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The Taxation of Mineral Extraction

by

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CHAPTER 1— INTRODUCTION

This study presents a survey of certain features of Canadian income tax practice that apply to mineral extraction, with an economic analysis of the results of that practice.

In the main, the particulars of Canadian tax practice that will be considered here are those that govern the application of the federal income tax to revenues derived from mineral extraction. 1/ That federal taxation takes special cognizance of mineral extraction can hardly be disputed. Whether this cognizance is justified at all or whether, on the contrary, present special treatment in comparison with other industries is inadequate, has been widely debated in Canada as elsewhere. The present study makes few claims to originality. What it attempts is to apply the fruits of economic analysis to existing Canadian conditions. To date such analysis has proceeded much further in the American context than it has in the Canadian. 2/

The group of industries whose taxation is to be considered is generally referred to as resource, extractive, or mineral industries; yet none of these terms is a completely correct description. The property they have in common is that all are natural resources, all are non-reproducible in the sense that the absolute stock, although unknown, may be taken as fixed by nature, all are extracted from the earth's crust by digging or boring, and all are then subjected to varying degrees of processing.

Although the semiprocessed products of this group of industries are referred to as minerals, they are not all minerals in the chemically correct sense of being natural, inorganic, chemical substances. Nor will we be concerned with every mineral that enters into the national product of Canada. Minerals à propos of which Canada's role is chiefly that of a processor of foreign ores do not receive special tax treatment and hence will not be considered here. 3/

The mineral extractive industry, as here defined, may be subdivided into three general categories: metals, industrial minerals, and fuels. As a group, these industries have been of great significance to the Canadian economy. In 1963, the industrial classification "Mining, Quarrying and Oil Wells", which excludes those mineral activities subsumed in the manufacturing classification, contributed about 4.1% to the value of the Gross Domestic Product of Canada. 4/ In terms of recent growth rates the mineral industries have outstripped the economy as a whole with a growth rate in real terms second only to the utilities industry. From 1946 to 1963 the mineral industry has grown at an average annual compound rate of 9.0% in real terms, compared to 9.6% for utilities, 3.9% for manufacturing and 4.1% for aggregate real domestic product. 5/

Using export criteria the mineral industries of Canada appear even more significant. In relation to Canada's merchandise export trade, minerals in raw and semiprocessed form constituted 31% of the total in 1962, having risen from 18% in 1951. During the same period, minerals in raw and semiprocessed form changed from 14% of total imports in 1951 to 10% of total merchandise imports in 1962. In 1962, the value of exports of raw and semiprocessed minerals from Canada was 1,931 million dollars; in the same year, the value of mineral imports in the same form was 650 million dollars. 6/

In terms of world output of minerals, measured by mineral content of the primary product, Canada is first in world output of nickel, asbestos, platinum metals, and zinc; second in uranium, cadmium, selenium, and sulphur; third in aluminum metal, gypsum, gold, tellurium and titanium, fourth in lead, silver, magnesium, and bismuth; and fifth in copper, iron ore, barite and molybdenum. 7/ In addition to the foregoing, the fuels, petroleum, natural gas, and coal, figure prominently in Canadian mineral output.

The economic process of mineral utilization may be divided into four phases: exploration, development, production, and disposition. The first phase, exploration, can, in turn, be divided into two stages: prospecting, reconnaissance, or primary exploration, and exploration proper. Reconnaissance refers to activities that establish the possible existence of a mineralized body, and the acquisition of property rights; exploration proper involves the testing, by drilling or digging of favourable ground to prove up the extent and quality of mineralization. In oil and natural gas extraction, exploration includes geological and geophysical expenses and the cost of drilling wells on unproven ground. There are various degrees of "ignorance" when an exploratory well is drilled. A "new field wildcat" is a well located far from producing pools and on a structure which has not produced before. A "new pool wildcat" is an exploratory well located to explore for new pools on a structure already producing but off to one side of the producing area. In addition, "shallow-pool tests", "deeper-pool tests", and "outposts", which are wells sunk with the object of extending the productive horizon or area of a producing pool, are also considered as exploratory wells. 8/

In mining for the solid minerals, the development phase involves capital expenditure and organization to prepare the mineral body for extraction of the ore in commercial quantities. In oil and gas a development well is one that is drilled on a proven structure in close proximity to a producing well.

With the plant in existence, the production phase consists of producing the mineral in concentrate or semipure condition. This phase tends to blend into the final one, which we have called disposition, and which includes further refining and fabricating of the mineral for its end-uses. The final phase is usually viewed as a form of manufacturing. However, since mineral extraction as an industrial process that is subject to special tax treatment is taken to refer only to the first three phases, the lack of a universally valid definition of the end of the production phase has led to a certain ambivalence in defining the extractive processes that qualify for such treatment.

The difference in the interaction of the exploration and development phases as between mining in the sense of mineral excavation on the one hand, and drilling for oil and gas on the other, is of some analytic importance. In oil and gas extraction, development investment is not as immediately tied to prior exploration as it is in mining for the solid minerals. In mining, exploration or property examination, and development refer to consecutive stages in the history of a particular piece of ground. In oil and gas, too, development depends on prior discovery of a new field or pool, but because of their fluid nature, development will be geographically differentiated from the immediate discovery well.

Oil and gas exploration may be taken to refer to the stage reached when a wildcat well has been drilled to completion. The exploratory well itself yields a final product. Development refers to the sinking of wells in proximity to a previous discovery. In mining there can be no production without development.

Thus, in oil and gas, exploration and development are more subjective and relative terms than they are in mining. The implication is that oil and gas land contiguous to a discovery well has a greatly increased market value after a discovery has been made. Another conclusion which follows is that there is no limit, other than geography or regulation, to the number of development wells that can be put down into a single formation.

In this study we will first review in summary fashion the special tax provisions that now apply to mineral extraction in Canada, and some of the more important non-tax provisions. This will be followed by an even briefer review of United States taxing policies.

Preparatory to analyzing these policies we will then define the criteria of horizontal equity and tax neutrality against which a tax system may be judged. We will then estimate the revenue cost of some of the present tax concessions in Canada, and will distinguish those characteristics of mineral extraction that might justify special tax treatment.

Next, we will analyze the requirements of the industry for capital wastage allowances on the criterion of horizontal equity, following which we will examine the contention that a uniform corporation tax is adversely non-neutral in its impact on the industry.

We will then examine what policy objectives might justify a conscious allocative bias towards the industry. Next, we will ask whether the present tax provisions are efficient in attaining the objectives sought. Finally, we will draw some conclusions suggested by the analysis. The text of the study is followed by a number of appendices that relate to the matters discussed.

REFERENCES

1/ One omission that has been made from the analysis has direct relevance to the impact of the federal income tax on mineral companies. This omission is the application of the provisions of section 11(1)(p) and regulation 701 that are designed to avoid double taxation of mining income under the federal statute and the various provincial mining tax statutes. The interpretation of these provisions is alleged to have involved a number of anomalies. The correction of such anomalies is, however, a technical rather than an economic matter and has received separate study on behalf of the Royal Commission on Taxation.

2/ Most of the U.S. studies, on which the present author has drawn, are detailed in references to the text of this study. However, to the following works of a more general nature his debt is too pervasive to permit only specific reference. They are: Stephen L. McDonald, Major Economic Issues in the Tax Treatment of Income from Oil and Gas Production, a background paper and Summary of the Conference Proceedings prepared for a conference of experts held at the Brookings Institution, October 18-19, 1962. Lee E. Preston, Exploration for Non-ferrous Metals, An Economic Analysis, Resources for the Future Inc., Washington, 1960. Alfred E. Kahn, "The Depletion Allowance in the Context of Cartelization", American Economic Review, Vol. 54, No. 4, June 1964, pp. 286-314.
The Federal Revenue System: Facts and Problems, 1961, Materials assembled by the staff of the Joint Economic Committee, Congress of the United States, Washington; U.S. Government Printing Office, 1961.
Federal Tax Policy for Economic Growth and Stability, papers submitted to the Joint Committee on the Economic Report, 84th Congress, Washington, 1955, esp. paper by Arnold C. Harberger, pp. 439-449. (Hereinafter referred to as 1955 compendium.)
Tax Revision Compendium, Papers on Broadening the Tax Base, submitted to the House Committee on Ways and Means, U.S. Congress, Washington, 1959, esp. paper by Peter O. Steiner, Vol. 2, pp. 949-966. (Hereinafter referred to as 1959 compendium.)

3/ Chief among the minerals omitted from special tax treatment and from consideration here is aluminum.

4/ National Accounts, Income and Expenditure, 1963, D.B.S., Table 21.

5/ Canada Year Book, 1965, p. 1018.

6/ The Canadian Minerals Yearbook, 1962, Mineral Resources Division, Dept. of Mines and Technical Surveys, Ottawa, 1964, p. 59.

7/ R. B. Toombs, Canadian Minerals in National and International Perspective, Mineral Resources Division, Dept. of Mines and Technichal Surveys, Ottawa, 1964, p. 55.

8/ Canadian Petroleum Association, Statistical Year Book, 1963, Calgary, 1964, p. 17.

CHAPTER 2— PRESENT GOVERNMENT POLICY IN CANADA

The extractive industries in Canada have for some years been the subject of special rules for the determination of income subject to tax and for the computation of federal income tax. What follows is a brief outline of the tax provisions as in force in 1965, the time of writing. 1/ This is followed by an indication of some of the non-tax policies of the federal and provincial governments within the context of which the tax policies operate.

TAX PROVISIONS

Some of the provisions apply to mining only, others to oil and gas well operators, others to special categories. This distinction is indicated in the following tabulation by the bracketed designation. 2/

1. Excluded from income subject to tax are returns from the sale of property by prospectors, and their financial backers (grubstakers) (mining). 3/

Until a 1965 amendment to the Act reversed this, the scope of this provision had recently been extended by a Tax Appeal Board decision where it was ruled that royalties received by a vendor who qualifies under the prospectors' and grubstakers' exemption, were also exempt from taxation. 4/

2. There may be deducted in computing income subject to tax certain exploration and development expenses (mining, oil and gas). In general, such expenses may be carried forward without any time limitation except that they must be claimed as soon as there is income subject to tax

against which to charge them. It would be impossible to do justice to the complexities of section 83A without prolonged discussion. The following will serve as an over-simplified description of the statutory rules as they now apply: 5/

(a) What May Be Deducted

(i) Prospecting, exploration and development expenses incurred in searching for minerals in Canada, to an extent that is conditional on the category of the taxpayer, and the year in which the expense was incurred. Such expenses do not normally include the cost of property rights, nor of buildings and equipment for which capital cost allowances may be claimed.

(ii) Drilling and exploration expenses for oil and gas in Canada, which include all general geological and geophysical expenses.

(iii) Bonus payments (capital payments for the right to explore for or take petroleum or natural gas), when made by a qualifying corporation (defined below) or an exploration syndicate, to the Government of Canada or a province, prior to April 11, 1962, and where the rights are surrendered as unproductive.

(iv) Other costs of land rights in petroleum and natural gas in Canada, acquired before April 11, 1962, to the extent of $1.00 per acre per year.

(v) The full cost of such land rights for the extraction of petroleum and natural gas in Canada, no matter from whom acquired, if acquired by a corporation after April 10, 1962.

(b) By Whom and to What Extent Deductions May Be Made

(i) A corporation that qualifies as to its principal business may deduct all the expenses detailed under (a) above against its income from any source. Consequently, such a corporation need not wait until the mine or well for which the expense was incurred itself yields an income. Corporations so qualifying are, at the time of writing, those whose principal business is exploring for, processing or fabricating mineral products, the marketing of oil or gas, and the operation of oil or gas pipelines. 6/

(ii) Individual members of associations, partnerships or syndicates formed for the purpose of exploring for, or drilling for petroleum or natural gas (only), may deduct their share of allowed oil and gas expenses, to the extent of their share in the income of all such syndicates.

(iii) A corporation that does not qualify as to the nature of its principal business may deduct the defined expenses whether for mining, oil or gas, if they were incurred after April 10, 1962, to the extent that the corporation has income from oil or gas wells, has oil and gas royalty income, or has received amounts from the disposition of property rights to oil or gas.

(iv) An individual may deduct expenses of drilling and exploring for petroleum and natural gas (only) incurred after April 10, 1962, to the extent that he has income from oil or gas wells, has oil and gas royalty income, or has received amounts from the disposition of property rights to oil or gas.

(v) Apart from the provisions of the foregoing two paragraphs, individuals and non-qualifying corporations are restricted in the costs which may be deducted and the income against which the deduction may be made. 7/ An individual or a non-qualifying corporation may deduct expenses for oil and gas exploration and development if they were incurred before April 11, 1962, only to the extent of the costs of drilling and only against the income from the specific well. 8/ In connection with mining, preproduction expenses are deductible by an individual or non-qualifying corporation, against income from a mine, to the extent of 25% of such expenses in any one year. 9/ The latter deduction may be used to create a loss whose carry-forward is restricted by the normal provisions.

(vi) Joint exploration corporations, which are corporations qualifying as to principal business, and which have fewer than ten shareholders, may renounce their expense allowance in favour of qualifying shareholder corporations, if those expenses were incurred after 1956 out of funds provided by the shareholders. 10/

(c) Provision for Taxing of Receipts for Drilling Rights

Offsetting the 1962 provision for the expensing of bonus payments in oil and gas 11/ is a provision whereby amounts received from the disposition of property rights to oil and gas are fully taxed except where such rights were acquired by inheritance or bequest or were acquired before April 11, 1962 and disposed of before November 9, 1962.

(d) Special Categories of Preproduction Expense

(i) Drilling costs only for oil and gas wells outside of Canada, may be deducted from income from the specific well. 12/

(ii) A qualifying corporation which acquires the property of another qualifying corporation may claim the unused portion of the preproduction expenses of its predecessor. This right is, however, confined to income derived from the property so acquired. A similar deduction is extended to a second successor corporation, for transactions after April 10, 1962.

(iii) Similar provisions apply to amalgamations, where unclaimed expenses are confined to income from property owned by the predecessors. 13/

(iv) A non-qualifying corporation whose principal business is producing and marketing sodium chloride or potash may deduct expenses incurred in exploration and drilling for halite or sylvite in the year incurred. This deduction may be used to create an ordinary loss carry-forward.

(v) Industrial minerals in bedded deposits do not qualify for the foregoing deductions. However, acquisition and preproduction costs may be amortized over the productive life of the mine.

3. Exempted from the corporate income tax is income derived from the operation of new mines for the first three years of their operation 14/ (mining only). In general, the exemption applies to income derived from the operation of a mine through the prime metal stage, so long as the output remains the property of the exempted corporation.

The three-year exemption applies to mining, in the sense of excavation through a shaft or pit, but sand, gravel, clay or shale pits, and stone quarries are excepted. It also applies to placer-gold dredging. However, prior to the 1966 amendment extending the exemption to sylvite deposits, the Department had held that it did not apply to minerals extracted through wells.

Since preproduction expenses or capital costs need not be written off against tax-exempt income, the period during which a new mine is free of taxation may extend for as long as six or seven years. To a qualifying corporation with other income, the tax exemption does not prejudice the write-off of preproduction expenses, as they arise, against such other income.

The three-year exemption has been held to apply to income derived from the reopening of an abandoned mine, 15/ and to royalties received by the lessor of a mine from an operating lessee. 16/

4. Operators and royalty holders are entitled to a percentage allowance.

(a) Operator's Allowance, General Case 17/

The operator of a mine, or an oil and gas well, with exceptions noted below, is permitted a deduction of 33 1/3% from his profits attributable to the output from the mine or the well. In effect the allowance is on the profit from production of crude oil or natural gas, or of metals up to the "prime metal" stage, or of certain industrial minerals.

The allowance is based on the taxpayer's income from the aggregate of all such operations, and on income net of all allowable deductions. The effect is thus to reduce the effective rate of tax by one third. Where there is no taxable profit, there is no "depletion" allowance.

(b) Gold Mine Operator

If at least 70% of the total value of output of minerals, produced by the taxpayer is from the production of gold, he may qualify for a larger allowance. In such a case he may claim an allowance of the larger of 40% of his total mineral profits, as defined above, or $4.00 per ounce of gold output. 18/

(c) Coal Mining

The operator of a coal mine is permitted to deduct an allowance of 10¢ for each ton of coal mined. This allowance is not dependent on any definition of income. 19/

(d) Industrial Minerals in Bedded Deposits

The operator of an industrial mineral mine where the mineral is contained in a bedded deposit (e.g., sand, gravel, clay and stone), is permitted to recover the actual cost of the mine, by amortizing the cost over its productive life. 20/

However, certain specified minerals, even though found in bedded deposits, still qualify for the general percentage allowance (item (a) above). Such minerals are sylvite, halite, silica or gypsum. 21/

(e) Non-operators' Percentage Allowance

Where a taxpayer who is not an operator (i.e., does not share in net profits) receives a royalty or rental that depends on the value of mineral production, he may deduct 25% of such income from his tax base. The non-operator's allowance is thus a gross allowance and applies even though the taxpayer has an overall loss during the year. 22/

5. Shareholders are entitled to a percentage allowance. A deduction of 10%, 15% or 20% is allowed from shareholders' dividend income when received from a corporation which is resident in Canada, and more than 25% of whose profits derive from mineral production. The exact rate allowed depends on the ratio of mineral profits to total profits of the corporation. 23/

6. The depreciation provisions apply to mines. Tax provisions for recovery of the capital cost of physical assets in mineral extraction, other than those covered by the exploration and development provisions, are not fundamentally different from those for industry in general. However, the rates provided may be regarded as favourable. Mining and oil and gas well machinery, buildings and equipment, fall into Class 10 (30% diminishing balance) rather than into Classes 3 (5%) and 8 (20%) into which such facilities would otherwise fall. Further, "a mine shaft, main haulage way or similar underground work", constructed after the mine came into production, qualifies under Class 12 for a 100% deduction in one year. 24/

7. Allowances in respect of provincial mining taxes are granted. Where a province levies a special tax on income derived from mining operations, the tax is allowable, within certain limitations, as a deduction in computing income for federal tax purposes. 25/

8. Iron ore companies are exempted from the provisions of section 110B. Companies mining iron ore in Canada, are specifically exempted from the 15% additional tax levied on the branch operations of non-resident corporations.

NON-TAX PROVISIONS 26/

Direct Financial Assistance

(a) Federal Subsidies

(i) Emergency Gold Mining Assistance Act

Higher cost gold mines are paid a subsidy based on their costs of production. This subsidy amounted to about 12.5 million dollars in each of 1960 and 1961.

(ii) Coal Subventions

Transportation subventions, administered by the Dominion Coal Board, are paid to improve the competitive position of Canadian coal chiefly in the central Canadian market. Such payments amounted to 17.4 million dollars in 1962.

(iii) Coal Bounties

Paid on the use of domestic coal to produce domestic pig iron. In recent years they have amounted to just over 200 thousand dollars a year.

(b) Federal Loans

The Coal Production Assistance Act provides low interest capital loans for modernization and mechanization.

(c) Federal Prospector Assistance Program

Beginning in 1962, the Department of Northern Affairs and National Resources has provided financial assistance to individual prospectors in the Northwest and Yukon Territories.

(d) Provincial Assistance

Some of the ways in which the provinces provide direct financial aid to phases of the mineral industry include bounties to assist infant metal processing industries, aid in moving miners from moribund communities and direct financial assistance to individual prospectors.

Other Government Services

Probably more important to a healthy and expanding mineral industry than direct assistance are those auxiliary services which are made available

to the industry at public expense, or which create a background climate favourable to the industry. Such services are rendered in generous measure, in Canada, by the federal and provincial governments. Their scope can only be sketched here in broadest outline.

(a) Research and Information

In general, such services are those which are most economically rendered by government. They include systematic geological mapping and the provision of reports and maps based on the most advanced techniques of the geosciences. They include basic and applied research and technical services, resource economics evaluations, and free assays.

(b) Provision of Transportation and Social Capital

Such services include direct government construction or financial assistance for the construction of roads, railroads, airstrips, power facilities, docks, harbours and housing, in assistance of mineral development. 27/

(c) Favourable Staking and Land-Holding Provisions

Mining claims may be staked anywhere in Canada, except in national and provincial parks and on Indian reservations, without the necessity of prior discovery of a mineral deposit. In general the laws regarding acquisition of mineral rights are simple and offer security of title at minimum cost. 28/

The foregoing tax provisions, imbedded as they are in a generally favourable climate, constitute a formidable array of advantages to mineral extraction in Canada. Before we enquire whether they are justified, we may glance briefly at the provisions of the federal taxing statutes of the United States, as they apply to mineral extraction. The latter are of relevance in a study of Canadian taxation both because a comparison of the two systems is so often made, and more fundamentally because the United States provisions have extraterritorial application to United States taxpayers with mineral interests in Canada.

UNITED STATES GOVERNMENT POLICY

The expensing of development costs and the percentage allowance to operators and royalty holders have equivalents in United States practice, although they differ in detail. 29/ Other items of mineral taxation, specifically the prospectors' and grubstakers' exemption, the three-year exemption to new mines, and shareholders' percentage allowance, are distinctively Canadian.

The United States depletion allowance presents an option under which the taxpayer may take the higher of cost depletion or percentage depletion on each of his mineral properties. Cost depletion provides for the amortization of the actual discovery cost or purchase price of the property on a pro rata basis over the life of the mineral deposit. Percentage depletion, on the other hand, is not limited to actual expenditures. It may be noted that the use of cost depletion for one or more years does not preclude the taxpayer from changing to percentage depletion when it becomes advantageous to do so.

Percentage depletion in the United States has three important definitional differences from the percentage allowance in Canada. It is based on gross income (with a net income limitation), it may be computed on a property-by-property basis and, in metal mining, it applies only to treatment processes up to but not including smelting.

The percentage which is applied to gross income of United States taxpayers varies from 27½% for oil and gas wells to a low of 5% for sand, gravel and stone. 30/ The deduction so computed is limited to a maximum of 50% of net income. The deductions from gross income, in arriving at net, include the usual operating, overhead and depreciation costs, plus

such permitted exploration and development expenditures as apply to that property, but not exploration costs related to non-productive properties.

The expensing allowances for mineral exploration and development, by United States statutes, are not, in the main, as broadly defined as are those in Canada, nor is their carry-forward unlimited. On the other hand, United States practice does not distinguish among classes of taxpayers in the definition of allowed expenses. The exploration and development expenditures that are allowed as specific deductions from taxable income to United States taxpayers may be briefly summarized as follows:

(a) Costs of exploration and land acquisition for properties that are abandoned as worthless are deductible as an ordinary business loss in the year in which the area is abandoned. Such costs include those of sinking dry holes in the search for oil and gas.

(b) For productive properties in mining, costs of development without limit, and costs of exploration to a limit of $100,000 in one year and a total limit of $400,000 for all mines owned by a taxpayer, may be deducted from income in the year incurred. Alternatively these amounts may be deferred and deducted ratably over the life of the mine. Amounts so deducted are taken into account in determining the net income as defined for purposes of the percentage depletion calculation.

(c) For productive oil and gas wells, intangible drilling expenditures are deductible from taxable income but, again, the deduction reduces the base for the net income limitation on the percentage depletion allowance. 31/

In comparing tax legislation as it affects mineral extraction in Canada and in the United States, we note that a number of the Canadian provisions are more generous. The three-year exemption, the more generous deduction of exploration expenditures, and the prospectors' and grubstakers' allowance, probably give a considerably greater liberality to mining taxation (in the narrow sense of mineral excavation) in Canada, despite the non-deductibility of land acquisition costs and the limitations on the depletion allowance.

In the case of oil and gas, too, Canadian law provides a more generous definition of deductible expenditures. However, it is with regard to oil and gas that adverse comparison is most often made between Canadian and United States statutes, although the comments in regard to depletion, taken alone, have validity to mining as well. The greater liberality of the United States depletion allowance stems not so much from the gross basis, nor from the disaggregation of properties, but from the elimination of "off-property" exploration— in effect, expenses connected with unproductive acreage— in the calculation of the net income limitation. In Canada, the expenses permitted under section 83A serve to reduce the basis for the depletion allowance, with the consequence that when unclaimed exploration and development expenditures exceed current income from mineral production net of all other costs, there is no depletion allowed. 32/

Another advantage to the mineral discoverer of the United States depletion rules is the combined effect of the cost depletion alternative and the lower rate of tax on capital gains. By this means the original developer of a productive property may sell it for its capitalized value and pay a 25% capital gains tax, on the excess over a "cost" that has been deflated by expenses written off at his highest effective tax rate. The purchaser, having paid a high price for the land, probably finds it expedient to take cost rather than percentage depletion, and in this way he writes off the land cost over the life of the mine or well at his own effective tax rate.

In Canada, a prospector may sell his discovery and attract no tax, but the purchaser cannot claim a tax deduction against his subsequent income from the mine. 33/ This factor no doubt dampens the price

inflation of partly proved mining properties. In oil and gas, since the 1962 amendments land costs are deductible by a purchaser, 34/ but the same amount is fully taxable in the hands of the vendor if he is a taxpayer.

We conclude this brief comparison of United States tax provisions as they relate to mineral extraction by noting that capital cost allowances under Canadian regulations appear to be higher than depreciation rates allowed to the extractive industries in the United States, 35/ and that a United States oil and gas operator cannot recover geological and geophysical costs related to productive properties other than through cost or percentage depletion.

REFERENCES

1/ A concise summary of the taxing provisions that apply to the extractive industries and of other special provisions, is to be found in Mineral Information Bulletin MR 73, Summary Review of Federal Taxation and Legislation Affecting the Canadian Mineral Industry, compiled by E. C. Hodgson and W. J. Beard, Mineral Resources Division, Department of Mines and Technical Surveys, Ottawa, 1964.

2/ A discussion of the definition of mining for purposes of interpreting the Income Tax Act and Regulations is to be found in C. G. Rounding, "What is a Mine?", Report of the 1963 Conference, Toronto; Canadian Tax Foundation, January 1964, pp. 194-198.

3/ Income Tax Act, ss. 83(2), (3), (4). In this study, unless otherwise specifically mentioned, all statutory references are to the Income Tax Act, R.S.C. 1952, c. 148.

4/ Bolduc v. M.N.R., 63 DTC 67 (T.A.B.). The effect of this ruling has, however, been nullified by a 1965 amendment to the Act, S.C. 1965, c. 18, s. 19(1).

5/ The following description derives from s. 83A, except where otherwise specified.

6/ The definition of a qualifying corporation given in the text above is a gross simplification of the subtleties of s. 83A. It may, however, serve as a rough guide to full "qualification" for purposes of deducting expenses incurred at the time of writing, August 1965. Over the years the definition has been extended progressively, so that it requires a detailed reading of s. 83A to determine whether a given corporation qualified for a given expense deduction in a given year.

7/ The effect of both the provisions in this paragraph is to confine the expenses allowed to those incurred in connection with successful ventures only.

8/ Regulation 1204. In this study, unless otherwise specifically mentioned, all references to regulations are to be regulations promulgated under the authority of the Income Tax Act.

9/ Regulation 1205.

10/ However, a 1965 amendment to the Act provides that the cost of land rights (cf. item (a) (v) above) acquired after April 26, 1965, may not be renounced by a joint exploration corporation in favour of a shareholder corporation. (S.C. 1965, c. 18, s. 20(3), which enacted s. 83A (5ab).)

11/ Item (a)(iii) above.

12/ Regulation 1204.

13/ Section 85I(3).

14/ Section 83(5), (6).

15/ North Bay Mica Co. Ltd. v. M.N.R., 58 DTC 1151 (S.C.C.).

16/ M.N.R. v. Hollinger North Shore Exploration Co. Ltd., 63 DTC 1031 (S.C.C.). A 1965 Budget Resolution (Resolution 14) would have had the effect of nullifying this decision. The Resolution specified that the benefit of the new mine exemption, for the 1965 and subsequent taxation years, was to be limited to income derived from the operation of the mine by the taxpayer corporation seeking the exemption. However, the Resolution was not translated into legislation by the Parliament then sitting.

17/ Income Tax Act, s. 11(1)(b), is the general authorizing section for these allowances, commonly referred to as "depletion". The operator's allowance is implemented by reg. 1201.

18/ Regulation 1201.

19/ Regulation 1203.

20/ Regulation 1100(1)(g) Schedule E.

21/ Regulation 1201.

22/ Regulation 1202.

23/ Regulations 1300 and 1303.

24/ Regulations, Schedule B.

25/ Income Tax Act, s. 11(1)(p); reg. 701.

26/ Cf. Summary Review of Federal Taxation, op. cit., and W. Keith Buck, Mineral Development Policy, Mineral Resources Division, Department of Mines and Technical Surveys, Ottawa, March 1963. Details of annual amounts paid in recent years under the heading "Federal Subsidies" are given in the tables of Statistical Appendix A to this study.

27/ Although most railroad construction, auxiliary to mine development, has in recent years been financed by the related mining project, an outstanding exception is the current financing by the federal government of a Canadian National Railway line to Hay River in the Northwest Territories, thus giving access to the huge lead-zinc ore body of Pine Point Mines Limited.

28/ For a contrast of staking and land tenure laws in Canada with federal mining law in the United States, which illustrates the advantageous position of the industry in Canada, cf. Thomas Elliot, "Some Comparisons between Mineral Exploration in British Columbia, Yukon and Alaska", address delivered to the American Institute of Mining, Metallurgical and Petroleum Engineers' Conference, held at College, Alaska, March 18-21, 1964.

29/ The sections of the Internal Revenue Code that cover these matters are ss. 611 to 616. They are explained and their historical development traced in, among many others: Federal Revenue System, op. cit., pp. 89-92; 1955 Compendium, op. cit.; and 1959 Compendium, op. cit. A full discussion of the legislative history of the provisions is to be found in John H. Lichtblau and Dillard P. Spriggs, The Oil Depletion Issue, Petroleum Industry Research Foundation, Inc., New York, 1959.

30/ Applicable rates for some of the more important minerals are as follows: sulphur, uranium: 23%; asbestos, lead, zinc, if mined in the United States: 23%; asbestos, lead, zinc, mined outside the United States: 15%; copper, iron ore, gold, silver: 15%; coal: 10%.

31/ Intangible drilling expenses include items like labour, fuel, and power, which are considered as not subject to salvage, although they do yield an asset whose benefits accrue over several accounting periods. Intangible drilling costs have been variously estimated at from 50% to 85% of total drilling costs. In the 1959 Tax Revision Compendium of the Ways and Means Committee of the U.S. Congress, Scott C. Lambert places them at 50% to 65% of the cost of wells. (Compendium, Vol. II, p. 1021.) C. Jackson Grayson, Jr., estimates them at 60% to 70%, (Grayson, Decisions Under Uncertainty: Drilling Decisions by Oil and Gas Operators, Division of Research, Harvard Business School, Boston, 1960, p. 106). However, in a study undertaken by the Canadian Petroleum Association, as a supplement to their submission to this Commission, the Association places intangibles at 85% of total drilling costs.

32/ This adverse feature, from the industry's point of view, was referred to in all the submissions to the Commission by members of the oil and gas industry. Cf. for example, Canadian Petroleum Association submission, p. III-12, Independent Petroleum Association of Canada, p. VII-2, British American Oil Company Limited, p. 29, Imperial Oil Limited, p. B-9. It was also commented on in the Alberta & Northwest Chamber of Mines and Resources submission, p. 7, in connection with mining.

33/ Except for that part of the consideration which is paid in the form of a royalty interest to the vendor.

34/ On a much accelerated basis over what they would be under cost depletion in the United States.

35/ Cf. Canadian Petroleum Association submission, p. III-18.

CHAPTER 3—BACKGROUND TO THE APPRAISAL OF TAX POLICY IN MINERAL EXTRACTION

Taken at their face value, the foregoing provisions for the taxation of the extractive industries appear to discriminate in favour of those industries. Those who defend them and, indeed, those who argue for their extension make their claim on three general grounds: first, that the character of a mineral deposit as a "wasting" asset requires special treatment in the definition of income subject to tax; secondly, that the provisions merely redress a bias which would exist in a system of uniform tax treatment of all business income that would serve to discourage investment in the mineral industries; thirdly, that the provisions, or their extension, are indeed discriminatory but that such discrimination is justified by the highly desirable national objectives it fulfils.

The present section, which is preliminary to the appraisal of these arguments, deals with three background guide posts. We first define general criteria against which tax policies may be judged. We then inquire as to the cost of the tax concessions to the extractive industries in terms of revenue foregone. Then we review the distinguishing characteristics of mineral extraction that might justify special tax treatment.

HORIZONTAL EQUITY AND TAX NEUTRALITY

The substantive criteria which are generally applied in judging a tax are those of horizontal equity and of allocative neutrality.

Horizontal equity involves the equal tax treatment of equals. Applied to business income it implies uniform definition of taxable income and of rates of tax as between industries. Uniform definition of taxable income in turn implies that the costs of earning income shall be equivalently defined for all industries.

A "neutral" tax system is one that leaves the relative prices and quantities of all goods and factors of production in the same relationship as they would have been in the absence of taxation. Thus, a neutral tax is one that has a neutral impact on the allocation of society's resources among competing end-uses.

In the absence of taxation, the greatest total value of product as judged by the wishes of final consumers is such that all activities yield the same return at the margin, per unit of effort, or cost. A neutral tax does not disturb the relative returns at the margin between different activities and, hence, in the absence of overriding considerations, it is seen to lead to an optimal allocation of resources.

Non-neutrality implies the relative favouring of one industry over another so that there is a shift of resources from the less favoured to the more favoured sector, and a somewhat different offering of final goods and services. Factor rewards will tend to be equalized at the margin, but these will be after tax returns. Since it is the rate of return before tax that measures the relative productivity of a factor of production in two different uses, a non-neutral tax is said to result in a misallocation of resources. Such a misallocation involves a cost to society in terms of the shift of resources from their highest valued use, so that under a non-neutral tax system the total value of goods and services produced is less than it might have been.

However, such a "misallocation" is not necessarily to be condemned. If it is the result of a conscious policy based on explicitly defined objectives, aimed at inducing a product mix that is different from what would prevail in the absence of taxation, it may well be justified. In the first place, the structure of the market itself, through elements of monopoly, market imperfection, or prohibitive risk, may be such as to prevent the equalization of marginal factor returns. Here government policy may be used to alter the pattern of resource allocation in such a way that factors of production are shifted to higher valued uses. If the policy is successful it will have increased the total value of the national output.

Secondly, even in a competitive equilibrium there may be a divergence between private and social values. An obvious example is the existence of economic pursuits that are a nuisance or a hazard. Again, non-economic objectives of higher national purpose may imply a greater emphasis of one economic activity over another for optimal social welfare than would the market allocation of resources.

A non-neutral tax is one device that may be used to foster a shift in resources to a pattern more in conformity with such objectives. But it is not the only such device. For a given purpose public regulation and spending or lending policies may be more appropriate. It should not be forgotten that a non-neutral tax, no less than a subsidy, involves costs as well as benefits in terms of the allocation of resources. In the interests of maximum social welfare, such a public policy should be subjected to rigorous scrutiny. Are the objectives valid? Are the means chosen efficient in terms of the excess of public benefit over public cost?

It also should be recognized that the measure of the success of a government incentive provision, whether by a consciously non-neutral taxing concession or by a subsidy, is the extent to which there is a different offering of final goods and services to what there would be in the absence of the provision. The measure of success of such a policy is the very degree that final output is changed. On the other hand, if the effect of the provision is to produce no change in the output of goods and services, it will have been a pure waste.

A tax provision that provides an economic rent or monopoly profit to a class of taxpayer without inducing behaviour on its part that is in any wise different from what it would have been in the absence of the tax provision is, in effect, a transfer payment with no allocative function. A capital gain is created for those who hold an equity interest in the favoured sector. They will be richer at the expense of the general taxpayer, but only to the extent that such a change in capital values induces an expansion of investment and output will the purposes of the provision be fulfilled. In this respect the market structure of the relevant sector and its prospects for expansion are of crucial importance.

In an effective monopoly, where further entry is proscribed, a tax concession that is dependent on profit will have no influence on the margins of investment. Such an effect may arise not only through monopoly in the usual single-firm sense, but also through a rigid vertically integrated marketing system, and through steeply rising long-run costs in the industry. In such a case the tax concession may be horizontally inequitable but it will have no impact on the allocation of resources, and in this sense it will be allocatively neutral. The enhanced earnings of

the industry will be reflected in relative capital values that take into account the change in earnings of this industry relative to others. But with no possibility for additional real investment there will be no change in the allocation of resources.

A qualification to the foregoing paragraphs must be introduced if one accepts the necessary level of tax revenues as stated. From this viewpoint the loss of tax revenue in the preferred sector requires higher taxes elsewhere or else precludes other desirable public expenditures. Thus, even though investment, outputs, and prices in the favoured industry may not be affected, other desirable activities will have to be reduced, and in this sense there will be a misallocation of resources.

It is also possible for a tax concession to increase investment in an industry without increasing production, thus resulting in a pure waste of capital resources. This will occur where the price of the industry's product is artificially pegged, and output is restricted but entry is free. In this case a tax concession that increases after-tax profits will induce entry and investment, but with no change in output or prices. Profits at the margin will be reduced until there is no further inducement to invest. But the results of the tax concession will have been to shift resources from other higher valued uses. 1/

In sum, assuming the validity of the objectives sought, only to the extent that a non-neutral taxing device has extended the margins of profitable investment in a given industry and that the extended investment has increased output, can it be considered effective.

THE REVENUE COST OF PRESENT TAX CONCESSIONS

The immediate effect of the present special provisions for the taxing of the extractive industries is to reduce the effective tax rate on firms in the industry below what it would be in their absence. We have made the following estimates of taxes forgone which, in the absence of these provisions, would have been paid: 2/

Three-year exemption: revenue forgone, 1962 taxation year, $58 million. 3/

Percentage depletion to corporations—operators' and non-operators' allowance (not including "cost" depletion to industrial minerals in bedded deposits): revenue forgone, 1961 taxation year, $53.5 million. 4/

Shareholder's dividend depletion: revenue forgone, 1961 taxation year, $1.5 million, approximately. 5/

Prospectors' and grubstakers' exemption: revenue forgone is difficult to estimate because the tax saving depends on the tax bracket of each individual. A very rough estimate of the recent annual average payment to prospectors and grubstakers (not their tax savings) is that it is of the order of $1 million a year.

Rapid write-offs of exploration and development expense: again it is not possible to make a precise estimate of revenue forgone. The advantage of this provision is that to the extent that current income is understated, the government has made a "loan" to the industry. The advantage to the industry in any year would be measured by the interest factor on the amount of the "loan" outstanding. The net benefit of the expensing privilege to the industry at any given time depends on the cumulative excess of expenses deferred to date, the period of deferment, and the relevant rate of interest.

However, it may be observed that if the industry is one with a constantly growing rate of capital investment, then expensing rather than amortizing capital costs results in indefinitely understating current income. The amount of tax deferred grows indefinitely. Such, indeed, is the case with exploration and development write-offs in the extractive industries.

It is this increase in the annual "loan" made by the government to the industry, through the expensing privilege, for which we have made an estimate. On the assumption that the average expenditure that is subject to immediate write-off is economically attributable to ten years of future output, the annual amount of taxes indefinitely forgone each year is $39.0 million. 6/

In sum, a rough estimate of the annual revenue cost of the special provisions for taxing the extractive industries would be of the order of $152 million in recent years.

DISTINGUISHING CHARACTERISTICS OF MINERAL EXTRACTION

The process of discovery of minerals and their conversion to utilizable industrial raw materials or fuels is, in a general way, analogous to the supply of any other form of capital good. Mineral products are factors of production used in the output of socially desired final goods. As in the case of any capital good the economic system has two allocative functions: the rate of use of the existing stock, and the provision for investment in renewing the known stock. The possibility of eventually exhausting the stock of mineral resources does not, of itself, alter their role as capital goods. As any capital good is used in production its remaining useful life is diminished. Production creates value, but in the process uses up some portion of the capital employed. Whether or not capital is renewed or enlarged by further investment depends on the relationship between the cost of the capital and its anticipated yield.

The twofold operation of the price system is that, in the first instance, if existing supplies of a capital good are not adequate to the demand for its output at prevailing prices, scarcities will lead to price rises of its products. The price rise will induce more intensive exploitation of existing supplies of the capital good, encourage the substitution of other factors of production and other end-products and technological innovations to make known supplies more productive, and will act as an incentive to increased investment in new sources of supply.

Under conditions of free entry, the rate of investment in new capital goods will be such that the marginal investment will yield an expected income stream whose discounted present value equals its cost.

What distinguishes the process of finding minerals and their production from the creation of many other forms of capital goods is the variability of discovery, and the long and variable time lags between initial investment and production.

Variability of Discovery

Variability of discovery involves a lack of specific relations between outlay and result. It may well be that, in the large, the percentage of successful ventures out of the total undertaken in search of a given mineral is a fairly stable and predictable ratio. However, for any single venture the probability of total loss is very great indeed, and in this sense is not comparable to the probability of failure for a single investment outlay in most other lines of endeavour.

One metal mining company advised the Commission that one out of 600 claims brought to its attention or discovered by it has developed into a profitable mine. Again, from a tabulation made of data supplied to the Commission by a group of large mining companies, it appears that of the total of properties examined by them in the five years from 1958 to 1962, on only one half of 1% had a decision been made to proceed with development. 7/

For oil and gas, data presented to the Commission by the Canadian Petroleum Association indicate that of 8,121 new field wildcat wells drilled in western Canada from 1947 to 1962, 1,548 or 19.1% showed some signs of initial success, and 597 or 7.4% proved capable of production.

It should also be noted that most discoveries build on knowledge accumulated through past successes and failures. Even negative results of an exploration programme yield information which may be of subsequent use in planning further exploration, not necessarily for the same explorer. 8/

Two implications follow from the condition of variability of individual success and the necessity for a certain number of failures.

First, in calculating the real cost of mineral discovery and development, consideration should be given to the totality of exploration costs, including those of unsuccessful ventures.

Secondly, it may be inferred that if investors are averse to risk, and if institutional arrangements are not available within the industry for pooling or insuring those risks, then investment in mineral exploration may be deterred. In such a case, prospects for large gains must be more than sufficient to offset possible total loss, so that the mathematically expected return from such an investment—the weighted "average" that the investor must expect in order to undertake the venture—will contain a risk premium over and above the expectation of return necessary to activate him towards an investment with a lesser range of variability among possible results. 9/

It should, nonetheless, be emphasized that the lack of a specific relationship between particular outlays and their result applies primarily to the initial or exploratory phases of the mineral extraction cycle. The later the stage, the more the circumstances of the investment decision become identical with those of any other capital-creating industry. Again,

predictability at the exploration stage will vary from mineral to mineral. Presumably the accuracy of predicted results in searching for clay or gravel is considerably higher than in searching for metals or petroleum. Moreover, a vast, known deposit such as the Athabasca oil sands involves no finding costs and, therefore, the investment decision depends only on the return necessary to induce development.

To illustrate the narrowing of the range of variability of expectations from the exploration stage to the development stage, the success ratios for new field wildcats in oil and gas, quoted above, may be compared with the success ratios for development wells in western Canada. In the eight years from 1956 through 1963 there were 14,292 development wells, excluding service wells, drilled in western Canada. Of this number, 12,722 or 89.0% were successful in finding oil or gas. 10/

Variable Time Lags

Related to the variability of discovery are the long and variable time lags from the commencement of a search for minerals to their discovery, and from discovery to production. Evidence cited before the Commission indicates that this time lag is longer than that which obtains for the realization of the results of other investment. 11/ The lag itself is something that could be planned for if its duration were known. However, what makes planning for future needs more difficult in mineral extraction is that the duration of the lag between search and production is itself highly variable. 12/ Mineral discoveries may be pure accident or, more usually, they are the result of long and painstaking search, the length of which is not predictable.

Mineral Supply and Demand

It is generally assumed that the short-run demand curve for most minerals is price inelastic, i.e., that the quantity demanded is relatively insensitive to price changes. 13/ 14/ It is a derived demand, reflecting the need for the end-products in which the mineral concerned is used. Price changes in one mineral are apt to induce substitution, but in the short run these are circumscribed by the productive processes in being for producing final goods.

Turning to short-run supply, because of the relatively high level of fixed costs, short-run marginal costs for each mineral producer are apt to be relatively low and fairly constant until his capacity is approached, and then to rise steeply. The industry short-run supply curve for a mineral—the sum of all the individual mine or well marginal cost curves—tends to be relatively flat at low levels of production and then to rise with increasing rapidity as higher cost supplies come into use. Because of increasing physical difficulty in supplying larger quantities from a geological environment and plant that are fixed in the short run, the supply curve is apt to have an increasingly steep slope as output is expanded. 15/

Now, assuming a competitive market, and given an inelastic short-run demand curve and an equilibrium position on the steeply rising portion of the short-run supply curve, a sudden increase in supply due to a major development coming "on stream" (or alternatively a downward shift in demand), will cause a marked fall in price. The demand curve for the individual producer will fall commensurately with the market price. He may then find himself operating over a long period in a

position where his average total costs— including his capital investment— are not covered. Unless the price falls so drastically that large numbers of producers do not cover even their variable costs, there will be little change in the quantity of the mineral offered by producers already in existence. In this situation the rate of return to invested capital will fall below what is necessary for the long-run replacement of the natural resources that are being used up.

We earlier noted that in a classic free market one response to a short-run over-supply of any commodity is a decline in the provision of new facilities for the production of that commodity. As existing capital goods are worn out and not replaced, the short-run supply of the commodity contracts. The downward price trend of the commodity tends to reverse, back toward a new position of long-run equilibrium. On the other hand, short-run under-supply will lead to a price rise, abnormal profits, new investment and a move toward a new long-run equilibrium of supply and demand.

However, for mineral extraction the long run could be very long indeed. Because of the long and variable time lags, and the variability of discovery, additions and contractions of supply could for some time move in the wrong direction, contributing to short-run instability. For, at each stage from reconnaissance through production there is a greater commitment of fixed costs, and a correspondingly lower level of variable costs. At any given time there will be a range of properties at various stages in this development progression. For example, in the case of a property that has been fully explored but not yet developed, the relevant cost that must be compared to the discounted expected future income stream is the cost of developing and producing. Discovery and

exploration costs are sunk and no longer relevant. Hence, even though prices and the expectation of future prices are not sufficient to cover the total long-run cost of production, so long as they are high enough to cover the relevant levels of "medium-run" variable costs for potential producers, it can be expected that new productive facilities will come "on stream". The most variable element of investment, not only as to result but as to continuity, would thus be that of prospecting. It may be expected that a decrease in demand, if it is expected to continue, will first curtail primary exploration while, at the same time, new productive facilities may be adding to the problem of over-supply in the industry. On the other hand, when prospects improve there may be few properties near the production phase. Increased demand, translated into increased output, may take many years to reach fruition.

Further, if the industry becomes depressed due to over-supply, there may be an expectation of further price drops, which introduces the element of negative "user cost" as a further depressant of the short-run supply price. 16/ In this manner the existing supply of a given natural resource might conceivably be near exhaustion before economic forces were set in motion to replace it.

The implication of the foregoing is that in a competitive market, there may be major fluctuations in investment activity. Investment will be undertaken only when shortages have led to price rises, and the expectation of large profits. By the time the investment has reached fruition, there may well be a glut and depressed prices. Long-run supply will not be equated to demand without price fluctuation and periods of alternating shortage and surplus. Such fluctuations in supply may be undesirable for policy reasons we will discuss presently.

Industry Organization

The foregoing analysis is explicitly based on the assumption of competitive markets. But free competition is not characteristic of mineral markets in general. It should be recognized that many sectors of the mineral industries have themselves attempted to stabilize their propensity toward wide swings of prices, output and investment. Such attempts which have met with varying degrees of success have been made through institutional devices such as monopoly, vertical integration, and cartelization, which tend to modify the conclusions regarding instability of investment and reserves.

Nickel is an outstanding example of a quasi-monopoly. Here a Canadian producer dominates the world market for the metal. The market price has been remarkably stable in an upward direction for many years, and has been virtually dictated by the International Nickel Company of Canada. 17/ The nickel industry has not been a passive agent in the matter of demand; it is constantly uncovering new users and customers through an active research programme. Thus, the major producers are able to influence the growth of demand and to anticipate it. The International Nickel Company, in particular, has been able to organize its investment policy in such a way that new productive facilities are available at the right time—just sufficiently in advance of market requirements to maximize its long-run profit perspective. 18/ Evidently the determining factor in nickel investment is the growth of demand; the variable time lags we have discussed are not an operative constraint.

In crude petroleum production, Alberta is the balance-wheel of Canadian supply and, there, output is regulated by a compulsory cartel

through the medium of production quotas. Alberta prorationing will be dealt with more fully later in this study. 19/ For the present, we may observe that prorationing has succeeded in stabilizing prices; however, it is ineffective as a device for raising long-run profit expectations because it cannot restrict entry.

A more informal cartel, one operating on an international scale, is found in copper. The international copper cartel has apparently made its appearance at various times, but its actual operation has not been fully documented. It seems to have been particularly active in the recent past. Its operations are credited with the relative stability of producers' copper prices in the period from May of 1961 to late summer of 1965. In the earlier part of the period, when there was downward pressure on prices, the stability stemmed from voluntary cutbacks in production by the world's major producers and the apparent trading skill of the three mammoth African producers who at the time dominated the key London market. In the more recent past, when demand was buoyant, the stabilizing force was the voluntary price restraint adopted by the major producers despite soaring prices on the free market. This "self-denying ordinance" presumably stemmed from inroads already made on copper's markets by competing materials, notably aluminum and plastics, and the fear that a temporary windfall could be gained only at the cost of a long-run decline in demand.

A further example of adjustment by the industry itself to the instabilities of mineral development is the prevalence of vertical integration, particularly exemplified by iron ore. If a given raw material has one predominating end-use there is a strong impetus to vertical integration of the entire production process. Such is the case

with iron ore where development requires the long-term contracts that are forthcoming only from steel mills. Because of the relative world-wide abundance of iron ore and the prevalence of economies of scale and indivisibilities in the techniques of extraction and concentration, the risks of primary production without assured markets are so great that backward integration from the users—the steel mills—is the almost universal method of industry organization. A tendency among minerals in general toward vertical integration has been reinforced in recent years with the rapid development of advanced and expensive technology in the search for and treatment of mineral ores, and with increased competition to established mineral uses from new materials and old materials used in new ways. A by-product of such integration has been a more stable price structure and a more orderly marshalling of investment to the requirements of long-run market demand.

We conclude that the extractive industries are not a homogeneous category. The need for special provisions for taxation of the industry and the effect of those provisions on output and investment must be evaluated in the light of policy objectives of government and the characteristics of particular minerals and their markets.

REFERENCES

1/ In the long run, there will occur a shift of capital from the rest of the economy to the favoured industry, unless the aggregate supply of both capital and labour is perfectly elastic in the long run. In the latter case, the increase in capital in the favoured sector will come from increased savings.

2/ It should be noted that these estimates of revenue losses are of "impact" effect only. They imply that other things would be equal if the special provisions were eliminated. It must be recognized that to the extent that elimination of the provisions would induce some shift of investment out of mineral extraction, the elimination of the provision would lead to less of a tax gain from mineral extraction itself than the "cost" estimate we are making. On the other hand, such a shift of investment would lead to an increase in taxable profits elsewhere in the economy. It should also be noted that to the extent that the provisions have no impact on the allocation of resources, they are a pure "rent" to the mineral producer who would have undertaken the activity in any event; to this extent they are a pure revenue loss to the government.

3/ Table A-2 of the Statistical Appendix lists the profits of tax-exempt mines from 1950 to 1962.

4/ Table A-1 of the Statistical Appendix lists the tax "savings" resulting from the percentage allowance for the taxation years 1948 to 1961.

5/ This estimate, which is very tentative indeed, is based on a sample survey of personal depletion claimed by a group of high-bracket taxpayers.

6/ The derivation of this estimate is given in Appendix B to this study.

7/ Similar data are supplied by E. K. Cork, Finance in the Mining Industry, a staff study for the Royal Commission on Banking and Finance, November 1962. At page 37 it is shown that out of 419,711 mining claims recorded in Ontario from 1907 to 1953, 348 or 0.08% resulted in producing mines, and 54 or 0.01% had paid dividends.

8/ In this connection, cf., for example, the submission of the Canadian Petroleum Association, p. 1-4, para. 10.

9/ The subject of "average" expectations and possible risk premiums is central to the whole discussion of mineral taxation. The concepts are more fully elaborated at p. 67.

10/ Canadian Petroleum Association, Annual Statistical Year Books, 1956 to 1963.

11/ For some extreme instances of the length of the time lag, cf. submission of the Canadian Metal Mining Association, Appendix 2; and Commission hearings, Canadian Petroleum Association, Vol. 96, p. 8905.

12/ It may be observed that the time lags experienced often depend on the accessibility of a deposit and thus on the provision of transportation facilities and other social capital. To this extent, the time lag is not beyond the control of society.

13/ A propos of oil, see, for example, McDonald, "Percentage Depletion in Federal Taxation of Income from Oil and Gas Production", in National Tax Association, 1962 Proceedings of the Fifty-Fifth Annual Conference on Taxation, Harrisburg, 1963, p. 376.

14/ A notable exception to the inelastic demand postulate is gold, for which, under present circumstances, there is an unlimited demand at a fixed price.

15/ See Paul Davidson, "Policy Problems of the Crude Oil Industry", American Economic Review, Vol. 53, No. 1, March 1963, pp. 89-90; and David B. Brooks, "The Supply of Minor Metals", Quarterly of the Colorado School of Mines, Vol. 58, No. 1, January 1963, pp. 1-30.

16/ A full discussion of user cost would take the exposition too far afield. Briefly, user cost is the opportunity cost of producing today as opposed to postponing production. (See Anthony Scott, Natural Resources, the Economics of Conservation, Toronto: University of Toronto Press, 1955, p. 6; also cf. Davidson, op. cit., p. 91.) The inference in the text above is of a negative user cost which implies an expectation of lower prices in the long run; this would tend to reduce the short-run supply price below marginal factor costs. The opposite case is, however, equally possible, i.e., where a price fall was generally considered temporary, user cost would be positive and the effects of falling demand, discussed in the text, would be considerably mitigated.

17/ By way of "the exception that proves the rule", the 1962 price reduction in nickel of 2¼ cents per lb. was initiated by Falconbridge Nickel Mines, the second largest producer. This instance was the first in the modern history of nickel in which INCO had relinquished price leadership. Significantly, up to that time, the price had not declined in over 30 years, "probably a record for a major resource material". (Hans H. Landsberg, Leonard L. Fischman, and Joseph L. Fisher, Resources in America's Future, Baltimore: Johns Hopkins Press, 1963, p. 444.)

18/ See Forbes magazine, Vol. 95, No. 1, January 1, 1965, p. 112.

19/ See p. 77.

CHAPTER 4— THE CRITERION OF HORIZONTAL EQUITY

TAX ACCOUNTING FOR CAPITAL WASTAGE

The effect of the three-year exemption for new mines, and the prospectors' and grubstakers' exemption is to increase the after-tax return in the industry concerned over what it would have been without them. Quite obviously, then, their purpose is to induce investment behaviour that is different from what it would be in their absence. They are tax concessions that it is hoped will act as incentives. Thus, their impact may be analyzed solely from the standpoint of resource allocation. They are a conscious inequity whose economic benefits, it is hoped, will exceed their cost.

The rapid recovery of exploration and development expenses and the depletion allowance are also intended as incentives. However, they are also often presented as capital recovery devices justified by the peculiar nature of mineral extraction. In judging the special provisions for mineral taxation by the criterion of horizontal equity, we must then inquire into what principles may be applied to the recovery of capital costs for industry in general, and how these may be applied to the extractive industries.

General Principles of Capital Cost Allowances

Income from any economic activity represents the increase in the taxpayer's wealth that accrues from that activity. It is on this accretion that income taxes are applied. In computing this income, for a productive process, it is proper that the taxpayer deduct from his gross

receipts the amounts he has expended for the raw materials and factors of production that have been utilized in the process. The factors of production, of whose cost account must be taken, properly include the value of capital instruments exhausted during the process. However, such costs of capital ought, in principle to be no different in their tax treatment from those of any other factor of production. The relevant tax offset should be related to their actual cost, for it is the excess of proceeds over these costs that represents income.

The problem of accounting for capital wastage in the computation of income subject to tax is complicated for any business endeavour by the necessity of fragmenting the income produced by a particular capital investment into periods of time. In order to reflect asset costs on a periodic basis, it has been necessary to develop accounting techniques for the capitalization of expenditures whose benefits will be reflected in several accounting periods, and for the subsequent expensing of those capital assets. The time-spread of the income derived from a capital expenditure raises two problems: the possibility that the benefit realized will differ from that expected when the investment was undertaken, and the choice of the correct time-pattern for allocating the cost of the asset to the income created.

Since, in an uncertain world, the benefits actually realized are but an imperfect reflection of the amounts expected when a long-lived investment was undertaken, the value in use of the capital instrument at any point in its life cycle will differ from its actual cost. But this market value of a capital asset in existence depends on the income realized, and it would be meaningless circularity to make the capitalized value of current earnings into the basis for determining the costs which

define those earnings. Thus, we conclude that, for any industry, capital cost allowances that are permitted as a deduction from gross revenue in computing tax liabilities ought to be equated to the actual cost of the capital instruments.

Various alternatives exist for the allocation of these costs over the time periods of production during which the asset will be utilized. However, the real cost of capital that is allocable to the income of each period depends on the proportion of the asset that is exhausted, either through physical deterioration or through obsolescence, during that period. If the taxing authority permits a portion of those costs to be allocated to a period prior to that in which a given portion of its economic exhaustion takes place, then that permission must be regarded as a tax concession. If capital costs are recovered out of income subject to tax more quickly than the capital is exhausted, there is a saving to the taxpayer in terms of the interest factor applicable to the deferred tax. If such a concession is granted to investment in capital goods in all lines of endeavour it may be regarded as giving investors in capital equipment something of an advantage that other taxpayers do not enjoy. However, if such a concession is granted only to a limited sector of investment in capital goods, then the non-uniformity of the device is accentuated. It must be regarded as increasing the relative rate of return on investment in the favoured sector over other classes of capital investment.

The foregoing propositions apply to the treatment of capital wastage whenever the benefit flowing from an expenditure extends over more than one tax-accounting period, whether or not the capital investment results

in a tangible physical asset. In the case of an intangible investment, it is apt to be more difficult to gauge in advance the period over which the benefits will flow. But, with the increasing importance of technological obsolescence, even this distinction between tangible and intangible investment is becoming blurred. The allocation of a time-span for computing capital cost allowances is always in the nature of a guess. Nonetheless, the principle that should be applied on grounds of horizontal equity is that if there is a benefit created by an expenditure, in the form of a future stream of income, the relevant costs ought to be allocated, as best they can be, to the periods in which the benefit is realized.

CAPITAL WASTAGE IN MINERAL EXTRACTION

When we turn to the extractive industries we observe that the "wasting" nature of mineral deposits is not, of itself, an argument for capital wastage charges that are different in concept from those of other industries. The exhaustion of a mineral deposit is quite analogous to the diminution in the value of a machine through use or obsolescence. For the reasons noted above, the capital value on which the allowance should be based is the cost of finding and developing the mineral deposit and not the value-in-use of the capital instrument thus created.

Again, the life index of the resulting income flow is the proper period over which the capital costs should be allocated. As we have noted in the general case, on grounds of horizontal equity this principle should apply equally to those costs commonly regarded as intangibles. Expenditures on prospecting, property examination and the like have the attributes of long-term capital investments. The timing of such

expenditures is discretionary and they are made in the hope that they will produce an income stream in the future.

The need for distinctive tax allowances for the recovery of the capital costs of the extractive industries stems from the unique nature of mineral exploration. Essentially, exploration is a sampling process in which a certain number of failures are a necessary cost of each success. Thus, in the interests of horizontal equity, the profit on which the industry is taxed should include consideration of aggregate real costs including those of unsuccessful exploratory efforts.

For a qualifying corporation with existing income there is, under present Canadian tax law, full allowance for the deductibility of the cost of unsuccessful ventures, and on advantageous terms of timing. On the other hand, to the economy at large deductibility of exploration losses is somewhat circumscribed. The present law places limitations on the expenses that may be claimed by individuals and non-qualifying corporations in such a manner that the deductibility of such expenditures is confined to those that turn out to be successful. In addition, the transfer of exploration and development costs through property sale or amalgamation is somewhat restricted.

Yet the amount of exploration expenditure that is not deductible from the taxable income of some taxpayers is not large. Certainly, it is not of comparable magnitude to the amount of taxes saved by the industry due to the concessions it now receives. The Royal Commission on Banking and Finance has stated that "... some 86% of prospecting expenses each year are now in fact made by producing mines." 1/ Annual costs of prospecting by the metal mining industry for each of the years 1959, 1960

and 1961 are estimated by the Dominion Bureau of Statistics as amounting to some $43 million per annum. 2/ If we take the 14% of such expenses not made by producing mines as the outside limit of prospecting expenses that are not deductible in computing income subject to tax, and apply to it a 50% tax rate, we arrive at a maximum for the "excess" annual taxation of the metal mining industry of some $3 million. Comparable figures for oil and gas exploration are not available but, apart from mineral rights in land purchased prior to April 11, 1962—a subject to be pursued further—such unclaimable costs of exploration are thought to be minimal.

It has been pointed out by the mining industry that costs of primary reconnaissance are not the only expenditures in mining that may prove abortive, that substantial capital expenditures may be undertaken in underground development of properties that prove uneconomic only when examined at depth. This is, of course, true in several cases. Yet, despite the limitations on the transfer of such expenses through property sale or amalgamation that we have noted, where such expenses are of a worthwhile magnitude it appears that they can be successfully transferred by merger or purchase. 3/ As a rule, then, such capital expenditures are a marketable asset that will eventually be deducted from the taxes otherwise payable by a producing mine. Where such transfers are consummated there is no violation of the principle that the taxation of the industry should include consideration of aggregate real costs.

The Cost of Land

The value of any land or, what amounts to the same thing, the right to remove minerals from the land is determined by the net income that may be expected from the land. To this extent, the desirability and

hence the cost of land is not independent of the tax treatment afforded the industry.

The maximum price a buyer will pay for land is the capitalized present value of the residue, after deducting from his anticipated gross income the amount of all necessary costs, including taxes, and the minimum net return required by the buyer. Thus, where land prices are determined in a reasonably competitive market, one direct determinant of the price will be the amount which the buyer expects to be taxed on the proceeds.

Another important determinant of land prices is the certainty with which a profit is anticipated. For unexplored land to have a marketable value, aside from alternative uses to which it could be put, the probability of the land containing the mineral sought has to be fairly high, and the net profit that may be expected from developing the mineral, when weighted by the probability factor, has to be sufficiently high to allow for the land payment out of the present value of future earnings.

In the case of mining for the solid minerals, it appears that uncertainty at the exploratory stage is so great that unexplored land, as such, has little value. As exploratory spending is applied to an area and a mineral body is proved up, such spending may be deducted from income subject to tax. To the extent that the property then changes hands, or that adjacent properties acquire some speculative site value, the anticipated income from the mineral find may be capitalized by a vendor. There is no provision for the recovery of such capitalized land costs by the purchaser against his income subject to tax. 4/ In this respect the treatment of mineral-bearing land is quite similar to that afforded the appreciation of site value in other connections in Canadian tax practice.

There are, however, two features of the taxing statute that are unique to the property costs of mining. One is that if the vendor of mining property is a prospector or grubstaker, the proceeds of the sale do not attract tax. The other is that the cost of finding and developing the mining property (as also that of an oil or gas property), which alone has created the capital value, may be recovered by a qualifying corporation. The equitability of the latter provision is incomplete, as we have mentioned, in that at least a part of the cost of unsuccessful exploration must be considered as part of the real cost of capital creation in mining, and not all such costs are tax deductible.

In any event, land acquisition costs do not appear to be a significant expense in mining. 5/ On the other hand, they are of some importance in oil and gas extraction. It appears that the nature of the formations in which these fluid resources occur renders their finding more predictable than that of the solid minerals in partly proved areas. The marketing arrangements which combine an assured share of the market with a firm price are sufficient to make undeveloped land marketable. The cost of land is, as mentioned, a function of its anticipated profitability, so that land costs tend to be much higher for development acreage than they are for acreage in rank wildcat territory where primary exploration takes place.

The extent to which the price of petroleum land may vary with its anticipated profitability is illustrated in Table 1. The types of provincial grants of Crown petroleum rights in Alberta are categorized by the state of exploration activity in a given region and its results to date. Table 1 shows the price paid per acre in 1961 for the three most important classifications of Crown petroleum grants, with a further breakdown of

Crown leases—the category where oil is most likely to be found—depending on the relative state of "proof" at the time of the sale. The most certain category, based on known information, sold for an average of $380.85 an acre. The least certain category, petroleum and natural gas reservations, sold for an average of $1.70 per acre.

TABLE 1

ALBERTA PETROLEUM LAND SALES, 1961

CROWN ACREAGE SOLD, TOTAL BONUSES PAID, AND BONUSES PAID PER ACRE, BY CATEGORIES IN DECREASING ORDER OF CERTAINTY

Type of Sale	Total Acreage Sold	Total Bonuses Paid	Bonuses Paid Per Acre
Crown Reserve Lease Sales (Proven Areas)	70,748	$ 26,944,410.21	$ 380.85
Crown Reserve Lease Sales (Unproven Areas)	88,478	4,169,243.79	47.12
Crown Drilling Reservation Sales	902,394	10,660,447.36	11.81
Provincial Reserve Sales (Reservations)	282,070	478,656.71	1.70

Source: Oil and Gas Activity in Canada, 1961, Compiled by the Canadian Oil Scouts Association, p. 12.

Until the 1962 amendments, substantially the only land costs that could be recovered against taxation were those related to abandoned Crown acreage. This provision of section 83A(6), which represented a departure from Canadian policy in regard to the costs of land, presumably was intended to stimulate exploratory drilling for new fields. The more certain—and higher priced—acreage in developed fields was less likely to qualify for this deduction.

The 1962 amendments provide for the expensing of all land costs in oil and gas according to the same rules as other section 83A expenses. It was to be expected that this provision would increase the cost of acquiring land, and from preliminary evidence this indeed appears to be the case. 6/

Admittedly, land costs are very real expenses for each individual producer. But it must be emphasized that capitalized land costs are themselves the result of potential profits that are in excess of the net return deemed necessary by the operator. Thus, provision for the expensing of land costs for tax purposes is a tax concession that is itself, in part, responsible for the values for which it is the intended means of recovery.

Nonetheless, if both the vendor and the purchaser of mineral rights are taxpayers subject to the same rate structure, there is no erosion of the tax base nor a violation of interindustry equity when revenues from land rights sales are taxed and the cost of the land is deductible. But the converse is equally true. In the interest of horizontal equity, if the vendor's capital gain beyond his actual expended costs escape taxation, there ought not to be a tax deduction on the part of the purchaser. We also observe that whichever method is chosen for dealing with mineral rights sales, the impact of taxation on resource allocation will be neutral so long as each side of the transaction is a taxpayer and the two sides are treated in a mutually consistent manner.

Percentage Depletion and Land Costs

It is sometimes averred that the purpose of percentage depletion is to provide for the recovery against income of the cost of mineral-bearing

land. We have already seen that the only land costs whose expensing is not provided for under the provisions of section 83A are the costs of purchased mining land, and of oil and gas land acquired prior to April 11, 1962, which land was not acquired from the Crown or which was acquired from the Crown and turned out to be productive. The amounts of the former, as noted, are not large. For oil and gas, it has been estimated by the industry that approximately $900 million was spent in acquiring land in Canada prior to April 11, 1962. 7/ This figure, it should be noted, includes the total cost of land including secondary sales of producing properties. Thus, the figure quoted includes some of the exploration costs of the previous owner, which would be tax deductible. It has also been estimated by the Commission staff that eventual abandonments of Crown land (deductible under section 83A(6)) amount to something over 15% of net land held. Thus, as a very rough estimate, perhaps some $650 million in land costs in oil and gas are not directly deductible under one or other of the existing provisions, other than percentage depletion.

As to percentage depletion itself, by its very nature it is related to taxable profits and not to costs expended. Unlike capital recovery devices, its provisions are in no way related to original asset cost, nor are they spread over a specified life. It is difficult to view the allowance, despite the name commonly given to it, as anything other than a reduction in the rate of tax that is applied to the income of certain corporations. As such, it may or may not be justified on allocative grounds. But it is not an allowance for the recovery of capital costs. 8/

The only relation of the percentage depletion allowance to the costs of land is the same as that of the other concessions granted to the extractive industries; if the effect of these concessions is to increase

the anticipated profit from an investment venture, then the amount that the operators have paid for the land has been increased over what the amount would have been in the absence of the concessions.

It appears then, on grounds of horizontal equity, that the only argument for continuing the percentage depletion allowance is that certain expenses were undertaken in the past on the anticipation that the allowance would be available in the future. Some of these costs, it should be noted, were undertaken when effective tax rates were lower, and the value of the rate deduction, represented by percentage depletion, was therefore smaller. But, more fundamentally, this is only an argument for transitional provisions, not for the permanence of the deduction.

Undoubtedly, removal of the allowance—as of any existing tax concession—would entail a capital loss on the part of present holders of oil and other mineral shares. The existing concessions have been capitalized, and their value is therefore reflected in a higher market price for such shares than would obtain in the absence of these concessions.

Nonetheless it would be unrealistic to advocate that such concessions be granted in perpetuity if this were their only justification. An argument based on privation to some individuals is an argument for change by degree, not for the permanent enshrinement of the status quo.

Land Costs as Intergovernmental Transfers

It is interesting to note that to the extent that the percentage depletion allowance and the expensing of land costs increase the value of potential oil land in the manner noted, the main beneficiaries are

the provincial governments. In Alberta, for example, the Crown holds the mineral rights to approximately 81% of the potential oil-producing land. 9/ Since Alberta produces some 70% of Canada's liquid hydrocarbons and has over 85% of Canada's proved reserves, this source of revenue is of the utmost importance to the provincial government.

The nature of the bidding for Crown reserves in Alberta (and also in the other provinces) is such that land payments are determined in a reasonably competitive market. 10/ At any land sale it may be expected that at least one bidder will possess more accurate information because of his drilling activities on proximate acreage. But he can never be sure of winning the prize unless he has made a realistic bid in relation to the potential yield of the land. It is apparent that if that yield is increased by the tax treatment of future revenue from the land, then a large part of the increased yield will be pre-empted by the province.

The revenues accruing to the province of Alberta from oil and gas rights are summarized in Appendix A, Table A-8. For the fiscal year ending March 31, 1963, petroleum and natural gas revenue was 31.55% of total provincial revenue on income account. 11/ For the 14 years beginning April 1, 1949, and ending March 31, 1963, petroleum and natural gas revenue was 40.13% of total provincial revenue on income account. For the same 14-year period, sales of Crown reserves alone (i.e., excluding rentals and royalties) were 19.44% of provincial revenues.

The other western provinces do not hold as high a proportion of potential oil-producing land, nor is their potential in terms of probable reserves nearly as great. However, only in that part of Manitoba suitable for oil and gas exploration are most mineral rights held in freehold. 12/

Thus, for the 14-year period from April 1, 1949, to March 31, 1963, petroleum and natural gas revenue was 8.12% of total provincial budgetary revenue in Saskatchewan, 13/ and a lesser percentage in British Columbia and Manitoba.

The conclusion is thus warranted that if the depletion allowance and the expensing of land costs create a windfall gain to the owners of undeveloped oil and gas lands, the effect, in Canada, unlike that in the United States where most mineral rights are held in freehold, is that of a revenue transfer from the federal to the provincial treasuries, particularly that of the Province of Alberta.

Percentage Allowance on Personal Dividend Income

This allowance, like that granted to the operator of an extractive enterprise, is often justified on the ground of equity in accounting for capital wastage. However, as we have seen, the wasting nature of the earnings base is not a phenomenon unique to mineral extraction. If the company's earnings, on which it is taxed before the payment of dividends, already reflect adequate deductions for the recovery of capital costs expended—and this is likely to be true where a company has achieved a dividend-paying position—then shareholder's depletion must be viewed as a duplicate deduction.

It may be observed that if all taxpayers could obtain the same tax advantage by buying equity stock in mineral companies instead of other companies, the advantages of dividend depletion would be capitalized in the market price of the shares, and the rate of return to stocks with the dividend-depletion privilege would be no different from that of other shares of similar quality. Conversely, the elimination of the provision

would result in some capital losses and a change in the relation of the market price of mining stocks to other stocks, but little change in the prospects for real investment by the firms involved.

However, the personal depletion privilege has a progressively more pronounced effect on a taxpayer's net returns as his income increases. The market price for equity shares represents the capitalized value of the market consensus of the return to all stock market participants—corporate, pension fund, foreign and Canadian individuals in all tax brackets. From data examined by the Commission staff, it appears that there is some inducement to hold more of these shares by individuals in the high marginal tax brackets, but not enough to cause complete capitalization of the additional earnings. Thus, the benefits of shareholder depletion are reflected in a higher rate of return to a relative minority of shareholders—those in the higher tax brackets. Since a large part of these holdings represents the controlling interest in mineral companies, it may be presumed that the elimination of shareholder depletion would have a minor effect on share prices of mineral companies relative to those of other companies.

REFERENCES

1/ Report of the Royal Commission on Banking and Finance, Ottawa; Queen's Printer, 1964, p. 341. Also cf. ibid., p. 42.

2/ See Appendix A, Table A-6.

3/ One well-known example is the case of Consolidated Sudbury Basin Mines Limited which spent a reputed $15 million in property development before abandoning plans for immediate production. On June 27, 1960 Consolidated Sudbury purchased the producing gold property of Giant Yellowknife Gold Mines Limited and then amalgamated with the latter company to form the new Giant Yellowknife Mines Limited, as of June 30, 1960. The amalgamated company qualified for the deduction of the preproduction expenses of the predecessor. The combined company will have been free of corporate income tax from its inception until well into 1965. According to its 1964 annual report, in the absence of the write-offs attributable to the predecessor company, the present operating company would have paid income taxes of $1,510,000 in 1964, and $1,190,000 in 1963.

4/ An exception is that part of the land costs which may be expensed through the royalty device. Royalties may be viewed as that part of the consideration of the sale whose value cannot accurately be capitalized at the time of the transaction and for which the vendor therefore receives a fixed interest in an undetermined future output.

5/ Cf. Commission Hearings, Canadian Metal Mining Association, Vol. 73, p. 5812.

6/ The cost of Crown petroleum and natural gas leases in Alberta rose from $16,049,000 in 1962 to $26,131,000 in 1963. The cost of drilling reservations rose from $11,212,000 to $18,777,000.

Comparing two consecutive years is not of itself proof that the price paid for land is increasing, because the quality of finds made during the year and changes in expectations will affect the relative intensity of land acquisition activity in the two years. Both 1962 and 1963 were rather dismal years from the standpoint of new discoveries, but they are roughly comparable in this respect.

Further, it is relevant to note that the increase in the scale of bidding caught even the provincial government, which is in perhaps the best position to assess bidding prospects, unawares. It is instructive to compare the budget speeches of the Hon. E. W. Hinman, Treasurer of the Province of Alberta, in 1963 and 1964. In projecting his revenue for 1963, he budgeted for a reduction in the proceeds from sale of Crown leases and reservations. The actual returns for 1963 were higher than those for 1962, and considerably higher than those anticipated. That this unanticipated increase was considered more than accidental and indeed was expected to continue thenceforth may be deduced from the 1964 budget speech in which further increases in land revenue were projected for 1964.

6/ Cont'd.

The conclusion seems warranted that the increase in bonus costs in 1963, the first full year of operation of the new provisions of s. 83A, was in large part the result of those provisions. A similar conclusion is reached in an analysis of Alberta oil revenue by James H. Gray in the Ottawa Citizen of 9 January 1964.

For the year 1964, revenues actually realized from the sale of Crown petroleum and natural gas leases in Alberta, at $59,516,000, reached the second highest figure in history and the highest in eight years. Cost of Crown drilling reservations rose to an all-time high of $23,660,000. The year 1964 was, however, not directly comparable with the two preceding years because of the Sylvia-Hondo-Mitsue Gilwood sand discoveries of northern Alberta, which made 1964 the best discovery year in five years. Nonetheless this dramatic increase in provincial land revenue tends to confirm our hypothesis that the 1962 amendments, permitting land costs in oil and gas to be expensed, have had a marked upward influence on the cost of acquiring land.

7/ Canadian Petroleum Association submission, p. III-7.

8/ For a confirmatory view of the percentage depletion allowance, cf. W. B. Coutts, F.C.A., Accounting Problems in the Oil and Gas Industry, Canadian Institute of Chartered Accountants, Toronto, 1963, p. 43.

9/ Canadian Tax Foundation, Oil and Gas Production and Taxes, ed. by Jacques Barbeau, Toronto, 1963, p. 98.

10/ For a description of bidding procedures and land holding conditions for Crown land in the western provinces, see ibid., pp. 100-105. Also, cf. The Royal Bank of Canada, Oil and Gas Bulletins, Oil and Gas Department, Calgary, Alberta.

11/ Alberta Public Accounts.

12/ Oil and Gas Production and Taxes, op. cit., p. 98.

13/ Saskatchewan Public Accounts.

CHAPTER 5— NON-NEUTRALITY OF A UNIFORM CORPORATION TAX

We now examine the contention that a corporation tax which applies uniform effective rates on all industries would itself be non-neutral in the sense that it has an unequal impact on different industries. Specifically, this type of argument holds that, in whole or in part, the tax concessions granted to the extractive industries serve to redress an allocatively non-neutral bias against these industries that would follow if they were taxed on the same basis as any other. The argument is based upon three alleged characteristics of the extractive industries— their capital intensity, their ratio of equity to debt, and their unusual probability of losses.

CAPITAL INTENSITY

Since the corporate income tax is a tax on the earnings of one factor of production, corporate capital, it is said that an equal corporation tax bears unequally on industries of unequal capital intensity. 1/ Capital intensity, in this connection, is properly measured by the ratio of capital employed to value added by the industry.

If the corporation tax is incorporated in final price so as to maintain the previous rate of profit, either through short-run forward shifting or through long-run capital movements out of the taxed sector and hence between industries, then a greater adjustment will be required for those industries in which the return on capital is a relatively large proportion of factor costs. In such a case, the final quantities produced and the capital employed in the capital-intensive industries of the

corporate sector will be reduced relatively more by a uniform corporation tax than they will be in less capital-intensive industries.

However, the extent of the relative impact of the corporation tax on a capital-intensive industry also depends on how responsive is consumer demand for the final product of the industry to relative changes in price. If the corporation tax is shifted forward in the form of price increases, but this shift results in a relatively minor decrease in final consumption of the product, then there is very little adverse allocative effect on investment in the capital-intensive industry. We have already noted that the demand for many minerals is relatively insensitive to price changes. 2/ Thus, even on the assumption that these industries were inordinately capital intensive, there would yet be little ground for ascribing a misallocation of resources to a uniform corporation tax. 3/

On the other hand, if these industries were competitive and taxed preferentially, then the reverse proposition would also be true. A lower rate of tax applied to an industry whose demand was insensitive to price change would cause little change in the prospects for new investment and, hence, little change in the allocation of resources. In such a case the preferential tax rate would be capitalized in higher returns to existing producers with little effect on the margins of investment. These matters will be pursued presently.

In any event, if the adverse allocative bias of a uniform corporation tax toward a capital-intensive industry is to be the basis for justifying a lower effective rate of taxation on the mineral industries, it would have to be demonstrated that these industries were inordinately

capital intensive relative to all others. To test this hypothesis, we must compare capital output ratios in the extractive industries with those of other branches of the corporate sector. 4/

The measure used was the ratio of an estimate made of gross plant and equipment to Gross Domestic Product at factor cost for each industry. Gross plant included the cumulative value of investment in physical plant in use, and excluded the cumulative cost of land. Land costs were excluded because, as argued in the previous section, they are themselves determined by profits and, in this sense, they are not relevant to the forward shifting of a corporation tax.

It was found that the capital output ratio for mineral extraction was higher than that for most, but not all, the other sectors of the economy. The ratios for the extractive industries were not so far removed from the modal values for all industry as to warrant their being considered exceptional in this respect. There were other sectors, notably transportation and communications, which had much higher ratios.

It might also be pointed out that within the mineral sector there was a great variability in capital output ratios, with the highest ratio in the base metals industry, and the lowest in coal mining.

We conclude that the allocative bias which may inhere in a system of uniform corporation tax because of different degrees of capital intensity is not a sufficient ground on which to single out the extractive industries as being uniquely deserving of ameliorative treatment.

DEBT/EQUITY RATIOS

Again, a uniform corporation tax may be non-neutral because, in so far as it is applied to income net of debt charges, it bears more heavily on firms and, hence, industries with a heavy ratio of equity to debt financing.

It has been argued that because of risk associated with mineral development there may be, in effect, a rationing of credit to the extractive industries that compels them to finance through equity stock to a greater degree than other industry.

This proposition was examined by comparing debt/equity ratios within sectors of the extractive industries with sectors of the manufacturing industries on the basis of available aggregate data. For example, the data summarized in Appendix Table A-9 show a comparison of the ratio of debt to equity for the mining and manufacturing industries of the corporate sector for the taxation year 1961, as derived from Taxation Statistics. 5/ This evidence does not suggest any significant differences in debt/equity ratios as between mineral extraction and manufacturing as a whole. 6/

Confidential data furnished by individual companies to the Commission's own corporate survey suggest a similar conclusion.

Thus, although the evidence shows some marked intrasectoral differences, there does not appear to be ground for assuming that mineral extraction, in the aggregate, must rely on equity financing to a degree that would make a uniform corporation tax discriminatory.

A UNIFORM CORPORATION TAX AND HIGH LOSS PROBABILITY

Variability of expected returns on investment will affect the net return on investment, in the presence of a corporation tax, provided there is no provision for the offset of losses against taxable income. This proposition is usually associated with high risk in mineral exploration—the possibility of a higher rate of return being necessary to induce investment in a risk-prone industry. The latter possibility was briefly introduced in a previous section and will be taken up again. For the moment we may observe that whether or not the investor is averse to risk, which is to say, whether or not expected earnings are higher in a risk-prone industry, the mere variability of the returns on investment, in the presence of profit taxation without the offset of losses, will prejudice investment in such an industry. 7/

This statement may be illustrated by a simplified numerical example. Suppose we compare investment in two industries. In the first there is an absolutely certain return of 10%. In the second there is an equal expectation of a 10% loss or a 30% profit. Then, in the second industry the expectation of the return on investment is the average of -10% and +30%, which is +10%. Suppose the investor is indifferent to risk. Then he will be indifferent in his investment choice between the two industries.

Now, suppose a 50% tax is imposed on profits, with no provision for loss offsets. The net return, after tax, in the first industry will be 5%. In the second industry the profit of 30% will be reduced, after tax, to a profit of 15%. The loss of 10% will be unaffected. In this case the after-tax, mathematical expectation of the return will be the average of -10%, and +15%, which is +2½%. Now, after tax, the first industry presents the greater expected return.

However, if, in the foregoing example, losses in the second industry are subject to a negative tax at the 50% rate, then, in the presence of the tax, the expectation of the return to investment in the second industry is the average of -5%, and +15%, which is +5%. The relative attractiveness of the two industries, as investment vehicles, has been restored.

It may of course be observed that if the positive component of the second industry were taxed at a lower effective rate— in the example, at 33 1/3% rather than 50%— then, without loss offset, the post-tax equalization of expected return between the two industries could be effected. It is in this way that the percentage depletion allowance is assumed to compensate for the greater dispersion of the results of mineral exploration.

However, it would be the merest accident if the rate of percentage depletion actually applied proved to be exactly the amount necessary to compensate the extractive industries for the possibility of total loss. The fact that the greater proportion of exploration expenses undertaken are, in fact, themselves deductible against taxable income, and on an accelerated basis, points strongly to the conclusion that the percentage depletion allowance represents in large a duplication of other compensatory devices.

If an objective of the taxation system is allocative neutrality, then the conclusion reached on this criterion, as on that of horizontal equity, is that the appropriate method of taxing the extractive industries is one which recognizes that the real costs of mineral extraction include those of unsuccessful ventures. 8/ The most appropriate means

implementing this recognition on both grounds involves the extension of the right to offset losses.

It may be, however, that other objectives justify a non-neutral policy. The next section examines the arguments that have been adduced in favour of a consciously reallocative taxing policy toward the extractive industries.

REFERENCES

1/ The non-neutrality of the corporation tax, as a possible justification for percentage depletion in the United States, and based on the capital intensity as well as the risk arguments, has figured prominently in the recent literature. The current round of discussion in the United States was begun by a provocative article by Stephen L. McDonald, "Percentage Depletion and the Allocation of Resources: The Case of Oil and Gas", National Tax Journal, Vol. 14, December 1961, pp. 323-337. The discussion has continued in that journal and in others. See articles in N.T.J. by Douglas H. Eldridge and Richard A. Musgrave, Vol. 15, No. 2, June 1962; by McDonald, Vol. 15, No. 3, September 1962; by Rene Pierre Manes, Vol. 16, No. 1, March 1963; by Peter O. Steiner, Vol. 16, No. 3, September 1963; and by McDonald and Steiner, Vol. 17, No. 1, March 1964.

A late summary of this debate, which incorporates an analysis of the allocative impact of the corporation tax and the depletion allowance within the context of the market organization of the crude oil industry is to be found in Kahn, American Economic Review, op. cit.

2/ See p. 33 above.

3/ In this connection see especially Kahn, op. cit., p. 297.

4/ For details of this comparison and its derivation, cf. Appendix C.

5/ See Table A-9, Statistical Appendix A.

6/ It has, however, been suggested to the author that the mining aggregates may be distorted by the inclusion of uranium producers, who are a special case inasmuch as they had guaranteed contracts and could raise substantial borrowings on that basis. It was not possible to isolate the uranium companies from the Taxation Statistics totals. However, these companies are all included in the category "other metal mining" in the listing of Table A-9. When the entire

6/ Cont'd.

subsector "other metal mining" is deducted from the total for "mining, quarrying, and oil wells" in Table A-9, the ratio of debt to equity for the mining sector falls from 20.7% to 19.6%. This suggests that even with the exclusion of uranium mining, the debt/equity ratio for the extractive industries as a whole does not differ significantly from that of manufacturing as a whole.

7/ The classic discussion of the effect of taxation on risk-taking is Evsey D. Domar and Richard A. Musgrave, "Proportional Income Taxation and Risk-Taking", Quarterly Journal of Economics, Vol. 58, May 1944, reprinted in American Economic Association, Readings in The Economics of Taxation, ed. Musgrave and Carl S. Shoup, Homewood, Ill.: Irwin, 1951, pp. 493-524.

8/ It must, however, be remarked that despite the nature of exploration as a sampling process, not all prospecting expenditures are in the nature of necessary real costs in the economically valid sense of minimum average costs. Those failures which are due to prospecting primarily for financial promotion and only in a secondary way for the purpose of discovery, and those due to avoidable bad judgment, are not necessary social costs. (Preston, op. cit., p. 36.) The section in Chapter 7 where we appraise the present prospectors' and grubstakers' exemption indicates some presumption that greater expenditures than necessary are made in fruitless exploration (cf. esp. reference No. 28 to Chapter 7). Also, cf. Cork, op. cit., pp. 47-48.

CHAPTER 6—POLICY OBJECTIVES TOWARD MINERAL EXTRACTION

STABILITY OF THE RESOURCE BASE

Earlier in this study we concluded tentatively that the nature of the extractive industries was such that, in the absence of mitigating institutional factors such as monopoly regulation of the price, there might be wide price fluctuations which would result in alternating periods of shortage and surplus. Available reserves might vary if investment were only undertaken when existing reserves have been depleted and prices were expected to rise and increase future profitability. These fluctuations are particularly related to the exploration and discovery phases of the extractive cycle.

Thus, the first reason a government might want to intervene in the mineral industries is a concern with stabilizing the raw materials and fuels base of the national economy. The purpose of such intervention might be stability as an end in itself or because certain minerals are vital for other policy reasons which we will discuss. The immediate objective of government intervention in this connection is to assure the continuity of long-run supply, and the policy measure indicated is a positive inducement to explore for specified minerals when reserves fall below a desirable level. The economic justification for such a concern is that society may wish to plan for future needs in terms of longer horizons than are typically applied by the individual investor in a competitive industry.

However, it should be established that the expansion of domestic reserves as a policy goal in itself cannot be divorced from considerations of the organization of a particular mineral market nor of comparative cost. Only if the long-run cost of new reserves is competitive with the cost of substitute materials or with the cost of foreign supplies, would erratic investment response create a justification for government intervention. A national policy of encouraging exploration can only be justified if the policy produces results in the form of discoveries that are commensurate with the costs involved, or if there are strategic or policy reasons for ignoring those costs.

RISK AND SOCIAL v. PRIVATE EVALUATION

A government may be concerned with the magnitude as well as the stability of its natural resource base. The argument here is concerned with risk premiums and the possible divergence of private and social valuations of investment returns.

A tax system which is neutral with regard to the spending patterns of consumers and investors will achieve the highest level of social welfare attainable only on the assumption that the pre-tax pattern of investment and consumption was such as to yield the highest level that could be attained. This assumption depends, in part, on the equality of the rate of discount applied to expected future benefits by the private investor and by society. The relationship of the private and social rates of discount depends, in turn, on the allowance that individual investors may make for the presence of risk.

An individual investor may be visualized as anticipating a mean rate of return, taking into account the probabilities of success and of

failure. As we noted in the previous chapter, where the results of an investment are less than certain, the possible profit component of such a calculation must be greater than for an absolutely certain result in order to yield an equal mean expectation. The lower the probability of success the greater must be the return on a successful result in order to yield a given weighted probable return.

We have seen that there is a wide variation in the returns on investment in mineral exploration. We have also seen that if there is full provision for the offset of losses, a uniformly applied tax system will not change the inducement to invest in this industry relative to another that would have existed in the absence of taxation. Yet it may be deemed socially desirable for the tax system to be actively non-neutral, in the sense that it attempts to redress an allocative bias that is anterior to taxation.

That such a pre-tax bias exists depends on the presence of two conditions. The first is that it is not possible for the individual investor, either through the sheer magnitude of his operations or else through private pooling or insurance devices, so to hedge his projected investments that variability does in fact constitute inordinate risk. The second condition is that the investor is repelled by risk. If these two conditions are operative, what may deter each individual decision-maker from investing in an industry with highly variable returns is the chance of losing all his capital. If such is the case, to him it is not sufficient that the mean expected return be as great as that in a venture whose expected result is less variable. This investor will require a risk premium in order to make the "high risk" investment equally attractive. In other words, the anticipated mean rate of return would have

to be higher when the probability of success is lower. The possible profit component of such a calculation would, of course, have to be higher again.

If the foregoing describes the consensus of investor attitudes toward risk, then for the whole of an industry with a wide dispersal of expectations, investment will not proceed up to the point where the expected yield on the marginal investment is equated to the expected yield in other lines of endeavour. The more lucrative investment possibilities in this industry will indeed be accepted, but investment will halt at a point where unrealized opportunities might yield a higher anticipated mean rate of return than investment actually undertaken in other industries. Yet to society as a whole, the possibility of total loss to one investor is offset by the possibility of gain to another, and there is no social purpose in a private risk premium. To put the matter another way, in such a case the rate of private discount applied at the margin of investment in a "high risk" industry would exceed the social rate of discount. The social return to all investment would then not be equated at the margin and there would be under-investment in a risky enterprise and relative over-investment in the rest of the economy; the economy would then not be producing the maximum total output of which it is capable.

However, as mentioned above, such an argument must assume not only that expected returns to mineral investment are highly variable, but also that institutional devices for insuring the risk are not effective and, perhaps more important, that investors are, on balance, averse to risk.

As to the first condition, when the size of the typical decision-making unit is large enough to undertake a considerable number of ventures, or when the structure of the industry is such as to permit different sized units to undertake ventures whose risk is commensurate with their size, then the wide dispersion of results need not lead to inordinate risk. Evidence suggests that in mining the significant explorers are the large companies who, when the occasion demands, can further pool the risks by forming syndicates. 1/ In oil and gas it appears that the chance of total loss has been reduced by a variety of pooling devices and a range of selectivity in the type of venture that may be undertaken. 2/

One evidence of risk would be a high incidence of bankruptcies. For the period 1955 to 1959, inclusive, total liabilities of insolvent companies in the mining sector were 0.00018% of average assets of the industry for that period. For the manufacturing sector the percentage of liabilities of insolvent companies to total assets was 0.00076%. This indicates an incidence of bankruptcy four times as high in manufacturing as in mining. 3/

As to the second condition, i.e., whether or not those who make investment decisions are on balance averse to risk, it is not possible to be unequivocal.

There is some evidence from stock market behaviour to suggest either that there is no inordinate overall risk in the extractive industries, or that investors are not repelled by risk, and may, indeed, be attracted by it. In this connection, the returns from equity purchases may be indicative of investor attitudes toward the mineral industries in

comparison with others. If investors insist on a margin for risk in the mineral industries, the market rate of return on mineral shares might be expected to be higher than that for equities in general. The inverse of the rate of return, that is, the ratio of market price to earnings, should then be lower for mineral shares.

A test of this hypothesis was made by comparing the relationship of stock market price to cash flow per share for a large number of active, listed, non-financial, Canadian corporations. The result, presented in Table 2, is summarized by the average of such price/cash flow ratios in a number of industrial classifications. Cash flow, rather than net earnings, was used here as an index of return, as rendering mineral and non-mineral companies more readily comparable by acknowledging the diversity of accounting techniques for dealing with the different types of cash accrual. 4/ This test indicates that, if anything, the ratio of market price to cash flow is higher (and the rate of return, lower) for mineral shares than for those of industry in general. The test then does not support the hypothesis of investor risk aversion toward mineral investment. 5/

Moreover, observation of stock market behaviour in general suggests that there may be a positive preference for the riskier of two investments promising the same average probable return, when total losses are limited to the funds committed and possible gains are considered unbounded. 6/ Perhaps it is not too far amiss to liken investment behaviour in this area to that in a lottery, where the average return is known to be negative but the prize is very large in relation to the size of the bet. 7/

TABLE 2

SHARE PRICE/CASH FLOW RATIOS

153 Listed Non-financial Canadian Corporations, 1960-64

Category	Number of Companies Averaged	Average Ratio of Price/Cash Flow
Manufacturing, excluding Petroleum Refineries	71	8.02
Petroleum Refineries	5	8.84
Total Manufacturing	76	8.07
Transportation, Communications, Utilities	24	10.45
Retail Trade	11	10.41
Total of foregoing: corporate, non-financial sector excluding primary mineral extraction	111	8.82
Mining (Metals, Asbestos)	29	11.48
Petroleum and Natural Gas Producers	13	14.38
Total Mining and Oil Production	42	12.38
Grand Total	153	9.80

Notes:

Share price for each component company is the average of the high and low for the common (or equivalent) listed equity stock for each of the five calendar years, 1960-64.

Cash Flow for each company is the average per annum available to each common (or equivalent) share over the five-year fiscal period ending closest to December 31, 1964.

Cash flow is defined to include net earnings after tax, plus depreciation, property amortization, and charges to special reserves.

Ratio of price/cash flow quoted is the average for each category of the component individual company ratios.

Finally, it should be observed that variability of returns giving rise to risk can mainly be attributed to the exploration phase of the mineral extraction sequence. The market risks associated with mineral production as such are in many cases less than those associated with other enterprises. It has been estimated that 89% to 90% of the number of oil and gas production loans made by Canadian chartered banks are at the prime rate. 8/ There has been only one reported case of loss on an oil production loan. 9/

It seems then that there is no conclusive evidence showing that mineral investment is subject to inordinate discrimination because of private aversion to risk. However, if the tax system or other government policies are to be directed toward correcting such a bias on this ground as on that of stability, they ought to be such as to promote exploration for minerals where such a need is deemed to exist, and where the costs involved are not excessive in terms of the results likely to be realized.

CONSERVATION OF RESOURCES

The concept of conservation is related to the socially preferred time-rate of use of a country's natural resources. It may be seen that the rate of renewal or discovery of new mineral reserves, which was discussed above, is one aspect of the conservation problem. Equally, however, conservation is concerned with the rate and quality of the commercial exploitation of known mineral bodies. A conservationist public policy has been defined generally as one "...which seeks to increase the potential future rates of use of one or more natural resources above what they would be in the absence of such a policy, by current investment

of the social income". 10/ The author of the foregoing definition goes on to explain that "investment" should here be understood as including not only projects for restoration, education, and research, but also "policies of reservation and hoarding of stocks". 11/

It may be demonstrated, however, that conserving a given resource for future use must necessarily imply a cost in terms of sacrifice of present consumption or of investment for future use in other capital goods. In this light, conservation becomes one aspect of the general economic problem of allocating scarce means among competing end-uses over time. 12/

The argument, then, that government policy must actively be brought to bear in the interests of conserving stocks of a given natural resource implies a divergence between private and social costs and benefits, over time, with regard to that particular resource. A conservationist viewpoint is that the rate of exploitation of a given part of the nation's natural endowment, which is arrived at by the consensus of private profit decisions, tends to be more prodigal than that which would be arrived at by consideration of the long-term welfare of society as a whole. In particular, a conservationist public policy toward mineral extraction would be directed toward correcting institutional defects that prevent the aggregate private decisions of mineral developers from approximating the social consensus.

It is helpful here to adopt Scott's distinction between specific and non-specific natural resources. 13/ Specific resources are fixed in location. All their services accrue to and may be marketed by a particular individual or firm. Moreover, costs arising from production

are borne as expenses by the producing enterprise. On the other hand, the use of non-specific resources and their costs are beyond the complete control of any one economic unit.

If a natural resource is specific in the above sense, all the costs and benefits of exploiting it are reflected in the calculations taken into account by the private decision-maker when he makes his plans. In this case there is no reason why the market mechanism should not be relied upon to govern the rate of utilization. Indeed, when some of the costs or benefits are beyond the control or interest of the individual decision-maker, the objective of government intervention will be fulfilled if its effect is to approximate conditions of specificity.

Mining— in the narrow sense, the extraction of solid state minerals— comes very close to being completely specific. The mining company, having clear and complete claim to use of its property, may be assumed to arrange its rate of extraction after taking into account all of the relevant costs, in order to maximize the present value of the asset. There is no a priori reason why the price system should not be trusted to resolve the problem of conservation of mined minerals. 14/

A qualification to the foregoing paragraph must be introduced, however, if we recognize that the life of a community surrounding a mine, and expressly existing for the sake of the mine, may be longer than the privately determined life of the mining venture. More generally, where a mineral development has brought forth social overhead capital such as new towns or railroads, which capital was supplied from outside the industry and whose life expectation is longer than that of the mine, the costs of the entire operation are no longer specific to the operator.

The optimum social time pattern for exhausting the mineral body may involve a slower rate of extraction than that determined by the market evaluation of the developing company. 15/ Taxation is but one method of dealing with this problem. A conservationist taxing policy, presumably, would be based on severance taxes that increase the short-run costs of production and impose a rate of output lower than that which would otherwise have been determined by the firm's pre-tax costs.

But if property rights to a mineral body are not exclusive to one decision-making unit, a much stronger case may be made for a conservationist policy. Oil and gas deposits are non-specific in this sense. Property rights are subject to the "rule of capture", under which whatever one holder of mineral rights can withdraw from the migratory underground pool is his to take and keep. Furthermore, ultimate total recovery of petroleum depends on adequate maintenance of gas pressure and the rate of flow of the liquid crude. Under these circumstances, it is in the self-interest of each producer to attempt to bring to the surface as much crude oil as he can, as quickly as possible, before his neighbour does the same. In the absence of public intervention or monopoly control, one could expect a more rapid rate of depletion and a lower ultimate recovery than would be socially desirable, as well as a waste of economic resources in the creation of excessive exploitive capacity.

It may be remarked that the ultimate answer to these tendencies appears to be compulsory unitization, whereby one operator works the entire pool on behalf of all the mineral rights owners. Under unitized operation, only the minimum necessary number of wells need be drilled at the optimum location, thereby assuring optimal rates of recovery and eliminating unnecessary duplication of facilities. 16/ Production of

natural gas from each reservoir, probably as a consequence of there being a single buyer in each field, is usually carried out as one entity on a sharing basis.

For crude oil, however, the solution to the conservation problem that has been adopted by most state and provincial regulatory agencies is a less drastic one involving regulation of maximum daily production rates, spacing of wells, target areas within which wells must be located, and restrictions on reservoir energy dissipation by control of the rate of removal of gas and water occurring in conjunction with the oil. Most important, particularly in the context of preferential taxation, is prorationing whereby, in Alberta, and in the major oil-producing states of the United States, market demand at the existing price is allocated among the producing units of the state or province.

Prorationing does promote conservation of crude oil reserve stocks by quantitative restriction of the rate of output, but it does not attack the problem of excess exploitive capacity and, in fact, encourages the drilling of as many development wells as are permitted by the spacing regulations in order to increase an individual operator's quotas. Social waste can exist not only in the form of over-rapid exploitation of a natural resource, but also in the waste of other resources for the sake of producing a limited output of the given natural resource. The effect is that of a compulsory cartel, with a stable price, but with no restriction on entry. Such a device cannot increase long-run profit expectations inasmuch as the rate of return is reduced by excess productive capacity.

The actual mechanics of prorationing as practiced in Alberta are at present in a transitional stage. It has been claimed with considerable

justification that the particular method of prorationing that had been in use encouraged output from high cost wells at the expense of low cost wells with higher productive capacity. Under the Alberta proration plan, which had been in effect with modifications since 1951, the total purchase nominations made by the refineries for a month were allocated on a two-stage basis. First, each well was granted an economic production rate which would return the investment in the well in less than six years. Secondly, demand in excess of the provincial total of the economic production rate was allocated to individual wells in proportion to their individual producing capacity that was surplus to their economic allowance. 17/

In the event, the economic allowances— the total of the first stage or fixed quotas— have taken a steadily rising proportion of the total monthly allowables, one that amounted to an average of 85% in 1963. 18/ The incentive toward drilling an excess of wells, inherent in any cartelized selling scheme, was increased by the guaranteed return implied by the economic allowance.

Dissatisfaction with the existing production control system led to new hearings by the Alberta Oil and Gas Conservation Board, beginning on November 5, 1963. The decision of the Board, handed down on July 26, 1964, provided for an extensive revision of prorationing policy which will take complete effect on May 1, 1969, with a series of transitional changes beginning on May 1, 1965.

Briefly, the new Alberta proration plan, when it comes into full effect, reduces the levels of the economic allowances and, more important, such a minimum well allowance will enter the calculation only as a

guaranteed "floor", and not as a distinct first stage. The total market allotment for all the wells in each pool will first be calculated according to a new formula which depends on both lifetime reserves of the pool and remaining reserves at the time of the calculation. If the allocation so computed exceeds the sum of minimum well allowances for all wells in the pool, the economic allowance will be disregarded for that pool. Only if the formula allocation for a pool is less than the sum of minimum well allowances, will the total of the latter become the operative quota for that pool. 19/

It is claimed that the effect of the new Alberta proration plan will be to increase allowables for wells in pools with high reserves and relatively wide spacing. 20/ To this extent the new scheme will, when it is in full operation, modify the strong incentive towards drilling high cost wells for the sake of their economic allowance. However, the basic waste of any compulsory cartel will remain. So long as a share of market output at the going price is guaranteed to all comers, prorationing will hold oil prices above the short-run marginal costs of the most efficient producers. By inviting surplus capacity such a scheme is ineffective in increasing long-run profit expectations. Indeed, it may be argued that since the result of development drilling is more certain than that of exploratory drilling, the burden of the excess capacity, by extending the pay-out period for successful wells, acts differentially to encourage development at the expense of exploration. 21/

The social cost of excess capacity in the production of petroleum must be measured in terms of the economic resources that would otherwise be devoted to other end-uses. Thus "conservation" by quantitative

restrictions on the output of one commodity is not conservation in the meaningful sense of maximizing the social evaluation of the total resource utilization of the nation. It is in this context that the special provisions for taxing petroleum profits must be viewed.

NATIONAL SECURITY

The need for emergency reserves of strategic commodities as a justification for special tax treatment of the extractive industries has received rather greater attention in the United States discussion of mineral taxation than it has in the Canadian. 22/ However, it is also relevant in the Canadian context. The chain of reasoning goes that if the security of the nation requires the availability of a certain commodity in a certain minimal quantity, and if the forces of the market are such that this quantity could not readily be made available, then some form of government interference with the market is called for. Such shortages might result from war or political upheaval in other supplying countries.

It may be observed that the security argument is a special case of the need for conservation in the dual sense of the need for a large and stable reserve capacity, and the prevention of waste in the conversion of known mineral stocks. Nor is this requirement entirely outside the decision-making criteria considered by private investors. If potential shortages are an ever present prospect, it is in the interest of private developers to maintain some reserve as a hedge against increased demand, and it may be expected that some of them will do so. A concern is felt, however, that again the time horizons included in individual calculations will be shorter than those required for the higher strategic interests of the nation.

It is apparent, however, that not all minerals are strategically crucial, and that many non-minerals are. Nor should the corrective measures taken be immune from cost-benefit analysis. Minimal cost considerations indicate that reserves should be maintained at the levels deemed adequate by strategic planners, but not in excess of this level.

The most obvious answer to a strategic need for a particular mineral is stockpiling, the accumulation of a stored reserve of the mineral in question up to the level deemed necessary. After that level has been achieved there is no further need to interfere with the market-induced allocation of resources. With regard to oil and gas, however, it is argued that the costs and hazards of stockpiling are much greater than those involved in so storing durable metals.

Failing stockpiling, defence requirements will best be served by measures which encourage the search for new sources of the needed mineral. Measures which tend to increase consumption from domestic deposits or to duplicate existing capacity for the utilization of already known sources do not promote the strategic requirement.

BENEFITS TO THE ECONOMY

The favouring of the extractive industries as a valid public policy objective is sometimes advocated on the ground that other benefits flow to society from these industries—benefits that are not directly measurable in terms of mineral output itself. Such objectives include assitance to particular regional economies, which will be discussed separately below.

The present discussion is concerned with the desirability of a deliberately non-neutral taxing policy toward mineral extraction because of the benefits such a policy brings to the economy at large in terms of balance of payments, growth stimulation, or employment effects.

Export Stimulation and Import Replacement

A policy of favoured treatment to the extractive industries is often advocated in Canada on the grounds that the industries in question contribute mightily to Canada's merchandise exports, or that they displace commodities which would otherwise have to be imported.

There is no questioning that metal mining, asbestos and natural gas are prime net earners of export dollars for Canada. There is equally little doubt that Canada's balance of trade position, in crude petroleum, has improved vastly since the Leduc discovery of 1947. Although imports of crude petroleum have increased over the period and still exceed exports substantially, the gap has been narrowed, while exports have climbed from zero to the neighbourhood of $200 million in 1964.

Industry spokesmen are justifiably proud of the progress made, and are often wont to express themselves in terms similar to the following:

> If Canada had not had a domestic oil and gas industry during the 1947 to 1962 period, the unfavourable current account balance during this period might have been between $4.9 billion and $5.8 billion higher. These estimates are based on loss of export markets for crude oil, petroleum products and natural gas as well as increased imports of these products, assuming demand for them would have been the same during this period regardless of whether Canada had a domestic oil industry or not. 23/

Similar balance of payments oriented arguments have been advanced in favour of a conscious policy of favourable tax treatment of the mineral

industries in general. However, this viewpoint is based on the implicit assumption that if a society's resources are not devoted to the extractive industries they would be devoted to nothing else. But, on the assumption of full employment, a condition which prevailed through much of the postwar expansion of Canada's mineral industries, it must be assumed that real resources applied in one sector must be denied to another. It has been argued in this paper, and by economists generally, that in the absence of overriding considerations of social policy the most efficient allocation of resources is that which reflects the decisions of consumers and investors in the market.

To the extent that the expansion of Canada's mineral exports (or substitution for imports) is a result of Canada's comparative advantage in mineral extraction, these developments are to be applauded. However, the stimulation of export industries, as such, is not, in general, an economically defensible argument for governmental concessions to the industry involved.

To favour one industry under conditions of full employment is to attempt to divert investment and production from other industries. If successful, the result, as noted, will be to distort marginal returns, and make for a less than optimum pattern of consumption in terms of consumer preferences. But, more than that, the effect on the balance of payments, itself, is indeterminate. Given a fully employed economy, an increase in the export of one commodity must be offset by a change in other commodity flows: a reduction in general domestic consumption or investment, or what is more likely, an increase in imports. If the last is the case, whether there is a net improvement in the balance of payments will depend on the effect on the terms of trade, that is, on the

demand and supply elasticities of the commodity in question and of other commodities that may be imported or exported.

There is some evidence that increased exports of crude petroleum have given rise to imports of other commodities. One obvious example is imports of oilfield and well-head equipment. 24/ One cannot say what other commodities were imported in increased quantities because of the diversion of resources to mineral extraction, generally, nor what were the net effects on the volume of exports and imports.

Whether the stimulation of a single industry causes a net improvement in the balance of payments depends on the effect this stimulation produces on the prices and quantities of all commodities that enter into the country's international trade. No evidence was found to indicate that the mineral industries had a differentially preferable impact on those prices and quantities than did the output of any other industry.

Where there is high unemployment and surplus capacity, the argument still favours monetary and fiscal policies of a general, rather than a particular nature. However, the case is not quite so clear cut. Where the export demand for a particular commodity is demonstrably elastic in the extreme, given unemployed resources, there may be a case for stimulating that industry without producing adverse effects on the terms of trade. Such, indeed, appears to be the original rationale for the three-year exemption from taxation of new mines, when it was first introduced in 1936. At the time, the major metal mining activity in Canada was gold mining. Since however large, the output of gold mines could be sold in the world market at a fixed price, the benefits, in terms both of employment and of balance of payments, could be obtained at virtually no real cost to the rest of the under-employed economy.

Thus, in introducing the three-year exemption, the then Minister of Finance, the Honourable Charles A. Dunning, said

> ...the most important branch of the industry, namely, gold mining, is in the fortunate position of producing a commodity for which the demand appears to be unlimited. In other industries production cannot be speeded up without creating oversupply and breaking the market. In the case of gold, however, overproduction seems under present conditions to be impossible and the price remains fixed at least for long periods of time. 25/

Even in the specialized circumstances of the time it is doubtful whether increasing the profitability of a relatively labour extensive industry like gold mining would have had as great a stimulus on employment as a more general policy aimed at increasing effective demand. And since we are, at this point, discussing balance of payments, it is doubtful whether the balance of payments was the most pressing issue of the day. The argument, in any case, does not have general applicability. 26/

In general, we must conclude that under conditions of unemployment, the remedy called for, on balance-of-payments considerations, is a monetary policy designed to increase exports generally and to reduce imports generally. Where there is reasonably full employment, incentives given to one industry, if successful, will either divert investment from other industries, curtail domestic consumption, or increase other imports.

Leading Sectors for Growth

A similar analysis may be applied to the argument, often made in favour of incentive taxation of the oil and gas industries, in terms of the leading position occupied by energy sources in advanced industrial countries. The argument is made that the growth of the economy is particularly dependent on abundant energy sources, and that, therefore, the oil and gas industries, whose share of total energy demand is growing, merit favoured treatment.

Again, we must observe that, on the assumption of full employment, resources diverted to one industry are obtained at the cost of output lost elsewhere in the economy. That a nation which is blessed with abundant sources of cheap energy is in a fortunate position is self-evident. The key factor is, however, comparative cost. If supplies of oil and gas, or indeed of other minerals that play an important role in the nation's growth, can only be produced domestically at a higher real cost than that at which they can be imported, then the country could attain a higher standard of living by importing the minerals and exporting what it is better fitted to produce. 27/ If it can produce the energy sources at competitive prices then there is no need, on growth criteria, of distorting the relative advantages of one factor use over another. In any event, having regard to the possibilities of substitution and the response of the price system to threatened scarcities, one must be sceptical about the existence of economic bottlenecks. 28/

Employment Stimulation

As a direct stimulant of employment the extractive industries rank rather low. On the criterion of net output per person employed, only the utilities classification, of the whole of industry, provides less direct employment per dollar of output than does the category mining, quarrying, and oil wells. 29/ The implications of the low direct stimulus to employment are relevant to the discussion below of regional development. However, in discussing the nation-wide impact of mineral extraction on employment it is rightly pointed out that mineral extraction has a multiplier effect on employment throughout the economy beyond its immediate impact.

Table A-12 of Appendix A utilizes information from the input-output tables for Canada, 1949, to tabulate total wages and income throughout the economy that result from a dollar's worth of final output in a number of industrial classifications. 30/ Three of the classifications in this table (the 3rd, 4th and 5th tabulated) constitute the extractive industries. The table indicates that the net wage effects of mineral output are on the high side compared to most industries, but they are not the highest, nor is the dispersion among all industries very wide. It can be said that the employment effects of mineral extraction are considerably greater than those inferred from immediate industry data. But they are not so inordinately high as to warrant stimulating the industry for its general employment effects. Certainly under conditions of full employment there are no grounds for favouring the employment stimulus provided by the expansion of any particular industry.

Even when there is widespread unemployment, mineral extraction is not superior to a number of other industrial categories as a stimulator of employment. Indeed, the position of no industry is so unique that it merits preference as the lowest cost means of raising the general level of employment. The effect of particularized incentives on sales and prices of existing producers would have to be taken into account. 31/ On allocative grounds one would prefer general fiscal and monetary measures designed to raise the level of effective demand, when there is general unemployment.

REGIONAL DEVELOPMENT

Regional Development in General

A more specific claim on behalf of the extractive industries stems

from their locational impact on employment—on the contribution they make to the regional spread of population.

The industrial classification, mining, quarrying and oil wells, constituted 1.88% of the total in the labour force of Canada, according to the 1961 census. However, when we look at the proportion of the labour force in this classification by province, a more regionally weighted pattern appears. The proportion of the labour force occupied in mining, quarrying and oil wells varies from 0.01% in Prince Edward Island to 4.27% in Nova Scotia among the provinces, and goes considerably higher in the territories. 32/

Within each of the political divisions of Canada there is a more marked regional specialization toward mineral extraction. While the extractive industries are spread across the face of Canada, they tend to be located in the more sparsely populated regions. As a generalization, they tend to make their direct contribution to employment at some distance from the main population centres.

Certainly, mining has played a prominent role in pioneering the frontier regions of Canada. However, the regional employment impact of mineral development does not appear to be large. 33/ As we have noted, mining and oil wells, as direct employers, rank very low on the scale. The "ripple" effect in terms of total employment created, is felt elsewhere, in distant centres where the minerals are refined and fabricated, and where the capital instruments for extraction are manufactured. But locally their impact on employment and population is not great. A propos of the territories, the Commissioner of the Northwest Territories remarks that, "the mines which have come into being have

given little stimulus to secondary industry, either locally or nationally". 34/ In general, Canada's raw material staples are capital using, not labour using, and are not conducive to intensive settlement.

It should also be recognized that there are social costs to mining in excess of those directly connected with the enterprise. Such costs, which were previously mentioned in the discussion on conservation, are related to the life of external capital that is necessary to develop a new mining region.

Nonetheless, many of Canada's distant regions are ill-suited to economic pursuits other than mining. If the spread of settlement is regarded as a desirable end in itself, mining has much to commend it as a means to this end. Incentives for this purpose should be related to specific regions, and there is no reason why they should not be extended to other industries that develop within the same regions.

Aid to Depressed Regions

Mining, as noted, is especially prone to regional specialization. Government aid to sectors of the industry is therefore often justified in the interests of ameliorating the impact on communities whose mineral base is faced with declining profit margins. Such is the justification for the direct subsidies paid to coal mining and to gold mining, and for the more favourable depletion allowances to these industries.

Such subsidization, on the grounds of social cost in terms of human dislocation, is justified as a short-run measure. But long-run solutions demand a shift of resources from declining industries. In this task government aid should play a role, most obviously in subsidizing

movement and retraining of people to other regions and into other industries. To the extent that such movement is not possible or desirable, government's role may include incentives to alternative industries in the affected regions.

A policy of encouraging new industry in declining mining regions need not exclude other branches of mining. But the new mine should be able to pay its own way, or else we have merely postponed the day of reckoning. The implication, then, is that incentives to new industry in depressed regions, in so far as they include mining, should be related to the finding and development of new minerals, and not to their permanent subsidization.

Northern Development

Special pleas have been made before the Commission on behalf of special tax incentives to mineral extraction in the far north: the Northwest Territories, the Yukon, and perhaps the northernmost sections of the provinces. 35/ In the past, the extension of settlement into the far north has been largely a by-product of mineral extraction. Mining has, however, mainly been limited to those areas that were sufficiently rich to offset the enormous cost disadvantages of the north.

There is no economic reason why the pace of development of raw materials with higher real costs should be forced before more accessible regions have been fully exploited. However, northern settlement may be related to strategic considerations which justify a higher cost for regional output.

If an active policy of northern settlement is to be pursued, it appears that the provision of transportation facilities and social capital is more effective in partially redressing the problems of high costs and below standard living conditions than are particularized tax concessions to one industry. Regional settlement subsidies to particular regions should be assessed in the light of national policy. Where they are deemed strategically vital, they ought not to be confined to one industry, but rather to specified areas. It should also be recognized that they involve real costs to society.

COMPETITION FOR INTERNATIONAL CAPITAL

A view which is sometimes expressed is that the inflow of foreign capital should be encouraged and that, since other countries grant tax concessions to the extractive industries, Canada must do the same or lose out in the competition for this capital.

Here again, however, as in the earlier discussion of general benefits to the economy, a generalized incentive must be presumed to be more efficient than a particularized one. A generalized incentive is not distortive in terms of outputs and prices of the entire economy and, hence, unless it can be shown that the particularized incentive is more effective in terms of capital attracted per dollar of tax concession, the generalized incentive is to be preferred.

To argue that the special incentive to the extractive industries is more effective than generalized incentives is to imply that there is a pool of specialized international capital that is earmarked for mineral extraction. On evidence from industry interviews this indeed appears to be the case. However, one would further have to assume that

the supply of this specialized capital is more elastic than is that of capital in general; that is, that its movements are more sensitive to small differences in the expected return than are the movements of less specialized capital.

This is a rather stringent pair of assumptions. One might reason that if mineral capital is so specialized that it will not go elsewhere than into mineral extraction, then there is a strong presumption that it will go where the expectation of finding an ore body is greatest, and that it will be less elastic than is capital in general. In the absence of conclusive evidence to the contrary, it must be assumed that an incentive aimed at attracting capital in general must be at least as productive as an incentive directed toward attracting capital imports to a particular industry.

ENCOURAGEMENT OF DOMESTIC OWNERSHIP

A view somewhat opposed to the foregoing is that tax concessions to the extractive industries are necessary as a countervailing influence to foreign, and particularly United States, ownership and control of Canadian industry. This view, far from rationalizing the present Canadian treatment of the extractive industries, implies that the present tax concessions in Canada are not generous enough, or that they are of the wrong kind. Since this view is usually associated with the position of the independent Canadian oil producer, 36/ it will be analyzed in terms of crude petroleum.

A comparison of Canadian and U. S. tax practices as they apply to mineral extraction was made in Chapter 2 of this study. Noting the extraterritorial application of the United States provisions, it

has been contended that the combined effect of the Canadian and United States laws is to favour the Canadian operations of U. S. citizens, private and corporate, over those of Canada. If Canadian statutes were equally attractive, this view holds, the extent of foreign ownership would be diminished.

It must first be pointed out that Canadian incorporated affiliates of the major international oil companies and, indeed, any oil company incorporated in Canada, do not obtain the advantages of United States tax practice on their Canadian operations. Thus, any differential advantage they possess over other Canadian companies stems exclusively from the application of Canadian law. The impact of United States tax law is only a factor when we consider branch operations in Canada of companies incorporated in the United States, or of U. S. individuals.

In analyzing the differential impact of U. S. tax practice on the operations of United States subsidiaries in Canada, it must be noted that any entity doing business in Canada is subject to Canadian taxation on its Canadian operations. If the company qualifies for the special privileges that are available to firms in the extractive industries, then its Canadian tax will be computed on that basis. In addition, the Canadian incorporated subsidiary of a foreign parent will deduct withholding tax on dividends paid to the parent, as is done on dividends from any Canadian corporation remitted to non-residents. As to the Canadian branch of a United States corporation, it will pay a 15% tax under section 110B on income that is not reinvested in Canada. In sum, if it has taxable income in Canada, the United States entity will pay at least as high, and in the case of remitted funds, a higher Canadian tax than will its all-Canadian counterpart.

The advantages to the U. S. entity may be very real at the outset of its exploration programme, when it can carry forward its pre-production expenses and write them off against future production income in Canada; at the same time, it can obtain an immediate recovery for intangible drilling costs and the cost of unproductive acreage against income otherwise subject to United States tax without affecting the size of its depletion allowance in the United States.

But there is an analogous situation among Canadian companies that stems solely from Canadian tax statutes. Any company qualifying under section 83A(3b), which has existing production income, will have a tax advantage over the beginning oil explorer. The Canadian purely producing company, or a mining company, may write off its oil exploration and development expenditures against its previously existing mineral income. While this deduction also has the effect of decreasing its depletion allowance, nonetheless, the value of an immediate tax saving is obviously greater than that of a deferred one.

The Canadian integrated company, or any other qualifying company which has taxable income from sources other than mineral extraction, will have a further advantage to the extent that its preproduction expenses exceed whatever production income it may already have. In this case, the excess deduction, written off against non-production income, not only has the advantage of immediacy, but also is a saving against "fully taxed" dollars, i.e., earnings which would not have been subject to the depletion allowance. 37/

Two changes are suggested by the petroleum industry: that depletion be based on gross income rather than net, and that section 83A

deductions be permitted against income from any source regardless of the status of the taxpayer. It is alleged that these changes would redress not only those differentials stemming from the impact of United States tax practice on the operation of U. S. branches in Canada, but also the last-mentioned differentials as between different types of Canadian operators that arise solely because of Canadian tax statutes.

But it could just as plausibly be argued that the elimination of the immediacy of the expense deduction, and the amortization on a time-table basis of such preproduction expenses, would eliminate the differentials as between Canadian entities. For, if exploration and development expenses could be deducted from income only on a time-table basis, there would be no advantage of timing or tax shelter to the larger operator. It is only in relation to the impact of United States tax law that gross depletion can be considered the preferred solution.

It should be noted that the advantages to the United States entity lose their significance once the company has reached the point where production income, in Canada, is large enough to absorb the costs of its current exploration and development programme. 38/ When that stage is reached, it is on a less-than-equal footing with the Canadian company. Its basic tax position is the same and, in addition, it has the disadvantage of section 110B. At this stage, of course, it has the option of incorporating in Canada, but it will still pay a withholding tax on remittances to its parent.

It may also be observed that a liberalization of the Canadian depletion system would apply to all oil and gas producers, including those subject to U. S. tax law. For the latter, the effective rate

of tax on their Canadian operation is, in effect, the higher of the Canadian or U. S. rates applicable to that operation. It may be inferred that a liberalization of the Canadian tax law has the effect of transferring income from the Canadian to the United States treasury.

The cost in terms of a reduction in the effective tax rate to an entire industry seems an excessive price to pay for a peripheral increase in Canadian ownership, an increase which is itself questionable, in view of the structure of the industry.

It must be noted that the Canadian operations of the major international oil companies, which account for the vast bulk of the statistical aggregates on foreign ownership and control, 39/ are, in the main, conducted through Canadian corporations and, hence, if they possess tax advantages, these advantages as noted could be redressed by a less generous construction of Canadian taxing statutes as well as by a more generous one. It is questionable, however, whether their dominance stems in any important way from the impact of taxation. Rather, it appears that the industry affords another illustration of the prevalence of vertical integration in mineral extraction—a circumstance that we observed rendered an industry's reserve base a less likely object for public concern.

The major international oil companies dominate not only the oil production of Canada but also that of the whole non-Communist world. Given their international predominance, their financial resources, their technical competence, their vested interest in pre-empting new sources of supply 40/ and the rather late emergence of Canada as a source of oil, it is hardly surprising that theirs should have been the moving force in the development of Canada's petroleum potential. Further, the large,

integrated, world-wide oil companies already dominated Canadian refining and marketing even before the imposition of the income tax in 1917. When the major discoveries were made in western Canada in 1947 and the following years it was almost inevitable that they should have been made by affiliates of the international majors, because only they were exploring in Canada on a scale large enough, and with sufficient knowledge of the new scientific techniques, to do so.

Furthermore, apart from the general argument over the desirability or otherwise of foreign ownership of Canadian business, there is a plausible case to be made in terms of Canadian public policy for a continuing U. S. vested interest in the production of Canadian crude oil. The relative costs of production and transportation of Canadian oil puts it at a disadvantage in most world markets and limits its present export markets to those in the United States. 41/ It may be inferred that the success of the National Oil Policy in Canada, and the effective exemption of Canadian crude from formal import quotas in the United States, are due in large measure to the vested interest of the United States refiners in Canadian output. In the context of Alberta prorationing, this interest has also translated itself into improved prospects for the independent Canadian producer.

The extent of the actual disability to the independent Canadian operator as against the United States, since the 1962 amendments, with many more generous features in Canadian practice, is open to serious question. This does not imply that the present tax concessions are justified on the ground that the United States is doing it and, therefore, we must do similarly in order to foster Canadian ownership. We

have advanced the proposition that a continuing U.S. interest in the industry may be beneficial to the industry and that, in any event, the structure of the industry has evolved independently of taxation.

More fundamentally, if real economic inefficiency is generated by a system of tax concessions, then tax concessions are not the most efficient way of limiting foreign ownership. If the evil of non-resident control of petroleum production is a danger to Canada's strategic interests, then the most efficient means of limiting it is by direct controls on foreign investment, not by encouraging an artificially high level of investment in the affected industry.

If the source of excessive investment in one industry can be traced exclusively to external considerations, then from the point of view of the recipient country the misallocation of resources is relatively minor. The foreign source incentives have the virtue of imposing no cost on the treasury of the recipient country. There appears to be no valid reason for the recipient country to extend concessions of its own if, thereby, it does not improve the efficiency of its resource allocation but, instead, substitutes a drain on the home exchequer for an equal drain on a foreign one.

POLICY OBJECTIVES AND MINERAL RESERVES

We conclude that, apart from special considerations of regional development, the arguments that constitute the most plausible justification for active public favour toward the extractive industries are related to the size and stability of reserves. It is, then, relevant to ask what are the present known reserves of Canadian minerals. Table 3

TABLE 3

MEASURED AND INDICATED RESERVES OF SOME CANADIAN MINERALS, 1963

Mineral	Mineral Content of Measured and Indicated Reserves 1/	Estimated 1963 Production	"Years of Supply" 2/
Iron in iron ore	2 billion long tons	15.9 million long tons	125
Nickel	5.5 million tons	218,649 tons	25
Copper	9.0 million tons	458,735 tons	20
Zinc	19.0 million tons	457,517 tons	44
Lead	8.0 million tons	205,900 tons	40
Uranium (U_3O_8)	207,000 tons	8,141 tons	25
Asbestos	50 million tons	1.3 million tons	40
Sulphur	100 million tons	1.2 million tons	83
Liquid Hydrocarbons 3/	5.8 billion bbl.	239 million bbl.	20
Natural Gas	39,000 billion cu.ft.	1,070 billion cu.ft.	36
Coal	30.8 billion tons	10.5 million tons	2,900

Source: Mineral Resources Division, Department of Mines & Technical Surveys.

1/ Does not include inferred and potential reserves.
2/ 1963 measured and indicated reserves divided by 1963 production.
3/ Crude oil and natural gas liquids. Does not include oil sands whose measured and indicated reserves are of the order of 300 billion bbl. and which therefore indicate 1040 years of supply on the basis of 1963 production of liquid hydrocarbons.

Definitions

Ore: a mineral substance that can be mined at present at a profit.

Measured (Proven) Ore: ore from which tonnage is computed from dimensions revealed in outcrops, trenches, workings, or drill holes, and for which grade is computed from adequate sampling.

Indicated (Probable) Ore: ore from which tonnage and grade are computed partly from specific measurement, samples, or production data, and partly from projection for a reasonable distance on geological evidence.

Inferred (Possible) Ore: ore from which quantitative estimates are based largely on broader knowledge of the geological character of the deposit and for which there are few, if any, sample ore measurements.

Potential Ore: mineral deposits the mining of which depends on improved prices, improvements in methods of mining or treatment, transportation facilities, etc.

summarizes a recent estimate of reserves of some of the most important Canadian minerals in relation to their current rates of production. It appears that, in general, present reserves are adequate to current requirements. For most minerals, reserves also appear to be growing, or at least to be holding their own in relation to current output. 42/

In the next chapter we will discuss how important a role tax concessions may have played in the discovery of these reserves, and the larger question of how efficient a tool of government policy is the present tax treatment of the extractive industries.

First, however, the case of crude petroleum again requires separate consideration, both because of the qualifications that must be attached to the "years of supply" calculation, and because of the additional dimension attached to the reserve picture by the existence of the Athabasca oil sands.

It has been brought to the Commission's attention that a "life index" of, say, 20 years in crude petroleum should not be interpreted as the length of time it would take to exhaust current known reserves at the current rate of production. The ability of oil reservoirs to produce declines with the age of the reservoir. Hence, present reserves will take longer than 20 years to exhaust but, if no new discoveries are made, present annual output could not be maintained ten or twelve years hence without impairing the ultimate recovery from the wells. It has been stated by the industry that a twelve-year supply is a minimum safe life index for Canada. 43/

Nonetheless, discussion of conventional oil reserves assumes an air of unreality when the existence of the huge untapped oil sands of northern

Alberta is introduced. The oil sands contain more than enough reserves to look after Canadian requirements for centuries to come, even on the most sanguine projections of increases in demand. The estimated 300 billion barrels of synthetic crude that could be extracted from the oil sands is roughly equivalent to the total reserves of conventional crude oil of the entire world today. Further, there is no exploration problem as such in the oil sands.

There is a division of opinion in the industry as to whether the cost of extracting oil from the tar sands, and converting it to synthetic crude, is indeed competitive with that of conventional crude. However, if we accept the position that has been advanced by the oil industry that real costs of finding conventional oil are rising, 44/ it appears that there is no long-run problem of excessive costs to extraction from the oil sands. 45/ The more fundamental obstacle to utilizing Athabasca oil is that, by its nature, it requires massive production near rated capacity. In other words, the productive process does not lend itself to prorationing and, thus, economic exploitation of Athabasca oil requires an assured market. Certainly, it appears that there are no technical obstacles now to producing commercial oil from the oil sands. 46/

The Alberta government has been understandably reluctant to give the green light to full-scale exploitation of the oil sands, so long as the province's output of conventional crude remains at something like 46.3% of its capacity to produce. In 1962 government policy was enunciated to the effect that, in the initial stages, output from the tar sands would be restricted to about 5% of total demand for Alberta's crude

oil, and greater production would only be allowed as demand expanded and conventional reserves declined. 47/

Nonetheless, the one project that met the size restriction, and which was approved in 1962, has proved too small to be economical. The production target was revised upward, and this project, by Great Canadian Oil Sands, for an output of 45,000 barrels per day of synthetic crude, to commence before the end of 1967, was approved by the Alberta Oil and Gas Conservation Board in February 1964. The Board, in its decision, estimated that this volume would amount to 7.5% of Alberta's production at the end of 1967, that the conventional oil industry would then be operating at some 46.4% of its productive capacity and that the "years of supply" index would then be 21.5 years. 48/ The Board, at the same time, rejected for the time being two larger projects with projected output of 100,000 barrels per day.

The conclusion seems justified that, if the reason for tax incentives to the crude petroleum industry is based on a concern with the size and stability of reserves, such concern is entirely irrelevant in the face of the potential of the oil sands. The additional social costs of the search for conventional oil, in the form of the taxes forgone due to the special concessions, is an unnecessary one, 49/ and such costs would produce greater benefits to the economy if they were devoted to other uses. There appears to be no reason why free market forces should not here determine the direction of investment. 50/

REFERENCES

1/ The study by Cork, op. cit., at pp. 37 and 51 offers conclusive evidence as to the large size of the typical decision-making unit in metal exploration. Examples of pooling of risk by syndication are offered in the iron ore developments of Iron Ore Company of Canada and Wabush Mines.

2/ In this connection, see especially, James W. McKie, "Market Structure and Uncertainty in Oil and Gas Exploration", Quarterly Journal of Economics, Vol. 74, No. 4, November 1960, pp. 543-571. Also cf. Richard J. Gonzalez, "Percentage Depletion for Petroleum Production", Vol. 2, 1959 Compendium of Papers on Broadening the Tax Base, of the Ways and Means Committee of the U.S. Congress, p. 1001. Also cf. Ronald A. Shearer, "Nationality, Size of Firm, and Exploration for Petroleum in Western Canada, 1946-1954", Canadian Journal of Economics and Political Science, Vol. 30, No. 2, May 1964, pp. 211-227.

3/ Bankruptcy data from D.B.S.are only available for mining companies on a distinct basis, for the period 1955 to 1959. Total asset data are the averages for the period, from Taxation Statistics.

4/ By using cash flow, depreciation and property amortization charges are added to net earnings. If net earnings alone are used, mineral companies typically show relatively a higher price/earnings ratio than in Table 2; hence they might appear to be a much "safer" category of investment than is the case when all cash accruals are considered.

The relevance of the cash flow concept as an indication of earning capabilities in the future is shown by the requirement of the Toronto Stock Exchange that makes listing contingent on "adequate financing and a cash flow sufficient to ensure the continued life of the company, i.e., about $25,000 to $50,000 annually". (Report of the Royal Commission on Banking and Finance, op. cit., p. 338.)

5/ It is recognized that the test employed in Table 2 is a very imperfect approach to the evaluation of the presence of risk and/or the extent of risk aversion. Stocks are purchased in the hope of future returns of dividends and capital gains. Thus, typically, a "growth" stock or one with rosy prospects sells at higher price/earnings or price/cash flow ratios than do others. A test of risk evaluation ideally should relate current price to anticipated earnings—unhappily a subjective phenomenon that is not measurable, but one which is particularly relevant in the case of companies searching for minerals.

The data of Table 2 relate current prices to cash generated currently by companies already returning a stream of benefits. Of necessity, companies that are not yet producing, or whose cash flow history is shorter than five years have been excluded. For these reasons the fact that the data show a lower rate of return in primary mineral extraction (higher ratio of price to cash flow)

5/ Cont'd.

should not be construed as proof positive that mineral extraction is less risky than other industries or else that the public prefers risky investments. Nonetheless the test employed is at least indicative and presents no support to the opposite hypothesis which is the one under test, viz., that the consensus of private investment decisions is such as to apply a greater rate of discount to expected benefits from mineral investment than the optimal rate of social discount.

6/ Ample evidence of stock market enthusiasm on rather low probabilities of success is provided in the celebrated recent sequence of junior mining stock gyrations following on the Texas Gulf Sulphur Company discoveries near Timmins in the spring of 1964, and culminating in the Windfall debacle.

Evidence which points to the low proportion of funds raised by junior mining companies actually used in exploration, is cited in Cork, Finance in the Mining Industry, op. cit., pp. 44-47.

7/ A similar suspicion is voiced in Wm. C. Hood, Financing of Economic Activity in Canada, Royal Commission on Canada's Economic Prospects, Ottawa, 1958, p. 244.

A discussion which is relevant to the lottery comparison is contained in Milton Friedman and L. J. Savage, "The Utility Analysis of Choices Involving Risk", Journal of Political Economy, Vol. 56, 1948, pp. 279-304, reprinted in American Economic Association, Readings in Price Theory, eds. Stigler and Boulding, Homewood, Ill., Irwin, 1952.

8/ David C. H. Stanley, The Financing of Oil and Gas Exploration and Production in Canada, Wood, Gundy and Company Limited, Toronto, November 1962, p. 52.

9/ Ibid., p. 56.

10/ Scott, Natural Resources, op. cit., p. 18.

11/ Loc. cit.

12/ For a complete discussion of the economic meaning of natural resource conservation, see Scott, Natural Resources, op. cit. Also cf. Scott Gordon, "Economics and the Conservation Question", Journal of Law and Economics, Vol. 1, October 1958, pp. 110-121.

13/ Scott, Natural Resources, op. cit., pp. 4 and 61.

14/ See Orris C. Herfindahl, Three Studies in Mineral Economics, Resources for the Future, Inc., Washington, 1961, p. 7.

15/ It should, however, also be recognized that to the extent that the mineral developer himself covers the cost of overhead capital, such costs become specific to him, and imply no necessary divergence between private evaluation and social evaluation.

16/ There is a voluminous recent literature on this subject. A provocative analysis of the guidelines for conservation policy in oil and gas is contained in Davidson, op. cit., pp. 85-108. Cf. also John S. McGee, "Conservation, Integration and Pricing in the Oil Industry of the United States, a Review Article", Journal of Industrial Economics, Vol. 9, No. 1, November 1960, pp. 63-82.

17/ The author is indebted to the technical personnel of the Canadian Petroleum Association for an informative discussion which, among other subjects, helped to clarify the intricacies of market prorationing.

18/ See Norman Strom, "Analysis of Alberta Proration Plan", Oilweek, Vol. 16, No. 14, May 24, 1965, p. 28.

19/ Ibid., pp. 29-31.

20/ Ibid., p. 31.

21/ In this connection, cf. Kahn, op. cit., p. 307.

22/ The American defence need for strategic minerals, especially for oil and gas, and its relation to taxation is discussed, among many other sources, in two papers in the 1955 Compendium, op. cit., James R. Nelson, "Percentage Depletion and National Security", pp. 463-473 and Arnold C. Harberger, "The Taxation of Mineral Industries", pp. 439-449. Also cf. Peter O. Steiner, "Basic Issues in the Federal Taxation of Income from Minerals", Quarterly of the Colorado School of Mines, Vol. 58, No. 1, January 1963, pp. 245-254.

23/ Independent Petroleum Association of Canada, submission to the Royal Commission on Taxation, November 1963, p. III-3.

24/ Imports of oilfield and well-head equipment into Canada, from 1947 through 1961 amounted to some $529 million (Report by the Tariff Board, Oil Field Equipment, Ottawa, 1964). During the same 15 years, exports of crude petroleum amounted to some $694 million (D.B.S., Industry and Merchandising Division).

25/ House of Commons Debates, May 1, 1936.

26/ The example cited, incidentally, illustrates one of the most glaring drawbacks of tax incentives as against more direct measures of stimulating an industry. They tend to become imbedded in the tax structure long after their original purpose has been forgotten.

27/ This proposition abstracts defence or emergency needs which may require a strategic reserve. It has been argued above that defence needs may imply reserve or stockpile requirements. They do not imply measures to increase consumption or domestic output.

28/ For a corroborating opinion on possibilities of substitution and the resilience of the price system in the face of threatened mineral shortages, cf. an article by the vice-president, exploration, of Kennecott Copper Corporation, James Boyd, "The Economics of Mineral Exploration", The Mines Magazine, Vol. 49, No. 6, June 1959, p. 32.

29/ See Statistical Appendix A, Table A-10.

30/ See Statistical Appendix A, Table A-12.

31/ The considerations leading to the preference for gold mining, in 1936, discussed at p. 83 are, of course, relevant in this connection.

32/ See Statistical Appendix A, Table A-13.

33/ In this connection see especially Richard E. Caves and Richard H. Holton, The Canadian Economy Prospect and Retrospect, Cambridge, Mass.: Harvard University Press, 1959, esp. pp. 46-47 and 210-212.

34/ Taxation in Northern Economic Development, a brief presented to the Royal Commission on Taxation by the Commissioner of the Northwest Territories, July 23, 1963, p. 15.

35/ See the submissions of the Commissioner of the Northwest Territories, The Alberta and Northwest Chamber of Mines and Resources, and the Canadian Metal Mining Association.

36/ See for example, submission of the Independent Petroleum Association of Canada, pp. IV-3, VII-3-5.

37/ The influence of the tax provisions on rates of return to an integrated, non-integrated and beginning Canadian company, as well as to a United States company operating in Canada, are illustrated in a numerical exercise the results of which are presented in Appendix E. The exercise uses data from the Canadian Petroleum Association to determine the hypothetical return to different types of companies. It also illustrates the influence of a "gross" depletion allowance on rates of return.

38/ This is also true of the advantage of the integrated Canadian company over the non-integrated. Once its current and deferred preproduction expenses have reached the point where they are no greater than current production income, the integrated company is on an equal footing with the large non-integrated company. It is alleged, however, that certain of the integrated companies are able to postpone this day by judicious organization of subsidiaries to take over productive properties.

39/ Data on foreign ownership and control are provided for the whole of the petroleum industry. They indicate that, in 1961, 60% of the Canadian industry (including production, refining, marketing and transportation) was owned by non-residents, and 69% was under the control of non-residents. (The Canadian Balance of International Payments, D.B.S.)

It has been estimated that the largest producer in Canada (foreign controlled, but incorporated in Canada) probably accounts for over 20% of Canada's crude oil reserves and 15% of Canada's crude production. (Stanley, op. cit., p. 16.)

The four largest refiners (all of them Canadian incorporated affiliates of the international majors) produce about one third of the crude oil output of Canada.

40/ In this connection, see Anthony Scott, "Policy for Crude Oil", Canadian Journal of Economics and Political Science, Vol. 27, No. 2, May 1961, p. 272.

41/ For a full discussion of the relative cost of Canadian crude and its implications in relation to export markets, see Royal Commission on Energy, Second Report, July 1959, esp. pp. 56-66. For an illuminating discussion of the importance of the United States market to Canadian oil, and of the crucial position of the U. S. refiner with interests in Canada in opening that market, see the evidence of Mr. Walter J. Levy, the well-known oil consultant, before the Royal Commission on Energy (Royal Commission on Energy Hearings, Vol. 40, esp. p. 5641).

42/ An interesting recent article, for example, points out that for the Province of Quebec combined production of gold, silver, and base metals was three times higher in 1961 than in 1945. Over the same sixteen-year period, reserves held by producing mines only, in the same minerals, increased 7.2 times. (P. E. Grenier, "What Happens when a Geologist Juggles with the Statistics of the Mineral Industry", Canadian Mining Journal, Vol. 85, No. 5, May 1964, p. 47.)

43/ For example, see Canadian Petroleum Association submission, p. II-22. A minimum ratio of reserves to output of 12-years' supply may perhaps be considered high. The United States, at present, has between 12 and 13 years of reserves at current rates of output, and yet production is only 64% of capacity to produce (Kahn, op. cit., p. 301).

44/ See, for example, Independent Petroleum Association of Canada submission, p. V-4.

45/ Indeed, the reason that costs of Athabasca extraction remain in doubt is because no project has yet been executed, although many are willing. If some of the projections made by the very knowledgeable people who have applied for the right to extract tar sand oil, are correct, costs may be lower even than finding and developing costs of conventional crude oil found some years ago

45/ Cont'd.

when finding costs were lower. An article in World Petroleum, Vol. 34, No. 3, March 1963 (Leslie Orr Rowland, "Over $800 Million in Tar Sands Projects", pp. 64-66) makes an intriguing comparison between the projected capital requirements of the Cities Service project, the highest priced of the tar sands projects placed before the Alberta Oil and Gas Conservation Board, and the cost of acquisition of the Pembina Oil Field, the most prolific conventional field in Western Canada. The producing rate for the Cities Service scheme is 100,000 bbl per day, about the same as the maximum capacity of the Pembina field. In contrast to the projected $350 million outlay for the oil sands project, Pembina's total outlay for land purchases, drilled wells, pipeline facilities, and secondary recovery equipment is estimated to have exceeded $700 million.

46/ Cf. for example, The Financial Post, May 9, 1964, p. 15.

47/ Petroleum Press Service, November 1962, p. 418, and March 1963, p. 91. Also see Budget Speech of the Hon. E. W. Hinman, Treasurer of the Province of Alberta, delivered to the 5th session of the 14th Legislature of the Province of Alberta, 1963, Edmonton: Queen's Printer, 1963, p. 5.

48/ Oilweek, Vol. 15, No. 2, February 24, 1964, p. 12.

49/ And if costs of finding are increasing rapidly, also an ineffective cost.

50/ It is also apparent that if the justification for special tax concessions is a concern with the adequacy of the mineral reserve base, then there is no justification for extending those tax concessions to the output of the tar sands. In the absence of the concessions, net costs to the individual tar sand operator would rise, and perhaps put upward pressure on the price of crude oil. But the latter is determined in world markets and, as we have argued, there is no valid reason, beyond a concern with reserve availability, for subsidizing higher cost domestic output if that output involves higher real costs than those of imports.

CHAPTER 7—EFFICIENCY OF THE PRESENT TAX CONCESSIONS

GENERAL EFFECT OF THE TAX CONCESSIONS

Tax concessions, as policy devices, attempt to structure incentives by altering margins. By increasing the net return on investment in the extractive industries, an attempt is made to push out the margin of investment in the affected industry, leading to increased exploration, discovery, development and output. To the extent that the concessions exceed the requirements of inter-industry equity, they are a form of subsidy. Assuming that the subsidy is justified, how well does it work?

The reduced weight of the income tax on the extractive industries, which is the immediate effect of the tax concessions, increases short-run profits after taxes and increases the amount of cash in the industries' possession. But whether this increase in profits will lead to increases in exploration, and whether increases in exploration will produce significant increases in ore discovery will depend on long-run supply and demand conditions in the industry, on market organization, and on the stage of the investment-production cycle at which the tax concession applies.

In general, as devices for increasing the long-run supply of minerals, such tax concessions are inefficient in that they apply to all production—that which would have taken place without the added incentive, and the additional supply, if any, which is induced by the incentive.

In the limiting case, if the absolute supply of a given mineral has already been located, then the increase in after-tax profits of that

mineral industry will be reflected solely in increased capital values of existing producers, or of proven but undeveloped land.

In the general case, it can be postulated that minerals are, in varying degrees, increasing-long-run-cost industries in the exploration and development phases. Typically, the more accessible regions and those with a greater probability of success, based on past performance, will be explored and developed first. This, to be sure, is not a universally valid description. There are economies of scale to exploration expenditure. A discovery breakthrough in a certain region increases the probability of further finds in the same area. Again, improvements in transportation and the availability of energy, brought about by one discovery, increase the expectation of future returns to further exploration in the same region. Moreover, the tendency to increasing costs may well be mitigated by improvements in the technology of exploration and production. 1/

However, over considerable periods the replacement cost of many minerals may be thought of as rising. If those costs rise rapidly, then a given increase in exploration will yield a much smaller increase in reserves. In any case, the cost of these new reserves must be measured in terms of the subsidy to the entire industry.

If the tax concession leads to increased exploration, discovery and output, we could expect some price reduction in the product which will partially offset the added cost of the subsidy. But the price reduction will be less than the tax reduction per unit of product because of the increasing cost of the additional output. Since the supply price of any commodity is determined by the long-run unit cost of the highest

price plant that can just earn enough net income to justify its entering the industry, the net effect on the industry supply price will be the result of the decrease in tax paid per unit of output and the increase in unit cost through the utilization of higher cost resources at the margin.

We have mentioned previously that whether the tax concession results in a significant increase in output also depends on demand conditions and on the structure of the market.

If the price of the product is determined by a world-wide price convention but entry is free—two conditions we associated with crude petroleum—the increased after-tax profit resulting from the concession will induce entry and new investment, but with no change in output or price. Profits at the margin will be reduced to the competitive level at the price of surplus capacity.

If the industry is subject to monopoly control, a condition approximated in the nickel industry, then presumably it is producing the profit-maximizing output, with or without the tax incentive. If entry is restricted, a tax concession that increases profits will have no effect on the decision to invest or on output. New investment will depend solely on demand considerations.

We have also noted that in a competitive industry, if demand for the product were insensitive to price changes, then increased output could only be sold at a more than commensurate reduction in price and, therefore, regardless of supply conditions, a tax concession could have little effect on output. However, this condition does not apply for those metals which are easily transported, which are sold in world

markets, and where Canada's share does not dominate world supply. For such minerals, if the supply can be expanded without prohibitive cost increases at the margin, then the added output could be sold without a significant decrease in price.

However, for a commodity like nickel or asbestos, where Canadian output is the major factor in world supply, an increase in Canadian output may cause a more than proportionate fall in world prices that would frustrate the attempt to extend the margins of investment in Canada. 2/

It may be observed that the least efficient type of tax concession, from the standpoint of incentives, is apt to be one that is related exclusively to current profits. In this respect the percentage allowance on mineral profits (depletion) is the worst offender among the concessions we are considering.

Drawing together the previous analysis, the allocative impact of a reduction in the effective tax rate on the mineral industries may be summarized as follows: by increasing immediate profits, the tax concession increases the capitalized market value of existing assets in the industry, including equity shares in existing producers and the value of proven or potential mineral-bearing land. If further entry to the industry is barred either through monopoly control or through the prohibitive cost of new discoveries, that is the end of the matter. There will, in effect, have been a capital gain made by the owners of mineral deposits, but no impact on the allocation of resources except to the extent that the general level of taxation may be higher than would otherwise be the case, and that the spending patterns of owners of mineral deposits may differ from those of the population at large.

If entry is relatively free and the cost of discovery does not rise at a prohibitive rate, higher current profits will induce a net shift of real resources into the industry. Here, too, it should be noted that a large part of the tax concession takes the form of windfall gains to owners of existing assets and, to the extent of these gains, such tax concessions are inefficient.

If the supply conditions of the previous paragraph hold, and if the country's increased output of a given mineral can be sold with no appreciable reduction in price, windfall gains will be at a minimum; the tax concession as incentive will be at its most efficient. There will be a substantially different product mix in the country's offering of final goods and services, with more of the given mineral produced, and less of other commodities. But this presumably was the objective of the concession.

But, if price is maintained by effective control of total output, with freedom of entry, new investment will indeed be attracted by the tax concession, but it will take the form of idle capacity. There will be no increase in the output of the industry in question, but there will yet be less of other commodities produced. In this sense, the reallocation of society's resources will have been pure waste. The net effect on the community's product will have been entirely negative.

On the other hand, if output is permitted to rise but the country's increased output of the given mineral can only be sold with a more than proportionate fall in price, a net increment of investment induced by the tax concession will quickly reduce profit expectations from further increments. Here, again, there will be little impact on the country's

final product mix, and the tax concession will be mainly capitalized in the form of windfall gains to owners of existing assets.

To the degree, then, that a tax concession involves a reduction in the effective tax rate on an industry, its primary impact is to increase the prosperity of those with a stake in it at the time the concession comes into force. Its efficiency as a consciously reallocative device depends on its secondary impact on the margins of investment and output.

There are many who argue, particularly with regard to the solid minerals, that the decision to explore is based on such vague criteria that, to approximate them by a weighted expectation of return that is subject to subtle changes induced by altering the tax levied on possible successes, is to endow the process of mineral discovery with far greater regularity and predictability than is in fact the case. To undertake any investment there must be some expectation, however vague, of the return. In this view, however, the return to mineral exploration is usually regarded as rather a vague band or spectrum of acceptable average results. The increase of the few per cent to the rate of return from successes alone that is the effect of the depletion allowance and the three-year exemption, is not enough to raise the vaguely defined expectations that are held at the reconnaissance stage to any noticeable degree.

In the view of one mining company official interviewed by the Commission staff, the limiting factor on exploration is not related to rate of return at all but to "the lack of trained geologists and prospectors to examine all the properties brought to its attention". If this view is carried to the limit, then no financial incentive could increase the pace of exploration. Again, another mining company official stated that

"prospective profitability could not be a factor in determining the extent or location of an exploration programme until the development stage".

Nonetheless, however vague, there must be some notion of the range of possible profits in the decision to explore. In the long run, the mining company cannot survive unless it succeeds in the profitable discovery of new ore bodies. On the other hand, if the rewards to exploration were so vast as to be limited only by the availability of personnel, one would suspect that the competition for personnel and the influx into the industry would, in the long run, increase costs and drive down prices, squeezing out abnormal profits. Thus, profit-related incentives must be regarded as having, at the very least, some notional influence on the size of profits that might be expected. How effective they are at the primary exploration stage is, however, a matter for considerable scepticism. An incentive that is more directly related to exploration may be presumed to be more efficient in altering the investment behaviour of the community.

DEPLETION ALLOWANCE TO OPERATORS

Net Depletion and the Inducement to Invest

The analysis that is relevant to the efficiency of the percentage allowance to mineral operators has been substantially covered in the foregoing section. To recapitulate, the main burden of the criticism of any allowance based on current profit as an incentive device is that it rewards the result of successful past exploration; its effects on new investment are only indirect, working through improved expectations at the margins of new investment. In the context of the immediate

deductibility of the cost of exploration and development, the Canadian net depletion allowance does not always have even this indirect effect.

It is sometimes alleged that the Canadian version of the depletion allowance, in the presence of the expensing provisions of section 83A which reduce the amount of depletion allowed to a firm that is actively exploring, actually acts as a deterrent to exploration. It appears, however, that to the extent that the depletion allowance is competitive with these deductions, its effect on the decision to invest is actually a neutral one.

The foregoing proposition may be illustrated by assuming, for the moment, that there is no income tax imposed on the industry. Then investment would take place for exploration only when the present value of the expected return from that investment exceeded its cost. If we now assume an income tax at any given rate, the expected return will be reduced by the tax factor and the inducement to invest will be correspondingly reduced.

But, if the costs of the investment may be deducted from existing income subject to tax immediately, then the cost of the investment is also reduced in the same proportion as the expected return, and the relation of the expected income stream, net of taxes, to its cost, also net of taxes, is restored to what it was in the absence of taxation.

Now, if the effective tax rate on both present and future income is reduced (which is the effect of the net depletion allowance), there will be no difference in the relation of the expected net return from

new investment to its cost from what it was in the absence of taxation. The depletion allowance thus does not add to nor detract from the decision whether or not to undertake a new investment. It should be noted, however, that there is a greater inducement to invest in this industry over others because of the immediate expensing privilege, which is more valuable than the deferred depreciation open to other industries.

However, for those firms which cannot deduct costs of exploration from immediate income, the depletion allowance does increase the expected net return in relation to outlay, and it must therefore be regarded as adding some inducement to new entry in the industry. 3/

Further, when a firm can immediately write off its investment cost against otherwise fully taxed income (as in the case of an integrated oil company) and recover the outlay in the form of less than fully taxed income, then the net depletion allowance provides some additional incentive to new investment.

It should also be observed that in mining—where we noted that exploration and development are directly related as consecutive stages of a single venture—the decision to explore is not unrelated to prospects for profitable development. Since a large part of development costs is in depreciable property which is not immediately expensible, depletion here is not fully competitive with the write-off allowance, 4/ and tends to increase the present value of the potential future income stream. In this way it may provide some indirect inducement to explore.

We conclude that, to the extent that the depletion concession is competitive with the write-off allowances, the further concession adds nothing to the inducement to invest which already exists thanks to the

write-off. To this extent, it is a non-effective concession that increases capital values and land costs in the affected industry, but does not alter the allocation of resources. Where the percentage allowance is not competitive with the write-off allowance (and with the three-year exemption), it may induce new investment by increasing expected returns. As previously discussed, it is not efficient in this respect because its expectational influence may be frustrated by conditions of supply and demand in a particular branch of mineral extraction.

Gross Depletion as an Alternative

As a further inducement to investment, the petroleum industry has advocated a depletion allowance based on revenue gross of all charges save royalties. This allowance, it is claimed, has the virtue of being unaffected by the amount of current investment and, therefore, it may be regarded as a positive spur to exploration.

Undeniably, a gross depletion allowance would make exploration more lucrative than does net depletion. In terms of cost, a 25% gross depletion allowance would be more expensive to the federal treasury than is the present net depletion allowance. 5/ The objection still remains that a depletion allowance, gross or net, is applied to revenue from past discoveries and is not directly related to the rate of exploration. Any incentive that attempts to influence future activity by rewarding all the results of past performance is a watered-down incentive.

Furthermore, particularly in the context of oil and gas, the new investment need not take the form of exploration. In fact, from the previous discussion we can infer that new investment would turn to exploration only after all possibility of increasing output and profit from

known sources has been exhausted. In this sense, the depletion allowance is anti-conservationist in its effects.

Certainly, in the context of prorationing and cartelization, the incremental investment encouraged by the depletion allowance, gross or net, may be expected to take the form largely of idle short-term production capacity. Much of the benefit is dissipated by rising land costs and by the higher real costs of the marginal operations it encourages. 6/

SHAREHOLDERS' DEPLETION

This allowance was discussed under the heading "Horizontal Equity" in Chapter 3. It was concluded that the effect of this allowance is not completely capitalized in share prices and, therefore, there may be some minor incentive for individuals in high personal tax brackets to invest in the shares of mineral companies and thus indirectly to contribute to real investment in the industry. Such effects, however, must be considered as distinctly minor.

NON-OPERATORS' DEPLETION ALLOWANCE

From the standpoint of resource allocation, the 25% gross depletion allowance now permitted to recipients of royalty income from mineral extraction has no function. Except to the extent that the land has alternate uses, royalty payments are almost entirely Ricardian or pure economic rent. Such payments are significantly different from payments made for capital or labour. These are necessary costs if production is to take place. Pure rent is a residual in excess of the return necessary to induce production. 7/ To this extent, the depletion permitted on such

royalties is a pure revenue loss to the government, with no effect on investment or output.

If, as we argued earlier, the operator's depletion allowance is in part shifted back in the form of higher lease bonus and royalty payments to the vendor of mineral rights, there is irony in the fact that these higher royalties are themselves subject to a lower effective rate of tax through the non-operator's allowance.

It has also been alleged that, particularly since the 1962 revisions of section 83A permitting the deduction of lease bonus costs, certain oil companies have found it expedient to become lessors rather than operators of some petroleum properties. Where a company's current section 83A expenses exceed its current revenue, there would be no operator's depletion allowed. However, if a part of the property acquired is leased to another operator, the lessor may claim non-operator's depletion on the royalties, which allowance creates a loss carry-forward. The cost of acquiring the land may nonetheless be written off by the lessor.

The comments regarding lack of allocative function to depletion of royalties also applies to depletion on the proceeds of sale of oil properties. Depletion is not now allowed on such revenue under section 83A(5b), but it has been contended that it ought to be. Depletion on such proceeds, again, would have no effect on investment or output and may be regarded as a functionless revenue loss.

EXPENSING OF EXPLORATION AND DEVELOPMENT COSTS

We have already indicated that the advantages of rapid write-offs of exploration and development expenses are that they yield an imputed

interest saving in comparison with capitalization and recovery over an extended period of time. We have also indicated that the interests of horizontal equity and allocative neutrality require merely that all such costs be deductible against future taxable income, not that they be deductible as quickly as income is generated. 8/

However, as a positively non-neutral device whose aim it is to stimulate a greater volume of investment in the affected industries, the expensing of these expenditures represents a more efficient means than do the other devices. It has the great virtue of incorporating a direct relationship between the stimulus and the desired response. Nonetheless, as an incentive, the rapid recovery of preproduction expenses can be subject to two major criticisms.

The present expensing provisions, particularly when combined with the depletion allowance and the three-year exemption, sets up a differential advantage to some taxpayers. The beginning entity is at a disadvantage in comparison with the company with existing income. The qualifying company, whose existing income is not subject to depletion, is in the most advantageous position of all. 9/

Further, the privilege of rapid write-off applies to all stages of the mineral investment cycle from reconnaissance through development and, since the write-off of unsuccessful expenditures is limited as we have noted, there is a bias built into the general allowance that favours the development of known reserves over pure exploration. Given that the risks of failure have been greatly reduced at the development stage, the direct effect of the expensing provisions is more likely to be the

more rapid conversion of known mineral deposits than the search for new deposits. If the consequence of more rapid development of known deposits is to depress the price of the mineral or to reduce output quotas, the device may even tend to discourage the search for new deposits.

Some further mention should be made of the cost of land or mineral rights. The subject of land costs was fully treated above in relation to the discussion of horizontal equity. From that analysis, it was concluded that the expensing of land costs against income subject to tax may be expected to increase the cost of land. Nonetheless, if both sides to a land transaction are taxed in a mutually consistent manner, whether or not land costs are tax deductible will have no net impact on resource allocation, except to the extent noted in the previous paragraph that development may be encouraged at the expense of pure exploration. That is, if land costs may be written off by a purchaser over the life of a property and the capital gain on the sale is taxed in the hands of the vendor on the same rate basis, the allocation of society's resources to mineral extraction would be much the same as if the price of the land did not enter into the tax calculations of either party. However, if land costs may be expensed on an immediate basis, there is, once again, a positive advantage to mineral investment over other endeavours because of the imputed interest saving to the purchaser.

THE THREE-YEAR EXEMPTION FOR NEW MINES

Nature of the Exemption

The logic of the three-year exemption from income tax for new mines

is apparently that the prospecting costs of a successful mining venture are likely to be low relative to the costs of proving, developing and bringing the property into production, and raising funds. It is intended that the exemption from taxation of first income will provide a spur to exploration and development.

The interpretive application of the exemption was summarized at the beginning of this study. 10/ It should be noted that the exemption applies to corporations only, and to income derived from mining up to the prime metal stage. 11/ The operative section of the Act does not define a mine except by specific exclusion of "an oil well, gas well, brine well, sand pit, gravel pit, clay pit, shale pit or stone quarry (other than a deposit of oil shale or bituminous sand)". 12/ In general, the types of mineral extraction that are eligible for the deduction have been left to administrative decision, and the application of the section has been fairly well delimited by practice. 13/ The extraction of minerals either by underground or open pit excavation, and excluding the categories of "pit" noted above, is generally eligible; wells are not. Thus, oil produced from bituminous sands will presumably be eligible, but conventional oil wells are not. The extraction of potash or halite by conventional underground mining methods is eligible, and since the 1966 amendment the extraction by well from sylvite deposits also receives the three-year exemption. 14/

The income that is exempted is that "derived from the operation of a mine" and is presumed to include the value added by smelting and refining up to the prime metal stage so long as the mineral is the property of the exempted corporation. The Act provides that the exempt period shall commence "with the day on which the mine came into production". It appears that this provision has been generously interpreted. The beginning date of the exemption

is usually negotiated, and the "commencement of production" is taken to mean "production in reasonable commercial quantities". 15/

The three-year exemption is less competitive with the expensing privilege than is the depletion allowance. Exploration and development expenses and capital cost allowances of new mines may be deferred and deducted from income earned after the tax-exempt period. Or again, to the advantage of the existing mining organization, preproduction expenses may be deducted from the corporation's other income in the year incurred, without prejudicing the full deductibility of income from the new mine. 16/ In practice, then, the effective period for which a new mine is exempt from taxation may extend as long as five to seven years. 17/ Before a mine has to pay taxes, it will either have recovered most of its capital costs, or it will have closed.

As an incentive device the three-year exemption has much to commend it in preference to the depletion allowance. Like the latter, it attempts to structure incentives by altering margins; it is therefore open to the same charge of attempting to influence future behaviour by rewarding past success. But unlike the percentage allowance, its impact is related only to the early productive period of a mine and not to its lifetime profits. Hence, its primary impact is not on asset values in the entire industry, but only on those mines that are in the development phase. Being more selective, it is apt to be less wasteful than the depletion allowance, but even so it involves an element of intramarginal waste.

Short-run Effect on Production Decisions

It is apparent that the immediate effect of the three-year exemption

is to enlarge the range of known and not yet developed mineral bodies whose anticipated return is sufficient to warrant their further development. Some marginal mineralized bodies, which would not otherwise have been considered commercial ore, are thus pushed into the range of profitability. It should, however, also be noted that the exemption applies to all new mines, so that the tax foregone is measured in terms of a subsidy by taxation to all new producers. The offsetting benefit must be measured only in terms of the extended margin of profitability of properties that come into production because of the exemption, but would not otherwise have done so.

The foregoing proposition may perhaps be illustrated by reference to the hypothetical mine of Appendix F. In that example, if we abstract from the depletion allowance, and the rapid recovery of development costs, the effect of the three-year exemption on a particular mining property is illustrated by "Case 10" and "Case 11". In this example, without the three-year exemption the cash flow rate of return to the project is 12.28%. With the three-year exemption the cash flow rate of return is increased to 14.83%. Let us suppose that the minimum acceptable expected rate of return for a mineral investment at the development stage is 10%. Then this property would be developed with or without the three-year exemption, and the tax concession to this operator is a pure revenue loss to the government. If the minimum acceptable rate of return were 15%, then the property would not be developed at present metal prices with or without the exemption. Only if the minimum acceptable rate of return were between 12.18% and 14.83% would the three-year exemption make the difference between the immediate development of the property and its indefinite postponement.

Taking the entire array of mineral properties, we see that production has been increased over what it would have been without the three-year exemption only in respect of those properties whose expected rate of return is brought within the acceptable range of profitability by the concession. It is irrelevant to those properties whose expected rate of return would in any event have been sufficiently acceptable to warrant development. It is equally irrelevant to those submarginal properties which would be unprofitable with or without the concession. Viewed from the standpoint of stimulating output from known reserves, the three-year exemption is not an efficient incentive. The cost must be measured in terms of a tax subsidy to most new producers; the benefit, in terms of increased output, derives only from production which would not otherwise have taken place.

Interestingly enough, about 40% of new mines that received the exemption between 1936 and 1959 failed to survive the three-year tax-free period. 18/ Of 319 metal mines (other than placer gold operations) that were granted the exemption during this period, 128 did not operate longer than three years. We do not, unfortunately, know how many of these "failures" were independent mines and how many were associated with existing operations against which capital expenditures could be written off.

For, if a mine is a new and independent operation and fails to survive the three-year period, then the three-year exemption could not have had much relevance in the decision of the mine to proceed with development. It may be recalled that costs of exploration and development are, in any event, deductible from first income and that, therefore, the new mine would have little likelihood of paying tax in its first

three years of operation. The marginal operation of this sort has, presumably, sunk a certain amount of capital into reconnaissance and property examination. It decides to develop and produce so long as anticipated revenue from known ore will exceed the direct cost of development and extraction. The tax exemption has little relevance because the overall operation, including fixed costs, does not result in a profit.

On the other hand, to a mining organization with other income, the three-year exemption may be very lucrative, despite the fact that a new mine does not survive the three-year period. Exploration and development expenses can be written off against other income, undepreciated capital cost can be transferred to its other operations. The three-year tax exemption is thus not "wasted" when a company has revenue adequate to offset the outlays on the new mine. 19/ Not merely the possibility of offsetting the cost of new projects, but the immediacy of the write-off, adds to the advantages of the established company. In combination with the three-year exemption, the existing tax structure gives enormous advantages to an established company, particularly in regard to short-term and otherwise marginal projects. 20/

Long-run Effect on Exploration and Reserves

Discussion of the effect of the three-year exemption on primary exploration parallels the earlier analysis of general effects of tax incentives and of the depletion allowance. By increasing the potential profit of a successful exploratory venture, it may be viewed as increasing the inducement to explore. But again, it may be observed that as an incentive to explore it is indirect, and its effect on decision making at that stage must be rather vague. Conditions of supply and demand for

particular minerals, mentioned earlier, are relevant to the ultimate impact of the three-year exemption on the long-run product-mix of the economy.

But there is another sense in which the three-year exemption may be said to contribute to the discovery of new mineral reserves and this, more directly, is related to the development rather than the exploration stage.

The nature of metallic ore bodies is such that their known extent typically tends to expand as they are mined. 21/ To this extent, if the three-year exemption is the deciding factor in extending the margin of profitable development, then in such cases it may also be viewed as contributing to the expansion of reserves.

However, it also appears that properties whose success appears doubtful at the preproduction stage seldom add materially to their reserves during subsequent development. 22/ It should also be recalled that the concession is granted to all new mines. It may be concluded that the net addition to reserves generated by the three-year exemption, through extending the margin of profitable development, is probably proportionately small relative to the cost.

Conservation Effects

The fear is sometimes expressed that the three-year exemption may lead to "gutting" of a mine, that during the exempt period output will be accelerated and, more crucially, that higher grade ores will be mined, so that the eventual value of ore extracted will be diminished.

Certainly, the three-year exemption establishes a motivation to do so as far as possible. However, from evidence examined of the history of a number of recent tax-exempt mines, it appears that technical considerations severely restrict a mine's ability significantly to accelerate the rate or quality of extraction. 23/

Summary—Three-year Exemption

It may be concluded that, where the three-year exemption is competitive with the write-off of exploration and development expenses, as it is in the case of a short-lived, independently owned property, it adds little to the profitability of a mine. Where it is applied on top of the write-off, it may add substantially to the profitability of development, especially where the write-off is obtained immediately against other income. Thus, its most potent impact is on a short-term project that is associated with an existing mine.

In terms of costs, the exemption is applied to all new mines whether or not their development would have taken place in its absence. In terms of benefits, the production for which the exemption is directly responsible includes only those properties which would otherwise have returned less than the minimum acceptable profit.

To the extent that the exemption increases the expected profit from successful mines, it may also have some influence on the extent of exploration activity, although expectations at the prospecting stage are so vague that the incentive effect of the exemption on primary exploration must be somewhat diluted. However, since the exemption is

more selective than the depletion allowance and is applied at a stage closer to primary exploration, its impact is less apt to end with an increase in capital values of known deposits and is more likely to invoke a shift of new investment into the industry than is the depletion allowance.

Where the exemption is the determining factor in the development decision, it may also contribute to the expansion of total known reserves. Nonetheless, properties whose success appears doubtful at the preproduction stage do not appear to add materially to their reserves during subsequent development.

The three-year exemption creates an incentive to mine rapidly and perhaps selectively. However, technical considerations severely restrict a mine's ability to do so. Evidence suggests that it does not significantly hasten the exhaustion of mineral deposits or the amount of contained metal that is extracted.

PROSPECTORS' AND GRUBSTAKERS' EXEMPTION

The exclusion from income subject to tax of receipts earned from the sale of mining properties by prospectors and their backers is, as we have noted, not very costly in terms of revenue foregone. How effective it is in promoting exploration is, however, a matter of considerable doubt.

Much has been made in recent writing on the subject of mineral exploration of the decline of the independent prospector. 24/ There is no doubt that, as prospecting becomes more and more a matter of finding mineral deposits that are completely overlaid by soil and water, using

expensive geophysical, geochemical and airborne techniques, the independent prospector and the small exploration company are being rapidly outpaced.

Yet, the extent of the eclipse of the individual prospector may be exaggerated. In an interview with a member of this Commission's staff, the manager of the exploration division of one of Canada's major mining companies expressed the view that the practical, "visual" approach of an experienced prospector is particularly valuable when an area has been narrowed down. The view was expressed, however, that the usefulness of the individual prospector, at least so far as the major exploration company was concerned, was in locating smaller, more valuable deposits, as, for example, in the case of gold; in delimiting a more massive deposit his usefulness was restricted.

Industry sources suggest that the prospectors' and grubstakers' exemption is not too successful in encouraging mineral exploration. One brief before the present Commission, which takes up in detail the case of the independent prospector, suggests that increasing the size of the possible reward for success (as do the present sections 83(2) and 83(3)) has not nearly the incentive effect that a tax provision to reduce the possible losses from the much more likely chance of failure would have. 25/ This conclusion may be open to some doubt in view of our previous conjectures on the nature of risk perspectives, but in any event our observations were not conclusive. 26/

The present section 83A restricts the rights of individuals and non-qualifying corporations to deduct prospecting expenditures from income subject to tax. In effect, the only way a prospector or his backer

(assuming that the latter is not a qualifying corporation already engaged in mining or an allied business) can recover such expenses against income subject to tax is by being successful. If he is successful and does not make a tax-free sale of the property, then he has the alternative of recovering his costs against future income under Regulation 1205. 27/ The exclusion from taxation of the proceeds of a successful exploratory effort, then, has an equity as well as an incentive purpose. The additional reward to successful exploration may be viewed as in some sense compensating the prospecting industry at large— if not specific individuals— for those real costs of mineral exploration which are not deductible from income subject to tax.

This is rough justice at best, and consideration of horizontal equity would be better served if the right to offset exploration losses against general income were extended to individuals and non-qualifying corporations. However, if this were done the present prospectors' and grubstakers' exemption would be open to serious abuse. Since it would then be exclusively an incentive device whose value is open to doubt, there would be little reason for its retention.

Even at present, it is said that the exemption of grubstakers' property sales from taxation abets certain abuses of promotional stock selling. 28/ But if grubstaking expenses were deductible at an individual's highest marginal tax rate and, in addition, the proceeds of the venture were tax free, abuses would surely multiply.

REFERENCES

1/ The impetus to iron ore development in Canada in the last decade is due in part to increases in demand due to the depletion of United States deposits, but equally it is due to technological advances in iron ore beneficiation which has made feasible the exploitation of low-grade iron formations that formerly were uneconomic.

2/ In April of 1965, W.S. Kirkpatrick, Chairman and President of Consolidated Mining and Smelting, warned that the intensive current build-up of Saskatchewan potash facilities could result in a period of surplus world supply and lower prices, despite the rising trend of world consumption. (Globe and Mail, Toronto, July 23, 1965, p. B1.)

3/ The foregoing verbal argument is developed with greater rigour in an algebraic exercise found in Appendix D. Appendix D uses seven hypothetical rules for tax computation to illustrate the effect of a "net depletion" allowance and provisions for writing off the cost of capital expenditures on each other and on the margins of investment.

4/ In regard to mine development, however, the depletion allowance is competitive with the three-year exemption.

5/ It may be demonstrated that any company, whether exploring or not, would retain more income under the gross allowance proposed than under present net depletion, so long as operating costs exceed 25% of gross producing revenue. From oil industry data, it appears that in petroleum operating costs, exclusive of depreciation, are on average about 25% of gross producing revenue. With depreciation they are considerably higher. We conclude that most petroleum operators would be better off under the proposed gross allowance, whether or not they were exploring.

6/ A confirmatory view of the effect of the U. S. gross depletion allowance is well argued in Kahn, op. cit., pp. 310-311.

7/ A full discussion of the application of percentage depletion to landowners' royalties is to be found in Stephen L. McDonald, National Tax Association 1962 Proceedings, op. cit., pp. 375-376.

8/ It may be indicative of the "correct" depreciation period for the capital cost of mining, in the sense of horizontal equity, that for purposes of applying the Emergency Gold Mining Assistance Act, the Mines Department permits a 15% write-off (depreciation, exploration, preproduction) on a straight-line basis.

9/ The differential impact of the expensing provision on new ventures as against those with existing mineral income is illustrated in two hypothetical numerical examples, worked out in Appendix E, for oil and gas, and in Appendix F for metal mining.

10/ See p. 11.

11/ Section 83(5). But the Act does not specify "prime metal stage".

12/ Section 83(6).

13/ Practical considerations that enter into the definition of a "mine" are discussed in Rounding, "What is a Mine?", op. cit., pp. 194-198.

14/ It should also be noted that placer gold mining is considered eligible for the three-year exemption, and that each separate "dredge" is considered a separate mine. Placer operations also qualify for Emergency Gold Mining Assistance.

15/ Rounding, op. cit., p. 180.

16/ The three-year exemption is, to some extent, competitive with the depletion allowance. That is, if there were no three-year exemption, total depletion allowed would be greater. The longer lived the mine, the more important the depletion becomes and the less "competitive" with the three-year exemption.

17/ The influence of these factors on rates of return to a hypothetical mine is illustrated in a numerical exercise on comparative rates of return, presented in Appendix F.

18/ See Statistical Appendix A, Table A-7.

19/ The difference this makes to rates of return of a mine of a specific size and life is illustrated in Appendix F.

20/ One special category of short-term project is the "satellite" mine, where an existing producer with large land holdings develops an outlying portion of his property as a "new" mine, mines it so long as it is tax free, uses his existing milling facilities, and charges development to his other income. When the tax exemption ends, he moves on to another area of mineralization and repeats the process. The three-year exemption is more productive of profit than are the expensing privileges because capital costs are not very large inasmuch as treatment facilities already exist in the parent mine. Yet the exemption applies to profits derived from the integrated operation through the prime metal stage.

It is doubtful whether the three-year exemption, in the case of satellite mines, has any relevance to the decision of whether or not to develop. The parent mine has existing overhead capital in the form of treatment facilities. So long as expected returns from the satellite cover the direct costs of developing it, the mine would in any case have been brought into production.

21/ In this connection see Grenier, Canadian Mining Journal, op. cit., pp. 47-48. Also cf. James Boyd, The Mines Magazine, op. cit., p. 33.

22/ Grenier, op. cit., p. 48.

23/ In this connection the assistance of Mr. E. C. Hodgson of the Mineral Resources Division, Department of Mines and Technical Surveys, is gratefully acknowledged.

24/ For example, see John Davis, Mining and Mineral Processing in Canada, Royal Commission on Canada's Economic Prospects, Ottawa, October 1957, p. 287. Also cf. Preston, op. cit., p. 32.

25/ Saskatchewan Chamber of Mines submission to the Royal Commission on Taxation, March 4, 1963, p. 8.

26/ See p. 71.

27/ This discussion is concerned only with prospecting for a mine. Oil and gas exploration does not carry the right to sell the property free of tax. On the other hand, the right of individuals and non-qualifying corporations to deduct costs of oil and gas exploration is also circumscribed, although somewhat differently, as noted in the early part of this study.

28/ The promotional opportunities abetted by the grubstakers' exemption are more than an unfortunate but necessary by-product of the search for mines. (Cf. also reference No. 8 to Chapter 5, above.) To the extent that "mining" the grubstakers' exemption becomes an end in itself, it may detract from genuine exploration effort and impose a needless waste of resources, or at best it may involve a transfer from the public at large to the grubstaker with no other impact on resource allocation.

It is not uncommon for an individual to employ a prospector for a relatively short period of time and "through the employee's efforts" to acquire a mining property, which may or may not have potential value. He will then sell this property to a corporation formed for the purpose, taking back, say, 20% of its authorized shares, referred to as "vendor's shares". An underwriting corporation (with which the individual may be closely connected) then makes a market for the remaining 80% of the shares in the course of which the individual sells the 20% which he has acquired. This 20% qualifies for the grubstaker's exemption under 83(3) and is not caught by the restriction in 83(4) because the individual has not himself carried on the "campaign to sell shares to the public". Alternatively a corporation controlled by the individual may acquire the vendor's shares and the market promotion will then be carried on by the individual.

CHAPTER 8— CONCLUSIONS

EQUITY AND NEUTRALITY

In so far as it is practically possible for a tax system to be horizontally equitable and allocatively neutral, such a system would tax the extractive industries in a manner that took account of all of their capital costs including sums expended on abortive exploration efforts.

Considerations of equity and neutrality do not require, however, that such costs be deductible on an accelerated basis.

So far as land costs in mineral extraction are concerned, there is no effect on the allocation of resources if both the buyer and the seller of mineral rights are taxpayers, and if the proceeds are taxed and the costs are amortized against income subject to tax. However, if the vendor is a provincial government, then the effect is that of a revenue transfer from the federal to the provincial treasury.

On the other hand, if land costs are not deductible and the proceeds not taxable, there is equally no allocative impact.

THE OBJECTIVES OF NON-NEUTRALITY

In general, public policy toward the extractive industries has been directed toward the immediate prosperity of those industries, with little concern for the effects of the policy on the prosperity of the nation or for the goals that a minerals policy might properly be meant to achieve.

Failing policy objectives that imply a conscious diversion of resources to mineral extraction, the forces of the market should determine the direction of investment. However, there may be valid objectives that require such a diversion. If so, the measure of success of the actions undertaken is the extent to which they change the patterns of investment and output.

We concluded that policy objectives that could be defended included a concern with the size and stability of the reserve base and considerations of regional development.

So far as reserves are concerned, minerals are not a homogeneous entity. In many cases known reserves are adequate for many years to come. In such cases the risk element that may be associated with exploration, and the time lags from exploration to production, are not operative constraints. Investment in further developing these reserves should be left to market forces.

The last statement may be qualified by the special problems of depressed communities whose mineral base is faced with economic extinction. Aid to such regions properly includes subsidization of the industry concerned. But such subsidization should be on a short-term basis. Long-run solutions demand a shift of resources from the declining industries. In any event, the subsidy should be an amount that is adequate to the task and, if such is the case, there is no need for the additional subsidy through taxation that is the essence of the gross depletion allowance granted to the gold and coal mining industries.

Where the market for a mineral is organized in the form of an effective monopoly or a cartel, or through vertically integrated channels, there appears to be little need for public concern with exploration and reserves, since this problem is settled within the institutional framework of the industry concerned.

It should perhaps be emphasized that steeply increasing costs of exploration are not an adequate argument in favour of special treatment. In fact, they create a presupposition that, if further exploration is subsidized, the subsidy will be largely wasted.

Concern with regional development requires measures to favour investment in those regions. Present concessions to the extractive industries do not give a differential preference to any particular region and, hence, do not alter the pre-tax advantages of more accessible areas. Regional subsidies to all industry in a specified area may be considered. However, in the far north provision of transportation and the amenities of civilization are probably more effective than are tax concessions.

RESULTS OF THE PRESENT TAX CONCESSIONS

The present tax concessions granted to the extractive industries are more than is required in the interests of equity and are inefficient as devices for shifting the allocation of resources.

There is little, for example, to commend the net depletion allowance either as a capital recovery device or as an incentive to further investment. Its removal would reduce the anomalies that now exist between different classes of taxpayers resulting from the differential

impact of section 83A deductions in combination with the depletion allowance.

The non-operator's allowance is a pure waste from the standpoint of resource allocation. Shareholder's depletion is almost equally ineffective.

The three-year exemption is probably more effective in channelling funds to mineral development but it, too, is inefficient as an incentive in that it reduces the effective tax on all new mines, whether or not it has induced behaviour different from that which would have taken place without it. In combination with the expensing of preproduction costs, it sets up differentials between classes of taxpayers.

As an inducement to invest, the provisions for expensing exploration and development costs are the most efficient of the present tax concessions. Objections to them, as conscious incentives, arise from their differential impact on different taxpayers and on their applying to development equally with exploration. The latter feature, in combination with the market structure of crude oil, gives impetus to the drilling of excess productive capacity—a pure waste of economic resources.

In the context of technical advances in prospecting, the prospectors' and grubstakers' exemption is of limited value in uncovering new mineral bodies. It is also open to a certain amount of abuse. It may well be that if the proceeds of such sales were taxed and, instead, the right to offset exploration losses by individuals and non-qualifying corporations were extended, the alternative might be more productive of exploratory effort. The latter alternative would also correct the one

major inequity in the present capital recovery provisions that apply to the mineral industries.

ENCOURAGEMENT OF EXPLORATION

From the foregoing it appears that, if there is a public concern that the mineral reserve base is inadequate, the most efficient tax concession would be one that operates through the expensing of exploration costs. If such write-offs against income from any source were permitted on an immediate basis, there would be a positive inducement to invest in exploration that would exceed the requirements of neutrality. If the depletion allowance and the three-year exemption were eliminated, the expensing of exploration costs would affect all taxpayers in a more nearly equal manner. 1/ If still greater incentive to discovery were deemed necessary for specific minerals at a specific time, consideration might be given to permitting tax write-offs in excess of expenditures. This type of incentive could also be applied on the basis of specific regions.

A distinction must be made between the tax treatment of exploration and of development. If the expensing of development costs were changed to a form of time-table depreciation, the emphasis of the expensing allowance would be placed on primary prospecting and property examination where the strongest case can be made for a government policy that overrides the operations of ordinary market forces. If there are extraordinary risks in mineral investment compared with the market economy at large, the differential risk must be presumed as less pronounced during the development phase. Any adverse impact on the industry of unusually high abortive expenditures at the development stage can be mitigated by a

liberal construction of tax write-offs in the event of purchase or merger. But it is recognized that, in practice, it is difficult to distinguish between expenditures made for exploratory purposes and those made for development. Operative rules would have to be developed to make the distinction unambiguous.

It should be observed that tax concessions are a form of subsidy, and not the only form which a subsidy to a particular industry may take. The objection to any tax write-off is that it tends to become fixed in the tax structure after the need for it has passed. If excess write-offs are granted, they should be confined to those periods and to those minerals where reserves are being utilized at a faster rate than they are being replaced, but where geological considerations indicate an untapped potential.

An alternative to tax incentives is a direct public subsidy of exploration (and if the need be felt, of development) at particular times or places or for particular minerals. Interest-free loans are another alternative if there is evidence of a shortage of capital that is available to the industry. These alternatives have the advantage that conscious interference with the market allocation of resources is brought into the open and subject to a more continuing scrutiny. 2/

REFERENCES

1/ But the beginning entity would still be at a disadvantage in comparison with a taxpayer with existing income.

2/ See Walter W. Heller, "Some Observations on the Role and Reform of the Federal Income Tax", 1959 Compendium, op. cit., Vol. 1, pp. 190-191.

APPENDIX A

TABLE A-1 - ESTIMATED REVENUE FORGONE DUE TO PERCENTAGE ALLOWANCE TO OPERATORS AND NON-OPERATORS, CANADA

Tax Year	Total Depletion Claimed. All Corporations Except those in Industrial Classifications Claiming Depletion on a Unit of Production Basis millions of dollars	Effective Maximum Federal Tax Rate	Corporation Tax Savings Due to Percentage Allowance millions of dollars
1948	71.1	30%	21.33
1949	62.5	(1/3)30%;(2/3)33%	20.00
1950	82.0	33%	27.06
1951	101.5	(1/3)38%;(2/3)46.5%	44.32
1952	85.0	(1/3)45%;(2/3)52%	42.21
1953	80.0	(1/3)52%;(2/3)49%	40.00
1954	84.8	49%	41.55
1955	112.3	(1/3)49%;(2/3)47%	53.53
1956	147.7	47%	69.42
1957	126.4	47%	59.41
1958	93.6	47%	43.99
1959	118.9	(1/3)47%;(2/3)50%	58.26
1960	101.7	50%	50.85
1961	107.0	50%	53.50
14 years	1,374.5		625.43

Source: Taxation Statistics, 1950 to 1963, Department of National Revenue.

Notes:
1. Tax rate applied in the table is the federal tax rate on the highest portion of corporate income.
2. Since data are based on taxation years, for purposes of designating an effective tax rate it is assumed that the "mean" tax year ends on August 31 of the relevant calendar year.
3. Table does not make allowances for credits for provincial corporation tax. Hence, it is a better approximation of the "advantage" received by corporate owners of mineral resources, than of revenue forgone by the federal government.

TABLE A-2 - PROFITS OF TAX-EXEMPT MINES

Claimed under Three-Year Exemption,
Canada, Taxation Years 1950 to 1961

	millions of dollars	
Taxation Year	Profit Companies	Loss Companies
1950	19.9	0.5
1951	26.0	0.7
1952	14.0	0.3
1953	7.4	0.9
1954	18.1	1.3
1955	16.8	0.1
1956	87.6	0.6
1957	106.1	0.3
1958	109.9	6.2
1959	92.3	7.6
1960	109.8	0.2
1961	90.4	
1962	116.3	

Sources: 1950-1954: Taxation Statistics, 1952 to 1956, inclusive;
1955-1962: Department of National Revenue;
Dominion Bureau of Statistics.

TABLE A-3 - ASSISTANCE TO GOLD MINES, CANADA FROM INCEPTION TO 1962

Estimated Assistance Payable under the Emergency Gold Mining Assistance Act */

	Estimated Assistance Payable
1948	$ 10,546,316
1949	12,571,457
1950	8,993,491
1951	10,728,504
1952	10,845,979
1953	14,680,110
1954	16,259,179
1955	8,885,479
1956	8,667,235
1957	9,679,753
1958	11,420,464
1959	12,001,753
1960	12,362,518
1961	12,842,520
1962	14,697,941

Source: Report on the Administration of the Emergency Gold Mining Assistance Act, Department of Mines and Technical Surveys, Ottawa, 1964.

*/ E.G.M.A. Act came into force by proclamation, June 15, 1948.

TABLE A-4 - COAL SUBVENTIONS PAID - CANADA

1948-1962

Year	Tonnage	Amount
1948	1,724,154	$ 1,620,487
1949	2,429,692	3,431,745
1950	2,132,970	2,619,915
1951	3,135,523	4,455,629
1952	2,712,762	6,530,103
1953	2,678,850	7,218,838
1954	3,875,221	12,133,290
1955	3,612,150	10,693,108
1956	3,595,993	9,596,827
1957	3,221,681	8,942,253
1958	3,027,344	9,549,923
1959	2,726,466	13,420,799
1960	2,986,310	16,344,196
1961	3,332,703	17,854,456 a/
1962	3,081,029	17,433,355

Source: D.B.S.

a/ Includes $500,000 paid by the Nova Scotia Government as its share of the joint cost of certain Nova Scotia subvention payments.

TABLE A-5 - COAL BOUNTIES PAID */ - CANADA

1948-1962

Year	Tonnage	Amount
1948	712,150	$352,514
1949	740,288	366,443
1950	830,752	411,222
1951	810,608	401,251
1952	698,449	345,732
1953	773,102	382,685
1954	492,196	243,637
1955	603,134	298,551
1956	654,620	324,037
1957	765,352	378,849
1958	557,445	275,935
1959	604,234	299,096
1960	693,581	343,323
1961	457,950	226,685
1962	420,036	207,918

Source: D.B.S.

*/ Payment of 49.5 cents per ton of bituminous coal mined in Canada and converted into coke to be used in the Canadian manufacture of iron and steel. (Paid from 1930 on.)

TABLE A-6 - COSTS OF PROSPECTING BY METAL MINING COMPANIES

(thousands of dollars)

Year	Placer Gold Mines	Gold Quartz Mines	Copper-Gold-Silver Mines	Silver-Cobalt Mines	Silver-Lead Zinc Mines	Nickel-Copper Mines	Misc. Metals & Mines	Total of Metal Mining
1943	N.A.	724	155	N.A.	N.A.	N.A.	N.A.	
1944	N.A.	1,320	197	N.A.	304	N.A.	N.A.	
1945	N.A.	4,450	373	N.A.	322	N.A.	N.A.	
1946	N.A.	6,417	890	N.A.	299	N.A.	N.A.	
1947	N.A.	4,184	352	N.A.	329	N.A.	N.A.	
1948	N.A.	2,496	800	29	449	806	514	5,095
1949	66	3,211	549	37	952	586	1,013	6,415
1950	61	2,759	801	86	575	614	457	5,353
1951	21	2,414	1,195	36	968	3,123	1,419	9,176
1952	12	2,567	1,740	106	2,268	5,124	1,760	13,578
1953	33	2,573	2,515	64	3,594	6,743	2,311	17,833
1954	35	3,400	3,189	25	6,844	6,786	6,537	26,815
1955	25	1,471	7,147	87	3,192	8,344	6,663	26,929
1956	32	4,265	18,316	111	3,571	13,310	8,795	48,400
1957	75	3,370	17,546	9	2,782	12,221	18,421	54,424
1958	91	2,246	10,239	10	1,351	13,895	4,674	32,507
1959	65	3,649	22,227	88	1,560	8,512	6,917	43,018
1960	119	3,815	19,105	27	5,603	9,411	5,474	43,554
1961	99	3,663	18,367	96	7,052	8,828	5,380	43,485

Source: D.B.S., Industry and Merchandising Division.

Notes: N.A. - Not Available.

The amounts shown are expenditures incurred by mining companies as classified by their main type of metal mining activity. These expenditures, however, apply to prospecting conducted by such companies in all sectors of the mineral industry.

Totals may not add due to rounding.

TABLE A-7 - LENGTH OF OPERATION OF TAX-EXEMPT MINES

(Exclusive of placer gold operations)

Year	Number of Exemptions Granted	Subsequent Length of Operation to 1963			
		More than 3 Years	More than 6 Years	More than 15 Years	Still Operating in 1963
1936	10	9	8	4	2
1937	14	6	5	4	3
1938	21	17	11	7	6
1939	25	14	7	3	3
1940	20	7	4	4	4
1941	11	4	3	1	0
1942	13	3	1	1	1
1943	7	2	2	2	2
1944	3	1	0	0	0
1945	4	2	2	2	2
1946	0	0	0	0	0
1947	9	5	4	3	3
1948	13	8	6	2	2
1949	19	14	13	-	7
1950	13	7	6	-	5
1951	11	4	4	-	1
1952	18	10	6	-	4
1953	9	5	3	-	1
1954	16	12	8	-	7
1955	15	14	11	-	11
1956	15	14	12	-	11
1957	14	7	-	-	6
1958	26	14	-	-	12
1959	15	12	-	-	12
1960	14	-	-	-	11
1961	11	-	-	-	11
	344				127

Source: Mineral Resources Division, Department of Mines and Technical Surveys.

TABLE A-8 - REVENUE TO THE PROVINCE OF ALBERTA FROM DISPOSITION OF CROWN MINERAL RIGHTS, WITH COMPONENTS OF "SALE OF CROWN RESERVES" CATEGORY, 1947-1964

(in thousands of dollars)

Year	Sale of Crown Reserve						Rentals	Royalties	Total Revenue
	P. & N.G. Leases	P. & N.G. Reservations	Drilling Reservations	Natural Gas Licences	Natural Gas Leases	Sub-total Sales			
1947							564	766	1,330
1948	3,142					3,142	2,019	1,379	6,540
1949	19,166	597				19,763	5,019	3,276	28,057
1950	36,260	-				36,260	8,585	4,852	49,697
1951	13,680	1,398				15,079	14,406	10,001	39,485
1952	22,357	35				22,393	17,952	12,861	53,206
1953	17,597	3,699		1,239	232	22,767	21,074	16,342	60,183
1954	23,811	32,888	7,245	876	31	64,851	24,402	19,668	108,921
1955	40,259	13,545	8,259	303	9	62,375	20,478	26,104	108,956
1956	66,730	1,104	3,858	962	7	72,660	24,959	35,434	133,053
1957	40,366	15,622	11,503	714	15	68,220	30,102	36,038	134,360
1958	26,944	10,681	11,882	996	580	51,082	30,064	24,295	105,440
1959	50,203	5,778	14,241	1,304	303	71,828	32,254	27,331	131,413
1960	39,564	1,469	9,227	3,649	56	53,964	31,992	27,540	113,496
1961	31,421	479	10,660	1,165	907	44,631	30,861	35,432	110,924
1962	16,049	3,312	11,212	2,515	67	33,154	38,476	47,990	119,620
1963	26,131	1,444	18,777	179	117	46,647	37,792	55,139	139,579
1964	59,516	1,573	23,660	-	71	84,820	42,771	60,854	188,445
18-year Totals	533,195	93,624	130,524	13,901	2,394	773,634	413,769	445,301	1,632,704

Source: Province of Alberta, Department of Mines & Minerals; Alberta Oil & Gas Picture, 1947-1962, and Oilweek.

Notes:
1. Totals may not add due to rounding.
2. These data are computed on the basis of the calendar year, and are therefore not comparable to Public Accounts Statistics.

TABLE A-9 - CORPORATE DEBT/EQUITY RATIOS IN MINING AND MANUFACTURING, 1961

Industrial Division	Debt/Equity Per Cent
Mining, Quarrying and Oil Wells	
Gold Mining	4.1
Other Metal Mining	21.7
Coal Mines	21.2
Oil and Natural Gas (Primary)	30.7
Other Non-metal Mines	6.2
Quarries	16.0
Mining, Unclassified	0.9
Prospecting and Contract Drilling	25.2
TOTAL: Mining, Quarrying and Oil Wells	20.7
Manufacturing	
Food and Beverages	9.8
Tobacco and Tobacco Products	13.5
Rubber Products	4.5
Boots, Shoes and Leather Products	10.2
Textile Products	9.6
Hosiery and Knit Goods	10.7
Clothing and Fur Goods	5.2
Sawmills and Wood Products	24.2
Furniture	13.1
Pulp and Paper Mills and Paper Products	18.9
Printing and Publishing	21.1
Iron and Steel, and Metal Smelting and Refining	49.7
Metal Fabricating	11.0
Machinery	13.6
Motor Vehicles, and Transportation Equipment	3.9
Electrical Equipment and Appliances	10.7
Cement, Clay, Stone, and Glass Products	24.2
Petroleum Refineries and Coal Products	18.6
Chemicals	19.5
Miscellaneous Manufacturing	7.1
TOTAL: Manufacturing	18.5

Source: Taxation Statistics, 1963, Section III, Table 4.

TABLE A-10 - NET OUTPUT PER PERSON EMPLOYED, BY INDUSTRIAL CLASSIFICATION

Canada, 1961

Industry	Gross Domestic Product at Factor Cost (millions of dollars)	Labour Force	Net Output per Person Employed (dollars)
Agriculture	1,547	640,786	2,414
Forestry	379	108,580	3,491
Fishing and Trapping	102	36,263	2,813
Mining, Quarrying, Oil Wells	1,499	121,702	12,317
Manufacturing	8,592	1,404,865	6,116
Construction	1,780	431,093	4,129
Transportation	2,173	385,031	5,644
Storage	89	17,677	5,035
Communication	787	130,074	6,050
Electric, Gas and Water Utilities	1,157	70,504	16,410
Wholesale Trade	1,531	289,884	5,281
Retail Trade	3,134	701,606	4,467
Finance, Insurance, Real Estate	2,539 a/	228,905	11,092
Public Administration and Defence	2,523	482,925	5,224
Service	4,549	1,263,362	3,601
Total	32,381 a/	6,313,257 b/	5,129

Source: National Accounts Income and Expenditure, D.B.S.; Census of Canada, 1961, Vol. III - 2, D.B.S.

Notes: a/ Finance, Insurance and Real Estate, and total GDP have been adjusted downward to compensate for imputed residential rent which is included in the usual gross domestic product.

b/ Undefined labour force has been deducted.

TABLE A-11 - LABOUR FORCE, CANADA, 1961

MINING, QUARRYING AND OIL WELLS, AND SOME SELECTED RELATED CATEGORIES

Industrial Classification	Labour Force
Total, All Industries	6,471,850
Mines, Quarries, Oil Wells (Total)	121,702
Metal Mines (Subtotal) a/	68,931
Placer Gold Mines	651
Gold Quartz Mines	16,516
Copper-Gold-Silver Mines	12,140
Nickel-Copper Mines	17,671
Silver-Cobalt Mines	601
Silver-Lead-Zinc Mines	4,427
Uranium Mines	6,040
Iron Mines	10,026
Other Metal Mines	859
Mineral Fuels (Subtotal)	19,765
Coal Mines	12,451
Petroleum and Gas Wells	6,133
Natural Gas Processing Plants	1,172
Oil Shale and Bituminous Sand Pits	9
Non-metal Mines, Except Coal (Subtotal)	11,465
Asbestos Mines	6,850
Gypsum Mines	673
Salt Mines	972
Other Non-metal Mines	2,970
Quarries and Sand Pits (Subtotal)	6,120
Stone Quarries	2,641
Sand Pits or Quarries	3,479
Services Incidental to Mining (Subtotal)	15,421
Petroleum Prospecting	4,459
Other Prospecting	1,281
Contract Drilling, Petroleum	4,901
Other Contract Drilling	2,317
Other Services Incidental to Mining	2,462
Manufacturing Industries (Total)	1,404,865
Smelting and Refining, Metal	24,286
Petroleum Refineries	16,036
Other Petroleum and Coal Products	923
Transportation, Communication and Other Utilities (Total)	603,286
Pipeline Transport	2,991

Source: Census of Canada, 1961, Vol. III, Part 2, D.B.S.

a/ Includes milling; excludes smelting and refining.

TABLE A-12 - TOTAL WAGES, SALARIES AND SUPPLEMENTARY INCOME RESULTING FROM THE PRODUCTION OF A DOLLAR'S WORTH OF FINAL OUTPUT OF SELECTED INDUSTRIES, CANADA, 1949

Industry	Wages, Salaries and Supplementary Income Resulting from a Dollar's Worth of Final Output in the Relevant Industry Dollars
Agriculture	.166
Forestry	.515
Metal Mining and Smelting and Refining	.411
Coal Mining, Crude Petroleum and Natural Gas	.543
Non-metal Mining, Quarrying and Prospecting	.493
Meat Products	.288
Grain Mill Products	.363
Alcoholic Beverages	.299
Rubber Products	.433
Clothing	.438
Furniture	.510
Wood Products	.538
Paper Products	.441
Printing, Publishing and Allied	.561
Primary Iron and Steel	.423
Agricultural Implements	.476
Iron and Steel Products	.472
Transportation Equipment	.418
Non-ferrous Metal Products	.467
Products of Petroleum and Coal	.211
Chemicals and Allied Products	.342
Miscellaneous Manufacturing	.423
Construction	.536
Transportation, Storage and Trade	.526
Electrical Apparatus and Supplies	.448
Non-metallic Mineral Products	.414
Communication	.578
Electric, Gas and Water Utilities	.323
Finance, Insurance, Real Estate	.287
Service Industries	.611

Source: Supplement to the Inter-Industry Flow of Goods and Services, Canada, 1949, D.B.S., October 26, 1959, Table 3B.

TABLE A-13 - LABOUR FORCE, MINING, QUARRYING AND OIL WELLS, BY PROVINCES, 1961

	Labour Force in Mining, Quarrying and Oil Wells	Mining, Quarrying and Oil Wells Labour Force as % of Total Labour Force of the Region
Canada	121,702	1.88
Newfoundland	4,293	3.82
Prince Edward Island	4	0.01
Nova Scotia	10,105	4.27
New Brunswick	1,628	0.91
Quebec	25,854	1.46
Ontario	42,660	1.78
Manitoba	5,620	1.64
Saskatchewan	4,007	1.23
Alberta	17,350	3.54
British Columbia	8,179	1.42
Yukon Territory	1,010	16.18
Northwest Territories	992	13.31

Source: Census of Canada, 1961, Vol. III, Part 2, D.B.S.

APPENDIX B

TAX REVENUE FORGONE DUE TO RAPID WRITE-OFFS OF MINERAL EXPLORATION AND DEVELOPMENT

AN APPROXIMATION OF CORPORATION TAX OTHERWISE PAYABLE WHICH IS INDEFINITELY DEFERRED EACH YEAR IN CANADA

Introduction

It was explained in the text that the advantages of rapid write-offs stem from the interest factor on the deferred tax obligation of each taxpayer. The government is, in effect, "lending" money free of interest. It was, however, also noted that in a growing industry this "loan" need never be repaid.

From the data we have available it is not possible to estimate the full benefit of rapid write-offs to the extractive industry, inasmuch as the full benefit depends on the cumulation to date of excess expenses deferred, as well as on a measure of the period of deferment and on the opportunity cost of capital to each firm.

It was, however, possible to make an estimate of the annual increment in the government's "loan" to the industry. In a growing industry, the payment of these deferred taxes may be postponed indefinitely, and it is the annual increase in the deferment that we are attempting to measure. Even here our measure cannot be exact because it depends on the assumption made about the true period over which a given investment yields an economic return.

Method

1. We assume that capital expenditures, which are subject to write-off, are a linear function of time

$$X_t = a + bt, \text{ where } X_t \text{ is the expenditure at time } t.$$

The actual write-off at time t is then a + bt.

But, if the expenditure, in fact, yields a return over n years, depreciation at time t should be $\frac{1}{n}$ times the expenditures for the n years ending in year t, or depreciation $= \frac{1}{n} \sum_{i=t-n+1}^{t} X_i$

$$= a + bt - \frac{b}{n} \left\{1 + 2 + \ldots + (n - 1)\right\}$$

$$= a + bt - \tfrac{1}{2}b(n - 1).$$

"Excess" depreciation allowed through write-offs is then $\frac{1}{2}b(n-1)$.

If the effective tax rate is 50%, the tax benefit of the excess write-off, in terms of the annual increment to the industry's tax-deferred reserve is $\frac{1}{4}b(n-1)$.

Obviously, if b is positive, the loan to the industry grows each year. If b = 0, the "loan" remains constant. If b is negative, the amount of the outstanding loan is being recouped by the government.

2. For the extractive industries as a whole, annual write-offs are in fact climbing, and it was found that a linear function gave a good approximation of the trend.

We regressed "Write-off Mine Development" per Taxation Statistics, for the total of mining, oil wells, and petroleum refining, for the taxation years 1952 to 1961, over time, and thus obtained an estimate of b in the

foregoing model. Our estimate of the regression slope, b, is 17.347 million dollars. (r^2 was .837.)

Applying this estimate to the formula above, the annual increment to the industry's total tax deferral reserve, the final estimate of the revenue cost of rapid write-offs is seen to depend on the magnitude assumed for n, the correct number of years over which the investment should have been amortized.

Thus, for different values of n, we get the following annual tax revenue forgone.

n, in years	Amount of Taxes Indefinitely Foregone, Per Annum, Due to Rapid Write-off of Exploration and Development Expenses
	millions of dollars
5	17.3
10	39.0
15	60.7
25	104.1

APPENDIX C

MEASUREMENT OF CAPITAL INTENSITY

In order to test the oft-made assertion that mineral extraction is capital intensive relative to most forms of economic activity, or the more extreme statement that it is the most capital intensive sector of the economy, we should compare capital/output ratios in mineral extraction to those of other sectors of the private economy.

Ideally, since, as emerges in the text of the study, we do not regard the extractive industries as a homogeneous group, we should also have ratios for at least the broader divisions of mineral extraction. Unfortunately, data, especially for such a finer division, are not readily available.

The appropriate measure of industry output is the gross domestic product, at factor cost. Gross domestic product for industry groupings, at a satisfactory level of disaggregation, and in terms of constant 1949 dollars, can be derived from Dominion Bureau of Statistics publications. 1/

The choice of an appropriate measure of the capital stock for each industrial division is more difficult. The first choice that must be made is between a measure of gross and of net stock. We chose gross capital employed in the industry as being more appropriate in appraising capacity and productivity of capital goods in place in any time. 2/ We also chose to omit a measure of investment in land because, as argued in the text of the study, land costs are themselves determined by expected returns. They are therefore not relevant to the purpose at hand which is to measure the capital intensity that is relevant to the forward shifting of the income tax burden.

The gross capital stock is not directly available. Data from Taxation Statistics are not of direct relevance because they are compiled on a firm basis, whereas the output data are on an establishment basis. We did use them in an approximation of the disaggregation of the mining sector, as described below. However these data, the results of which appear in Table C-2, are certainly of less reliability than the broader sectors of Table C-1.

Up to 1943, the Bureau of Statistics compiled annual data on capital stocks on a disaggregated basis for mining and manufacturing. These data were the aggregation of individual corporate balance sheets and are subject to differences in interpretation by different respondents. 3/ The same drawback also holds in the case of Taxation Statistics. Further, the D.B.S. pre-1943 series represents net stocks, and certain questionable assumptions would have to be made in converting them to gross stocks.

The most appropriate means, then, of deriving gross stocks appears to be the cumulation or "perpetual inventory" method. This method, which is now in common use, is described in detail by Hood and Scott, among others. 4/ Briefly, it is based on annual data for gross investment, appropriately deflated for price changes, and cumulated over the assumed "service lives" of the assets in an industry. The stock data actually used were kindly provided by the Dominion Bureau of Statistics from an unpublished research project undertaken by Mr. T. K. Rymes. The Rymes series is similar to the Hood-Scott, in that both are based on the annual Private and Public Investment data, by industry. The Rymes series, however, divides investment not only as between Construction and Machinery, but also divides the former as between Building and Engineering. The gross stocks here presented in Table C-1 are 1961 stocks in terms of constant 1949 dollars.

Ideally, we should have extended this series to the various sectors of the mining industry. Unfortunately, the investment data on which it is based are only available on a disaggregated basis for mining from 1948 onward, a period not long enough to embrace one life cycle.

Two drawbacks of the mining capital stock data should be mentioned. The first concerns service lives. The actual lives used by Rymes—20 years for machinery and equipment, 25 years for building, and 30 years for engineering—are no doubt accurate enough estimates of average durability. However, in mining, where physical plant is peculiarly tied to a given mineral location, and salvage values are low, it is possible that the lives used are too long if the average life of a mine is less than the service life of the plant. To this extent capital stocks in mining would be overstated.

On the other hand, the Private and Public Investment data on which the series is based do not include the cost of surface exploration. "Capital Expenditures" as reported in this series does include the cost of sinking shafts and drilling wells, but it does not include generalized exploration costs. The latter have only recently been compiled separately. Cost of prospecting, in mining, from 1952 to 1961 amounted to 350.5 million dollars and geological and geophysical expenditures in petroleum have amounted to 603.9 million dollars for the same period; the total of the two amounted to about 25% of "Capital Expenditures" that were recorded as such over the same 10 years. The net effect of including such expenditures in the "real" physical capital of the industry might then be to inflate the capital stocks of the mining industry by something of the order of 25%. If these approximations hold, then the capital/output ratio as reported in Table C-1, for mining, would be understated by about 20%. Whether

this error is of sufficient magnitude to offset the one in the opposite direction, as discussed in the previous paragraph, is of course not known.

The data described are used to derive capital/output ratios for mining, quarrying and oil wells, and for the other sectors of the economy, including subsectors of the manufacturing division.

From these tables, it may be deduced that primary mineral extraction in the aggregate is more capital intensive than are most comparable sectors of the economy. However, there are other sectors, transportation, communications, storage, and paper products manufacturing, in particular, that have higher capital/output ratios.

In order to break the data into finer divisions for the mining industry, the measurement of output again presented no major problems, and was derived from D.B.S. indexes of real domestic product. However, to make an estimate of capital stocks for the sectors of the mining industry we had to go to the corporation data published in Taxation Statistics. As mentioned, these are presented on the basis that the entire firm is allocated to its dominant industrial activity. From discussion it has been concluded that the greatest discrepancy within the mining sector, as between firm and industry, lies within the petroleum and natural gas division. Here, a number of the large integrated firms are reported in Taxation Statistics under "petroleum refineries" within the manufacturing sector. We took the "buildings and equipment" component of both mining and the manufacturing subsector within which "petroleum refineries" lies and deflated them to 1949 prices. It was found then, as expected, that total mining fell short of the Rymes aggregates, and "petroleum and coal products" exceeded them. It was then assumed that

the "surplus" under "petroleum and coal products" represented that part of petroleum extraction attributable to firms classed under "refining" in Taxation Statistics. This surplus was then added to the deflated capital stock for "oil and natural gas" extraction. In this way, an estimate was obtained for the capital stock of the subsectors of the mining industry. It should be emphasized, however, that these stock estimates, as reported in Table C-2 are indicative only.

The estimates of Table C-2 indicate the highest capital/output ratio to be in "other metal mining", which includes copper, nickel, iron ore and uranium. "Non-metal mining", which includes asbestos, also ranks high. Gold mining and coal mining, neither of which have had much addition to their capital stock in recent years, have lower ratios. The petroleum and natural gas sector also appears to have a lower ratio of capital to output. This may perhaps be explained by the observation that a large part of capital expenditure in petroleum and natural gas is not in the cost of plant as such, but of land.

TABLE C-1 — GROSS CAPITAL/OUTPUT RATIOS, BY INDUSTRY

Plant, Machinery and Equipment in Relation to Value of Output 1961 Data in Terms of 1949 Dollars

(millions of dollars)

Industry	Gross Capital, 1961 in Constant 1949 Dollars	Gross Domestic Product, 1961 in Constant 1949 Dollars	Capital/ Output Ratio 1961
Mining, Quarrying & Oil Wells	3,397.5	1,289.2	2.64
Manufacturing Total	14,103.6	6,226.4	2.27
Food & Beverages	1,842.5	875.4	2.10
Tobacco, Rubber, Leather	360.0	258.4	1.39
Textiles	634.3	325.2	1.95
Clothing	253.3	287.1	0.88
Wood Products	696.5	438.0	1.59
Paper Products	2,348.0	604.9	3.88
Printing & Publishing	455.1	280.8	1.62
Iron & Steel Products	1,739.9	835.4	2.08
Transportation Equipment	881.3	512.2	1.72
Non-ferrous Metals & Electrical	1,694.7	737.1	2.30
Non-metallic Mineral, Petroleum & Coal Products	1,728.2	457.8	3.78
Chemicals	1,323.8	449.3	2.95
Miscellaneous Manufacturing	146.0	166.1	0.88
Utilities	2,273.2	778.4	2.92
Construction	1,115.4	1,599.0	0.70
Forestry	518.5	410.4	1.26
Trade	4,441.8	3,429.1	1.30
Storage	307.3	75.4	4.08
Transportation	9,903.5	1,551.8	6.38
Communications	3,131.9	514.6	6.09
Fishing	171.6	78.1	2.20

Sources of Raw Data:

Gross physical capital: Rymes series (D.B.S., unpublished);
Output: (GDP at factor cost)
1949 data: National Accounts, Income & Expenditure, 1926-1956, D.B.S.
1961 data in 1949 dollars: Indexes of Real Domestic Product by Industry of Origin, 1935-61, D.B.S., May 1963.

TABLE C-2—GROSS CAPITAL/OUTPUT RATIOS, SECTORS OF MINING INDUSTRY

(millions of dollars)

Industry	Gross Capital, 1961 in Constant 1949 Dollars	Gross Domestic Product, 1961 in Constant 1949 Dollars	Capital/ Output Ratio 1961
Gold Mining	178.8	88.7	2.02
Other Metal Mining	1,795.3	460.6	3.90
Non-Metal Mining	243.9	84.5	2.89
Coal Mining	60.4	41.2	1.47
Crude Petroleum & Natural Gas	952.0	546.3	1.74
Total Mining (including above plus quarrying & contract drilling)	3,397.5	1,289.2	2.64

Sources:

Gross Plant & Equipment: Taxation Statistics, 1963, Department of National Revenue, adjusted as explained in text.

Gross Domestic Product: Indexes of Real Domestic Product by Industry of Origin, 1935-61, D.B.S., May 1963, and Index of Industrial Production, (Monthly), D.B.S.; since the latter are given on a commodity basis, gross domestic product, 1961, in the gold mining industry and in the other metal mining industry were derived by adjusting the commodity output index for gold to take account of the relative increase in the gold produced by other metal mines as indicated in The Gold Mining Industry (Annual), D.B.S.

REFERENCES

1/ Esp. Indexes of Real Domestic Product by Industry of Origin, 1935-61, D.B.S., May 1963, and Index of Industrial Production, D.B.S., monthly.

2/ For similar purposes, this is the conclusion reached in Wm. C. Hood and Anthony Scott, Output, Labour and Capital in the Canadian Economy, Royal Commission on Canada's Economic Prospects, Ottawa, February 1957, pp. 251-253.

3/ In this connection, see Hood and Scott, op. cit., p. 232.

4/ Ibid., p. 234 ff.

APPENDIX D

AN ALGEBRAIC DEMONSTRATION OF THE EFFECT OF A "NET DEPLETION" ALLOWANCE AND THE PRIVILEGE OF IMMEDIATE WRITE-OFF OF CAPITAL EXPENDITURES, ON EACH OTHER, AND ON THE MARGINS OF INVESTMENT

Assumptions

1. An established firm with sufficient current revenue to cover the cost of new investment (generally assumed to be expenditure on exploration and development of minerals) of whatever magnitude it may contemplate.

2. Diminishing marginal returns on investment.

3. Seven cases are considered under various assumptions as to tax liability.

Explanation of Symbols

R = Present producing revenue, net of all costs save depletion and taxes.

t = Tax rate $(0 < t < 1)$.

p = Depletion rate $(0 < p < 1)$.

X = Investment expenditure, (on exploration or development).

Y = Expected future revenue, net of all costs save depletion and taxes, and discounted to the present at an appropriate rate of discount.

F = Net cash flow on account of current operations.

G = Net cash flow on account of future operations due to new investment, and discounted to the present.

$Y = f(X); \qquad f(0) = 0; \frac{d^2Y}{dX^2} < 0.$

Case 1

No depletion allowance, no taxation. Without new investment: $F = R$
$G = 0$.

With new investment: $F = R - X$
$G = Y$.

Total "worth" of the enterprise, with new investment
$= F + G = R - X + Y$.

Investment will take place so long as expected increase in worth of the enterprise is not negative.

i.e., investment will continue so long as

$$\frac{d(F + G)}{dX} \geq 0,$$

or $$-1 + \frac{dY}{dX} \geq 0.$$

This implies that the firm's marginal investment or final increment of new expenditure will be such that $\frac{dY}{dX} = 1$.

Case 2

No depletion allowance, income tax rate of t

Without new investment: $F = R(1 - t)$
$G = 0$.

Case 2A:

Investment is NOT allowed as a deduction against any income for tax computation, either now or in the future.

With new investment: $F = R(1 - t) - X$
$G = Y(1 - t)$.

Total worth of the enterprise, with new investment
$= F + G = (R + Y)(1 - t) - X$

$\frac{d(F + G)}{dX}$ again must not be negative, if investment is to take place.
This implies that $-1 + \frac{dY}{dX}(1 - t) \geq 0$.
And for the marginal investment this, in turn, implies that $\frac{dY}{dX} = \frac{1}{1 - t}$.
Since $\frac{1}{1 - t} > 1$, the amount of investment undertaken will decline from what it would have been in the absence of taxation (Case 1).

Case 2B

Investment deduction is allowed against income over the life of the new asset.

With new investment: $F = R(1 - t) - X$
$G = Y(1 - t) + taX,$

where a is a discount factor $(0 < a < 1)$, reflecting the fact that a tax saving in the future must be discounted to get its present value. The magnitude of a depends on the rapidity of the depreciation of X, and on the rate of discount applied to it. The shorter the period for depreciating X, the closer a is to 1.

$$F + G = (R + Y)(1 - t) + taX - X$$

$$\frac{d(F + G)}{dX} = \frac{dY}{dX}(1 - t) + ta - 1$$

for the marginal investment this implies that $\frac{dY}{dX} = \frac{1 - ta}{1 - t}$.

In this case, comparing with Case 2A, the numerator on the right hand side is smaller and therefore the amount of investment undertaken will be greater than what it would be with no recoupment of the cost of investment. However, since $\frac{1-ta}{1-t} > 1$, this case implies less investment than there would have been in the absence of taxation (Case 1). This case may be seen to correspond to normal taxation practice for other than the extractive industries, where the capital cost of a new asset is depreciated over the life of the asset. In this general case, the presence of income taxation is seen to reduce the inducement to invest (unless the supply of capital is perfectly inelastic).

Case 2C

Investment deduction is allowed immediately against existing income, before current tax is applied.

With new investment: $F = (R - X)(1 - t)$
$G = Y(1 - t)$

$$\frac{d(F + G)}{dX} = \frac{dY}{dX}(1 - t) - (1 - t).$$

For the marginal investment this implies that $\frac{dY}{dX} = 1$, exactly as Case 1.

Thus, the immediate expensing of investment costs means that the profitability of new investment is unaffected by taxation. If one industry is so privileged and others are not, the industry so privileged has become a more attractive investment vehicle relative to industry in general, as compared with the pre-taxation case.

Case 3

Depletion allowance at rate of p; tax rate of t.

Without new investment: $F = R(1 - t + tp)$.
$G = 0$.

Case 3A

Investment is NOT allowed as a deduction against any income.

With new investment: $F = R(1 - t + tp) - X$
$G = Y(1 - t + tp)$.

Total worth of the enterprise, with new investment

$$= F + G = (R + Y)(1 - t + tp) - X.$$

Again, $\frac{d(F + G)}{dX}$ must not be negative for investment to continue.

or $\frac{dY}{dX}(1 - t + tp) - 1 \geq 0$

This implies that for the marginal investment

$$\frac{dY}{dX} = \frac{1}{1 - t + tp}.$$

And since $\frac{1}{1 - t + tp} > 1$, it may be seen that the amount of investment undertaken will be less than it was in the absence of taxation (Case 1).

It is, however, pertinent to compare this case with the three situations of Case 2, to see whether the depletion allowance (without expensing or depreciation) has enlarged the range of profitable investment.

Comparing with Case 2A; it can be seen that

$\frac{1}{1 - t + tp} < \frac{1}{1 - t}$ and therefore the depletion allowance without any provision for the recovery of capital costs, has enlarged the investment horizon.

Now, however, this industry may or may not be equitably treated as compared to "ordinary" industry, in regard to new investment. ("Ordinary" industry is taken as roughly equivalent to Case 2B.)

Whether investment in the industry is favoured, equally treated, or unfavourably treated, relative to other industry, depends on whether, respectively,

$$\frac{1}{1 - t + tp} \lessgtr \frac{1 - ta}{1 - t}$$

If $t = .5$, and $p = .33$, this condition becomes whether $1.5 \lessgtr \frac{1 - .5a}{.5}$

or whether $a \lessgtr .5$ i.e., if in ordinary industry, the discount factor representing tax "savings" due to depreciation is less than 50%, the extractive industries, with depletion but without any provision for the recoupment of capital costs, are being more than "fairly" treated in regard to new investment.

The factor a depends on the rate of discount applied to future earnings, and the rate of depreciation permitted.

The formula for a is roughly equivalent to $a = \frac{d}{r + d}$ where d is the rate of depreciation using the diminishing balance method and r is the rate of discount applied to future earnings.

By way of illustration, if the rate of depreciation is 20% (diminishing balance) for a to be as low as 50%, the rate of discount applied would have to be 20%. Again, if the depreciation rate were 30% (diminishing balance) for a to be as low as 50%, the rate of discount applied would have to be 30%.

It thus appears that (comparing Case 3A with Case 2B) if this industry has a depletion allowance but no provision for recovering the costs of investment there is some discrimination placed upon it relative to other industries

Finally, comparing Case 3A with 2C, the inducement to invest of the latter is the same as that in the "no tax" case. Therefore the former case, which assumes depletion but no expensing or depreciation, implies a lesser investment expenditure than does the latter, with no depletion but immediate write-offs.

Case 3B

Investment deduction is allowed against future income over the life of the new asset. Depletion on future income will be net of this capital allowance.

With new investment: $F = R(1 - t + tp) - X$
$G = Y(1 - t + tp) + taX(1 - p)$.

Where a is a discount factor, as before $(0 < a < 1)$.

Here, $\frac{d(F + G)}{dX} = ta\ (1 - p) - 1 + \frac{dY}{dX}\ (1 - t + tp)$.

This implies that, at the margin of investment, $\frac{dY}{dX} = \frac{1 - ta\ (1 - p)}{1 - t + tp}$.

Since $\frac{ta\ (1 - p)}{1 - t + tp} > 0$. the investment horizon has been extended beyond that of Case 3A (no recoupment of investment cost) and <u>a fortiori</u> beyond that of Case 2A.

<u>Comparing Case 3B</u> with the "no tax" Case (Case 1) or the "no depletion, immediate offset" Case (Case 2C), because $a < 1$,

$$\frac{1 - ta\ (1 - p)}{1 - t + tp} > 1.$$

Therefore, the amount of investment undertaken will be reduced in the present case from what it would have been in the other two.

When we <u>compare Case 3B with Case 2B</u>, which is taken as corresponding to taxation with depreciation of capital costs over time, but no depletion allowance, we note that

since $tap < tp$

$$\frac{1 - ta + tap}{1 - t + tp} < \frac{1 - ta}{1 - t}.$$

Therefore, investment in this case (depletion plus expensing over time) is encouraged beyond that in Case 2B which does not receive a depletion allowance.

Incidentally, the inducement to invest in Case 3B can be viewed as equivalent to that of a "new" firm in the extractive industries, in that investment costs can be written off against future income only.

Case 3C

Investment deduction is allowed against immediate income, but depletion currently available is thereby reduced.

With new investment: $F = (R - X)(1 - t + tp)$
$G = Y(1 - t + tp)$

Here, $\frac{d(F + G)}{dX} = \left\{\frac{dY}{dX} - 1\right\}(1 - t + tp)$

This implies that for the marginal investment $\frac{dY}{dX} = 1$.

Thus, in this case, the pretax investment perspective is restored. But it should be noted that the range of profitable investments is no greater than it was in Case 2C where immediate expensing was permitted but there was no depletion allowance.

We conclude that if a large part of the capital costs of the extractive industry may be written off rapidly, and those of other industries are subject to deferred depreciation, there is a relative inducement to invest in mineral extraction in comparison with other industry over what would obtain in the absence of taxation.

But, if we assume that all the costs of an investment may be written off against existing income, no further inducement to invest is provided by the net depletion allowance. With immediate write-off of investment costs, the depletion allowance is "neutral" in the sense that it does not add to nor detract from the decision whether to undertake a new investment.

With less than complete provision for the immediate write-off of investment costs, the depletion allowance does play a positive role in adding to the inducement to invest in the mineral industries relative to others.

It may be inferred that the extent of the investment "advantage" to the extractive industries depends primarily on the present worth of the tax offsets it is allowed, relative to the present worth of such offsets allowed to industry in general, and secondarily on the existence of a depletion allowance.

APPENDIX E

COMPARATIVE EFFECT OF ALTERNATIVE TAXING PROVISIONS ON THE HYPOTHETICAL YIELD OF AN INVESTMENT IN OIL AND GAS WELLS

DISCOUNTED CASH FLOW RATE OF RETURN UNDER DIFFERENT ASSUMPTIONS AS TO CORPORATE OWNERSHIP AND TAXATION PROCEDURES

Introduction

In order to illustrate the comparative effect of alternative taxing provisions on the yield from an investment in petroleum extraction, it was thought that a hypothetical model would be instructive.

There are a great many types of companies in the business of searching for and producing oil and gas, and the way the present tax law and its possible revisions affects each is often quite different. Specifically, we should like to know how tax concessions influence the earnings of each type of firm.

In comparing rates of return, published data of oil companies are not of much help. Practices in treating exploration and development expenses vary from company to company. Furthermore, because the industry is fairly young and growing, cash outlays have been larger than cash generated. When most of these outlays are charged against current profit, earnings reported are greatly deflated. In order to compute a "true" rate of return some account would have to be taken of the value of reserves in the ground and, for the vast majority of oil companies, these reserve figures are not available.

Further, published data are unsatisfactory because it is impossible to separate production income of integrated companies from their refining income.

It was therefore decided to approach the problem by means of a hypothetical model, to assume certain costs and success ratios, and to test the effect of changing the tax provisions and the form of corporate ownership on the resultant yield from investment.

Our point of departure is a study conducted by the Canadian Petroleum Association. This study, which was submitted to the Commission as an Appendix to the Association's brief, had as its purpose the computation of relative tax burdens of a non-integrated Canadian, an integrated Canadian, and a United States corporation producing crude oil in Canada. The study is a completely hypothetical one, but is based on aggregate expenditures and success ratios of the Canadian crude petroleum industry in 1962. 1/ As such, it may be viewed as an index of the expectation of future operating results of a firm commencing operations at the present time.

In brief, the C.P.A. study assumes that a firm, under the three alternate corporate forms, drills 10 wells a year for 25 years. It has "average" costs and "average" success (based on 1962 published data). Each of the successful wells has a life of 25 years. The C.P.A. brief then computes the taxes payable over a 25-year period for each corporate form.

One difficulty to be overcome is that the "typical" firm finds natural gas as well as oil. The C.P.A. converts "average" gas findings to oil equivalent. It takes account of expenses that are necessary to

utilize the natural gas, but the entire operation is treated as a combined petroleum gas package in terms of petroleum volumes and prices.

We have used the data developed in the C.P.A. study as our point of departure. However, since the specific purpose of the C.P.A. study is not to determine a rate of return, and since the resultant return is in part determined by the number and timing of wells dug, and further, since the exercise postulates constant costs of exploration for 25 years, we decided to base our own study on one, or at the most two, wells. In this way, we attempt to determine the effect on the rate of return of a single investment under several precisely defined variable conditions, in order to test for the effect on profit of each of the relevant tax and corporate ownership parameters.

The Model

The C.P.A. study was based on a continuing programme of 10 wells dug each year, 6 of which are successful, and analyzed under 3 forms of corporate ownership: a non-integrated Canadian, an integrated Canadian and a United States corporation.

Our own numerical model is based on 15 different combinations of ownership and taxation variables. We assume, however, that the firm digs only one well at the beginning of the period under review. The well is assumed to be successful in the same proportion as the C.P.A. study, i.e., that this is a composite well, partly successful and partly not. 2/ In 2 of the 15 cases, we assume the digging of a second similar well in a specified later year.

Expenses are also based on the C.P.A. study, reduced to a "per well" basis, with the proportion of the exploratory well and development well components, as used in the C.P.A. study, based on 1962 industry experience.

On the foregoing data, for each case a cash flow is derived for each year of operation of the well. The well is presumed to produce for 25 years. The rate of return is then that rate of discount which equates the stream of cash generated by the wells, over time, to the present value of the capital cost of the wells.

The results, in terms of rate of return, under various conditions, are reported in the "Summary Table" in this appendix. The variable and constant conditions for each case are also explained in the notes appended to the Summary Table.

In the schedules labelled "1" to "3", the amounts of revenue, depreciation, and expenses used in the study are given.

Some Further Notes About the Methodology

1. We have assumed that all the capital required during Year 1 must be on hand at time 0, the beginning of the first year of operation. On the other hand, we have assumed that the cash generated during each year does not become available until the end of the relevant year. This may tend to understate the rate of return, since cash required is anticipated, but cash generated is deferred. However, it may be assumed that some working capital is required during the year, and this method makes ample allowance for working capital.

2. No provision is made for time lags—i.e., it is assumed that expenditures undertaken at time 0 yield their first return at time 1. To this extent, the overall cash discount rate of return is overstated.

3. The model is a static one, assuming no changes in costs, output per well, or revenues from those originally postulated. Most seriously, the model tends to obscure the fact that some "costs" (i.e., land) are themselves determined by potential profit. This shortcoming may be misleading in view of the base year chosen. The amendments to section 83A enabling land costs to be expenses came into effect during 1962. However, the full effect on the scale of bidding for land certainly did not make itself felt in the first year of the new allowances. The C.P.A. study, whose data we have utilized, assumes the land expensing allowances in effect in 1962, but the figure used for land costs does not allow for the effect of those allowances on future land costs. If the analysis of our main study is correct, the effect of the new rules may be to increase the economic rent paid for drilling rights. To this extent, the profit rate may be overstated, and some part of the return may be expected to be dissipated in the form of higher land costs.

4. For all the above reasons the model is not to be taken literally as saying, for example, that the rate of return to a new, independent company is 8.6%. However, the model is useful in comparing relative potential rates of return, at a moment in time, under differing conditions of tax law and ownership.

Some Inferences That May Be Drawn from the Model

1. For the four "cases" in the study that represent existing tax procedures, four extreme "types" of company can be distinguished with

differing rates of return on a single investment in productive capacity, as follows:

Case No.	Type of Company	Rate of Return
1.	A new purely exploration company incorporated in Canada. No other income.	8.6%
3.	A "qualifying" Canadian company, with other income adequate to offset allowable expenses. No previous production income.	12.0%
4.	A Canadian producing company, with existing production income adequate to offset allowable expenses.	9.75%
11.	The branch of a United States company with no other income in Canada, but other income in the United States.	10.68%

The order of magnitude of differential advantage places the Canadian company whose other income is of a "qualifying" type, but which does not yet claim any depletion, in the best position; the United States company is second; the Canadian company with previous production income is third; and the beginning exploration company is last.

2. It should be noted that as investment in extraction grows, these differentials are reduced. The beginning exploration company, as it acquires income against which to offset new investment expenditure, (Case 2 compared with Case 1) acquires the advantages of a producing company with existing production income.

On the other hand, it would be a mistake to conclude that Case 3 represents the position of most integrated companies. The huge advantage of the qualifying company starting out on an exploration programme, is that section 83A expenses can be immediately offset against otherwise fully taxed dollars. To retain any continuing advantage, current and

deferred exploration expenses must exceed current production revenue. In that case the "excess" may be charged against non-production revenue. However, if current and deferred exploration expenditures are less than current production income, the return to the integrated company will be the same as Case 4, the large producing company. In practice, it may be inferred that the "average" integrated company falls between Case 3 and Case 4.

The United States company, as has been noted, loses its initial advantages once it reaches the point where production income in Canada is large enough to absorb the costs of its current exploration and development programme. At that stage its net earnings position on new investment is that of Case 4, less the additional cost of the Canadian withholding tax, under section 110B.

3. The very worst off of the companies under the present rules (Case 1) has an advantage that produces profits some 41% higher than if it were to receive no tax concessions (Case 12). Thus, the package of depletion plus section 83A allowances is a potent instrument for increasing after-tax profits (with the important proviso, as noted, that the increased profit is not shifted as higher rents to the landowners).

4. Either of the two incentives—expensing of drilling, exploration and land costs, and net percentage depletion—is by itself quite powerful in increasing the yield. Together, they tend to cancel each other out to some extent. On balance, depletion appears to have slightly the stronger impact (Case 6 compared with Case 5). Either incentive, by itself, raised the potential yield by 20% to 25% over the "fully taxed" case (Case 12). Given one of them, the further increment in profitability

introduced by the second is of a lesser order of magnitude. This, of course, is because a net depletion allowance comes into effect only when allowable expenses are exhausted. When only part of the expenses are deductible (land excluded, Case 10) the decrease in present value of allowable deductions is, in part, compensated for by the increase in allowable depletion.

5. We should note that the integrated company with full offset of expenses against other income (Case 3), is actually better off than if there were no taxation at all of crude petroleum profits. This seeming anomaly is explainable in terms of a negative rate of tax—an actual subsidy—in the first year of Case 3, due to the offset of expenses against otherwise fully taxed refining income. The anomaly depends on a differential rate of taxation between the two sections of a refining company's operation. In effect, the integrated company is able to shift income from the fully taxed sector to the tax-sheltered sector.

6. A shift to gross depletion, as advocated by the industry (Cases 7, 8, 9), would increase the potential yield to all the operators (provided, again, that rents on land do not absorb the increase). Relatively, the greatest improvement would accrue to the non-integrated company. However, the integrated company would retain a substantial advantage, i.e., the timing advantage of immediate deduction of section 83A expenses. In this case, however, an integrated company would have no advantages over an equally large, established, non-integrated company. In both cases, there would be other income against which to charge expenses of new ventures, and the total amount of depletion claimed would not be affected by whether these charges were offset against refining or production income.

SUMMARY TABLE

COMPARATIVE EFFECTS OF ALTERNATIVE TAX COMPUTATION RULES AND FORMS OF CORPORATE OWNERSHIP ON HYPOTHETICAL YIELDS FROM AN INVESTMENT IN AN OIL OR GAS WELL

(Based on Industry Data for 1962)

Case No.	Type of Company	Second Well Dug and When?	Depletion Allowance (Canadian)	Costs of Drilling And Exploration (Canadian)	Land Expenditures (Canadian)	Well Production Equipment (Canadian)	Rate of Withholding Tax (If U.S. Firms)	Cash Flow Rate of Return on Investment	Index Rate of Return "No Tax" Case = 100	Index Rate of Return "Amortization" case = 100
1	New Cdn.	No	33–1/3% Net	Expensible	Expensible	30% D.B.	N/A	8.6%	76.79	140.98
2	New Cdn.	End of 8th Year	33–1/3% Net	Expensible	Expensible	30% D.B.	N/A	8.74%	77.95	143.28
3	Ref'g. Cdn.	No	33–1/3% Net	Offset Refining	Offset Refining	30% D.B.	N/A	12.0%	107.14	196.72
4	Prod'g. Cdn.	No	33–1/3% Net	Offset Producing	Offset Producing	30% D.B.	N/A	9.75%	87.05	159.84
5	New Cdn.	No	None	Expensible	Expensible	30% D.B.	N/A	7.4%	66.07	121.31
6	New Cdn.	No	33–1/3% Net	Amortized	Amortized	30% D.B.	N/A	7.61%	67.95	124.75
7	New Cdn.	No	25% Gross	Expensible	Expensible	30% D.B.	N/A	9.45%	84.37	154.92
8	New Cdn.	End of 8th Year	25% Gross	Expensible	Expensible	30% D.B.	N/A	9.55%	85.27	156.56
9	Int. Cdn.	No	25% Gross	Offset	Offset	30% D.B.	N/A	12.5%	111.61	204.92
10	New Cdn.	No	33–1/3% Net	Expensible	Not Deducted	30% D.B.	N/A	7.94%	70.89	130.16
11	U.S.	No	33–1/3% Net	Expensible	Expensible	30% D.B.	15%	10.68%	95.36	175.08
12	Cdn.	No	None	Amortized	Amortized	30% D.B.	N/A	6.1%	54.46	100.00
13	Cdn.	No	---------No Tax ---------		No Deductions-----	---------	N/A	11.2%	100.00	185.61
14	Cdn.	No	None	Offset	Offset	Offset	N/A	9.25%	82.59	151.64
15	Cdn.	No	None	30% D.B.	30% D.B.	30% D.B.	N/A	7.26%	64.82	119.02

Explanation of Entries in Table: See next page.

Explanation of Entries in Summary Table

VARIABLE CONDITIONS

Column (1): case number in the study.

Column (2): type of company.

New Cdn: a Canadian company beginning its operations with the first well in the study.

Ref'g Cdn: a Canadian company, with existing income from refining or other non-producing sources, but which qualifies for section 83A deductions against such non-producing income. Company has no previous producing income.

Prod'g Cdn: a qualifying Canadian company whose previous income from production is more than adequate to absorb the capital costs of the well dug in the study.

Int. Cdn: either of the two preceding types; i.e., any Canadian qualifying company with previous income.

Cdn: any of the first three types, i.e., any company incorporated in Canada.

U.S.: branch of an American company, with other income outside Canada, but commencing its Canadian operations with the well in the study.

Column (3): second well dug and when? If the example postulates the digging of a second well (under the same cost and revenue assumptions as the first), the time of digging is indicated here.

Column (4): depletion allowance (Canadian): 33-1/3% net: the present rules. An allowance of 1/3 is deducted from the tax base after all allowable expenses.

25% gross: as proposed by the petroleum industry. An allowance of 1/4 of gross revenue, after royalties but before all other expenses.

None: no depletion allowance.

Column (5): costs of drilling and exploration (Canadian): Canadian treatment of drilling and exploration expenses.

Expensible: drilling and exploration expenses deductible from income subject to tax as soon as income is available.

Column (5) (Cont'd): Offset refining: drilling and exploration expenses deductible, as they arise, from other income. In the present case, from other income which is not subject to the depletion allowance.

Offset producing: drilling and exploration expenses deductible from other income which would, however, otherwise be subject to the net depletion allowance.

Offset: drilling and exploration expenses may be deducted from income subject to tax regardless of source.

Amortized: drilling and exploration expenditures are capitalized and amortized over the life of the well for tax purposes.

30% D.B.: costs expended may be deducted from income subject to tax on the basis of a maximum 30% of the diminishing balance of the cost.

Column (6): land expenditures (Canadian): Canadian tax treatment of acquisition of right to drill.

Expensible:) Explanation the same as "drilling and
) exploration" (supra).
Offset:)
Amortized:)
30% D.B.)
Not Deducted: No provision either for expensing or amortizing land costs. This is somewhat more stringent than rules before 1962 amendment, because even then costs of Crown land that proved unproductive could be written off against income in the year of abandonment.

Column (7): well production equipment (Canadian):
30% D.B.) The Canadian tax treatment of these
Offset:) capital costs is the same as "drilling and exploration" (supra).

Column (8): rate of withholding tax (if U.S. firm): rate of Canadian withholding tax on income after corporation tax, of a foreign subsidiary operating in Canada, under section 110B of the Income Tax Act.

Column (9): cash flow rate of return on investment: the effective rate of return that equates the present value of the cash flow, for which the investment is responsible, to the cost of the investment.

Column (10): index rate of return, "no tax" Case = 100: the relative rate of return for each case in the study, using Case 13 (no taxation of production income) as the index.

Column (11): index rate of return, "amortization" Case = 100: the relative rate of return for each case in the study using Case (12) (amortization of drilling and land costs) as the index.

CONDITIONS APPLICABLE TO ALL CASES (SEE TEXT)

1. One well dug at t_o, beginning of first year.

2. Each well is a composite, with degree of success, output, and gross revenue as per C.P.A. data for 1962.

3. Each well has a life of 25 years.

4. Cost data are as computed by C.P.A., on a "per well dug" basis.

5. Costs and receipts remain constant over life of the well.

6. Corporation tax rate is 50% in Canada (except in Case 13, where no tax is assumed on income from oil production), and 52% in the United States.

7. Canadian capital cost allowance on equipment directly related to the well is assumed at 30% of the diminishing balance in all cases except Case 14, as noted in the table. However, the Canadian capital cost allowance on "gas plant and other" equipment is in all cases at the rate of 20% on the diminishing balance of cost. The division of asset costs as between the two capital cost allowance rates is that presented in the C.P.A. study. (Appendix to their brief to this Commission.)

8. United States regulations (where applicable) on depreciation, expensing intangibles, depletion, etc., are those now in effect, as interpreted in the C.P.A. study. It is therefore assumed that the firm elects to expense intangibles. It is also assumed that the firm claims cost depletion in the first year and percentage depletion in subsequent years.

SCHEDULE 1. (EXPLANATORY TO APPENDIX E)

Cost and revenue data, based on C.P.A. study
(which, in turn, is based on industry data for 1962) on a "per well dug" basis, i.e., their "full-year" data, based on 10 wells dug is divided by 10. This gives data associated with one well dug, and return is therefore less than that for each successful well.

Production Income, per year

Gross Revenue	$29,009	
Less Royalties	3,629	$25,380
Less Lifting Costs		4,644
Net Production Revenue		20,736
Administration		1,203
Revenue Before Fixed Charges		$19,533

Drilling, Exploration and Land Costs			
Geological and Geophysical		$20,500	
Drilling		77,000	
Total Drilling and Exploration			$ 97,500
Land Costs			47,500
Total Drilling, Exploration, and Land			145,000
Depreciable Equipment			
Production Equipment:	30% rate		$ 15,000
Gas Plant and Other:	20% rate		10,840
Total Capital Required, per Well Sunk			$170,840

SCHEDULE 2 (EXPLANATORY TO APPENDIX E)

Computation of depletion under hypothetical 25% Canadian gross depletion allowance.

Revenue per well, net of royalties:	$ 25,380
Annual depletion, at 25%	6,345

SCHEDULE 3 (EXPLANATORY TO APPENDIX E)

Cost and revenues for U.S. tax purposes (per C.P.A. study), on per well basis.

Drilling Costs			
Intangibles:	85%	$65,600	
Casing:	15%	11,400	
			$ 77,000
Geological and Geophysical			
"Non-producing" (expense):	75%	$15,400	
"Producing" (capital):	25%	5,100	
			$ 20,500

Land Costs

Acquisition (expensible):	$26,600	
Acquisition (capital):	6,700	$33,300
Lease rentals:		14,200
		$47,500

Cost Depletion

Capitalized costs per well		
Geological and geophysical:	$ 5,100	
Land acquisition	6,700	$11,800

Cost Depletion per year, $\frac{11,800}{25}$ = $472

Percentage Depletion

Gross Income

27½% of $25,380 = $6,980

Net Income limitation will not apply after first year.

Depreciation for U.S. tax purposes
(Per C.P.A. study), at 6 2/3% per annum on straight-line basis

Well equipment:	$15,000	
Gas plant and other:	10,840	
Casing:	11,400	$37,240
6 2/3% per annum		$2,483

Drilling and Exploration, expensible for U.S. tax purposes
(Per C.P.A. study).

Intangibles (Drilling), as above:	$65,600
Geological and geophysical, as above:	15,400
Land acquisition, expensible, as above:	26,600
Lease rentals, as above	14,200
	$121,800

REFERENCES

1/ In later submissions to the Commission, the Canadian Petroleum Association expressed some misgivings as to the data it had presented, on two accounts:

1. Success ratios quoted for new field wildcats were deemed too high in the sense that the annual data published by C.P.A. and used in its original study, rates as a "success" a discovery well that produces some oil or gas. More recent study by the C.P.A. indicates that of new field wildcats indicating some initial success, a large percentage are actually abandoned as not capable of commercial production. To this extent it feels that its published success ratios are over-optimistic, as are the ratios used in the study.

2. The Association also feels that the average life of the wells assumed in the study is more indicative of average experience for the period 1947 to 1962 than it is for reserves actually discovered in 1962.

2/ Our annual revenue figures are slightly, but not significantly overstated because our study, based on the original C.P.A. data overstates the success ratio of new field wildcats as noted in reference 1. In the C.P.A. study, overall success for the ten wells dug was assumed as 60% and, therefore, in computing annual revenue we assumed that we had one "60% successful" well. Actually our well, based on 1962 industry experience, should only be 58.1% successful.

Actual industry experience, as reported in the C.P.A. Statistical Yearbook for 1962 is as follows:

	Total Number of Wells Dug, Excluding Service Wells	Successes as Reported in Yearbook	Amended Successes in Later C.P.A. Submission
New Field Wildcats	679	158	28
Other Wildcats	94	42	
Development Wells	1,709	1,373	
Total	2,482	1,573	1,443
Overall Success Ratio		63.4%	58.1%

Thus, our annual revenues, based on 1962 data, are overstated by 3.3%. In the overall result this is not a significant percentage. In any event, we are not so much interested here in the absolute return as in the relative return given different conditions of ownership and different tax rules. The relative returns will not be affected, since the same basic revenue is assumed in each case.

APPENDIX F

COMPARATIVE EFFECT ON HYPOTHETICAL YIELD FROM INVESTMENT IN A METAL MINE, UNDER ALTERNATIVE RULES FOR COMPUTING TAX

THE DISCOUNTED CASH FLOW RATE OF RETURN UNDER DIFFERENT ASSUMPTIONS AS TO PREVIOUS MINING INCOME AND AS TO TAXATION PROCEDURES

Introduction

A comparative illustration of the change in the hypothetical yield from an investment in oil and gas extraction, under different variable conditions, was presented in Appendix E. It was thought desirable that a similar model be set up for metal mining in order to compare rates of return under the present Canadian tax rules, with several possible alternatives.

It should be noted that, while the oil and gas study was not an actual case study, it was nonetheless based on industry aggregates for one year. Unfortunately, in mining, the results of investment are even more heterogeneous, and it is not possible for the mining industry to produce aggregate data that are in any way comparable to the investment, success ratio, and output data of the petroleum industry.

For this reason our hypothetical model in metal mining has to be even more arbitrarily determined than that in oil and gas.

The model is therefore presented with the following cautions:

1. The rates of return derived in the model should not be taken as implying that these are the rates of return earned by a typical firm in the mining industry.

2. Specifically, these rates of return are not comparable with those derived for oil and gas in Appendix E. In the oil and gas model we were able to take account of unsuccessful ventures in the "average" results of exploration and development. The mining model is a wholly successful one. To the extent that other abortive ventures are ignored, the result would tend to overstate the overall profits of the industry.

Nonetheless the hypothetical model is valid as an illustration of the impact of differing taxation and ownership variables on the return of a given mining venture.

The Model

We have assumed a "medium-sized" metal mining venture whose total capital costs amount to $11,500,000, whose "life" is 15 years, and whose annual operating income, net of direct operating costs, is $3,000,000. The actual amounts of each capital cost element, and the year of its disbursement, are given in the explanation to the summary schedule at the end of this appendix.

The precise conditions which will yield the rates of return envisaged in the model do not depend on the absolute size of the venture, but on the relative magnitude of the fixed values of the model and on the life of the mine. Specifically, the model postulates the following relationships given that total preproduction costs equal 100.

Preproduction Costs

Property acquisition	1.74
Exploration	8.70
Mine preparation and development	34.78
Plant construction	54.78
Total capital outlays	100.00

Net operating income, per annum
(before write-offs, capital costs and taxes): 26.09

Life of mine: 15 years.

The figures chosen are arbitrary. However, we have based the model on an "average" of published cost and revenue data for several mines that have come into existence in the last 10 years. 1/ Net operating income was arbitrarily assumed after looking at the financial statements of a number of recently opened mines.

Given the assumed conditions, we then postulate 17 cases in which the ownership is varied between a new mining company and one sponsored by a qualifying corporation which has existing mineral revenue, and in each case one or more of the tax parameters is varied.

It is also assumed, in every case, that the actual process of mine development takes place over 4 years. The mine commences production at the beginning of the fifth year, and produces an equal annual operating revenue until the end of the 19th year. Our assumed disbursement of the capital costs, over the four-year preproduction period, is listed at the end of this appendix. No salvage value at the end of the 19 years is assumed.

Computation of Rate of Return

As in Appendix E, it is assumed that all the capital that will be required during a given year must be available at the beginning of the year. On the other hand, we have assumed that the cash generated during each year does not accrue until the end of that year. This procedure may tend to understate the rate of return, but can be justified as providing for working capital.

Thus, where time 0 represents the beginning of the first year, and times 1, 2, ... 19 represent the end of years 1 to 19 inclusive, and where

K_i is capital required at time i,

R_i is net cash flow after taxes at time i,

the rate of return, r, is such that

$$K_0 + \frac{K_1}{(1+r)} + \frac{K_2}{(1+r)^2} + \frac{K_3}{(1+r)^3} = \frac{R_1}{(1+r)} + \frac{R_2}{(1+r)^2} + \ldots + \frac{R_5}{(1+r)^5} + \ldots + \frac{R_{19}}{(1+r)^{19}}$$

It should be noted that R_1 to R_4 inclusive apply only to cases where the company has other revenue. R_1 to R_4 then represent the "tax saving" against other income, due to present investment, in those cases where an offset against other income is postulated. These amounts are properly considered part of the total cash generated by the present venture. On the other hand, for a new company, there will be only 15 entries on the right hand side, from R_5 to R_{19} inclusive.

Some Inferences that May Be Drawn from the Model

1. Cases 1 and 2 represent the present tax laws as they apply to new mines in Canada. Case 1 is a new and independent mining company; Case 2 postulates existing income adequate to write off all allowable section 83A expenses as they arise. It should be noted that we assume this existing income to be otherwise subject to the depletion allowance, and therefore the tax "saving" due to offsetting exploration and development expenses, is worth only 1/3 of the amount thus offset.

The advantage of the company with existing income is that of timing. Preproduction expenses are written off in years 1 to 4, whereas, for the "new" company the write-off does not commence until after the tax-free period, viz., year 8. In both cases, costs of plant construction are written off by means of capital cost allowances at 30% diminishing balance, commencing in the 8th year (4th year of production).

The "new" mine does not pay any income tax until year 11 (7th year of production). The mine belonging to a company with existing income becomes taxable in year 8 (4th year of production), its preproduction expenses having been utilized in years 1 to 4.

The advantage of earlier deduction by the existing company is such as to give it an overall rate of return some 10% higher than that of the beginner. However, even the beginning company, under present tax rules (Case 1), has an advantage that gives it profits some 50% higher than if all preproduction and plant construction costs were written off on a unit of production basis, and if there were no tax-free period and no depletion allowance (Case 14). 2/

2. A comparison was made of the rate of return under United States rules for computing taxable income (Case 16). Under United States expensing and depreciation regulations, net income for computing depletion would be $2,286,667 per annum and depletion, based on 50% of net, would be $1,143,333. Since, regardless of gross income, this would be the maximum depletion allowed, this is the depletion allowance we have assumed in Case 16. Thus the rate of return under U. S. rules, as shown in Case 16, is a maximum and, at 14.46%, it is some 10% lower than the return to the independent mine under Canadian regulations.

3. Case 15 represents a situation where there is no tax levied on this mine. The rate of return is 17.85%. A direct comparison cannot be made between Case 2 (present rules, company with existing income) and Case 15, because the former postulates a situation where there is some tax saving against other income. However, we can compare Case 1 (present rules, no existing income) with the no tax case, and deduce that the net burden of the income tax serves to reduce the rate of return by only some 10%.

4. In cases 3 to 14 we remove progressively one or more of the present tax concessions to the mining industry to test for their effect on the rate of return. In our hypothetical model the three-year tax exemption is of greater effect in increasing the rate of return than is the depletion allowance (Case 5 compared with Case 3, and Case 6 compared with Case 4). This relative effect depends on the length of operation of the mine. In general, the longer the life of the mine the greater the contribution of the depletion allowance to profit, relative to that of the three-year exemption.

5. In Case 9, expensing of development expenses is removed, and for it a 30% diminishing balance capital cost allowance is substituted. The effect is very minor. However, when both the three-year exemption and the depletion allowance are removed (Cases 7, 8 and 11) the effect is to reduce the rate of return by some 23%. If all capital expenses, including land, were made expensible as soon as income arose, but the three-year exemption and the depletion allowance removed (Case 12), the effect is still to reduce the rate of return by some 21% from the present situation. In the latter case (write-off of all capital costs, but no tax-free period or depletion), the rate of return would, however, still be about 20% higher than if all tax concessions were removed (Case 14).

Explanation of Entries in Summary Table

VARIABLE CONDITIONS

Column (1): case number in study.

Column (2): first mine or other mining income.

Type of company undertaking the venture, in relation to whether or not there is other income available against which tax-deductible expenses may be offset.

First: the present investment is the first for the company involved. There are no related corporations whose other income would qualify for the deduction of the costs of the present venture.

Other: the present investment is sponsored by a qualifying corporation which has other mineral revenue against which exploration and development expenditures of the present venture may be charged for taxation purposes.

SUMMARY TABLE – APPENDIX F

COMPARATIVE EFFECT ON HYPOTHETICAL YIELD FROM A METAL MINE BASED ON ALTERNATIVE RULES FOR COMPUTING TAX, AND ON WHETHER OR NOT THERE IS PREVIOUS MINING INCOME

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Case Number	First Mine or Other Mining Income	Write-off of Costs for Tax Purposes: Land	Exploration	Development	Plant Construction	Three-Year Exemption	Depletion Allowance	Cash Flow Rate of Return on Investment	Index Rate of Return "No Tax" Case = 100	Index Rate of Return, "Amortization" Case = 100
1	First	None	Expensible	Expensible	30% D.B.*	Yes	33–1/3% Net	16.1%	90.20	150.47
2	Other	None	Offset	Offset	30% D.B.	Yes	33–1/3% Net	17.75%	99.44	165.89
3	First	None	Expensible	Expensible	30% D.B.	None	33–1/3% Net	14.5%	81.23	135.51
4	Other	None	Offset	Offset	30% D.B.	None	33–1/3% Net	15.43%	86.44	144.21
5	First	None	Expensible	Expensible	30% D.B.	Yes	None	15.1%	84.59	141.12
6	Other	None	Offset	Offset	30% D.B.	Yes	None	17.5%	98.04	163.55
7	First	None	Expensible	Expensible	30% D.B.	None	None	12.46%	69.80	116.45
8	Other	None	Offset	Offset	30% D.B.	None	None	13.7%	76.75	128.04
9	First	None	Expensible	30% D.B.	30% D.B.	Yes	33–1/3% Net	16.05%	89.92	150.00
10	First	None	Expensible	30% D.B.	30% D.B.	Yes	None	14.83%	83.08	138.60
11	First	None	Expensible	30% D.B.	30% D.B.	None	None	12.28%	68.80	114.77
12	First	Expensible	Expensible	Expensible	Expensible	None	None	12.71%	71.20	118.79
13	Other	Offset	Offset	Offset	Offset	None	None	15.78%	88.40	147.48
14	First	None	Amortized	Amortized	Amortized	None	None	10.7%	59.94	100.00
15	------	No tax	----------	No Deductions	---------			17.85%	100.00	166.82
16	First	None	Amortized Limit $400,000	Amortized	Amortized	None	15% Gross, limited to 50% Net	14.46%	81.01**	135.14
17	N/A	30% D.B.	30% D.B.	30% D.B.	30% D.B.	None	None	12.23%	68.57	121.45

* D.B. = Diminishing balance amortization

** U.S. rules for computing taxable income, but applying Canadian rates.

Note: Cases 12 and 13, which permit the hypothetical write-off of land costs, made no allowance for an increase in land costs which might then be expected.

Column (3): land.
Column (4): exploration.
Column (5): development.
Column (6): plant construction.

} Write-offs for tax purposes. The tax treatment of the capital costs of the project under 4 headings.

Expensible: capital costs, under the relevant heading, are deductible from income subject to tax as soon as income is available. Where there is a tax-free period, such expensing is deferred until after the tax-free period.

Offset: capital costs, under the relevant heading, are deductible in the year in which they arise from other income. However, in cases which specify a net depletion allowance, the income against which these costs are offset would otherwise be subject to the depletion allowance.

30% D.B.: the relevant capital costs are deductible only against the income from the investment directly involved. Basis is a maximum of 30% per annum on a diminishing balance. Where there is a tax-free period, such deductions may be deferred until after the tax-free period.

Amortized: the relevant capital costs are capitalized and written off against income pro rata over the life of the mine.

None: no provision for the recovery against income of the relevant capital cost.

Column (7): three-year exemption. If the relevant case postulates a three-year period for a new mine free of tax, it is so indicated here.

Column (8): depletion allowance. In all cases except Case 16, if the case postulates a depletion allowance it is a net allowance of 1/3 of income deducted from the tax base after all allowable deductions. Case 16 postulates a depletion allowance of 15% of gross income, subject to a net income limitation of 50%. It is assumed that the net income limitation applies.

Column (9): cash flow rate of return on investment. The effective rate of return that equates the present value of the cash flow for which the investment is responsible to the present value of the cost of the investment.

Column (10): index, rate of return, "no tax" case = 100. The relative rate of return for each case in the study, using Case 15 (no taxation of mining income) as the index.

Column (11): index rate of return, "amortization" case = 100. The relative rate of return for each case in the study using Case 14 (no depletion allowance or three-year exemption; all expenses amortized) as the index.

CONDITIONS APPLICABLE TO ALL CASES (SEE TEXT OF APPENDIX F).

1. One venture only in exploration, development and production from a metal mine.

2. Capital costs of mine:

Property acquisition	$ 200,000
Exploration	1,000,000
Mine preparation	4,000,000
Plant construction	6,300,000
	$11,500,000

3. Mine has a producing life of 15 years.

4. Net operating income for each productive year, $3,000,000.

5. Operating income commences in 5th year of the project and ends in the 19th year.

6. Capital costs are expended as follows:

	Total	Property Acquisition	Exploration	Mine Preparation	Plant Construction
1st year -	$ 700,000	$200,000	$ 500,000		
2nd year -	1,000,000		500,000	$ 500,000	
3rd year -	4,000,000			1,700,000	$2,300,000
4th year -	5,800,000			1,800,000	4,000,000
	$11,500,000	$200,000	$1,000,000	$4,000,000	$6,300,000

7. Capital costs required for a given year's expenditure must be provided at the beginning of the relevant year. Operating revenues accrue at the end of each year of production.

8. Corporation tax is 50% of net taxable income.

REFERENCES

1/ Specifically, we found most useful a summary of "Cost of Bringing Mines into Production", for 10 recent mining ventures, published in the Canadian Mining Manual, 1962, Gardenvale, P.Q.: National Business Publications Limited. We used the average of the mines listed therein as a guide to the relative breakdown of the components of preproduction. However, the actual figures we used are entirely our own, and quite arbitrary.

2/ The conditions of Case 14 are somewhat more stringent than those that now apply for corporations in general, in that all capital costs would be written off at 6-2/3% per annum, straight line, as against a norm of, say, 20% diminishing balance, for industry in general.