The Drilling Gap in Non-OPEC Developing Countries: The Role of Contractual and Fiscal Arrangements

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The Drilling Gap in Non-OPEC Developing Countries: The Role of Contractual and Fiscal Arrangements†

INTRODUCTION

Despite the tremendous increase in the real price of oil over the past decade, exploration and development activity in many non-OPEC developing countries (NODCs) has languished relative to other areas of the world.¹ Factors responsible for this skewed pattern might include poor geologic prospects, excessive political risk, and lack of infrastructure development. Poorly designed contractual and fiscal arrangements, which result in an unsatisfactory sharing of risks and rewards between the host government and foreign investors, might also constrain petroleum investment in NODCs.² This article analyzes the sources of risk in oil exploration and development activity, and how insights from economic theory can be used to analyze the efficiency of risk-sharing in contractual and fiscal arrangements.

ECONOMIC RISK IN PETROLEUM EXPLORATION AND DEVELOPMENT

Investment in petroleum exploration and development is a risky economic activity. There is considerable uncertainty about the relationship between funds expended and output, and uncertainty about costs and future prices. Drilling expenditures may produce dry holes or only small discoveries. Indeed, uncertainty pervades the complex relationships between the different investment decisions and outcomes which occur throughout the various stages of the petroleum supply process. Moreover,

¹National Petroleum Council, Third World Petroleum Development 8 (1982).
²For an analysis of the relative importance of contractual and fiscal arrangements, resource potential, political risk, and infrastructure development as determinants of exploration activity in NODCs, see Broadman, Incentives and Constraints on Exploratory Drilling in Developing Countries, 10 Ann. Rev. Energy (1985).
the process of exploration and development of a non-renewable resource, such as petroleum, is inherently dynamic. Both expectations about the time path of prices and the effects of current decisions on future costs must be taken into account. The effects of resource depletion must also be incorporated into the sequence of investment decisions.\(^3\)

Figure 1 illustrates the time profile of cash flow for a "typical" exploration and development project. Current cash flow is important because project costs are generally deductible from current revenue. Cash flow is negative until the extraction, or production, process begins. The area denoted by \(a\) depicts early exploratory work, for example, seismic sur-

veys. Area \textit{b} includes other exploration costs and the costs of field development. The overlap of areas \textit{a} and \textit{b} depicts that the time paths of costs expended in exploration and development activities typically do not have discrete boundaries. Area \textit{c} is operating revenue, and \textit{d} depicts the operating costs of production. Operating costs include those associated with well servicing, and to the extent they are used, with enhanced recovery techniques.

Operating costs tend to increase while operating revenues decrease over time because as a well becomes depleted its productivity declines.\textsuperscript{4} Because the various costs and revenues occur over time, net profitability of a project cannot be measured by simply summing and comparing the areas above and below the time line. Rather the present value of revenues must be compared with costs also appropriately discounted.

Owing in large part to the economic distinction between exploration and development activities, different risks are associated with each of the two stages. Exploration entails risk that derives largely from uncertainty about the resource potential of an area's geology, which not only includes the uncertainty about the existence of resources but also the size, quality, and accessiblility of the deposits. Development risk also emanates from uncertainty, over the same factors, which largely determine cost conditions. Development risk also reflects uncertainty about the factors which affect the extent to which an investment will be commercial, such as the price of oil and competing fuels. The economic risk associated with exploration is usually thought to be greater than that associated with development.\textsuperscript{5}

The allocation of funds invested among exploration and development projects is determined by ranking each project's expected or probability-weighted net present value, that is, the sum of discounted net revenues after adjustment for risk where risk is conventionally measured as the variance of a project's profit.\textsuperscript{6} All other things being equal, the more risky the project the lower its risk-adjusted net present value. Economic efficiency requires that under the assumption of risk aversion, in the absence of extraneous considerations, the reward structure of investment should match that of risk. A lower expected return is, therefore, required to induce risk-averse parties to invest in low-risk ventures than the expected return that is required for riskier investments.

Fundamentally, there are two dimensions of risk. One component is associated with all exploration and development projects and is attributed

\textsuperscript{4} S. MCDONALD, PETROLEUM CONSERVATION IN THE UNITED STATES: AN ECONOMIC ANALYSIS 16 (1971).

\textsuperscript{5} M. ADELMAN, THE WORLD PETROLEUM MARKET 25 (1972).

to systematic economic forces, which affect the outcome of all such investments, such as the price of oil. The other component of risk results from various project-specific characteristics which include the geologic structure of the area in which exploration is contemplated and the degree of field accessibility. Economic theory suggests that, from the standpoint of an individual investor, all risk which is project-specific can be diversified away by taking on other exploration and development projects. Project diversification, however, cannot eliminate the portion of risk inherent in all exploration and development investments. It is this non-diversifiable risk with which we are concerned.

In NODCs, as in other areas around the world, the allocation of risks and rewards between the parties to an exploration and development investment, the host government and a foreign oil company, is governed by institutional arrangements: contracts and taxes. The theory of principal-agent relations and optimal incentive contracting provides insights into how such arrangements can establish an economically efficient distribution of risk and create incentives for each party to perform according to the contract in an efficient manner.

Briefly, starting from the definition of an efficient allocation of risk as one in which one party cannot be made better off without impairing the other party, the theory suggests that an efficient allocation of risk will be realized only if a contract adequately reflects differences between the parties in terms of their risk-bearing attitudes. In the specific case where all parties to a contract are risk-averse, an optimal contract is one that provides for risk-sharing (in accordance with each party's relative degree of risk-aversion). In addition, the theory indicates that efficiency in contract performance will depend on the need for and the cost of contract monitoring, and the degree to which there is "opportunistic" behavior by one of the parties, for example, reneging on an entire contract or on some specific provisions of the contract. Finally, the theory shows that the extent to which an efficient risk-reward structure can be negotiated into a contract will depend, in part, on the relative bargaining power of the parties.

Keeping in mind these observations from theory, the allocation of risk and the degree of efficiency embodied in the contractual and taxation

9. Id.
10. See, e.g., Shavell, Risk Sharing and Incentives in the Principal and Agent Relationship, Bell J. Econ. 55-73 (1979) and Harris & Raviv, Optimal Incentive Contracts with Imperfect Information, 20 J. Econ. Theory 231-59 (1979).
11. Id.
arrangements governing petroleum exploration and development in non-OPEC developing countries in practice will be examined.

CONTRACTUAL AND TAXATION ARRANGEMENTS IN NODCS

Contracts

In this section, contractual arrangements, the institutional rules governing the allocation of risks and rewards as well as the distribution of management responsibilities for the actual operation of NODC exploration and development projects, will be considered. Below is a discussion of the companion set of institutional rules, taxation arrangements, which also governs the allocation of risks and rewards but does not govern the distribution of management responsibilities. The conditions set forth by NODC contractual and taxation arrangements may be defined on a case by case basis for each specific project or they may be codified more generally into a host country’s petroleum legislation.  

Whether defined on a project-specific basis or by the host country’s legal system, several basic provisions are typically covered in NODC oil exploration and development contracts. In the exploration stage, the mandated conditions include delineation of the geographic area to be explored, minimum work and expenditures, conditions for relinquishment, data sharing, and the duration of the contract. Provisions relating to the development and production phase include the definition of a commercial discovery, the level and rate of production, disposal of associated gas, access to and ownership of crude supplies, transfer of technical expertise, the value (“market” price) of oil produced, and conditions for determining the allocation and remittance of profits derived from the operation.

Conceptually, four broad classes of contractual arrangements can be distinguished: (1) concessions, (2) production-sharing contracts, (3) non-risk service contracts, and (4) risk service contracts. A fifth, joint venture, is sometimes identified as a separate category, but is more accurately only a variation or subset of the other four. These four different contractual arrangements provide for four somewhat different allocations of risks and rewards between the host country and the foreign investor.

Concessions are arrangements under which an oil company obtains a lease from a government to explore in a well-defined geographic area. The company provides all the capital for exploration, and if petroleum is discovered, the company is free to develop and market it. In exchange,

13. Id. at 26-43.
14. Id.
15. Supra note 12, at 44-46.
the company usually pays a royalty to the host government for each barrel produced. Traditional concession agreements are of long term (10-60 years) and, like the 1901 Anglo-Persian concession in Iran,\textsuperscript{16} give the contractor more discretion over rates of exploration and production than do recent versions. Modern concession arrangements often give the contractor more limited property rights and more strictly define the timetable of operation and company obligations.\textsuperscript{17} In general, however, concessions do not provide for any direct participation in exploration and development operations by the host government. Still, while all exploration risks are borne by the contractor, the government shares indirectly the development risks associated with the company’s ability to market, and hence extract and pay royalties on, discoveries.

Under production-sharing contracts, the oil company again provides all exploration and development capital. But if it makes a commercial discovery, rather than recovering its costs by income generated from sales (as under concessions), the company recovers its costs by obtaining a portion of the oil produced, referred to as “cost oil.”\textsuperscript{18} The balance of output, “profit oil,” is divided between the government and the oil company according to the provisions of the contract.\textsuperscript{19} The government share of profit oil varies widely; for example, Chile receives fifteen percent of profit oil; Peru, fifty percent; and Egypt eighty-five percent.\textsuperscript{20} The government’s share of profit oil is analogous to the royalty received on output under traditional concession arrangements. Generally, taxes are also paid to the host government by the oil company on the company’s share of profit oil. Like concessions, the oil company bears all exploration risks under production-sharing contracts. Unlike concessions, however, under production-sharing arrangements the government shares directly in the development risks; if the outcome of the company’s exploration efforts is a commercial discovery, the host country, in effect, compensates the oil company with a return commensurate with the exploration risk the company bore.

Non-risk service contracts are arrangements whereby the oil company provides an exploration and/or development service and is then compensated by the government for the investment and operating costs of services rendered.\textsuperscript{21} For exploration services, compensation is generally a flat fee; for development services, compensation can be in cash or crude, but is usually a flat fee per barrel, and sometimes includes the right to “pur-

\textsuperscript{17} 1 World Petroleum Arrangements, supra note 12, at 44-46.
\textsuperscript{18} Id. at 49.
\textsuperscript{19} Id.
\textsuperscript{20} Id. at 48.
\textsuperscript{21} Id. at 65-68.
chase" a share of the output. In either case, the contractor receives compensation regardless of the outcome of its activity. Under such contracts all risks are borne by the host country, and the company is guaranteed its fee regardless of the efficiency of its performance.

Risk service contracts combine features of production-sharing and non-risk service contracts. Under risk service contracts, all exploration risks are borne by the foreign investor, but the host country assumes the development risks. The oil company provides the exploration outlays, and if a commercial discovery is made, the company contracts with the host country to develop the discovery. The development service fee is structured such that the company must make the development outlays, and is compensated for its exploration and development costs only after production begins. Usually the company also obtains a share of sales. Compensation is most often made in cash, but can be made with oil. A variant of this type of contract is where the host country’s state-owned oil company is responsible for the production phase of the project, but the foreign company still conducts the exploration and development operations. In both cases, title to the oil is retained by the host country.

Joint ventures, wherein the host government participates as an equity partner with a foreign investor, usually occur in NODCs in the development rather than in the exploration stage. With the company assuming the exploration risks, joint ventures usually provide first for recovery of the company’s exploration costs. The balance of the oil is shared in proportion to each party’s equity interest in the project. The company is compensated for any development costs it incurs and receives any profits obtained in the sale of the oil, both in proportion to its equity interest. The oil company generally also pays the host government taxes on its share of the profits. A pure joint venture wherein both parties share, in proportion to their equity interest, the risks and rewards of a combined exploration and development project is rarely formed in NODCs.

Within the last two decades in NODCs there has been a shift away from almost exclusive reliance on concession arrangements toward a mixture of contract forms. While concessions are still predominant, production-sharing contracts are becoming increasingly common. Service contracts, both the risk and non-risk forms, are more widespread, too, but are in practice often limited to those countries such as Argentina, Brazil, and Peru which have existing production, proven reserves, and a certain level of indigenous expertise in petroleum development.

22. Id. at 57-64.
23. Id. at 68-73.
25. Id.
26. Id.
If there is one overriding implication of the shift away from concession arrangements that has taken place, it is that, generally, there is now greater government participation in petroleum investment activity in NODCs. There is greater government assumption of risk, though primarily at the development rather than the exploration phase, stronger government voice in management and operations, and more government ownership of crude. It is symptomatic of this shift that many international oil company exploration and development contracts in NODCs are no longer with foreign ministries, but with newly-formed enterprises nominally responsible for overseeing domestic hydrocarbon development, state-owned oil companies. 27

Particular contract terms have also been rewritten to accommodate an increased role of the host government. The definition of commercial discovery, traditionally decided by the foreign oil company, is now usually determined by the company in conjunction with the host government. In Brazil, for example, the definition of commercial discovery is made in conjunction with the state-owned oil company (Petrobras) on the basis of an estimated discounted cash flow. 28 Also, the introduction of "sole risk" provisions allows one partner in a joint venture, usually the host government, to proceed with development without the agreement of the other partner. Current contracts, moreover, often contain specific provisions for the training and participation of host country nationals in the petroleum exploitation process. 29

On the other hand, some areas previously denied to foreign oil companies have been made accessible. For example, since 1973, Brazil 30 and India 31 have relaxed previously established state monopolies for petroleum investment and now permit foreign oil companies to undertake exploration and development, usually in offshore areas. Nonetheless, despite these relaxations, there are still limitations on foreign exploration and development of certain acreage in many NODCs. 32

Taxation

There are three dominant types of taxation schemes for oil exploration and development in NODCs: (1) royalties, (2) signature bonuses, and (3) profit taxes.

Royalties based on a fixed percentage of production historically have been the predominant form of taxes and are generally used in conjunction

28. 1 WORLD PETROLEUM ARRANGEMENTS, supra note 12, at 61-62.
29. Id.
30. 3 PETRO-CANADA & PETROLEOS DE VENEZUELA, WORLD OIL SUPPLY PROSPECTS (1980).
31. F. GHADAR, supra note 27, at 145.
32. See generally supra note 30.
with concession arrangements. Under a traditional royalty system, the host government collects cash from the contractor as soon as commercial production begins. The fact that royalty payments are a function of output, and hence revenue, rather than profits, has important implications for the allocation of risk. Typically an exploration and development project begins earning revenues long before it begins earning a profit. As a result, production-based taxes, such as royalties, allocate most of the development risk to the contractor.

Under signature bonuses, the contractor generally pays an amount of money to the host government when a contract is initiated. Signature bonuses are most often used when the companies participate in competitive bidding for contracts and are a measure of a company’s willingness to pay for the opportunity to explore for oil. Signature bonuses are also used in negotiated contracts which, in contrast to the U.S. competitive bidding system, are more prevalent in NODCs. In any event, signature bonuses are not the primary tax instruments in NODCs; they serve only a nominal revenue-raising function.

Profit taxes are analogous to royalties except they are not determined by output or gross revenues but are based on the company’s net income. The tax burden, therefore, falls on the company later in the life of a project than it would under a royalty system. Moreover, relative to royalties, taxes on profits tend to result in a higher degree of risk-sharing.

Increasingly prevalent in NODCs are various types of profit taxes designed to earn the host government revenue when there are “windfall” profits. One such tax scheme, based on the concept of resource rent, usually involves subjecting the contractor’s net income to a higher tax rate when the rate of return on the project exceeds a particular level. This taxation scheme was first introduced in Papua New Guinea. Another type of profit tax is also aimed at capturing “windfalls.” Malaysia, for example, imposes higher income taxes when international oil prices rise above a specified level.

There is another important difference between royalties and taxes on income. Income taxes paid to foreign governments can, in some countries including the United States, be entirely credited against taxes owed to the company’s home government. Income taxes are, therefore, less onerous to oil companies engaged in foreign investment than are royalties, because royalties are only deductible rather than creditable. Taxes paid by an oil company to a host government in the form of oil, as is often

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33. 1 World Petroleum Arrangements, supra note 12, at 17-20.
35. Garnaut & Clunies Ross, supra note 34; Palmer, supra note 34.
36. MiKeeSELL, supra note 6, at 87.
the case in a production-sharing agreement, however, have been disallowed in the United States as a tax credit since 1976. As a result, in some countries, for example, Indonesia, production-sharing contracts were renegotiated so that the U.S. companies' tax payments in the form of oil to the host country appeared in the form of taxes creditable against the companies' other U.S. tax liabilities. Of course, in the countries where this type of renegotiation has not occurred, the effective tax burden on U.S. oil companies will likely be higher under production-sharing contracts than under other contract forms.

In general, in the United States, tax policy has become more restrictive with respect to the crediting of taxes paid to foreign governments against U.S. tax liabilities. In 1975, Congress enacted a statute which allowed U.S. oil companies to exclude from their total taxable foreign oil-related income any losses incurred in another country. The so-called single country loss rule effectively raised the level of foreign oil-related income and allowed a greater application of foreign tax credits than would otherwise be the case. The net impact of the rule was to stimulate new exploration projects abroad. In 1982, however, Congress passed the Tax Equity and Fiscal Responsibility Act (TEFRA) which repealed the single country loss rule.

The overall trend in petroleum exploration and development taxation in NODCs over the last fifteen years has been toward higher tax yields accruing to host governments. The change has been almost uniform owing to a "demonstration effect." The increase in tax yields is the result of higher levels of taxation and a change in the mix of instruments. Higher levels of taxation have been accomplished in two ways. First, in administering any given instrument, higher tax rates have been applied. Second, there has been movement from specific to ad valorem taxes, reductions in tax holidays, decreases in percentage depletion allowances, and greater scrutiny of transfer prices governing transactions between foreign oil company exploration and development affiliates and their parent companies.

The most notable change in the mix of fiscal instruments has been a shift from flat royalties to graduated income taxes and, in a number of cases, to taxes on resource rent. The greater reliance on profit taxes, in

37. NATIONAL PETROLEUM COUNCIL, supra note 1, at 17-19.
38. MIKESELL, supra note 6, at 61-62.
39. NATIONAL PETROLEUM COUNCIL, supra note 1, at 17-21.
40. Id.
42. See Gillis, Evolution of Natural Resource Taxation in Developing Countries, 22 NAT. RES. J. 619 (1982).
43. Id.
particular, resource rent taxes, implies that, for the same level of tax yield, the structure of taxation is different.

Tax structure is critical in determining how efficiently petroleum resources of different quality will be exploited. In this regard, a key question is to what extent does the typical tax structure in NODCs discriminate among fields of different size? Generally, exploration and development costs per barrel vary inversely with field size. Accordingly, economic profits and rent will similarly vary with field size. Until recently, tax structure within most NODCs tended to be constant across oil fields of all sizes. Because profitability is a function of field size, however, tax systems which yield satisfactory returns for large, low-cost fields may not provide adequate returns for small, high-cost fields. An efficient tax structure is one that allows the host government to capture its desired portion of economic rent but does not distort investors’ incentives to explore and develop oil resources of varying quality. A progressive tax system in which tax rates increase with oil field profitability meets this efficiency test. In theory, a progressive tax reduces investor risk, that is, reduces the variance of return, and increases both the level of company investment and host country proceeds.

This suggests that the high-cost, low-volume fields, which are thought to be characteristic of NODCs, may be made more attractive by introducing a progressive tax structure. A signature bonus often amounts to committing large cost outlays even before an investment proceeds. A signature bonus is, therefore, regressive, and raises the investor’s variance of returns. Traditional royalties, depending upon how they are structured, may be regressive but could be proportional across fields of varying sizes. Production-based taxes, in general, result in the contractor assuming a larger share of the super-profits generated from large fields than the share of profits generated from small fields that are only marginally profitable on a pre-tax basis. Resource rent taxes, on the other hand, are progressive and have the advantage of providing the contractor with a specified rate of return, reduced exposure to risk, and quicker cost recovery on small fields. Although the main cause for the introduction of this last type of tax was to capture windfalls for the host country, it also introduces progressivity into the structure of taxes.

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45. Gillis, supra note 42, at 633.
47. MIKESELL, supra note 6, at 8-9.
The recent trend toward the adoption of resource rent taxes is thus likely to make petroleum exploration in NODCs more efficient. Other changes in tax arrangements, such as differential royalties (for example, a two-part or sliding-scale tariff type of regime), would make exploitation of small, high-cost fields more attractive as well.

The results of recent simulation experiments provide further evidence of the bias inherent in regressive or proportional tax systems against exploiting small volume, high-cost fields. This bias applied to all systems investigated, including those in Papua New Guinea, Malaysia, and Egypt. Current taxation arrangements were found to bring about a considerable drop in the profitability of marginal fields when the price of oil decreases only slightly. In general, these experiments suggest that despite recent changes in taxation arrangements, present tax systems still discriminate against exploiting high-cost, small deposits.

Progressive resource rent taxes are an attractive instrument for NODC host governments desirous of attracting foreign investment to exploit small, high-cost fields, providing tax rates are set at realistic levels. Such taxes, however, present governments with a tradeoff: progressive resource rent taxes are more efficient than other taxes in exploiting small, high-cost fields, but the tax structure also shifts a greater portion of risk to the host government. Depending upon the host country’s attitude toward risk-bearing, the government may be reluctant to assume greater risk. Moreover, apart from the greater share of economic risk borne by the host country, resource rent taxes may impose political risks on the government because petroleum tax revenues, which often rouse nationalistic feelings, will not begin to accrue until a project is well underway and profitability reaches the predetermined “windfall” level.

Observations

A number of important interrelated effects result from the changes in NODC contractual and taxation arrangements that have taken place. One consequence is a blurring of the distinction drawn between the different types of institutional arrangements which govern the overall structure of risks and rewards. Rather than a set of discrete arrangements, a continuum of contract/taxation schemes now provides for different degrees of host country and foreign investor control over operations, risk assumption, ownership of crude, and share of profits and rent. For example, concession arrangements now include some measure of host country participation, exposure to risk, and discretion over the disposal of crude. At the same
time, risk service contracts have become more prevalent than the non-risk variety, and thus the share of the risks assumed by the oil companies has increased.

A corollary to this continuum of oil exploration and development institutional options is that different contractual and taxation schemes can be designed to achieve a similar configuration of risks and rewards. Thus, the host government and contractor can face the same set of risks and rewards through concessions which rely heavily on royalties or through other contractual arrangements which rely on sharing of output and income or profit taxes. This risk-reward parity can also be achieved by varying tax rates without altering contractual arrangements. Different production-sharing splits can yield the same host government/oil company proportionate share of risks and benefits when combined with varying income tax rates. This suggests that the wide variation in profit oil splits noted earlier may have only a nominal rather than a real effect on the allocation of risks and rewards between the host country and the contractor.

Flexibility also exists in using different combinations of contractual and taxation arrangements to achieve similar payback rates. Moderately rapid paybacks can be achieved through a variety of contractual schemes, including a variable fee per barrel which is analogous to a royalty. 52

Finally, increased flexibility and overlapping of contractual and taxation arrangements are reflected in the structure of contracts which has followed the changes in tax structure toward allowing the host countries to capture a progressively higher share of rent. Thus, in some production-sharing contracts, the host government’s share of profit oil increases as production rises. For example, the production-sharing contracts concluded between the India Oil and Natural Gas Commission and foreign oil companies start sharing profit oil at sixty-five percent in favor of the government, but increase to a government share of eighty percent as production levels rise. 53 Bangladesh has a similar system. 54

CONCLUSION

The foregoing discussion suggests that contractual and taxation arrangements may be important determinants of the relatively limited scope of oil exploration and development investment in non-OPEC developing countries. Economic theory indicates that investments involving parties that are risk-averse, perhaps a trait common to both the typical oil com-

53. 2 BARROWS COMPANY INC., WORLD PETROLEUM ARRANGEMENTS 99 (1980).
54. Id. at 22.
pany and NODC government, should be governed by risk-sharing arrangements with the allocation of risk determined by each party’s attitude toward risk-bearing. If, for example, a host government, although willing to bear some risks, allocates all the risks to the contractor through its contractual and taxation arrangements, the level of exploration and development investment that takes place in the country may be lower than it would otherwise be. If this is the case, a reallocation of risk toward the host government through changes in these institutional arrangements, for example, replacing traditional concession agreements with service-type contracts and substituting progressive profit taxes for flat royalties, will likely increase the level of investment.

There are, however, tradeoffs. First, the general level of taxation in NODCs may be excessive. High tax rates may fill host government tax coffers in the short-run, but in the long-run foreign investors will leave the country or will be deterred from entering the country at all. Tax yields, moreover, will decline, and oil resources will remain unexplored and undeveloped. The increase in efficiency brought about by institutional arrangements better suited to risk-bearing attitudes, exemplified by lower tax rates, will likely be reflected not only in more investment but also in a greater shared return to the involved parties. For the host country, greater government revenues result; for the foreign investor, greater profits. Progressive profit-based taxes create incentives for exploitation of small, high-cost fields which are characteristic of oil deposits in the NODCs. Such a tax structure, however, might burden the host country with a disproportionate share of the risk relative to the government’s willingness to bear risk.

Finally, risk-bearing attitudes are likely to differ across NODC governments. An institutional arrangement that appropriately governs the allocation of risks and rewards of exploration and development in one country may not be appropriate for another country. Two countries which are equally geologically promising but which have different attitudes toward risk-bearing, therefore, should offer different contractual and taxation arrangements to attract the same level of investment. Thus, the substantial degree of uniformity in these institutional arrangements, that has been characteristic of these countries for the past decade and a half, may, all other things equal, explain the relatively low level of exploration investment in some of these areas.