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## ALLOCATING AND TAXING RIGHTS TO STATE-OWNED MINERALS

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Is Indonesia using the most effective possible strategies to derive revenue from its mineral resources? Auctions and work program bidding are the main ways of allocating mineral leases. In addition to the company taxes applied to all companies, governments can raise revenue from minerals owned by the state through auctions, royalties and rent taxes paid by private firms, and through dividends from state-owned firms. Indonesia uses work program bidding to allocate leases, and its production-sharing contracts are roughly equivalent to a rent tax at a high rate. This paper considers these options for raising revenues from mineral resources. It argues that efficiency and government revenue would both be increased if Indonesia relaxed direct controls on the operations of mining companies, and allocated leases by means of auctions, combined with a much lower rate of rent tax or, better still, a royalty.

Keywords: *oil and gas, resource management, natural resources*

### INTRODUCTION

Article 33 (3) of Indonesia's Constitution states that '[t]he land, water and the natural resources contained within them are to be controlled by the state and used for the greatest possible prosperity of the people'. This constitutional provision leaves open the question that is the subject of the present paper: what policies for allocating mineral rights and taxing mining companies are most likely to achieve 'the greatest possible prosperity of the people'? In most of this paper it is assumed that the mineral being discussed is petroleum.

A state that owns mineral resources and wants to derive revenue from them must consider two sets of questions simultaneously:

1. How should the rights to explore for minerals and to develop successful finds be allocated among mining and petroleum extraction companies?
2. What taxes should be imposed on the operations of these companies?

These questions cannot sensibly be discussed in isolation, because a tax system that is efficient under one allocation method may be inefficient under another.

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\* I am grateful for helpful comments from Ross McLeod and two anonymous referees. The responsibility for the views expressed and for all remaining mistakes is of course mine.

Interactions between taxation and allocation are therefore examined in some detail below.

Allocation is generally the responsibility of a government ministry of minerals and petroleum. There are usually two main steps in the allocation process: first, exploration rights are allocated; later the government ministry allocates the rights to develop a successful find. The initial explorer generally gets first option to develop the find, subject to agreement with the relevant government ministry on the terms on which development is to take place. Both exploration and development rights are usually allocated for a limited time, with the possibility of renewal on modified terms.

Exploration rights are generally allocated by one of the following four methods, or some combination of them.

- Allocation of prospective leases to a state-owned oil company.
- Open access for exploration, subject to the purchase of an exploration licence.
- Auctions – that is, the allocation of prospective leases by cash bidding.
- Allocation of prospective leases by ‘work program’ bidding in a tender process.

Government may derive revenue directly from the allocation itself, as in the case of a cash auction, or from dividends paid to it if it allocates the mineral rights to a company it owns. Revenue may also be derived by taxing the operations of private exploration and development companies. Apart from company income tax, the main alternative types of tax are royalties and resource rent taxes. Company income tax is not analysed in detail in this paper. Rather, it is assumed that it is applied on the same basis to all companies.

In any country, but particularly in a developing country, the allocation of valuable rights generates scope for corruption. The relevance of this to the allocation and taxation of mineral rights depends on the differential impact of corruption on the various allocation and tax alternatives. The need to minimise corruption generates an argument in favour of auctions and royalties. An open cash auction provides less scope for corruption than does work program bidding, in which the criteria for choosing the winning bid are not clear cut. And royalties are less open to corruption than other tax arrangements because of their administrative simplicity: the prices of minerals and the quantities produced by particular projects are easier to measure than the prices and quantities of the inputs used in particular projects. This is all the more likely to be true when account is taken of the difficulty of allocating a diversified mining company’s inputs among the many projects that it is likely to operate.

The next three sections discuss the relative merits of royalties, auctions and allocation by non-price means – that is, to a state-owned oil company or by work program bidding. Open access to holders of an exploration licence is a mechanism used for sites that are too small, or too non-prospective, to make it worthwhile for the state to gazette and auction them by either price or non-price means. It is not discussed in detail here. The paper then analyses rent taxes, arguing that Indonesia’s production-sharing contracts are roughly equivalent to the resource rent taxes (RRTs) used in many other countries, but at a very high tax rate. The overview section brings together the earlier analysis to suggest ways in which Indonesia might improve the efficiency of its allocation and

taxation methods in order to increase the revenue it derives from its mineral resources.

## ROYALTIES

A royalty is a form of production tax, since its base is the output of minerals produced on a lease. It may be either *ad valorem* (that is, the amount paid is a fixed proportion of the value of output) or *specific* (the amount paid is fixed in terms of dollars per tonne of output). *Ad valorem* royalties are generally used for relatively valuable products such as metal ores, while *specific* royalties are commonly used for less valuable products such as construction materials.

The main advantage of royalties, relative to other methods of deriving revenue from minerals, is their simplicity, which comes from the relative ease with which production can be monitored. A private oil company cannot easily export oil without the state having a good estimate of the amount exported. The same is true of domestic sales.

The downside of royalties is that at low tax rates the state gets only a small fraction of the potential value of its resources, but at high rates a substantial proportion of the resource will be left in the ground, even though the cost of extracting it is less than its value. If, for example, the royalty is \$10 per tonne and the price paid by the buyer is \$100 per tonne, it will only be profitable to extract minerals whose cost of extraction is \$90 per tonne or less. Minerals whose cost of extraction is between \$90 per tonne and \$100 per tonne will be left in the ground even though their value exceeds their cost of extraction. Therefore, if a mining company must pay a royalty and can choose the profit maximising level of output, it will set output below the socially optimal level: the value of the firm's profits together with the value of the government's royalties will be less than the value of the firm's potential profits in the absence of any tax or royalty. The amount of the shortfall will be the value of the minerals left in the ground as a result of the royalty minus the cost of extracting them. This amount is the deadweight loss caused by the royalty.

## ALLOCATION BY AUCTIONS WITH CASH BIDDING

Before auctioning mineral rights, the owner must define the rights clearly and specify all relevant conditions, such as royalties and environmental regulations, that any purchaser must abide by. The seller or the auctioneer advertises the auction, and the seller informs the auctioneer of the reserve price that must be met if any bidder is to secure the rights. Auctions may be 'sealed-bid' auctions or open auctions. In an English-type open auction the auctioneer calls for an opening bid, and only accepts other bids that are higher than any previous bid. The item being auctioned goes to the highest bidder at the last price bid.<sup>1</sup> In a sealed-bid auction, the rights go to the highest bidder at either the highest or the second-highest bid price. The former (highest-price) type of sealed-bid auction

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1 It is also possible to have open auctions in which the auctioneer calls out a very high price and then steadily reduces it. The object being auctioned goes to the first person to make a bid. This process is known as a Dutch auction.

does not necessarily produce a higher price than the latter type, since it provides bidders with an incentive to bid less than the amount at which they value the rights being auctioned.

Auction design is not the subject of this paper and it will simply be assumed here for analytical convenience that the rights being auctioned are sold to the firm that values them most highly at a price equal to the valuation of the second-highest bidder. This is approximately what happens in an English auction, since the highest bidder need bid no more than the price at which the second-highest bidder stops bidding.

Cash auctions work best when the following three conditions are fulfilled:

- the rights to be auctioned can be clearly defined;
- there are many bidders and they are not able to collude; and
- the successful bidder can pay up-front.

In the case of a government-owned resource, a fourth condition is also important: the government must be able to make a credible commitment to keep to its side of the bargain by not imposing any *ex post* surcharge or tax if the value of the rights being auctioned turns out to be more valuable than was originally expected.

If these conditions are fulfilled and if many firms have access to similar technological opportunities, and if risks can be pooled or insured, then an auction with cash bidding will raise more revenue for the seller than will royalties alone, or any combination of cash bidding and royalties. The reason is that since royalties are in effect a tax on output, they generate deadweight losses that an auction avoids.

If risks cannot be pooled or insured, or if the most efficient firm has access to technological opportunities that its potential competitors all lack, then there may be a case for combining an auction either with royalties or with a rent tax. This is explained below in the section headed 'Rent taxes'.

Despite the apparent superiority of cash bidding – perhaps supplemented by a rent tax but not combined with royalties – to all other allocation methods, it is not widely used in practice. Examples of the use of cash bidding are provided by the USA and were once provided by Australia. Cash bidding for offshore petroleum leases was initially used in Australia after the introduction of the Petroleum Resource Rent Tax in 1985, but it has not been used since 1992. In the USA, auctions of mining leases are the norm, but these auctions are combined with royalty regimes and the royalties are more important, in terms of revenue raised, than the cash amounts paid at auction.

The owners of the sub-surface minerals in the USA are sometimes also the owners of the surface land, but in many cases a situation known as 'split estate' applies. In these cases, the owner of the surface land does not own the sub-surface minerals, and complex contracts and laws govern the rights of the two owners. The owner of the surface land must grant 'reasonable' access to the minerals, but can insist on some limits to the noise and pollution caused by mining operations. Split estate can happen in various ways. For example, the original private owners of the surface land and sub-surface minerals may have chosen to split the ownership of the minerals from that of the surface land and sold the mineral rights to others. Split-estate situations also arose in the development of the western states of the USA because, when the federal government allocated surface land rights to the original European pioneers, it generally reserved the mineral rights for itself.

The USA therefore differs from most other countries, including Indonesia, in that in the USA some minerals are owned by private companies and individuals, while others are owned by state and federal governments.

In the USA, the owners of mineral rights are seldom the mining companies that explore and develop the leases. Instead, the owner ('lessor') typically auctions a lease to a mining company ('lessee'). The mining company makes three forms of payment to the lessor. There is an up-front payment to secure the lease, known as the bonus; there is an annual rental; and there is a royalty on the minerals produced. The lessor specifies the rental and royalty rates in advance of the auction and grants the lease to the company that bids to pay the highest bonus. The lessor also specifies the 'primary term' of the lease before the auction is conducted. This is the period within which the mining company must begin production or lose the lease, unless some more complex arrangement exists to cover contingencies that may delay production, such as natural disasters or low product prices. Primary terms are usually 3–10 years. Provided that the mining company has begun production within the primary term, the lease agreement normally guarantees its right, again perhaps subject to various contingencies, to extend the lease for as long as it continues to produce.

Despite the widespread use of cash auctions in the USA, the bulk of the revenue raised by leasing mineral resources comes from royalties, not from the bonuses paid at auction. For example, in the five fiscal years 2006–10, US federal royalties from all minerals amounted to \$50 billion. Over the same period the revenue raised from bonuses was \$16 billion, and a further \$1.5 billion was raised from rents and other mineral lease payments.<sup>2</sup>

## NON-PRICE ALLOCATION METHODS

### Allocation to a state-owned monopoly

Many oil-rich countries have created state-owned oil companies. Following the discovery of offshore petroleum reserves in the Norwegian section of the North Sea, for example, the Norwegian government initially engaged foreign companies to exploit Norway's reserves on its behalf, but subsequently directed the state-owned hydro-electric company, Norsk Hydro, to diversify into the offshore petroleum sector. In 1972, the government created a company, Statoil, to specialise in this sector. In 2007 Statoil was merged with the petroleum activities of Norsk Hydro to form StatoilHydro ASA.<sup>3</sup>

In Indonesia, PT Permina was established to manage the Dutch petroleum assets that were forcibly nationalised in 1957. Subsequently, a second company,

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2 These data cover petroleum, natural gas and all other minerals for federal onshore and offshore leases and leases on American Indian lands (source: Office of Natural Resource Revenues, US Department of the Interior, Statistical Information, available at <<http://www.onrr.gov/ONRRWebStats/default.aspx>>).

3 In addition to this production company, the Norwegian government also owns a financial company, the State's Direct Financial Interest (SDFI), which acts as a financial partner with private exploration and development companies. Because the SDFI shares in the revenues and expenditures of the projects in which it is involved, its effects approximate the effects of an ideal rent tax, as defined below.

PN Pertamina, was set up and given a monopoly on the exploration, development and production of oil and gas. In 1968, these two companies were merged to form Pertamina. Under the leadership of General Ibnu Sutowo, Pertamina built up a business empire that extended far beyond the petroleum sector. In the mid-1970s this empire collapsed, with debts so large that their resolution had substantial macroeconomic effects on Indonesia's money supply and foreign exchange reserves (McCawley and Manning 1976).

Indonesia's constitutional requirement that natural resources 'are to be controlled by the state' was initially interpreted to mean that only state-owned firms could undertake exploration and production. This interpretation was later softened. Exploration and production are now almost entirely performed by international oil companies under production-sharing contracts (PSCs), and Pertamina is involved mainly in distribution and administration. Even its former role in allocating leases and supervising PSCs has now been taken over by the Executive Agency for Upstream Oil and Gas Activity (Badan Pelaksana Kegiatan Usaha Hulu Minyak dan Gas Bumi, BPMigas) in the Ministry of Petroleum and Energy.

Access to state-owned mineral resources gives a state oil company the potential to earn profits in excess of the normal return on the capital that is needed for its operation, and these profits can be returned to the state in the form of dividends. The potential benefits to a government of setting up a state-owned oil company are that the company can help in the acquisition of technical expertise from private companies, and that it can provide the government with information on the value of its mineral resources and how best to exploit them. The risks created by this strategy for deriving revenue from state-owned resources arise because it is hard to monitor the efficiency of the managers of the state-owned company and because there is an inevitable conflict between the interests of the managers and employees of the state-owned company on the one hand and those of the government and taxpayers on the other. These risks were vividly demonstrated in Indonesia by the 1970s Pertamina collapse discussed above.

### **Allocation by work program bidding**

In Indonesia, mineral leases are allocated by work program bidding (WPB), rather than by cash bidding. As with cash bidding, under work program bidding the lease may be selected, defined and advertised by the government ministry responsible. Under WPB the ministry calls for private firms to submit proposals for the exploration and development of the lease, which is then allocated to the firm whose proposal best meets the criteria set out by the ministry. The government ministry may also require or encourage firms submitting work program bids for a lease to operate in a consortium with state-owned firms or other private firms.

A variant on the procedure described above is for a firm that wishes to explore a particular lease to approach the government ministry with a work program bid without waiting for the ministry to advertise the lease. This is usually referred to as 'over-the-counter' allocation, and is used for leases that the ministry has not yet defined and advertised. These are generally the less valuable leases. When an over-the-counter work program bid is submitted, the ministry may accept it, reject it or advertise for other firms to submit competing bids. If the ministry's

general practice is to accept the initial bid, this system can be described as 'first come, first served'.

The distinction between WPB and cash bidding is clouded in two ways.

- Even at an auction where the amount bid is the primary criterion for determining the winning bid, it is seldom, if ever, the sole criterion, since bidders generally have to satisfy various prerequisites of competence and trustworthiness.
- Some of the expenditures promised in a work program bid may be 'surrogate government spending'. For example, a mining company may make a commitment to provide infrastructure or other facilities that are not directly needed for exploration and development of the mineral resource, and that would otherwise have been provided by the government. Expenditure by a private firm on infrastructure that would otherwise have been paid for by the state is obviously roughly equivalent to a direct payment of the same amount to the government by the firm and is therefore similar to a cash bid.

WPB can mean very different things depending on how it is administered by the responsible government ministry. One possibility is that the ministry grants the exploration rights to each lease to the firm that promises to spend the most money on exploration and then leaves the firm to make its own decisions, subject to its keeping to the agreed program. The defect of this allocation method is that competition among potential bidders will result in the dissipation of most of the potential value of the lease. The reason is that if the work program bid by one firm would leave a profit for it in excess of a normal return on capital, and if another firm has access to the same know-how and facilities, then that other firm will have an incentive to bid to spend more than the first firm. This reasoning shows that firms will have an incentive to keep increasing the amount to be spent on exploration until there is no expected surplus for the second most efficient firm, and the expected surplus for the most efficient firm comes only from its superior efficiency and greater past investments in know-how and infrastructure facilities relative to the second most efficient firm.

The implication of the above reasoning is that if the only tax on mining were an ideal rent tax (as defined below) and if mining rights were allocated by a WPB process in which bidders did not collude and under which the rights were awarded to the company that committed to spend the most on exploration and development, all that would prevent the dissipation of the entire potential value of the resource would be the difference in costs between the two most efficient firms. If there were no difference between the costs of these two most efficient firms, bidding between them to outspend each other would continue to the point at which all rent – and therefore all revenue from an ideal rent tax – was zero. In practice, the deviations of any actual rent tax from an ideal rent tax, the existence of income and other taxes, collusion between bidders and differences in efficiency between firms combine to prevent the extreme inefficiencies that would otherwise result. The important conclusion is that a tax on rent is only efficient if it is combined with an allocation mechanism that does not dissipate most, or all, of the potential rents from mineral resources.

At the opposite pole to the previous pessimistic case is the utopian possibility that WPB is administered by an all-powerful and benevolent ministry that controls every aspect of the operation of the private firms and forces them to operate

at the socially efficient optimum. The revenue derived by the government could arise from royalties, which would not be distorting in this utopian case because the ministry would force the mining company to produce the socially optimal amount. Or the revenue for the state might be derived from surrogate government spending by the firm that is awarded the lease.

In a less than ideal world, the outcome of very close supervision by the responsible government ministry might be far from optimal. Machmud (2000) cites the general manager of an American oil company to suggest that the supervision of private oil companies in Indonesia in the period following the Pertamina crisis was closer to a bureaucratic nightmare than to a social optimum: 'Every facet of life in the field seemed to be regulated, from ordering equipment and services to hiring, firing, promoting and demoting personnel. It was also the beginning of an era of bitter battles over the commerciality of new discoveries, about what constituted a new field, about resource calculations, about development costs, or about determining the successful bidder under a tender ... All this led to delays in doing business, since no project could be started without Pertamina's final approval' (Machmud 2000: 71).

The fact that Pertamina has withdrawn from undertaking exploration and development itself provides further evidence that the utopian case is unlikely to be relevant in Indonesia. If government agencies had the knowledge and abilities assumed in the utopian case, there would be no need for foreign oil companies to be involved at all: exploration, development and production could all be undertaken by state-owned companies alone.

## RENT TAXES

### Ideal rent taxes and resource rent taxes

All rent taxes are variants of the cash flow tax proposed by Brown (1948). Under an ideal rent tax at 40%, for example, the government would collect 40 cents of every dollar received by the firm and contribute 40 cents for every dollar spent by the firm. This would obviously give the government 40% of the net cash flows from the project. Although the government does not share in the legal ownership of the project, the division of profits and losses between the government and the original shareholders is exactly the same as it would be if the government had acquired 40% of the equity in the project. An ideal rent tax differs from an income tax in two ways.

- *Borrowing, lending and interest*: under a rent tax, borrowing, repayment of principal and payment of interest are normally all excluded, but they could all be included. For example, under a 40% rent tax, incentives would be unchanged if the government took 40% of every dollar borrowed by the firm being taxed, contributed 40% of every dollar of interest paid out and also contributed 40% of all repayments of principal. Under an income tax, borrowings are not assessable and repayments of principal are not deductible, but interest paid out is deductible and interest received is assessable.
- *Investment, capital gains and depreciation*: under an ideal rent tax, gross investment expenditure is immediately deductible, but capital gains and losses, including depreciation, are not assessable. Under an income tax, capital gains are assessable

and capital losses are deductible. Net investment spending cannot be deducted, but depreciation can be deducted because it is a form of capital loss.

The approximations to rent taxes that are actually observed inevitably deviate from the ideal rent tax defined above. This paper follows the tradition of referring to these real-world taxes as 'resource rent taxes', even though the crucial distinction between them and an ideal rent tax has nothing to do with resources and everything to do with the refusal of governments to contribute to three types of expenditures that would result in payments from the government to mining companies under an ideal rent tax. These are as follows, and all are further discussed later in this section.

- When a government introduces a rent tax unexpectedly, existing projects are never given an allowance for past expenditures that is equal to their contribution to the value of the project before the announcement of the tax. This exclusion, which amounts to a form of de facto expropriation, is probably the main attraction of rent taxes to governments and the main source of the revenue that they raise.
- As proposed by Garnaut and Clunies Ross (1975), in periods when net cash flows are negative, RRTs provide for credits against future rent tax liabilities that are carried forward with interest, rather than cash payments by the government to the firm.
- Under actual RRTs, costs that are not specific to the project being taxed are not allowed as deductions even when they contribute to the revenue that the project generates. Examples include head office expenses, investment in goodwill, and research and development spending. The tax that results from this type of exclusion is a combination of an ideal rent tax and a tax on the excluded inputs.

### **Ideal rent tax applied to a lease allocated by cash auction and announced before the auction**

Provided that the rent tax is announced *before* the auction is held, as assumed in this section, the government 'pays' for the equity that it acquires in the form of a reduction in the price received at the auction. Suppose that the value of the lease to firm  $i$  in the absence of a rent tax is  $V_i^0$ . The superscript indicates the rate of the rent tax, which is 0 in the absence of a rent tax. Without loss of generality, the firms can be numbered so that  $V_1^0$  is the highest of all the valuations and  $V_2^0$  the second-highest. If the rights to the lease are sold at an English auction, if it is announced in advance of the auction that the cash flows from the lease will be subject to a rent tax at rate  $\alpha$  and that the amount bid at the auction cannot be deducted against the positive cash flows from the project, then the value of the lease to firm  $i$  (and therefore the maximum amount that firm  $i$  is willing to bid at an English-type auction) will be  $V_i^\alpha = (1 - \alpha)V_i^0$ .

The preceding logic shows that the auction will be won by firm 1 at the maximum price that firm 2 is willing to bid,  $V_2^\alpha$ , which is equal to  $(1 - \alpha)V_2^0$ . The present market value of the future rent tax payments by firm 1, appropriately discounted for risk as well as for date paid, will be  $\alpha V_1^0$ . If the rent tax and the auction are combined, the market value of the government's total receipts will therefore be  $V_2^0 + \alpha(V_1^0 - V_2^0)$ , which is necessarily greater than or equal to the amount that it would have received from an auction alone,  $V_2^0$ , since by assumption  $V_1^0 \geq V_2^0$ .

The analysis above shows that the effective base of a rent tax announced in advance of an English-type auction is not the full value of the resource,  $V_1^0$ , but only the difference between the value of the resource to the two highest bidders,  $(V_1^0 - V_2^0)$ . Part of this difference is likely to be a return to some factor of production, such as know-how or infrastructure investment, in which firm 1 has invested more heavily than firm 2. Although the rent tax being analysed is assumed to have been announced in advance of the auction, it may not have been announced in advance of the decisions by the two firms on how much to invest in know-how, infrastructure and other similar long-term assets. Therefore, even in the case of a rent tax announced before a lease has been allocated, the term 'rent tax' is a misnomer. A much better name would be 'quasi-rent tax', since quasi-rents are the returns to factors of production that are fixed in the short run but variable in the long run. This name would highlight, rather than obscure, two important facts. Taxing these efficiency-enhancing factors of production will diminish the incentive for firms to invest in them in the future, and taxing them at arbitrarily high rates would result in firms not investing in them at all. A so-called rent tax is only neutral on the implausible assumption that there is no scope for varying investments in these factors.

Part of the difference  $(V_1^0 - V_2^0)$  may be the result of firm 1's ownership of facilities that are natural monopolies, such as ports and railways. The standard prescription for dealing with a natural monopoly is for a regulatory agency to require the monopolist to allow access to others at a regulated price. This standard prescription may or may not be effective, but it at least attempts to overcome the inefficiencies resulting from monopoly, whereas a rent tax does nothing to reduce these inefficiencies, although it may capture part of the monopoly profits.

There is no reason in principle why a private firm that auctions an asset should not sell its asset subject to a contractual obligation on the buyer to pay the seller a proportion – call it  $\alpha$  – of the net cash flow from the asset. Under this suggestion, the buyer would effectively agree to pay the private seller a rent 'tax' at rate  $\alpha$  as a condition for buying the right being auctioned. By doing so, the seller would in principle raise its total receipts from  $V_2^0$  to  $V_2^0 + \alpha(V_1^0 - V_2^0)$ . The fact that such contracts are never observed suggests that the benefits would be more than outweighed by the costs of measuring cash flows and preventing transfer pricing – that is, the setting of artificially high prices on inputs and artificially low prices on outputs in deals between the firm that is subject to the tax and firms that are not subject to the tax but are at least partially owned by the owners of the taxed firm.

Why then do many governments operate resource rent taxes? The most likely answer is that, unlike a private seller, governments can (and invariably do) combine the introduction of a rent tax with de facto expropriation, by making inadequate allowance for past investments and risk bearing. This is analysed in the next section.<sup>4</sup>

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4 A reviewer of this paper suggested that governments have informational and scale advantages over a private lessor, having already established bureaucracies that administer company tax and that require similar types of information. This may be correct, but it is not clear to me why a private lessor and lessee could not take full advantage of the information available to the tax authorities, by writing contracts that used information from the lessee's tax return on revenue, costs and so forth.

### Rent tax announced after a mining right has been allocated

The previous section showed that under an ideal rent tax the government effectively acquires equity in the project, and that if the tax is announced before the allocation of a lease by auction, the government 'pays' for its equity by obtaining a lower price than would have been paid in the absence of any rent tax. Now consider an ideal rent tax that is applied to the operation of a lease under which exploration and production rights had been allocated before the announcement of the tax. It does not make any difference to the analysis of this sub-section whether the rights were allocated by WPB or by an auction with cash bidding.

In the case of an ideal rent tax applied to an existing project, the price 'paid' by the government for the equity that it acquires is the tax rate times the value of the allowance that the government grants to the firm for its past investments. Suppose that the project is being operated by firm 1, and let  $V_1^0$  be the risk-adjusted present value of the future cash flows from the project in the absence of the tax, and therefore the contribution of the project to firm 1's market capitalisation if no rent tax is anticipated. Now suppose that after the lease has been allocated, and perhaps after some exploration and development have been undertaken, an ideal rent tax is unexpectedly introduced at rate  $\alpha$ . Suppose also that the firm operating the project is allowed a deduction of  $A$  against future net cash flows to compensate for its past investments.<sup>5</sup> By assumption, the tax is an ideal rent tax. It is therefore neutral and the total cash flows from the project are therefore unchanged, and so is their present market value, which reflects the market valuation of the riskiness of the project. This means that what the government gains in the present market value of its new taxes must equal what the firm's shareholders lose owing to the reduction in the market value of their shares. This amount – the rise in tax revenue and the fall in share value – is  $\alpha(V_1^0 - A)$ . If the tax being introduced is an ideal rent tax, this implies that it can only raise revenue from existing projects by the de facto expropriation of some of the equity originally held by private investors in those projects. This of course assumes that the introduction of the rent tax is not compensated for by the reduction or removal of some less efficient tax.

There is no essential economic difference between an ideal rent tax with less than full allowance for the market value of the project being taxed and outright expropriation. But there are important legal and political differences. A rent tax will avoid a constitutional check on expropriation if courts take a narrow view of what constitutes expropriation and rule that such a check applies only when the state seizes the legal ownership of the asset itself, and not when it appropriates to itself a share of the cash flows generated by the asset. Since shares have value only to the extent that they provide ownership of the cash flows generated by a firm's assets, the legal distinction between ownership of cash flows and ownership of assets is an empty distinction in an economic sense.

The important political difference between outright expropriation and the introduction of a rent tax with less than full allowance for past expenditures is that the latter can be disguised as a way of getting a 'fair share for the nation' on 'nationally owned resources'. The fallacy in this claim is that once a project is under way, the nation no longer owns the lease to the minerals. Almost no one

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<sup>5</sup> In principle, it makes no difference if, instead of an immediate deduction, the firm is given rent tax credits with the same present value.

would be deceived by the claim that a private landlord who had leased a house at specified terms should subsequently be allowed to impose an additional rent, not provided for in the original lease agreement; but this is exactly equivalent to what a government does when it introduces a resource rent tax on a project for which the lease has already been allocated. All three versions of the resource rent tax proposed in 2009 by Australia's 'Henry Committee' (Committee to Review Australia's Future Tax System 2009), and subsequently adopted in amended forms by the Rudd and Gillard governments, are examples of this type of expropriation.

Of course, every tax can be expected to disadvantage either the consumers or the producers of the good or service being taxed, or both. In this sense, every tax involves an element of expropriation. However, in the case of an ideal rent tax, expropriation is the essence of how it raises revenue without distorting business decisions.

### **RRT credits and the taxation of risky projects**

When cash flows are negative, RRTs give the firm a credit rather than a refund. This raises two related questions:

- What should happen if a project is abandoned before it has generated enough positive net cash flows to be able to make use of all its credits?
- What should be the carry-forward rate of interest?

On the assumption that the answer to the first question is that the unused credits would become worthless because the government would not redeem them for cash, Garnaut and Clunies Ross (1975) proposed that the interest rate should be the cost of capital to the project. The problem with this proposal is that, since risks are typically much higher at the exploration stage than at the development stage, no single interest rate can preserve neutrality. If, for example, the carry-forward interest rate on RRT credits were set at the long-term rate on government bonds plus 10%, it would be too low to prevent the resulting RRT from reducing expenditures on very risky projects, such as those that typically occur at the exploration stage, but still high enough to create inefficient incentives for firms to delay the extraction of a proved resource at the less risky development stage.

Fane and Smith (1986) and Fane (1987) pointed out that, if RRT credits are certain to be cashed out even if a project is abandoned before they have been used, and if the margins between borrowing and lending rates and the margin between the interest rates at which mining companies and the government can borrow are all negligible, then setting the carry-forward interest rate on RRT credits equal to the government bond rate would preserve neutrality. Since these assumptions are most unlikely to hold exactly, there is a strong case for cashing out credits at once, rather than carrying them forward.

### **RRTs as input taxes**

Defining the expenditures that can be deducted against a particular project is an unavoidable difficulty in calculating the rent attributable to that project. It is obvious that a firm's profits from a project are attributable partly to its past investment in infrastructure and know-how and to its expenditures on inputs such as head office costs that contribute to many projects. Because the allocation of such

expenditures among projects is inevitably arbitrary, any actual rent tax can never be truly ideal. In practice, governments do not attempt to approximate an ideal rent tax. The resource rent taxes that are observed in practice generally disallow deductions of all inputs that are not clearly project specific. For example, under Australia's Petroleum Resource Rent Tax there are 15 categories of input expenditures that are not allowed as deductions.

An actual rent tax that does not attempt to approximate an ideal rent tax, but instead deliberately disallows deductions for certain inputs, is equivalent to a non-distorting rent tax together with a distorting input tax. In comparing a production royalty to an RRT that deliberately taxes certain inputs, it should be noted that taxes on a sub-set of inputs are generally more inefficient than an output tax that yields the same revenue. The reason is that taxes on a narrow base are generally less efficient than taxes on a broad base.

### **Rent taxes applied to open access resources or to leases allocated by WPB**

The danger has been noted that, if mining rights are allocated by WPB, competition for leases will lead to the dissipation of potential rents. In such a case, an ideal rent tax would raise little or no revenue from new projects, though it might raise revenue by the de facto expropriation of existing projects. In this situation, and in the absence of royalties, what appear to be the defects of an RRT – the denial of refunds on loss-making projects and the taxation of inputs – would actually be its sole redeeming features, since they would be the only things preventing the dissipation of all potential resource rents.

### **Indonesia's production-sharing contracts**

Like most countries with substantial oil reserves, Indonesia allocates mineral and petroleum leases by a system of WPB, with oversight by the Ministry of Petroleum and Energy and its agency BPMigas. Indonesia's revenue arrangements are based on production-sharing contracts. Although the name suggests that PSCs are analogous to royalties, they are actually roughly equivalent to an RRT. They are based on a distinction between 'profit oil', which is shared between the mining company ('the contractor') and the government, and 'cost oil', which the company can keep to compensate it for costs incurred.

The profit oil derived from any particular lease is defined as gross production less the amount of oil whose market value is equal to the allowable costs incurred by the company. That is, profit oil is gross production in billions of barrels (bbl) minus allowable costs in bbl equivalent. Allowable costs in bbl equivalent can be defined as allowable costs in dollars divided by the price of oil in dollars per barrel. Potentially allowable costs are operating costs plus depreciation on actual capital investment plus investment credits – that is, what can be depreciated for tax purposes is a multiple of what is actually spent on capital investment. The investment credit is fixed as a proportion of capital investment and varies from contract to contract in a range between 17% and 55% (PricewaterhouseCoopers 2010: 40). Actually allowable costs are capped as a proportion of output, and the excess of potentially allowable costs over actually allowable costs is added to potentially allowable costs in the next year.

In the absence of the investment credit, the fact that capital investment may only be depreciated, rather than immediately deducted, would make Indonesia's

PSC arrangements approximate more closely to an income tax than to a rent tax. To the extent that the investment credit may roughly compensate the investor for delays and uncertainty in deducting investment spending, the arrangements can be regarded as an approximation to a rent tax. They certainly correspond more closely to an RRT than to an ideal rent tax, since most overhead and non-lease specific costs are not part of allowable costs, and since a company is not allowed to deduct the cost of unsuccessful exploration in one lease against gross production in another lease.

There have been many changes in the PSC arrangements since their introduction in the 1960s. For most existing PSCs, the rate of the equivalent RRT is 71%, since the government receives 71% of the profit oil and the company can keep only 29%.<sup>6</sup> This is a very high RRT by international standards, even before allowance is made for corporate taxes and the 'domestic market obligation' (DMO) – a requirement that the company must sell part of its 'profit oil' to the domestic market at a price below the export price. Since corporate tax is levied at 35% and since branch profit dividend tax is levied at 20% on the income remaining after the deduction of corporate tax, this split is equivalent to 85% to the government and 15% to the contractor, even before any allowance is made for DMO.<sup>7</sup>

## OVERVIEW AND RECOMMENDATIONS

If the problems of measuring cash flows and preventing transfer pricing were unimportant, auctions combined with the closest possible approximation to an ideal rent tax would be the most efficient way of allocating mineral leases, and also the one that would raise the most revenue for the owner of the minerals. This conclusion applies not only to the case of state-owned minerals, but also to the case of privately owned minerals since, as noted earlier, a private owner could in effect operate the equivalent of a rent tax by auctioning a lease subject to the condition that the lessee would be obliged to pay the lessor a specified fraction of all subsequent net cash flows. The feasibility of using the private equivalent of a rent tax can be confirmed by noting first that a rent tax is equivalent to the combination of an output tax and an input subsidy, and second that private owners regularly impose royalties, which are equivalent to an output tax. If inputs could be measured easily, private owners could also provide lessees with the input subsidy that would convert royalties into a rent tax, thus allowing the owner and the lessee to share risks without distorting incentives in the inefficient way that results from royalties alone.

6 In frontier areas, for natural gas and under new contracts, the companies receive more favourable treatment (PriceWaterhouseCoopers 2010: 40).

7 The total tax take resulting from the corporate tax at 35% and the branch profit dividend tax at 20% on the remainder is 48%. This is because  $35\% + [1 - 0.35] \times 20\% = 48\%$ . After paying tax at 48% on the 29% of pre-tax 'profit oil', the contractor is therefore left with 15.1% of total 'profit oil' (PSC Discussion Forum, 2008, available at <<http://pscforum.wordpress.com/2008/07/28/psc-cost-recovery-demystified/>>). Of course adding a rent tax to an income tax is a dubious exercise that only really makes sense if borrowing and lending are negligible and gross investment is equal to depreciation, so that the two taxes have equal bases.

In practice, however, the combination of auctions and a close approximation to an ideal rent tax is seldom, if ever, observed. In the 1980s, Australia did briefly use a combination of auctions and an RRT to allocate offshore petroleum leases, but auctions were abandoned and Australia's Petroleum RRT is far from being the closest possible approximation to an ideal rent tax that could be legislated if it were desired to approximate an ideal rent tax.

As explained above, royalties have the disadvantage of discouraging the lessee from extracting all of the minerals whose value exceeds their cost of extraction, and the waste induced in this way is borne by the owner of the minerals, because it reduces the amount that potential lessees will bid at auction. However, in the USA both private and government owners of mineral rights use auctions combined with royalties. One reason for preferring a combination of royalties and auctions to auctions alone is presumably that the waste induced by royalties, at least at the rates used in US contracts, is usually more than offset by the benefits, which will ultimately accrue mainly to the owner, of sharing the risks involved in exploration and production between the lessee and the owner.

In the case of the allocation of mineral rights owned by a government, a second reason that has been suggested for supplementing an auction with an RRT, announced in advance of the auction, is sovereign risk: if the rights turn out to be much more valuable than was expected at the time of the auction, the government would be likely to raise royalties, or impose an ex post RRT (Emerson and Lloyd 1983). Therefore, according to this argument, the government should announce an RRT before the auction is held. The difficulty with this argument for supplementing an auction with an RRT is that an administratively simpler, but otherwise equivalent, arrangement would be for the government to reserve an equity stake in the project at the time of the auction.

A question raised by the US practice of combining royalties with auctions is why private and government owners of mineral rights prefer this combination to that of auctions and the closest possible approximation to an ideal rent tax, since the latter combination would appear to provide an even better way of sharing risks and would not produce the inefficient incentives produced by royalties. The answer to this question is probably that the difficulty of accurately defining and measuring input costs – and particularly the difficulty of allocating overheads among projects – more than offsets the inefficiencies due to production royalties alone. But if this conjecture is correct, it raises the question of why governments in many other countries have chosen to impose RRTs. The answer suggested in this paper is that rent taxes have an attraction for governments that is not available to private owners of minerals: when governments introduce rent taxes, they invariably take the opportunity to combine them with the de facto expropriation of shareholder equity, by not allowing mining companies, when calculating assessable rent for tax purposes, to deduct the full market value of their past investments from the revenues generated by these investments. Once a rent tax has been imposed, subsequent governments have little or no incentive to remove it, because this would reduce government revenue, and it would be hard to trace the original owners whose equity had been partially expropriated.

This paper has argued that the RRTs imposed in practice are usually combined with WPB and are deliberately designed to depart from ideal rent taxes by taxing certain categories of inputs and by providing credits, rather than refunds, in

periods when investment spending exceeds revenue. The latter practice discourages risk-taking, because projects that do not generate sufficiently large positive net cash flows are unable to make use of the rent tax credits received in the early phases of exploration and development. These deviations of RRTs from ideal rent taxes are instances of 'government failure', as opposed to 'market failure', and arise when leases are allocated by WPB rather than by auction. The attraction for governments of combining WPB and rent taxes is that this allows them to have direct control over exploration and production and to deflect the criticism, to which they would otherwise be vulnerable whenever mining companies make abnormally large profits, of failing to protect the national interest. It has been argued here that, despite its political attractions, this way of allocating leases is less efficient than auctioning them and imposing royalties, but is chosen by governments because the resulting inefficiencies cannot easily be observed and measured.

It is also necessary to explain the preference of governments for RRTs over the much closer approximations to an ideal rent tax that would be feasible if they wished to make use of them, since under the assumptions that make rent taxes efficient, governments reduce the total revenue that they receive from their minerals by deviating from an ideal rent tax. The explanation suggested here is again government failure: once leases are allocated by WPB rather than by auction, the neutrality of an ideal rent tax is likely to be a *disadvantage* since, as argued above, allocation by WPB may result in the dissipation of much of the potential value of mineral resources. If potential rents are largely dissipated by WPB, an ideal rent tax would raise little or no revenue from new projects. The non-neutrality of actual RRTs would therefore become an advantage, since it prevents the dissipation of potential rents that would occur under WPB alone, or under WPB combined with a neutral tax regime.

In the light of the above overview, Indonesia's PSCs appear to have little merit: they combine work program bidding with an approximation to a resource rent tax at a very high rate. What merit they do have comes from the fact that they are well understood and have been in place for a very long time. There is a something to be said for the maxim 'If it ain't broke, don't fix it'. However, if some gradual changes were to be introduced, it would be sensible to reduce the implicit RRT rate, to reduce the extent of direct controls in the WPB system and to combine the reduced RRT with cash auctions.

The recommendation that leases be allocated by auctioning them was made almost 30 years ago in this journal by Emerson, Garnaut and Clunies Ross (1984). However, these authors took a much more favourable view of RRTs than that adopted here, and therefore recommended combining auctions with an RRT. In contrast, the conclusion of the present paper is that it would be better, in terms both of overall efficiency and of raising government revenue, if Indonesia moved away from work program bidding towards auctions, combined with low royalty rates and far less direct controls on private mining companies. The case for allocating mineral rights by auction, subject to low royalty rates, is strengthened by the discussion, in the introduction to this paper, of the differential impact of corruption on alternative allocation and taxation methods.

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