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A Primer on Mineral Taxation

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Abstract

The paper discusses options available to tax mineral extraction projects particularly in developing countries. A desirable government share of the economic rent generated from mineral extraction can be achieved through different tax and non-tax instruments. This gives some room to design a fiscal regime that will be attractive to investors while providing the government with a fair share of the economic rent. However, achieving this will require a careful assessment of the appropriate distribution of risk and reward between the investor and the government. Moreover, there is growing pressure on countries to provide increasingly lenient fiscal terms so as to remain competitive as global investment destinations.

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I. INTRODUCTION

In many developing countries, the extraction of mineral resources plays a dominant role, both as a source of export earnings and, to a lesser extent, as a source of employment. But perhaps the most important impact of mineral extraction is from the fiscal link, with taxation of mining and petroleum projects being a major revenue source. To ensure that the state as resource-owner receives an appropriate share of the economic rent generated from mineral extraction, the proper design of the fiscal regime is of key importance, including the need to weigh the desire to maximize short-term revenue against any deterrent effects this may have on investment. This will require a balanced sharing of risk and reward between the investor and the government.

This paper provides an overview of the main economic issues a policy maker or adviser would need to consider when designing or reforming the fiscal regime in the mineral sector. The focus here is on both hard-rock mining and hydrocarbon extraction. While there are substantial differences between the two that require different approaches in analysis and policy formulation, there are also general principles of mineral taxation that apply to both activities (see Box 1).

Fiscal regimes for mineral extraction have changed quite significantly over time. Historically, royalties on output were the main form of mineral taxation, but starting in the 1950s, hybrid fiscal regimes combining royalties with ordinary taxes became more common. In the post-OPEC period, throughout the 1970s and 1980s, the fiscal burden in the mineral sector generally increased. Many countries also began experimenting with more direct involvement in production either through equity participation or production sharing arrangements. Contemporary regimes in the 1990s have given more attention to international competitiveness and fiscal incentives are increasingly used to attract investment also in the mineral sector.[2]

Often the tax regime becomes a key issue in project negotiations between the government and mineral investors, where potential revenue may be given up to attract companies to explore and develop mineral resources. It is commonly argued by investors that more lenient fiscal terms are needed to compensate for the excessive costs or risks from operating in a particular country.[3] It can also be claimed that the revenue loss is not real. Since the investment may not take place in the absence of the fiscal incentives, the government would be better off collecting some revenue under a more lenient regime, rather than none under a tax regime that may discourage investment. However, uncertainty obscures the picture and makes it difficult for the policy maker to assess whether the fiscal terms sought by an investor are really justified or if they will result in an excessive revenue loss. The critical, and difficult, issue is to determine if the

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[2] See Kumar (1995).

[3] The higher costs could arise from a requirement to provide infrastructure services in the vicinity of a project site, to offset high transport costs to markets, to compensate landowners or for security related costs.

investment would go ahead in the absence of fiscal incentives. Making this assessment may be complicated by the investor and the government typically having asymmetric information as to the likely profitability of a project.

Box 1. Oil, Gas, and Mining Tax Regimes

Mineral extraction is here defined inclusive of both hydrocarbons (such as oil, condensate, and gas) and scarce hard-rock minerals (such as copper, silver, and gold; but excluding abundant minerals with little rent such as sand and gravel). There are sufficient similarities in the economics of extraction of these minerals to derive general principles for taxation (e.g., the generation of economic rent). At the same time, there are sufficient differences between types of resources that justify different tax treatment, with respect to both the total tax burden and tax design. In addition, project prospects differ regarding geological size and quality of resource deposits, geographical distance, costs of development, operation and transportation, and risk. At times, this may justify a case-by-case approach when designing the tax regime.

Mining

Mining projects range from artisan mining to very large-scale projects with substantial macroeconomic impact. Small-scale mining activities are often treated differently for tax purposes than large-scale mines. Some countries include small mines within the standard tax regime, with micro-scale mining activities completely escaping taxation, or only being taxed by licensing fees or perhaps some kind of royalty payments.

Oil

Oil projects are often larger than mining projects though some countries have developed relatively small projects. Economic rents generated from the extraction of oil have historically been higher than for hard-rock minerals. This partly reflect the ability of major producers (primarily through OPEC) to prevent a sustained fall in prices over time, in contrast to many other minerals. Oil prices have also been fluctuating sharply over recent years, which of course provides for the possibility that even projects with normal profits can experience periods where excess profits are generated. Typically, the fiscal regime provides a higher state take under oil regimes than under mining regimes in expectation that extraction may generate higher profits. It is also far more common to see production sharing arrangements in the oil sector compared to the mining sector. This, however, may partly be historically determined; partly a reflection of there being less to share from mining and often little domestic demand for the extracted mineral.

Gas

Gas projects are quite different in nature from other hydrocarbon projects, partly because of the need to commercialize the gas. Typically, this involves long-term supplier agreements for the produced gas being negotiated prior to project development. The investment required is also often much more substantial particularly for downstream processing facilities (e.g., for a liquefied natural gas plant) or for transportation facilities (e.g., pipelines or dedicated gas transportation ships). The economic rent generated is typically lower than for oil projects; however, the magnitude of the investment, the long lifetime of a project and its fiscal impact may at times far outweigh the impact of oil projects. Fiscal regimes for the gas sector are typically negotiated with a large amount of flexibility on a contractual basis to accommodate the characteristics of a particular project.

II. TAX POLICY

A. Economic Rent and The Supply Price of Investment

The justification for having a separate fiscal regime for the mineral sector is related to the special role of economic rent in mineral extraction. The scarcity of an exhaustible resource, such as minerals, leads to the generation of economic rent when it is extracted.[4] Economic rent can be thought of as the difference between the market price for a commodity and the opportunity cost of engaging in supplying the commodity. Pure rent represents a surplus, a financial return not required to motivate economic behavior, and could therefore, in theory, be taxed without influencing production decisions (i.e., without distorting the resource allocation). Even with all pure rent taxed away, resource owners would earn an acceptable return on their investment, so the resource allocation would be unchanged and the investment would go ahead. This is the theoretical argument underpinning the policy advice that the government can aim at taxing a large share of the economic rent from mineral extraction and for specific proposals for rent taxes.

The opportunity cost of supplying a commodity is given by the supply price of investment, which is the return that is required by an investor to justify a decision to invest. This should be sufficient to cover the cost of exploration, development and production, the cost of capital, and a risk premium. For a given total return on an investment, the lower the supply price of investment, the higher the potential economic rent. The allocation between these two will determine how high a tax burden the government can impose without discouraging the investment from taking place.

While all investment outcomes are unknown ex ante, mineral extraction projects face an especially high degree of uncertainty, particularly related to geological, commercial and political risks. In the light of this uncertainty, most investors are risk-averse in the sense that choosing between two projects with the same net present value, the less risky project is preferred to the more risky project.[5] For a more risky project to go ahead, an investor will therefore require a higher risk premium, which increases the supply price of investment. The share of the total return that the government can tax without discouraging the investment from taking place (the economic rent) will therefore be smaller the riskier an investor perceives a project to be.

The investor's risk premium will reflect both sovereign (political) and project (commercial) risks. The magnitude of the risk premium, however, is affected by actions of the government,

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[4] For an early contribution, see Hotelling (1931).

[5] Large investors may still be able to cope better with taking on risk than a government if their project portfolio is sufficiently diversified.

and will be lower if commercial and political risk can be reduced. The government can reduce commercial risk, for example, by making freely available exploration data or perhaps by financing exploration activities. Political risk can be reduced by strengthening macroeconomic and fiscal stability. This illustrates that there are actions the government can take to minimize uncertainty, which will reduce the supply price of investment, thereby increasing the economic rent that can potentially be taxed without discouraging the investment from taking place.

B. Fiscal Regimes and Types of Taxes

After settling on an appropriate government share of economic rent, focus should be on how best to collect this. While that can be achieved through different combinations of instruments—and there is not one optimal model—the specific design of the fiscal regime will have an impact on project profitability and risk sharing. The choice of instruments will also influence the investor's assessment of project potential: two different fiscal regimes that provide the same sharing of rent may lead the investor to have a very different assessment of project viability. This provides some flexibility to design a fiscal regime that meets the objectives of both the investor and the government. However, this will require a careful assessment of the impact of taxes on both the government and investor, particularly as regards the sharing of risk and the timing of revenue collections.[6]

Direct tax instruments

Corporate income tax

Most countries include mineral projects within the standard corporate income tax regime. However, in an attempt to capture more of the economic rent, a higher tax rate is some times applied. One attraction of this approach is that it does not require the introduction of a separate tax regime, and tax officials (as well as taxpayers) will already be familiar with the legal framework and administrative procedures. At times, though, the taxable entity will be project or field-based rather than firm-based requiring the need to consider the impact of ring-fencing (see Box 2). In addition to income tax, the taxpayer may also pay withholding tax on dividends, often only when these are distributed to non-residents, and perhaps on interest payments. However, some countries compensate for a higher tax rate on mineral extraction by exempting the distribution of dividends from withholding tax.

Operating across many tax jurisdictions, there is ample scope for mining and petroleum companies to reduce revenues or inflate expenditure deductions in order to minimize the tax liability in a particular country. The incentives to engage in such behavior will increase the higher is the tax rate in the host jurisdiction relative to the home jurisdiction. Often it is therefore necessary to include in the tax legislation safeguard provisions to close loopholes for

[6] Section C below provides an assessment in this regard of the various tax and nontax instruments.

tax avoidance, such as through restrictions on deductible interest costs or by requiring that transactions be assessed on an arm's length basis.[7]

Box 2. Ring Fencing

A common difference between a mineral tax regime and the standard income tax is the delineation of the taxable entity. Whereas the standard corporate income tax typically applies to the consolidated operations of a firm, often under a mineral tax regime, the subject of taxation is the operations of individual projects. The difference being that mining and petroleum projects can be ring-fenced. In practice this means that a firm operating one project while developing a new project cannot reduce its taxable income from the former with losses from the latter. Ring fencing is introduced to protect present tax revenues, which could otherwise be postponed through continuous deductions. It will also to some extent avoid advantaging existing firms relative to newcomers. The benefit of this, however, must be offset against the impact this has on future revenue if a too tight ring fence discourages exploration and investment activities by existing firms.

Ring fencing can be introduced in different ways. Most commonly, the boundary of the ring fence follows the license area of the mineral deposit. In most cases, this also coincides with the physical boundaries of the project. However, project boundaries could be wider incorporating several license areas. This can be the case with gas projects where gas may be fed from several fields. Some countries have responded to this by broadening the ring fence to include the entire project. It is important, though, not to introduce too much discretion in this process, but make the determination of boundaries be as rule-bound as possible.

Another problem relates to projects that incorporate extraction, processing and transportation activities (this is typically the case for gas projects, but can also occur in mining and petroleum projects). To ensure consistency, the whole project could be treated within one ring fence. However, if the mineral tax regime is tougher than for other economic activities, there is an incentive for a project developer to seek to have the processing and transportation classified as downstream activities to be included within the standard tax regime. In other words, the ring fence will be narrowed to incorporate extraction activities only. While there may be economic reasons for this treatment, it does expose the revenue collections to a substantial risk from transfer pricing between project entities and a general revenue loss from applying lower tax rates.

Progressive profit tax

Another option is to introduce progressivity to the corporate income tax in anticipation that a mineral project may become very profitable and to ensure that the government shares in the upside. Often this is achieved in an ad hoc manner, for example by having a stepped tax rate

[7] See Box 5 below for a discussion of transfer pricing issues.

schedule linked to higher product prices, production volume, sales turnover, or the profit-to-sales ratio.[8] The problem with these measures, however, is that they are not necessarily fully correlated with the rate of return of a project and that they may also increase administrative costs. A progressive tax could also have negative implications by increasing the incentives for taxpayers to underreport income and may deter investors.

Resource rent tax

Recognizing the potential for mineral extraction to generate large economic rents, in the late 1970s attempts were made to design a tax system that would tie the tax burden more directly to economic rent, through special resource rent taxes.[9] These can be divided into so-called R-factor based systems and rate of return based systems. The first type links taxation to the investment payback ratio (the R-factor), defined as the ratio of the contractor's cumulative receipts over the cumulative costs (including the upfront investment). The tax kicks in when the R-factor exceeds one. This approach has been applied in some production sharing contracts with the government's share increasing with the payback ratio. Under the R-factor based system, the accumulated cash flows are not discounted, which distinguishes it from a rate of return based tax.

This other type of resource rent tax is a cash flow based tax linked to the real rate of return. It applies after a target real rate of return on the investment has been realized. In principle, the target real rate of return should equal the supply price of capital; in other words, represent the return on investment just sufficient to induce the investor to go ahead with the project. In practice, the target rate of return is often set as some mark-up on the return from a safe alternative investment, with the mark-up representing a country-specific risk premium. The tax is calculated by increasing the annual cash flow (typically without deductions for interest cost and depreciation allowances), which is initially negative because of the investment outlay, by the target rate of return, and continuously carry this forward until it turns positive.[10] When the carried-forward cash flow turns positive, the target real rate of return has been realized and the resource rent tax applies on profits above this threshold. Some fiscal regimes have incorporated a stepped resource rent tax schedule with incremental brackets to smoothen the shift to the higher tax regime.

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[8] See Land (1995) for a more comprehensive treatment.

[9] See Land (1995) for a useful discussion of various aspects of resource rent taxation, whereas Goss (1986) covers applied aspects of resource rent taxation. For a more theoretical discourse, see the seminal article and book by Garnaut and Clunies-Ross (1975, 1983). Other useful articles are Emerson et al. (1984) and Palmer (1980).

[10] By increasing the cash flow every period by the target rate of return, the real value of the cash flow is maintained so long as the investor's discount rate is equal to the target rate of return.

Though a resource rent tax has some very positive features, there are practical problems associated with it. The main attraction is that the tax, in theory at least, both secures the target rate of return for the investor and provides an appropriate share of economic rent to the government. By relying solely on a resource rent tax, however, the government's revenue stream becomes back-loaded, and for less profitable projects that do not achieve the targeted rate of return, the government will not receive any revenue at all. This can be addressed by combining the resource rent tax with either royalties or a standard profit tax that will provide some revenue early on, and only for very profitable projects will the resource rent tax then become effective. To assure an effective tax, it is also important to derive the appropriate thresholds for the target rate of return and the tax rate. If these are set too high, chances are that the resource rent tax will never apply (incentives for tax avoidance are certainly high); if the threshold is too low, the tax may become a major deterrent to investment. Perhaps the biggest question mark regarding the resource tax is the very low level of revenue raised from this tax in the few countries that actually apply one.[11]

While it is often implied that a fiscal regime relying solely on a resource rent tax will remove all disincentives to investment from taxation, this is not strictly speaking true. Since the resource rent tax reduces the after-tax profit at high rates of return, but the government does not share the losses from non-profitable projects, the tax will necessarily reduce the expected after-tax profitability of the investment. In that sense, the tax regime will be less neutral than would a pure cash flow tax, such as a Brown tax.[12] Of course, this raises questions whether it would be appropriate for the government to take on project risk. Moreover, it is still correct to say that a resource rent tax will result in less disincentives to investment than other tax regimes, including standard profit-based taxes, relying on more up-front payments to the government. The neutrality of the tax is also dependent on how close the presumed target rate of return is to the investor's actual discount rate (the opportunity cost).

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[11] This could either reflect design problems (e.g., if the threshold is set too high), increased tax evasion motivated by the higher tax burden, or be an outcome of less profitable projects (on which the resource rent tax would not apply to).

[12] Under a Brown tax, all cash flows will be taxed proportionally so that negative cash flows trigger a subsidy to the investor (negative tax). While the Brown tax therefore is neutral with respect to investment, there is a large credibility problem if the investor doubts the commitment of the government to pay subsidies. That may increase the perception of sovereign risk, partly because the financial risk taken on by the government could become quite large. In practice, this tax has never been applied in its purest form, though some countries do provide subsidies to corporations, thereby through a combination of tax and subsidy instruments, approximating a similar outcome as with a Brown tax. The impact of a Brown tax can also be replicated by the government acquiring equity in a project on commercial terms. For the original reference, see Brown (1948).

Indirect tax instruments

Royalties

Royalties have historically been the most important instrument for taxing mineral extraction. These are attractive to the government, because they ensure an up-front revenue stream as soon as production starts. A royalty can also be regarded as a factor payment for the extraction of the mineral resource similar to factor payments on capital and labor inputs (Conrad et al, 1990). However, if royalties are imposed at a too high rate, they can constitute a major deterrent to investment by increasing marginal cost. High royalty rates therefore risk making it unprofitable to develop marginal reserves by increasing the economic cut-off grade. The impact of this is to leave undeveloped mineral ore or petroleum deposits that would be economically feasible to extract in the absence of the royalty.

Royalties can be applied in a variety of forms, some are based only on production volume, but more typically they are assessed on the value of production.[13] Likewise, royalties can be calculated on a gross or net of cost basis. The latter is more typical for petroleum projects, where a netback formula can be applied to adjust for production and transportation costs before the royalty is assessed.[14] Some royalties are progressive with a rate that increases with the mineral price. In some countries, royalties are shared between the central and the local level governments, and at times even directly with traditional landowners.[15] While royalties assessed on a volume basis generally are simpler to administer, problems may arise where it is costly or difficult to monitor production or if the extracted output is not very homogenous. It may then be easier to assess royalty on the sales value. However, this in turn leads to problems related to valuation, particularly if transactions are conducted between related parties at non-arm's length prices.

Import duties

In principle, mineral projects should be treated similarly to other economic activities with regard to import duties. In practice, however, the mining and petroleum sector in many countries is treated differently either due to its unique features or as a special incentive offered to investors. Without special treatment of import duties, these would be an attractive way for the government to secure an up-front revenue stream. Given the very substantial import needs during project development, this revenue is typically even more front-loaded than royalty payments. For the same reason, duty exemptions are highly attractive to investors. Exemptions

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[13] For an overview of royalty practices in a wide range of countries, see Otto (1995).

[14] For example, to change the price base from the point of export to the well-head price adjusting for pipeline and other costs.

[15] The latter is the case, for example, in Papua New Guinea where all royalties are shared between local governments and landowner groups (Hancock, 2001).

can also be sought as a way to minimize dealings with customs officials, where foreign enterprises with substantial import needs can be an easy target for rent-seeking behavior.

It is quite common to exempt specialized equipment for exploration and development from import duties. At times, this exemption only applies if the equipment is re-exported after its use. At other times, all inputs (perhaps restricted to products that are not available locally) receive a blanket exemption. Some countries provide guarantees against discriminatory duties being imposed on mining and petroleum companies, perhaps by applying a maximum allowable duty. This may result in reverse discrimination whereby duties on imports for mineral projects are in effect lower than for other importers. In addition to special exemptions, countries with rebate systems for exporters typically also apply these to mineral projects.

Value-added tax

A mineral extraction project in a developing country will often export, if not all, most of its output. Combined with the very large investment needs, this can complicate the treatment for VAT purposes. Under a destination-based VAT regime with all exports being zero rated, the project will be in a constant refund position when reclaiming VAT paid on investment goods or on inputs. While this in an economic sense is a desirable treatment, it may constitute a challenge for a weak administration, which can face problems paying refunds in a timely fashion. This situation is further exacerbated by the magnitude of the VAT refunds, which can be substantial particularly during the investment period.

Faced with this refund problem, many countries choose to zero-rate mineral exports but to exempt from VAT imported capital goods and sometimes imported inputs for mineral extraction as well. This treatment may also be sought for domestic suppliers to projects, though this can be particularly problematic since it opens a loophole for domestic firms to evade VAT. That said, if the capacity is not in place to administer a refund based system, it may be an unavoidable option to introduce an exemption for capital goods, perhaps extended to certain specialized inputs used by mining and petroleum projects. It is important that the exemption will not apply to inputs that can easily be used by other sectors in the economy since this will open another loophole for tax evasion. Moreover, if imports of goods that are also produced locally are exempted, this will be an inadvertent incentive for firms to purchase directly from foreign suppliers rather than from local producers.

Non-tax instruments

Fixed fees and bonus payments

Many countries require payment of various fees, either fixed or auctioned, such as rental fees (e.g., for the land). Common for oil projects in some countries is the requirement to pay signature, discovery and production bonuses. The attraction to the government of bonus

payments is that these are received early in the project cycle;[16] for the same reason, they may discourage marginal investments. However, collecting bonus payments requires little administrative effort and is a desirable way to ensure some early revenue from a mineral deposit.

Auctions for exploration or development rights could in theory be a very attractive way of securing the state's share of economic rent. However, for countries where political risk is perceived to be large, or with a high level of geological uncertainty, investors will be very risk averse prior to development. The bids received are therefore likely to be lower than the expected net present value of a mineral deposit in a situation of no uncertainty. This could lead to demands to increase the government take if a project turns out to be more profitable than the ex ante bid would reflect. Despite this bias, an auction can be a desirable way to administer the allocation of exploration rights among companies, though it would be unrealistic to rely on this as a major revenue source.

Production sharing[17]

Production sharing arrangements are particularly common in the petroleum sector. While the specific design of a production sharing contract differs, one distinguishing feature is that ownership of the resource remains with the state and the company is contracted to extract and develop the resource in return for a share of production. There are three generic types of production sharing: (i) the concession agreement; (ii) the production sharing contracts (PSC); and (iii) the risk service contract. Concession agreements were very common vehicles through the 1950s for granting exploration rights in developing countries. The PSC concept was originally developed in Indonesia in the 1960s, but has since been adopted in various forms in several countries. The risk service contract is a variant of a PSC, under which the contractor is paid either a flat fee or a fee based on profits for providing specified services (Mikesell, 1984).

The production sharing contract (PSC) is a long-term arrangement between a national oil company and a foreign investor, where the investor assumes all the pre-production risk and recovers both cost and profit share out of production. When production starts, profit oil is derived from gross production by deducting allowable production costs. The profit oil is then shared between the government and the contractor, typically with a predominant share going to the government (at times the contractor will also be responsible for the marketing of all produced oil). In some contracts, the government share increases as the production volume, price, or rate of return go up. Other contractual agreements focus on revenue or profit sharing.

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[16] Signature and discovery bonuses are received prior to project development, whereas production bonuses are paid when production commences or reaches a certain prescribed level.

[17] For an accessible introduction to production sharing arrangements in the petroleum industry, see Johnston (1994). Other useful references are Mikesell (1984) and Machmud (2000).

However, the nature of these arrangements remains similar to production sharing (Machmud, 2000).

The allowable production costs that the contractor can claim back in any year are often capped as a percentage of total production and any excess costs may then be carried forward, either for a limited period of time or until they are fully exhausted. Where a cap is imposed on the deduction of costs, and actual costs are at the limit, this will have a similar economic impact as a royalty, with profit oil being shared as soon as production commences. In some countries, corporate taxes are also assessed on the company's share of profit oil, though the tax liability is at times paid out of the government's share of profit oil.[18] Who actually pays the tax will have an impact on whether or not a foreign contractor is able to claim a home country tax credit against the tax paid to the host country.[19]

A production sharing agreement can provide a flexible tool to adjust the fiscal package to suit a particular project without changing the overarching fiscal framework. While another attraction of a production sharing agreement would seem to be its simplicity, in practice, production sharing can be as complex to administer as profit-based taxes. Difficulties relate particularly to the determination of allowable costs. Moreover, it is possible that the ex ante agreement becomes quite inappropriate as the real profitability of a project becomes known, which can lead to a renegotiation process. It is also often the case that the contractor has an informational advantage over the government during the negotiations, which may make it difficult for the government to secure an appropriate share of economic rent.

State equity

Some governments prefer to hold equity in a mineral project to secure a higher take from very profitable projects by sharing in the upside. Non-economic reasons motivating a government to acquire equity include a desire to increase the sense of ownership, to facilitate transfer of technology and know-how, or to provide more direct control over project development. However, equity participation can become a costly option when financial obligations, such as cash calls, are taken into account.[20] There are also possible conflicts of interest arising from the government's role as regulator overseeing the environmental or social impact of a project,

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[18] This provides an implicit fiscal stability assurance. Box 4 below has a discussion of fiscal stability clauses.

[19] In Indonesia, for example, under the first-generation PSC, the state oil company paid all taxes on behalf of the contractor. Subsequently, the US Internal Revenue Service ruled that this would be regarded as a royalty payment and therefore no longer creditable against US tax liabilities. This led to a change in the second-generation PSC leaving the contractor responsible for the payment of taxes so as not to lose tax creditability (Machmud, 2000).

[20] Cash calls are the ongoing requirements for joint venture partners to contribute their share of development costs.

which may differ from its objectives as an equity shareholder. In many instances, the government would therefore be better off by solely taxing and regulating a project rather than being directly involved as an equity participant. Many investors would also regard a requirement to provide state equity as a deterrent to investment that is likely to be offset by an attempt to lower other taxes.

Equity participation can take several forms, including: (i) paid-up equity on commercial terms, which places the government on a similar footing as a private investor; (ii) paid-up equity on concessional terms, whereby the government acquires its equity share at a below-market price; (iii) a carried interest, whereby the government pays for its equity out of production proceeds, including an interest charge; (iv) tax swapped for equity, whereby the government's equity share is acquired through a reduced tax liability; (v) equity in exchange for a non-cash contribution, for example by the government providing infrastructure facilities;[21] and (vi) so-called "free" equity, which really is a bit misleading since this usually results in some, more or less transparent, off-setting reduction in other taxes (Daniel, 1995).

The choice between tax and non-tax instruments

The desired state take can be achieved by different combinations of instruments that may have a similar economic impact, though the taxes at first sight may appear quite different (Table 1). In principle, a production sharing arrangement can be replicated by a combination of royalties and income tax, with the government share of profit oil equal to the income tax rate and any cap on cost oil equal to the royalty (at least so long as the project is up against its cost oil ceiling). Likewise, if the state participates on commercial terms in a project by acquiring paid-up equity, this is equivalent to a Brown tax with the tax rate equal to the share of equity participation. A carried interest is equivalent to a resource rent tax with the equity share equal to the tax rate and the interest rate on the carry equal to the threshold rate of return. A concessional equity share could be designed equivalent to a resource rent tax combined with an income tax at a rate representing the share of initial development expenditure not contributed to by the government.[22]

Since the fiscal terms can be replicated by different instruments there is no intrinsic reason to prefer a tax/royalty regime to a production sharing regime or vice versa. The choice between the two will reflect administrative preferences or a particular structure that may be most suitable for local conditions. This provides some leeway to design a fiscal regime that provides the best fit

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[21] It has been argued that this could be appropriate where the state has access to concessional financing. Since the private investment needs will be reduced, the risk premium and the supply price of investment are likely to be lower, thereby increasing the economic rent available to the government (Garnaut and Clunies-Ross, 1983).

[22] See Garnaut and Clunies-Ross (1983) and Daniel (1995) for a more detailed exposition of these results. This is also discussed in Nellor and Sunley (1994).

for particular project circumstances, while providing an appropriate sharing of risk and reward between the investor and the government.

Table 1. Equivalency Results For Profit Taxes and Other Forms of State Participation

	Royalties	*Corporate income tax*	*Resource rent tax*	*Brown tax*
Production sharing 1/	royalty rate = cost oil cap	tax rate = government profit share		
Paid equity				tax rate = equity share
Carried interest			tax rate = equity share; target real rate of return = interest rate	
Concessional equity		tax rate = share of initial concessional investment	tax rate = equity share; target real rate of return = interest rate	

Sources: Based on Garnaut and Clunies Ross (1983); and Daniel (1995).
1/ A production sharing system with an uplift factor could be replicated through a resource rent tax perhaps supplemented by a royalty or corporate income tax.

C. Impact of Taxes

Taxes will have an impact on the efficiency of the resource allocation, on the sharing of risk between the investor and the government, and on the administrative requirements. While it should in principle be possible to tax the economic rent generated from the extraction of exhaustible resources without introducing distortions to the factor allocation, in practice there is a trade-off between maximizing revenue collections and not introducing too much production inefficiency. Taxes will also in general reduce the expected return of a mineral project and therefore have a negative impact on exploration and investment.[23] This will constrain the government in its desire to raise revenue from mineral extraction. Moreover, there are unique distortions from mineral taxes, some of which are summarized in Box 3. A related issue is that taxes can also be used to encourage sound environmental behavior as a market based alternative to direct regulatory intervention. This is becoming an increasingly important issue in light of the potential considerable environmental damage from mineral extraction.

[23] The exception to this is a pure cash flow based tax, such as the Brown tax, or a tax system with so generous write-off provisions for capital expenditure that investment is effectively subsidized.

Box 3. Inefficiency Impact of Mineral Taxes

The more important inefficiency effects arising specifically from mineral taxation are:

- a royalty raises the cut-off grade, leaving otherwise economic ore or petroleum undeveloped;
- royalties assessed on the volume of production tend to tilt the output path by reducing initial output.

These effects have typically been used to caution against relying excessively on royalty taxation, though profit-based taxes also result in some efficiency loss. In a more recent article, though, Osmundsen (1995) has shown that an optimal response to asymmetric information between the government and firm about production cost may still include royalties.

Source: Heaps and Helliwell (1985).

This section will compare the various tax instruments based on their impact on: (i) neutrality; (ii) risk; and (iii) administrative requirements. Table 2 provides a summary assessment on a seven-point scale where +3 indicates the best performance relative to a specific criterion and –3 indicates the worst performance. Each tax can be compared vertically as to how it performs relative to other taxes for a particular criterion. However, it is not possible to provide an overall quantitative assessment of each tax (i.e., rank the taxes based on their aggregate score), without assigning weights to the different criteria, which would require specifying a preference function for policy makers. In other words, the table can only be read vertically and not horizontally.

Table 2. Comparative Assessment of Mineral Taxes

	Neutrality	*Investor risk*		*Government risk*			*Implementation*		
	Efficiency	Stability	Project risk	Loss	Flexibility	Delay	Design	Admini-stration	Tax credit
Fixed fee	-3	-3	-2	+3	-2	+3	-2	+2	-3
Royalties	-3	-1	-1	+2	-1	+3	-1	+1	-3
Corporate income tax	-1	+1	0	0	+1	+2	+1	-1	+3
Progressive profits tax	+1	+3	+1	0	+2	+1	+2	-2	0
Resource rent tax	+2	+3	+2	-2	+3	-1	+3	-3	-2
Production sharing	-1	+1	0	0	+2	+2	+2	-2	-3
Paid equity	+3	-1	+3	-3	+3	-2	+3	+3	0
Carried interest	+2	+3	0	+3	+3	-3	+3	+1	-1

Sources: Adapted from Daniel (1995) and Garnaut and Clunies-Ross (1983).

Neutrality

The neutrality of a tax can be assessed by its impact on the resource allocation. One approach is to define a tax as being neutral if it leaves the pre-tax ranking of possible investment outcomes equal to the post-tax ranking.

The resource rent tax will have some distortive impact on investment allocations. Since negative cash flows are not subsidized, for some set of potential project outcomes, the pre- and post-tax ranking will differ. However, since the tax is only imposed after the investor's required real rate of return has been realized, the distortionary impact of the tax will be limited, at least as long as the investor's discount rate is close to the target rate of return. The impact on neutrality of the carried interest equity is equivalent to the resource rent tax, whereas the progressive profit tax is somewhat less neutral. While the tax burden on more profitable projects is higher relative to less profitable projects, the tax may be assessed before the investor's target rate of return has been realized. A corporate income tax will further reduce investment neutrality, since the tax will be assessed on profits at a proportional rate before the target rate of return has been realized. A production sharing contract can be structured equivalently to an income tax combined, perhaps, with a royalty. Finally, fixed fees or royalties will have a very negative impact on investment neutrality. Since the tax burden will be relatively unresponsive to changes in profitability, the ranking of possible project outcomes before and after taxation is likely to be quite different. [24]

Risk

Risk will affect both the investor and the government. While the traditional view has been that the investor is risk averse whereas the government is risk neutral, this is unlikely to be the case in many developing countries. There are clearly limits as to how much risk it would be prudent for a small mineral rich country to carry. A tax will have an impact on investor risk in terms of the perception of fiscal stability and how it affects commercial (project) risk. While the investor's perception of fiscal stability depends on a country's political and economic track record, a specific concern is that the fiscal terms may change during the life of a project. This often leads to a desire to have fiscal stability clauses included in project agreements (see Box 4). However, this concern may also be partially accommodated through an appropriate policy design. It can be argued that the more flexibly the government's share adjusts to unforeseen changes to profitability, the lower is the incentive for the government to revise the fiscal terms through renegotiations (though, of course, all taxes can always be changed).

This would suggest that the investor's perception of fiscal stability can to some extent be enhanced by taxes that provide the highest correlation between the tax burden and the rate of return. This will give prominence to the progressive profits tax, the resource rent tax, or a carried interest equity. Production sharing agreements and corporate income taxes may provide less reassurance to an investor of fiscal stability. If a project turns out to be very profitable, it is

[24] At least as long as the mineral firm is a price taker, so that the tax burden cannot be shifted forward.

more likely that the government will seek renegotiations to increase the government take; the investor may likewise put pressure on the government to renegotiate in cases where a project turns out to be less profitable than expected. This is even more pronounced with royalties where, for very profitable projects, the state take will not increase proportionally, giving the government a large incentive to seek to renegotiate the fiscal terms.

Box 4. Fiscal Stability Clauses

Given the nature of investment in mineral extraction—long term, large-scale and up-front—a particular concern for investors is to guard themselves against unforeseen changes to the financial premises of the project. Of particular concern are changes to the fiscal framework. One safeguard mechanism that is often sought by investors is the inclusion of a fiscal stability clause in the project agreement. While this to the government can seem an attractive and, in the short run, inexpensive way of minimizing investor risk, in the longer run it may have costs by limiting the government's flexibility to set tax policy. This can be further exacerbated if the practice spreads to other sectors in the economy, potentially resulting in a large revenue loss and increased administrative costs.

Fiscal stability clauses come in different forms. One approach is to "freeze" the tax system at the time of the project agreement. However, if the general tax system is later changed, this will imply a special treatment of a particular taxpayer. This will add to the administrative burden, especially if a number of projects are each operating under different tax systems. Another approach is to guarantee the total investor take. In other words, if one tax is increased, this will be offset by a reduction in another tax (or in principle by paying a compensatory subsidy). This perhaps preserves better the integrity of the tax system. Still, it may be quite difficult in practice to agree on compensatory measures that can satisfy both government and investor, particularly when there is uncertainty about future exogenous variables that will affect the project outturn differently under different tax systems. There are also some stability clauses that are asymmetric: protecting the investor from adverse changes to the fiscal terms but passing on benefits of economy-wide reductions in tax rates.

Fiscal stability clauses are widespread, particularly in the petroleum sector. Of 109 countries surveyed in 1997, a majority (63 percent) provided fiscal stability clauses for all fiscal terms (see annex Table 4). A small group (14 percent) had partial fiscal stability clauses excluding income tax. Finally, a minority (23 percent) did not provide any fiscal stability clauses in project agreements (at least up until 1997). However, this does of course not prevent an investor from seeking to negotiate new fiscal terms to offset the impact of policy changes.

The fiscal regime will also have a direct impact on the risk sharing between the government and the investor, where a tax will reduce investor risk if it shifts some commercial (project) risk to the government.[25] A resource rent tax will shift a large share of project risk to the government,

[25] An extreme example of this is the Brown tax, where the government subsumes project risk by subsidizing negative cash flows before the actual profitability of a project is known. A similar risk sharing can be achieved by the government acquiring an equity share on commercial terms.

since there is no tax assessed until the target rate of return has been realized, whereas a progressive profit tax will shift some project risk to the government by imposing a relatively lower tax burden on less profitable projects. The risk sharing will be lower under a corporate income tax, though higher than under a royalty-based fiscal regime. The latter will not adjust directly in line with profitability, particularly if the royalty is assessed on a volume basis. The impact of a production sharing agreement will be equivalent to an income tax.

While it is obviously attractive for the investor to shift commercial risk to the government, there are limits to how much risk the government can prudently take on. There may be some countries with a large, diversified stock of mineral projects, where the risk of a particular project turning out poorly is of less importance to the government than it is to the individual investor. In a sense, losses on one project can be made up for by gains on other projects. However, for most developing countries, this is likely not to be the case. Particularly for smaller countries with few developed mineral resources, a large project is likely to play a very dominant role in the economy, whereas it may weigh much less in the project portfolio of a large investor.[26] This suggests that the government should be concerned about minimizing the risk it takes on particularly relating to: (i) the potential fiscal loss; (ii) the responsiveness of the government take to changes in profitability; and (iii) the timing of revenue. Unfortunately, these are often conflicting objectives. For example, a tax that maximizes expected revenue for profitable projects may imply that the revenue stream becomes very back-loaded and uncertain.

To minimize the risk of fiscal loss, the most desirable tax for the government is a fixed fee, which is received up-front with no further financial obligations. Likewise, with a carried interest equity where the government pays for its equity share out of production proceeds. Should a project turn out to be unprofitable, there will be no direct losses to be covered by the government. Royalties are also effective in minimizing any potential fiscal loss. As long as production continues, royalty revenue will flow to the government even if a project turns out not to be making any profit. Both the corporate income tax and the progressive profit tax are more neutral. Even if a project turns out to be less profitable than expected, there is likely to be some income tax payable, and the same applies to a production sharing agreement. With a resource rent tax, on the other hand, the government may never receive any revenue if an investment turns out to be below the target rate of return.

As seen above, a tax that automatically adjusts the government's take in line with changes to the profitability of a project reduces the foresight required, ex ante when agreeing on the fiscal terms, to predict actual project outturn. The government would therefore have a preference for a fiscal regime that increases the state take for very profitable projects and, though the desire perhaps is less heartfelt, reduces this for less profitable projects. A resource rent tax scores high on this criterion; a progressive profit tax or a production sharing arrangement slightly less so.

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[26] The mineral sector is also susceptible to exogenous movements in prices that tend to affect all projects in a similar manner, thereby compounding the risk to the government, though differences in price hedging strategies imply that projects can be affected differently by price movements.

The tax take from a corporate income tax will also adjust to changes in profitability, though not as progressively. Royalties will respond less to changes in profitability, particularly if these are imposed on a volume basis, and may apply even if a project is unprofitable. Likewise for a fixed fee, which is typically paid before the actual profitability of a project is known.

A government is likely to prefer to receive revenue up-front. While it has been argued that the government should be less concerned about the timing of revenue than would a private investor, this would imply that the government is applying a lower discount rate (perhaps approximating zero) than a private investor, and is not facing any liquidity constraints. This hypothesis can only be justified in the absence of sovereign risk or if the government has unlimited access to concessional financing. However, most developing countries face a quite different fiscal situation where the opportunity cost of delaying the receipt of revenue can seem very large. It is therefore more reasonable to assume that most governments will strongly prefer revenue received earlier rather than later. The taxes that provide revenue with the least lag are fixed fees and royalties, followed by corporate income tax or a production sharing agreement. Under a progressive profit tax, most of the revenue is likely to be received somewhat later, as a project typically becomes more profitable over time. Under both a resource rent tax and a carried interest, the revenue flow becomes very back-loaded.

Implementation and administration

The impact of a tax system should also be evaluated in terms of how difficult it is to design, to administer for the tax authorities, and to comply with for taxpayers. Of particular concern is the informational requirements for the government to design a tax framework that will provide a reasonable share of economic rent (i.e., tax rate, threshold, and tax base). A specific issue that is likely to prove important for some foreign taxpayers' assessment of a particular tax regime is whether tax paid to the host country can be credited against any home tax liability.

The various taxes all differ in terms of how much information is required to design these in a satisfactory manner. Since the ex post profitability of a project is uncertain, both the government and the investor face a large informational deficit when estimating the fiscal parameters that will provide an appropriate government take.[27] The ranking of the tax instruments reflects how flexible the tax take is in adjusting to changes in profitability without explicit policy changes. Since this is similar to the ranking under the flexibility criteria in the risk section above, it will not be repeated here.

Another concern when designing or reforming a tax system is the capacity to properly administer it. This, of course, varies considerably across countries. However, for some countries the administrative capacity in the tax authority is likely to be a serious constraint, both in the project negotiation phase as well as when it comes to the actual assessment and collection of

[27] Though the informational deficit regarding expected project profitability is likely to be asymmetric between the investor and the government.

mineral taxes. This requires close attention to the administrative demands imposed on the authorities, particularly the need to keep the tax system simple and unambiguous (though these objectives often clash). This is especially important given that the risk of tax avoidance is likely to increase with the complexity of the tax regime. Focus should also be on the corporate strategies that can be used to minimize host country tax liabilities through transfer pricing by shifting income away from or allocate deductions to the host country (see Box 5). While transfer pricing issues are not unique to the mineral sector, the predominance of multinationals makes this a particularly challenging administrative issue.

Box 5. Transfer Pricing

A global mining or petroleum company will have tax liabilities in many countries. This provides fertile ground for attempts to lower the overall tax liability through transfer pricing and other means of tax avoidance. Through transfer pricing, a taxpayer seeks to minimize income and maximize deductible expenditures in high-tax jurisdictions and vice versa in low-tax jurisdictions.

Some transfer pricing mechanisms that affect revenues are:

- The sale of export proceeds at below-market prices to an affiliated company located in a low-tax jurisdiction. However, this is likely to be less of a challenge in the mineral sector, at least as long as the extracted mineral is a homogenous product with a transparent price.
- However, it can become problematic if firms make creative use of price hedging mechanisms perhaps involving transactions between related parties. It can be very difficult to assess if hedging instruments are used for transfer pricing purposes rather than for reducing price risk.

Measures to maximize expenditure deductions include:

- The provision by related parties of debt finance at above-market interest rates perhaps leading to highly leveraged projects.
- Claiming excessive management fees, deductions for headquarter costs, or consultancy charges paid to related parties.
- The provision of capital goods and machinery in leasing arrangements at above-market costs charged by a related-party lessor.
- If the mineral tax rate is above the standard tax rate, there may be an incentive to establish a domestic shell firm that will on-lend financing capital from related parties to the mineral firm giving rise to an interest deduction at a higher tax rate than is charged on the interest earnings in the shell company.

For most tax administrations, transfer pricing is an enormous challenge that can be very difficult to detect and prevent. Properly designing the tax code, though, is an important first step. At a minimum, the tax legislation should include safeguards requiring that transactions between related parties be assessed on an arms-length basis, or perhaps that certain deductions be capped as a share of total costs. Some countries also impose a limit on the allowable (for tax purposes) debt-leverage of a project. It would also be beneficial to seek close cooperation with the tax authorities in the home countries of the mining and petroleum companies.

Governments should have an obvious strong preference for administrative simplicity. The equity option would be relatively easy to administer, except that a government may find it difficult to meet its financial obligations. Likewise, the collection of a fixed fee does not require particular administrative capabilities. The administrative requirements for the collection of royalties, while relatively limited, will depend on the particular design of the royalty system. A specific royalty would be the easiest to collect, whereas an ad valorem royalty require more effort, particularly for non-arms length transactions or if a net-back pricing formula is used. Still, ad valorem royalties are simpler to administer than a profit-based tax system, which requires an assessment of taxable income. If the income tax is incorporated in the standard corporate tax legislation, it may be somewhat easier to administer than a separate mineral tax legislation. A progressive profit tax may require new tax legislation, whereas a production sharing arrangement will typically be specified within a special project agreement (perhaps guided by a framework law). A resource rent tax may be imposed under a separate legislation, and could also require more administrative vigilance since incentives for tax avoidance are higher. However, being cash flow based, it does avoid the added complexities of depreciation allowances and interest cost deductions.

An issue that is likely to influence many foreign investors' assessment of a tax is whether the host country tax liability is creditable against the home country tax liability. Most large-scale mineral extraction in developing countries is carried out by multinational companies that may have additional tax liabilities in their home countries (unless foreign-sourced income is exempt in the home country). It is important for them if the tax paid in the host country will give rise to a tax credit against their home country tax liability rather than a tax deduction. Whether or not a tax is creditable depends, of course, on the particular tax law in the home country and on any double tax treaties between the home and host countries. But as a guiding principle, a host country tax that in nature resembles a home country tax will most likely qualify for a tax credit. Therefore, a higher rate of income tax will almost automatically qualify for a tax credit. On the contrary, some resource rent taxes may be deemed to differ in nature from a standard corporate tax and, therefore, could face difficulties in qualifying for a tax credit. At times, the same argument applies to royalties, fixed fees and taxes paid under production sharing agreements, which often do not qualify for tax credits (see Box 6).

Box 6. Foreign Tax Creditability in the United States

A particularly important feature for a foreign investor is whether taxes paid to the host country qualify for a tax credit in the home country, or if any foreign taxes will only lead to a deduction against home country taxes payable. This differs from country to country and depends on whether a country exempts foreign-sourced income or credits foreign taxes paid, but as an illustrative example the principles applicable to U.S. investors are described briefly here (see Westin, 1995).

Whether a U.S. corporation can claim a foreign tax credit against U.S. income tax for payment of overseas taxes relates to the nature of the foreign tax. More precisely, the foreign tax should have the predominant character of an income tax in the U.S. sense. To determine this, the following three tests may provide some guidance: (i) the realization requirement—the tax should be imposed upon events that would result in a taxable transaction under the U.S. tax code; (ii) the gross receipt requirement—the tax should be imposed on the basis of gross receipts; and (iii) the net income requirement—the base of the tax should be computed by reducing gross receipts to permit recovery of the significant costs and expenses attributable to such gross receipts (ibid., p. 357).

While the issue requires case-by-case consideration, a few general observations may be warranted. First, royalties are generally not creditable, particularly if the royalty is considered a payment for the right to extract natural resources. Second, a tax may not qualify if it is deemed that the allowable deductions under this are either insufficient or too generous to comply with the net income requirement. Potentially, an issue could relate to the exclusion of interest payments in the calculation of taxable income under the resource rent tax. Third, an issue may arise if under a production sharing agreement any income taxes assessed on the contractor are paid out of the state share, which may be regarded as a subsidy payment.

D. Macroeconomic Impact

Mineral extraction has important macroeconomic implications on the fiscal, external and real sectors of the economy. The macroeconomic impact of mineral taxes can be analyzed from a number of different perspectives, the more important being: the change to domestic saving and consumption through the fiscal link; the volatility of revenue and foreign exchange earnings; and the intergenerational changes in wealth.[28]

The main macroeconomic impact of mineral extraction in a developing country is likely to be through the fiscal link. In more developed economies, there will also be important structural links as opportunities for the local industry to provide inputs to a mineral project or perhaps to use mineral outputs for own production are realized. However, in many developing countries

[28] For example, see Daniel (1992), Gelb (1988), and Auty and Mikesell (1998) for a discussion of some of these points.

the structural links will be less extensive, and the main macroeconomic impact will come from the revenue collected by the government, particularly where the mineral sector operates as an enclave economy. Though there will also be a real sector impact in the form of job creation, this would tend to be somewhat limited in scope since mineral extraction is capital intensive and requires specialized skills that may be scarce in the labor force.

There will also be an impact on the balance of payments. During the construction phase imports will increase, financed by an inflow of investment capital, and after production begins export earnings will grow. This is likely to lead to an appreciation of the real exchange rate, and may result in "Dutch disease" effects. This can be explained as follows: the inflow of foreign capital and the higher export earnings lead to an increase in domestic money supply; in regimes with a fixed exchange rate this will increase the price of domestic non-tradables and, in regimes with a flexible exchange rate, to a demand-induced appreciation of the nominal exchange rate. In both instances, the real exchange rate will have appreciated. This tends to make the domestic tradable sector less competitive and thereby leads to a resource reallocation to the non-tradable sector or in extreme cases to de-industrialization. Some countries also have experienced rapid increases in asset prices or of real estate prices, often leading to speculative bubbles or construction booms (Collier and Gunning, 1994).

Given the prominence of the fiscal link, what the government does with the revenue generated from mineral extraction becomes of key importance from a macro point of view. The inflow of mineral revenue will facilitate an increase in government consumption, investment or saving. If the government decides to spend the higher revenue rather than save it, this will result in: (i) higher public investment, either directly productive or infrastructure; (ii) higher expenditure on goods, services or transfers, either temporary or permanent; or (iii) a temporary or permanent increase in public employment. The economic impact of these three alternatives is likely to be quite different. All options carry the risk that a temporary revenue windfall will lead to permanently higher expenditure commitments. Even a one-off increase in investment can have recurrent implications by increasing future operation and maintenance costs. If a sudden jump in revenue leads to a rapid increase in public expenditures, this may also provide opportunities for increased rent seeking and corruption.

The government will have a preference for maximizing its share of economic rent as well as minimizing fluctuations to the revenue flow. It is also likely that the government will prefer to receive revenue up-front rather than later in the project cycle. It is apparent that these objectives are likely to conflict. If the government designs a tax system that maximizes its share of economic rent (such as by a resource rent tax), this may result in revenue fluctuating from year-to-year or being excessively back-loaded. A revenue stream that fluctuates excessively will be a challenge for the government in terms of expenditure management. One option would be to stabilize expenditure levels through borrowing. However, the uncertainty from projecting mineral revenue receipts would question the prudence of spending in anticipation of future revenue streams (see Box 7). Alternatively, the government could build up a mineral stabilization fund and draw on this to stabilize expenditure levels over time. In practice, though, the experience with mineral stabilization funds has often been that these are no cure-all, and that

it is difficult to prevent possible fiscal problems from spilling over into these (see Davis et al, 2001).

Mineral extraction will also have intergenerational consequences that should be taken into account. Clearly the extraction of minerals reduces the net wealth of a country to the detriment of future generations, though current generations benefit from the higher production and consumption made possible by the mineral extraction (and future generations may be compensated through higher investment). One way to address this intergenerational conflict is through the establishment of a separate fund for the revenue generated from mineral extraction to be invested for future generations. Some oil exporting countries such as Kuwait, Norway, and Oman have followed this approach (ibid.).

Box 7. Revenue Forecasting

Realistic revenue forecasting from the natural resource sector is important to ensure good budgeting practice. Given the volatility of the revenue flow from the mineral sector, the annual budget can easily become quite unrealistic unless revenue forecasts are soundly based, though substantial uncertainty particularly from price volatility will affect projections.

Given the nature of the mining and petroleum sector, projections prepared on a project basis will probably provide the most realistic forecasts. One option is to construct a simple model to derive the tax payable for each major project. This will require information on expected production volume, price, and major deductible expenditure items. The realism of the forecast is likely to be enhanced if the model inputs are based on direct reporting by the operating companies. The price projections should be compared against industry-wide forecasts to ensure consistency with market expectations, though it would be appropriate to factor in very cautious assumptions. It may be preferable to prepare annual revenue forecasts for the mineral sector on a rolling medium-term basis.

III. FISCAL MINERAL REGIMES IN DEVELOPING COUNTRIES

To illustrate the range of fiscal regimes actually used to tax mining and petroleum operations, Table 3 provides an overview of current practice in a wide number of developing countries. A point of caution is called for, though, since cross-country comparisons are fraught with difficulties, particularly so for mining and petroleum projects. Since it is common in many countries to apply special fiscal terms to individual projects, either through separate legislation or on a contractual basis, the information shown in Table 3 should only be regarded as indicative of general fiscal terms or standard contracts in the mineral sector, whereas a particular project may actually be operating under different fiscal terms.

Mineral fiscal regimes are strikingly diverse across countries.[29] Still, some general observations can be inferred. The majority of countries in the country sample apply royalties in order to secure a stream of revenue up-front. However, while almost all countries assess royalties on an ad valorem basis, the actual rates vary from 2 percent to 30 percent; a common range for countries with royalties would be 5-10 percent.

Production sharing arrangements are widespread in the petroleum sector where about two-thirds of the countries surveyed have this as the main core of their mineral fiscal regime. Quite common is a formula-based system with the rate for sharing of profit oil linked to the volume of production. It is typical to have at least 50-60 percent of profit oil going to the state, but in some countries a higher share applies. While it is not shown in the table, countries also differ regarding limits for allowable costs the operator can offset against production to derive at profit oil. In some countries, even if income taxes are nominally due, these are paid out of the state's share of production. Finally, a few countries have a rate of return based sharing of profits rather than of oil production.

Countries without production sharing arrangements typically apply a higher profit tax rate in the mineral sector than for other economic activities. Likewise, if there are separate fiscal terms for mining and petroleum, the tax burden for petroleum is often higher than in the mining sector, reflecting the typically larger economic rents associated with petroleum projects. Some countries have combined a corporate profit tax with a resource rent tax, often rate of return based, whereas a few countries apply a higher profit tax rate when mineral prices exceed a certain trigger level. While not shown in the table, some countries have provided for more lenient taxation of natural gas projects, partly reflecting the typically higher investment requirement and larger risk involved than under an oil project.

Investment incentives are widely available with the most common being full current expensing of exploration and/or development costs, accelerated depreciation allowances, and investment

[29] One would expect that (i) countries with large mineral reserves and relatively low exploration and development costs will be able to have a tougher fiscal regime; and (ii) high-cost countries with smaller mineral reserves will have to offer more lenient fiscal terms to be successful in attracting investment.

tax credits. Tax holidays or reduced tax rates are less common, but some countries do offer these, particularly for smaller projects or for investments in certain less explored regions. Many countries provide exemptions from customs duties and VAT on imports, at times only for specialized equipment that will be re-exported after project exploration or development is completed. Another common incentive is flexible loss carry-forward provisions, in some countries for an unlimited period of time.

Many countries retain the right to take equity in a project. Often this is done on a carried interest basis, whereby the cost of the equity is paid back to the company out of production proceeds. However, many countries do not actually exercise their right to equity participation or at least not fully, partly due to the high financial obligations that arise from project participation.

Some regional patterns are also apparent. In Africa, about one-half of the surveyed countries rely on production sharing. Of the other half with a profit based tax system, quite a number applies a resource rent tax in addition to the corporate profit tax. In Asia, production-sharing arrangements are widespread, with only a few countries in the Pacific using resource rent taxes. In the Western Hemisphere, production sharing is quite rare outside of the Caribbean, and very few countries apply resource rent taxes. There are also several Latin American countries that have brought down taxes noticeably over the last couple of years, particularly Argentina, Chile and Peru. In the Middle East, the majority of countries rely on some form of production sharing. In the transition countries surveyed, production sharing arrangements are also common.

Table 3. Key Characteristics of Fiscal Mineral Regimes, Selected Developing Countries

Country 1/	*Royalties*	*Production sharing 2/*	*Income tax rate*	*Resource rent tax*	*D.W.T. (nonres)*	*Investment incentives 3/*	*State equity 4/*
Africa:							
Angola (M)	2-5%	None	35%	None	...	None	...
Angola (P)	16-20%	50-90% (V)	50%	None	...	Yes (E)	25%
Benin (P)	12.5%	55%	None	None	...	Yes (E,U)	15% (C)
Botswana (M)	Yes	None	25%	None	15%	Yes (E,U)	None
Cameroon (P)	Negotiable	None	57.5%	None	25%	Yes (O)	50% (C)
C.A.R. (P)	12.5%	None	50%	None	40%	None	None
Chad (P)	12.5%	None	50%	None	20%	None	10%
Cote d'Ivoi. (M)	2.5-3%	None	35%	Excess pr.	12%	Yes (A,I, H)	10% (C)
Cote d'Ivoire (P)	None	60-90% (V)	None	None	12%	Yes (O)	10-20%
Ethiopia (M)	None	None	35%	None	10%	...	...
Ethiopia (P)	None	15-75% (V)	50%	None	10%	Yes (E)	10%
Gabon (P)	10%	65-85% (V)	None	None	...	Yes (E)	15% (C)
Ghana (M)	3-12%	None	35%	25%	10%	Yes (A,U,I)	10-30%
Ghana (P)	12.5%	None	50%	12-28%	10%	...	25%
Mozambique (P)	15%	10-50%	None	None	...	Yes (E)	None
Namibia (P)	12.5%	None	42%	Formula	None	Yes (E,U,I)	None
Namibia (M)	...	None	Formula	25-45% rr	10%	Yes (E,U,I)	None
Niger (P)	12.5%	None	50%	None	18%	Yes (E)	...
Nigeria (P)	0-20%	20-65%	85%	None	10%	Yes (E, Cr)	Variable
Senegal (P)	5-12.5% V	0-50% (ror)	35%	Yes	10%	...	5-20%
South Africa (P)	2-5%	None	30%	40%	...	Yes (O,U,I)	20% (C)
South Afric. (M)	None	None	Formula	Progress.	12.5%	Yes (E,U,I)	None
Sudan (P)	...	60-80%	None	None	None	...	None
Tanzania (P)	20%	45-72.5%	None	25-35% rr	10%	...	15% (C)
Tanzania (M)	3-5%	None	30%	None	10%	Yes (E, I,U)	None
Uganda (P)	None	None	30%	0-80% ror	15%	Yes (E,U)	25%
Zambia (P)	10%	0-25% (ror)	Contract	Yes ?	15%	Yes (E,I,U)	10%
Zambia (M)	2%	None	35%	None	15%	Yes (E,I,U)	None
Zimbabwe (M)	None	None	37.5%	None	20%	Yes (E,O)	None
Asia and Pacific:							
Bangladesh (P)	None	60-70% (V)	None	None	...	Yes (I)	None
Brunci (P)	...	None	55%	None	None	Yes (A)	50%
Cambodia (P,M)	5-12.5%	40-65% (V)	30%	None	None	Yes (E)	None
Indonesia (P)	...	80-90% (V)	35%	None	13%	Yes (I, A,Cr)	10%
Indonesia (M)	Yes	None	30%	None	20%	Yes (I,E)	None
Malaysia (P)	10%	50-70%	38%	70% (Pr.)	None	Yes (A, E,U)	25%
Mongolia (P)	12.5%	35-60%	40%	None	20%	Yes (I)	None
P.N.G. (P)	2%	None	45%	20-25% rr	None	Yes (I, Cr)	22.5 (C)
P.N.G. (M)	2%	None	30%	20-25% rr	10%	Yes (I, Cr)	30%
Philippines (P)	None	60%	32%	None	15-32%	Yes (E)	None
Philippines (M)	3%	None	32%	Excess	15-32%	Yes (I,H,A,E)	None
Solomon Islands	Yes	None	35%	Yes (ror)	None	Yes (Cr)	None
Thailand (P)	12.5%	None	50%	None	10%	Yes (E)	None
Vietnam (P)	6-25%	65-70% (V)	50%	Formula	15%	Yes (H)	15%
Europe:							
Bulgaria (P)	12.5-17.5%	50%	40%	None	15%	Yes (H)	None
Poland (M)	2-10%	None	30%	None	20%	Yes (O)	None
Turkey (P)	12.5%	None	25%	None	20%	Yes (E)	None

See footnotes on the following page.

Table 3. Key Characteristics of Fiscal Mineral Regimes, Selected Developing Countries (concl.)

Country 1/	*Royalties*	*Production sharing 2/*	*Income tax rate*	*Resource rent tax*	*D.W.T (nonres)*	*Investment incentives 3/*	*State equity 4/*
Latin America:							
Antigua (P)	5%	30-50% (T)	None	None	...	None	None
Argentina (P)	12%	None	30%	None	35%	None	None
Argentina (M)	Up to 3%	...	35%	None	35%	Yes (E,H,A,I)	None
Aruba (P)	None	79-89.5% (V)	39%?	None	None	Yes (E,U)	None
Barbados (P)	12.5%	50-70% (V)	None	None	15%	Yes (E,U)	None
Belize (P)	7.5%	5-15% (V)	25%	None	15%	Yes (U)	5%
Bolivia (P)	31%	None	25%	25%	12.5%	Yes (E,U)	None
Bolivia (M)	1-7%	None	25%	25%	12.5%	Yes (U)	None
Chile (P)	Formula	None	15%	None	35%	Yes (A)	35%
Chile (M)	None	None	15%	None	35%	Yes (A,U)	None
Colombia (P)	20%	None	12.5%	None	7%	None	50% (C)
Costa Rica (P)	1-15%	None	30%	None	15%	None	None
Dominican Rep.	17-30%	None	25%	None	25%	Yes (I)	None
Ecuador (P)	12.5-18.5%	None	25-44.4%	Formula	25%	...	None
Guatemala (M)	5%	None	27.5%	None	10%	Yes (E)	None
Guatemala (P)	20%	30-70% (V)	31%	None	None	Yes (E,U,I)	None
Guyana	None	50-70% (V)	35%	None	10%	Yes (E)	None
Honduras (P)	1-15%	None	25%	None	10-15%	None	None
Mexico	None	None	35%	None	7.7%	Yes (E,I)	None
Peru (P)	Negotiable	None	20%	None	None	Yes (E,A,I)	None
Peru (M)	None	None	20%	None	None	Yes (E,A)	None
Trinidad & T (P)	...	Variable	50%	0-45% Pr	...	Yes (A,H,I)	None
Venezuela (P)	16.7%	None	67.7%	None	None	Yes (E, Cr)	0-35%
Middle East:							
Abu Dhabi (P)	12.5-20%	None	55-85%	Product.	...	None	60% (C)
Algeria (P)	10-20%	50-85% (P)	None	None	20%	None	51%
Bahrain (P)	None	70%	50%	None	...	None	None
Dubai (P)	12.5-20%	None	55-85%	None	...	None	None
Egypt	10%	70-87% (V)	40.55%	None	None	Yes (I)	None
Libya (P)	16.67%	Yes (P)	65%	None	...	...	...
Morocco (P)	...	None	39.6%	Yes (ror)	20%	Yes (A,I)	35%
Oman (P)	None	80%	55%	None	None	None	None
Qatar (P)	...	80-90%	None	None	None	None	None
Tunisia (P)	...	None	50%-75%	Yes (ror)	None	Yes (E,U,I)	Negotiable
Yemen (P)	3-10%	70-80%	None	None	None	Yes (E,U)	None
Transition econ.:							
Azerbaijan (P)	None	45-65% (P)	30%	None	15%	Yes (E,O,U)	7.5-20%
Kazakhstan (M)	Negotiable	Yes	30%	4-30%	15%	Yes (I,A)	None
Kyrgyz Republic	None (Oil)	60-80% (V)	None	None	15%	Yes (H)	None
Turkmenistan (P	12%	40%	25%	None	15%	...	None
Uzbekistan (P)	Yes	Yes	33%	None	15%	...	50% (C)
Uzbekistan (M)	1-24%	...	33%	None	15%	Yes (H,I)	Negotiable

Sources: Barrows (1997), Coopers & Lybrand (1998), PricewaterhouseCoopers (1999), Otto et al. (2000), and International Bureau of Fiscal Documentation (various).

1/ Separate fiscal regimes for mining (M) and petroleum (P) operations.

2/ Production sharing linked to physical volume of production (V), years of production (T), or realized profitability (P)

3/ Investment incentives: tax holiday (H), accelerated depreciation (A), tax credit (Cr), current expensing of exploration and/or development cost (E), exemption of imports of equipment and capital goods (I),unlimited loss-carry forward (U) and other (O).

4/ The maximum equity share that the state can select to take, often on a carried basis (C).

IV. CONCLUSIONS

It is unlikely to be possible to design one optimal fiscal regime suitable for all mineral projects in all countries. Countries differ, most importantly in regard to exploration, development and production costs; the size and quality of mineral resources; and investor perception of risk. Likewise, projects may differ sufficiently that some flexibility is necessary in deriving an appropriate fiscal regime. At times, this could justify a case-by-case approach to project negotiations, though it is desirable if the chosen fiscal framework is sufficiently flexible to respond to unforeseen changes so as to minimize the need for ad hoc negotiated changes. These factors will have an impact on how large the government's revenue take can be: a country with large proven resources and low exploration and development costs, will be able to negotiate a higher revenue share than a country that has a short, and perhaps somewhat uneven, track record, particularly if there is uncertainty regarding the size, quality and extraction costs of its mineral reserves.

Despite these qualifications, it is still possible to outline some desirable features to aim for when designing a mineral fiscal regime. Ideally, this should combine some up-front revenue with sufficient progressivity to provide the government with an adequate share of economic rent under variable conditions of profitability. This can be achieved through a tax-based system combining a corporate income tax with a rate of return based resource rent tax (or a progressive profit tax), and desirably a royalty to secure some up-front revenue. However, it could also be achieved by a production sharing arrangement with a moderately progressive government take linked to product prices or rate of return. The latter, however, may be more difficult to negotiate for countries with few successfully developed projects. Under those circumstances, a resource rent based tax system could prove more flexible while requiring less information ex-ante about potential project profitability. Still, the capacity of a particular country to competently administer a complex taxation-based system must be taken into account when designing the fiscal regime, and attempts should naturally be made to keep the legislation and administration as simple as possible, while maintaining sufficient safeguards to counter tax avoidance, particularly the risk from transfer pricing.

While there is broad consensus as to the desirable characteristics of a fiscal regime, some observers have voiced concern about increasing fiscal competition among countries seeking to attract investment capital. The share of economic rent to the government may become excessively low as countries compete in attracting mineral projects, particularly if the fiscal regime is used in an attempt to compensate for an otherwise unattractive investment environment or high political risk.[30] Though the pressure to provide generous fiscal terms to attract an investor can seem substantial, there is likely to be an option value from saving a nonrenewable resource for later development. Indeed, there may even be a lower bound for the government share from mineral extraction below which it would be more desirable to postpone development of a mineral deposit rather than forego too much economic rent. A better option would be to take measures that would improve the overall investment climate.

[30] For example, see Andrews-Speed and Rogers (2000).

Table 4. Petroleum Contracts: Fiscal Stability Clauses 1/

Fiscal stability clause		Fiscal stability clause, excluding corporate income tax	No fiscal stability clause
70 countries (63%)		15 countries (14%)	26 countries (23%)
Abu Dhabi	India	Albania 2/	Argentina
Algeria	Indonesia	Azerbaijan	Aruba
Angola	Jordan	Belize	Bolivia
Antigua	Kazakhstan	China	Brazil
Bahamas	Kenya	Costa Rica	Czech Republic
Bahrain	Kyrgyzstan	Ecuador	Fiji
Bangladesh	Laos	Eritrea	Hungary
Barbados	Liberia	Ethiopia	Jamaica
Benin	Libya	Guatemala	Lithuania
Brunei	Madagascar	Lebanon 2/	Nicaragua
Bulgaria	Malaysia	Mauritania	Papua New Guinea
Burundi	Moldova	Namibia	Paraguay
Cambodia	Mongolia	Pakistan 2/	Poland
Cameroon	Morocco	Senegal	Russia
C.A.R.	Mozambique	Ukraine	Seychelles
Chad	Myanmar		Slovakia
Chile	Nepal		Suriname
Colombia	Niger		Thailand
Congo	Nigeria		Tonga
Cote d'Ivoire	Oman		Trinidad & Tobago
Croatia	Panama		Tunisia
Dominican	Peru		Turkey
Republic	Philippines		Uruguay
Dubai	Qatar		Uzbekistan
Egypt	Romania		Venezuela
El Salvador	Somalia		Zambia
Equatorial	South Africa		
Guinea	Sudan		
Gabon	Syria		
Gambia	Tanzania		
Ghana	Togo		
Guinea	Turkmenistan		
Guinea Bissau	Uganda		
Guyana	Vietnam		
Honduras	Yemen		

Source: Barrows (1997)

1/ Information reflects contracts in existence up until 1997, since then more countries have been offering fiscal stability assurances.

2/ Fiscal stability clauses for off-shore projects.

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