BINDING FUTURE GOVERNMENTS:
TAX CONTRACTS AND RESOURCE DEVELOPMENT

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UCLA Working Paper #297

Revised, August 1984

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ABSTRACT

The implications for resource taxation of the fact that governments cannot be forced to observe a contract are examined. When the probability that the contract between producer and government will be abrogated in the future is increasing with after-tax cash flow and decreasing with agreed tax payments, it is shown that:

(i) it will typically be in both the developer's and the current government's interest to make payments to a future government. and

(ii) the appropriate level of future payment is determined by the firm's perceived probability of expropriation function, and

(iii) the future tax payment should fluctuate with the cash flow of the development.

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1. Introduction

Federal and state governments own the mineral rights to a large fraction of the onshore prospects and all of the offshore prospects in the United States. Outside the U.S., government ownership of the mineral rights is the rule rather than the exception. Income from natural resource development is an important portion of government revenue in many jurisdictions.[1] However, private firms often do the actual exploration, development, and extraction of the resource under lease from the government.

There is a considerable literature discussing the appropriate means by which government should gain a return on these publicly-owned resources. In general, it is suggested that government levy a scarcity rent tax.[2] The practice of resource taxation, both in the U.S. and elsewhere, diverges from this prescription with primary importance being given to ad valorem royalties based on the value of output. The literature views such taxes as inferior as they raise the marginal cost of extraction. In this paper we suggest, as one explanation,[3] that the resource-owning country's sovereignty changes the underlying character of the natural resource contract from that found in a strictly private contractual arrangement. In particular, as a government cannot bind itself, or a future government, to observe a contract to which it is a party, there are important transaction costs in concluding a sustainable natural resources contract which ensures efficient exploration, development and extraction decisions.

It is in the producer's interest to seek a contract which is binding on future governments. While this may also be in the governments interest, this is typically not possible, and therefore the firm will seek arrangements which make it more costly to change any agreement undertaken. The cost incurred by seeking to increase the penalty of breaking the agreement can be viewed as

part of the transactions costs of concluding a viable contract.[4]

The paper is organized as follows. The second section examines the special characteristics of resource lease contracts. We argue that an important factor influencing the observance of a natural resource contract, and hence the risk of investment in such activities, is the magnitude and nature of future tax payments. In Section 3, we outline a two-period model where the tenure of government is limited to one period. Governments are concerned about tax revenue received during their own term of office and we propose that the probability of a government expropriating the returns from resource development is a function of the tax revenue it receives and the net cash flow of the resource development. Using this model, in Section 4 and 5, we demonstrate that:

(i) it will typically be in both the developer's and the current government's interest to make payments to a future government although the current government has no intrinsic interest in future tax revenue, i.e., there is a presumption against sole reliance on bonus bidding, and

(ii) the appropriate level of future payment is determined by the firm's perceived probability of expropriation function, and

(iii) the future tax payment should fluctuate with the cash flow of the development.

Section 6 compares these theoretical results with current practice and draws conclusions.

The paper therefore provides an explanation of natural resource taxation by relaxing the assumption of binding contracts typically made in natural resource tax analysis. There has been discussion of the "obsolescing bargain" and political sovereignty in the economic literature on natural resources.[5]

In other contexts, researchers have explored the designs of contracts in the presence of capital commitments.[6] This paper brings together these strands in examining payments in public-private resource contracts.

2. The Nature of Resource Lease Contracts

If resource exploration, development and extraction took place at an instant in time and/or government could bind themselves and their successors to observe resource tax arrangements, tax proposals based on conventional efficiency criteria may be appropriate. In fact, though, government is not only party to contractual arrangements, but also enforcer of them, and secondly, due to its nature, resource development is characterized by long lead times and significant rents which include quasi- as well scarcity rents. This section briefly outlines the implications of these factors.

2.1. Government as a Contractual Party

The development of natural resources is frequently characterized by large initial investment and long lead times until production occurs. Intertemporal choice is a fundamental element of the production of an exhaustible resource and that choice is affected by the security of property rights. Contracts exchanging at least a portion of the mineral rights are frequently employed because of the distinction between the developer and the owner of the mineral rights and because of the difficulties associated with the owner bearing the entire profit or loss. In the case of privately-owned rights, such contracts are presumably enforceable in the courts. In addition, the seller — that is, the owner of the mineral rights — is unlikely to be able to affect substantially the value of the prospect once the contract is signed.

There is a fundamental difference when the resource rights are publicly held. The government administering publicly-owned rights occupies a dual role. It is a party to the exchange of property rights and it has the power to legislate and enforce reforms which can dramatically modify the value of the rights it has given up. Many examples could be cited, even in the United States, of unilateral alterations. Alaska changed its corporate tax law in a manner hurting the oil companies after production began.[7] Montana imposed a 30 percent severance tax on coal as the price of coal increased.[8] The Federal government has imposed price controls and a "windfall profits" tax on oil. More broadly, Federal tax policy had repeatedly relied on investment incentives, which favor new capital relative to existing capital and may lead to losses for owners of existing capital.[9] In many countries, the courts have no constitutional authority to intervene. In countries where the courts are controlled by the government, the question of enforceability against the government is obviously irrelevant.

The possibility that a future government will expropriate some or all of the returns from a resource development will result in a lower payment to the current government for the development rights and, other things being equal, will lead to less extraction and more rapid extraction. The possibility of expropriation will make marginal deposits unprofitable and therefore, everything else constant, will lower extraction. If the risk of expropriation is high enough, no prospect, however profitable, will be privately developed without subsidy. The resource that is developed will tend to be extracted too rapidly since any returns after expropriation will be worthless to the developer.[10] A possibility of a new tax or other form of lowered returns in the future will make the present value of current production higher relative to postponed extraction. The current government will receive a lower payment

for the mineral rights since the possibility of expropriation lowers the expected present value of development from the point of view of the firm, and no potential developer would voluntarily pay more than that for the right to produce the resource.

2.2. Characteristics of Resource Extraction

The possibility of expropriation affects investment and production decisions for any firm with a large initial outlay. This outlay is a fixed cost, which creates a quasi-rent which can be taxed or expropriated without the firm shutting down. There are, though, reasons for believing that the problem is particularly severe for natural resource development.

First, the return to investment in natural resources, especially oil and natural gas, is highly variable due to our lack of knowledge of geological structures. Dry holes or unproductive mines result in large capital losses. As a result, the return to successful projects will be above the market rate and therefore present a tempting target. Since it is difficult to demonstrate what the expected value of the project was prior to exploration, it may be hard for resource developers to present convincing counterarguments. The cost of nationalization without any compensation may be quite high: restricted access to world financial markets, loss of assets, including traded goods, in other countries, and a damaging signal sent to other investors. Since the successful resource project will usually have a high rate of return, compensation for capital invested can be paid and yet money still be made on the nationalization.

Another reason resource projects are particularly vulnerable to ex post changes is that, as owners of the mineral rights, the government should receive the expected net present value of the prospect in a competitive

market. Future governments may, and often will, charge that "the nation's birthright was given away". It is quite possible that they will be right, since corruption, collusion among bidders, or asymmetric information among bidders can lead to an absence of effective competition for the prospect.[11] In any case, the argument can be used to justify breaking the original agreement, perhaps with less damage to the government's reputation than would otherwise occur.

Finally, a single natural resource project may be quite large relative to government revenues, export earnings, and, indeed, national wealth. A major negative consequence of any nationalization is the damage it does to the government's reputation. The government may get lower revenues in future negotiations or may induce capital flight or smaller foreign investment. These losses stem from the fact that capital investments are undertaken repeatedly. If the resource project is sufficiently large, the benefits may outweigh these costs.

In sum, while there is a substantial literature discussing how the scarcity rents associated with exhaustible resources should be taxed, this work implicitly assumes that contracts are binding. If resource exploration and development took place at an instant of time, this assumption might be appropriate even when the government owns the mineral rights. In fact, since there are large investments and long time horizons, there will be not only scarcity rents but also quasi-rents or returns, which accrue in subsequent periods but which are a return on the initial investment. This distinction between scarcity and quasi-rents is extremely important when contracts are not binding. While the literature distinguishes between private and public ownership of mineral rights only with regard to likely attitudes towards risk, there is another critical difference. The absence of a binding contract for

publicly owned resource rights can and should influence the design of agreements that are concluded.

3. The Model

To analyze the problem, it is necessary to model the potential response of future governments to resource developments which are characterized by large initial investments and long lead times and hence will, at least in expected terms, generate large positive net cash flows in the future. To capture the characteristic that the contract is not binding but that the actions of government can be influenced by the nature of the tax arrangements currently adopted, we consider a two-period model with three agents — a current government, a potential producer, and a future government. Restricting the model to two periods and three agents highlights the issues without altering the conclusions significantly.

The potential producer is assumed to maximize expected profits and, in negotiating with the current government for resource rights, to have the option of not entering into any agreement. We assume that governments are interested in maximizing tax revenue during their one-period term of office. In particular, they have no interest in tax revenue received in other periods. While we believe this assumption to be a fair approximation in cases of resource development which takes place over extremely long periods, we will briefly consider the alternative assumptions that governments are concerned about current and future tax revenue.

Tax revenue to the current government is assumed to be a monotonically increasing function of the expected net present value of the resource from the producer's point of view. This is eminently reasonable if there is competition among several potential producers and the current government auctions off

the rights.[12] Even if only one firm is a potential producer and therefore there exists a bilateral monopoly, such solution concepts as the Shapley value would lead to the government's revenue having this property.

The future government either receives the tax payment negotiated in the contract between the current government and producer or expropriates the resource. If expropriation occurs, the producer is assumed to have a zero future cash flow. Allowing only expropriation as an option for the future government is a simplifying assumption that does not change qualitatively the nature of the results.[13] The critical assumption of the model is the function which determines the probability of future expropriation perceived by the producer. We argue that a plausible form for the function is:

$$\rho = \rho(T_F, NCF_F) \quad \text{where} \quad \rho \in [0,1] \quad \text{and, for} \quad \rho \in (0,1), \qquad (1)$$

$$\rho_1 < 0 \qquad \rho_2 > 0 \qquad \rho_{11} > 0 \qquad \rho_{22} < 0 \qquad \rho_{12} < 0$$

T_F is the tax payment negotiated in period 1 but accruing to the second period government and NCF_F is the after-tax cash flow of the development in the second period.

There must be some cost to expropriation, or it would always occur when the net cash flow was positive. The economic gain to nationalization is the difference between the cash flow the project would have in government hands and the tax payments the government receives.[14] The higher the net cash flow, the more likely is expropriation, since a higher net implies a larger gain without increasing the loss from a government takeover. There are at least two reasons why higher tax payments might reduce the probability of expropriation, holding the after-tax cash flow constant. The cash flow the project would attain in government hands may be substantially lower than the gross-of-tax cash flow, so that the higher is the tax, the lower is the net gain from

expropriation. In addition, the firm would be facing a higher tax rate in the absence of expropriation and could be said to be paying more of its 'fair share'; equity considerations might argue against takeover. This might be important in negotiations on future projects, which, as suggested earlier, is one of the costs of expropriation.

4. Future Taxes with Certain Cash Flow

The producer was assumed to maximize the expected present value of profits. This is just the sum of current after tax cash flow and expected discounted future after tax cash flow. If all investment is made in the current period, operating costs are proportional to output, and the firm is a price taker in the product market, this can be written as:

$$\pi = -I_C + (P_C - O_C) \cdot Q_C - T_C + [(1-\rho)([P_F - O_F] \cdot Q_F - T_F)] \cdot \left(\frac{1}{1+r}\right) \quad (2)$$

where P, O, Q, and T represent price, operating cost per unit, quantity produced and taxes in the respective periods, I_C is the initial investment, r is the discount rate and ρ is the probability of expropriation. If the firm could only choose T_F (which is, recall, the contractual level of payments made to the future government) and whether or not to produce at all, and if positive expected profits were possible, the first order condition for profit maximization would be:

$$\frac{\partial \pi}{\partial T_F} = \frac{-(1-\rho)}{(1+r)} - \rho_1 \frac{NCF_F}{(1+r)} + \rho_2 \frac{NCF_F}{(1+r)} = 0 \quad (3)$$

where ρ_1 is the derivative of ρ with respect to T_F, ρ_2 the derivative with respect to NCF_F and NCF_F is the second period net-of-tax cash flow, or:

$$NCF_F = (P_F - O_F) \cdot Q_F - T_F \quad (4)$$

The first term of equation (3) represents the loss in future profits of an additional dollar of future tax payments, at the existing probability of expropriation. It is negative, but small at low tax levels since the probability of expropriation would be high. The last two terms are the gains increases in future tax payments bring by reducing the probability of expropriation directly and indirectly (by reducing cash flow). These terms are positive by the assumption on the signs of the derivatives and assuming positive future cash flow. They are largest at small tax levels by the second derivative assumptions.

Given the derivative assumptions, a necessary and sufficient condition for a desired positive level of future taxes is that $(\rho_2-\rho_1)NCF_F - (1-\rho)$ be positive at $T_F = 0$. A sufficient, but by no means necessary, condition is that the probability of expropriation be 1 if $T_F = 0$. Solving equation (3) explicitly for the optimal T_F, we obtain:

$$T_F^* = (P_F-O_F) \cdot Q_F - \frac{(1-\rho)}{(\rho_2-\rho_1)} \tag{5}$$

Since, by assumption, prices, operating costs, and quantities are known and invariant, any future tax which yields this revenue is optimal from the point of view of the producer. The first term of equation (5) is positive while the second is negative. The optimal level of future taxes from the producer's point of view is, of course, less than the future cash flow.

It is interesting to consider the producer's choice of an extraction path for the resource under these conditions. If the total quantity of the resource available is fixed, that is,

$$Q_F + Q_C \leq \bar{Q} \tag{6}$$

then, when the constraint is binding, the following equation must hold:

$$P_C - O_C - \frac{\partial T_C}{\partial Q_C} - \frac{(1-\rho)}{(1+r)}\left[(P_F - O_F) - \frac{\partial T_F}{\partial Q_F}\right] \tag{7}$$

$$- \frac{NCF_F}{(1+r)}\left[-\rho_2\left(P_F - O_F - \frac{\partial T_F}{\partial Q_F}\right) - \rho_1 \frac{\partial T_F}{\partial Q_F}\right] = 0$$

If the probability of expropriation were zero and if there were no taxes, then, unsurprisingly, one is left with the familiar necessary condition that the scarcity rent grow at the interest rate. In the actual problem, the producer will extract more slowly (rapidly) than in the no government case if the sign of

$$- \frac{\partial T_C}{\partial Q_C} + \frac{\rho}{(1+r)} \cdot \left[(P_F - O_F) - \frac{\partial T_F}{\partial Q_F}\right] \tag{8}$$

$$- \frac{NCF_F}{(1+r)}\left[-\rho_2\left[P_F - O_F - \frac{\partial T_F}{\partial Q_F}\right] - \rho_1 \frac{\partial T_F}{\partial Q_F}\right]$$

is negative (positive).

So far, only the producer's problem has been discussed, but the current government's decision is really quite similar. The reason is that, by assumption, producers have the option of not participating. Producers must expect non-negative present value of profits or they will not enter. The current government's problem, if it is solely interested in maximizing current revenue, is:

$$\underset{T_C, T_F}{\text{Max}} \; T_C \text{ s.t. } - I_C + (P_C - O_C) \cdot Q_C - T_C \tag{9}$$

$$+ \frac{(1-\rho)}{(1+r)}\left[(P_F - O_F) \cdot Q_F - T_F\right] \geq 0$$

The first order condition for the choice of second period tax payments — when

the quantity produced in each period is fixed — is exactly the same as equation (3). That is, the current government would choose the same level of future tax payments that the producer would. Note that the government's expectation regarding expropriation does not matter; it is the producer who must expect not to lose money.

If the current government cares about future, as well as current, government revenue, the problem becomes more complex and depends on the value of the expropriated property. It can be written as:

$$\underset{T_C,T_F}{\text{Max}} \; U(T_C,(1-\rho^g)T_F + \rho^g EXPV) \quad U_1 > 0 \quad U_2 > 0 \quad U_{11} < 0 \quad U_{22} < 0 \tag{10}$$

$$\text{s.t.} - I_C + (P_C-O_C)Q_C - T_C + \frac{(1-\rho)}{(1+r)}\,[(P_F-O_F)Q_F - T_F] \geq 0$$

where EXPV is the value of the expropriated property to the future government and ρ^g is the current government's perception of the probability of future expropriation.

Maximizing the Lagrangian with respect to T_F:

$$I_2[(1-\rho^g) + \rho_1^g(EXPV-T_F) - \rho_2^g(EXPV-T_F)] \tag{11}$$

$$+ \lambda[-\frac{(1-\rho)}{(1+r)} + (\rho_2-\rho_1)\frac{NCF_F}{(1+r)}] = 0$$

At the maximum of current taxes, the second term is zero. A government caring about future revenue will have higher future tax payments than one not caring if and only if:

$$(1-\rho^g) - \rho_1^g(T_F-EXPV) + \rho_2^g(T_F-EXPV) > 0 \tag{12}$$

at that point. All three terms will be positive if $T_F > EXPV$. Under the case where future taxes are greater than the expropriated value of the firm, at the value of T_F from equation (3), the current government which cares about future revenue will have a higher level of future tax payments than one

which does not. Since $T_F > EXPV$ means that expropriation costs money, the intuition is that the current government in this case, in addition to trying to raise future revenue directly, wants to reduce the chance that the future government will hurt itself. Obviously, the future government must not be maximizing revenue or this would not be a possibility (perhaps it faces a public outcry). If $EXPV > T_F$, future tax payment may be larger or smaller than the solution to equation (3).

5. Future Taxes with Uncertain Cash Flow

In the previous section, it was assumed that the second period cash flow was known in the first period. In this case, the form which the future tax payments took was irrelevant, since all three agents care only about the magnitude of the payment when production was inelastic. If producers can alter the production time path in response to incentives, the form of the future tax payments still does not matter, since the desired production pattern could be achieved by the appropriate choice of the current tax function without affecting the magnitude of current or future taxes collected.

When the future cash flow of the project is uncertain, the form of tax payment matters a great deal. The optimal tax payment, for both producer and selfish current government, is still as determined in equation (5) when quantities are not choice variables:

$$T_F^* = (P_F - O_F) \cdot Q_F - \frac{(1-\rho)}{(\rho_2 - \rho_1)}$$

since the producer maximizes expected profits. Future taxes should depend on $(P_F - O_F)*Q_F$ -- that is, future cash flow gross of tax (CF_F) — as well as on the expropriation function.

Unfortunately, the relationship between the optimal level of future taxes and gross cash flow is not a simple one. Differentiating the above equation with respect to CF_F (and dropping the F subscripts), one can obtain the following:

$$\frac{\partial T^*}{\partial CF} = 1 - \frac{(\rho_2-\rho_1)}{(\rho_2-\rho_1)^2}\left[-\rho_2 + \rho_2 \frac{\partial T}{\partial CF} - \rho_1 \frac{\partial T}{\partial CF}\right] \tag{13}$$

$$+ \frac{(1-\rho)}{(\rho_2-\rho_1)^2}\left[\rho_{22}-\rho_{12}-\rho_{22}\frac{\partial T}{\partial CF} + \rho_{21}\frac{\partial T}{\partial CF} - \rho_{11}\frac{\partial T}{\partial CF} + \rho_{12}\frac{\partial T}{\partial CF}\right]$$

where all the derivatives are evaluated at T_F^*. By the envelope theorem,

$$\frac{\partial T_F^*}{\partial CF} = \frac{\partial T_F}{\partial CF}\Bigg|_{T_F^*} \tag{14}$$

Therefore terms can be combined in equation (13) into the following:

$$\frac{\partial T^*}{\partial CF}\left[2 - \frac{(1-\rho)}{(\rho_2-\rho_1)^2} \cdot [2\rho_{12}-\rho_{11}-\rho_{22}]\right] \tag{15}$$

$$= 1 + \frac{\rho_2}{\rho_2-\rho_1} + \frac{(1-\rho)}{(\rho_2-\rho_1)^2}[\rho_{22}-\rho_{12}]$$

The first two terms on the right side of the above equation are positive. If $\rho_{22} - \rho_{12}$ is positive, both the bracketed expression on the left side and the remaining term on the right side are certainly positive. There does exist a range of values for ρ_{22}, however, which would make $\frac{\partial T^*}{\partial CF}$ negative.

Three special cases are worth examining. Consider the case where the expropriation function depends solely on the net of tax cash flow. Equation (15) then simplifies to:

$$\frac{\partial T^*}{\partial CF}\left[2 + \frac{(1-\rho)\rho_{22}}{(\rho_2)^2}\right] = 2 + \frac{(1-\rho)\rho_{22}}{(\rho_2)^2} \tag{16}$$

That is, the marginal tax rate on cash flow should be 100% in the future in this case. This is not surprising. When the probability of expropriation depends only on the net cash flow, there is one optimal future net cash flow no matter what the magnitude of the gross revenue.

Another special case occurs when the expropriation function is only a function of the future tax payment. Equation (15) then becomes:

$$\frac{\partial T^*}{\partial CF}\left[2 + \frac{(1-\rho)\rho_{11}}{\rho_1^2}\right] = 1 \tag{17}$$

The bracketed expression is positive and larger than 1, so the marginal tax rate should be positive and less than 100%. This again fits the intuition, since a higher cash flow implies that more expropriation insurance, in the form of higher tax payments, should be purchased.

In the final special case that we shall consider, the change in $\rho_2 - \rho_1$ caused by changes in cash flow is assumed to be zero. This is not completely unreasonable since the sign of that derivative is ambiguous. The assumption means that the terms containing second order derivatives can be ignored, so that equation (15) becomes:

$$\frac{\partial T^*}{\partial CF}[2] = 1 + \frac{\rho_2}{\rho_2 - \rho_1} \tag{18}$$

The marginal tax rate is again positive but less than one, because the second term on the right hand side is between 0 and 1.

The modifications to the above analysis when the current government includes future taxes directly in its utility function add few insights. The optimal marginal tax rate for the current government will depend in part on the change in the value of the property if expropriated as the private cash flow increases.

When the producer can choose the quantity produced in the two periods, little is changed. If the producer can merely choose his second period output, nothing is changed from the above case, since a tax on second period profits will not affect his decision. When the firm is producing an exhaustible resource, and can switch his output across periods, the structure of the current tax payment can be molded in such a way that the desired production pattern can be achieved, in this simple two-period model, for any given future tax function.

6. Conclusions

The model in this paper had one critical assumption: the potential producer perceived that a contract between it and the government would not be binding on future governments, with the probability that the future government would change the contract in an unfavorable way thought to be an increasing function of the after-tax cash flow and a decreasing function of taxes paid to it. Under these circumstances, a current government, interested only in the taxes it receives, will frequently wish to choose a contract with the developer which specifies a positive level of future taxes. When future cash flow is uncertain, the level of future tax payments should be a function of that flow.

These results provide some justification for the practice followed in offshore oil lease auctions in the United States. The bidding is over a cash payment, to be paid when the lease is signed. This can be viewed as the taxes paid to the current government. The developer also agrees to pay a specified fraction, usually either 12 1/2% or 16 2/3%, of the gross revenues from any oil that is produced. In the context of this paper, this could be viewed as the taxes paid to future government. The royalties are closely correlated

with the cash flow from the project. The choice of payments which fluctuate with gross revenue rather than cash flow might be related to one of the considerations mentioned in Robinson [1983]: cost of monitoring, offer comparability, or landowner risk aversion.

A similar structure is observed in the agreement involving the mining of diamonds at Ashton in Western Australia, despite a very different institutional environment. The contract involved payment of 7% of the gross revenue or 22% of the cash flow, whichever was larger. In addition, there was agreement on a work program, which represents a type of payment to the current government in the form of increased employment.

The claims for this model should not be too immodest. Robinson [1983] uses a quite different set of assumptions to show that a similar structure is reasonable for resource prospects which are owned either publicly or privately. The results of this paper help confirm the usefulness of payments over time which fluctuate with the cash flow when contracts are not binding on the owner of the mineral rights.

Footnotes

*The authors would like to thank Michael Boskin, Timothy Bresnahan, John McLeod, Charles McLure and Michael Porter for helpful discussions without implicating them in what remains. This paper was begun at the Centre of Policy Studies, Monash University, to which we are grateful for financial support. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the International Monetary Fund or the Centre of Policy Studies.

[1]The percentage of total government receipts furnished by natural resources in the mid-70's for some developing countries (Gillis (1982), p. 628):

5-15%	Thailand, Colombia, Honduras, Panama, Peru and the Phillipines
15-25%	Chile, Malaysia
>25%	Ecuador, Mexico, Jamaica, Liberia, Zaire and Zambia
>50%	Bolivia, Indonesia, Gabon, Papua New Guinea

[2]See, for example, the discussion of Garnaut and Clunies-Ross (1975) and Mikesell (1979) of a resource rent tax and Leland (1978) who discusses the combination of such a tax with bonus bidding.

[3]For another explanation, also applicable in the case of private contractual arrangements, see Robinson (1983).

[4]While in this paper we concentrate on tax policy, there are other methods of raising the costs of discretionary ex-post changes to contracts. In Indonesia, some contracts provide clauses specifying arbitrarion by the International Center fo rthe Settlement of Investment Disputes and other procedures in the event of default in the performance of obligations. See Gillis and Wells (1980), p. 179.

In Australia in response to unstable natural resource policy, many new resource developments involve the negotiation of "Indenture Agreements". The argument between resource developers and State governments are ratified as acts of parliament and contain all details of the terms under which the particular lease is undertaken. No Minister can change the terms on his own authority. Moreover if a future government wishes to amend the tax arrangements for resource development in general, it must amend the particular Indenture Ratification Acts; it cannot simply make across-the-board changes. Not only is it more costly to change agreements from a legislative perspective but also the explicit contractual nature of the tax arrangements suggests that, if negotiations for resource development are a repeated game, the cost could be more far-reaching.

[5]Dam (1976) states, for example,

> What is crucial is the degree of protection afforded against state abrogation of the license and against retrospective measures that have the effect of reducing the value of the license.... In large measure the degree of protection depends upon the legal system of the state. (p. 175)

The literature on political risk is extensive; see, for example, Kobrin (1980) and (1981) and Prast and Lax (1982).

[6]There have been a number of theoretical articles discussing how contracts are constrained when one or more parties cannot bind themselves to observe the terms. See, for instance, Bulow (1982) and Stiglitz and Weiss (1981).

[7]The issue is currently in litigation in Federal courts.

[8]Gordon (1978), p. 12.

[9]Economic Report of the President (1983), p. 94.

[10]It has been suggested that such behavior helps explain the fall in real oil prices in the 1950's and 1960's; oil companies might have feared the loss

of their concessions and increased production from the fields of the Middle East.

[11]See Robinson (1983).

[12]Even considering strategic (though not collusive) behavior, bids will be an increasing function of the value of the resource under common auction rules. See Riley and Samuelson (1981).

[13]Expropriation eliminates future cash flow in the model. Any ex-post reduction in firm profits could be converted into a probability of expropriation.

[14]Kobrin (1980) provides evidence that economic factors influence expropriation. Kobrin (1981) argues that it makes sense to talk about expropriation (or renegotiation) on a project level. As an example he notes that when Chile nationalized ITT's copper holdings, it left untouched the ITT-owned Sheraton Hotel.

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