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PETROLEUM CONTRACT EVALUATION IN THE PACIFIC RIM: A COMPARATIVE ANALYSIS

By

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TITLE OF STUDY: Petroleum Contract Evaluation in the Pacific Rim: A Comparative Analysis

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SCOPE AND METHOD OF STUDY: This study analyszes contract terms for oil exploration in five Pacific Rim countries: Australia, China, Indonesia, Brunei, and Malaysia and then develops probable cash flows based on varying opil prices. The cash flow amounts are evaluated using the tools of financial analysis and then compared to determine which contract terms provide the investor with the most attractive financial returns.

FINDINGS AND CONCLUSIONS: Discounted cash flow amounts and internal rates of return differed widely among the countries analyzed. Australia and China provide the investor with the best probable financial results. Varying oil prices show a linear relationship with anticipated financial results and demonstrate the effect of volatile world oil prives on decision making.

ADVISOR'S APPROVAL Janice W. Jadlow

PETROLEUM CONTRACT EVALUATION

IN THE PACIFIC RIM:

A COMPARATIVE ANALYSIS

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CHAPTER I

INTRODUCTION

One of the most important functions of corporate management is the allocation of scarce resources. Typically, management has limited sources of capital and must decide upon funding competing projects. The proper and appropriate analysis of the economic characteristics of prospective ventures is one of the most critical areas of any company's operations; the company will prosper or fail on the basis of its evaluation of investment opportunities and the results of its decisions.

The allocation of capital resources by petroleum companies for oil exploration illustrates this decision process. Oil exploration ventures are characterized by large investment outlays, long lead times to project completion, and long periods of project output and payout. These characteristics make oil exploration ventures especially sensitive to uncertainty. Indeed the current environment in the petroleum industry offers little certainty for those charged with allocating scarce resources. A major unknown is the path of crude oil prices. While the changes in the world oil markets between 1974 and 1982 have increased the wealth of all oil exporting countries, the volatility of oil prices has increased the uncertainty associated with the future income of these countries and the investor companies. In addition, these characteristics are coupled with incomplete sharing of information and technology which leads to significant differences in the ability and inclination of the various parties to bear the risks involved. Uncertainty concerning the sharing of project risk and return creates a potential for disagreement between the host country and the potential investor company. As a result, projects that are economically attractive in aggregate terms become unattractive to one or both parties. Hence, the structure and application of petroleum contract terms between host countries and foreign companies have major implications for the viability of oil development projects.

The purpose of this paper is to examine the impact of the terms and conditions of petroleum exploration contracts on the evaluation of oil exploration opportunities. The contract terms and conditions used to develop the analysis are from selected Pacific Rim countries. As a group these countries offer the potential investor a host of investment options. The terms and conditions include, but are not limited to, the required investment, cost recovery, production splits and tax rates. These factors typically differ from country to country and have a direct bearing on a project's cash flow. The impact of these contract terms on the variability of cash flow is the main focus of this paper. Corporate management must then evaluate the economics of potential oil development projects, as well as other investment opportunities, in the light of overall corporate aims and goals. Very quickly what appears to be a relatively defined exercise becomes complex.

Specifically, the objectives of this research are twofold:

1) to compare and contrast the known fiscal terms for petroleum exploration in Australia, Brunei, China, Indonesia, and Malaysia; and

2) to evaluate the desirability, from the perspective of the potential foreign investor, of several alternative contract structures, taking into account both economic and political considerations. The distribution of risk between the host country and the foreign contractor (investor) and the incentives for company behavior that are created under each type of contract are of particular importance.

The first portion of the research design is a description of the relevant fiscal terms now offered for petroleum exploration in the selected countries, i.e., production splits, rate of tax, cost recovery, and royalty payments. The second part is the derivation of estimated cash flows from the application of contract terms of each country under different crude oil price scenarios. Finally, the estimated cash flows are the subject of an analysis to incorporate geological and financial risk. The results of this analysis, will enable a potential investor to determine which of the countries offer the most attractive terms for conducting petroleum exploration. This analysis does not incorporate the special incentives offered by some host countries on a one time basis and implicitly assumes a standardized production cost/benefit profile for each investment opportunity. Thus, although this is a simplification of actual business arrangements, it should prove helpful for those responsible for making investment decisions concerning oil exploration ventures.

This paper is organized into five chapters. Chapter I is an introduction and overview of the process of decision making in petroleum investment situations. Chapter II provides a review of the literature relevant to the analysis of exploration strategies. Chapter III first outlines the contract terms for petroleum investment; the chapter then explains the methodology employed to estimate the cash flows generated by oil production and the allocation of these cash flows between the parties to the contract. Chapter IV presents the results of the simulation. The conclusions and recommendations for further research are in Chapter V.

CHAPTER II

SURVEY OF THE LITERATURE

Investment in petroleum exploration is a high-risk economic activity. There is considerable uncertainty about costs, future prices, and ultimately the ability to transfer wealth from any oil found in the ground. Therefore, good economic analysis is especially difficult but valuable. It includes both capital budgeting estimates and sophisticated management experience, common sense, and intuition. The analysis must go beyond estimations made for a single project and be subject to careful scrutiny across several projects. Thus the single project is evaluated across a wide range of investment opportunities.

Over the years many different criteria and techniques have been used for making such decisions; and new methods and philosophies are being introduced almost daily.[1] Early economists used methods such as book rate of return, debt vs. equity ratios, and payout. Practicing managers differ, too, in the application of various techniques and criteria used in analysis.

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[1] I. Field Roebuck, Economic Analysis of Petroleum Ventures, SEC Exploration, Inc. (Oklahoma City, OK 1979), p. 5.

A study by Dean concludes that executives, by and large, show widespread failure to measure the investment worth of individual proposals directly; lack defensible, objective standards for acceptability of an investment; and have distorted dedication to procedures and paper work, with inadequate understanding of the economic content of the concepts used.[2]

He then describes the several ways management can go about economic analysis. He builds a strong case for the discounted cash flow method based upon the following principles:

1) is economically realistic in confining the analysis to cash flows and forgetting about customary book allocation.

2) forces guided thinking about the whole life of the project and concentration on the lifetime earnings.

3) weights the time pattern of the investment outlay and the cash earnings from that outlay in such a way as to reflect real and important differences in the value of near and distant cash flows.

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[2]Joel Dean, "Measuring the Productivity of Capital, Harvard Business Review, Vol. 33 No. 1, January 1954.

Simple as these concepts may seem, they were not widely applied in the oil industry until the late 1950s.[3] During the post-World War II drilling boom, oil companies were producing some 20 percent net returns on net shareholder investment; money was available at 3 and 4 percent interest rates; and in general, management did not feel a compelling need for highly refined profitability criteria. It was in the early 1960s the oil industry began to accept the principles laid out in Dean's paper. The emerging emphasis at that time, and still largely in practice today, suggests that cash flow, discounted at the cost of capital, is still the most reliable criterion.

A problem of discounted cash flow is the question of how to measure the "cost of capital." Modigliani and Miller state that "average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class."[4] Other scholars have argued the cost of capital is the weighted average of the cost of each type of capital - common stocks, senior securities and loans.[5]

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[3] Michael Silbergh and Folkert Brons, J. "Profitability Analysis - Where Are We Now?", Journal of Petroleum Technology, Vol. 24, No. 1, January 1972.

[4] Franco Modigliani and Merton H. Miller, "The Cost of Capital, Corporation Finance and the Theory of Investment," American Economic Review, June 1958, p. 275.

[5] Ibid., p. 267.

In spite of this controversy, the discounted cash flow rate of return approach is widely used in practice today. On a practical basis one must overcome the theoretical hurdles. Given that the cost of capital cannot be measured precisely, the discount rate chosen as best representing the cost of capital would, within the limits of accuracy, generate a similar result using either basis for the cost of capital.

The internal rate of return method is another tool to evaluate a projects' worth, although it has limitations. The best applications appear in those cases where there is one investment that is made at the beginning, and there is only one apparent solution, i.e., one rate of return.[6] This approach is complicated where there are several alternate periods of investments and profits, or there appear to be several solutions (rates of return). The internal rate of return may be defined as the rate of interest that will reduce the future net incomes so that the sum of their present values equals the initial investment. This may be written as:

$$0 = -C + \frac{S1}{(1+i)^{.5}} + \frac{S2}{(1+i)^{1+.5}} \cdots \frac{Sn}{(1+i)^{N-.5}}$$

[6] Arthur W. McCray, Petroleum Evaluation and Economic Decisions, Prentice-Hall, Inc., New Jersey, p. 28.

where:

C = initial investment, dollars

S_1 = net cash flow, considered to be spread through the first year

i = interest rate, per year.

A study of exploration choice necessarily includes an analysis of risk. According to modern finance theory, riskiness of an investment from the perspective of a specific investor depends on two things: the riskiness of the investment when viewed by itself, and the extent to which this risk can be diversified away in the investor's portfolio. The former will be the same for all investors, but the latter may vary significantly among investors. The extent to which project specific risks can be diversified depends on how many of an investor's dollars are applied to a single project. Risk analysis with specific reference to the petroleum industry is also discussed in the literature.

Cozzolino explains the primary risk of exploration is dry hole risk and a secondary risk is one of finding non-commercial quantities of oil.[7] Systematic risk is illustrated by changes in oil prices which may affect all units of business in the same way at the same time. Risk diversification in exploration reduces the possibility of a significant level of loss. The method of risk diversification in exploration is participation

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[7] Jane M. Cozzolino, "Exploration Risk Management," Exploration and Economics of the Petroleum Industry, Matthew Bender, New York, 1981, p. 54-64.

in many projects such that risk is spread over a number of projects each with its own level of risk.

Ramsey noted that a firm's objective function is the maximization of its expected net present discounted value of its future income stream; in short, maximization of net worth.[8] This is standard in the finance literature. He approaches the evaluation of a series of projects using a thorough analysis of risk and the probability of ruin. Ramsey further recognizes that risk affects the decisions of even very large firms since even large firms do not have unlimited resources of risk capital.

Arps and Arps argue that the prudent risk-taking approach is a combination of two concepts.[9] The first concept is that successive risk-taking ventures should be undertaken only in such a manner that the risk money in each venture is less than the amount that would create a "break-even" situation in the long run. This approach assumes that an investor would continue to invest risk money to the extent he had been successful in prior ventures. This break-even concept was originally defined by Whitworth and first applied to exploration ventures by Hayward.[10]

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[8] James B. Ramsey, "Some of the Policy Implications of the Economics of Exploration," Contemporary Studies in Economic and Financial Analysis, Vol. 26, JAI Press, Greenwood, Conn., 1982, p. 159-172.

[9] J. J. Arps and J. L. Arps, "Prudent Risk Taking," Journal of Petroleum Technology, Vol. 26, No. 7, 1974.

[10] W. A. Whitworth: Choice and Chance, B. E. Stechert, New York, 1965 and J. T. Howard: "Probabilities and Wildcats," Drilling and Production Practices, API (1934) 11, p. 167-175.

Hayward argued that based on probability analysis there was an upper limit on the amount to be invested in any one opportunity.

The second concept proposed by Arps and Arps is that the amount of money risked on any one venture should not exceed the amount that would increase the risk of "gambler's ruins" beyond acceptable limits.[11] "Gambler's ruin" is defined as a situation in which a risk-taker with limited funds goes broke through a continuous string of failures that exhausts his or her available funds.

A study by Blitzer concludes that, like any other investment, the drilling for oil and gas has its share of "systematic risk" and "project-specific" risk.[12] For example, an investment in drilling for petroleum has an expected rate of return that is dependent on the value of the oil found. This value depends on the number of recoverable barrels found, the cost of extracting those barrels, and the world market price at which they can be sold. The quantity of oil in the ground is primarily a geological phenomenon and is a "project-specific" risk.

In summary, investment in oil exploration and development involves significant risks. As stated above, at the exploration stage there is

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[11] Arps and Arps, p. 5.

[12] Charles R. Blitzer, Donald R. Lessard, and James L. Paddock, "Risk Bearing and the Choice of Contract Forms for Oil Exploration and Development," The Energy Journal, Oelgeschlager, Gunn & Hain, July 1984, p. 6.

great uncertainty concerning geological factors (e.g. reserves, flow rates), eventual development and operating costs, and revenues (oil prices).

In addition to uncertain returns and significant risks for each oil exploration project, there exists the complication of negotiating a contract between the investor company and the host country. The contract terms allocate the risks and returns between the two parties. When deciding who should bear a greater proportion of the returns and of each risk, it is necessary to consider whether either party has a comparative advantage in risk bearing. This comparative advantage depends on how large an exposure each party has to each type of risk and the ability to diversify that risk. A host government must decide what contract terms will attract the international oil community given the geological significance of a country and yet generate the most revenue for the country. The direct relationship between the contract terms and the attractiveness of the country considered for exploration is the focus of this paper.

CHAPTER III

RESEARCH DESIGN

METHODOLOGY

This study begins with a general description of the various types of exploration contracts found in use today and then proceeds with the specific forms of contractual relationships in selected Pacific Rim countries. The five countries of the study are: Australia, Brunei, China, Indonesia, and Malaysia. From this background the tools of financial analysis are used to evaluate the contractual relationship.

In order to form a basis of evaluation, a hypothetical investment and production scheme is established. The terms and conditions of exploration contracts typical for each country are applied to the hypothetical investment and production scheme. This procedure generates the projected cash flows for each country. In addition, the model is applied for three alternative crude oil price scenarios: $35.00, $25.00 and $20.00 per barrel, respectively. The estimated project cash flows for each country and each scenario are then discounted at fifteen percent. Fifteen percent is chosen as representative of the cost of capital. The cost of capital, expressed as an annual percentage, is a firm's weighted average cost of the various types of funds it obtains. It is not assumed that an individual project is financed with all debt or all equity. Rather, each project should be considered to be financed with debt and equity in proportion identical to the firm's capital structure. In addition, the internal rate of return is calculated for the sample for each scenario for each country. Requiring that the return on a project be at least equal to the cost of capital is equivalent to requiring that a project not reduce the company's value. These rates of returns can be evaluated for each country. Of greater importance, however, is the comparison of rates of return among the countries. An extension of the analysis is to evaluate the impact of contract changes which might be considered in each country in order to stimulate and enhance the attraction of foreign investment. Finally, we compute a project's internal rate of return.

The final step in the analysis is to utilize the theories of Gambler's Ruin and expected value. Both of these applications are an attempt to establish an acceptable level of risk. Every company, large or small, must consider each investment not only on its own merit, but also on the basis of its potential effect on the financial health of the enterprise. A company must not expose itself unduly to the disastrous consequences of a series of failures. This is precisely the concept behind the theory of Gambler's Ruin. The theory of expected value implies that the average value of all possible outcomes weighted on the basis of the respective probabilities. It should be noted that it is the average outcome (value) expected from a large number of ventures of the same type.

Finally, the research calculates the minimum probability of success (maximum probability of failure) which makes a viable project. Naturally the lower the minimum probability of success the better chance the project has in meeting its expected outcome.

CONTRACT DESCRIPTION

As stated above, the analysis begins with a general description of the various types of exploration contracts found in use today and a more specific description of the type of exploration contract used by the five countries of this study.[13] There are various types of contracts relating to exploration and production arrangements for oil and gas. Throughout the history of the oil industry no contract form has stood the test of time. None has been uniquely successful nor withstood the pressure of changing circumstances of either party. Basically these may be subdivided into about four broad categories as follows: Concessions, *Joint Ventures*, *Production Sharing Arrangements*, and Risk Service Agreements.

Concession Agreements

The concession agreement is the oldest form of exploration and production agreements. It originated in Iran in 1901. Basically, an oil concession is an agreement between the host government on the one hand and a company or individual, the concessionaire, on the other. The concession agree-

[13] The description is drawn from an unpublished report, Phillips Petroleum Company, Bartlesville, Oklahoma, 1980.

ment grants to the company, or individual, the use of a territory for exploring, developing and trading of oil in return for some payments, usually in the form of taxes, royalties, rentals, and bonuses. The early concessions were usually for long periods of time and granted the concessionaire wide latitude insofar as the rate of exploration and development, the marketing and pricing of oil, the importation of materials, and the repatriation of profits. It was, in fact, a result of this wide latitude that host governments began to reevaluate the rights given to a concessionaire and began to develop other forms of agreements.

Most recently the trend has been to devise more ornate tax systems allowing the host country to share in higher production. Various "windfall profits" schemes are in force as means for a supplementary tax where profits exceed a certain limit. A rate of return is commonly used for determining such a limit.

Joint Venture Agreement

Joint venture agreements differ from concession agreements in that they constitute the basis of a legal and economic partnership between the host government and the exploration company, with the government usually participating through a nationally-owned oil company. The participation is created through ownership of a facade company or via a joint structure arrangement between the national oil company and the exploring company. In addition to this participation, the host country also levies income taxes (usually 50 percent or more). Another significant difference, which is of vital importance to the host government, is the fact that this arrangement does not alienate ownership of the minerals; that is, the producing company's access to the minerals only occurs after the oil is produced and brought to the ground.

Production Sharing Contract

The production sharing contract was first popularized in Indonesia in the 1960's and has spread throughout the world as a major legal structure. This contract form provides that the contractor (oil company) will advance all the funds for exploration, development and operating expenses and later recoup such costs out of its proportion of eventual production. Usually recoupment is restricted to a certain percentage each year, with the balance of production split between the producing company and government oil company. Taxes are paid either by the contractor out of his production share or by the host government with the contractor receiving a split free and clear of a tax burden.

Possible variations of the production sharing arrangement have led many countries to adopt this form of agreement and to modify these terms to fit local situations. Terms which can be modified include the level of cost recovery (expressed as a percent), allowable costs, acreage relinquishment, rate of taxation and method of payment, production splits and bonuses, and management of operations.

Risk Service Contract

The risk service contract resembles concession agreements and production sharing contracts in terms of duration, work obligations, etc. but differs in several important aspects. Its basic distinctive feature is that it pays the producing company in cash rather than oil, although it may have some provision permitting the company to buy back an amount of crude oil at an international market price. As with the production sharing contract, the contractor is granted no minerals or mineral rights and receives remuneration from the oil actually lifted and shared with the host government.

CRITERIA FOR JUDGING THE DESIRABILITY OF CONTRACTS

Each of the contract forms outlined above involves different assignments of return (net benefits) between the host country and the foreign contractor under various outcomes defined by potential reserves, oil field development and operating costs, and world oil prices. Clearly the host country will want as large a share of returns as possible. But trade-offs and concessions will occur because countries compete for foreign technology and risk capital. The contract types and terms differ among countries because the contract negotiated depends on the country's bargaining power and negotiating skill, as well as country-specific criteria for judging the desirability of various contract structures.

The focus for developing countries should be on the latter issue, i.e., identifying efficient contract structures. A contract is defined as efficient if there is no way for one party to improve its position without making the other worse off. This movement toward contract efficiency is a nonzero sum process in which both parties can gain or in which one can gain while the other does not lose. Improving contract efficiency from the country's viewpoint involves improving the country's overall position because it is assumed that the country can exploit its bargaining positions. Hence, such a contract insures that the foreign (investor) company receives a share that is sufficient to attract its participation but does not receive all of the incremental revenue from a rise in oil prices. A rise in oil prices does not necessarily mean that all additional revenue will go to the contractor. There must be some flexibility in fiscal terms for a host country to share in the possible windfall.

From the viewpoint of a host country the efficiency of a particular contract depends on its specific circumstances, including the extent to which it is exposed to related risks such as hard currency drain, its capacity to manage exploration and development, its ability to monitor contractors' performance, and its knowledge of its own geological prospects. These circumstances, in turn, determine the country's comparative advantage vis-a-vis foreign suppliers of technology in assuming various responsibilities and risks and in negotiating specific contracts.

Host countries and foreign contractors are likely to trade off particular risks and expected returns to see which party might have a comparative advantage in bearing those risks. For example, one party may be much more exposed to geologic or price risks than the other and, hence, be at a comparative disadvantage in absorbing that risk. In this case, both parties may improve their position by agreeing on an appropriate distribution of the risks between themselves. The same holds true for managerial incentives, because foreign contractors are used, in part, to provide technology and experience that are in short supply in many foreign countries. This implies that the government is not in a position to fully specify all actions by the contractor. In such cases, the prime assurance the government has that the project will be managed appropriately is to structure a contract whereby it is in the contractor's own interest to manage the project as the government would manage it if it had comparable information and technical expertise.

Finally, the reduction of contracting risks is of mutual advantage because such risks typically reduce the total potential benefits of the project. Though the government might potentially gain from unilateral action in the future (expropriation), the contract, recognizing the likelihood of such action, would demand compensation in the form of reduced investment or a higher promised share. The bottom line, however, seems to be that there is really no choice but to come to an agreement given that the other default-means of financing oil development in less developed countries is by bank borrowing, primarily from World Bank sources, bank borrowing which attaches its own terms and conditions for making a loan, thereby taking an active role in the management of the operation. Depending on the local situation this may be a viable alternative.

COUNTRY DESCRIPTION

Australia

Oil exploration and production in Australia is conducted under concession agreements. The concession agreements differ between offshore and onshore areas. Offshore areas are controlled by the Petroleum (Submerged Lands) Act 1967, as amended and governed by Federal authorities. Onshore areas are controlled by the States and Territories on an individual basis. For the purpose of this study we will analyze the offshore fiscal terms.

Offshore areas are normally put up for competitive bidding with the proviso that the company offering the most "cash money" up front is given the right to accept the offer of a Permit. The concession agreement then entered between the successful bidder and the Commonwealth of Australia provides for a 6 year exploration period with the rights of renewal for successive periods of 5 years each. The company is required to perform an exploratory work obligation in accordance with international petroleum industry practices. A small exploration fee is attached to each block awarded.

The most unique development in Australia's licensing framework has been the introduction and application of the resource rents tax (RRT). The RRT regime, applied to profits, is a most efficient mechanism for deriving for the State an appropriate share of the large returns that can be associated with oil production.

The RRT applies to offshore petroleum projects effective from July 1, 1984. Since RRT is payable on a "project" basis all income and expenditures derived by an entity are split into project and non-project. Income and expenditure are to be accounted for on a cash basis. The actual or deemed proceeds from a sale of petroleum at the point of first marketability is the primary assessable receipt and is reduced by the relevant exploration expenditure where it was incurred in relation to the original exploration licence from which the specific production licence was created. Other capital and operating expenditures which are directly attributable to the project are also eligible for deduction, i.e., expenditures on plant or articles used in the extraction operations. Nondeductible amounts include interest payments and cash bid monies.

In a fiscal year in which the resultant cash flow of the particular project is negative, the resulting deficit will be compounded by a threshold rate (long term bond rate plus 15 percentage points) of approximately 29%. This is also applied to the second year's cash flow if it too is negative. In the circumstances in which the net cash flow in a year (after deducting a prior year's compounded deficit) is positive the applicable rate to calculate the tax payable is 40%. The amount of RRT payable for the year of income will be an allowable deduction for corporate income tax purposes in that same year. Accordingly corporate income tax will be less than otherwise as a result of the RRT. The corporate tax rate is 50%.

Brunei

Oil exploration and production in Brunei is governed by the Petroleum Mining Enactment of 1963, the Petroleum Mining (Amendment) Enactment of 1969, and the Income Tax Petroleum (Amendment) Enactment of 1969 (as amended in 1982).

In its purest form, this legislation is representative of the concession form of agreement. The investing company is required to commit to a minimum exploration expenditure during a specified of time normally about 8 years. If a discovery is made the company may retain 25% of the original area for development purposes, the balance reverts to the government.

The government participates via a fixed royalty of 10% , payable in cash or kind, on the value of petroleum revenue at the wellhead. This is applied to both oil and natural gas. The value of petroleum revenue is determined on the basis of the average actual sales price less transportation expense. Contractor's revenue after payment of royalty is subject to a corporate tax rate of 55%.

In addition the Government of Brunei has the right to participate up to 50% in a commercial discovery. Generally, a commercial discovery is a discovery of oil capable of producing a reasonable rate of return. It is assumed the Government would pay its proportionate share of exploratory costs associated with the discovery.

China

Although oil and gas exploration is not new in China, this country only opened her doors to foreign participation in 1979.

Offshore oil exploration work is governed by the 1982 Petroleum Regulations and is patterned after one or two model contracts associated with competitive bid rounds in 1982 and 1985 respectively. The bid rounds were open to industry participants in a 1979 geophysical survey. Potential bidders were required to bid a work program, production splits, and any special contributions. Tax matters are defined in the Foreign Enterprise Income Tax Act dated 21 February 1982.

The contractual framework for conducting oil exploration and production operations in China is most akin to a production sharing form of agreement. The foreign contractor generally bids a proposed work program over a predetermined area. This bid is judged on (1) the relative merit in terms of work which will be conducted over the areas and (2) a set of production splits which is also biddable by a foreign contractor. The splits, based on levels of production, determine how "profit oil" is shared with the Chinese. Up to fifty percent of the oil revenue is allocated to "cost oil" which allows the contractor to recover exploration expenses associated with the commercial discovery of oil. The balance of the revenue stream, if any, is shared according to the profit splits bid by the contractor.

The basic petroleum agreement includes a 12.5 percent governmental royalty plus a 5.0 percent Consolidated Industrial and Commercial Tax which comprise a 17.5 percent effective royalty on gross production. This amount is paid before profit splits. The effective tax rate is 50 percent and is generally creditable for U.S. income tax purposes.

Like most production sharing contracts, obligations for substantial training and technology transfer rest with the foreign contractor. Actual monetary costs are usually cost recoverable under the terms of the agreement.

Indonesia

The classic production sharing contract (PSC) was promulgated in Indonesia in early 1960s. Although slow to be accepted by other less developed countries, this form of agreement is now accepted as a legal standard.

The Indonesia model PSC provides that a contractor will provide all the capital, technology and manpower to conduct exploratory operations. The exploration risk is borne entirely at contractor's sole risk, cost, and expense and is recovered out of 100% of available production in the event of a commercial discovery. The PSC further requires the contractor to furnish funds in foreign exchange for the performance of the work program, including payment to foreign third parties who perform services as a contractor.

In this production sharing arrangement, ownership of any petroleum discovered remains with the national oil company or the host country and the contractor does not acquire title to its share of the petroleum until the oil reaches the export point or a mutually agreed delivery point. The effective tax rate is 48 percent and is valued on the Government Schedule of Price (GSP), currently set at $29.00 per barrel (1984). A net realized price f.o.b. Indonesia is used for valuation of crude oil taken by contractor. The production split is 71/29 in favor of Pertamina, the Indonesia Government state oil company. A most recent improvement is the investment credit (or up-lift) which allows cost recovery of 120% instead of the usual 100%.

Malaysia

The Malaysian PSC closely resembles the Indonesia model PSC, although the Malaysia model generally follows more stringent fiscal regime.

The limit on the amount of cost recovery in Malaysian PSC is 20-30 percent as compared to 100 percent in Indonesia. Also, the split on production is 70/30 in favor of the government. Net revenues are subject to a 45 percent income tax. There is a remittance tax of 25 percent and a flat 10 percent royalty. An additional fiscal burden is a 70 percent "excess profits" tax over a base price which is payable to Petronas, the Malaysian state oil company. The base price was initially $12.72 per barrel, increasing 5 percent per annum.

Table 1 depicts the various contract forms in a tabular form.

TABLE 1

		Australia	Brunei	China	Indonesia	Malaysia
1.	Contract Form	Concession	Concession	Prod. Sharing	Prod. Sharing	Prod. Sharing
2.	Tax System	Resource Rents Tax	Tax on Profits	Prod. Sharing & Taxes	Prod. Sharing & Taxes	Prod. Sharing & Taxes
3.	Royalty (%)	12.5	11.5	17.5	None	10%
4.	Cost Recovery	Excess Carried Forward for Max. 7 yrs.	No Limit	50% of Gross Revenues	100% (a)	30% of Gross Revenues
5.	Depreciation	5 Yr. Straight Line	Initial Allow. of 50% Then 20% Per Annum Declining Balance	5 Yr. Straight Line	Double Declining Balance of Straight Line of 7 Yrs.	10% Initial Then 8% Per Annum
6.	Production Sharing	None	None	Negotiable	71:39 (b)	60:40 (c)
7.	Profits Tax (%)	51	55	50	48	45
8.	Remittance Tax	None	None	None	None	25
9.	Government Participation (%)	None	50 option	51 option	50 option	None
10.	Other				a) 20% Uplift b) Domestic Oil Obligation. 20/bbl or 8.52% of Gross Production	70% excess Profits Tax

KR/lp
TABLE1/1

THE MODEL

The hypothetical investment and production scheme used for the financial analysis is as follows:

The prospect is located in water depths of approximately 200 feet. Successful exploration (1988) includes 1200 kilometers of seismic acquisition, two exploratory wells and delineation drilling. Estimated gross reserves of 200 million barrels have been assumed for this case. Total gross estimated exploration and development cost is estimated to be $455.5 million. The development program (1988-1991) includes installation of one combination drilling/production platform, two protector platforms, processing equipment, and offshore (onshore) storage and loading facilities. Development drilling includes drilling 48 wells (10 dry holes). Production commences in 1992 and peaks at 65,000 barrels of oil per day in 1995; and declining approximately 5,000 barrels of oil per day over a twenty year field life.

The projected value of the oil is $35.00 per barrel in 1992 in the high price scenario, $25.00 in the most likely case and $20.00 per barrel in the low price scenario case. The price of oil is assumed to increase at 5 percent per year beginning with production in 1992. The investment requirements for the project are:

		$MM
1987	Geological and Geophysical	2.0
1988	Exploratory Wells	8.5
1988-87	Delineation Drilling (4 wells)	25.0
1989-1991	Development Producers (40)	175.0
1989-1991	Development Dry Holes	30.0
1991-1992	Platforms/Engineering Design	110.0
1990-1992	Storage and Loading Facilities	50.0
1992	Processing Equipment	55.0
		455.5 MM

CHAPTER IV

RESULTS AND ANALYSIS

COUNTRY ANALYSIS

The results of the financial analysis of different contract forms are summarized in Table 2. The table shows for each country under each scenario the internal rate of return, the net present value of the cash flows, and undiscounted cash flow amounts. The study clearly demonstrates Australia offers the highest return to the foreign contractor providing an internal rate of return (IRR) of 41.41 percent and a cash flow discounted at 15 percent of $515.3 million based on a crude oil price of $35.00 and production commencing in 1992. The second highest return is offered by China with an IRR of 38.6 percent and a cash flow discounted at 15 percent of $494.9 million. Brunei follows in third place offering an IRR of 31.41 percent and a cash flow discounted at 15 percent of $106.0 million. Indonesia and Malaysia offer remarkably lower results.

Next the study closely examines the results on a per country basis which will clearly demonstrate the effect of lower oil prices on the internal rate of return and the present value of the discounted cash flows. More importantly the study demonstrates the variation of financial results based on terms for conducting exploration in a particular country.

TABLE 2

	Oil Price	IRR (percent)	Present Value $MM	Undiscounted Cash Flow $MM
Australia*	$35.00	41.41	$515.328	3118.013
"	25.00	33.88	312.098	2104.039
"	20.00	28.84	206.847	1588.761
Brunei	35.00	31.41	106.090	754.400
"	25.00	24.96	55.488	499.600
"	20.00	20.95	30.160	372.000
China	35.00	38.6	494.9	3624.3
"	25.00	31.5	301.9	2508.7
"	20.00	27.0	204.3	1950.9
Indo	35.00	20.5	73.226	996.988
"	25.00	16.14	13.761	693.736
"	20.00	13.51	-17.059	538.764
Malaysia	35.00	14.41	-7.553	709.299
"	25.00	9.61	-61.487	402.800
"	20.00	6.26	-90.590	235.100
*Australia	35.00	28.86	182.518	1342.798
(resource rents tax)	25.00	20.55	64.817	849.199
	20.00	16.75	18.911	634.799

Three separate analyses have been generated for each country. The cases have been analyzed by varying the price received for crude oil, thus changing the overall gross revenue stream and ultimately, the IRR and the discounted cash flow amount. The crude oil prices are $35.00 in the high case; $25.00 in a most likely case, and $20.00 as a low price scenario. The discussion begins with the results for Australia.

Australia

The concession terms offered in Australia offer very attractive returns to a potential investor. Positive net cash flows beginning in the year of production (1992) remain favorable throughout project life, although the order of magnitude drops depending on the crude oil price (gross revenue). The absence of government participation is a stabilizing factor on the bottom line results.

The discounted cash flows have been calculated at various discount rates, and the internal rates of return are shown below in Table 3:

Table 3

Australia Summary

Cash Flow, $MM

Alternative Oil Prices:	$ 35.00	$ 25.00	$ 20.00
Discount Rate %			
0.0	$3118.0	$2104.0	$1588.7
5.0	1664.7	1100.3	811.7
10.0	919.0	587.9	416.8
15.0	515.3	312.1	206.8
20.0	287.8	159.1	92.1
	IRR = 41.41%	IRR = 33.88%	IRR = 28.84%

Consideration of the effects of the resource rents tax, imposed on a net profits basis, demonstrates a dramatic reduction in the contractor's cash flow. The net present value of the cash flows and the internal rate of return are shown in Table 4.

Table 4

Australia Summary

(After Resource Rents Tax)

Cash Flow, $MM

Alternative Oil Prices:	$35.00	$25.00	$20.00
Discount Rate %			
0.0	1342.79	849.199	634.79
5.0	698.98	403.62	279.82
10.0	363.79	180.27	106.14
15.0	182.52	64.81	18.911
20.0	82.03	4.49	-24.779
	IRR = 28.86%	IRR = 20.55%	IRR = 16.75%

China

The financial results for China show strong contractor cash flows and high internal rates of return. These results are summarized in Table 5:

Table 5

China Summary

Cash Flow, $MM

Alternative Oil Prices: Discount Rate %	$35.00	$25.00	$20.00
0.0	$3624.3	$2508.7	$1950.9
5.0	1801.6	1218.6	926.5
10.0	934.3	608.0	444.0
15.0	494.9	301.8	204.3
20.0	260.8	141.4	80.8
	IRR = 38.6%	IRR = 31.5%	IRR = 27.0%

These results are strong considering the state oil company has a right to begin paying its 51 percent of future costs at the time of development project. In effect these numbers have been reduced in half due to this factor. One feature of the China contract provides for competitive bidding of production splits or so-called x-factors. These x-factors are the amount of oil remaining for the contractor after taxes, royalty, and recovery of costs. The analysis assumes 100 percent x-factors.

Brunei

The concession agreement terms in Brunei offer a potential investor promising economic returns. In the high case, the internal rate of return is 31.41 percent which is only slightly lower than China's 38.6. As expected, cash flow is negative until production commences in 1992 but holds steady thereafter depending on production rates. Table 6 provides a summary of the economic analysis:

Table 6

Brunei Summary

Cash Flow, $MM

Alternative Oil Prices: Discount Rate %	$35.00	$25.00	$20.00
0	$754.398	$499.6	$371.99
5	390.929	249.8	178.6
10	205.364	122.5	81.0
15	106.090	55.5	30.16
20	51.278	19.4	3.39
	IRR = 31.44%	IRR = 25.0%	IRR = 21.0%

Although the internal rates of returns are acceptable, the discounted cash flows are considerably less than Australia or China. This is due, in part, to the government's back-in rights at the point of commercial discovery. Obviously this reduces the cash flow available to the foreign contractor. More will be said about the trade-offs between cash flow and internal rate of return in the next chapter.

Indonesia

In the high oil price case ($35.00) the Indonesian model terms offer the potential investor an internal rate of return of 20.5 percent and a cash flow discounted at 15 percent of $73.226 million. The low oil price case

($20.00) demonstrates a fall in the internal rate of return to 13.51 percent and a negative discounted cash flow. A brief summary of the results are shown in Table 7 below:

Table 7

Indonesia Summary

Cash Flow, $MM

Alternative Oil Prices:	$35.00	$25.00	$20.00
Discount Rate %			
0	$996.987	$693.735	$538.763
5	468.549	300.900	214.777
10	206.859	109.084	58.616
15	73.226	13.761	-17.059
20	4.638	-32.726	-52.156
	IRR = 20.5%	IRR = 16.14%	IRR = 13.51%

Positive factors in the Indonesian model contract include: 1) the full recovery of costs before profit oil is subject to production sharing and 2) the absence of government equity participation. Negative factors affecting cash flow are relatively high before tax profit split in favor of the government and an obligation to supply a pro-rata share of oil to the domestic market at the rate of $.20 per barrel.

Malaysia

The contract terms in Malaysia offer a potential investor the lowest predicted economic returns compared to the other four countries analyzed.

In the high price case, an internal rate of return equal to 14.41 percent is estimated; however, the cash flow discounted at fifteen percent is a negative $7.553 million. This is due primarily to a limitation on cost recovery in the early years and high government share throughout the life of the project. Table 8 depicts the results:

Table 8

Malaysia Summary

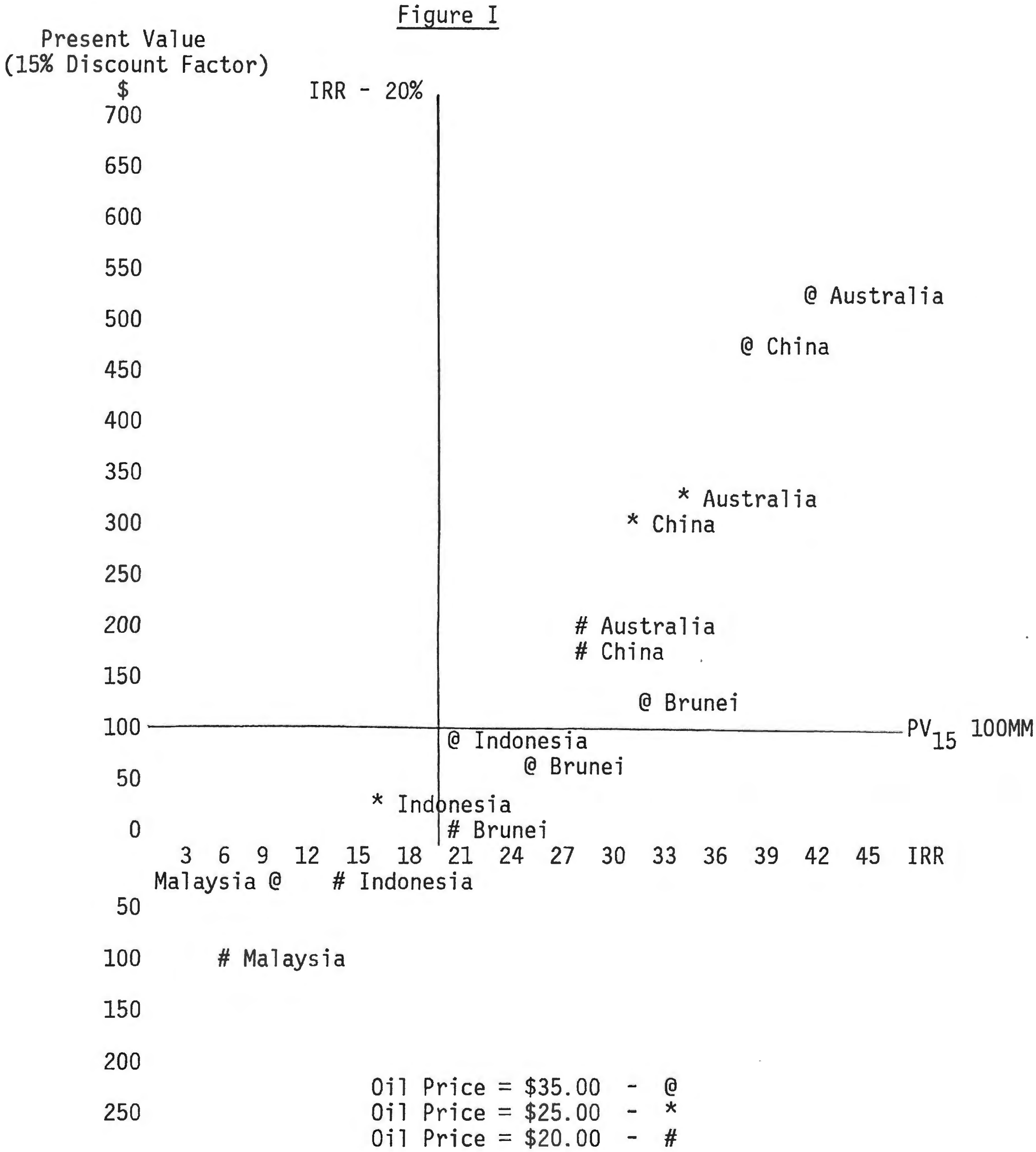
Cash Flow, $MM

Alternative Oil Prices:	$35.00	$25.00	$20.00
Discount Rate %			
0	$709.299	$402.800	$235.100
5	281.107	119.801	29.492
10	84.058	-6.679	-57.190
15	-7.553	-61.487	-90.590
20	-48.773	-82.271	-99.433
	IRR = 14.41%	IRR = 9.61%	IRR = 6.26%

COMPARATIVE ANALYSIS

The above discussion presents the estimates of cash flows discounted at various discount rates and the internal rate of return from the set of cash flows generated for each country in the study. It is important to analyze the relationship, if any, between the various projects and, in particular to, determine what projects would most likely receive funding given capital rationing.

A simplistic approach to this analysis appears in Figure I.



Based on the results of this diagram the following projects would be funded:

			Oil Price
1)	Australia	-	35.00, 25.00, 20.00
2)	China	-	35.00, 25.00, 20.00
3)	Brunei	-	35.00

If the $100 mm discounted cash flow constraint was dropped, for example, to $50 million, then Indonesia in the high case scenario and Brunei in the most likely price scenario would receive funding. The linear relationship between the results in each price scenario should be noted since cash flow is directly related to oil price (revenue).

RISK ANALYSIS

The term risk is well defined but almost universally misused. Risk is actually associated with and defined by the dispersion of the possible outcomes; that is, risk is a measure of the degree of uncertainty and does not necessarily reflect a high probability of a bad outcome. Of all the decisions that business executives must make, none is more challenging than choosing among capital investment opportunities. What complicates this problem is defining the assumptions and their impact on project economics. Each assumption offers its own degree of uncertainty; and, taken together, these combined uncertainties can multiply into a total risk of critical proportions. The evaluation of risk is difficult. The analysis that follows applies the theories of expected value, break-even analysis, and Gambler's Ruin to better incorporate risk analysis in the decision making process.

Consider the choice between two investment alternatives, e.g., Australia and China, and the risk factor. In the $35.00 per barrel case both the IRR and the net present value are roughly equal for the countries. The analysis thus far has assumed no differences in geological risk. Suppose the geological certainty was not equal and China had a slightly better chance of meeting its profitability criteria.

For example:

China

	Outcome MM$ Cash Flow	Probability	Extension MM$
Failure:	-200	.75	-150
	-400	.25	-100
			EV_f -250
Success:	100	.20	20
	200	.30	60
	500	.50	250
			EV_s 330
Failure:	-250	.70	-175
Success:	330	.30	99
			EV = -76

Australia

	Outcome MM$ Cash Flow	Probability	Extension MM$
Failure:	-200	.80	-160
	-400	.20	-80
			EV_f -240
Success:	100	.30	30
	200	.50	100
	500	.20	100
			EV_s +230
Failure:	-240	.70	-168
Success:	230	.30	69
			EV = -99 MM

Therefore, given different probability distributions, China is more attractive than Australia since the expected value is -76 MM in the case of China and -99 MM in the case of Australia.

Another test of acceptability is to calculate a minimum probability of success on the two projects. Given that

$P_s + P_f = 1.0$ where P_s = probability of success
and P_f = probability of failure

and setting the expected value to zero

$$EV = (P_s \times S) + (P_f \times F) = 0,$$

one can solve for the minimum probability of success. Using China as an example,

$$0 = (P_s)(330) + (1-P_s)(-250).$$

Solving for P_s

$$330\ P_s - 250 + 250\ P_s = 0$$

$$580\ P_s = 250$$
$$P_s = \frac{250}{580}$$
$$P_s = .43$$

Thus, the minimum probability of success to obtain an expected present value cash flow of $330 MM is 43 percent in China.

In the case of Australia, the same procedure demonstrates that the minimum probability of success necessary to obtain an expected present value of $230 MM is 51 percent in Australia.[14] Given the choice between a minimum probability of success to assure profitability in China of 43 percent and 51 percent in Australia, the decision maker would choose an investment in China over the investment in Australia.

RISK THEORY APPLICATION

This paper previously discusses the concepts of Gambler's Ruin and break-even analysis. With application of these basic approaches, it is possible to apply a conservative approach to a program of risk-oriented undertakings so that the probability of complete failure of such a program is reduced to manageable proportions. This paper presents such an approach as applied to oil and gas exploration in selected Pacific Rim countries.

Gambler's Ruin is described as a situation in which a risk-taker with limited funds goes broke through a continuous string of failures that exhausts his available funds. Therefore, the amount of money risked on any one venture should not exceed the amount that would exacerbate the risk of ruin beyond acceptable limits.

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[14] Australia Example

$P_s = P_f = 1.0$
$EV = (P_s \times S) + (P_f \times F)$
$0 = (P_s)(230) + (1 - P_s)(-240)$
Solving for P_s, $P_s = .51$

Decision making in oil and gas ventures is concerned with risk-taking for high stakes and normally involves the following basic parameters:

1. The amount of available risk capital, C.
2. Project risk money, or cost of failure, X.
3. The potential reward or gain from success, R.
4. The probability of success, Ps.
5. The minimum probability of success, Pm.
6. Probability of Gambler's Ruin, Pb.

With unlimited funds available as risk capital: Pm = X/R.

However, for limited funds, as is usually the case in exploration companies, a formula incorporating the cost of failure should be applied in order to prevent the reality of "Gambler's Ruin."

The Whitworth equation accurately describes this situation as follows:[15]

$$[1 + R/C) - (X-C)]^{P_s}[1-(X/C)]^{(1-P_s)} = 1$$

The equation states that each time a venture is successful, the available funds, C, are increased by a factor of (1+R/C-X/C) and each time a venture is unsuccessful, the available funds are reduced by a factor of

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[15] Roebuck, pg. 145.

(1-X/C). The respective probabilities, P_s and $1-P_s$, are indicated by the exponents, and the overall product must equal unity.

From this and $P_m = X/R$, the minimum acceptable probability of success:

$$P_m = \frac{[1 - \ln [1 + (R/C) - (X/C)]]^{-1}}{\ln [1 - (X-C)]} \text{ - for break even.}$$ [16]

With the binomial theorem, the chance of Gambler's Ruin is:

$$P_b = (1-P_s)^{C/X}$$

where C/X = number of failures to deplete all the available capital

and, therefore, the minimum acceptable probability of success is:

$$P_m = 1-(P_b)^{X/C}$$

The conservative risk-taking approach can also apply a simplistic break-even analysis. This concept is that successive risk-taking ventures should be undertaken only in such a manner that the risk money in each venture is less than the amount that would create a "break even situation" in the long run.

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[16] Ibid, pg. 146.

The most likely scenario confronting management is to determine where limited available funds, C, may prudently be invested in a venture that promises a reward, R, so that by repeating the operation each time on a scale proportionate to the available funds, the investor will in the long run break even.

Using China as an example, let

$X = \$\ 560$

$R = \$3624$

$C = \$2000$

Assuming we are willing to bear a 25% chance (P_b) of Gambler's Ruin, and there is a 30% probability of success (P_s).

$X/C = 560/2000 = .28$

$R/C = 3624/2000 = 1.812$

Break even:

$$P_m = \left[1 - \frac{\ln (1 + 1.812 - .28)}{\ln (1 - .28)}\right]^{-1} = .261 = 26.1\%$$

Gamblers Ruin:

$$P_m = 1 - (.25)^{.28}$$

$$= 1 - .678$$

$$= 32.2\%$$

Therefore, the project is not acceptable since 32% is greater than the 25% chance (P_b) of Gambler's Ruin we are willing to assume.

However, if the amount of risk capital (C) is increased to 3000 then:

$$X/C = 560/3000 = .1867$$

$$R/C = 3624/3000 = 1.208$$

Break even:

$$P_m = [1 - \frac{\ln(1 + 1.208 - .1867)}{\ln(1-.1867)}]^{-1}$$

$$= .226 = 22.6\%$$

Gambler's Ruin:

$$P_m = 1 - (.25)^{.1867}$$

$$= 1 - .77$$

$$= .23 \quad = \quad 23\%$$

Therefore the project is acceptable on both counts.

Alternatively, by application of the theory of Gambler's Ruin, investments in China would be acceptable provided a minimum of \$2240 million (C) is available for risk capital. The minimum amount of risk capital needed to support the level of risk is determined as follows:

where $R/C = 3624/2240 = 1.617$

$$P_m = \frac{[1-\ln[1+(R/C)-(X/C)]]}{\ln\ [1-(X/C)]}^{-1}$$

Break even: $P_m = [1 - \frac{\ln\ (1+1.617-.2)}{\ln\ (1-.2)}]^{-1}$

$$= \ .20 \quad = \ 20\%$$

Gambler's Ruin: $P_m = 1 - (.25)^{.2}$

$$1 - .75$$

$$= .25 \quad = 25\%$$

Similar results are shown for Australia and Brunei, both assuming the high price case scenario.

Australia $X/C = 455/3000 = .1515$

$R/C = 3118/3000 = 1.039$

Break even: $$P_m = [1- \frac{\ln (1 + 1.039-.1517)}{\ln (1-.1517)}]^{-1}$$

$$= .2057 = 20.57\%$$

Gambler's Ruin: $$P_m = 1 - (.25)^{.1517}$$

$$= 1 - .81$$

$$= .19 = 19\%$$

Brunei $X/C = 116/3000 = .0386$

$R/C = 754/3000 = .2513$

Break even: $$P_m = [1- \frac{\ln (1 + .2513-.0386)}{\ln (1-.0386)}]^{-1}$$

$$= .168 = 16.8\%$$

Gambler's Ruin: $$P_m = 1 - (.25)^{.0386}$$

$$= 1 - .947$$

$$= .053 = 5.3\%$$

In conclusion investment in Brunei and Australia is profitable using break-even analysis and application of Gambler's Ruin theory.

If risk capital (C) were reduced to \$580mm, investment in Brunei would still be acceptable on both counts. The demonstration of a reduction in risk capital is shown as follows:

where $R/C = 754/580 = 1.3$

$$\text{Break even:}\quad P_m = [1 - \frac{\ln(1+1.3-.2)}{\ln(1-.2)}]^{-1}$$

$$P_m = .23 = 23\%$$

$$\text{Gambler's Ruin:}\quad P_m = 1-(.25)^{.2}$$

$$= 1-.75$$

$$= .25 = 25\%$$

This analysis demonstrates that since X, the cost of failure is low, the amount of risk capital, C, can also be low and still support the project above minimum economic levels.

As demonstrated in the foregoing examples, the amount of risk capital available to the decision maker has a very significant effect on the amount of risk money one can commit to a given project. The greater the risk capital, for a given probability of success, the greater the degree of risk the decision maker can afford to take on a prospect. Finally, this should put the small operator at a disadvantage with respect to a large one in that for the same probability of success a large operator can afford to pay more for a given investment than can a smaller operator.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study demonstrates the variation in expected returns arising from the distinct terms and conditions offered for petroleum exploration in five Pacific Rim countries. Although the results were not entirely unexpected, the magnitude of the variation of the expected discounted net present value cash flows and the internal rates of return were dramatic.

The high oil price case ($35.00) resulted in a maximum discounted cash flow of $515 million in Australia to a minimum of a $-7.553 million in Malaysia. Internal rates of return vary from a high of 41 percent to a low of 14 percent. The low oil price case ($20.00) resulted in a maximum discounted cash flow of $206 million in Australia to a minimum of -90.59 million in Malaysia.

Based on this analysis, investments in Australia, China, and Brunei appear to be worth funding in the high oil price scenario. Less attractive are investments in Indonesia and Malaysia although one could possibly argue in favor of funding a project in Indonesia in the high oil price case.

To determine whether a project is desirable, an indication of its expected future cash flows is needed in order to relate expected project performance to corporate goals and performance measures. This approach however, probably does not go far enough to determine specific funding criteria when projects of equal returns are compared. This dilemma forces one to consider risk. Expected present values based on geological and statistical averages can be utilized to determine an absolute priority. Definitely one cannot judge the relatively merits of competing projects on internal rates of return only although this measure is a good starting point.

Two constraints have been considered: (A) breaking even in the long run, and (B) avoiding Gambler's Ruin. This first constraint is an attempt to identify the maximum amount that an investor with limited funds may prudently invest in a project. The second constraint is based on a binomial theorem which states that the chance of investor going broke through a continuous string of failures.

Finally, the analysis demonstrates the attractiveness of investments in Australia, China, and Brunei given our assumptions about risk (probability of success) and return. We have further derived the minimum amount of risk capital required to deliver a reasonable return in China and Brunei.

Decision makers must come to grips with risk analysis. In addition to geologic risk the decision maker must be aware of nonquantifiable risks that may impact project economics. Commercial and political risk are two other types of risk which weigh in the decision making process.

Subjective opinions about these risks are their only real measures. Incorporation of these risks could be the subject of further research.

This paper has identified a workable process to evaluate projects competing for risk capital. The basic concepts of fundamental financial analysis have been applied. The key to informed decision making is evaluating all available information in a well understood process in order that one can communicate to others the outcome of the process as well as the process itself.

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