A REVIEW OF THE NORTHERN TERRITORY GOVERNMENT'S
"GREEN PAPER ON MINING ROYALTY POLICY FOR
THE NORTHERN TERRITORY

P.L. Swan

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ABSTRACT

The Green Paper on Mining Royalty Policy for the Northern Territory represents one of the few attempts made by Australian governments to provide a discussion of mineral royalty policy and is remarkable for its rejection of traditional ad valorem and specific royalties on one hand and economic rent (i.e. pure profit) based royalties on the other. I argue that the Paper's recommendation for a 35 per cent royalty levied on historic cost accounting income, in addition to the traditional company income tax, is arrived at by largely ignoring the efficiency and equity criteria laid down as objectives. Instead far too much weight seems to have been placed on the need for a "stable flow" of revenue with little consideration of the potential of the mining industry. My preferred alternative combines an auction or bidding system for a series of lease payments, as a means of allocating mineral leases, with a pure profits royalty based on net cash flows.
1. INTRODUCTION

The Green Paper (1981) is on the whole reasonably well done. Moreover it draws much more on the academic literature than one might expect, given its origins. In particular the recommendation to abolish specific and ad valorem royalties in favour of a far superior profits (more strictly historic cost income) based royalty scheme is a major step in the right direction as is the proposal to introduce lump sum bidding via an auction mechanism as a means of allocating mining leases. This bidding arrangement is only a supplement to the proportional profits royalty scheme. Thus I find a great deal to admire in the Green Paper with its analytical approach which is generally competent. The specific criticisms which are made should be seen within the context of this overall favourable light. I shall confine my comments and criticisms largely to those arguments which bear on the policy recommendation and the rejected alternatives. Most of the criticism relates to the fact that the Green Paper recommendations are a rather uneasy compromise between the traditional bureaucratic-technocratic solution of ad valorem or specific royalties on one hand and the almost unanimous academic economists' recommendation for an auction mechanism combined with a surplus profits, i.e. pure economic profits, tax or a resource rent tax variant of the pure profits tax. The actual recommendations are not going to appeal to either group although the latter group would recognise that major strides have been made in moving away from the traditional Australian bureaucratic-technocratic view and in the direction of one which is much more in accord with royalty policy in Alaska, and North American practice generally.

2. THE OBJECTIVES OF ROYALTY POLICY

In Chapter 5 (pp.52-53) the five objectives of the royalty system are listed of which, in my opinion, the most important ones are:
"(a) facilitate minimization of inefficiencies in the utilization or allocation of resources in the economy";  

"(c) ensure an equitable distribution of the nett value of minerals between mining enterprises and the people of the Northern Territory".

One is an "efficiency" and the other an "equity" criterion while the remainder are really incorporated in these two or are relatively minor. Clearly, the costs of administration and compliance should be kept to a minimum but at the same time higher administration and compliance costs than the absolute minimum ones would be justified if the overall allocation of resources including the costs of administration and compliance were as efficient as possible. The criterion to "facilitate economic development that is in the best interests of Territorians" is largely superfluous since an efficient allocation of resources which maximizes social welfare will presumably promote the right amount of economic development. The final objective "to yield a stable flow of real revenue commensurate with the potential of the mining industry" is, in my opinion, given far more weight than it deserves in the final analysis and perhaps as much as the other criteria put together.

The Green Paper (p.53) argues that there will be conflicts between these objectives and states that trade-offs will be required. I would argue to the contrary that a close to ideal royalty system which is also practicable can by and large fulfil all the criteria laid down so long as the criteria are interpreted properly. A case in point is the "stable revenue" criteria. This criteria is used to argue against the "surplus profits" royalty (p.122) and resource rent royalty (p.123) so that it is a major weapon used to justify the choice of a conventional income base (proportional profits royalty).
The first objection to such a criterion is why have it at all! A pure auction mechanism which sells off the mining right to the highest bidder may maximize the return to the owner (the Crown) for the scarcity rents associated with a particular site and in doing so may be perfectly efficient and equitable as laid down by the Green Paper, but it would not satisfy the Green Paper’s requirement of a stable revenue flow since it might result instead in one large pre-payment. This argument is akin to a man refusing a one million dollar gift on the grounds that he requires a stable income of (say) $100,000 for ever. However, given the existence of a capital market in which the $1 million could be invested at a real rate of return of (say) 10 per cent the man should clearly accept the gift and generate his permanent income stream via the capital market. One of the important functions of capital markets including borrowing and lending possibilities is to allow the smoothing of a fluctuating revenue stream and there is no reason why the Northern Territory Government should not make use of capital markets to carry out this smoothing process.

Secondly, the volatility of “surplus profit” royalties and similar schemes which attempt to obtain a return to the Crown which is related to the true value of the resource in which the Crown has property rights is far from being an undesirable property of such a royalty arrangement as the Green Paper claims (p.132). This is because if there really is risk aversion on the part of the mining company, as the Green Paper suggests (pp.39-43), then an optimal royalty arrangement will incorporate some risk sharing features ideally via a “surplus profits” royalty (Leland, 1978; Emerson and Lloyd, 1981). The volatility of the royalty payments do no more than reflect the volatility of the cash flow stream earned by the mining company due to fluctuating mineral prices and costs, and to insist that these be all absorbed by the mining company could have adverse affects on the royalties obtained by the Crown.
Finally, the idea that royalty receipts should not only be as stable as possible but also "commensurate with the potential of the mining industry" is a dangerous one - either if it means that the efficiency criterion is violated by a distorting tax (which may in fact reduce royalty receipts) or if the royalty attempts to confiscate more than the net value of the minerals themselves belonging to the Crown so that the equity criterion is violated. The idea that the royalty should raise at least the equivalent of a 10 per cent ad valorem royalty on F.O.B. value on average (pp.141-142) and regardless of the existence or magnitude of the net value of the mineral rights to be disposed of by the Crown is consistent with the mistaken revenue criterion but not necessarily with either the efficiency or equity criterion. If the economic rents arising from desirable mineral deposits either do not exist or are not sufficiently great to pay the equivalent of a 10 per cent ad valorem royalty then economically desirable mining development which would otherwise have taken place in the Northern Territory either simply will not take place or will be on a smaller scale than would otherwise have been the case under an appropriate royalty arrangement.

Moreover, the Green Paper (p.42) stresses that there are likely to be both successes and failures in relation to exploration programs and therefore "a realistic post-discovery assessment of the net value of mineral deposits in the area under consideration would necessitate off-setting the unsuccessful explorers' exploration expenditures in the area against the favourable nett outcomes of those firms which are successful overall". In other words full loss offset, or at least a reasonable approximation to it, is required before one can be sure that the royalty is levied on economic rents rather than simply on the "winners" based on pure chance. This contrasts with the statement on p.122 that schemes based on full loss offset will not raise sufficient revenue. Does this mean that there may be negligible true economic rents
5.

on which to levy a royalty?

5. THE EFFICIENCY CRITERION

This section of the Green Paper (pp.53-58, Appendix B) is generally well done. It states correctly that, setting other possible distortions aside, an efficient royalty is a levy on the pure economic surplus which is the "surplus above the full economic costs of exploration, development and extraction, including normal rates of return on capital appropriate to investments involving the degree of risk and uncertainty encountered in exploration and mining". Such a levy will be "neutral" in that it will not affect the willingness of supply of inputs into exploration and mining. However, this discussion sits very oddly with the subsequent recommendation to choose a royalty base which is termed a "proportional profits royalty" which includes in the base a normal return on capital. The policy recommendation (p.134) allows for explicit interest deductibility on debt (debentures and fixed interest borrowings) but not for an allowance for the implicit interest earnings on equity capital, i.e., shareholders funds and retained earnings, which is the "normal rate of return" referred to in the Green Paper. Thus the Green Paper recommends the inclusion of the normal rate of return on equity capital in the royalty base but explicitly excludes the return on debt capital. The inclusion of the normal return on equity capital in the base is certainly far from neutral and may have serious distorting effects, both in relation to the level of output, which may be reduced or the mining development not undertaken at all, and in relation to the degree of capital intensity of the mining development. The nature of the mining operation, for example, open cut or underground mining and the combination of factor inputs, labour and capital, may be distorted by the inclusion of the normal return to capital in the royalty base.

Of course, if there is an easier avenue as an alternative to
distorting production and investment decisions, then the company is likely to choose such an alternative method of at least partially avoiding the royalty. One obvious method would be to alter the company's financial structure and thus to lower the degree of equity investment by relying more heavily on debt finance. In fact, it may not be too difficult, for many large mining companies particularly, to disguise what is effectively equity capital as debt capital for the purposes of the royalty. The authors of the Green Paper are clearly aware of some of the problems associated with the substitution of debt for equity capital arising from the way the royalty base is determined (p.80, pp.82-84). One potential response to such an artificial reduction in the royalty base would be for the Northern Territory government to itself control the debt/equity ratio of mining firms but this might be regarded as unwarranted interference in the affairs of companies, especially since the normal return to capital does not belong in an appropriately defined royalty base.

One argument in relation to efficiency which is made in a number of places in the Green Paper (e.g. pp.55-56, and Appendix B) is the dissipation of the potential economic surplus due to premature exploration expenditure from insecure pre-development tenure and low royalties. I would argue that the problem does not necessarily result in low mineral prices as the Green Paper alleges (p.55) because such prices tend to be determined in world markets. However, the Green Paper's argument about the dissipation of the economic surplus, particularly from insecure pre-development tenure, would appear to have validity. A possible solution here is to allocate the initial exploration rights to promising areas by an auction mechanism combined with a surplus profits royalty with an appropriate pre-specified royalty rate. In this way full security of tenure is given and at the same time the present value of the pure economic surplus should be captured by the Crown from the highest bidder. Such a mechanism for allocating mining rights should
avoid the problem of premature exploration in an endeavour to obtain security of tenure when there is currently no profitable market for the mineral concerned or when the expected appreciation of the real value of the mineral in the ground is greater than the real rate of return which could be obtained by mining the mineral and investing the proceeds in the capital market. Once tenure has been secured by offering the highest bid there is no longer any incentive to incur premature exploration costs.

4. THE EQUITY CRITERION

Once again this section (pp.58-59) is quite well done. Most economists working in the area of royalties would most probably agree with the authors of the Green Paper that "a royalty is really a price rather than a true tax" (p.59). It is the price associated with the transfer of the property right in a valuable mine site from one owner, the Crown, to the new owner, the mining company. However, since it is a price which should ultimately reflect the discounted present value of the pure economic profits or rents arising from the site after deducting all costs including the normal supply price of capital, it is hard to see why the Green Paper should insist on a base for royalties which includes the normal supply price of capital. The Green Paper, having rightly concluded that a royalty is no more than a price for the transfer of property rights, wishes to incorporate in the price what really amounts to a tax on the input, capital, to be supplied by the mining company itself. Unless sound reasons can be produced to support this position, the logical conclusion the Green Paper should have reached is that the ideal price be some combination of an auction and a levy on the annual pure economic profits. For risk neutral bidders a simple auction excluding a royalty element subsequently payable should realize an amount which represents the net present value of the stream of pure economic profits and thus, under certain circumstances at least, represents an appropriate
measure of the true price of the mining site.

We now turn to the most interesting sections of the Green Paper which deal with why various alternatives which have been put forward have been rejected and why a particular type of royalty scheme has been proposed.

5. SPECIFIC AND AD VALOREM ROYALTIES

Once again I can only agree with this section of the Green Paper (pp.76-78). Specific and ad valorem royalties do have all the undesirable properties that the Green Paper attributes to them unless, as with the two part royalty discussed by Dowell (1978, pp.132-134), the royalty is actually zero over the relevant output range in which case the two-part royalty is really a lump-sum levy in disguise. The crude oil levy is by far the most important specific royalty type arrangement we have in Australia at present since it raises thousands of millions of dollars in revenue annually for the Commonwealth Government. Presumably in an attempt to mitigate some of the worst effects of such a massive levy on incentives for exploration the Government has exempted so called "New Oil" discovered after a certain date from the levy but the serious disincentive effects on "Old Oil" subject to punitive rates of tax remain. In particular, unless the levy on "Old Oil" is eventually removed, this will have serious consequences in relation to oil which will be left in Bass Strait because it will not be worthwhile to incur the necessary expenditure to extract it.

Another serious consequence of specific royalties, in addition to the propensity to lead to the premature closure of existing mines, is that the government may advocate low mineral prices in an effort to maintain sales and hence royalty receipts when there would be a gain
both to the mining company and Australia generally from higher revenue resulting from a higher price. At least ad valorem royalties are free of this particular defect but at the same time both specific and ad valorem royalties leave a great deal to be desired in terms of the misallocation of resources that such royalty systems promote.

Relatively high rates of ad valorem or specific royalties can also have serious adverse effects on the type of mining system which is chosen at a particular site. This is because the ad valorem and specific royalty includes in its base, not only the pure economic profit or surplus but all the inputs provided by the mining company itself. Like the Green Paper recommendation of a proportional "profits" or income royalty the normal return to capital is included but so also is the cost of labour and materials etc. Thus, suppose that in the absence of a royalty, or with an ideal royalty which taxes only pure economic profits, the best mining arrangement is to use underground mining which is not only labour-intensive relative to open cut mining but requires more inputs in toto than open cut mining. An ad valorem or specific royalty may now make it more economic to abandon underground mining and to use open cut methods to "skim the cream" of high grade ore near the surface and to leave the bulk of the ore which is of lower grade or less accessible in the ground. Such distortions to optimal mining techniques can be highly wasteful and inefficient.

6. "SURPLUS" OR "PURE" PROFITS ROYALTY

I can find a great deal to both agree with and disagree with in this section of the Green Paper (pp. 92-96). I have discussed what the Green Paper calls "surplus profit royalties" as what I have called the Brown Tax (Swan 1976a, 1976b) and as a net cash flow or "consumption tax" (Swan, 1980). As the Green Paper points out the "surplus profits" royalty is neutral or non-distorting in regard to ore bodies which vary
from high to low grade. Because all the costs of mining low grade ore including the normal supply price of capital, are tax deductible the miner will proceed just as if no tax or royalty is applicable. In fact with low grade or hard to reach ore which is marginal and for which therefore there is no rent, no royalty is payable. This contrasts with an ad valorem or specific royalty and also with what the Green Paper calls a proportional profits royalty. The pure economic profits royalty takes only a fixed percentage of the net cash flows generated by the mining activity and therefore a fixed percentage of the net present value of the stream of pure economic profits. Any attempt to distort the nature of the mining activity or even the timing of extraction or output rate will be counter-productive as far as the mining company is concerned since it will reduce the residual rents or pure economic profit remaining with the company.

The Green Paper (p.93) points out correctly that at high royalty rates the residual amount remaining with the company may be so small as to affect managerial incentives. In other words, there is a potential gain to management with high rates of tax approaching 100 percent to disguise what is essentially consumption expenditure as investment and cost outlays which would be fully deductible. In effect the Crown becomes the major equity shareholder in the company and it becomes necessary to devote real resources to monitoring the activities of management. The problem was well posed by Gaffney (1967, p.401):

"When we tax even economic rent on a realized-cash basis we motivate taxpayers to convert cash income to psychic income. The critical value, the maximum economic rent, is much less sharply defined when the taxpayer keeps only a small fraction of it.

A bumbling manager or superior land would show little net income over costs, including his and his nephew's inflated
11.

salaries and overpriced supplies from his brother-in-law. Thus land rent, which we set out to tax, would be diverted to private pockets or dissipated by incompetence..."

Where a high rate of tax on the relatively narrow base of pure profits is called for, measures need to be devised to prevent the diversion of what would otherwise be royalty payments into perks for management. A relatively expensive and probably inefficient way to overcome the problem which arises with a high royalty rate would be for the authorities to closely monitor cost outlays by management. Some better ways which do not require a large investment in staff by the Crown or excessive interference into company affairs are discussed below.

The Green Paper admits that the "surplus profits" royalty will be neutral with respect to decisions relating to the mine but alleges that the neutrality property will not hold if there are alternative excess profit opportunities (p.93). The argument concerning other excess profit opportunities would seem to be wrong. Even if there are other excess profit opportunities that is no reason to reduce your wealth by making distorting decisions in relation to your mining activities. Any alteration to behavior in relation to mining in response to a flat-rate royalty on net cash flow will tend to hurt the miner as much as it will the Crown as it reduces the residual rents remaining with the mining company.

The Green Paper (p.94) goes on to state that "the industry is likely to be in a continuous state of adjustment. Abnormally high high or low short term returns will arise from time to time in response to changing market situations. This induces or deters investment as
required. The Green Paper then alleges that "a surplus profits royalty would levy high short-term returns at a very high rate, reducing incentives to invest and adversely affecting the allocation of resources and economic development". No arguments or evidence are presented in favor of this proposition. The supporting reference to Steele (1967) has a page reference which does not refer to Steele's contribution at all and I have been unable to find support for the proposition in Steele (1967) or more than the vaguest of statements in Fitzgibbon (1978) which is the other reference. In any case the proposition is incorrect for the very reason that the Green Paper has already explained. The "surplus profits" royalty takes only a proportion of the economic rents which motivated changes in the rate of investment. Therefore any distortion to investment behaviour will also be damaging to the profitability of the mining company.

The Green Paper (p.95, p.121) also states that a "pure" profits royalty will institutionalize the dissipation of the net value of minerals because the full loss offset provision means that the Crown compensates the firm for the Crown's share of search and exploration costs, given by the royalty rate, at the time these outlays are made. In effect the Crown pays its share of the interest costs on exploration outlays between the time the outlays are made and development of the mine commences. The "resource rent" royalty version of the pure profits tax explicitly allows a deduction for these interest payments while the pure profits tax does so by allowing expensing of these outlays.

Although there is an element of truth in this proposition, the distortion is not arising from the royalty system per se but rather from the lack of tenure. Once secure tenure has been granted the pure profits royalty will not encourage premature exploration. Thus as
suggested above, the solution which overcomes the problem of insecure tenure is to auction off the tenure rights in combination with an appropriate royalty scheme. Consequently the Green Paper has not made a case against pure profit royalties on these grounds. Rather it has made a case for a better allocation of tenure rights than the "first come - first served" allocation to the first discoverer. This highly inefficient system of tenure allocation tends to be almost universal in Australia although the auction mechanism, or bonus bidding as it is called in the USA, is used extensively overseas.

The Green Paper's major objection to a pure profits royalty seems to arise from what should be a major advantage of the scheme, namely its full loss offset feature. As Mayo (1979) and others have pointed out the pure profits scheme, unlike the resource rent royalty or proportional profits (i.e. income) scheme, allows the Crown to share equally in the risks as well as the rewards so that risky but otherwise potentially desirable projects would still be undertaken with a pure profits royalty.

Consequently with full loss offset only true economic rents are taxed with proper allowance made for unfortunate losers that have outlayed funds on exploration but have not succeeded in finding an economic deposit. The recommendations of the Green Paper actually minimize the opportunities for provision of "loss offset" by the advocacy of a proportional profits (income) royalty with no provision for loss offset by expensing or by carry forward of losses, i.e., negative cash flows, at some threshold rate. Moreover the royalty is to be on a projects basis rather than a company basis (p. 134) so that successful companies cannot even treat losses from exploration or unsuccessful exploration as a deduction from the revenue from successful projects.
A company basis would be superior from this viewpoint but would still be discriminatory against small companies with only a few projects. A company basis would provide obvious incentives for small companies to amalgamate so as to provide greater scope for loss offset. 

A pure profits royalty would extend loss offset even to a company which undertook only one project which turned out to be unsuccessful. While there are obvious dangers in such a situation for possible fraud and careful monitoring and justification for such expenditures would be required, there are possible benefits as well. An important advantage is that risky projects would not be undertaken as they would be under the Green Paper's proposal. The Green Paper (p. 122) argues that: 'a full loss offset scheme is beyond the financial capabilities of the Territory'. The dubious nature of this argument based on the revenue criterion has already been discussed. A possible compromise proposal would be to permit sale of royalty "losses", i.e., negative cash flows, which have been fully substantiated to companies with positive net cash flows that could then claim the "losses" of companies not currently liable for royalty payments as an outlay for the purposes of determining the royalty payment. In this way there would be an automatic lower limitation on the royalty receipts of zero in a year in which more exploration and investment outlays are being undertaken than revenue is being earned. In years in which the overall royalty base is positive it would act like a full loss offset scheme. Obviously under such an arrangement the outlays for the "royalty losses" would not class as an outlay for the purpose of determining the base on which the royalty is levied.
7. RESOURCE RENT ROYALTY SYSTEMS

The Green Paper (pp. 96-101) correctly points out that the resource rent variant of a pure profits tax in which losses, i.e. negative cash flows, are carried forward at some threshold rate of interest, instead of being expensed as under the pure profits tax, has a number of potential disadvantages as compared with the pure profits tax. Lack of complete loss offset, particularly if on a projects basis, will adversely affect risky projects, and unless the relevant supply price of capital is set equal to the threshold rate the royalty will not be completely neutral as with the pure profits royalty. In particular too high a threshold rate could induce over investment and factor substitution at the expense of revenue. However, given that the Green Paper rejects the pure profits royalty a more appropriate comparison might be between the resource rent royalty with its imperfection and the actual policy recommendation.

A severe weakness in the logic of the Green Paper is revealed by its criticism of the rent royalty scheme on the grounds that "setting the threshold rate too low would deter investment and reduce employment and output. This would occur because part of the return required to induce investment is levied by the royalty" (p.98). The Green Paper (p. 123) also claims that "long run revenue yields of rent royalty schemes are problematical. Dowell (1979) has argued that small departures in either direction from the appropriate threshold rate of return are likely to cause significant reductions in royalty revenues." While the Green Paper is right to emphasise that the pure profits royalty with immediate expensing of outlays has an advantage over the resource rent royalty in that no information is required about the normal supply price of capital, what the Green Paper does not point out is that its argument about the undesirable effects of small departures from the
correct supply price of capital is also a very damning argument against its own recommendation of what it calls a proportional profits royalty.

In Dowell's (1979, p. 106) study the royalty base consists of "company income" which corresponds to the Green Paper's proposed "proportional profits royalty" since it excludes a normal return on capital plus a term which represents the allowed threshold rate of interest times the value of the firm's capital stock. Thus when the threshold rate equals the true supply price of capital there will be no distortion and when the threshold rate is set equal to zero the royalty base corresponds to the tax base recommended by the Green Paper. Thus as the resource rent royalty is condemned for the possibility of small departures from the supply price of capital or normal rate of return, then the Green Paper should have condemned its own policy recommendation even more heavily for it results in a maximum departure from the ideal threshold rate in a downwards direction by setting the threshold rate of zero.

To check on Dowell's computer simulations would be a major job, so for purposes of this analysis I shall simply accept his results, as does the Green Paper, although I must confess some of the results seem rather surprising and not a great deal of intuitive explanation for them is given. However if one accepts the relevance of his simulations the results look extraordinarily bad for the Green Paper's policy recommendation. With the zero threshold rate implied by the "proportional profits royalty" the royalty revenue achievable would vary from about 75 per cent to 95 per cent of the revenue obtainable under the ideal pure profits royalty, or with the correct threshold rate, as one reduces the degree of capital intensity. The revenue loss
will be higher the greater the degree of capital intensity (Dowell, 1979, p. 117, Figure 3a). With low yield ore deposits there is little revenue loss but for high yield deposits there could be up to 40 per cent revenue loss under the "proportional profits royalty" (Dowell, p. 120, Figure 3b). Dowell also examines the effect of varying the elasticity of substitution and the degree of risk. Risk has an effect on royalty revenue in Dowell's model since under the resource rent royalty like the proportional profits royalty no loss offset is provided on unsuccessful projects.

As one would expect, royalty revenue is lower under the Green Paper's "proportional profits" royalty than under the pure profits royalty or even the resource rent royalty with a reasonable approximation to the ideal threshold rate because the effect of an attempt to tax the normal supply price of capital under the latter proposal leads to sizeable reductions in the size of projects or even to complete discouragement. Thus it seems surprising that the Green Paper should quote Dowell's results as supporting its policy conclusion and at the same time to argue that the proportional profits royalty, including a tax on the required income of capital, is superior on the basis of revenue raising possibilities than either the pure profits or resource rent royalty systems. Dowell's simulations at least do not support the Green Paper's claim. This does not mean that the Green Paper's conclusion is necessarily false since Dowell's simulations do not attempt to model the attempts which would be made by management to pass off perks as investment or cost outlays, which are justifiable deductions under the royalty scheme, as the royalty rate approaches 100 per cent.
The Green Paper claims that both "surplus" profit and resource rent royalties are a tax on returns to managerial ability (p.99). It admits that the same problem faces a "proportional profits" royalty but to a lesser extent. There is only justification for these fears when for some reason the price of managerial services is too low given managerial ability. In such cases the shareholders or the firm itself would obtain rents arising from this underpricing of managerial talent. However this problem is self correcting to the extent that other firms become aware of these rents and try to bid away the managerial talent. Via this market process the managerial salaries will be bid up until the rents are transferred from the firm or its shareholders to the able management where these rents belong.

It is also claimed that "industry acceptance would not readily be forthcoming" in the case of the resource rent royalty system (p.7). I cannot understand why mining industry should be adverse to a resource rent or pure profits royalty base especially when the base will be smaller than the inappropriate base recommended by the Green Paper. I am surprised in fact that the mining industry should have views on the relative merits of the proposed "proportional profits" royalty and the pure profits based royalties in the absence of information about the proposed royalty rates and other details of the scheme. Until this information is known the share of pure economic profits which will reside with the miners cannot be known. Surely such "hip pocket nerve" considerations will have an influence on the acceptability of the alternative proposals?

3. LUMP SUM BIDDING

In situations at least in which property rights have not yet been allocated, the Green Paper plays down the system of lump-sum
bidding and auction mechanisms as the whole or at least as the major part of a desirable royalty arrangement. While the Green Paper (p.125) assumes that firms tend to be risk averse in the face of uncertainty, no evidence is presented to support this assertion. The usual assumption underlying most empirical work on capital markets is that firms as such are not risk averse and that risk aversion stems instead from the preferences of the firm's owners, namely shareholders and investors. The Capital Asset Pricing Model, CAPM, used extensively in the finance literature, is based on this assumption (Copeland and Weston, 1979). An implication of this finance literature approach is that only non-diversifiable risk will be priced in the market place. Since most shareholders in mining companies are likely to have well diversified portfolios only risks associated with mining which tend to move with the sharemarket as a whole are likely to bear any significant risk premium. Thus to the extend that metals prices move with the stock market, risk aversion may be important but it may be less significant in relation to assessing geological information.

What this means is that the depressing effect on bid prices at auction arising from risk aversion and the uncertainty concerning geological information may not be all that great. Errors made in relation to geological information will affect rates of return but these alterations to rates of return on the mining investments should not be highly correlated with the general movements in the rate of return from stock market investments. Consequently, we would expect bid prices at auction to be not all that far below the expected value of the mining right. Once it is recognized that it is largely non-diversifiable risk which is priced in the market place, the claim apparently made by Garnaut and Clunies Ross (1979), according to the Green Paper (p.129), that "lump sum bidding is likely to generate
little revenue in Australia because of risk aversion, does not necessarily have much validity.

Moreover, it is sometimes argued that in certain circumstances the winning bid at auction may exceed a realistic assessment of the net present value of the mining or exploration right because each bidder will have some subjective assessment of the expected value of the resource in mind and clearly the winning bid is likely to go to the most optimistic bidder. While one would imagine that experienced bidders would make an allowance for the possibility of over-optimism, this may not always be the case.

A system of bidding could take several forms such as an oral (English) auction in which the price is bid up until the winning bid is announced or it could take the form of a sealed bidding arrangement. The Green Paper (p. 126) seems to support a sealed bidding system under certain circumstances in which the winner puts in the highest bid and the lease is awarded at this maximum bid price. Some of the literature dealing with bidding arrangements conducted under experimental conditions advocates instead the awarding of the lease to the highest bidder, but at the bid price of the second highest bidder. Under these arrangements the highest bidder, or any bidder for that matter, will not have any incentive to disguise his true valuation of the lease since if he is the highest bidder he will actually pay a price which is determined by someone else, namely the second highest bidder. This is equivalent to the standard English auction since the winning bid will be only marginally above the valuation of the second highest bidder.

The great advantage of bidding mechanisms over the other royalty schemes which have been discussed is that there is no possible managerial disincentive effect since the royalty payment is lump sum and independent of the mining company's actual cash flows. Thus, it
is easily the best scheme from the point of view of the costs incurred by the Crown since there virtually are none. In particular it overcomes the problem which can arise with a high royalty rate approaching 100% under either the pure profits or resource rent royalty. At a 100% royalty rate both these schemes would break down entirely since management would have no incentive to minimize costs at all. However, a bidding system can extract close to 100% of the expected economic rents without giving rise to any of the problems with managerial inefficiency which have been discussed above.

It would probably be very foolish for the Crown to attempt to obtain a single payment in advance which represents the entire net present value of the mining right. This is partly because politicians generally take a relatively short-term view depending on the number of years before re-election while mining companies have an incentive to take a long term view when they bid for a mining right at auction. Thus, if there is no royalty other than the single payment at the auction, the politicians and the voters may forget after some years that the mine royalty consisted of a large once-over payment and institute some additional royalty arrangement at a later date. Unless there is constitutional protection, no legal agreement between the Crown and a mining company is beyond the power of the legislature to alter at some later stage.

The mining company foresees the possibility of the old agreement of a single royalty payment being torn up in future and will consequently depress its bid price in anticipation of such an eventuality. Thus, the possibility of the Crown "recontracting" in future could have a severe depressing effect on bids at the auction.
The obvious way to overcome this problem is to spread the royalty payments out over the life of the mine. One way to do this is to combine the auction mechanism with the pure profits, net cash flow royalty. The higher the royalty rate on net cash flows the smaller will be the advance payment and the less likely it will be for the Crown to institute an additional royalty. If the mining company is risk averse and is more risk averse than the Crown then the greater the disparity in risk aversion the higher should be the royalty rate on net cash flows (Leland, 1978; Emerson and Lloyd, 1981). However, the royalty rate should not be so high as to interfere with managerial incentives towards efficiency.

This combination of an auction mechanism, which also provides tenure to the mine site, with a pure profits royalty still has the possible drawback that it might distort managerial incentives, particularly if the royalty rate is set too high. A superior system might be a series of lump-sum payments made over the life of the mine. Gaffney (1967, p.p. 364-374, p.p. 401-402) has a discussion concerning the possibility of converting the cash-flow royalty into a form of property tax based on the annuity value of the bid price taken over the expected life of the mine. However, to use an annuity approach would require knowledge of the appropriate interest or discount rate. A method which would avoid this which has been suggested by Ted Sieper would be to extend the system which was adopted for a while in the Australian Capital Territory. Instead of specifying a single bid each bidder would specify a series of lease payments for a specified number of years into the future. For a mining lease the lease payments would be specified over the expected life of the mine and the mining right would then go to the bidder promising to pay a stream
of lease payments which has the highest present value using a discount rate nominated by the Crown. These lease payments could be denominated in dollars of the time of the bid and then subsequent lease royalty payments could be indexed according to the general movement of inflation as represented by (say) the CPI. With such a system the problem of managerial incentives would largely disappear since the firm would retain all revenue in excess of these lump-sum payments.

A serious problem obviously arises in relation to mining leases which have already been granted, presumably on a "first come first served" basis. A bidding solution might be possible if the company and the Crown could agree on a price for the mining site which covers the entire cost of exploration and site development to the present, including interest on capital outlays.

All interested companies including the current occupier of the site could then put in bids for annual lease payments but subject to the proviso that a successful bidder who does not currently possess the site must compensate the existing occupier in full. Failing such an agreement as to the value of the contribution made by the occupier of the site, a pure profits royalty could be imposed so long as the rate is not set so high as to adversely affect managerial incentives.

9. PROPORTIONAL PROFITS ROYALTY

The Green Paper (p.134) recommends a proportional profits royalty with interest deductibility for debt and straight line historical cost depreciation of capital outlays including exploration expenditure over the shorter of economic life of assets or 20 years. The proposed royalty rate is 35% which is to be levied prior
to company tax so that the combined tax rate is 35% plus 46% of residual income of 65% making an overall effective rate of 35% plus 30% equals 65%. The Northern Territory's prior claim on company income will increase the burden borne by companies but also reduce the tax take of the Commonwealth Government.

While the authors of the Green Paper are correct in emphasising that the "proportional profits" base, which is similar to the company income tax base, is superior to ad valorem or specific royalties, most of the other arguments to the effect that the "proportional profits" royalty is superior to the "pure economic profits" base are generally highly misleading or fallacious. It is claimed for example that the "proportional profits" royalty is non-distorting in relation to investment decisions "provided a firm could finance incremental investments by borrowing" (p.79). However, this argument while formally correct is not relevant in a situation in which a specific activity, namely equity capital invested in mining, is being taxed at a far higher rate than capital invested elsewhere. If interest on debt is deductible then the obvious incentive is to finance the entire investment outlay using debt capital in which case the outcome is non-distorting but the tax base has been reduced back to that of pure profits. Obviously for the Green Paper's proposal to be viable the Crown would have to prevent the marginal investment from being financed by debt in which case the result could be highly distorting.

Dowell's (1979, p.121, figure 4) simulations suggest that for elasticities of substitution of less than 2 between labour and capital, the employment of labour is significantly reduced for a threshold interest rate below the normal supply price of capital.
The threshold rate is effectively zero under the Green Paper's proposal since the entire normal return on equity capital is included in the royalty base. Moreover, as we have already seen, the potential royalty receipts are lower than under a pure profits royalty system according to Dowell's simulations.

The Green Paper (p.78) also states that

"given the level of investment in a mine, a proportional profits royalty takes a constant proportion of the difference between price and marginal cost of each unit of ore. Therefore, the royalty on a marginal unit of ore will be zero."

Once again, although formally correct, this is misleading because the level of investment clearly will not be fixed. The normal supply price of capital will be taxed and this will have a distorting effect on output, capital intensity, employment, the ranking of mining projects and mining methods and could also lead to premature abandonment of the mine.

A further set of distortions is introduced by the retention of historical cost depreciation allowances and deductibility of nominal (money) interest payments without proper allowance for the effects of inflation on the value of assets and liabilities or for changing relative asset values (see Swan, 1980 for a discussion). Most of these problems would disappear with the auction mechanism or the pure profits royalty. In the case of the pure profits royalty all revenue and outlays are measured in dollars of the same period so that the problem of inflation adjustment does not arise.
10. CONCLUSIONS

The Green Paper's policy recommendations in favour of what amounts to a similar royalty base to the existing company income tax base do not really follow from the analysis contained in the Study at all. Rather the impression one gets is that a policy conclusion was tacked onto a document arguing for some other more rational recommendation at the very last possible moment. A revenue target was selected quite independently of the true economic profits potentially available and then, based on existing company profitability information (Green Paper, p.p. 141-142), a large enough base was selected to generate sufficient revenue without having to apply enormously high tax rates. However, it is quite improper to argue from historically given accounting income levels in relation to the royalty base since once a royalty is imposed on an unsuitable base, which includes the normal return to capital, all kinds of responses and evasive actions are possible which will have the effect of reducing the accounting income or proportional profits base. If Dowell's (1979) simulations are any guide there could be output and employment reduction effects which may also affect royalty receipts.

The various comparisons which are made between the "proportional profits" royalty and the pure economic profits royalty which favoured the former are mostly deceptive or invalid. In particular a rather poor understanding of how the pure profits base affects investment and other decisions is revealed. Many of the alleged defects in the pure profits royalty turn out not to be defects in the royalty at all but reflect rather the inability of the pure profits royalty to provide security of tenure when tenure to a mine site is decided on a "first come - first served" basis.
The major defect with a pure profits based royalty scheme relates to managerial incentives when the royalty rate on a narrow base is set too high. Thus in order to provide full tenure as well as to keep the royalty rate down to an acceptably low level, the pure profits royalty should be combined with an auction mechanism for allocating leases. If circumstances permit I would tend to favour a system of bidding on the height of a series of inflation-indexed lease payments extending over the life of the mine where there is a possibility that management may be able to pass off consumption items, e.g., Lear jets, and managerial perks as genuine investment and cost outlays designed to increase the value of mine output. In this way the managerial incentive problem can be almost entirely avoided.

In my opinion it is not in the interests of both the Crown and the mining companies concerned to adopt either an ad valorem or a specific royalty or the "proportional profits" royalty. The economic efficiency and "equity" arguments for a combination of an auction or bidding mechanism, perhaps combined with a pure economic profits royalty, are far stronger.
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