant.

Extending the carryforward and carryback from the present 3 years back and 7 years forward to 4 years back and 10 years forward, had very little effect on the present value of the mines studied. The results are shown in the following table:

Table 24

Increase in Present Value When Carryover Period Allowed in Investment Tax Credit is Extended

| | Total Change for Industry (discounted 1978 dolllars) | Total Properties | Properties Affected | Average Total Properties | Percent Change Affected Properties |
|---|---|---|---|---|---|
| Copper | | | | | |
| producers | $ 464,000 | 32 | 4 | -0- | 0.4 |
| nonproducers | $1,801,000 | 24 | 7 | 0.2 | 0.7 |
| Lead/Zinc | | | | | |
| producers | 634,000 | 16 | 3 | 0.2 | 0.8 |
| nonproducers | -0- | 4 | -0- | -0- | -0- |
| Molybdenum | | | | | |
| producers | 165,569 | 3 | 1 | -0- | -0- |
| nonproducers | 96,000 | 1 | 1 | -0- | -0- |
| Total | | | | | |
| producers | $1,263,687 | 51 | 7 | 0.1 | 0.1 |
| nonproducers | $1,897,000 | 29 | 8 | 0.2 | 0.2 |

Other changes in the investment tax credit tested were decreasing the carryover periods to two years back and five years forward, and limiting the credit in any one year to $25,000, plus 50 percent of the tax liability above this amount. Neither change had any significant effect.

## REFUNDING THE UNUSED PORTION OF THE INVESTMENT TAX CREDIT

One way in which taxes can be used to benefit the financially profitable mines is by refunding the unused portion of the investment tax credit. Using the model we found that $121 million (in undiscounted dollars) of the investment tax credit could not be used by domestic copper, lead/zinc and molybdenum mines in the allocated time period.

The table below shows that this $121 million is 34 percent of the total credit available to the mines.

Table 25

Percent of Available Investment Tax Credit Unused by Domestic Mines

| | Total investment tax credit available | Investment tax credit unused | Percent unused |
|---|---|---|---|
| | (undiscounted 1978 dollars) | | |
| Copper | $296,471,000 | $109,942,000 | 37 |
| Lead/Zinc | 30,108,000 | 6,918,000 | 23 |
| Molybdenum | 28,823,000 | 4,037,000 | 14 |
| TOTAL | $355,402,000 | $120,897,000 | 34 |

Most of the unused credit is being lost by financially profitable and unprofitable mines. As the table below shows, these mines would receive 99 percent of the undiscounted tax expenditure benefits if the unused credit was refunded.

Table 26

Investment Tax Credit Unused by Producing Mines
--by Profitability Category
(undiscounted 1978 dollars)

| | Economically Profitable | | Financially Profitable | | Unprofitable | | Total | |
|---|---|---|---|---|---|---|---|---|
| | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (percent) |
| Copper | $742,000 | 1 | $28,613,000 | 26 | $80,587,000 | 73 | $109,942,000 | 100 |
| Lead/Zinc | W | | W | | W | | 6,918,000 | 100 |
| Molybdenum | W | | W | | W | | 4,037,000 | 100 |
| TOTAL | $773,000 | 1 | $32,660,000 | 27 | $87,464,000 | 72 | $120,897,000 | 100 |

The "W" signifies that the data is withheld to avoid disclosure of confidential information.

More work is needed to determine the effect that refunding the unused portion of the credit would have on the present values and internal rates of return of domestic mines.

## EFFECT OF EXPENSING EXPLORATION AND DEVELOPMENT COSTS

The mineral industry enjoys special tax treatment for costs associated with mine exploration and development. Exploration costs are those the industry incurs in determining the location, quality, and quantity of mineral deposits that had not previously been commercially exploited. Exploration costs can either be capitalized or expensed. If capitalized, they are included with the cost basis of the property to determine the cost depletion allowance for the mine. If expensed, they must be recaptured when the mine reaches the production stage. After the existence of ore in marketable quality and quantity has been established, the mine must be prepared for production. Mine development costs include those that are necessary to gain access to the ore body in the pre-production period. These costs can either be expensed in the year incurred or be deferred and deducted in later years. If they are deferred, the amount applicable is the excess of development costs over the net receipts from the mine during the year. No recapture is required for expensed development costs.

### Exploration costs

Prior to 1951, exploration costs were considered to be capital expenditures recoverable through the depletion allowance rather than current expenses, which are deductible when paid or incurred. In 1951, to encourage exploration, the Congress provided a deduction for some exploration costs. Since that time, exploration expenditures have been deductible to some extent and under certain conditions; a variety of elections and options have been available at different times. Prior to 1966, limits were placed on the amount and timing of exploration cost deductions. In 1966 the taxpayer was given additional choice of deducting all exploration costs as incurred with a requirement in one of two ways. Since 1970 there has been no provision for deduction without one of the two types of recapture.

The taxpayer, if he so elects, may recapture the exploration costs by including with gross income for the year an amount equal to the "adjusted exploration expenses", with respect to all mines reaching the production stage that year. The amount included in gross income is added to the depletion cost basis of the respective mine. If the taxpayer does not elect this option, the amount of adjusted exploration expenditures for all mines or deposits reaching the production stage in the taxable year must be deducted from the allowable depletion with respect to these mines or deposits until the exploration costs are recaptured. The first method is advantageous to the taxpayer who has large amounts of other deductions for the tax

year. The second method allows the recapture requirement to be spread over a number of tax years, depending on the allowable depletion deduction.

For producing mines, the ore has already been commercially exploited, so no exploration costs are incurred. For nonproducing deposits, the model capitalizes all exploration costs and includes them in the basis for cost depletion. For these deposits, we determined the effect of expensing the exploration costs subject to recapture through the depletion allowance. We found that when the exploration costs are expensed, the total increase in the present value of all the mines in this study is $27.6 million. This represents the potential tax expenditure cost if these deposits are brought into production. 1/ A breakdown by mineral is given in the table below.

Table 27

Potential Present Value-Tax Expenditure Cost of Expensing Exploration Costs Subject to Recapture Through the Depletion Allowance-Nonproducing Deposits
(discounted 1978 dollars)

| | |
|---|---|
| Copper | $26,121,000 |
| Lead/Zinc | 960,000 |
| Molybdenum | 492,000 |
| TOTAL | $27,573,000 |

The unprofitable deposits receive most of the tax-expenditure benefits of this provision. One reason for this is because more than half, 16 out of 29, of the potential deposits considered are unprofitable, four are economically profitable and nine are financally profitable. Most deposits benefit from the expensing provision for exploration costs. The table on the following page indicates the potential tax-expenditure benefit by profitability condition.

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1/ This is an understatement of the actual tax expenditure amount. Because the model does not consider actual corporate structure--nonproducers in our study were not able to deduct exploration costs from other corporate income--the value of this tax provision to the mines is understated.

Table 28

Potential Tax-Expenditure Benefit of Expensing Exploration Costs Subject to Recapture Through the Depletion Allowance by Profitability Condition (discounted 1978 dollars)

| | Economically Profitable | | Financially Profitable | | Unprofitable | | Total |
|---|---|---|---|---|---|---|---|
| | (dollars) | (percent) | (dollars) | (percent) | (dollars) | (percent) | (dollars) |
| Copper | W | W | W | W | W | W | $26,121,000 |
| Lead/Zinc | W | W | W | W | W | W | 960,000 |
| Molybdenum | W | W | W | W | W | W | 492,000 |
| TOTAL | $1,263,000 | 5 | $5,559,000 | 20 | $20,751,000 | 75 | $27,573,000 |

The "W" signifies that the data is withheld to avoid disclosing proprietary information.

## Development costs

In general, expenditures for development of a mine or mineral deposit other than oil and gas can be expensed in the year incurred, or, at the taxpayers election, be deferred and deducted in later years. The deferred expenses are capitalized and deducted ratably over the period of production. Other tax considerations are taken into account in deciding whether to expense or defer development costs. These include

--the impact of deducting such expenditures on net income limit for percentage depletion, and

--the minimum tax.

From an analytical point of view, deferral is cumbersome and difficult to incorporate in a cash-flow analysis. From a practical point of view, deferral would probably be used if a company built its own mine and mill complex, whereas expensing would be selected if the mine-mill complex were built by an outside contractor.

For producing mines, the model expenses all development costs. Permitting the expensing of such costs incurred after a mine has begun production is a departure from normal accounting

rules and hence considered a tax expenditure. For nonproducing deposits, the model capitalizes such costs and amortizes them over the life of the potential mine on a ratable basis, as minerals resulting from these development costs are produced and sold. Using the model we compared this method of deferring development costs with the current expensing of such costs to estimate the present-value, tax-expenditure cost of the expensing provision. As the table below shows, the total present value of all mines decreases if all mines were required to expense development costs. 1/

Table 29

Change in Present Value if Potential Deposits Were Required to Expense Development Costs
(discounted 1978 dollars)

| | |
|---|---|
| Copper | $ ($3,957,000) |
| Lead/Zinc | 599,000 |
| Molybdenum | (848,000) |
| TOTAL | $ ($4,206,000) |

Examining the change in present value by profitability category, as shown in Table 30, indicates that the present value of economically profitable deposits increases when development costs are expensed, but the present value of financially profitable and unprofitable deposits decreases. Actually, only the aggregate change in financially profitable deposits is negative. Of the nine financially profitable in this study, the present value of four increases and the present value of five decreases.

1/ As with exploration cost, the value of this tax provision--expensing of development costs--to the nonproducers is understated.

Table 30

Change in Present Value if Potential Deposits Were Required to Expense Development Costs--by Profitability Category

| | Economically Profitable | Financially Profitable | Unprofitable | Total |
|---|---|---|---|---|
| | (discounted 1978 dollars) | | | |
| Copper | $ 927,000 | $(68,000) | $(4,816,000) | $ (3,957,000) |
| Lead/Zinc | W | W | 0 | 599,000 |
| Molybdenum | 0 | 0 | W | (848,000) |
| TOTAL | $1,526,000 | $(68,000) | $(5,664,000) | $ (4,206,000) |

The "W" signifies that the data is withheld to avoid disclosure of proprietary information.

All of the economically profitable and some of the financially profitable or marginal deposits receive present-value, tax expenditure benefits from the expensing of development costs. According to the model, the total present value amount of benefits to these mines is very small, however, actual corporations may realize more benefits through their more complex tax structures.

# CHAPTER 3

## CHANGES IN STATE TAXES AND THEIR IMPACT ON MINING PROFITABILITY

State taxes can have a significant effect on the profitability of existing mines, the development of known deposits, and the level of exploration activity within a State. State taxes often represent a large portion of the total taxes paid by a mine. Over the lives of the mines included in this study, 40 percent of the total taxes paid will be to State and local governments.

Unlike Federal taxes, which for the most part are based on net income or profits, State severance and property taxes are often based on production, gross proceeds (gross value), or the full cash value of the mine. Some States utilize these tax methods, such as gross proceeds, because they are relatively easy to establish and administer, for example, Arizona's transaction privilege tax or Utah's mining occupation tax. Some States levy severance taxes to recoup part of the nonrenewable wealth that is being extracted, for example, Montana's resource indemnity trust tax or New Mexico's resource excise tax.

At the local level, property taxes are levied to support schools and other public services. In general, States have imposed or substantially increased these types of taxes without the benefit of analysis that shows how they may affect mineral production, development or exploration. This is a critical matter, for taxes not associated with net income or profits tend to discourage the full extraction of low grade ores and thereby impair the efficient use of mineral resources.

In states that produce a substantial portion of the domestic supply of a mineral, for example Missouri (which in 1979 produced 88 percent of the Nation's primary lead) or Arizona (which produced 65 percent of our primary copper), tax actions could have a significant effect on national mineral policy goals. More communication is needed between the Federal Government and the latter to inform the States about Federal mineral policies and to provide assistance to the States for their evaluation of the effects of alternative taxing schemes on mineral production, development and exploration.

## ANALYSIS OF CHANGES IN STATE TAXES

Changes in State mineral tax laws have a significant impact on the profitability of mining ventures and the mining

industry's ability to expand or contract production. The results of our analysis indicate that

--changes in State taxes affect a wide spectrum of a mine's costs,

--percentage change to various taxes results in different impacts on the profitability of producing mines and non producing deposits, and

--tax impacts differ according to the financial condition of the mine.

Determining the effect changes in State taxes have on profitability is very complex. One approach is to use impact analysis. This type of analysis measures the impact that a change in one State tax has on the other components of a mine's cash flow and on its profitability. We focused on four tax parameters which can significantly influence profitability:

--The bases of the tax.

--The tax rate.

--The timing of the tax.

--The interrelationships between taxes.

## TYPE OF TAXES PAID BY THE MINING INDUSTRY

The mining industry, like other commercial enterprises, pays State income tax, franchise, unemployment, sales, excise, and Federal income taxes. However, the mining industry is often treated differently regarding property tax assessment and it is one of the few industries that pays severance taxes. The total amount of taxes the industry pays in any State depends on the number of taxes in effect, the deductions and exemptions allowed, the tax rate, and the base to which it is applied. The following table illustrates the estimated amount of State and Federal taxes that will be paid over the lives of the producing mines included in this study.

### Severance tax

A severance tax is distinguished by its relationship to the actual removal of the natural resource and measured by a value or quantity of the product removed or sold. Severance taxes specifically aimed at the mining industry first occurred in 1846 when Michigan enacted a 4-percent tax on the products of all mines. By 1910, seven States had written severance taxes for

Table 1

ESTIMATED STATE AND FEDERAL TAXES TO BE PAID BY MINING OPERATIONS

| Commodity | | Property tax | Severance tax | Income tax | Total State tax | Federal tax | Total taxes |
|---|---|---|---|---|---|---|---|
| | | (millions of undiscounted 1978 dollars) | | | | | |
| | Arizona | $ 857.7 | $ 913.8 | $ 204.2 | $ 1,975.7 | $ 1,551.9 | $3,527.6 |
| | Utah | 735.5 | 166.8 | 164.3 | 1,066.6 | 1,848.1 | 2,914.7 |
| | New Mexico | 17.3 | 66.3 | 18.8 | 102.4 | 172.9 | 275.3 |
| | Montana | 66.0 | 108.9 | 49.2 | 224.1 | 348.1 | 572.2 |
| | Nevada | 1.3 | - | - | 1.3 | 6.6 | 7.9 |
| | | 1,677.8 | 1,255.8 | 436.5 | 3,370.1 | 3,927.6 | 7,297.7 |
| Molybdenum: | Colorado | 315.2 | 124.5 | 100.1 | 539.8 | 996.5 | 1,536.3 |
| | New Mexico | 2.3 | 2.5 | 2.8 | 7.6 | 28.4 | 36.0 |
| | | 317.5 | 127.0 | 102.9 | 547.4 | 1024.9 | 1,572.3 |
| Lead/Zinc: | Missouri | 3.5 | 1.4 | 55.6 | 60.5 | 983.8 | 1,043.3 |
| | Tennessee | 22.6 | - | 4.9 | 27.5 | 16.3 | 43.8 |
| | New York | 3.1 | - | - | 3.1 | - | 3.1 |
| | | 29.2 | 1.4 | 60.5 | 91.1 | 1,000.1 | 1,091.2 |
| Grand Total | | $2,024.5 | $1,384.2 | $ 599.9 | $ 4,008.6 | $ 5,952.6 | $9,961.2 |
| Percentage | | 20.3 | 13.9 | 6.0 | 40.2 | 59.8 | 100 |

the mining industry. Currently, 29 States have enacted specific mineral production tax laws and the basis for these taxes varies from State to State. For example, Colorado's and Missouri's severance taxes are based on each ton of ore removed from the mine. Other States included in our study base their severance tax on gross value or net proceeds. A severance tax based solely on the amount of ore removed has the most detrimental effect on mineral reserves since the mine operator will seek to produce the highest quality and most accessible ores in an effort to minimize the per unit cost of the tax. A severance tax based on gross proceeds or on a similar basis, for example, gross value or revenue, is less detrimental because the tax is a function of price. When mineral prices are low, the tax burden is less. Severance taxes based on net proceeds do more to encourage the mining of low-grade ore, because the net proceeds basis takes into account the cost of production.

The chart below illustrates the rates and bases the States included in this study used to determine severance taxes.

Table 2

Comparison of State Severence Taxes (note a)

| State/Mineral | Name of tax | Rate and basis |
|---|---|---|
| Arizona: | | |
| Copper | Transaction privilege tax | 2 percent of gross value. |
| Colorado: | | |
| Molybdenum | Severance tax | $0.15 per ton of ore. |
| Missouri: | | |
| Lead/Zinc | Mine inspection fee | $0.03 per ton of lead concentrates and $.015 per ton on lead and zinc carbonate. |
| Montana: | | |
| Copper | Metalliferous mine tax | Up to 1.438 percent of gross value. |
| Copper | Resource indemnity trust fund | 0.5 percent of gross value over $5000, minimum of $25. |
| New Mexico: | | |
| Copper and Molybdenum | Resource excise tax | Varying rates on the value of the ore--copper, 0.75 percent, and molybdenum, 0.125 percent. |
| | Severance tax | Varying rates on the value of the ore--copper, 0.5 percent, and molybdenum, 0.125 percent. |
| Utah: | | |
| Copper | Mining occupation tax | 1 percent of gross value. |

a/ Nevada, New York, and Tennessee do not impose a severance tax.

## Property tax

The property tax, which is almost always an ad valorum tax is one of the oldest taxes on mining operations and for many years was the principal source of State and local revenues. Several important mineral-producing States still rely on it as their principal mining tax. In some States, the tax is levied against the value of the mine. However, the value is often approximated by income or proceeds from mining operations. In line with the concept that property taxes are imposed on the value of the property, most States utilize an assessor who evaluates the surface improvements, machinery, and similar equipment, and a State agency that determines the value of the ore body.

States generally use one of two approaches to evaluate the ore in place for property tax purposes. Some States levy these taxes based on production or proceeds. Others attempt to determine the full cash value of the deposit using discounted cash flow methods which require assumptions regarding mine life, rates of return, and the price of the metal.

The table below describes the property taxes levied by the States included in this study.

Table 3

Comparison of Ad Valorum or Property Tax Procedures

| State | Basis of tax |
|---|---|
| Arizona | 60 percent of full cash value. Full cash value is capitalized net future proceeds. |
| Colorado | Higher of 25 percent of gross proceeds or 100 percent of net proceeds for producing mines and 30 percent of actual value for nonproducing mines. Also all metal mining properties are taxed an additional amount based on 0.1 percent of assessed value. |
| Missouri | 33-1/3 percent of true market value. Market value is defined as original cost plus improvements. |
| Montana | Real and personal property, other than gross proceeds, are taxed at various rates. Gross proceeds are taxed at the rate of 3 percent. |
| Nevada | General property is assessed at 35 percent of full cash value (net proceeds). |

| | |
|---|---|
| New Mexico | Personal property is assessed at 1/3 the property value and taxed at various rates. Mineral value is assessed at 300 percent of annual net production. |
| New York | Physical property valued at cost. Mineral value based on production over a 5-year period. |
| Tennessee | Real and tangible personal property assessed at 40 percent and 30 percent, respectively, of market value. Market value is based on per acre assessment. |
| Utah | Twice the average annual net proceeds for the last 3 years. |

In those instances where States base value on production, mathematical formulas or averaging techniques that minimize tax receipt fluctuation are usually employed. Hence, property taxes often become fixed production costs. One effect of this form of taxation is the possibility of prematurely closing a mine because the higher-grade ores have been extracted and the remaining lower grade ores are not economically recoverable. Any tax based on the value of production is detrimental; by raising ore grade, it reduces the size of mineral reserves and the future recovery of minerals. This impact is lessened when net proceeds rather than gross proceeds or production are used as a base.

State income tax

State income taxes are usually patterned after the Federal income tax, but at a much lower rate. States usually allow mining operations to deduct mining and processing costs, and general and administrative expenses. State taxable income is limited to income derived within the State and taxes are calculated on a flat or graduated rate. The table below provides a comparison of the rates and bases of State income taxes.

Table 4

Comparison of State Income Taxes

| State | Rate and basis of tax (note a) |
|---|---|
| Arizona | Maximum of 10.5 percent of net income above $6,000 with lesser percentages on a sliding scale down to 2.5 percent on net income under $1,000. Federal income tax is deductible before arriving at State taxable income. |

| | |
|---|---|
| Colorado | Five percent of taxable income. Federal income tax is not allowed as a deduction to compute State taxable income, however severance taxes paid are allowable deductions |
| Missouri | Five percent of taxable income, based on Federal income reported. Federal tax is deductible. |
| Montana | Six and three-quarters percent of net income. Federal and State taxes are not allowable deductions for arriving at State taxable income. |
| New Mexico | Five percent of taxable income. Federal taxes are not allowable deductions to arrive at State taxable income. |
| New York | Ten percent of net income. |
| Tennessee | Six percent of Federal taxable income but Federal income tax is not an allowable deduction. |
| Utah | Four percent of taxable income. Federal taxes paid are not deductable but 1/3 of the depletion allowance is deductible. |

a/ Nevada does not impose an income tax.

The mining industry prefers the income tax because it is based on profitability. Income taxes in comparison with other forms of taxation encourage mineral conservation, exploration, and long-range planning since ore reserves in the ground are not translated immediately into tax payments. From the States' viewpoint, income taxes are easy to administer, but they lack revenue certainty or predictability as a result of changes in economic conditions and hence complicate the States' budgetary planning process.

## TAX BASES VARY AMONG STATES

Taxes based on net proceeds result in more efficient use of the Nation's resources since they consider profitability and the mines' ability to pay. The net proceeds tax basis is preferable because it does not interfere with the optimum rate of recovery, nor does it discourage the mining of low-grade ore. Only four of nine States in our study have tax structures that use the net proceeds method for levying severance and property taxes. The other States base their mining taxes on unit of production or gross proceeds.

Severance taxes are the easiest to administer since under the unit-of production rule, only a tonnage figure is needed to which the rate is applied. The gross proceeds tax method is slightly more complicated to administer since a value of the ore must be determined, and the stage of production to which it is applied must be defined. Some States base the value of the ore on prices in trade publications while others use gross revenue. When different methods of production are used (i.e., mining and milling for sulfide ores versus mining and leaching for oxide ores), difficulty arises in defining when mining stops and processing begins, and hence, determining the appropriate tax base.

The gross proceeds method generally provides more stable tax revenues for States than net proceeds. For local governments which depend on mining property taxes for a large portion of their revenue, stability is the major concern. For example, a Montana county received over $15 million in 1975 in property taxes from mining operations, based on mineral valuation of net proceeds. In 1976, no property taxes were received due to low mineral prices and an overall slump in the industry. The Montana legislature, attempting to stabilize the tax receipts of localities, changed the tax base on the value of minerals in place from net proceeds to gross proceeds.

States adopting a net proceeds tax must cope with the possibility of large fluctuations in tax revenue and must also have sufficient auditing staff to verify the income and deductions claimed. To avoid these huge fluctuations in tax revenue caused by net proceeds, some States have taken various approaches. Utah averages the companies' net proceeds over the previous 3 years, which tends to even out large fluctuations from year to year. Colorado assures some proceeds will be taxed by requiring a property tax assessment valuation of net proceeds or 25 percent of gross proceeds, whichever is greater.

## STATE TAX CHANGES ARE MADE WITHOUT IMPACT ASSESSMENTS

Since passage of the Mining and Minerals Policy Act in 1970, most of the States in our study increased mining taxes. While the Bureau of Mines has the capability to assist States in assessing the impact a tax change would have on its mining industry, this service has been requested by only one State--Minnesota.

Officials from Arizona, Nevada, New Mexico, Utah, and Montana told us that they did not perform studies to determine the impact tax changes had on the mineral industry in their States. Most States limit their assessment to the effect the tax change will have on State revenues.

A Colorado study was performed but was limited to examining other States' taxes and the various approaches taken to taxing

the mining industry. The study did not determine the total impact new taxes would have on the industry or the States' reserves. Wisconsin attempted to perform a tax impact study through the use of a mine model. However, sufficient mining and capital cost data to estimate accurately the impact on the industry was not available.

Wisconsin has one of the highest tax rates on nonfuel minerals in the Nation. Its primary tax on mining is the occupation tax, which was enacted in 1977, and is based on average net proceeds over a 3-year period. While a tax based on net proceeds provides the least impact on the Nation's reserves, Wisconsin's occupation tax has a progressive rate structure that ranges from no tax on the first $100,000 of net proceeds to 20 percent on net proceeds exceeding $30 million. Industry officials stated that the progressive rates penalize those companies that make large capital investments. For example, a company having $50 million in net proceeds pays the same occupation tax ($8.4 million) whether the company's investment is $100 million or $400 million. Therefore, companies that could risk large amounts of capital may be reluctant to invest in Wisconsin. The State, however, found that progressive rates

--place a heavier tax burden on mines that have large profits and a lesser burden on those with lower profits,

--lighten the tax burden on marginal mining operations, and

--encourage continued operation and continued employment.

The effect of the Wisconsin mining tax law is still unclear. The State has not yet received any revenue from this tax. Although two large ore bodies have been discovered, they are not yet in production. State and mining officials told us that since passage of the tax and other laws which make the opening of new mines difficult, exploration has declined and has been limited to defining known ore bodies. These officials anticipate no new announcements of potential mine development. One mining firm, which is considering a potential mine, plans to reassess its project on a continuing basis as more precise cost data become known. Another mining official told us that the occupation tax has forced his company to stop exploration in Wisconsin and to move its activities to other States.

## MEASURING THE EFFECTS OF CHANGES IN TAX RATES

State taxes significantly affect a mining operation's profits: the greater the discounted value of the tax, the greater its impact

on profits. The amount of the tax depends on both its basis and rate. The effects of different bases were discussed earlier. This section illustrates the results of changing various tax rates which we accomplished by using impact analysis.

We varied the rates of property, severance, and income taxes in each of the nine States we studied. Ideally, since it is not the name of the tax--property or severance--tnat matters, for example, one state could have a tax on gross proceeds and call it a severance tax and another state could have a similar tax classified as a property tax. One would want to examine the effects of rate changes associated with different bases. However, in the model and in the States, taxes are classified by name rather than base, so we examined the rate changes associated with different types of taxes rather than with different tax bases.

The figures below reveal that in two of the five copper-producing States changes to the property tax had a greater impact on profitability than changes to severance and income taxes. Conversely, in two other States severance tax changes had a greater effect on profits than changes to property and income taxes. In one State--Nevada--the property tax was the only tax imposed.

In two of the three lead/zinc-producing States, changes to the property tax had a greater effect than changes to the income tax. These two States do not impose severance taxes. In the remaining State, a change to the income tax had a greater impact than changes to the property and severance taxes.

In one of the two States with molybdenum-producing mines, changes to the income tax had a greater impact than changes to the two other State taxes. In the other State, changes to the property tax had a greater impact on profitability than changes to the severance and income tax.

For nonproducing copper deposits, changes to the property tax had a greater effect on profitability than changes to severance and income taxes. In one State-Nevada-only the property tax is imposed. In the lead/zinc State with a nonproducing deposit, changes to the State income tax had a greater impact compared to changes in the property and severance tax. In the one State with a molybdenum nonproducing deposit, changes to the property tax had a greater impact on profits than changes to the severance and State income tax.

The percent changes in each figure represent the differences between the "as is" case and the hypothetical tax change, and reflect discounted dollars, net present value (NPV).

FIGURE 1

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF COPPER MINES AND DEPOSITS IN ARIZONA

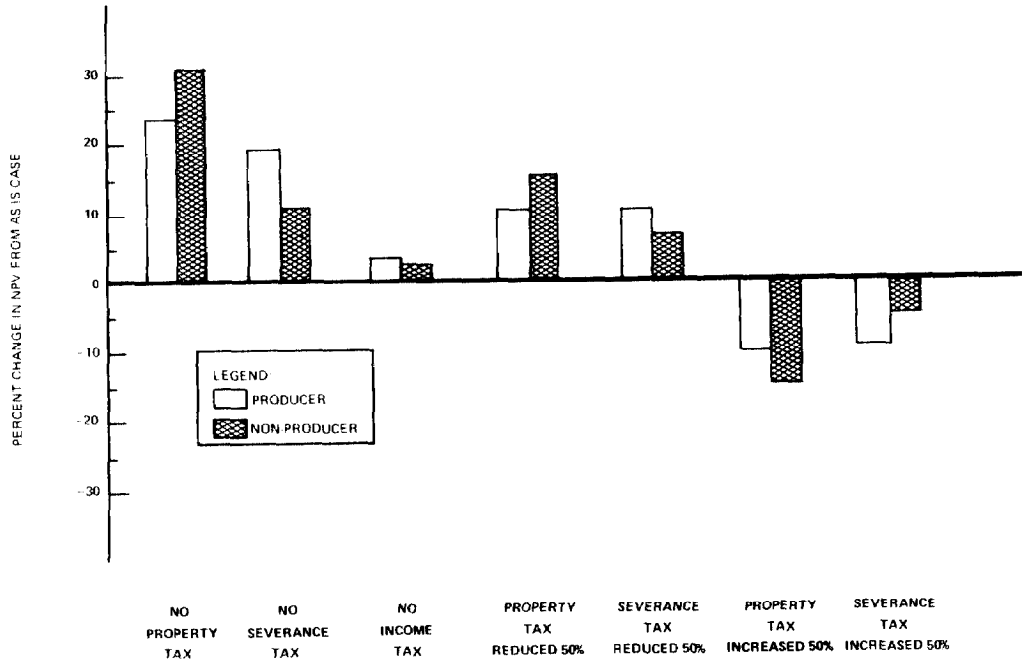



FIGURE 2

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF COPPER MINES AND DEPOSITS IN NEW MEXICO

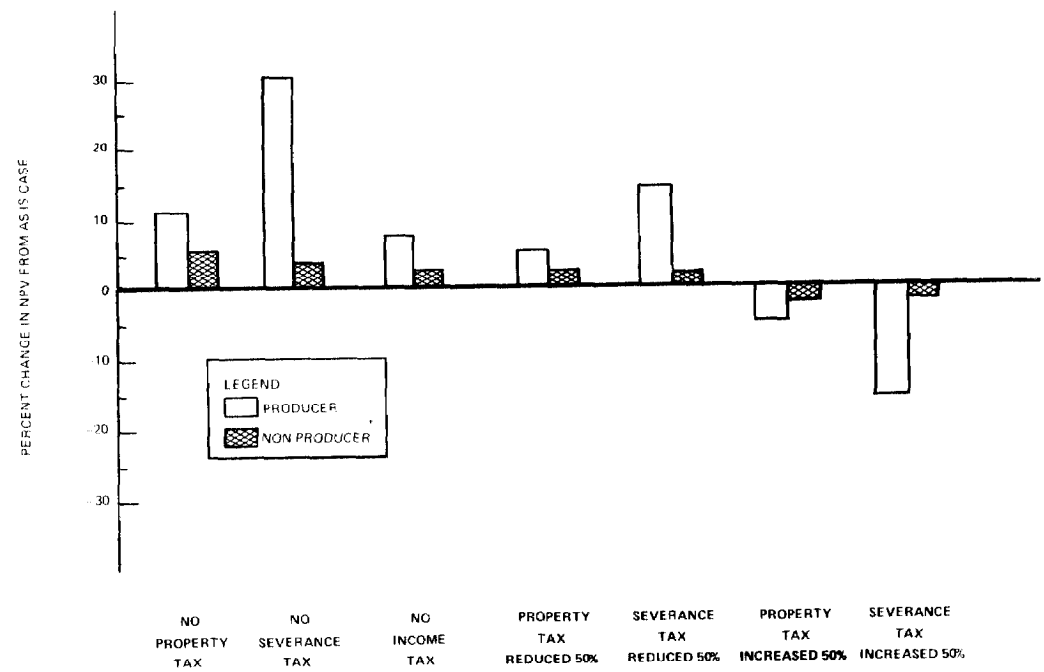


FIGURE 3

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF COPPER MINES AND DEPOSITS IN MONTANA

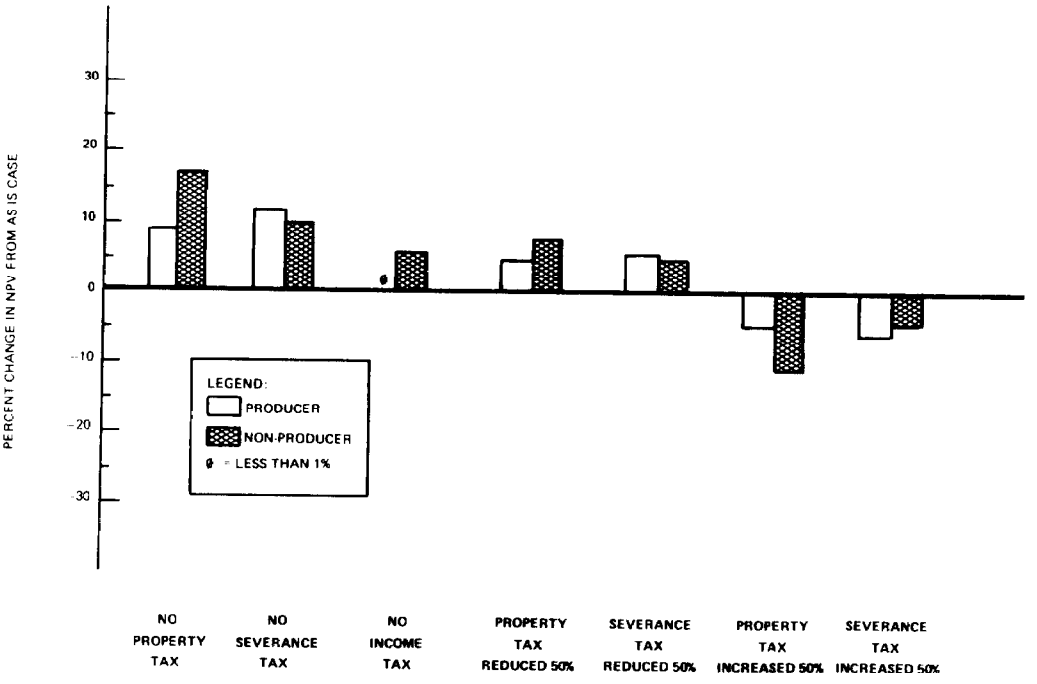



FIGURE 4

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF COPPER MINES AND DEPOSITS IN NEVADA

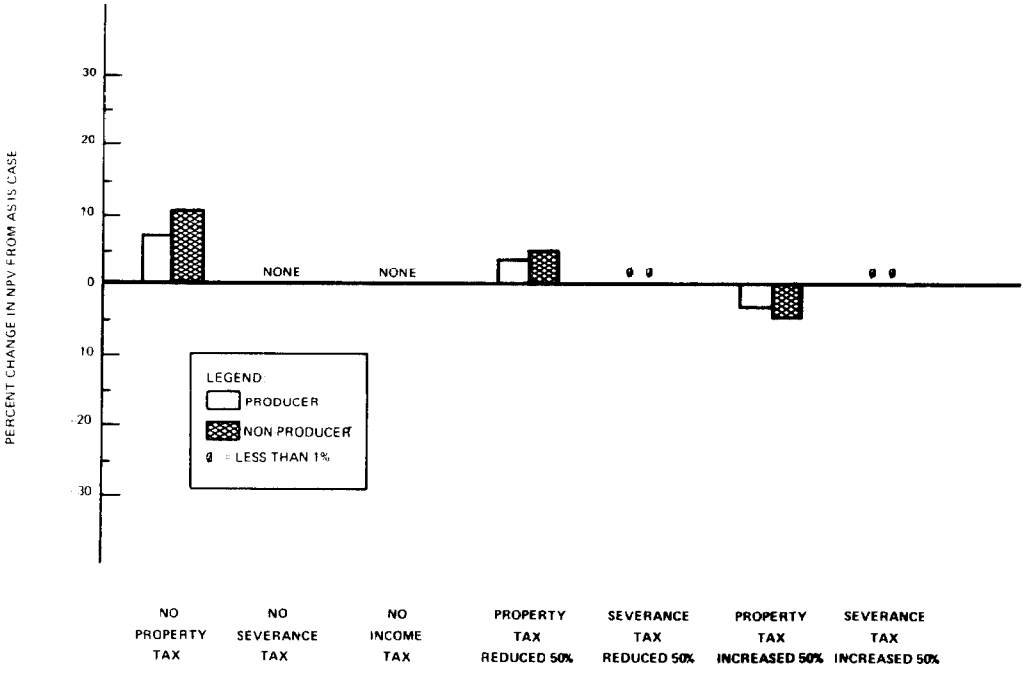


FIGURE 5

**IMPACT OF TAX CHANGES ON THE PROFITABILITY OF COPPER MINES AND DEPOSITS IN UTAH**

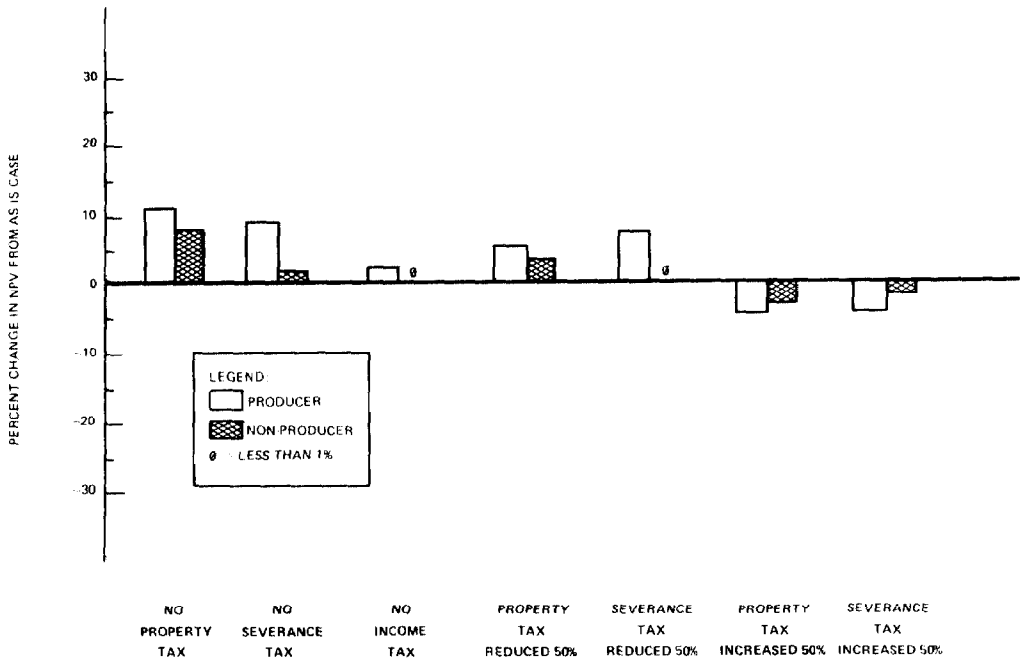


FIGURE 6

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF LEAD/ZINC MINES AND DEPOSITS IN MISSOURI

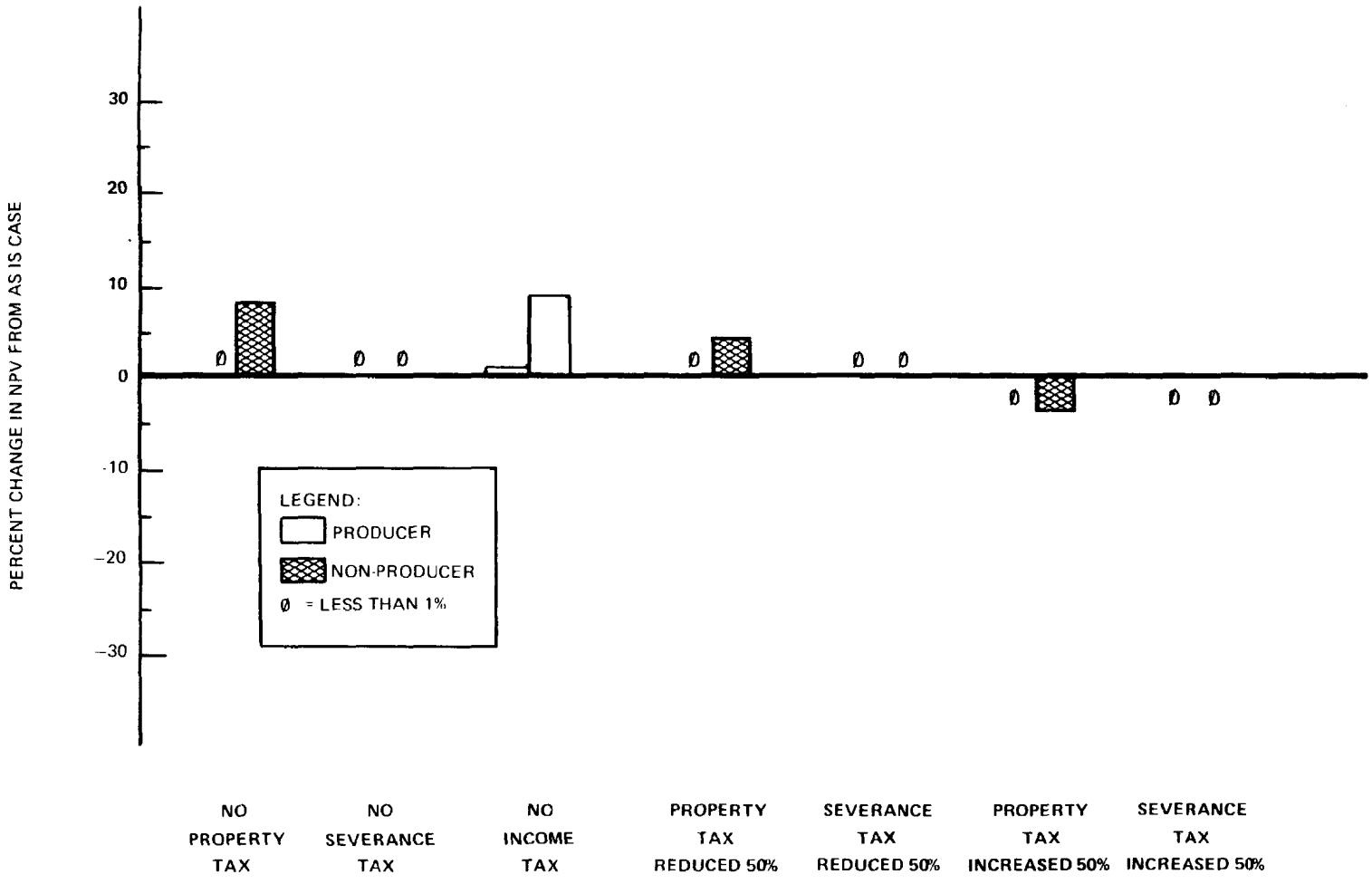


FIGURE 7

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF LEAD/ZINC MINES IN NEW YORK

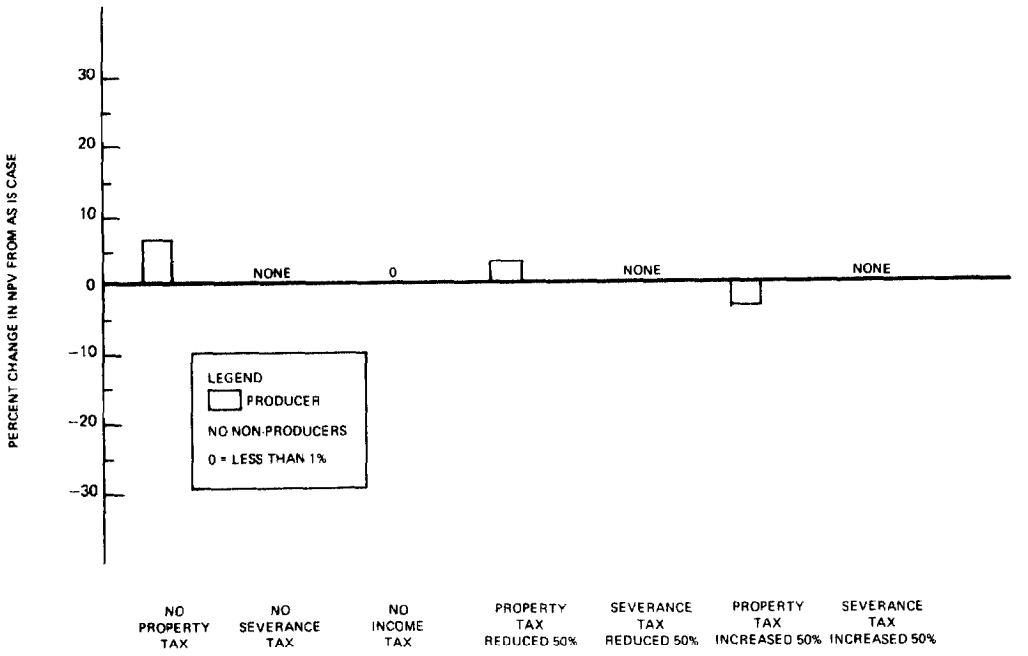



FIGURE 8

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF LEAD/ZINC MINES IN TENNESSEE

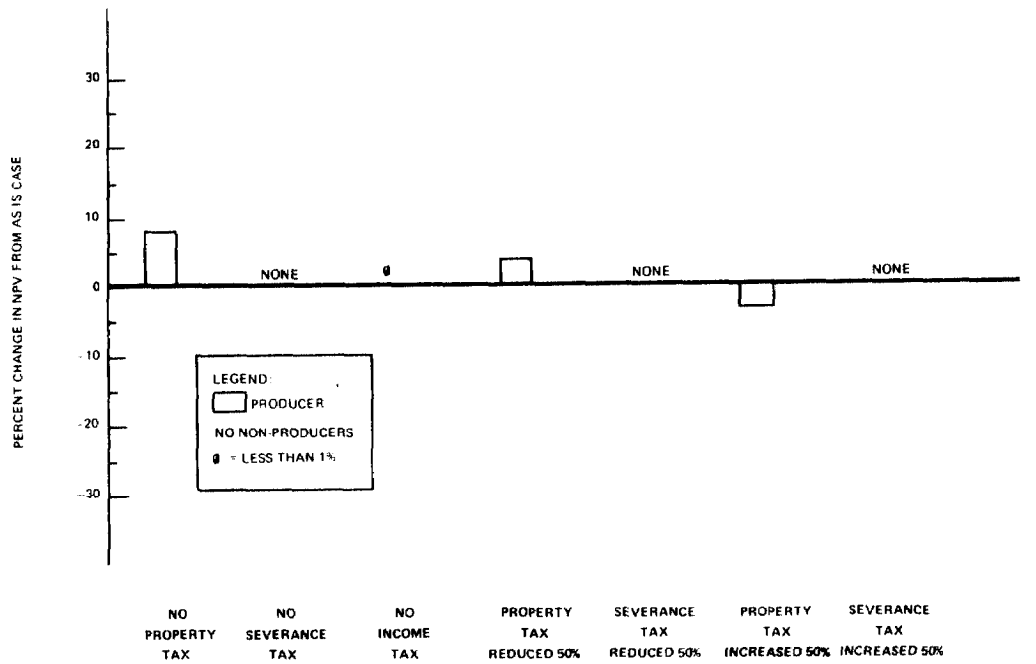


FIGURE 9

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF MOLYBDENUM MINES AND DEPOSITS IN NEW MEXICO

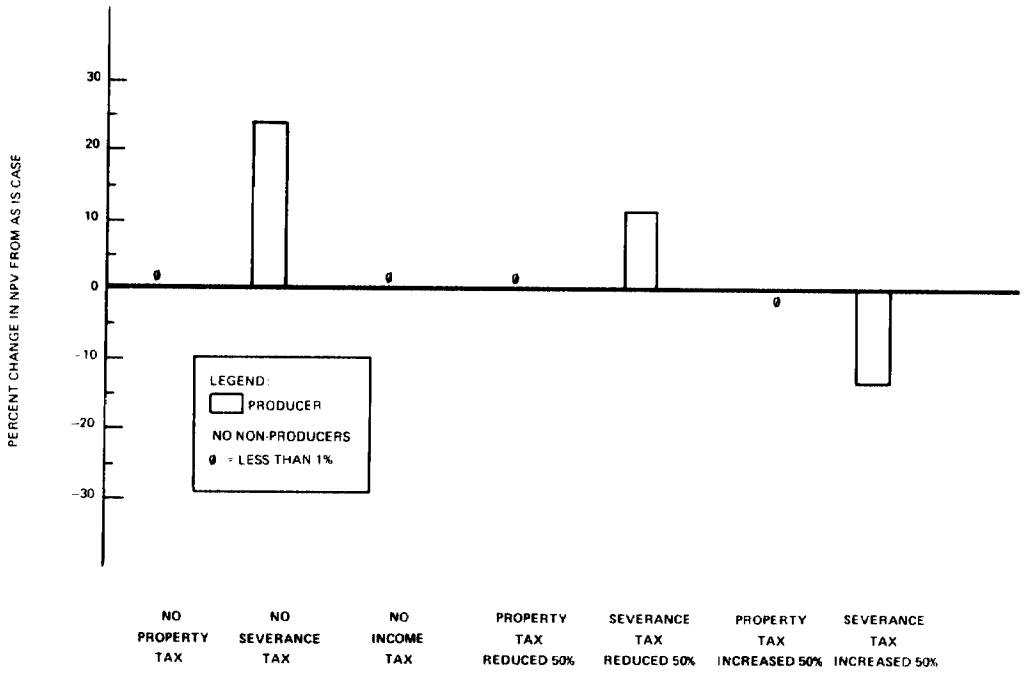
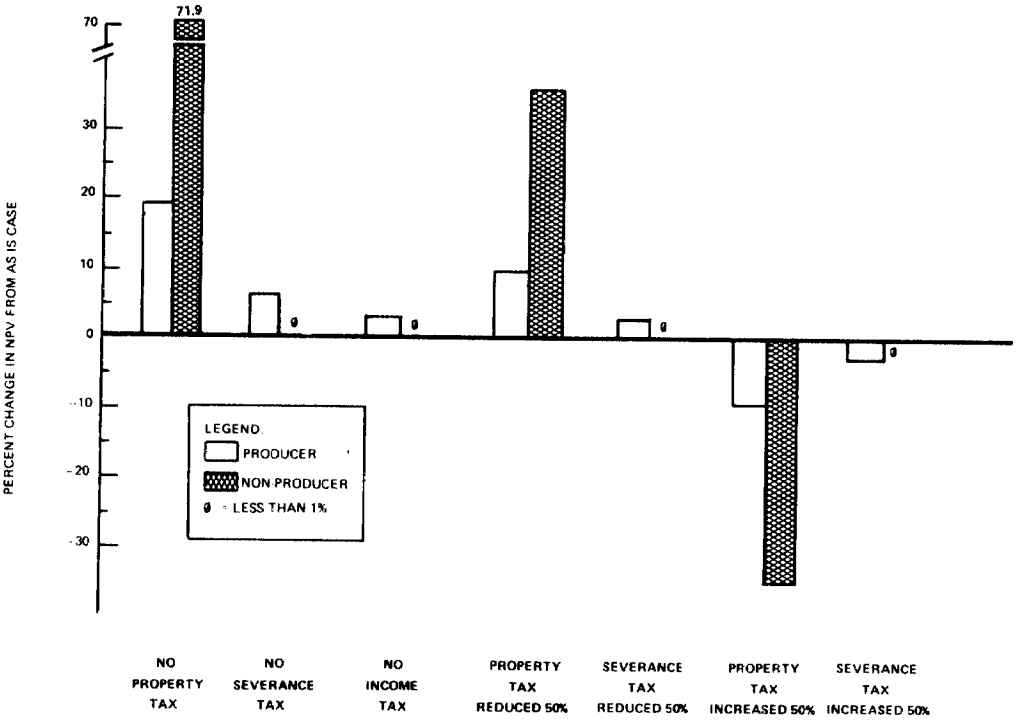



FIGURE 10

IMPACT OF TAX CHANGES ON THE PROFITABILITY OF MOLYBDENUM MINES AND DEPOSITS IN COLORADO



In addition to examining the effect that rate changes have on all mines, it is also important to determine their impact on mines with different profitability conditions. As seen below, changes in the Arizona property and severance taxes have the greatest impact on financially profitable mines and deposits, whereas removing the State income tax has the greatest impact on economically profitable mines. The effect that alternative tax provisions have on profitability is measured by the percentage change in net present value from the "as is" case to each situation.

Mines and deposits that are financially profitable have net present values closer to zero than those categorized as unprofitable. Hence, percentage changes that result from different tax rates are large; this reflects the actual situation facing these mines. Mines and deposits that are financially profitable are marginal operations, and small changes in any cost category can significantly affect them. If taxes are increased, these marginal mines are the most likely to shut down and if tax treatment becomes more favorable, these are the deposits most likely to be developed. Economically profitable mines are likely to produce unless very severe tax increases are implemented, but production rates and cut-off grades may change to reflect these additional costs.

According to the model, mines that are unprofitable generally are producing only because they expect conditions to change. The model does not take this into account. However, unprofitable deposits are unlikely to be developed unless conditions change drastically. The figures below show the effect tax changes have on producing mines and non-producing deposits in different financial categories.

FIGURE 11

IMPACT OF STATE TAX CHANGES ON
ARIZONA COPPER DEPOSITS -- BY PROFITABILITY CATEGORY

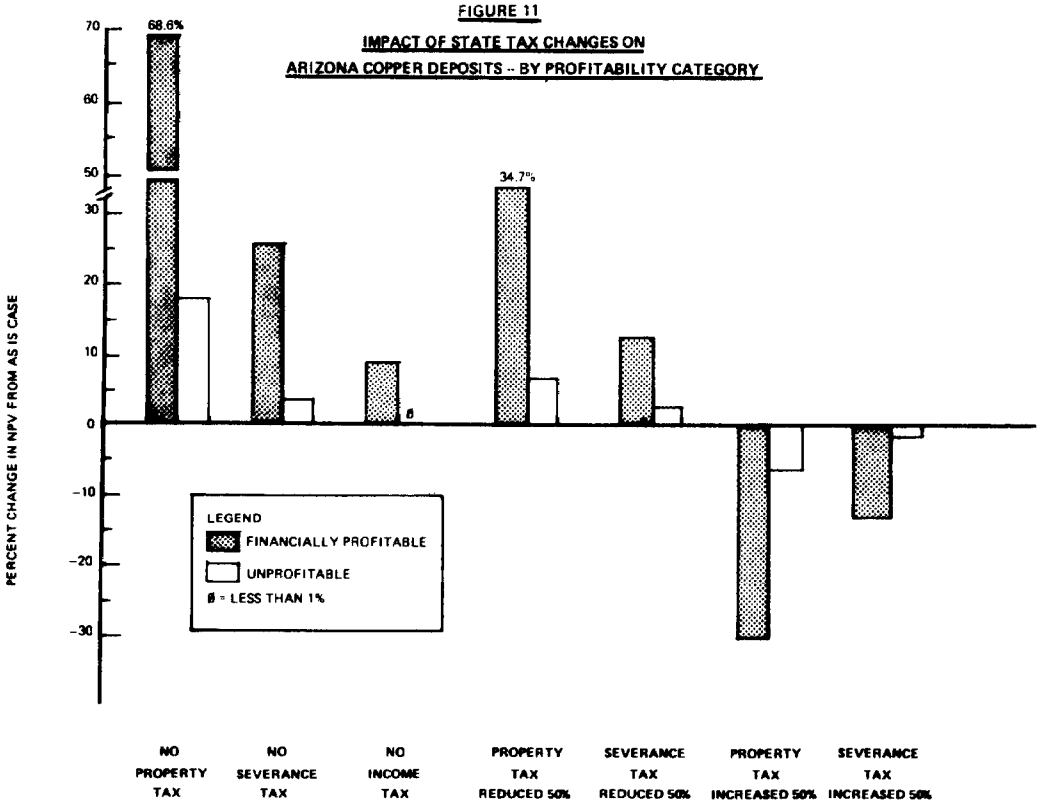
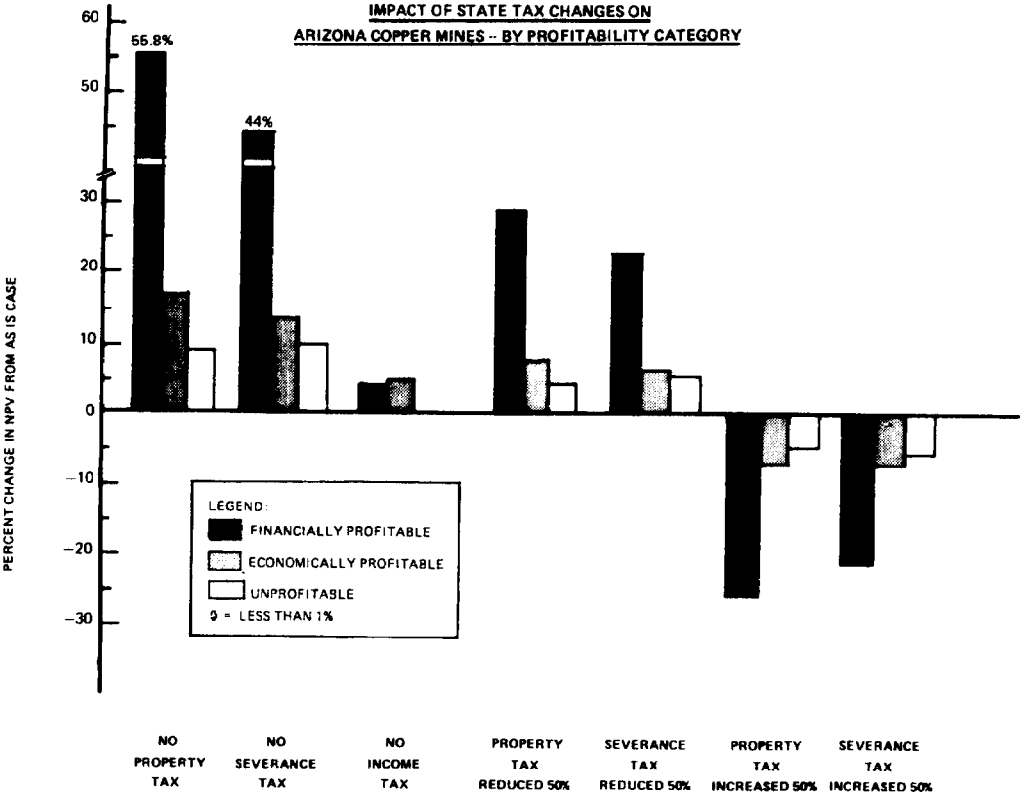



FIGURE 12

IMPACT OF STATE TAX CHANGES ON
ARIZONA COPPER MINES -- BY PROFITABILITY CATEGORY



## TIME AND TAX BASES IMPACT ON INVESTMENT DECISION

One of the critical elements in the decision as to whether a company will invest in a mining operation is the magnitude and timing of annual cash flow. In the early stages of development, massive capital outlays sometimes approaching $1 billion may be needed in order for the mine to go into production. Also, it is usual for a mine not to generate revenues until production commences which can take from 5 to 10 years after the investment decision is made. Our model revealed that on an undiscounted basis, the greatest tax burden for producing mines was the property tax in five States, the severance tax in three States, and State income tax in two other States. For nonproducing deposits, the property tax was the heaviest burden in six States, and State income tax in one other State. When tax dollars are discounted to reflect the opportunity cost of capital, however, tax burdens sometimes switch. The tables and graphs below depict how tax burdens on copper properties located in Arizona and New Mexico change over the life of the mine.

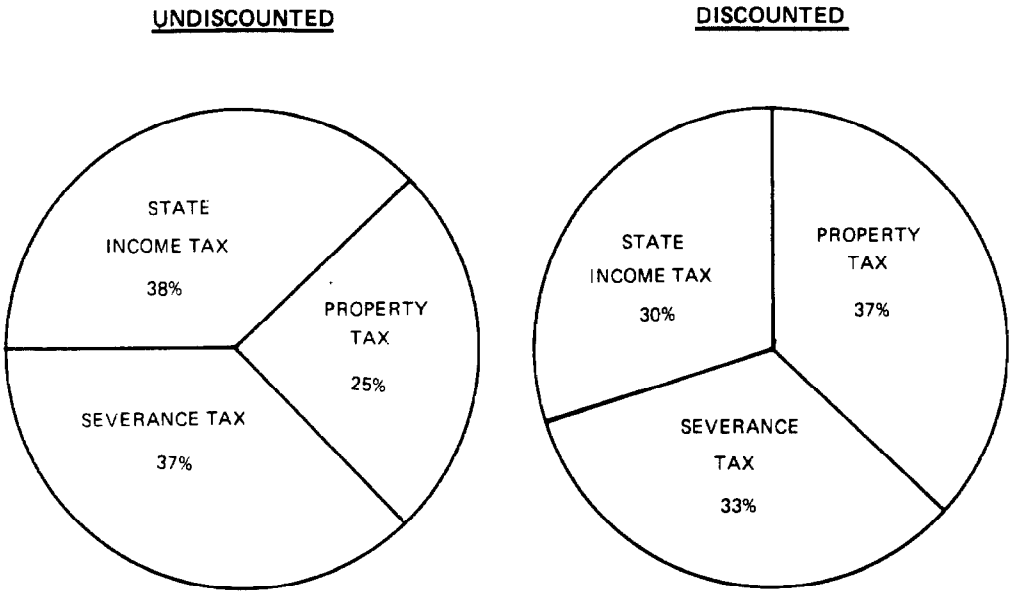
On a discounted basis, changes in magnitude occur because of the time the tax is levied and the basis used. For example, in New Mexico, the property tax is levied on the value of capital improvements and production. For a nonproducing deposit, the bulk of the capital expenditures are made in the early years (first 4 years) of operation and, correspondingly, the property tax paid is at its peak. As shown below, additional property and severance taxes are levied once production begins, and in the fifth year, as the mine becomes profitable, State income taxes begin to be paid. But, since a dollar in "year one" has a higher present value than a dollar in "year five", the effect of the property tax is magnified, and the impact of the income tax on the investment decision diminished.

Table 5

Change in State Tax Burden of a New Mexico Deposit When the Time Value of Money is Considered

| Year | Undiscounted | | | Discounted | | |
|---|---|---|---|---|---|---|
| | Property tax | Severance tax | State income tax | Property tax | Severance tax | State income tax |
| | (1978 dollars) | | | | | |
| 1978 | $ 65 | $ - | $ - | $ 59 | $ - | $ - |
| 1979 | 65 | - | - | 50 | - | - |
| 1980 | 105,432 | - | - | 67,317 | - | - |
| 1981 | 198,695 | - | - | 105,966 | - | - |
| 1982 | 174,423 | 168,124 | 24,280 | 77,698 | 74,893 | 10,816 |
| 1983 | 150,216 | 168,124 | 177,218 | 55,892 | 62,556 | 65,939 |
| 1984 | 126,009 | 168,124 | 178,429 | 39,162 | 52,251 | 55,454 |
| 1985 | 101,803 | 168,124 | 179,639 | 26,427 | 43,643 | 46,632 |
| 1986 | 77,596 | 168,124 | 180,849 | 16,825 | 36,454 | 39,213 |
| 1987 | 53,389 | 168,124 | 182,060 | 9,669 | 30,449 | 32,973 |
| 1988 | 30,964 | 168,124 | 189,881 | 4,684 | 25,434 | 28,725 |
| 1989 | 10,321 | 168,124 | 197,613 | 1,304 | 21,244 | 24,970 |
| 1990 | - | 168,124 | 236,934 | - | 17,744 | 25,006 |
| Total | $1,028,978 | $1,513,116 | $1,546,903 | $ 405,053 | $ 364,668 | $329,728 |

As shown below for this same deposit on an undiscounted basis, the State income tax in New Mexico represents 38 percent of total taxes and is the largest tax levied, while the property tax represents 25 percent of the burden. However, on a discounted basis, when the value of money over time is considered, the property tax increases to 37 percent of the burden while State income tax declines to 30 percent.

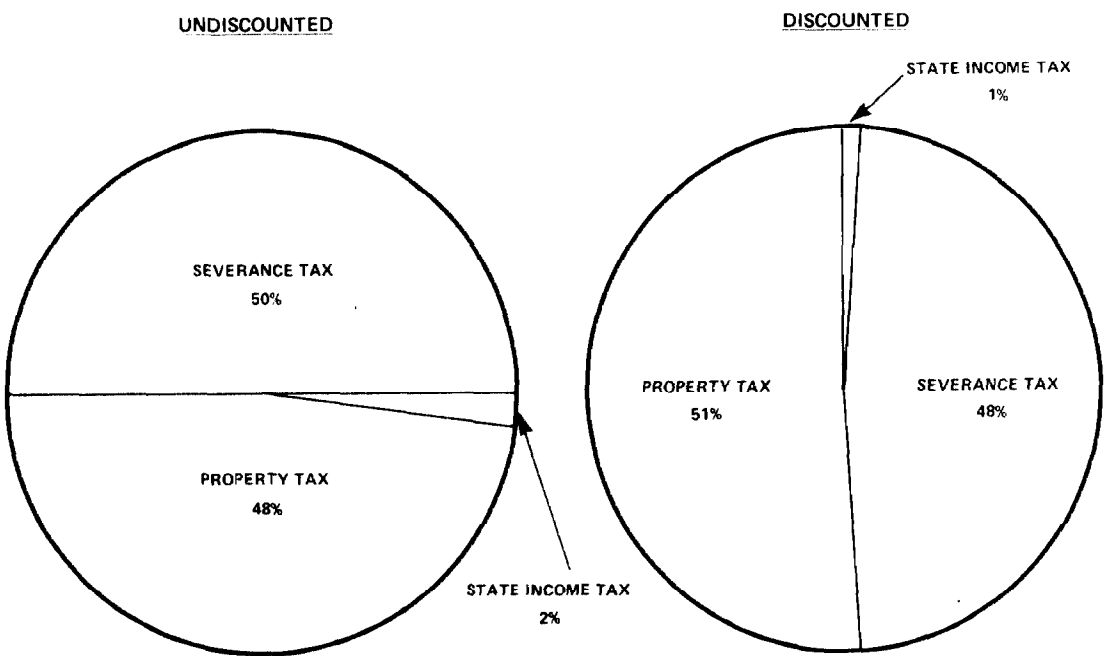


The tables and graphs below illustrate a similar change in tax burdens on an Arizona producing property. Over the life of the mine, which for this study was assumed to begin in 1978, severance tax represents the greatest burden at 50 percent and property tax 48 percent on an undiscounted basis. But, Arizona's basis for property tax is the value of the mine, which is the greatest in its early stage. As ore is depleted, the value of the mine declines, until 1981 when, on a discounted basis, the severance tax, which is based on gross proceeds, exceeds the property tax. Over the life of the mine, on a discounted basis, the property tax represents the largest burden at 51 percent with the severance tax at 48 percent.

Table 6

Change in State Tax Burden on an Arizona Mine When the Time Value of Money is Considered

| Year | Undiscounted | | | Discounted | | |
|---|---|---|---|---|---|---|
| | Property tax | Severance tax | State income tax | Property tax | Severance tax | State income tax |
| | (1978 dollars) | | | (1978 dollars) | | |
| 1978 | $ 2,258,613 | $ 1,613,547 | $ - | $2,066,992 | $1,476,654 | $ - |
| 1979 | 1,912,833 | 1,613,547 | - | 1,462,189 | 1,233,411 | - |
| 1980 | 1,714,788 | 1,613,547 | - | 1,094,875 | 1,030,234 | - |
| 1981 | 1,546,395 | 1,613,547 | - | 824,708 | 860,521 | - |
| 1982 | 1,426,984 | 1,613,547 | - | 635,664 | 718,771 | - |
| 1983 | 1,252,930 | 1,613,547 | - | 466,190 | 600,369 | - |
| 1984 | 1,077,387 | 1,613,547 | 467,531 | 334,841 | 501,474 | 145,304 |
| 1985 | 326,725 | 760,024 | 172,247 | 84,815 | 197,295 | 44,714 |
| Total | $11,516,655 | $12,054,853 | $639,778 | $6,970,274 | $6,618,729 | $190,018 |



## INTERACTION OF TAXES AND THEIR IMPACT ON PROFITABILITY

Changes in State taxes have a rippling effect that transcends State revenue streams and affects Federal tax receipts, allowances, and credits and have a major impact on the overall profitability of a mine. The model allowed us to measure this impact. The following are examples of the effects of hypothetical changes in State taxes. These illustrate the type of analysis the Federal Government could provide to the States so they could better understand the impact of tax changes.

### Increasing Montana's severance tax

Montana has two severance taxes that are applied to the copper industry--the metalliferous mine and the resource indemnity trust taxes. The metalliferous mine tax is levied at varying rates on the gross value of the ore. The latter tax is applied as a flat percentage rate to the gross value of the ore in excess of $5,000. Gross value is defined as gross sales minus all processing costs. Both taxes are used as deductions to arrive at the Federal income tax rate. The table below illustrates on an undiscounted basis, in 1978 dollars, the cumulative effects that a 50-percent increase in the severance tax rate has on a producing mine.

Table 7

Effects of a 50-Percent Increase in Montana's Severance Tax on a Producing Mine

| Taxes and allowances | Current rate structure | Severance tax rate increased by 50 percent | Change |
|---|---|---|---|
| | (undiscounted 1978 dollars) | | |
| Severance taxes | $108,930,386 | $163,395,899 | $54,465,513 |
| Property taxes | 66,043,966 | 66,043,966 | - |
| State income taxes | 49,217,514 | 47,030,221 | ( 2,187,293) |
| Depletion used | 661,155,662 | 639,094,498 | (22,061,164) |
| Investment tax credit | 19,239,792 | 19,239,792 | - |
| Federal income taxes | 348,148,887 | 333,024,843 | (15,124,044) |

Over the life of the mine, the State would collect an additional $54.5 million if severance tax rates were increased by 50 percent. This is offset by the $2.1 million reduction in State income tax caused by the mine's lower taxable income. The mine utilizes percentage depletion based on the 50 percent of net income constraint. By increasing severance taxes, the mine's net income is reduced, resulting in a smaller depletion allowance. The overall net present value of the property dropped by 6.1

percent as a result of the increased severance tax. This corresponds to a decrease of 4.2 percentage points in the mine's internal rate of return. 1/

Increasing Arizona's severance tax

Arizona imposes a 2 percent severence tax on the gross or marketable value of copper. The rate was 2.5 percent, but because copper prices were depressed, the rate was reduced to 2 percent for the period July 1, 1978 to June 30, 1980. It was reverted to 2.5 percent on July 1, 1980.

The tables below illustrate the effect of a 25 percent increase, i.e., from 2 to 2.5 percent, in severance tax on a financially profitable, producing property and a financially profitable, nonproducing deposit. All amounts are in undiscounted 1978 dollars and cumulative over the mine's life.

Table 8

Effects of a 25-Percent Increase in Arizona's Severance Tax

Producing Property
(undiscounted 1978 dollars)

| Taxes and allowances | Current rate structure | Severance tax rate increased by 25 percent | Change |
|---|---|---|---|
| Severance tax | $ 33,792,990 | $ 41,879,677 | $8,086,687 |
| Property tax | 85,648,523 | 85,734,530 | 86,007 |
| State income taxes | 12,824,221 | 12,581,342 | (242,879) |
| Depletion used | 191,698,143 | 187,943,469 | (3,754,674) |
| Investment tax credit | 20,878,393 | 20,878,393 | - |
| Federal income taxes | 73,618,757 | 71,413,726 | (2,205,031) |

1/ The drop in the internal rate of return is not an average percentage change in the internal rate of return but rather an actual decrease in the rate.

Nonproducing Property
(undiscounted 1978 dollars)

| Taxes and allowances | Current rate structure | Severance tax rate increased by 25 percent | Change |
|---|---|---|---|
| Severance tax | $ 5,549,226 | $ 6,787,418 | $1,238,192 |
| Property tax | 16,018,083 | 16,030,084 | 12,001 |
| State income tax | 1,107,629 | 1,055,783 | (51,846) |
| Depletion used | 22,912,122 | 22,311,451 | (600,671) |
| Investment tax credit | 1,571,535 | 1,439,118 | (132,417) |
| Federal income tax | 7,793,080 | 7,581,842 | (211,238) |

Over the life of the producing mine, it would pay the State and local governments an additional $8 million in severance and $86,000 in property taxes. Property tax increases because the mine's full cash value increases. This occurs because deductions from gross income, such as Federal and State income taxes, that are used to determine the property's full cash value decline. State income taxes, however, decline because the mine has greater expenses (severance and property taxes) that reduce State taxable income. The Federal tax burden is reduced for the same reason. Depletion used declines because the mine uses percentage depletion limited by 50 percent of net income. By increasing State taxes, net income is reduced, resulting in less depletion used. The investment tax credit remains unchanged because it is not large enough to be constrained by Federal tax liability. The mine's net present value decreases by 2.6 percent as a result of the tax change. The internal rate of return decreases by 0.2 percentage points.

The changes were similar for the nonproducing deposit except for investment tax credit. The credit decreased because it was constrained by Federal tax liability. The net present value and the internal rate of return decreased by 2.2 percent and 0.2 percentage points, respectively.

Increasing Colorado's property tax

An increase in Colorado's property tax rate results in substantial changes to a mine's Federal and State tax liability and its net present value. Colorado imposes two forms of property tax on molybdenum mines:

--Mine tax. Based on 0.1 percent of the assessed value of the mine.

--General property tax. Based on the greater of 25 percent of gross proceeds or 100 percent of net proceeds for producing mines.

The chart below illustrates the cumulative effects in 1978 dollars that a 50-percent increase in property taxes has on a producing molybdenum mine.

Table 9
Effects on a Molybdenum Mine of a 50-Percent Increase in Colorado's Property Tax
Producing Property

| Taxes and allowances | Before change | Property tax increased 50 percent | Difference |
|---|---|---|---|
| | (undiscounted 1978 dollars) | | |
| Depletion used | $684,424,621 | $652,013,999 | ($32,410,622) |
| Investment tax credit | 11,876,283 | 11,876,283 | - |
| Property taxes | 137,363,802 | 206,045,702 | 68,681,900 |
| Severance taxes | 50,135,063 | 50,135,063 | - |
| State income taxes | 33,179,053 | 31,365,489 | ( 1,813,564) |
| Federal income taxes | 337,519,362 | 319,184,802 | ( 18,334,560) |

A property tax rate increase of 50-percent will result in a $69-million increase in local taxes which would be partially offset by a $20-million reduction in State and Federal income taxes. Federal and State income taxes decline because the property tax is a deduction in computing these. Depletion used declines because the depletion allowance is limited to 50-percent of net income and the increase in property tax lowers the net income. Overall, the mine's net present value declines by 15.4 percent. This corresponds to a decrease of 1.4 percentage points in the mine's internal rate of return.

Removing Tennessee's income tax

Removal of the 6-percent Tennessee income tax provision will result in several minor changes to Federal and State taxes and allowances on a producing zinc mine as illustrated below. All figures are in 1978 dollars.

Table 10
Effects on a Zinc Mine of Removing Tennessee Income Tax
Producing Property

| | Before tax change | After tax change | Difference |
|---|---|---|---|
| | (undiscounted 1978 dollars) | | |
| Depletion used | $4,606,434 | $4,887,067 | $280,633 |
| Investment tax credit | 836,667 | 859,398 | 22,731 |
| Property taxes | 2,166,529 | 2,166,529 | - |
| State income taxes | 575,350 | - | (575,350) |
| Federal income taxes | 1,529,983 | 1,676,541 | 146,558 |

Over the life of this property, eliminating the State tax provision will save the mine approximately $575,000. However, since State taxes are a Federal corporate income tax deduction, a smaller State tax burden results in a larger Federal tax liability.

The removal of the State income tax results in a 1.9 percent increase in the mine's net present value. This corresponds to an increase of 0.3 percentage points in the mine's internal rate of return.

## POSSIBLE INSTITUTIONAL MECHANISMS FOR COORDINATING STATE TAX AND FEDERAL MINERALS POLICIES

Given the foregoing demonstration of the critical interaction of Federal mineral policy, State tax policy, and the profitability of domestic mining, we believe that new institutional means should be devised to try and better harmonize tax policy with national mineral production objectives without obstructing the rights of various governmental levels to levy and collect taxes.

We believe the Federal Government could assist the States in their formulation of appropriately sensitive mineral tax policy. The Government could do this by providing information to States on Federal mineral policies and by providing analytical capabilities to States for their use in assessing the effects that proposed tax changes would have on mineral production, development, and exploration.

Who might take the lead in establishing a continuing liaison between the States and the Federal Government? There are several possibilities, which include

- --the Department of the Interior with assistance from the Treasury Department, so that Treasury's Office of Tax Analysis can contribute its knowledge of the tax code and its expertise in tax analysis;
- --the Advisory Commission on Intergovernmental Relations; or
- --a new, appropriately designed institutional mechanism.

We have not yet attempted an assessment of these institutional alternatives. We believe that the States should first have an opportunity to review the content of this report, and express themselves regarding the suggested continuing liaison function. We will be ready to assist the Congress in further examination of the matter at an appropriate future date.

# CHAPTER 4

# CONCLUSIONS, RECOMMENDATIONS, AND AGENCY COMMENTS

## CONCLUSIONS

During the 1970s the domestic minerals industry experienced a severe and prolonged downturn leading to concern about its financial health. Contributing factors included the cost of implementing environmental programs, the increase in debt for many firms that previously had relied primarily on equity financing, and competition from foreign producers, often subsidized by their governments, that led to artificially depressed world minerals prices. Industry experts and others in Government believed that the poor financial condition of U.S. mineral producers could have serious implications for domestic mineral supply, which in turn has implications for the Nation's security and economic well-being.

One means by which the Federal Government and the States affect the economic and financial condition of the domestic industry is through the tax system. We found that for the most part, adequate information is not available and sufficient analysis has not been undertaken to determine the effect that various Federal and State tax provisions, even those specific to the minerals industry, have on domestic mineral supply.

In seeking to develop a method for measuring the impact that Federal and State taxes have on domestic mineral profitability, production and investment, we used, with modifications, a computer model developed by the Bureau of Mines. Our report is intended only as an initial effort in mineral tax analysis and more extensive and refined work is needed in the area. We believe, however, that this report presents an important contribution to the development of quantitative assessment methods for analyzing mineral and tax policy issues.

### Federal Taxes

Many provisions of the Federal tax code affect the domestic minerals industry. Among the more important are the depletion allowance, the investment tax credit, and the expensing privilege for exploration and development expenditures.

Percentage depletion is the most basic Federal mineral tax provision; its development was evolutionary and complex. Initially, most of the arguments surrounding percentage depletion were based on ideas of tax equity or tax simplicity. Since the 1950s, however, percentage depletion has been viewed by both supporters and opponents more in terms of achieving mineral policy rather than tax policy. Percentage depletion has been viewed (1) by a Treasury official as an inefficient subsidy to domestic mineral production, (2) by Interior as a part of the

market system that works adequately in meeting our Nation's mineral supply needs, and (3) by the American Mining Congress as a time-proven tax incentive for capital investment in the minerals industry and as an important source of capital funds for the industry. We accept the view that percentage depletion should be an incentive to mineral production and investment. As such, we believe that percentage depletion should be considered from the perspective of mineral policy rather than tax policy.

There have not been enough quantitative studies to analyze the effectiveness of percentage depletion as an incentive for mineral production, investment or exploration. Nor has there been significant analysis on the investment tax credit or on the tax benefits provided to the minerals industry through the expensing of exploration and development costs.

Section 4 of the National Materials and Minerals Policy, Research and Development Act of 1980 (P.L. 96-479) requires the President, through the Executive Office of the President, (a) to coordinate the activities of responsible departments and agencies in regard to all aspects of minerals policy and (b) to assess Federal policies at all stages of the minerals cycle, including tax policies. We are unaware of any formal Presidential assignment of responsibility for implementing the 1980 Act to any organization in the Executive Office of the President. The President must submit to the Congress by October 21, 1981, a program plan setting forth, among other things, the institutional changes within the Executive Branch necessary to fully implement the Act. In selecting the Executive Office as the focal point for policy development and coordination, the Congress recognized the Department of the Interior's traditional leadership role on minerals policy issues, including its responsibilities under the 1970 Act. We expect that Interior will play a major role in developing an integrated Federal materials and minerals policy.

Because the analyses discussed above are important to the development and implementation of Federal minerals policy, we believe they should not be delayed until the institutional structure for implementing the 1980 Act is in place. Given Interior's traditional leadership role in the minerals policy area, we believe it is appropriate that Interior, building upon the analysis presented in this report, should take the lead in assessing the effect of various tax provisions in encouraging domestic mineral production, investment and exploration. As soon as the President has made clear which organization within the Executive Office is responsible for policy assessments under the 1980 Act, the Secretary of the Interior should inform the head of such organization of the progress and nature of the study and invite any assistance in its completion and evaluation. When completed, the study could be used by such organization in its policy analysis and decisionmaking functions.

With the analysis presented in chapter 2, we have taken the first step in this direction. The work requires expansion as we did not fully examine the effect of the depletion allowance on mineral investment or exploration. Moreover, our analysis, which was performed using a discounted cash flow investment model, is based on many assumptions and has substantial limitations. Some of the more critical of these are: the type and accuracy of data base available to us and the fact it relates to only four of the more than 100 minerals; the assumption that each mine is a separate taxpayer, which among other things does not take into account the impact on mining operations of significant costs (e.g., exploration and development costs and the costs of holding mineral lands for future development and production) and the impact of the cash flow provided by various tax provisions on mineral exploration and development; the cost assumption of an average rather than a marginal cost curve; and the assumption that mineral prices are constant over time as compared to the typical pattern of significantly fluctuating mineral prices. Not withstanding these limits, this initial study is, however, an important contribution to developing a means of quantitatively assessing the effects of the depletion allowance on mineral production, investment, and exploration.

Our analysis indicates that 97 percent of the tax expenditure benefits of the depletion allowance go to mines which would be profitable even without this incentive. Only a small percentage of the benefits go to marginal mines which might not produce otherwise. By profitability category, such changes in the depletion allowance as increasing or removing the net income limit or lowering the statutory rates do not alter the distribution of benefits in favor of the marginal producer primarily because of the manner in which the allowance is computed. Our analysis does show, however, that modifications could be applied which would increase the benefits of the allowance to marginal mines and could result in increased production.

The present model could not examine the effect of the depletion allowance on exploration activity. More work is needed to determine if the tax savings resulting from percentage depletion provide a sufficient incentive and source of funds for further exploration to increase domestic reserves.

The investment tax credit also provides tax expenditure benefits to the mineral industry. While not an industry-specific tax provision, it does increase the present value of profitable mines and some deposits. It has little or an insignificant effect on unprofitable ones because they have no Federal tax liability against which the credit might be applied. The model results show that 34 percent of the available investment tax credit cannot be used by domestic copper, lead/zinc

and molybdenum mines. If this unused portion were refunded, most of it would benefit marginal and unprofitable mines.

The present model is not capable of determining whether the credit rewards production that would have occurred, regardless, or whether it encourages new investment. While the credit may not be large enough to encourage investment in new capacity, it may alter the mix of labor and capital used at a specific mine and hence may lead to more or less efficient production. Changes in various provisions of the credit, such as the carry over period, had little effect on domestic mines and deposits.

Some exploration and development costs may be deducted as current expenses instead of being capitalized and deducted over the life of a mine. Exploration costs that are deducted currently must be recaptured when the mine begins production. Most deposits benefit from this expensing provision for exploration costs. Only the economically profitable deposits benefit if they were required to expense development costs. The tax expenditure costs of these provisions are low relative to those of percentage depletion and the investment tax credit.

State taxes

State tax actions can have a significant effect on the profitability of the domestic minerals industry and on the level of domestic mineral production. The State tax burden is a substantial portion--40 percent--of the total taxes paid by all mines in this study. Some States are unaware of Federal mineral policy objectives and, in order to obtain stable revenue streams or for other purposes, sometimes enact taxes that may discourage efficient mineral production.

Adequate analysis has not previously been undertaken to determine the effects that State taxes have on mineral production and investment decisions. In our analysis, we found that changes in the bases, rates, and timing of State taxes can significantly effect the present value of producing mines and the investment potential of nonproducing deposits.

Given the critical interaction of Federal mineral policy, State tax policy, and the profitability of domestic mining, we believe that new institutional means should be devised to result in a better harmonization of tax policy with national mineral production objectives without obstructing the rights of various governmental levels to levy and collect taxes.

We believe the Federal Government could assist the States in their formulation of appropriately sensitive mineral tax policy by providing information to them on Federal mineral policies and by providing analytical capabilities to the States for their use in assessing the effect that proposed tax changes would have on mineral production, development, and exploration.

There are several possibilities as to who might take the lead in this regard, including

--the Department of the Interior with assistance from the Treasury Department;

--the Advisory Commission on Intergovernmental Relations; or

--a new, appropriately designed institutional mechanism.

We have not attempted an assessment of any institutional arrangements to provide these functions. We believe that the States should first have an opportunity to review the content of this report, and express themselves regarding the suggested continuing liaison function. We plan to invite each State, through its Governor, to comment on the final report.

RECOMMENDATIONS

Because (1) the President has not yet formally designated an organization within the Executive Office of the President to implement the 1980 Act, (2) the study is important to the development and implementation of Federal minerals policy, and (3) the Department of the Interior has been the traditional leader in the area of minerals policy, we believe it is appropriate that the Secretary of the Interior now take the lead in developing and refining a framework to quantitatively analyze the link between taxes and mineral policy, and report to the Congress on his findings. At such time as the President formally designates an organization within the Executive Office of the President to be responsible for policy assessments under the 1980 Act, the Secretary of the Interior should inform the head of that organization of the progress and nature of the Interior study and invite any assistance in its completion and evaluation. When completed, the study could be used by such an organization in its policy analysis and decisionmaking functions. Interior's studies should include:

--A broadening and sharpening of the analysis of percentage depletion presented herein. The analysis should be broadened to include the 23 critical minerals included in the Bureau of Mines Minerals Availability System data base and eligible for percentage depletion. It should be sharpened to reduce the uncertainty in the major assumptions, especially those relating to cost, price, and the treatment of each mine as a separate taxpayer. Sensitivity analysis should be performed to determine the importance of the assumptions to the results. This analysis should not be either a defense or support of percentage depletion, but rather, it should objectively examine the effectiveness of percentage depletion as a tax incentive for production, investment, and exploration.

--A more refined analysis to determine the effects of the proposal to refund the unused portion of the investment tax credit. Given that a substantial portion of the investment tax credit is unused, and that the beneficiaries of refunding the unused credit would be marginal and unprofitable mines, further attention should be paid to this type of refund as a way to stimulate production at marginal mines and to provide a source of funds for mineral exploration and development.

--Further work on the provisions for expensing exploration and development costs. This should include an analysis of the effect of the recapture provision for exploration costs on the profitability of domestic deposits.

In making this assessment, the Secretary of the Interior should consult with the Secretary of the Treasury so that Treasury's Office of Tax Analysis can contribute its knowledge of the tax code and its expertise in tax analysis. The review should also include an examination of alternative tax policy approaches which might be more effective than those currently in place.

## MATTERS FOR CONSIDERATION BY THE CONGRESS

### Federal taxes

The analysis reflected in this report is the first step in determining the effectiveness of percentage depletion and other tax provisions on mineral exploration and production. More work needs to be done to examine the effects that various provisions have on the incentive and source of funds for increasing domestic reserves and supplies.

We have recommended that the Secretary of Interior take lead responsibility for broadening and sharpening our initial work to assist in congressional decisionmaking on national self-sufficiency and other critical minerals policy issues. The Congress should exercise close oversight of Interior's effort on the recommended study.

### State taxes

Given the critical interaction of Federal mineral policy, State tax policy, and the profitability of domestic mines, we believe that institutional means should be devised to result in a better harmonization of tax policy with national mineral production objectives.

We will be ready to assist the Congress in further examination of the issue at an appropriate future date and following consideration by State governments of this report.

## AGENCY COMMENTS

At the time our report was ready for agency review, the President had not yet determined how the 1980 Act would be implemented and no organization in the Executive Office was formally designated to have responsibility for the Act. Consequently, the report was submitted to the Departments of the Interior and the Treasury for substantive review and comment, because of their respective roles in the mineral and tax policy areas. Their most salient comments are discussed below and, where appropriate, our report has been modified to reflect agency views.

### Department of the Interior

Interior agrees that there are elements of the existing U.S. tax code that have particular bearing on minerals productivity and hence minerals policy. Some tax provisions, such as depletion allowance, are unique to the minerals industry; others, such as the investment tax credit, not restricted to the minerals industry, are also of particular importance. Interior recognizes the responsibility for its involvement in more detailed examination of the relation of minerals and tax policy.

However, Interior believes that further analyses recommended in our report cannot be conducted in the timeframe we suggested (end of 1981). They contend that a mass of data on 23 critical minerals is needed before there can be any realistic quantitative analyses of the link between mineral policy and taxes. At current funding levels, Interior estimates that the required data bases will not be ready until fiscal year 1984. In view of Interior's comments, we have deleted the requirement that the study be completed by 1981.

We continue to believe that Interior could substantially augment the analytical framework in this report by the end of 1981. However, in light on agency comments, we have modified our recommendation and now call for Interior to inform the Congress of the additional resources that could be usefully employed to accelerate the achievement of expanded data base and analytic capability for the 23 critical minerals. Particularly in view of growing concern over adequacy of the Nation's minerals base, development of improved analytic tools for enhancing the potential of domestic minerals production capacity should be accomplished as rapidly as possible.

The Department of the Interior also made several comments on report detail. A complete copy of Interior's comments is included in appendix IV.

### Department of the Treasury

Although the minerals-specific provisions of the tax code involve primarily mineral policy questions and, as such, are

under the purview of the Department of the Interior, we provided the Department of the Treasury an opportunity to comment on our draft report.

The Treasury Department agrees with our conclusion that the impact on mineral policy is the key consideration and that Federal tax laws have been used to influence domestic mineral production in significant ways. It also agrees that our report is aimed toward the right set of questions, namely, how have the tax subsidies provided through the Federal tax system increased the domestic output of minerals and at what budgetary costs. However, although the Treasury Department would endorse and enthusiastically support the recommendation that the Department of the Interior take the lead in organizing the systematic analysis and empirical estimation of the output effects and budgetary costs of the mineral tax subsidy program, it questioned the utility of our analytical framework and empirical methodology as a model for such a study effort.

The Treasury Department believes that the draft report contributes little or nothing to either a clarification of the questions raised or to reliable quantifiable estimates of effects and budgetary costs. (See Appendix V.) It believes that the draft report muddies analysis by:

--Failing to systematically distinguish the normal tax regimes at State and Federal levels, departures from which constitute "incentives" or "disincentives" to mineral production.

--Failing to process the Bureau of Mines data base in a manner that would permit the estimation of effects and budgetary costs of existing tax structures.

We disagree with Treasury's position.

Prior studies by GAO and others 1/ have systematically distinguished between "normal" tax regimes on the Federal level and tax expenditures, which are the dedication of money to an activity by allowing a special reduction in taxes. Our intention in this report was not to repeat such work, but rather to use these analyses as a basis to examine the tax expenditure costs of certain provisions important to the mineral industry. The general concept of tax expenditures is discussed on p. 17. The subsidy element of percentage depletion is identified on p. 19. The tax expenditure costs of expensing provisions for exploration and development costs are shown and discussed beginning on p. 49.

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1/ Tax Expenditures, Committee Print, U.S. Senate, Committee on the Budget, September, 1978; and Tax Expenditure: A Primer, U.S. General Accountig Office, November, 1979.

Treasury states that it is inappropriate for us to treat the investment tax credit as a "minerals policy issue" as it applies to any investment made in "tangible depreciable personal property." Our report repeatedly recognizes that the investment tax credit is not a mineral industry-specific provision. However, as pointed out in the introduction to chapter 2, we choose to analyze the investment credit because changes in the credit are often cited by mining officials as a means to increase mineral industry profitability.

Treasury asserts that on the State level we do not address the question of whether State tax laws are applied in a nondiscriminatory manner to mineral producers. Treasury further states that if the States impose discriminatory taxes, these become 'negative' preferences, but this cannot be established or quantified unless the "normal tax burden" is prescribed. From this Treasury concludes that chapter 3 of the draft report provides no basis for the recommendation that new institutional means should be devised to result in better harmonization of tax policy with national mineral production objectives.

We acknowledge that no attempt was made to define "normal tax burdens" on the State level. This task is much more analytically complex than defining "normal tax burdens" on the Federal level. Most Federal revenue is raised by means of a single income tax applied to individuals and corporations. State taxing schemes, on the other hand, include a wide variety of taxing methods, for example, property, severance, income, sales and excise taxes. The overall tax regime in each State is unique. Because of this complexity, it is analytically very difficult, perhaps impossible, to define a "normal tax burden" for the States. But even in the absence of "normalized" standards, there is still ample evidence of the substantial and important effect that State tax actions have on national mineral production objectives.

We believe that the importance of State taxes demonstrated in chapter 3, the complexity of analyzing State taxes, and the significant effect that State tax actions can have on the profitability of domestic mines and consequently on national mineral production objectives support our conclusion that a new institutional means should be devised to better harmonize State tax policy and national mineral production objectives.

The detailed comments indicate that Treasury misunderstood our use of the data base and our modeling methodology. For example, in its comments Treasury stated that we assumed that all of the mines in the model produce for 80 years. But table I, p. 96 (app. II), shows that while the maximum possible life of a property is 80 years the actual number of years of

operation is a specific input parameter for each property. Treasury also contends that the model incorrectly accounts for investment costs because all equipment will last for 80 years. But table 2, p. 101 (app. II), shows that over the life of a property reinvestments are made as equipment wears out or becomes obsolete.

Treasury contends that if the Bureau of Mines data base were processed correctly, then, given some market price of the mineral, both the increase in domestic output and budgetary impact could be estimated. Initially it was our intention to use the model to measure the effects of various tax regimes on output as suggested in Treasury's comments and as attempted in the Treasury report, Federal Tax Policy and Recycling of Solid Waste Material. However, after analyzing the model results for all 80 properties included in the data base and after discussions with Bureau of Mines personnel familiar with the current operating status of the mines in the data base, we found that in a few cases there was not a direct correspondence between a mine being judged profitable or unprofitable by the model and it's current operating status. For this reason, and given the assumptions and limitations of the model, we did not want to make the assumption that mines judged profitable will operate and mines judged unprofitable will not. Still, our recommendation to the Department of the Interior that the analysis be sharpened to reduce the uncertainty in the major assumptions and that sensitivity analysis be performed, assumes that the Department will utilize the tax expertise of Treasury's Office of Tax Analysis.

## MINERALS AVAILABILITY SYSTEM DATA RELIABILITY

To measure the impact of Federal and State taxes on mining profitability, we used the Bureau of Mines' Minerals Availabilty System. Part of the overall system includes deposit information on operating and capital costs of active, undeveloped, and explored mines and deposits.

### Model property data base

The property data base represents the single largest data base available to the Government. It includes both domestic producing mines and nonproducing deposits for the four minerals being reviewed. The same minerals may exist in other States, but they represent only a small fraction of the domestic supply.

TABLE 1
MODEL PROPERTY DATA BASE

| Commodity | State | Producing properties a/ | Nonproducing deposits a/ | Total |
|---|---|---|---|---|
| Copper | Arizona | 23 | 16 | 39 |
| | New Mexico | 4 | 3 | 7 |
| | Nevada | 3 | 1 | 4 |
| | Montana | 1 | 3 | 4 |
| | Utah | 1 | 1 | 2 |
| | Total copper properties | 32 | 24 | 56 |
| Molybdenum | Colorado | 2 | 1 | 3 |
| | New Mexico | 1 | 0 | 1 |
| | Total molybdenum properties | 3 | 1 | 4 |
| Lead/Zinc | Missouri | 7 | 4 | 11 |
| | Tennessee | 6 | 0 | 6 |
| | New York | 3 | 0 | 3 |
| | Total lead/zin properties | 16 | 4 | 20 |
| | Total | 51 | 29 | 80 |

a/ Producing properties represent individual mines in operation during 1978. Nonproducing deposits are potential mining operations that were converted by the Bureau of Mines into operating properties.

The copper sample consists of 56 properties in five States. They represent 82 percent of the domestic copper resources likely to be mined profitably. The 32 producing properties cover 95 percent of the copper produced in the United States during 1978.

Three of the four molybdenum properties are producers. They represent all of the primary domestic production during 1978, and about 68 percent of total molybdenum production. Molybdenum mined as a byproduct (usually of copper production) is a substantial portion of domestic supply and accounts for an additional 32 percent of production. When primary and byproduct production amounts are considered, our sample covers total domestic production in 1978.

The 20 lead and zinc properties represent 81 percent of the 1978 domestic production of lead and 48 percent of domestic zinc production.

PROPERTY COMPOSITION

The information in the properties contains both financial and mineral data. Financial information includes:

--A description of investment, including the year made, the dollar amount, and the method of depreciation to be used. In all instances, we used the straight-line method.

--All costs of operation for mining, transporting, and processing minerals are given a dollar amount. Processing recovery rates express the efficiency of the mining operation. Costs are characteristic of the mining and processing methods.

--Federal income taxes and other tax provisions: minimum tax, investment tax credit, percentage depletion allowance, and the ability to either expense or capitalize exploration and development costs. Basis and rate information is included so that State taxes can also be calculated.

Mineral information also needed to specify annual cash flows includes:

--The ore grade that gives the amount of pure mineral that is contained in the mineral ore.

--The number of ore units that will be mined annually, or the production rate.

--The price per pound of the mineral produced.

PRICE

The prices used for copper, lead/zinc, and molybdenum were converted to represent the 21-year average in constant 1978 dollars of the commodities. These prices are applied to every property. The prices of such byproduct commodities as silver and gold were too volatile during 1978 to convert with assurance. The remaining byproduct mineral commodity prices furnished by the Bureau of Mines were maintained.

Prices used include:

TABLE 2
Price Assumptions in Model

| | Units | Assumed Prices (constant 1978 dollars) | June 1980 Prices |
|---|---|---|---|
| Copper | $/pound | $ 0.80 | $ 0.92 |
| Lead | $/pound | 0.29 | 0.34 |
| Zinc | $/pound | 0.32 | 0.36 |
| Molybdenum | $/pound | 3.33 | 9.00 |
| Silver | $/troy oz. | 6.00 | 15.75 |
| Gold | $/troy oz. | 211.05 | 600.72 |
| Cadmium | $/pound | 2.44 | 3.00 |
| Limestone | $/metric to | 3.31 | - |
| Selenium | $/pound | 15.00 | 11.00 |
| Ferromoly | $/pound | 5.34 | 9.90 |
| Nickel | $/pound | 2.08 | 3.45 |
| Tungsten | $/pound | 9.55 | 14.70 |
| Tin | $/pound | 5.92 | 8.53 |

RELIABILITY OF DATA BASE

Since we last reviewed the Minerals Availability System, 1/ the Bureau of Mines has made improvements in gathering and reviewing the data it uses for analysis.

We reviewed the data collection and verification procedure for three mines--two copper mines and one zinc mine. The data on the mines' operations and mineral contents usually comes from onsite visits, discussions with company personnel, or mining trade journals. Cost data are estimated unless they are provided by the company, in which case, they are considered confidential. Bureau of Mines' officials do not know what percentage of this cost is furnished by companies. However, a larger percentage of cost data is estimated for nonproducing

1/ "The Department of the Interior's Minerals Availability System," EMD-78-16, July 17, 1978.

properties than producing properties. For costs that are estimated, the Bureau of Mines uses a cost-estimating handbook written for them by STRAAM Engineers, Inc. The handbook states that "use of the handbook will produce a estimate which should fall within 25 percent of expected actual costs." Mining engineers told us that the handbook is excellent for estimating costs, that the 25 percent tolerance range is acceptable within the industry, and that most estimators would be pleased with that degree of reliability. For the data on the three mines we verified, all figures were supported either through published reports or by information from the handbook.

## DESCRIPTION OF THE MODEL USED TO MEASURE THE IMPACT OF TAXES ON THE PROFITABILITY OF DOMESTIC MINES

To assess the impact that Federal and State taxes have on domestic mineral production, profitability, and investment, we used a computer model developed by the Bureau of Mines. This model, called MINSIM 4, performs discounted cash flow calculations and is part of a larger supply analysis model employed by the Bureau of Mines for resource availability studies. 1/ The Bureau uses the model to determine the price of a commodity needed to obtain a specified rate of return. At a given rate of return, this needed price is calculated for producing mines and nonproducing deposits. A "supply curve" is then drawn to show the production potential of that commodity at various metal prices.

Alternatively, given a specified commodity price, the model can be used to measure the profitability of the domestic mines and deposits included in the data base associated with the model. 2/ Two measures of profitability can be calculated.

--When an appropriate discount rate is chosen, the model can be used to calculate the net present value of mines and deposits.

--Assuming a zero net present value the model can calculate an expected discounted cash flow rate of return on invested capital.

We used the model to measure the effects that different tax scenarios have on the relative profitability of producing mines and nonproducing deposits.

This appendix provides a detailed description of how the model works, including examples of typical inputs and outputs; a discussion of how GAO used the model to determine the effects

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1/ See:

Bennett, H.J., L. Moore, L.E. Welborn, and J.E. Toland, An Economic Appraisal of the Supply of Copper From Primary Domestic Sources, BuMines IC8598, 1973; Rosenkranz, R.D., R.L. Davidoff, and J.F. Lemons, Jr., Copper Availability - Domestic, BuMines 8809, 1979; and Davidoff, R.L., Supply Analysis Model (SAM): A Minerals Availability System Methodology, BuMines IC8820, 1980.

2/ The data base is described in app. I.

of tax changes; enumeration of the assumptions and programming compromises employed; and a discussion of the model's limitation for tax analysis. Finally, suggestions are given on how the version of the model which we used and the subsequent analysis could be modified and expanded for a more complete assessment. 1/

## HOW THE MODEL WORKS

The MINSIM 4 program combines physical deposit information and operating and capital costs with accounting provisions such as depreciation, depletion, and Federal and State tax rates to analyze the financial status of producing mines and nonproducing deposits. These mines and deposits are referred to as properties. The model can take into account five different commodities at each property, i.e., it considers coproduct and byproduct production, and allows for mining, milling, smelting, refining, and leaching operations. Each mine is assumed to operate until its reserves are depleted. The maximum time for a mine to operate is 80 years.

Associated with each property is a set of financial input data. The data contain cost and revenue information that is applied to every year of mining activity. Replacement expenditures, for example mine and mill equipment reinvestments, are included as capital expenditures and depreciated, where appropriate, for income tax purposes. A substantial amount of this property-specific information is estimated by the Bureau of Mines. The table below shows the detailed inputs considered for each property. The Bureau of Mines converted all estimated costs and revenues to 1978 dollars for us and identified the properties as producers or nonproducers.

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1/ The Bureau of Mines has substantially increased and expanded the model's capabilities since we began our work. Many of our suggestions for modifications and improvements have already been incorporated into the model.

TABLE I

MINSIM 4 Documentation --
Input Parameters for a Mineral
Deposit (note a)

I. General Information

1) Number of preproduction years
2) Number of production years (maximum = 80)
3) First production year
4) Leach option (identify commodity)
5) Discount method (continuous or discrete)
6) Discount rate or target rate of return desired
7) Option for whether depletion allowance should be used or ignored
8) Option on whether analysis is a price determination or a DCFROR (discounted cash flow rate of return) analysis

II. Investment Parameter Records and Options

1) Exploration capital
   -years of occurrence
   -capital may be expensed or capitalized
2) Acquisition capital
   -years of occurrence
3) Mine preparation and development capital
   -years of occurrence
   -depreciation method options
      -straight line
      -double declining balance
      -double declining balance with switchover
      -sum-of-the-years digits
      -investment depreciation period
      -year in which depreciation begins
      -investment salvage value

III. Loan Parameter Records and Options

-years of occurrence
-loan payback method options
   -amortized payments
   -fixed interest payments with balloon payment at end of term
-read-in-payments (interest and principle)
-loan term
-loan interest rate

a/ This table illustrates both the data needs and the parameter choices contained in the model.

IV. Operating Cost Parameter Records

1) Working capital
2) Mine operating costs
3) Mill operating costs
4) Smelter operating costs
5) Refinery operating costs
6) Leach operating costs
7) Transportation cost
   -mill to smelter
   -smelter to refinery
   -refinery to market

V. Operating Commodity Parameter Records (up to five commodities plus leach)

1) Ore feed grade
2) Mill recovery
3) Mill concentrate grade
4) Smelter recovery
5) Smelter concentrate grade
6) Refinery recovery
7) Leach precipitate grade

VI. Commodity Parameter Records

-name of commodity
-severance tax option
   -multiple options
-severance tax rate
-depletion allowance rate

VII. Royalty Parameter Records

-years of occurrence
-choice of one or all commodities
-method of royalty calculation
   -multiple options
-factors or value per unit rate

VIII. Tax Parameter Record

1) Federal tax parameters
   -years of occurrence
   -tax loss carry option (yes or no)
   -investment tax credit (yes or no)
   -investment tax credit rate
   -Federal tax options
      -multiple options
   -Federal tax rate
   -minimum tax provisions

2) State tax parameters
-years of occurrence
-State tax option
-multiple options
-State tax rate
3) Property tax parameters (based on revenues)
-year of occurrence
-property tax option
-multiple options
-mill levy rate
-assessment rate
-Hoskold rates
-fixed property tax (e.g., dollars per acre)
4) Property tax parameters (based on investment values)
-years of occurrence
-property tax rate
-assessment value rate
-property value being assessed
-multiple options
5) Sliding scale tax parameters
-years of occurrence
-calculation options
-rates
-ranges
-type of tax option
-multiple options

IX. Depletion option records
-years of occurrence
-rates
-calculation of depletion basis
-multiple options

Using this financial input data and fixed commodity prices, a cash flow measured in constant (uninflated) dollars 1/ is projected over the life of each property. For producing properties, cost and revenues begin in 1978. The depreciated value of investment made before 1978 is treated as initial investment in 1978, i.e., previously depreciated sunk costs are considered to be written off. The number of years specified to depreciate the 1978 initial investment is actually the number of depreciable years remaining from the true date of expenditure. For example, if an investment is made in 1974 and depreciated on a straight-line basis for 8 years, our property would carry an initial investment at 50 percent of the original value to be depreciated on a straight-line basis for 4 years.

Because of this treatment of initial investment costs, discounted cash flow rates of return appear high, and the effect of taxes on past investment decisions may be understated. Before a mine is developed, high investment costs are anticipated early in its life, with revenues occurring after these initial investments have been made. The discounted cash flow rate of return calculated later, when these initial investments have been fully or partially depreciated, will be greater than the rate of return calculated before a mine is developed. When the initial investments are fully or partially depreciated, and consequently when the rate of return for a producing mine is high, a tax incentive may only appear to make an already profitable mine more profitable. However, before that mine was developed, when the discounted cash flow rate of return was lower, the tax incentive may have played an important role in the development decision.

On the other hand, the purpose of depreciation and depletion deductions in computing taxable income is to recognize that capital goods are not immediately consumed in production, but rather their consumption is spread over a number of years. It is advantageous for firms to take these deductions as soon as possible, and the tax code allows most capital investments to be fully depreciated prior to the end of their useful lives. In addition, under current law, the depletion deduction may, and usually does, exceed the amount of capital invested in a mine. It would be inconsistent to evaluate tax measures based on the undepreciated or undepleted value of capital investments when the effects of the tax provisions are to accelerate or increase the allowed depreciation and depletion deductions.

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1/ With the model it is also possible to use current dollars and inflate costs and prices at different rates.

Nonproducing properties are tracts of land with known mineral deposits but with no mine in place. In the model, nonproducing deposits begin developing in 1978, regardless of their economic viability. For these properties, start-up production costs are estimated for 1978. Each nonproducer is allotted an estimated number of years to prepare for mining activity. This estimate, made by the Bureau of Mines, is based on the size and nature of the mining operation necessary to extract the ore from the known deposit. After this preproduction period, the nonproducer begins mining and its costs and revenues are treated similarly to those of a producing property. The table below shows the type of deposit information required for financial evaluation of a copper deposit.

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TABLE 2

Example of Hypothetical Deposit Information Required for Financial Evaluation of a Copper Property

| Category description and units | | Year of occurrence Beginning | Ending | Annual category value |
|---|---|---|---|---|
| Exploration | Dollars | 1978 | 1979 | $ 470,000 |
| Land acquisition | " | 1980 | 1980 | $ 538,000 |
| Mining preparation | " | 1979 | 1980 | $ 1,791,000 |
| Mine plant | " | 1979 | 1980 | $ 898,000 |
| Mine equipment | " | 1979 | 1979 | $ 2,286,000 |
| Do | " | 1980 | 1980 | $ 2,846,000 |
| Mine equipment reinvestment | " | 1984 | 1984 | $ 604,000 |
| Do | " | 1985 | 1985 | $ 632,000 |
| Do | " | 1986 | 1986 | $ 955,000 |
| Do | " | 1987 | 1987 | $ 2,292,000 |
| Do | " | 1990 | 1990 | $ 1,198,000 |
| Do | " | 1991 | 1991 | $ 1,244,000 |
| Mill plant and equipment | " | 1979 | 1980 | $18,703,000 |
| Working capital | " | 1981 | 1981 | $ 2,366,000 |
| Mine operating cost | $/MT ore | 1981 | 1995 | $ 1,450,000 |
| Mill operating cost | $/MT ore | 1981 | 1995 | $ 1,700,000 |
| Ore mined per year | metric tons | 1981 | 1995 | 4,520,000 |
| Copper: | | | | |
| Feed grade | percent Cu | 1981 | 1995 | 0.43 |
| Mill recovery | percent | 1981 | 1995 | 93.00 |
| Concentrate grade | percent Cu | 1981 | 1995 | 25.00 |
| Smelter recovery | percent | 1981 | 1995 | 98.00 |
| Smelter grade | percent Cu | 1981 | 1995 | 98.00 |
| Refinery recovery | percent | 1981 | 1995 | 99.90 |
| Smelter operating cost | $/MT conc | 1981 | 1995 | $ 93.00 |
| Refinery operating cost | $/MT blister | 1981 | 1995 | $192.00 |
| Transportation to smelter | $/MT conc | 1981 | 1995 | 6.90 |
| Transportation to refinery | $/MT blister | 1981 | 1995 | $ 9.90 |
| Molybdenum: | | | | |
| Feed grade | percent Mo | 1981 | 1995 | 0.013 |
| Mill recovery | percent | 1981 | 1995 | 63.00 |
| Concentrate grade | percent Mo | 1981 | 1995 | 50.00 |
| Price | $/pound | 1981 | 1995 | $ 4.01 |
| Gold: | | | | |
| Feed grade | troy ounces/MT | 1981 | 1995 | 0.003 |
| Mill recovery | percent | 1981 | 1995 | 90.00 |
| Concentrate grade | troy ounces/MT | 1981 | 1995 | 0.20 |
| Smelter recovery | percent | 1981 | 1995 | 95.00 |
| Selling price | $/troy ounce | 1981 | 1995 | $173.69 |
| Silver: | | | | |
| Feed grade | troy ounces/MT | 1981 | 1995 | 0.06 |
| Mill recovery | percent | 1981 | 1995 | 90.00 |
| Concentrate grade | troy ounces/MT | 1981 | 1995 | 3.53 |
| Smelter recovery | percent | 1981 | 1995 | 95.00 |
| Selling price | $/troy ounce | 1981 | 1995 | $ 4.93 |

Once all the cash flow information is assembled, the model then discounts the cash flow for each property at an 18-percent real, after-tax discount rate and calculates the net present value of each property. A continuous discounting factor is used: 1/

$$df = \frac{e^{rj} - 1}{r\, e^{rj}}$$

where

df is the discount factor
e is the exponential (= 2.718)
r is the discount rate (in this case 18 percent)
j is the year

Assuming a zero net present value, the program also calculates the discounted cash flow rate of return for each deposit. The present value and the internal rate of return are presented in the output along with

--cumulative undiscounted values of various tax parameters,

--a commodity production summary, and

--total initial investment data.

A sample output is shown in the figure below.

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1/ For a discussion of this discount factor see:

Stermole, J., Economic Evaluation and Investment Decision Methods, Investment Evaluations Corporation, Golden, Colorado, 1974, pp. 391-393.

deNeufville, R. and J. H. Stafford, Systems Analysis for Engineers and Managers, McGraw-Hill, Inc., New York, 1971, pp. 160-163.

Haley, C. W. and L. D. Schall, The Theory of Financial Decisions, Mcgraw-Hill, Inc., New York, 1973, pp. 39-42.

Basically, this formula assumes that net payments are continuous and equal through the year. Using an 18 percent discount rate in this formula is approximately equal to using a 19.7 percent discount rate in the discrete and more familiar formula, $1/(1 + i)$. The effect of this difference on net present value depends on the timing of the cash flows at the various mines.

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TABLE 3

FINANCIAL EVALUATION GAO/#4 BEGINNING OPERATION IN 1978 AND ENDING OPERATION IN 2025 WITH 0 PREPRODUCTION YEARS USING 1 SIMULATION(S) AND A TARGET RATE OF RETURN OF 18.0 PERCENT (note a)

| | |
|---|---|
| LAST YEAR ADDITIONS TO CASH FLOW | |
| CUMULATIVE WORKING CAPITAL | 2235600. |
| CUMULATIVE SALVAGE VALUE | 0. |
| OTHER CUMULATIVE VALUES | |
| REVENUES | 1943760155. |
| ROYALTIES | 0. |
| TOTAL DEPRECIATION | 41592909. |
| DEPLETION USED | 214957665. |
| SUM TAX LOSS CARRY | 0. |
| SUM INVEST TAX CREDIT | 4257371. |
| PROPERTY TAXES | 739419. |
| SEVERANCE TAXES | 157914. |
| STATE INCOME TAXES | 5586859. |
| FEDERAL INCOME TAXES | 112521049. |
| CASH FLOW | 316307936. |
| LAST YEARS ANALYSIS FIGURES | |
| CONTINUOUS RATE OF RETURN | 105.698 |
| 18.00 PCT PRESENT VALUE | 28989241. |

Commodity Summary Data

| COMMODITY | REVENUES | UNITS RECOVERED | PRICE/UNIT |
|---|---|---|---|
| LEAD | XXXX | XXXX | 639.450 |
| ZINC | XXXX | XXXX | 705.600 |
| COPPER | XXXX | XXXX | 1764.000 |
| SILVER | XXXX | XXXX | 158631.780 |
| CADMIUM | XXXX | XXXX | 5380.200 |

TOTAL INITIAL INVESTMENT DATA (note b)

| ITEM | AMOUNT |
|---|---|
| EXPLORATION | 0. |
| LAND ACQUISITION | 0. |
| DEVELOPMENT | 3905800. |
| MINE PLANT AND EQUIP | 39938800. |
| MILL PLANT AND EQUIP | 4359680. |
| WORKING CAPITAL | 2235600. |
| MISC INVEST & OP COSTS | 0. |
| TOTAL UNITS TREATED | 54420000 |

a/ Continuous discounted cash flow is used.

b/ These are the depreciated values of investments made before 1978.

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## HOW WE USED THE MODEL TO DETERMINE THE EFFECTS OF TAXES

Each of the profitability outcomes--net present value and internal rate of return--provides useful information about a property. We determined the effect of taxes by comparing profitability outcomes in the "as is" case to profitability outcomes when taxes are changed or removed. The "as is" case represents 1978 Federal and State tax law. By allowing only one tax feature to change, while holding everything else constant, we were able to quantify the effect which changes in that one tax have on the profitability outcomes, the cumulative cash flows, and on the other tax outputs shown in Table 3. For example, in chapter 3 we showed the effect of a hypothetical change in Arizona's severance tax on a producing mine.

On the Federal side, we examined the depletion allowance and minimum tax provision, the investment tax credit, and expensing provisions for exploration and development costs. For these Federal tax provisions we measured the present-value tax expenditure costs of alternative taxing schemes by comparing the change in the sum of the present value of all mines in this study under various tax scenarios with the sum of the present values in the "tax-neutral" case. 1/ We also examined how changes in taxes affected the internal rates of return for the mines in the study, and in some cases, we calculated average percentage changes in net present value. The table below shows the Federal tax scenarios considered.

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1/ We used tax expenditure cost and the "tax-neutral" case as defined in Tax Expenditures, Committee Print, U.S. Senate, Committee on the Budget, September, 1978.

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Table 4
Federal Tax Scenarios Considered

| Tax Provision | Tax Scenario |
|---|---|
| Depletion Allowance | --"As is" case (the greater of percentage or cost depletion). |
| | --Cost depletion only. |
| | --Decrease statutory depletion rates for all products of the mine by 50 percent. |
| | --Increase the net income limit from 50 to 65 percent. |
| | --Remove the net income limit. |
| | --No depletion at all. |
| | --Eliminate the minimum tax on the excess of percentage depletion over the cost basis. |
| Investment Tax Credit | --"As is" case. 1/ |
| | --Eliminate the investment tax credit. |
| | --Extend carryover to 4 years back and 10 years forward. |
| | --Cutback carryover to 2 years back and 5 years forward. |
| Exploration and Development | --"As is" (for producing properties exploration and development costs are expensed, for nonproducers they are capitalized). |
| | --Development expensed only. |
| | --Exploration expensed only. |

1/ Although not in effect in 1978, the investment tax credit was changed in that year so that the credit could not exceed $25,000 plus some percentage of the tax liability. This percentage was 70 percent for the year ending in 1980 and increased by 10 percent per year until it reached 90 percent. We considered this the "as is" case.

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To determine what types of mines were most affected by the different tax scenarios we classified the mines by the following profitability categories. 1/

--Economically profitable mines that have a positive net present value at a real discount rate of 18 percent. These mines have a discounted cash flow rate of return greater than 18 percent, are recovering all their opportunity costs, and are making "economic" profits.

--Financially profitable mines that have a negative net present value at 18 percent, but have a positive, undiscounted, cumulative cash flow. These mines have a discounted cash flow rate of return between zero and 18 percent, and are not recovering all their opportunity cost, but are making financial or accounting profits. These are considered the marginal mines.

--Unprofitable mines that have negative net present values at 18 percent and negative, undiscounted, cumulative cash flows. These mines have a zero rate of return and are losing money.

Classifying the mines by these criteria allowed us to examine the impact that tax changes have on the marginal as well as profitable mines.

At the State level, changes in property, severance, and income taxes were analyzed. Sales and use taxes, while included in the estimation of a deposit's investment costs, were not examined separately. The table below shows the tax scenarios considered for the mines in each of nine States.

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1/ We classified mines using a net present value criterion because for some mines the discounted cash flow rate of return calculation yielded dual roots, so the rates of return were not known.

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Table 5
State Tax Scenarios Considered

| Tax Provision | Tax Scenarios |
|---|---|
| PROPERTY | --"As is" case. |
| | --Eliminate property tax. |
| | --Increase the mill levy rate by 50 percent. |
| | --Decrease the mill levy rate by 50 percent. |
| SEVERANCE | --"As is" case. |
| | --Eliminate severance tax. |
| | --Increase severance tax rate by 50 percent. |
| | --Increase severance tax by 25 percent. |
| | --Decrease severance tax rate by 50 percent. |
| INCOME | --"As is" case. |
| | --Eliminate income tax. |

To analyze the effect of changes in State taxes, we examined the average percentage change in net present value from the "as is" case for the different tax scenarios. As in the Federal tax analysis, we classified the mines and deposits by profitability categories to determine the effects of these tax changes on different types of mines.

## ASSUMPTIONS AND PROGRAMMING COMPROMISES EMPLOYED IN THE MODEL

Anytime a mathematical model is used to represent complex economic behavior many assumptions are needed to make the modeling problem tractable. The major assumptions behind the model were discussed briefly in chapter 2. The discussion below provides more details about these assumptions and their implications, and presents other assumptions used in the model. The assumptions discussed below concern:

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--the discount rate chosen;
--the corporate structure;
--the future path of costs and prices;
--the shape of the cost curves;
--the timing of new investment;
--the depreciation option;
--the debt/equity ratio;
--the discounting techniques employed;
--inherent assumptions in internal rate of return calculations;
--the general programming compromises; and
--state tax programming compromises.

THE DISCOUNT RATE CHOSEN

When most people think about discount rates, they think about nominal rates. The prime lending rates and long term bond rates quoted in newpapers are based on expectations that future prices will be higher because of inflation. In the model, however, all future costs and prices are assumed to remain constant in 1978 dollars, i.e. the analysis is done in real dollars. Therefore, the discount rate chosen must be a real and not nominal discount rate. Real and nominal discount rates are related through the following formula:

$$r_r = \frac{1 + r_n}{1 + r_i} - 1$$

where

$r_r$ is the real discount rate

$r_n$ is the nominal discount rate

$r_i$ is the inflation rate.

After talking to mineral economists, mining engineers, and investment banks, we chose to use an 18 percent, real, after-tax discount rate in the model. At an inflation rate of 10 percent, this is equivalent to a nominal after-tax rate of 30 percent. At a 12 percent inflation rate this is equivalent to a 32 percent nominal rate.

We also spoke with representatives of the Office of Management and Budget about discount rates. They recommended that a real, before-tax discount rate of 10 percent be used in evaluating projects. On an after-tax basis, considering that the effective tax rate for mining companies is 28 percent, this is equivalent to a real rate of 7.2 percent. By OMB standards, the discount rate we chose was high. This means that our judgment about the profitability of a mine is conservative. A mine has to earn an 18 percent return to be judged profitable by our criterion but only a 7.2 percent return by the OMB criterion.

The choice of a relatively high discount rate also has implications for the measurements of tax effects. The higher the discount rate chosen, the less effect future tax situations will have on the profitability outcomes measured by the model. For example, the model can be used to compare profitability outcomes with and without percentage depletion. If a mine is unprofitable and unable to take advantage of the depletion deduction in its early years, but can later use this deduction to reduce its tax liability and thereby increase its profitability, then the higher the discount rate and the later in a mine's life the tax situation changes, the smaller the effect of this change will be on the overall profitability of the mine.

We applied the same discount rate to producing and nonproducing properties. This assumes that the risk of developing a new mine is the same as the risk in continuing operations at an existing mine. We applied the same discount rate for all mines, regardless of the type of mine or the mineral produced. This assumes that all ventures are equally risky.

## THE CORPORATE STRUCTURE

For simplicity's sake and because the data provided by the Bureau of Mines was masked, i.e., we did not know what company owned what mine, we assumed that each mine operates and pays taxes as a single corporate entity. This is not completely unrealistic because such tax provisions as percentage depletion and the expensing of exploration and development costs are administered on a per mine basis, however, they can be deducted against other corporate income. On the other hand, this assumption ignores the fact that most mines are a part of a larger corporate structure and that Federal and State income taxes are levied on the total, unified income of corporations, not mines. The corporate structure often allows greater accounting flexibility for such provisions as the investment tax credit and the minimum tax, thereby providing additional tax benefits to the firms. Because we assume that developing properties have no other income from which they can deduct exploration and development costs, the model fails to capture all of the advantage of these tax provisions. Some of these advantages, however, are taken into account through tax losses carried forward.

## THE FUTURE PATH OF COST AND PRICES

The analysis was done in constant 1978 dollars, meaning all future costs and prices were assumed to increase at the same rate. While this is unrealistic, it was not clear that our assuming future rates of change for prices and for individual components of costs would have significantly improved the analysis. However, the assumption does cause the depreciation and depletion accounts to be overstated. Normally, when a firm buys a piece of depreciable equipment, the depreciation allowed on the equipment is based on its original costs. However, the depreciation deduction is used in later years when the value of all other costs and revenues has increased due to inflation and the time value of money. Therefore, the longer the allowed depreciation period, the less the deduction is worth to the firm. Because the model uses constant 1978 dollars for all future costs, the value of the depreciation deduction does not decrease over time. This means that in the model, both the depreciation and cost depletion accounts are overstated. In the model, the mines get more benefits from these deductions than would actually be the case. Consequently, mines are probably a little less profitable than they appear in the model. Because the estimates of tax expenditure costs use the overstated cost depletion account as their basis, the tax expenditure costs are probably higher than they appear in the model results.

In the model we assumed that prices were constant, which is antithetical to the much discussed cyclical behavior of metal prices, particularly copper prices. Hence, the model does not account for production or inventory behavior resulting from cyclical prices. The assumed prices are shown in appendix I.

## THE SHAPE OF THE COST CURVE

The data used in the model carry the inherent assumption that each property is continuously mined at capacity. There are no provisions for work stoppages or for production changes due to price effects. The model also assumes that all ore mined and processed during any year can be sold at the assumed metal price in that same year.

In the data base, the Bureau of Mines assumes that each piece of property generates all its production at a single cost per ton. In economic terms this means that the resulting marginal costs are constant and equal to average costs and that the marginal cost curve for each mine is linear and horizontal up to capacity, and then vertical. This means that the model can detect changes in supply only when a mine comes into production or shuts down. The model cannot take into account the variance of output with price at individual mines.

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## THE TIMING OF NEW INVESTMENT

Because the model was developed primarily for supply analysis, unrealistic assumptions are made about the timing of new investments. The model was developed to answer the question. "How much of a commodity can be supplied at a given time, at various prices?" Hence, the model evaluates potential deposits as if their development were to begin immediately, regardless of their economic viability at current prices. Essentially, the Bureau developed the model to determine the price at which these deposits would become economic.

This assumption restricts the usefulness of the model in evaluating the effect of taxes on new investments. In addition, by assuming investment in a property begins immediately, the model ignores the opportunity costs of holding large parcels of undeveloped land. Mines that are unprofitable at current prices do not pay Federal income taxes, so changes in tax provisions appear to have no effect on the investment potential of these mines. However, if these mines were to become economically viable--for example, if real metal prices increased or technological advances caused real costs to decrease--then various tax provisions would affect their profitability. Most of the deposits that were economically and financially profitable in 1978 are currently being developed.

In a sense, the model understates the effect of taxes on new investment. However, if these deposits are not developed for another 10 years then the present value of tax effects correctly accounted for and then discounted at an 18 percent real, after-tax rate would be very small.

## THE DEPRECIATION OPTION

In the model, we assumed that all depreciation is calculated on a straight-line basis. This simplified the minimum tax analysis, because the difference between an accelerated method of depreciation--sum-of-the-years digits or double declining balance--and straight-line depreciation is in some cases a tax preference item. Because we used straight-line depreciation, the only preference item subject to minimum tax was the excess of percentage depletion over the cost basis. Hence, we could isolate the effects of percentage depletion with and without the minimum tax.

Mine and mill plants are depreciated for 15 years. Equipment and machinery is depreciated on an 8 year basis, with similar provision for reinvestments. There is no salvage value.

The straight-line method is generally a less favorable way to treat the depreciation deduction. Most firms will use an accelerated depreciated method whenever possible. Therefore, our assumption of straight-line depreciation causes profitability to be slightly understated.

## THE DEPT/EQUITY RATIO

Although the model has the capability to account for different debt/equity ratios, we assumed that all the mines were 100 percent equity financed. This simplified the choice of an appropriate discount rate.

## THE DISCOUNTING METHOD

The model can accommodate both continuous and discrete discounting techniques; we chose to use continuous discounting. Continuous discounting is analogous to compound interest based on the continuous receipt and disbursement of funds. The discounting formula used was presented earlier (see p. 102).

## INHERENT ASSUMPTION IN THE NET PRESENT VALUE AND INTERNAL RATE OF RETURN CALCULATIONS

Although the internal rate of return and net present value methods generally lead to the same results regarding the desirability of an investment, important differences exist between the methods, and they must be recognized. The conflict between these two methods is due to different assumptions with respect to the marginal reinvestment rate on funds released from the proposal. The internal rate of return method implies that funds are reinvested at the internal rate of return over the remaining life of the proposal. The present value method implies reinvestment at a rate equivalent to the required rate of return used as the discount rate. Because of the differing assumptions, the two methods can give different rankings of investment proposals. If the choice must be made, the present value method generally is considered to be superior theoretically. In this analysis, we relied primarily on present value results and supplemented these with information based on internal rate of return calculations.

## GENERAL PROGRAMMING COMPROMISES

The model contains a number of assumptions made to facilitate the programming. Among these are a ceiling on the discounted cash flow rate of return of 120 percent. Any mine with a rate of return above this is shown as having a 120 percent rate of return. Also, the maximum life of a mine is assumed to be 80 years.

## STATE TAX PROGRAMMING COMPROMISES

The MINSIM 4 program is equipped to handle several general State tax routines. These general tax routines allowed us to choose from a few prevalent tax bases--such as gross revenues or taxable income--and specify each tax rate.

On several occasions these routines did not give us enough flexibility to incorporate each State tax concisely. Special

programming by the Bureau of Mines was required. When special programming was not possible, compromises were made.

The following are examples of compromised State tax programming:

--A property tax required taxing investments in pollution devises at a lower rate than other investments. A weighted tax rate was used for the lump category because the separate dollar amounts were not available.

--A sliding-scale income tax has seven rates and ranges to determine the total tax. The MINSIM 4 general sliding-scale tax has only five groupings. The compromise required collapsing the first three scales into one scale to fit the system needs. It will overestimate tax when the total tax base is less than the amount covered in the first range. However, this was not used for any of the deposits we examined.

## LIMITATIONS OF THE MODEL

The scope of a model and the assumptions made in constructing a model always impose limitations on the use of the model's analytical results. The purpose in building the model employed herein was for supply analysis. As economic models go, this one is relatively simple. It addresses only one aspect of economic behavior, namely the financial evaluation of individual mines and deposits. Validity of this financial evaluation depends on the many assumptions employed. Despite the simplicity of this model and the many assumptions used, we believe that our results can help policy analysts and decisionmakers to better understand the effect the taxes have on the profitability of domestic mines. However, we caution users of these results to beware of the model's limitations, which are described below.

The model is limited in scope, it addresses only one criterion of an investment decision. From the results only limited judgements can be made about the effect of taxes on supply/demand interactions and expected prices. The model does not address questions of the effect of taxes on exploration. Again, from the model results, only limited judgement can be made about these effects.

The model includes only primary domestic production. This limits the usefulness of the results in making judgements about the impacts that various tax provisions have on supply from foreign deposits subject to U.S. tax provisions and from secondary production. In addition, the model includes only four metals. Care must be taken in applying the results to other metals and nonmetallics, and to the mineral industry, in general.

SUGGESTIONS FOR FURTHER WORK

More work is needed to determine how sensitive the results of this analysis are to the assumptions used to simplify the modeling task. Specifically, sensitivity analysis should be performed by varying such parameters as the discount rate chosen, the future path of cost and prices and the level of prices, and by examining the effect of these changes on the profitability outcomes. Since this work was undertaken, the Bureau of Mines has substantially modified and expanded its supply modeling capabilities and has increased the ease with which sensitivity analysis can be performed.

In addition, more could be done to incorporate the actual structure of mining companies, and their attendant tax situations, into the model. This is a difficult task because some domestic mining firms are owned by large diversified corporations with many other sources of income. For example, Anaconda Copper is part of the Atlantic Richfield Company. It is often difficult for these organizations to apportion their corporate tax bill to specific operations. While it would not be feasible for the model to capture the total effect of corporate structure, the model's tax calculations could be improved and made more realistic by aggregating the mines owned by a specific corporation, calculating the corporate tax bill, and then allocating the taxes among the mines.

More information is needed before the assumption about the shape of the cost curve can be improved upon. Information must be gathered or developed to determine the variance of cost with output at each mine or deposit. This information should be incorporated into the data base, and the capability of handling costs specified as a function of output must be built into the model.

Other areas where this analysis could be improved include the determination and selection of an appropriate debt/equity ratio for each mine or deposit, use (in the model) of the more frequently chosen accelerated depreciation options, and more realistic assumptions about the timing of new investments.

STATUTORY DEPLETION RATES FOR VARIOUS MINERALS 1/

(1) 22 PERCENT -

(A) sulphur and uranium; and

(B) if from deposits in the United States-anorthosite, clay, laterite, and nephelite syenite (to the extent that alumina and aluminum compounds are extact therefrom), asbestos, bauxite, celesite, chromite, corundum, fluorspar, graphite, ilmenite, kyanite, mica, olivine, quartz crystals (radio grade), rutile, block steatite talc, and zircon, and ores of the following metals: antimony, beryllium, bismuth, cadmium, cobalt, columbium, lead, lithium, manganese, mercury, molybdenum, nickel, platinum and platinum group metals, tantalum, thorium, tin, titanium, tungsten vanadium, and zinc.

(2) 15 PERCENT -

(A) gold, silver, copper, and iron ore; and

(B) oil shale (except shale described in paragraph (5)).

(3) 14 PERCENT -

(A) metal mines (if paragraph (1)(B) or (2)(A) does not apply), rock asphalt, and vermiculite; and

(B) if paragraph (1)(B), (5) or (6)(B) does not apply, baul clay, bentonite, china clay, sagger clay and clay used or sold for use for purposes dependent on its refractory properties.

(4) 10 PERCENT - asbestos (if paragraph (1)(B) does not apply), brucite, coal, lignite, perlite, sodium chloride, and wollastonite.

(5) 7-1/2 PERCENT - clay and shale used or sold for use in the manufacture of sewer pipe or brick, and clay, shale, and slAte used or sold for use as sintered or burned lightweight aggregates.

(6) 5 PERCENT -

(A) gravel, peat, pumice, sand, scoria, shale (except shale described in paragraph (2)(B) or (5)), and stone (except stone described in paragraph (7));

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1/ 26 U.S.C. 613.

(B) clay used, or sold for use, in the manufacture of drainage and roofing tile, flower pots, and kindred products; and

(C) if from brine wells-bromine, calcium chloride, and magnesium chloride.

(7) 14 PERCENT - all other minerals, including, but not limited to, aplite, barite, borax, calcium carbonates, diatomaceous earth, dolomite, feldspar, fullers earth, garnet, gilsonite, granite, limestone, magnesite, magnesium carbonates, marble, mollusk shells (including clam shells and oysters shells), phosphate rock, potash, quartzite, slate, soapstone, stone (used or sold for use by the mine owner or operator as dimension stone or ornamental stone), thenardite, tripoli, trona, and (if paragraph (1)(B) does not apply) bauxite, flake graphite, fluorspar, lepidolite, mica, spodumene, and talc (including pyrophyllite), except that, unless sold on bid in direct competition with a bona fide bid to sell a mineral listed in paragraph (3), the percentage shall be 5 percent for any such other mineral (other than slate to which paragraph (5) applies) when used, or sold for use, by the mine owner or operator as rip rap, ballast, road material, rubble, concrete aggregates, or for similar purposes. For purposes of this paragraph, the term "all other materials" does not include--

(A) soil, sod, dirt, turf, water, or mosses;

(B) minerals from sea water, the air, or similar inexhaustible sources; or

(C) oil and gas wells.

For the purposes of this subsection, minerals (other than sodium chloride) extracted from brines pumped from a saline perennial lake within the United States shall not be considered minerals from an inexhaustible source.

# United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

NOV 10 1980

Mr. J. Dexter Peach
Director
Energy and Minerals Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Peach:

The General Accounting Office (GAO) draft report "Domestic Taxes and Minerals Availability: A New Method for Understanding Their Relationships" was sent to the Secretary of the Interior on October 12, 1980, for review.

The main themes of the report are that inherent in tax policy is mineral policy, and that the Department should take the lead in conducting analysis to assess existing tax policy with a view to modification. The report suggests taking into account state and local government tax policies to provide a more complete assessment of the real impacts of taxation on resource development.

We accept the concept that there is a mineral policy component in our tax policy, and there is a need for Interior to conduct studies to assess impacts. However, as GAO clearly points out, the analytic tools needed to conduct this type of analysis do not exist, and to develop a complete industry model for each commodity would require a large team of specialists and a considerable amount of time. The present state of the art for the Bureau of Mines Minerals Availability System has taken nearly 10 years to develop and despite recent increased funding it will take significantly more work to refine it. We believe our present course of action, which depends on planned funding, will permit us to complete the supply analysis for the 23 critical commodities we plan to cover by FY'84. It is our view that a critical mass of data must exist before there can be any realistic quantitative analysis of the link between taxes and mineral policy, much less a broadened analysis to include all or most minerals eligible for percentage depletion as proposed by GAO. A parallel course of action we plan to take is to develop more sophisticated analytic tools to conduct such sensitivity analyses.

[See GAO note, p. 120.]

The GAO study is a good initial effort in highlighting the impact of taxes upon the mineral industry but more work is needed, as recommended in the report, to indicate the cost of taxes and their affect upon the quality and quantity of mineral resources that can be produced. Accordingly, we believe that the GAO's proposal is a good one and one which we can support in principle. The GAO proposes a report to the Congress by December 1981 on subjects for which there are limited data upon which to base an analysis and inadequate analytic tools to conduct the analysis, namely, the impact of percentage depletion, investment tax credit, and expensing of exploration and development on the incentive for increased exploration, production, and investment in the mineral industry. The Bureau of Mines is developing the tools and data to effectively examine these subject areas, but the 1981 date is unrealistic.

In general, throughout the GAO study the limitations placed on the study were due to the parameters established by the GAO and not due to the capabilities of the MINSIM 4 computer program. This relates to statements on pages 15-18.

Some additional specific comments are as follows: Page 3. Last sentence does not follow to page 3.

Page 18. Tables 1 and 2. Why illustrate this information in the study if there are so many reasons that the data are not comparable. Also, table 2 values are in constant dollars and table 1 is in current dollars. Oil and gas is included in table 1 and not in table 2.

Pages 18 and 19. Values in table 2 are discounted values, values in table 3 are undiscounted. The data provide an over- or understatement of effect depending upon what you want to present.

Page 19. Table 3. The title is confusing because there is not a comparison of cost depletion and percentage depletion in the table.

Page 20. Figure 1. We question the value used to determine cost depletion. It is not a valid comparison if GAO used the undepreciated capital of a producing property for the basis of cost depletion.

Page 21. Table 4. The data reveal the profitability status of a molybdenum property in New Mexico; persons familiar with the industry can identify the property. This reveals proprietary information and should be deleted.

Page 23. Bottom of page - mathematically the equation should read:

$$\frac{\text{cost}}{\text{Gross revenue}} \geq 1\text{-}2\ (\text{depletion rate})$$

given that the root equation is:

Depletion rate x gross revenue $\leq$ 1/2 (gross revenue minus cost)

Page 25. This statement is not true. To be the most profitable does not necessarily require the largest capital investment.

Page 28. Financially profitable mines in this study have a depletion deduction less than the net income of the mine but this statement should not be generalized to the entire industry.

Page 30. Table 10 "Copper - No Limit" percentage totals to 106 percent.

Page 39 and 40. Titles of tables 19 and 20 are not correct; perhaps it was intended to be producing versus non-producing copper mines.

Page 69. Data in figures 7 and 8 reveal individual company status. Proprietary data should be deleted.

The Bureau of Mines in reviewing this report took appreciative note of the kind words GAO used to describe their assistance to them.

Sincerely,

Sgd. William D. Kendig
Assistant Secretary, Policy, Budget, and Administration

GAO note: Page references were changed to reflect their location in this final report. Cross reference page numbers have been similarly changed.

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DEPARTMENT OF THE TREASURY
WASHINGTON, D.C. 20220

ASSISTANT SECRETARY

NOV 14 1980

Dear Mr. Anderson:

This is in response to your letter of October 16 forwarding for comment copies of a Draft Report, "Domestic Taxes and Minerals Availability: A New Method for Understanding Their Relationship." On the basis of our own experience in attempting to convey to Congress and our sister agencies an understanding of the subtle, but nevertheless significant, ways in which the Federal tax laws have been used to influence domestic mineral activity we would agree that the Draft Report is aimed toward the right set of questions. Beginning in 1918 with the introduction of "discovery value depletion" allowances in lieu of conventional procedures for determining mineral capital consumption allowances, Congress has enacted a sequence of preferential income tax accounting rules applicable solely to mining for the express purpose of "encouraging," or subsidizing, this sector of the economy. Since the minerals industries are essentially competitive, these purposive tax preferences, or tax subsidies, have served to induce more domestic mining than would have occurred if the normal rules of income taxation had been uniformly applied. In effect, as the title of the Draft Report suggests, the tax subsidies have affected domestic mineral "availability," or mineral supply, in the technical jargon of economists. And the interesting questions thus raised are: How much has been the increase in domestic output of minerals, and at what budgetary cost?

Unfortunately, for reasons detailed in the enclosure, execution of the Draft Report contributes little or nothing to either a clarification of the questions raised or to reliable quantitative estimates of effects and budgetary costs. Rather, the Draft Report muddies analysis by failing to systematically distinguish the "normal" tax regimes at state and Federal levels applicable to mineral producers, departures from which constitute "incentives" or "disincentives" to mineral production, and it fails to process the Bureau of Mines data base in a manner that would permit the estimation of effects and budgetary costs (gains) of existing tax subsidies (penalties). Thus, although the Treasury Department would endorse and enthusiastically support the recommendation that the Department of the Interior take the lead in organizing a systematic analysis and empirical estimation of the output effects and budgetary costs of mineral tax subsidy programs, we would question the utility of the Draft Report's analytical framework and empirical methodology as a model for such a study effort.

[See GAO note, p. 139.]

As in the past, we would be pleased to work with your staff in a revision of the Report to whatever extent they may find useful.

Sincerely,

Donald C. Lubick by EMS

Donald C. Lubick
Assistant Secretary
(Tax Policy)

Mr. William J. Anderson
Director
General Government Division
General Accounting Office
Washington, D.C. 20548

Enclosure

APPENDIX V

## Comments on "Domestic Taxes and Minerals Availability: A New Method for Understanding Their Relationship"

**General comments:**

1. **Absence of an operational distinction between "tax policy" issues and industry-specific tax preferences, negative or positive.**

In common with all economic activities undertaken in the private sector, mineral production confronts market conditions affected by government policies. Access to land (natural resources) is governed by a legal system of property rights imposed and administered by the Federal and state governments; terms on which labor may be employed (labor contracts) are governed by labor laws and OSHA/MSHA regulations that regulate bargaining procedures, working conditions and minimum employee compensation; the terms on which capital may be employed are governed by securities and general property laws; and the environmental consequences of production are subject to regulation by environmental protection laws. Thus the prices of inputs to mining--costs of production--are not only determined by available stocks of natural resources, labor and capital, and by mining technology, but also by the institutional constraints on access to inputs and the choice of technology.

Similarly, governments carry out a wide range of activities that require the direct use of resources, as in the production of public goods and services. To effect this direct diversion of resources from purely private to public uses, governments impose taxes on activities undertaken in the private sector. These taxes, levied on broadly or narrowly defined bases at stipulated rates, also necessarily affect the market prices of resources and private sector outputs by interposing a wedge between the market value of goods and services produced by suppliers of labor and

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capital and the net rewards realized by the suppliers. Along with the other "rules of the game" established by government, the basic tax system is part of the price determining environment in which mineral production and consumption takes place. The basic tax structure, along with other natural and institutional constraints constitutes the environment in which mineral industries operate. Since these are parameters for the entire private sector, their effects on mineral industries, or other specific activities, cannot be considered reasonably to be controllable as elements of industry-specific economic policies.

At the same time that government establishes general rules that help govern the composition of output and relative prices in the private sector, government also employs its budgetary powers to modify particular market outcomes. It may act to reduce market prices of certain outputs by providing subsidies either to the output of specified goods and services or to the use of particular kinds of inputs in the production of those goods and services. When it so acts, it has been customary to account for the cost of resources thus diverted on the expenditure side of the budget, leaving it to the tax system to raise the funds by which to accomplish the diversion. Through a system of taxes, the government collects funds by which to pay producers subsidies so that they may sell their goods and services at market prices that are below the social costs of production they have incurred and which reflect the aforementioned institutional constraints. But, inasmuch as all producers and suppliers of services are also subject to taxation, governments with increasing frequency carry out these expenditure (subsidy) functions by clearing payments through tax accounts. For example, in lieu of appropriating funds to pay suppliers of minerals a subsidy so that these producers may pay their suppliers of productive services market prices (pre-tax incomes) and their own normal tax liabilities while selling minerals at lower market prices, governments simply "clear" the subsidy payments through the mineral producers' tax accounts as special credits against tax otherwise due, or as special deductions to reduce the amount otherwise subject to tax.

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The analysis of "tax policies" and "subsidy policies" affecting a particular industry entail distinctively different methodologies. Tax policy analysis is concerned with the efficiency and equity by which resources are extracted from the private sector to carry out the things governments wish "to do," taken altogether; subsidy policy analysis is concerned with the benefits and costs of programs by which governments seek to modify market outcomes in particular markets whether the programs are paid for in cash or cleared through tax accounts. From the point of view of a particular industry, tax policy issues are solely those of determining whether the general rules of the tax, whether it is a levy on property, income, or sales, are applied reasonably and fairly to those engaged in that industrial activity. The only permissible tax policy question is whether a particular industry is paying its "fair share" of tax, not whether it is subject to tax. In the case of a mineral producing activity, the questions of Federal government tax policy are whether the basic rules for recognizing income, the accounting for capital expenditures (capitalization and imputation of future capital consumption), and the valuation of inventory, are applied to mineral-producing activities in a nondiscriminatory manner. Evaluation of tax policy impacts on the mineral industry therefore requires an extensive knowledge of the basic tax laws applicable to all private economic activities and a thorough understanding of the mineral activity and mineral markets so that neutrality in application of these rules may be determined.

In contrast, analysis of a "subsidy policy" applicable to a particular industry concerns these issues: (1) the justification for governmental intervention, i.e., the identification of "externalities" private markets do not account for; (2) a specification of the structure of the industry; (3) specification of the determinants of market supply, including imports; and, (4) a specification of the determinants of market demand, including exports. In those instances in which industry "assistance"

programs are implemented by appropriations, the analysis is straightforward (though empirically difficult): The budgetary impact of the subsidy, which appears as a net addition to the expenditure (outlay) side of the budget, is a measure of the (market price) of the resources diverted by the subsidy; the "effectiveness" of the subsidy is measured by the increase in output (and employment of resources) achieved; and evaluation of the program consists in a comparison of program cost with achievement of the objective. In other instances, when the subsidy program is implemented by tax preferences, the methodology is essentially the same, but certain additional operations are required. First the tax preference must be identified. Again, this requires that normal tax treatment of the activity be specified so that the departure from this normal tax treatment may be quantified. Second, the effect of the departure must be transformed into an expenditure equivalent so that the budgetary impact--cost of resources diverted, measured in market prices--may be estimated for comparison with the estimated achievement of the program's output objective.

In its present state, the Draft Report, "Domestic Taxes and Minerals Availability: A New Method for Understanding Their Relationship," does not satisfactorily distinguish between the questions of tax policy--the normal application of Federal and state tax system rules--and departures from these rules that specifically assist, or impede, the domestic supply of minerals. For example, states normally impose property and sales taxes on activities within their jurisdictions. It is a tax policy issue whether state tax laws are applied in a nondiscriminatory manner to mineral producers, but this question is not addressed in the Report. If states impose discriminatory taxes, these become "negative" preferences, but this cannot be established or quantified, unless the "normal tax burden" is prescribed. Thus, the discussion of Chapter 3, "Changes in State Taxes and Their Impact on Mining Profitability," provides no basis for the

recommendation that "new institutional means should be devised to result in a better harmonization of tax policy with national mineral production objectives without obstructing the rights of various governmental levels to levy and collect taxes" (assuming that a Constitutional means can be found).

At the Federal level, failure to identify the "normal" application of income tax accounting rules mars the discussion of percentage depletion and the special expensing privileges accorded to exploration and development expenditures and again undermines the analysis of these clearly overt subsidies to mining. Moreover, failure to clearly identify the subsidy elements in these preferences has precluded an analysis of the efficiency of these subsidies. Finally, at a different level of generality, it seems no more appropriate to treat the investment credit, and its structural flaws, as a "minerals policy issue" than it would be to treat the unintegrated corporation income tax as such an issue. Just as any enterprise organized as a corporation must contend with the corporation income tax regardless of the output it produces, so any investment made in "tangible depreciable personal property" qualifies for the investment tax credit regardless of the activity in which it is used. From the point of view of the minerals industries, the investment tax credit is simply an input cost determinant, like the manufacturers' excise on trucks or the Fair Labor Standards Act.

2. Absence of a reference to any justification for a "minerals policy."

It is apparent from the selection of tax law provisions reviewed in the Draft Report that the aim is not to evaluate tax structural issues generally but, rather, to evaluate industry-specific subsidies cleared through Federal tax accounts (and to assess impediments to mineral production imposed by

discriminatory state laws). This being so, the question of subsidy/penalty policy justification arises. Why, from the point of view of national economic welfare, would the domestic output of the several minerals examined be too high, or low, absent government intervention? If there is a national security benefit to higher production that is not internalized in the U.S. markets for the minerals, what is it and how much per pound of particular minerals? Does this category of minerals worthy of subsidy include sand, gravel, clay and mollusk shells? Similarly, if the operation of mining establishments within a state imposes net public service burdens on affected governments, what are they, and how much are the costs per ton of ore extracted and processed that might constitute the basis for an industry-specific charge to cover this externality?

While it may well be beyond the scope of the Report to empirically estimate these external costs and benefits of domestic mining, the need for such estimates to evaluate the subsidies/penalties reviewed in the report should be emphatically noted. Absent some measure of the subsidy/penalty that is justified by externalities, no useful evaluation of the efficiency of existing subsidies and penalties can be performed.

3. Incomplete adaptation of the Bureau of Mines financial model ("MINSIM") to analysis of the effects of tax subsidies/ penalties on the annual supply of minerals.

The analytic aim of the Draft Report is to quantify the effects of tax subsidies and/or penalties on the annual output of specified minerals. Given a set of determinants, such as the quality of ore deposits, the opportunity costs of securing access to these deposits, a state of technology, the prices of labor and capital goods, the opportunity costs of attracting funds (willingness of suppliers of funds to hold debt and equity instruments), and the institutional parameters (environmental,

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worker safety and health, and basic tax laws), some annual rate of output of particular minerals will ensue. This is the "base case" for analytical purposes. Then, if some "incentive" or "disincentive" is provided, the annual output will be increased, or decreased. In the case of "incentives", the question of interest is the increase in annual rate of production over the base case and the budgetary cost of achieving it. Conversely, in the case of "disincentives," the question concerns the reduction in annual output and the resultant budgetary gain to the government imposing the disincentive. Evaluation of the outcomes of government intervention then entails an analysis of welfare gains or losses, and this depends on the shapes of market demand and supply functions, including export and import functions.

The Draft Report, for understandable reasons, restricts its empirical investigation to the effects of tax subsidies/penalties on the domestic supply function. There are two empirical approaches to this estimation process. Under one, time-phased "engineering" estimates of physical inputs and outputs are converted to economic magnitudes with the aid of market prices of inputs to produce "long-run" estimates of "supply price," i.e., the market price of output necessary to cover all the opportunity costs of production and, therefore, the price which will elicit an estimated annual rate of output. This is the approach which was taken by the Treasury Department in its 1979 Report, Federal Tax Policy and Recycling of Solid Waste Materials.

Under the second empirical approach, a combination of physical information on output, company income statement data on operating costs, and simulated balance sheet information on "investment" or capital costs are used to derive the same estimates of industry supply functions, with and without "incentives" and "disincentives." This is the approach taken in the Draft Report. In principle, either approach should yield the same result. If the financial statement information is carefully

transformed into outlays for inputs and these in turn are related to output flows, appropriate discounting should produce the same present values as would be produced by an engineering specification of time-phased outlays (physical quantities of inputs times their prices) related to the corresponding flows of output. However, as described in the appendices to the Draft Report, it appears the transformation of financial data is both incomplete and, in some instances, misspecified:

a. The "investment" information for mineral properties in production during 1978 includes pre-1978 "investment" amounts, but they are "depreciated" (by unspecified rules) to derive a 1978 "capital investment" value which is then depreciated over the remaining "life of the property." For potentially productive properties, estimates of 1978 investment outlays are made, and these are then "depreciated" over the remaining life of the activities. For both kinds of properties, it is assumed that 80 years of production ensues, but 80 years is not taken as the "life" of the capital investment for "depreciation" purposes.

If 80 years were taken as the "life", then financial "depreciation" would have no function to perform. If $X spent on establishing a mineral productive facility in 1978 would provide a productive capacity for 80 years, then the only question is whether the present value of 80 years worth of production, less the "operating costs" plus taxes, equals or exceeds $X, or whether the internal rate of return (the discount rate which equates the net revenues for 80 years to $X), equals or exceeds the "target" or threshold rate of return required by suppliers of capital. But, of course, $X spent in 1978 cannot possibly provide a plant and equipment which will produce for 80 years and then crumble into dust like the "one-hoss shay" of Oliver Wendell Holmes. Periodically, worn equipment will have to be replaced (a future outlay), and further mine development investment on the same property will have to be made. If the amount of financial

"depreciation" is an annual estimate of the outlays required to maintain the productive capacity of the mineral property, then these should be treated as outlays in the discounting operation (and appropriately capitalized and depreciated for tax purposes). In this event, properties operating in 1978 should be "carried" at their pre-1978 investment cost, inflated to 1978 prices, assuming that prior years' financial "depreciation" was expended to maintain productive capacity.

b. It is unclear what is included in "operating" costs. If these include replacement expenditures, then financial "depreciation" is irrelevant, as noted above, and the replacement expenditures should be capitalized and depreciated for income tax purposes.

c. The structure of the (Federal and state) income tax calculator is unclear. There is no mention, for example, of the tax depreciation rules used nor how the "mining income" is computed for purposes of determining percentage depletion. Nor is it clear that state and local taxes were treated as deductible for Federal income tax purposes.

d. The lack of recognition of debt in the capital structure of the mining companies is a serious omission. Not only is the interest expense not taxable at the corporate level--the point at which the analysis takes place--the proper discount rate to use in the operation is a weighted average of the borrowing rate and the (after-corporate-tax) equity rate of return. While 18 percent is not an unreasonably high nominal equity rate of return to apply to a mining operation, though it would appear to be high under the assumption of zero inflation, this is not the cost of funds to a going concern. (Since BOM knows the corporate identities of the mineral properties in its data bank, it would be a simple matter to find the parents' debt equity ratios, estimate a borrowing rate to accompany the equity rate of return assumed, and compute a weighted average discount rate.)

e. As noted above, there is no indication that a specification of a norm, or base case, was attempted. This omission makes interpretation of the results, such as they are, extremely difficult.

4. Unsuitability of the "discounted cash flow" methodology for estimation of mineral "supply," or "availability."

Data in the BOM file of existing and potential mineral properties include investment and "operating" cost items, along with estimates of output. If these are taken as "representative" of domestic mineral production potential, given an appropriate weighted opportunity cost of capital funds and a "normal" tax regime, they might be directly used to determine quantities of output that would be forthcoming at different market prices of the minerals. That is, for each property, the present value of the sales revenue required to cover costs and "normal" taxes could be computed, converted to a "level" annual annuity, and divided by the property's annual output to determine that property's minimum long-run supply price for its output. These results for all properties could then be aggregated to derive an "industry supply" curve. Then, retaining the same investment and "operating" costs and discount rate, changes in tax regimes could be introduced to recompute outputs and "industry supply" curves. Differences between the "normal" tax regime "supply" curve and the others examined would then indicate the effects of the tax subsidies implied by the other tax regimes. Then, <u>given</u> some market price of the mineral, say the world price, or the average of recent prices, an estimate of both the increase in domestic output <u>and</u> the budgetary impact (in market prices) could be estimated. Of course, these estimates would be subject to the caveats noted in the Draft Report concerning cost assumptions and coverage of the sample properties.

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The Draft Report does not utilize the POM data file in this way. Instead, it employs a methodology designed to evaluate potential investment projects, which is probably why an 18 percent discount rate was selected. It is not uncommon to use such a high discount rate when evaluating project proposals incorporating uncertain estimates of costs, output, and mineral prices; it is a dubious practice to apply so high a discount rate to existing, continuing operations. Under this methodology, a future prevailing market price(s) of output(s) is assumed and either the internal rate of return, or the present value of net revenues (at 18 percent), is computed. While the results are relatable to a "supply curve," as computed they only indicate variations in profitability, or excess present value of net revenues (at an 18 percent discount rate) at the assumed price. Consequently, nowhere in the Draft Report will one find an estimate of the change in supply that would result from the changes in tax regimes considered, nor an estimate of the budgetary impacts of the changes, belying the title of the report. Indeed, the "benefits" of tax changes are presented only in present value terms; and these cannot be related to either quantities or value of output nor can they be transformed into budgetary impacts.

Specific comments (page references are to the final Report):

5: The pre-1918 depletion allowance was not a form of "accelerated depreciation." It was, and remains as an option to percentage depletion, a straightforward "units-of-production" form of cost recovery: based on estimates of recoverable minerals at the beginning of the year, that proportion of the minerals that are extracted during the year is the proportion of the original unrecovered basis (cost) recoverable during the year. Obviously, this procedure does not permit a write-off of the cost of a deposit before the deposit is depleted or abandoned.

5: The implications of "discovery value depletion" are not appreciated by the authors. In principle, this method exempts from tax the income earned in discovering a mineral. (See OTA paper No. 2 for a discussion of this, or the November 1978 paper by Piekowsky, "Taxation and the Depletion Allowance.") The unqualified statement that discovery value depletion benefitted large companies but not "small wildcatters" is plainly wrong.

7: The statement at the bottom of the page that percentage depletion was viewed "primarily as a tax policy device" is unsupportable. Nor is it consistent with later comments about "incentives."

12: The view about the irrationality and inefficiency of percentage depletion as a subsidy is not the official position of the Treasury, nor is the quotation from an official Treasury document.

14: The statement that the authors found no study "that addressed the depletion question for nonfuel minerals which was based on characteristics of actual domestic operations" betrays a regrettable ignorance of the literature. See the 1979 Treasury report referred to above and the works therein cited.

16: The statement near the bottom of the page that percentage depletion and expensing of exploration and development (E&D) costs are administered on a property basis is not entirely correct. The percentage depletion allowance, and its income limitation, is on a property basis, but expensing of E&D costs provides deductions which may be taken against the taxpayer's income from any source.

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17: Since "tax expenditures" are estimated as "revenue losses," their magnitudes are in "after-tax" dimensions. However, since they are intended to achieve a resource diversion normally accomplished by an expenditure subsidy, they need to be adjusted. The government can increase mineral output by paying subsidies to producers, in which case the amount of the subsidy enters producers' gross income and, hence, taxable income, or government can achieve the same result with a payment cleared through tax accounts. If the payment is made in tax-exempt form, whether in cash or a remission of tax otherwise due, the resource cost of the subsidy is understated in the budget in comparison with other measures of resources in market prices. Again, see the 1979 Treasury Report.

19: The reason why percentage depletion is a subsidy is both that it permits the investor to "recover" more than the capital he has invested and more quickly than his capital is depleted.

19: The question that has been raised by the Treasury Department is not "who is being subsidized,...getting the benefits" of mineral tax subsidies; rather, the question that has been raised is by how much do the tax subsidies increase domestic output and at what budgetary cost. Since it may reasonably be assumed that the minerals industries are competitive--the minerals reviewed in the Draft Report are all traded in world markets--any subsidy provided to mineral production will shift market (domestic) supply curves to the right. But, the degree to which a particular subsidy per unit of output increases supply will depend on the price elasticity of domestic supply; and the degree to which the increase in domestic supply (shift of the supply curve to the right) will increase domestic mining depends on the characteristics of import supply and domestic demand.

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If ore-bearing lands were of uniform quality and infinitely accessible at constant cost, then the domestic supply curve would also be uniformly elastic and the increase in output resulting from a subsidy would be a function of domestic demand and import supply response to a lowering of the domestic supply price by the amount of the subsidy. In this extreme case, all the subsidy is used to expand domestic supply, and the increase in domestic mining, or reduction in imports, would simply cost the subsidy per ton times the total output per ton.

But ore-bearing lands are not of uniform quality nor infinitely accessible at constant cost. Mining is the classic example of an "increasing cost industry," which is to say that the domestic supply curve is positively sloped, i.e., has a price elasticity less than infinity. This means that a given subsidy per ton of mineral will elicit a lesser increase in domestic supply; part of the subsidy will be consumed as higher economic rents accruing to the owners of superior quality, or more accessible, ores. In the limit, if there are no additional ore-bearing deposits, elasticity of supply is zero, and all the subsidy is consumed as higher economic rent by the owners of the existing deposits.

Thus the question is: what are the elasticities of domestic supply and of domestic demand and import supply that determine the increase in output (reduction in imports) and the portion of the subsidy consumed as economic rent? The Draft Report, for reasons discussed above, sheds no useful light on this set of questions.

25: The comments about the "appropriateness" of percentage depletion as a "capital recovery" method for profitable producers clearly demonstrate the authors are not aware of

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the role of a cost recovery allowance in an income accounting system. Whether a firm is "profitable" or not can only be determined after making some allowance for capital consumption. And the allowance for capital consumption ought to be independent of the degree of "profitability" of the firm which it presumably helps to measure.

36: If Congress provides a tax subsidy in the form of percentage depletion, or any other form of artificial deduction, why cannot Congress limit the amount of the subsidy by imposing a tax like the minimum tax on the excessive deductions? If the argument is that the minimum tax is an irrational reduction of an irrational subsidy, this should be demonstrated, but demonstrating the obvious--that the minimum tax degrades the percentage depletion allowance subsidy--performs no useful function. More generally, it is hard to understand why the discussion of percentage depletion appears independently of the minimum tax and of the related treatment of E&D capital outlays. Public policy formulation and evaluation is not advanced by mindless independent parametric variations of interrelated tax subsidy provisions.

51: The discussion of the tax treatment of development costs fails to note that permitting the expensing of such costs incurred after a mine has begun production is a departure from normal rules of income accounting and, for this reason, a subsidy. For example, the construction and equipping costs of a new manufacturing facility are capitalized and recovered as capital consumption allowances when the plant is used to produce output. Replacement costs of building components and machinery, the analogs of additional gallery construction, the extension of mine transport lines, etc., in mining, are capitalized like the

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original outlays and recovered by subsequent capital consumption allowances. The expensing allowed mining investment is a departure from the norm.

51: The conclusion that the tax treatment of E&D expensing yields little benefit is unsupportable and results from the nonspecification of normal tax treatment. As noted in the comment 2-44 above, the subsidy value of any element of tax subsidy is dependent on the presence or absence of other elements.

62: The observation that state tax changes are made without assessment of their effects on the mining industry illustrates the fundamental weakness of the Draft Report as a guide to tax and mineral policy evaluation. Although it is noted that state and local governments levy taxes on a variety of bases, some of which encompass mining along with other bus ness activities, to finance the provision of services, there is no basis provided for determining whether the application of these tax levies to mining is discriminatory. Why should states, or the Federal government, be more concerned with the particular effects of their general tax systems on the mineral industries than on others? The observation on p.63 that "state taxes significantly affect a mining operation's profits..." is tautological. All taxes interpose a wedge between the market prices of output and the net rewards to factor suppliers; this is a cost of government which all should share. Again, leaving aside the point of view of particular taxpayers who always believe their tax burden is too high, how does one demonstrate that any particular system of general fund taxes "overburdens" an activity?

73: The discussion of "Time and Tax Bases Impact...." is analytically naive. Establishing and operating any economic activity entails uneven time streams of outlays unsynchronized with output and, hence, revenue flows. This ineluctable fact is one of the reasons that capital performs a productive function and that its maintenance and reward constitute a significant cost of production. Then, what purpose is served by this discussion of "undiscounted" tax payment streams?

82: The statement that the Treasury Department has not "acknowledged responsibility" for analysis of mineral tax subsidies is incorrect. See the previously cited 1979 Report for a refutation.

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