ECONOMIC EVALUATION OF EXTERNALLY FUNDED PROJECTS IN THE INDEPENDENT PETROLEUM INDUSTRY

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ABSTRACT

The independent oil industry relies upon external financing for a significant portion of the funding of its activities. It has been noted that this industry sector does not practice the full use of economic evaluation and investment decision methods in the analysis of their investment opportunities. The combination of these two points exposes a weakness that has been previously manifested in the problems of energy lending; borrowers and lenders have not practiced valid methods of analysis in their project selection, funding proposals, or loan structures. Leverage effects which increase project economic risk are present but not generally appreciated by either side of an external funding arrangement.

This study presents a methodology for developing economic evaluations for externally funded projects. Utilizing a case study, a recommended approach included analysis of 100 percent cash scenarios to determine project acceptability, leveraged DCFROR analysis of similar external funding structures to determine which structure is most attractive, and the addition of an intermediate step between cash and leveraged DCFROR analysis to determine the impact of equity reversions from the borrower to the

lender. Conclusions drawn from this work include the analysis of any externally funded project should begin with the determination of the project's 100 percent cash funded scenario. This practice will establish a base case for comparison of the leveraged case studies that may follow. Leveraged analysis should be made for comparison purposes only when financing structures are similar. These suggested practices will become necessary as the funding sources for this industry sector shifts towards institutional investors and the financially sophisicated firms that advise them on their placement of funds.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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Chapter 1

EXTERNAL FINANCE IN THE INDEPENDENT PETROLEUM INDUSTRY

1.1 Purpose and Statement

The independent petroleum industry relies heavily upon external financing for its drilling activities. Traditional methods include commercial bank loans and the sale of partnership interests; more innovative techniques draw funding from pension funds and university endowments. The individual firm utilizing external funds must recognize the financial objectives of the different funding sources and account for these objectives in the structuring of investment and loan proposals. It is important that the firm investigate the economic effect the project financial structure has upon the investment decision process.

Financial vehicles which draw funds from partners in a project are thought of as joint venture projects. These arrangements may involve a promotional participation where a partner may agree to pay a higher proportion of costs than he will receive from project revenues. Vehicles of this type include partnerships, both public and private, and farm-out agreements. These structures provide an interesting evaluation process but they are not normally involved with the repayment of funds pledged to the project. The obligation to repay funds to lenders and sponsors creates a situation of economic leverage which is reflected in the evaluation of a project's discounted cash flow rate of return (DCFROR). This work is directed towards determining the leverage effects of borrowing funds for project financing and avoiding errors in interpreting the results of economic evaluations utilizing DCFROR techniques. Several financing vehicles that have become popular will be addressed, including mezzanine financing, a combination of traditional lending with an equity interest provided to the lender in return for the use of its funds.

Beginning with the firm's basic management function, investment decision making, finance, and marketing are all observed as deeply interwoven in the fabric of daily business. Traditional techniques of analysis avoid the interplay between these three sectors. This lack of interplay isolates the affect each sector has upon the firm. The financial and marketing analyses concerning the source of funds are typically separated from the economic analysis concerning the use of funds.

The use of external financing for projects draws a link between the financial source of funds and the investment analysis involved in the use of these funds. The lending process includes an analysis of project attributes and a study of the ability of the borrower to repay the loan. The lender may allow the individual project to stand alone in the repayment of borrowed funds in a structure called project or nonrecourse financing. Other structures, in which a loan or funding situation involves the pledging of collateral to guarantee repayment, are more common. This guarantee arrangement involves the possibility of additional funds being drawn from the enterprise's treasury to pay for the cost of the external funds. The source of collateral will not be discussed, but it is important to note that once pledged these sources of collateral may not be used to secure other projects and may impact the firm's balance sheet.

The case study developed in this paper is a valuable guide in illustrating the proper development of economic evaluation for investment decision-making purposes when external financing is considered. This will aid those familiar with discounted cash flow analysis but not familiar with the analysis problems created by external financing. This audience could include the staff of petroleum companies, energy lending officers of banks or funding entities, and equity investors.

It appears little has been written on this specific subject. The Stermoles have commented on leveraged concepts in Economic Evaluation and Investment Decision Methods (Stermole and Stermole, 1987). Much of this study is based on the concepts outlined in their book. Hoover (1983) has commented on the need of the independent petroleum industry to use discounted cash flow analysis with risk-adjusted parameters for petroleum investments. Newendorp (1987) discussed proper techniques for risk-adjusting potential reserves for drilling proposals which are in direct agreement with the Stermoles' methods.

Related to this subject, Regan (1983) discussed the bank's viewpoint in petroleum project lending. Mountjoy (1980) presented the investment decision process from a joint economic and financial perspective. Silbergh and Brons (1973) coauthored a study of leveraged transactions using utility profitability analysis. Helfert (1977) considered the operator/borrower and the transfer of project risk away from the borrower to the lender.

1.2 The Role of External Financial Funds

In 1983, the Chase Manhattan Bank reported that, unlike major oil companies, independent petroleum companies relied on external funds for 70 percent of their drilling capital (Hoover, 1983). The majority of this external funding was provided as commercial bank loans. At that time, the remainder of the independent industry's funds came from the sale of drilling partnerships. Today, the funding not obtained from commercial banks is provided through financial arrangements among a variety of institutions. Insurance companies, pension funds, and university endowments have quietly reentered the world of petroleum investment. Also, arrangements between end users and petroleum producers have enabled the development of reserves that were not previously tapped because of a lack of funds rather than from a lack of economic potential.

The independent petroleum industry's access to external funds has become increasingly more difficult. Problem energy loans have undermined several banking institutions. The drop in product prices and slack demand has had a role in creating problem loans, foreclosures, and business failures, but numerous lenders are still providing funds for drilling investment. It has been widely suggested that the oil market euphoria present in the early 1980s created situations where banks and borrowers developed forecasts with continual product price escalation, and that these overly optimistic projections are to blame for the resulting financial chaos.

Considering the importance of external financing and the recent problems experienced by borrowers and lenders, it is suggested that the independent petroleum industry take steps to avoid similar problems in the future. The review of procedures concerning raising and investing external funds and adjusting those procedures could mean the difference between success and failure.

1.3 The Lender's Perspective of Petroleum Investment Profitability

The decline in external funds available to the industry has not changed the fundamentals of petroleum exploration profitability. Hoover (1983) outlined three factors which effect an investor/lender's perception of profitability in drilling activities: 1) the net revenues received by the company after production expenses and taxes are paid, 2) the finding costs associated with the successful and unsuccessful drilling necessary to discover petroleum reserves, 3) the promotion applied upon participants by the sponsor.

Hoover's study mentions that investors and banks were attracted to the independent petroleum industry by their perception of its great profitability. This perception changed rapidly as the rise in product prices peaked and began to fall. Hoover suggests the investor saw the drop in product prices as causing an unfavorable decrease in the net revenue that would received by producers.

The initial impact of dropping prices was that profitability did suffer. Drilling activity fell from record levels which caused a sharp decrease in demand for drilling and services. Competition in the service sector caused a drop in average finding costs from $14 per barrel in 1981 to roughly $10 per barrel in 1983 (Hoover, 1983). The 40 percent decrease in this factor of profitability has an obviously favorable effect for the investor. However, the investor's perception of profitability can be quite different from the actual conditions that can be expected in a drilling project. It is important that all subjective factors, for instance, perceived profits, be investigated properly in project analysis. The financial aspect of providing funds for investment should be separated from the economic evaluation of a project for investment decision purposes. In this same vein, the intangible aspects of perceived conditions affecting the investment project should be held separate from the financial and economic aspects. This is not to suggest that intangible aspects should be ignored in investment decision making but only that the intangible factors be recognized as such.

Chapter 2

INVESTMENT DECISION MAKING IN THE INDEPENDENT PETROLEUM INDUSTRY

2.1 The Investment Decision and Its Role in the Management Function

The initial task of any business is to establish the general objectives and specific goals of the firm. The management team can then assess the strengths and weaknesses of such concerns as technical ability, administrative talent, market standing, and financing possibilities (Helfert, 1977). The firm's management can use this assessment as a point of reference to determine appropriate strategies for the firm. It is at this point that business decision making begins.

Business decision making is intertwined in three areas: operations, financing, and investments. Helfert (1977) describes the interaction of these sectors as being most dependent on investment decisions. The investment process has the longest time horizon and it relies most on assumptions about future conditions that will provide the economic gains to justify the proposed investment.

An alternative model suggested by Fletcher (1983) presents the minimum in management functions for a successful enterprise: planning, organizing, staffing, communications, motivation, and controlling. As in Helfert's model, planning precedes all other functions, and Fletcher states, "The results must be an objective that is specific, measurable, understandable, and obtainable."

These management functions lead to the basic activities of the firm. Fletcher's categories overlap the three categories presented by Helfert, but their conclusions are similar. The financial function must yield returns from investment that allow for the coverage of operating costs, reinvestment, and the distribution of earnings to investors.

One important point stressed by Fletcher is the need for technical competence in specific duties and the ability to transfer from those duties into the generalized role of supervision. It is suggested that in his generalized role, a manager must understand the basics of his and his firm's functions. Considering the basic nature of the investment decision in the firm's activities much attention should be given in training mangers in investment decision analysis.

2.2 A Typical Investment Decision Process

The independent petroleum industry has received much criticism for its financial management practices. Dwight

Moorhead, formerly chief financial officer of Petro-Lewis Corporation, stated that many oil companies could have avoided their need to merge had they been managed by "shrewd financial men rather than oil men" (Hendon, 1983).

Generally, it appears that technically oriented "oil men" have not completed their transition to management by mastering the financial aspects of their industry. This necessary transition has been stressed by Fletcher and observed by many. The author believes the petroleum manager should be both a shrewd financier and a competent oil man. The mastery of financial methods alone does not ensure the success of a firm.

Hoover (1983, p.1) outlined a petroleum investment evaluation situation he considers typical. An independent petroleum company does an excellent geological analysis of a drilling proposal but a poor job in the financial and economic evaluation for investment decision purposes:

> Comanche Oil Company (Comanche) offers Cowboy Petroleum Corporation (Cowboy) a one-quarter working interest in the Armadillo prospect in the Permian Basin. The terms are an "industry third-for-a-quarter deal" -Cowboy pays a third of the leasehold and drilling costs and a quarter of the completion costs. Cowboy's geologist (a highly qualified petroleum scientist but a relatively unsophisicated financial analyst) thoroughly evaluates the geologic data provided by the prospect originator. This data is correlated with independently obtained data, all of which is very competently assessed, drawing on the

> geologist's experience in the area. Some members of Cowboy's staff also compute Cowboy's share of potential net revenue and compare it with their share of the acreage and drilling costs. If the project might support additional development, a similar analysis is made of potential development wells. Based on these evaluations and the prior dealing relationship of Comanche and Cowboy a decision is made to accept the deal.

In his example, Hoover views Cowboy objectively analyzing the geologic potential and return on investment. Hoover points out that the geologic study provides a single estimate for reserve potential; no consideration is given to the chance of drilling a dry hole. Also, he believes the fact the decision was made in part because the two companies have dealt with each other does not add any economic advantage to the project. This past history between partners does reveal how an intangible project factor can influence an investment decision.

Hoover maintains Cowboy may experience problems because of its failure to quantify economically important factors that were only reviewed subjectively. The measure of return on investment could be improved to consider the time value of money and the impact of taxation by employing discounted cash flow analysis techniques. Also, he implies that the situation could be improved with a statistical review of the probability of a dryhole and various possible production decline rates. He presents a technique of determining risked reserves to include several probable reserve outcomes in one risk-adjusted reserve size. The author must differ with this approach and provides Newendorp's methodology for this practice in this chapter.

2.3 A Recommended Investment Decision Process

It is suggested that drilling investment proposals be evaluated with techniques accounting for the time value of money and the tax consequence of the project. It is assumed the reader has some knowledge of these techniques. For a full review of these techniques, reference can be made to the Stermoles' book, Economic Evaluation and Investment Decision Methods.

The improvement of firms' investment decision analysis using discounted cash flow analysis can be further enhanced by quantitative risk and uncertainty analysis. The proper application of risk and uncertainty analysis can provide a view of the range of variation in project results, develop a probability of certain outcomes in a project's economic life, and generate an idea of the sensitivity of project final outcome due to changes in certain project parameters. Using these techniques, the economic performance of an investment alternative structured for external project financing can be investigated.

The incorporation of probability into investment decision analysis can become extremely complicated. The use of computers has become commonplace with such techniques as Monte Carlo simulation. This area of evaluation is outside the scope of this study. It will be more valuable to develop an understanding of sensitivity and probability analysis through the use of decision tree, probability tree, and sensitivity analysis techniques.

2.3.1 Decision Tree Analysis

Probability tree and decision tree analysis has been employed in making business decisions for uncertain investment conditions since the late 1950s (Ulvila and Brown, 1982). The successful use of this technique is based on its simplicity. The use of a simple display with separate subsidiary models to detail summarized points on a master tree has been helpful in maintaining clear presentations of the analysis (Ulvila and Brown, 1982). Sensitivity analysis can refine this type of analysis as will the integration of top managers in building a model that provides the desired information necessary for investment decision making (Ulvila and Brown, 1982).

Transferring some simple outcomes of a drilling project into a decision tree diagram will illustrate the use of this technique as seen in Figure 2.1. The outcome of Event One is that the well will either be potentially productive or a dry hole, a nonproductive well. The branch of the tree ends after the dry hole outcome as the project ends. The branches of the tree continue to Event Two and beyond as the well will undergo a completion operation that will yield one of three possible outcomes: a highly productive well, a marginally productive well, or a well that will not produce because of a failure in the completion effort. It should be noted the branches of the tree can be increased to accommodate any possible outcome. Finally, the financial results of each branch have been included revealing the branch which represents a completion failure will lose more money than the branch representing a dry hole. This is pointed out to show abandoning a well can be good economic idea if the chance of completing a well with an economic reserve volume is in question. Including probabilities for the outcome of uncertain events in a decision tree yields a probability tree diagram.

2.3.2 <u>Probability Tree Analysis</u>

Probability tree analysis is a widely used technique to determine the expected outcome of a project. Conditional or independent events can be included in these

```
   Event One        Event Two

   Drill Well    Establish Production          Outcome
        |                    |
        |                    |
        V                    V     Highly        Make
                             +-----------------  A lot of
                             |   Productive      Money
           Potentially       |
        +----------------+
        |  Productive        |
        |                    |   Marginally      Make
        |                    +-----------------  Some
        |                    |   Productive      Money
--------+                    |
        |                    |                   Lose
        |                    |   Completion      Drilling
        |                    +-----------------  Completion
        |                         Failure        Money
        |
        |    Dry                                 Lose
        +----------                              Drilling
             Hole                                Money
```

Figure 2.1 Decision Tree Diagram for a Drilling Project forms of analysis. Blank (1980) has described conditional events where the occurrence of one event is dependent on a second event. If the chance that an event occurs is not changed by the occurrence of some other event, the two are independent events (Blank, 1980).

A decision tree is transformed into a probability tree with the inclusion of the probabilities of a project's conditional and independent events. Starting from the left, the branches of the tree represent the possible outcomes for the project. The alternatives resulting from a single decision or chance originate from a node or common point that indicates the dependence of the possible outcomes on the event represented by the node. Each alternative final outcome is made up of the series of branches leading to that outcome or conditional event. The probability of occurrence for each conditional event is the product of the dependent probabilities of the events that occur along the branch leading to that outcome. The events that are independent of one another will not be connected in the tree diagram.

A coin toss situation is a simple example illustrating conditional and independent events and how the events would be described in a probability tree diagram. Tossing a coin with equal probability that the outcome will be "heads" or "tails" is an event descriptive of the coin toss. The outcome of a second toss is independent of the outcome of the first toss. The second event could take place with the same coin tossed at a later time or with a second identical coin tossed concurrently with the first coin. This sequence of events and their possible outcomes are represented in the probability tree diagram, Figure 2.2.

The probabilities listed in Figure 2.2 include the chance of a "heads" or a "tails" occurring as the result of an event, a coin toss. This value is equal to 0.5 in all cases. Thus the probability of each final outcome equals 0.25. Using the decision tree developed in Figure 2.1, the probability of occurrence for each of the possible alternatives can be added. In Figure 2.3 these values have been added to the decision tree, a hypothetical NPV for each outcome inserted, the conditional probability of each possible outcome calculated, and the expected NPV outcome determined. This expected outcome is developed multiplying the NPV for each outcome by the likelihood of its occurrence. The algebraic sum of these product terms is the expected monetary value (EMV) of the project (Newendorp, 1987). The fact that this project has a positive EMV reveals that over a large number of investments with this structure, the aggregate value of all

```
    Event One   Event Two                          Probability
                                       Final        of Final
    Coin Toss   Coin Toss             Outcome       Outcome
        |           |
        V           V  Heads
                    +------------  Heads - Heads    0.25
           Heads    |  p = 0.5
        +-----------+
        |  p = 0.5  |  Tails
        |           +------------  Heads - Tails    0.25
        |              p = 0.5
--------+
        |              Heads
        |           +------------  Tails - Heads    0.25
        |  Tails    |  p = 0.5
        +-----------+
           p = 0.5  |
                    |  Tails
                    +------------  Tails - Tails    0.25
                       p = 0.5                     _____
 Sum of Conditional Probabilities of All Outcomes = 1.00
```

Figure 2.2   Probability Tree for Two Coin Tosses

```
                                                   Conditional
Event One     Event Two                            Probability  Expected
                                          NPV      (Cp) of       NPV
Drill Well Complete Well                Outcome    Outcome      Outcome
   |             |
   |             |
   V             V
                    p = (0.20)
                 +------------ +$1500  *  (0.14) = +$210.00
                 |  Highly
                 | Productive
                 |
                 |
  p = (0.70)     | p = (0.65)
   +-------------+------------ +$ 400  *  (0.46) = +$184.00
   | Potentially | Marginally
   | Productive  | Productive
   |             |
   |             |
   |             |  p = (0.15)
---+             +------------ -$ 425  *  (0.10) =  -$42.50
   |              Uneconomic
   |               Reserves
   |
   | p = (0.30)
   +-------------              -$ 250  *  (0.30) =  -$75.00
        Dry                                         -------
        Hole

                Sum of Expected NPV Outcomes
                  or Expected Monetary Value      = +$276.50
```

Figure 2.3 Probability Tree Diagram for a Drilling Project the projects would equal $276.50. Reviewing the possible outcomes it is apparent no single outcome will yield an amount equal to the EMV of this project. This EMV is useful only for decision purposes and does not imply the outcome of a single project. The consistent use of expected value analysis in decision making based on selecting projects with positive expected values will, in the long run, provide enough income to more than cover all the projects costs. The problem is a positive expected value is a necessary but not a sufficient condition for a satisfactory investment (Stermole and Stermole, 1987). The reasoning involved in this statement is that expected value is meaningful for a large number of investments of a similar type. If drilling several dry holes in a row would bankrupt the firm, the choice of this type of investment should be questioned.

Problems in developing proper expected values for parameters can result if care is not taken in the probability weighting of parameters. In oil, the most critical parameter often handled improperly is the expected size of reserves. Developing "risked reserves" by multiplying the probability of occurrence of each possible reserve size by the value of the reserves and summing the product terms yields a number that is used in a single discounted cash flow analysis. This analysis will provide an incorrect and misleading decision parameter (Newendorp, 1987). Common errors include the improper adjustment of development and operating costs to the size of the reserves discovered, and the costs associated with dry holes. Expected value analysis should approach each possible outcome individually. It is after this step that the probability of occurrence for uncertain parameters should be considered. Figure 2.4 shows how complicated this can become when price and operating cost parameters are added.

Figure 2.4 expands the probability tree presented in Figure 2.3. The addition of three price scenarios and two cost scenarios results in a tree with nineteen branches. Note the dependence of cost probabilities on the product price scenarios. An increase in product prices is expected to increase the probability of high operating costs.

A full economic evaluation of the project requires a discounted cash flow analysis for each of the nineteen conditional outcomes. However, a range approach can cut calculations in an initial screening procedure. The range approach involves evaluating three producing cases: the best possible, the worst possible, and the most likely. These cases provide an upper and lower limit of economic results for producing outcomes. The variation between

```
                                                        Probability
     Reserves          Prices        Costs            of Occurrence

                                      Low
                                   +-----------          0.0075
                         High      | p = 0.50
                      +---------+
                      |p = 0.10 |  High
                      |         +-----------          0.0075
                      |          p = 0.50
                      |           Low
                      |         +-----------          0.0630
        High          | Medium  | p = 0.60
 +--------------------+---------+
 | 100,000 Bbls       |p = 0.70 |  High
 |  p = 0.15          |         +-----------          0.0420
 |                    |          p = 0.40
 |                    |           Low
 |                    |         +-----------          0.0210
 |                    |  Low    | p = 0.70
 |                    +---------+
 |                     p = 0.20 |  High
 |                              +-----------          0.0090
 |                               p = 0.30
 |                                 Low
 |                              +-----------          0.0225
 |                       High   | p = 0.50
 |                    +---------+
 |                    |p = 0.10 |  High
 |                    |         +-----------          0.0225
 |                    |          p = 0.50
 |                    |           Low
 |                    |         +-----------          0.1890
 |       Medium       | Medium  | p = 0.60
 +--------------------+---------+
 | 60,000 Bbls        |p = 0.70 |  High
 |  p = 0.45          |         +-----------          0.1260
 |                    |          p = 0.40
 |                    |           Low
 |                    |         +-----------          0.0630
 |                    |  Low    | p = 0.70
 |                    +---------+
 |                     p = 0.20 |  High
 |                              +-----------          0.0270
 |                               p = 0.30
```

Figure 2.4 An Expanded Probability Tree Diagram

(continued on next page)

```
                                                  Probability
         Reserves      Prices        Costs      of Occurrence
-------------------------------------------------------------
        |                             Low
        |                          +-----------      0.0050
        |                High      | p = 0.50
        |              +----------+
        |              |p = 0.10  |  High
        |              |          +-----------      0.0050
        |              |            p = 0.50
        |              |             Low
        |              |          +-----------      0.0420
        |   Low        |          | p = 0.60
        +-------------+----------+
        | 35,000 Bbls |p = 0.70   |  High
        | p = 0.10    |           +-----------      0.0280
        |             |             p = 0.40
        |             |              Low
        |             |           +-----------      0.0140
        |             |   Low     | p = 0.70
        |             +----------+
        |               p = 0.20  |  High
        |                         +-----------      0.0060
        |                           p = 0.30
        |
        |  Dry Hole
        +-----------------------------------       0.3000
           p = 0.30
                                                   ------
           Total Conditional Probability (Cp) =    1.0000
-------------------------------------------------------------
```

Figure 2.4 (continued)

These limits defines the project's expected economic risk. This range of outcomes can then be compared to the dryhole outcome and a judgment made concerning the ability of producing outcomes to offset the high risk of a dry hole. Figure 2.5 presents a model of this approach. The project may be deemed undesirable at this point and rejected with a minimum of evaluation effort. If the project is found promising, more complete methods may be used. These include narrowing the range of production limits by excluding cases with the lowest probability of occurrence. The choice of limits could exclude approximately 5 percent of the expected producing outcomes outside the boundaries. This would give a view of outcome that avoids the extremes that seldom occur.

```
   Producing Outcomes     Cp              Parameters

             Best
          +- Case ----   0.0075    High Production and Prices
          |                        Low Costs
          |  Most
   +-----+- Likely --    0.1890    Medium Production and
Prices
   |      |  Case                  Low Costs
   |      |
   |      +- Worst ---   0.0060    Low Production and Prices
   |         Case                  High Costs
   |
   +- Nonproducing -     0.3000    Dry Hole Outcome

    Cp = Conditional Probability of Occurrence
```

Figure 2.5 A Range Approach to Decision Tree Analysis

Figure 2.6 represents a tree diagram that has eliminated the two best cases with a combined conditional probability of occurrence of 0.015 and the bottom three worst cases with a combined conditional probability of 0.0480. This adjustment has trimmed 0.0630 of the extreme outcomes from the decision tree. The use of this technique yields a more meaningful range of probable outcomes for screening purposes. The highly optimistic or pessimistic cases are "filtered" out and the risk boundaries may be more useful for initial screening purposes.

2.3.3 Sensitivity Analysis

Sensitivity analysis considers the effect on economic evaluation results caused by the uncertainty in project parameters. The uncertainty of a project parameter is represented by the possible values a parameter might possess. The parameters that can be investigated include, but are not limited to, capital costs, operating costs, product prices, and reserve size. Sensitivity analysis isolates a single parameter, and a separate economic investment evaluation is made for each of the possible parameter values being studied. Parameters whose variation generates greater changes in project economic evaluation measures are considered more sensitive than parameters

Case	Cp	Parameters
Best Case	0.0075	High Production and Prices Low Costs
Second Best Case	0.0075	
Upper Boundary	0.0630	High Production Medium Prices Low Costs
Most Likely Case	0.1890	Medium Production and Prices Low Costs
Lower Boundary	0.0420	Low Production Medium Prices High Costs
Third Worst Case	0.0280	
Second Worst Case	0.0140	
Worst Case	0.0060	Low Production and Prices High Costs

Cp = Conditional Probability of Occurrence

Figure 2.6 A Modified Range Approach to Decision Tree Analysis whose variation produces little change. The more sensitive parameters therefore present a greater project risk (Stermole and Stermole, 1987).

Applying sensitivity analysis to the example developed in Figure 2.4 parameters for product price and operating costs can be held constant and the size of recoverable reserves varied to provide the basis for three economic evaluations for investment decision making. The results of this work can be compared with another sensitivity study investigating the sensitivity of product price variation and a third study of the sensitivity of operating costs. A case study developed in the next section provides a framework for generating a summary of these studies.

2.4 A Hypothetical Case Study

A hypothetical case study will illustrate the techniques discussed above. Basic assumptions about the investigating firm include its industry status as an independent producer with other income to offset the project's tax benefits in the year incurred. It considers its minimum rate of return standard to be 15 percent. Investments are made at the beginning of an annual period, and income is realized at the end of the year. Projections for costs and income are calculated on an escalated basis.

The firm is currently considering projects with a five-year life and any remaining book value on assets at the end of the project will be written off.

2.4.1 Production Assumptions

The hypothetical firm has investigated several oil producing basins and determined development drilling in one particular basin to be in their best interest. The required reserve size for development drilling projects is in the range of 60,000 barrels to 100,000 barrels, although prior drilling projects have uncovered reserves of only 35,000 barrels. In this basin, initial production rates are a factor of reserve size and all reserves can be recovered in five years regardless of size. Also, production rates decline at 30 percent during the first year and stabilize at 15 percent in the remaining years. The annual production for various reserve volumes are shown below:

End of -Year-	Large	Medium	Small
1	26,012	15,619	9,131
2	22,747	13,659	7,985
3	19,564	11,747	6,868
4	16,970	10,190	5,957
5	14,778	8,873	5,188
Total Reserves Recovered	100,071	60,089	35,129

2.4.2 Price Assumptions

The company has developed three price scenarios for the next five years. Their low price scenario assumes a flat price per barrel of $12, and their medium price scenario is set at a flat $15. The assumption for high prices begins with $16 per barrel in 1989 and a 14% annual price escalation. These price projections follow:

High Price Scenario

1989	1990	1991	1992	1993
$16.00	$18.24	$20.79	$23.70	$27.02

Medium Price Scenario

1989	1990	1991	1992	1993
$15.00	$15.00	$15.00	$15.00	$15.00

Low Price Scenario

1989	1990	1991	1992	1993
$12.00	$12.00	$12.00	$12.00	$12.00

2.4.3 Cost Assumptions

Tangible costs are projected at $225,000 and intangible costs are estimated at $175,000. The leasehold for this project covers 200 acres with an acquisition expense of $10,000. Operating costs will be stable for the life of the project with an annual expense of either $9,000 or $18,000. The variation in annual operating expense projections is the result of the competitive environment for service companies where lower product prices will force these costs down. The firm expects higher product prices to increase the likelihood of higher operating costs. Royalties due mineral owners are estimated at a 20 percent annual rate which is standard in the area.

2.4.4 Before-Tax Cash Flow Calculation

The determination of before-tax cash-flow figures will help outline the methodology to be used in all cash-flow calculations in this study. The assumptions chosen for this example are a medium reserve size of 60,000 barrels, a flat product price of $15 per barrel, and operating costs of $9,000 per year.

The first two years of cash-flow calculations are typical of all periods:

	Beginning of Year 1	End of Year 1	End of Year 2
Revenue		234,289	204,879
-Royalties		-46,858	-40,976
Net Revenue		187,431	163,903
-Operating Costs		-7,500	-9,000
Net Income		179,931	154,903
-Capital Costs	-410,000		
Cash Flow	-410,000	179,931	154,903

The calculation of the before-tax discounted cash-flow rate of return (DCFROR) incorporates this scenario's annual cash flow values:

$$\begin{aligned}\$410{,}000 = \$179{,}931\,(P/F_{i,1}) &+ \$154{,}903\,(P/F_{i,2})\\ &+ \$131{,}968\,(P/F_{i,3})\\ &+ \$113{,}277\,(P/F_{i,4})\\ &+ \$\ 97{,}482\,(P/F_{i,5})\end{aligned} \qquad (2.1)$$

The variable "i" equals 22.18 percent, the project DCFROR, which discounts the cash flow stream to equal the capital cost incurred at the beginning of the project. The above method of notation and the formulas represented by this notation system can be found in the Stermoles' text, <u>Economic Evaluation and Investment Decision Methods,</u> and will be used consistently in this study.

It is important that DCFROR values be used properly in analysis. They will be used in this work to illustrate the differences between scenarios of the same investment alternative or of investment alternatives where incremental analysis must be applied. A computational format similar that used for DCFROR is used for this scenario's NPV calculations:

$$\begin{aligned}\$63{,}595 = \$179{,}931\,(P/F_{i*,1}) &+ \$154{,}903\,(P/F_{i*,2})\\ &+ \$131{,}968\,(P/F_{i*,3})\\ &+ \$113{,}277\,(P/F_{i*,4})\\ &+ \$\ 97{,}482\,(P/F_{i*,5})\\ &- \$410{,}000\end{aligned} \qquad (2.2)$$

Briefly, the concept of NPV analysis involves the discounting of future cash flow streams to the beginning of a project using the minimum rate of return, i*, in computations. The discounted cash flow stream is netted againest the present value of capital costs as shown in Equation 2.2. The project generates a favorable return in terms of i* when the NPV is equal to or greater than zero. In this case, the NPV equals $63,595. The Stermoles' text is useful in detailing the proper use of this technique.

2.4.5 After-Tax Cash Flow Calculations

Projects will be involved with tax laws where costs that may be involved with deductions for depreciation and loan interest, and allowances for depletion. In order to compare alternatives on an equal basis, it is necessary to perform all discounted cash flow analysis on an after-tax basis (Stermole and Stermole, 1987). The development of the case study example for after-tax analysis will illustrate the impact of taxes on a project.

2.4.6 Federal and State Taxes

Federal tax laws now call for an upper limit of 34 percent on business income tax. In most states, state income taxes are deductible from federal taxable income, but federal taxes are not deductible from state taxable income. An approach to develop an effective tax rate for both income tax rates follows:

$$\text{Effective Tax Rate} = s + f(1-s) \qquad (2.3)$$

where s is the incremental state tax rate in decimal form and f is the incremental federal tax rate in decimal form.

In a situation where the firm's incremental state income tax rate is 9 percent and the incremental federal income tax is 34 percent the following calculation results:

$$0.09 + 0.34*(1-0.09) = 0.40 \qquad (2.4)$$

The case study will use a tax rate of 40 percent.

Severance and excise taxes are other methods in use by governing authorities to levy taxes on mineral projects. These taxes take many forms including unit taxes based on the amount of product removed or ad valorem taxes based on the value of the product removed. These taxes are considered business expenses and are deductible. The case study will assume a severance tax of 3 percent on production revenues after royalties have been deducted.

2.4.7 Adjustments to Determine Taxable Income

Certain deductions to gross income from operations are allowed for business expenses necessary to generate the income. These adjustments to income result in a figure representing the adjusted taxable income. Operating costs and intangible drilling costs are expensible deductions in the year incurred. Depreciation, depletion, and amortization involve noncash deductions from production revenue. Operating costs include direct and indirect labor costs, materials used, royalties, severance taxes, and interest on project loans.

Intangible drilling costs (IDC) are expenses generated in drilling an oil and gas well to the point of completion. These costs include work related to preparing the location of a well, agreements involved between the partners and contractors, drilling and testing expenses, and the reclamation of the well site (Stermole and Stermole, 1987). The hypothetical firm is an independent so this study will expense IDC's in full.

Depreciation will be considered as a tax allowance represented as a noncash deduction from income before taxes. In this case, tangible costs are treated as ACRS seven-year life assets, and annual deductions come from the modified ACRS depreciation schedule. This schedule uses a 200 percent declining balance switching to straight line depreciation and the mid-quarter convention in the first year. The project begins in December of the current year and the assets will be assumed to be retired at the end of the fifth year. The economic analysis will consider the December depreciation as a time zero event. The year five write-off is the remaining depreciable basis. The depreciation calculations follow:

Year	Method	Rate	Adjusted Basis	200% Declining Balance (DB) to Straight Line (St. Line) Depreciation
0	200% DB	(0.286)* (1.5/12)	225,000	8,036
1	200% DB	0.286	216,964	61,990
2	200% DB	0.286	154,974	44,278
3	200% DB	0.286	110,696	31,627
4	St. Line	0.333	69,069	26,356
5	St. Line &	0.333	69,069	26,356
	Write Off			26,356

Depletion is a deductible noncash item designed to reimburse the owners of economic interests in petroleum and mineral projects for the wasting nature of their reserves. There are two methods of depletion calculation: cost and percentage. Cost depletion generally covers mineral-right acquisition costs and continues only as long as there is cost basis remaining. This cost basis is reduced annually by the actual depletion taken from the higher of the calculations for cost and for percentage depletion. The annual factor used against the adjusted basis is the amount of mineral units removed for the period, divided by the amount of mineral units recoverable at the beginning of the year. Percentage depletion is a deduction calculated as a percentage of production income after royalties for the year. There is a 50 percent limitation; the deduction is limited to 50 percent of taxable income before depletion. Percentage depletion, unlike cost depletion, can accrue in excess of the cost basis of the property. For this reason, the property basis that relates to cost depletion is normally kept at a minimum by investors. The cost depletion basis for the case study is $10,000, the lease acquisition cost of the prospect. The rate of 15 percent is specified by statute for percentage depletion.

The inclusion of the tax aspects of cash and noncash deductions can be seen in Table 2.1. These calculations for the first two years are indicative of all the later years in this project. The after-tax cash flow figures from the entire project can be found below:

$$\begin{aligned} \$336{,}786 = \$140{,}627\ (P/F_{i,1}) &+ \$117{,}537\ (P/F_{i,2}) \\ &+ \$\ 97{,}753\ (P/F_{i,3}) \\ &+ \$\ 83{,}645\ (P/F_{i,4}) \\ &+ \$\ 84{,}046\ (P/F_{i,5}) \end{aligned} \qquad (2.5)$$

The after-tax NPV equation follows:

$$\begin{aligned} \$28{,}257 = \$140{,}627\ (P/F_{i*,1}) &+ \$117{,}537\ (P/F_{i*,2}) \\ &+ \$\ 97{,}753\ (P/F_{i*,3}) \\ &+ \$\ 83{,}645\ (P/F_{i*,4}) \\ &+ \$\ 84{,}406\ (P/F_{i*,5}) \\ &- \$336{,}786 \end{aligned} \qquad (2.6)$$

Table 2.1 After-Tax Cash-Flow Calculations

	Beginning of Year 1	End of Year 1	End of Year 2
Revenue		234,289	204,879
-Royalties		-46,858	-40,976
Net Revenue		187,431	163,903
-Operating Costs		-7,500	-9,000
-Severance Tax		-5,623	-4,917
-Intangible	-175,000		
-Depreciation	-8,036	-61,990	-44,278
Before Depletion	-183,036	112,319	105,708
-50% Limit	56,159	52,854	48,056
-Percent Depletion		-28,115	-24,585
-Cost Depletion		3,886	
Taxable Income	-183,036	84,204	81,122
-Tax @ 40%	73,214	-33,682	-32,449
Net Income	-109,821	50,522	48,673
+Depreciation	8,036	61,990	44,278
+Depletion		28,115	24,585
-Capital Costs	-235,000		
Cash Flow	-336,786	140,627	117,537

The table below provides a comparison of the before-tax cash flow results to the after-tax cash flows. The DCFROR and NPV results are quite different:

	Before-Tax	After-Tax
DCFROR	22.18%	18.90%
NPV	$63,595	$28,257

The differences are the result of the tax impact. Treating taxes as an actual project expense requires all cash-flow studies in this work be on an after-tax basis.

2.5 The Economic Evaluation of the Hypothetical Case Study

The economic evaluation of the hypothetical case study will be conducted using the techniques and assumptions mentioned above. First, a range approach will be observed and further refined by a modified range analysis. Second, the entire project will be studied using all 19 scenarios. This includes a sensitivity analysis of the impact of price variation and the impact of production volume variation. Finally, the DCFROR results for all the scenarios will be summarized.

The NPV and DCFROR results of the range of outcomes to be studied are listed in Figure 2.7. Observing the range

Producing Outcomes	Cp	NPV	DCFROR
Best Case	0.0075	$419,307	61.37%
Most Likely Case	0.1890	28,257	18.90
Worst Case	0.0060	-168,100	-11.25
Dry Hole	0.3000	-96,000	N/A

Cp = Conditional Probability of Occurrence

Figure 2.7 A Range Approach to the Case Study of NPV results shows there is a large amount of upside potential in this project. However, applying the probability factors associated with each scenario, the combined expected NPV of the outcomes is -$21,323. There appears to be a skewing of results as the worst case of the producing outcomes has a greater negative NPV than the dry hole outcome. This skewing may be reduced through the use of a modified range approach.

The development of a modified range approach is shown in Figure 2.8. The lower boundary was chosen to yield a NPV that is not a greater negative number than the dry hole outcome. It is apparent a large portion of the worst case scenarios are being withdrawn for this modified range study. However, the combined conditional probabilities of the withdrawn worst case scenarios is only 0.09 or 9 percent. The total combined conditional probabilities of all withdrawn cases is 0.105 or 10.5 percent. The combined expected NPV of the boundaries of the modified range, the most expected case, and the dry hole case is -$8,463. This negative NPV figure requires further study. One direction that could be taken is to compare this negative NPV to the -$21,323 NPV computed in the first range approach and observe that it represents a smaller loss. The problem is it still reflects a negative expected return for the

	Cp	NPV	DCFROR
Best Case	0.0075	$419,307	61.37%
Second Best Case	0.0075	401,988	59.67
Upper Boundary	0.0630	242,897	46.54
Most Likely Case	0.1890	28,257	18.90
Lower Boundary	0.0050	-61,129	6.89
Fourth Worst Case	0.0420	-105,737	-0.60
Third Worst Case	0.0280	-123,941	-3.69
Second Worst Case	0.0140	-145,813	-7.05
Worst Case	0.0060	-168,100	-11.25
Dry Hole	0.3000	-96,000	N/A

Cp = Conditional Probability of Occurrence

Figure 2.8 A Modified Range Approach to the Case Study project. The next step may be to reject the proposed project. This may not be necessary as the result is a small negative value of expected return. This may encourage a firm to redefine the decision tree that represents the possible project scenarios and increase the expected NPV parameters for the lower boundary.

A subsidiary branch of the hypothetical case study representing the low production volume scenario is found in Figure 2.9. The inclusion of NPV results for each possible outcome reveals all are negative values while only two have a negative value greater than the NPV of the dry hole scenario. Redefining the decision tree for the case study involves eliminating the low production subsidiary branch of the tree and combining the 0.10 probability of the branch's occurrence with the dry hole branch. The idea is to declare any production volume scenario of less than 60,000 barrels, the medium production scenario, as grounds to place the project in the dry hole category. This increases the probability of occurrence to 40 percent for the dry hole branch. This assumes the volume of production can be assessed before well completion is attempted. If the production volume cannot be estimated before the completion expenses are incurred, the decision tree should not be altered and the project should be rejected.

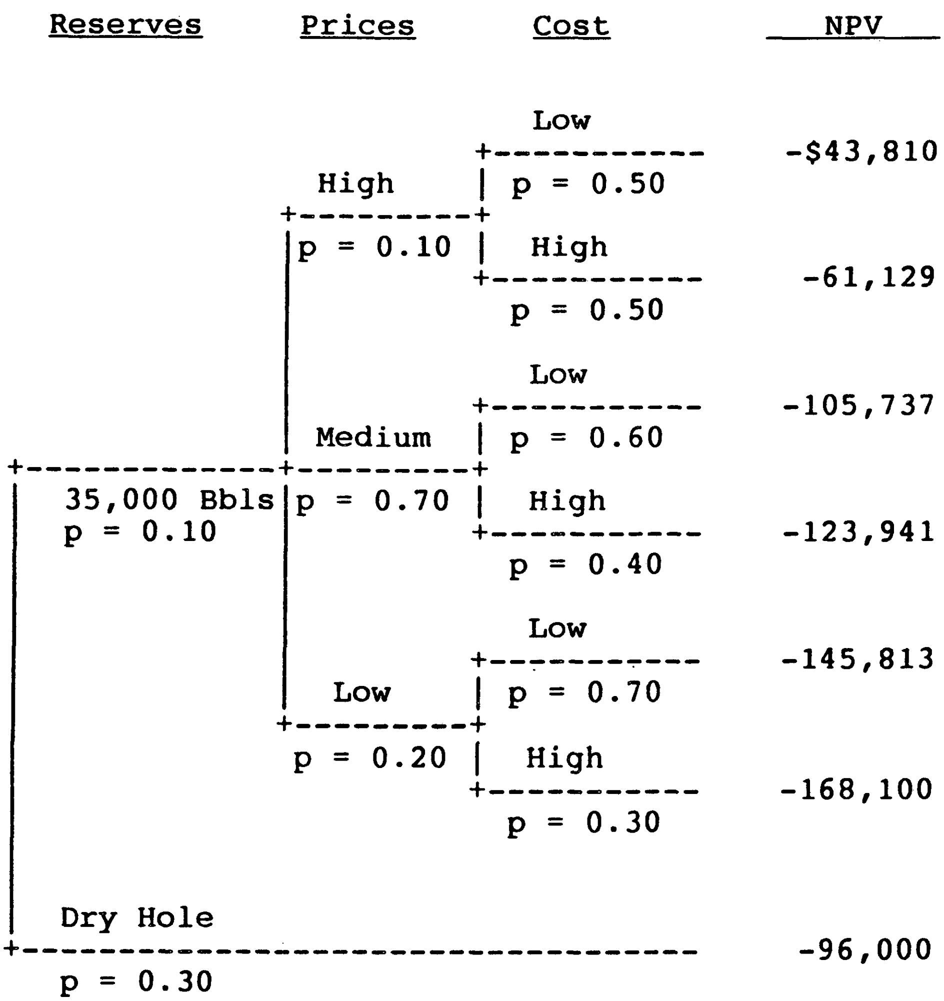

Figure 2.9 The Low Production Subsidiary Branch of the Case Study Decision Tree

Assuming a production volume of less than 60,000 barrels can be predicted the new decision tree for the case study appears in Figure 2.10. An expected NPV for the project can be calculated using the conditional branches of the new tree. The expected value is $14,685 which supports the decision to undertake the project. It is important to note that the abbreviated range methods presented above are guides for understanding the characteristics of a project but should not be used as decision criteria. These methods helped redefine the project's dry hole scenario and clarify the decision to complete the well; if less than 60,000 barrels is expected the well should be abandoned.

The use of these recommended techniques can provide a superior investment decision-making process in comparison with typical methods used in the independent petroleum firms. The use of the range approach can provide a quick overview of the project attributes and help in the development of project scenarios. It must be remembered shortcuts will not provide an adequate basis for proper analysis. If the project is attractive, a full evaluation is warranted.

```
Reserves   Prices   Costs       NPV        Cp         ENPV

                    +------ $419,307 * 0.0075  = $ 3,145
             High   | Low
          +---------+
          |         | High
          |         +------  401,988 * 0.0075  =   3,015
          |
          |         +------  242,897 * 0.0630  =  15,303
  High    | Medium  | Low
+---------+---------+
| 100,000 |         | High
|  Bbls   |         +------  225,578 * 0.0420  =   9,475
|         |
|         |         +------  135,453 * 0.0210  =   2,845
|         |  Low    | Low
|         +---------+
|                   | High
|                   +------  118,134 * 0.0090  =   1,064
|
|                   +------  134,185 * 0.0225  =   3,020
|            High   | Low
|         +---------+
|         |         | High
|         |         +------  116,866 * 0.0225  =   2,630
|         |
|         |         +------   28,257 * 0.1890  =   5,341
| Medium  | Medium  | Low
+---------+---------+
| 50,000  |         | High
|  Bbls   |         +------   10,938 * 0.1260  =   1,379
|         |
|         |         +------  -36,258 * 0.0630  =  -2,285
|         |  Low    | Low
|         +---------+
|                   | High
|                   +------  -53,577 * 0.0270  =  -1,447
| Dry
| Hole
+-------------------------  -96,000 * 0.4000  = -28,800
                                                  -------
             Project Expected NPV =  ENPV      = $14,685
```

Figure 2.10 Expected NPV for Case Study

Chapter 3

THE ECONOMIC EFFECTS OF EXTERNAL PROJECT FINANCE

3.1 Economic Risk and External Funds

External financing provides a major portion of funds for the drilling activities of the independent petroleum industry. Project financing has been an important part of the external funds used for these activities, but recently the structure of this financing vehicle has changed. Traditional project financing arrangements have placed the burden of repayment on the project being funded. The development of structures including guarantees of repayment from assets outside the funded project came with the funding of projects not thought strong enough to fund on their own merit. This drew the economic analyst into considerations of where collateral would be drawn in a situation where the guarantee was exercised. The use of external funds and the direct linkage of repayment to a project's future performance causes several problems in economic investment evaluation. Traditionally, economic risk associated with a venture would be the variability of operating cash flows of the project caused by the uncertainty in operating parameters (Helfert, 1977).

Project financing changed the economic risk inherent in the project although in different ways. Debt financing of projects creates a condition referred to as leverage. The obligation of fixed repayment expenses created by project loans forms a "fulcrum which magnifies the gains or losses of a project in comparison to similar situations in the same project funded entirely with cash" (Helfert, 1977). Leverage increases the variation in project outcome and by definition, thereby increases the project's economic risk.

3.2 Economic Risk and Leverage

In comparison to cash equity funding of a project, the use of debt in project financing produces a leverage effect on the venture's discounted cash-flow analysis. This leverage effect creates an incremental benefit when the project's discounted cash-flow rate of return (DCFROR) is greater than the after tax cost of the borrowed funds (Stermole and Stermole, 1987). Additionally, the fixed obligation of principal and interest payments creates an incremental loss of benefit when the cash investment DCFROR is less than the after-tax cost of debt.

An illustrative example of leverage can be drawn from the net cash-flow diagrams for a cash investment scenario and a leveraged scenario of the same income-producing investment project. These before-tax scenarios and the calculation of the resulting DCFROR figures are shown in Table 3.1. The difference between the scenarios is the addition of the loaned funds as an income at time zero which reduces the cash investment in capital and the addition of annual costs representing the principal and interest charges in uniform and equal amounts. The DCFROR figure for Scenario One, the cash investment case, is 13.21 percent while the leveraged DCFROR for Scenario Two, the loaned funds case, is 21.24 percent. These results show a marked increase in DCFROR from the addition of loaned funds to the project. The downside of this situation is illustrated in Table 3.2. In these scenarios all parameters are identical with the exception of the project's revenue stream which has been reduced by 20 percent. The drop in income impacts the project as seen below:

	Cash Investment DCFROR	50% Leverage DCFROR
100% Revenues	13.21%	21.24%
80% Revenues	-1.26%	-7.60%

The greater range of project DCFROR outcomes in the leveraged case supports the position stated in the last section that external funds increase project economic risk.

Table 3.1 An Income-Producing Investment Project

Scenario One: Cash Investment

```
                        I = +500       I = +500       I = +500
         C = -1000     OC =  -75      OC =  -75      OC =  -75
         |-------------|--------------|--------------|
         0             1              2              3
NCF =        -1000          +425           +425           +425
```

Before-tax Project DCFROR = 13.21%

Scenario Two: Leveraged Investment;
Simple Interest of 10%

```
                        I = +500       I = +500       I = +500
         L =  +500     OC =  -75      OC =  -75      OC =  -75
         C = -1000      P = -183       P = -183       P = -184
         |-------------|--------------|--------------|
         0             1              2              3
NCF =         -500          +242           +242           +241
```

Before-tax Leveraged Project DCFROR = 21.24%

LEGEND

C = Cash Cost of Investment	OC = Operating Costs
I = Income	L = Loaned Funds
P = Principal and Interest	NCF = Net Cash Flow

Table 3.2 An Income-Producing Investment Project with a Reduced Revenue Stream

---

Scenario One: Cash Investment Assuming 80% Revenue Stream

```
                      I = +400      I = +400      I = +400
        C = -1000    OC =  -75     OC =  -75     OC =  -75
        |------------|-------------|-------------|
        0            1             2             3
NCF =       -1000         +325          +325          +325
```

Before-tax Project DCFROR = -1.26%

Scenario Two: Leveraged Investment Assuming 80% Revenue Stream and Simple Interest of 10%

```
                      I = +400      I = +400      I = +400
        L =  +500    OC =  -75     OC =  -75     OC =  -75
        C = -1000     P = -183      P = -183      P = -184
        |------------|-------------|-------------|
        0            1             2             3
NCF =        -500         +142          +142          +141
```

Before-tax Leveraged Project DCFROR = -7.60%

LEGEND

C = Cash Cost of Investment	OC = Operating Costs
I = Income	L = Loaned Funds
P = Principal and Interest	NCF = Net Cash Flow

The use of leverage has been shown to increase project economic risk. It is important to note the increase in the proportion of leverage to cash investment in total project investment also increases the variation in possible project economic outcomes and thus increases the economic risk. The results of our previously mentioned DCFROR calculations can be combined with those from Table 3.3 and Table 3.4 to illustrate this increase in project economic risk.

	Cash Investment DCFROR	Leveraged DCFROR 25%	50%	75%
100% Revenues	13.21%	15.90%	21.24%	36.31%
80% Revenues	-1.26%	-3.37%	-7.60%	-21.76%

The increase in variation of project DCFROR outcomes as revenues vary and leverage increases is clear. The cause of the increase in economic risk as leverage increases is based on the decreasing amount of initial cash investment net cash flow. The unamortized investment is smaller in the leverage cases and the leveraged economic analysis results are more sensitive to changes in project parameters than in the cash investment case (Stermole and Stermole, 1987). The difference in unamortized investment between the cash investment and the 50 percent leverage case is important. The meaning of the investment DCFROR is

Table 3.3 An Income Producing Leveraged Investment Project with Different Proportions of Leverage

---

Scenario One: Leveraged Investment With 25% Leverage and Simple Interest of 10%

```
                         I = +500      I = +500      I = +500
         L =  +250      OC =  -75     OC =  -75     OC =  -75
         C = -1000       P =  -91      P =  -92      P =  -92
         |------------|------------|------------|
         0            1            2            3
NCF =         -750          +334          +333          +333
```

Before-tax Leveraged Project DCFROR = 15.90%

Scenario Two: Leveraged Investment With 75% Leverage and Simple Interest of 10%

```
                         I = +500      I = +500      I = +500
         L =  +750      OC =  -75     OC =  -75     OC =  -75
         C = -1000       P = -275      P = -275      P = -275
         |------------|------------|------------|
         0            1            2            3
NCF =         -250          +150          +150          +150
```

Before-tax Leveraged Project DCFROR = 36.31%

LEGEND

C = Cash Cost of Investment
I = Income
P = Principal and Interest

OC = Operating Costs
L = Loaned Funds
NCF = Net Cash Flow

Table 3.4 An Income Producing Leveraged Investment Project with Different Proportions of Leverage and Reduced Revenues

---

Scenario One: Leveraged Investment With 25% Leverage Assuming 80% Revenue Stream and Simple Interest of 10%

	0	1	2	3
		I = +400	I = +400	I = +400
	L = +250	OC = -75	OC = -75	OC = -75
	C = -1000	P = -91	P = -92	P = -92
NCF =	-750	+234	+233	+233

Before-tax Leveraged Project DCFROR = -3.37%

Scenario Two: Leveraged Investment With 75% Leverage Assuming 80% Revenue Stream and Simple Interest of 10%

	0	1	2	3
		I = +400	I = +400	I = +400
	L = +750	OC = -75	OC = -75	OC = -75
	C = -1000	P = -275	P = -275	P = -275
NCF =	-250	+50	+50	+50

Before-tax Leveraged Project DCFROR = -21.76%

LEGEND

C = Cash Cost of Investment
I = Income
P = Principal and Interest
OC = Operating Costs
L = Loaned Funds
NCF = Net Cash Flow

different from the meaning of the leveraged DCFROR because the unamortized outlays these DCFRORs are based on are completely different (Stermole and Stermole, 1987). The loan of 50 percent of the initial investment cost reduces the initial cash investment. The amount borrowed postpones the actual payment of that amount over the three-year life of the loan. The repayment of the principal and the interest charge is deducted from the annual net cash flow. The differences in the initial cost creates a situation where leverage investment DCFROR results cannot be compared to cash investment DCFROR results. This case underlines the importance of proper techniques in evaluating leveraged projects for investment decision purposes.

Five general rules for analyzing leveraged investments have been proposed by Stermole and Stermole:

> 1. Always compare all alternatives with the same or similar leverage, including the project alternatives that determine the minimum rate of return. Since the risks and uncertainties and the meaning of economic results with different amounts of leverage are not the same, it is not reasonable for investment decision making purposes to compare project analysis results based on different amounts of leverage.
>
> 2. Since more and more leverage gives higher and higher DCFROR results, the use of leveraged economic analysis results for decision making purposes can sometimes mislead the decision-maker into thinking a marginal project is a better project than it actually is. For this reason

there is considerable merit in making zero leverage, the cash investment case, as the common basis for comparing all investment opportunities. This approach is based on analyzing all projects from the viewpoint, "Would I be willing to invest my cash in any or all of the projects considered if I had the money?" If the answer is yes, "Which projects would be best?" The cash investment analysis approach is used by a majority of companies. Another advantage of this approach is that it does not require knowing the financing conditions when the analysis is made. Since financing arrangements often are not finalized until just before initiation of a project, using cash investment economic analysis eliminates the need to guess and make sensitivity analysis for different borrowed money assumptions. Remember if the after-tax cost of borrowed money is less than the cash investment DCFROR, leverage will work for you and the leveraged DCFROR on your equity investment will be greater than the cash investment DCFROR for any and all investment projects. If the cash investment economic analysis results look satisfactory, the leveraged results will look even better if the after-tax borrowed money interest rate is less than the cash investment DCFROR.

3. There are exceptions to every rule. In cases where interest free nonrecourse loans are made available by another company to be repaid out of production product, or revenue if a project is successful, the leverage considerations are not the same as we have been discussing. To illustrate this concept, in past years some companies needing natural gas reserves have funded drilling companies in this manner. If the obligation to repay the loan does not exist if the project fails, the risk and uncertainty conditions are obviously very different than when repayment of the loan must be made whether we succeed or fail. In the non-recourse loan analysis case we would want to verify that the net present value that we could get by tying up our equipment and employees would be at least as great as the net present value we could generate by putting (the same resources) on other projects being considered.

Comparing DCFROR results is of little or no value in this case because you get an infinite percent DCFROR with 100% borrowed money.

4. Different projects attract better financing than others because of the relative risks involved with different projects in the eyes of the lender. Cash investment analysis does not take this into account. Looking at projects on a cash investment basis is going to give you a good and probably the best basis for evaluating how a lender will view the economic potential and risk and uncertainty associated with projects, but it may be necessary to make a leveraged analysis comparison to take into account financing differences. Remember, the number one concern of a lender is "will there be sufficient project cash flow to cover mortgage payments over the life of the project?"

5. Finally, the use of borrowed money relates to a finance decision as well as having an effect on economic evaluation results with and without leverage. Remember, we have been discussing how to determine the best projects from an economic viewpoint regardless of where the money is coming from to finance these projects. Now after it has been determined that given projects look satisfactory from a cash investment viewpoint, if we have the money to spend, it may also be necessary to analyze the projects from a leveraged viewpoint for financial as well as economic reasons if the financing terms are different for the different projects. This was mentioned in the previous paragraph. Remember to use the same leverage in all analysis cases and use incremental analysis if the alternatives are mutually exclusive. For non-mutually exclusive alternatives use cumulative NPV or use growth DCFROR or Present Value Ratio to rank the projects that will maximize the profit on your available equity capital. (Stermole and Stermole, 1987, 383-385)

The concepts involved in the first two rules have been discussed. Rule 1 is based on maintaining similar amounts of unamortized investment in leveraged economic analysis in order to equalize the risks and uncertainties in projects being evaluated. Rule 2 addresses the idea of evaluating investments using zero leverage in order to evaluate alternatives using the minimum rate of return for cash investment. This practice avoids the distortion leverage creates in economic project evaluation. Rules 3, 4, and 5 involve the terms of external financing arrangements. Lenders may require collateral in certain cases or they may impose higher interest charges to compensate for their perception of higher levels of risk and uncertainty in a project's ability to repay the loan. The ability of the economic analyst to handle these situations where financial terms vary between alternative investments can be enhanced by considering lenders' requirements for providing capital.

3.3 Lenders' Viewpoint of External Financing

The lender's viewpoint towards a leveraged project is in regard to the return from the funds he provides to the project. Considered is the time value of money, the economic risk of the cash case of the project, and the additional economic risk created by the leverage being funded. Risk premiums are tied to the lender's view of project risk and economic risk which are a part of the interest rate proposed for the funding arrangement. Most important is the lender's measurement of the ability of the project to repay the loan and interest costs.

Coverage measurements gauge the ability of a project's annual net cash flow to service debt obligations. Coverage is generally measured as the ratio of cash flow available for debt service (CFADS) to the principal and interest payments (Regan, 1983). The most important coverage ratio is the one which occurs during the first year of repayment. This ratio measures how much coverage there is on the maximum amount of borrowed funds; subsequent ratios are based on the declining loan balance (Regan, 1983). There are various methods for determining CFADS and the ratios describing coverage. It is important that the needs of a lender be considered in the use of any specific technique.

Undiscounted coverage will be defined for this study as the remaining project CFADS divided by the remaining principal and after-tax interest payments. The life-of-loan coverage ratio considers the CFADS only during the loan term. The life-of-reserves coverage ratio considers the CFADS for the entire project. It is important in comparisons of similar ratios from alternative investment projects that the CFADS be accounted for over the same length of time (Regan, 1983).

Considering the range of possible project outcomes, the lender is most interested in the portion of project outcomes where meeting debt obligations could become impossible. The lender's opinion of the worst possible but realistic outcome and the coverage present in that situation is a common method of evaluating the lender's risk in a possible loan.

The coverage ratio required for the most expected project outcome is generally between 1.5 to 2.0 (Toal, 1988). Banks normally look to a 2.0 life-of-loan ratio while other sources such as mezzanine financiers look for at least 1.5 life-of-loan coverage. The key to the lower acceptable coverage would be revenue-sharing arrangements or the pledging of collateral to secure the loan.

The determination of suitability for lending should begin with the evaluation of the zero leverage case of an investment project. If the cash investment project meets the minimum rate of return, the next step is to structure a desirable loan. The structure should include the desired loan amount, interest rate, and term. Incorporating this structure into the project analysis may take the help of the potential lender as the payment schedule may involve the accelerated payment of interest or other methods not obvious to a borrower. This level of analysis should include the determination of CFADS and the calculation of coverage ratios for both the life of the loan and the life of reserves (life of the project). At this point, the analyst has enough information to adjust the proposal to meet the standards of the potential lenders. The economic analysis for investment decision purposes of a four-year project is exhibited in Table 3.5. In Scenario One, a zero leverage case, the project's before-tax DCFROR is 16.52 percent. This will be considered an acceptable cash investment DCFROR and analysis will continue with leveraged DCFROR and coverage ratio calculations. Scenario Two assumes 50 percent leverage, a discrete interest rate of 10 percent applied against the outstanding amount of principal, and a loan term of three years. The revenue stream of this four-year project is unchanged from Scenario One. Calculations for Scenario Two follow:

50% Leveraged Before-Tax DCFROR = 20.84%

Coverage Ratios	Year 1	Year 2	Year 3
Life of Loan	1.81	1.88	1.97
Life of Reserves	2.41	2.83	3.94

The life-of-loan coverage ratios of the 50% leveraged case support the lending arrangement with values starting at 1.81, but they may be below the standards of some lenders. If so, a loan with a collateral agreement may be necessary.

Table 3.5 An Income Producing Investment Project with Coverage Ratio Calculations

---

Scenario One: 0% Leverage Assuming 100% Revenue Stream, Discrete Interest of 10% on Remaining Principal and Loan Term of 3 Years

	0	1	2	3	4
	L = 0	I = +400	I = +400	I = +400	I = +400
	C = -900	C = -75	OC = -75	OC = -75	OC = -75
NCF =	-900	+325	+325	+325	+325

Before-tax Project DCFROR = 16.52%

LEGEND

C = Cash Cost of Investment
I = Income
P = Principal and Interest
LOL = Life Of Loan
LOR = Life Of Reserves
OC = Operating Costs
L = Loaned Funds
NCF = Net Cash Flow
CFADS = Cash Flow Available for Debt Service

(continued on next page)

Table 3.5 (Continued)

Scenario Two: 50% Leverage Assuming 100% Revenue Stream, Discrete Interest of 10% on Remaining Principal and Loan Term of 3 Years

```
L =      +450 I  = +400     I  = +400     I  = +400     I  = +400
C =      -900 C  =  -75    OC  =  -75    OC  =  -75    OC  =  -75
|-------------|-------------|------------|------------|
0             1             2            3            4

CFADS = -450       +325          +325          +325         +325
P     =    0       -195          -180          -165            0
        ----       ----          ----          ----         ----
NCF   = -450       +130          +145          +160         +325
```

Before-tax Leveraged Project DCFROR = 20.84%

Coverage Ratios	Year 1	Year 2	Year 3
LOL	975/540 = 1.81	650/345 = 1.88	325/165 = 1.97
LOR	1300/540 = 2.41	975/345 = 2.83	650/165 = 3.94

LEGEND

C = Cash Cost of Investment
I = Income
P = Principal and Interest
LOL = Life Of Loan
LOR = Life Of Reserves
OC = Operating Costs
L = Loaned Funds
NCF = Net Cash Flow
CFADS = Cash Flow Available for Debt Service

(continued on next page)

Table 3.5 (Continued)

Scenario Three: 50% Leverage Assuming 75% Revenue Stream, Discrete Interest of 10% on Remaining Principal and Loan Term of 3 Years

```
L =     +450 I = +300     I = +300     I = +300     I = +300
C =     -900 C =  -75    OC =  -75    OC =  -75    OC =  -75
|------------|------------|------------|------------|
0            1            2            3            4

CFADS = -450      +225          +225          +225       +225
P     =    0      -195          -180          -165          0
        ----      ----          ----          ----       ----
NCF   = -450       +30           +45           +60       +225
```

Before-tax Leveraged Project DCFROR = -6.42%

Coverage Ratios	Year 1	Year 2	Year 3
LOL	675/540 = 1.25	450/345 = 1.30	225/165 = 1.36
LOR	900/540 = 1.67	675/345 = 1.99	450/165 = 2.73

LEGEND

C = Cash Cost of Investment	OC = Operating Costs
I = Income	L = Loaned Funds
P = Principal and Interest	NCF = Net Cash Flow
LOL = Life Of Loan	CFADS = Cash Flow Available for Debt Service
LOR = Life Of Reserves	

(continued on next page)

Table 3.5 (Continued)

Scenario Four: 40% Leverage Assuming 50% Revenue Stream, Discrete Interest of 10% on Remaining Principal and Loan Term of 3 Years

```
L =     +360 I = +200     I = +200     I = +200     I = +200
C =     -900 C =  -75    OC =  -75    OC =  -75    OC =  -75
|------------|------------|-----------|-----------|
0            1            2           3           4

CFADS = -540      +125         +125         +125         +125
P     =    0      -156         -144         -132            0
        ----      ----         ----         ----         ----
NCF   = -540       -31          -19           -7         +125
```

Before-tax Leveraged Project DCFROR = -33.90%

Coverage Ratios	Year 1	Year 2	Year 3
LOL	375/432 = 0.87	250/276 = 0.91	125/132 = 0.95
LOR	500/432 = 1.16	375/276 = 1.36	250/132 = 1.89

LEGEND

C = Cash Cost of Investment
I = Income
P = Principal and Interest
LOL = Life Of Loan
LOR = Life Of Reserves
OC = Operating Costs
L = Loaned Funds
NCF = Net Cash Flow
CFADS = Cash Flow Available for Debt Service

The year one life-of-reserves ratio of 2.41 shows project lifetime cash flows would cover a collateral agreement.

The lending institution will be interested in a worst case scenario which will be assumed as a case of receiving 75 percent of the estimated revenue stream. This case is shown in Scenario Three of Figure 3.5 and summarized below:

50% Leveraged Before-tax DCFROR = -6.42%

Coverage Ratios	Year 1	Year 2	Year 3
Life of Loan	1.25	1.30	1.36
Life of Reserves	1.67	1.99	2.73

The leveraged before-tax DCFROR in this case is a disturbing -6.42 percent. However, the lender is not worried about the borrower's return. The lender will be happy to find that the coverage ratios indicate the project will still be able to meet loan payments in either the life-of-loan or the life-of-reserves arrangements. These findings may assist the borrower in his loan proposal and in negotiations to finalize the loan structure. This situation could occur where the worst case possible in the view of the borrower varies from that of the lender. The project developed in Table 3.5 may have to be considered using a worst case of revenues being reduced to one-half of original estimates. Scenario Four of Figure 3.5 covers this decrease in revenues and the leverage percentage of total project funding is reduced to 40 percent, which is considered the minimum amount the borrower must obtain to undertake the project. The results of this case follow:

40% Leveraged Before-tax DCFROR = -33.90%

Coverage Ratios	Year 1	Year 2	Year 3
Life of Loan	0.87	0.91	0.95
Life of Reserves	1.16	1.36	1.89

The leveraged before-tax DCFROR is a disastrous -33.90 percent. The life-of-loan coverage ratios indicate the loan would not be repaid in any of the three years of the loan if the project revenues decreased by 50 percent. This is indicated by the ratios being less than 1.0. The life-of-reserve ratios indicate a brighter situation; all ratios are greater than 1.0 which means the loan could be paid from the proceeds of the project. The loan proposal could be adjusted to a leveraged level of 40 percent of the total project investment cost and include a collateral agreement pledging project revenues for the life of the project.

3.4 Leveraged Economic Evaluation of the Hypothetical Case Study

The hypothetical case study introduced in the last chapter provides an excellent example of an after-tax leveraged evaluation. The project assumptions remain unchanged; financing arrangements are defined in Table 3.6.

The calculation of leveraged cash flow streams is straightforward. Interest charges are considered expensible items in computing taxable income. The loan is considered a positive adjustment to the net cash flow; it reduces the actual cash outlay of the firm. Principal payments are considered as negative adjustments to the net cash flow; they reduce actual cash flow in the same way as capital costs. The leveraged cash flow calculations for two years of the case study's most likely case can be found in Table 3.7. This method of computation continues for the remaining years of this scenario and will be observed for all leveraged cash flow calculations in this work. The leveraged DCFROR value for this scenario is 21.44 percent. This compares to the cash DCFROR for the same scenario of 18.90 percent. The leveraged effect of the borrowed funds increases the project DCFROR. Table 3.8 summarizes a price sensitivity analysis for the cash and leveraged scenarios. The cash DCFROR of -0.60 percent for the low production scenario is below the after-tax cost of borrowed funds. The increasingly negative effect of leverage is present as the fixed obligation of principal and interest payments creates an incremental loss of benefit.

Table 3.6 Assumptions for Leveraged Case Study Evaluation

Before-tax Interest Rate	=	12.00%
After-tax Interest Rate	=	0.12 * (1-0.40)
	=	7.20%
Loan Term	=	Four Years
Loan Amount	=	25% of Tangible Costs
	=	$58,750
Payment Structure	=	Uniform and Equal Payments

Amortization Schedule

Period Ending	Principal	Interest	Total	Remaining Balance
12/88	58,750			
12/89	11,397	6,491	17,888	47,353
12/90	13,942	4,932	18,874	33,412
12/91	15,710	3,164	18,874	17,702
12/92	17,702	1,172	18,874	
TOTAL	58,750	15,759	74,509	

Table 3.7 After-Tax Leveraged Cash-Flow Calculations

	Beginning of Year 1	End of Year 1	End of Year 2
Revenue		234,289	204,879
-Royalties		-46,858	-40,976
Net Revenue		187,431	163,903
-Operating Costs		-7,500	-9,000
-Severance Tax		-5,623	-4,917
-Intangible	-175,000		
-Depreciation	-8,036	-61,990	-44,278
-Interest		-6,491	-4,932
Before Depltn	-183,036	105,827	100,775
-50% Limit		52,914	50,388
-Percent Depltn		-28,115	-24,585
-Cost Depltn		3,886	
Taxable Income	-183,036	77,712	76,190
-Tax @ 40%	73,214	-31,085	-30,476
Net Income	-109,821	46,627	45,714
+Depreciation	8,036	61,990	44,278
+Depletion		28,115	24,585
-Principal		-11,397	-13,942
-Capital Costs	-235,000		
+Borrowed	58,750		
Net Cash Flow	-278,036	125,335	100,636

Table 3.8 Sensitivity Analysis of Leveraged DCFROR for the Case Study

Reserves	Prices	Costs	Cash DCFROR	Leveraged DCFROR 25%	50%	75%
High	Medium	Low	46.54	54.44	66.49	87.29
Medium	Medium	Low	18.90	21.44	25.27	31.80
Low	Medium	Low	-0.60	-2.03	-4.30	-8.14

3.5 Overview of External Financing

The use of external funds affects the economic risk inherent in a project. The increased variation of possible outcomes increases the need to establish a consistent basis of analysis: equal amounts of leverage in investment alternatives, similar funding structures and collateral arrangements, and equal project lives. The vast array of possibilities that external financing adds to project economic evaluation stresses the need to perform zero leverage analysis to ensure the project is worthy of further examination. It is remarkable but extremely common for borrowers to approach lenders without having considered the zero leverage scenario of their project proposal. This tendency results from the desire to lever as much as possible to accelerate the firm's growth (Regan, 1983).

Borrowers may also be watchful of lenders who ignore poor zero leverage returns and proceed with the structuring of onerous loan arrangements.

Chapter 4
NEW SOURCES OF EXTERNAL FUNDS: MEZZANINE FINANCING

4.1 The New Market for External Funds

The market in obtaining and placing external funds in the independent petroleum industry has changed dramatically. The problems resulting from lending in the boom days of early 1980s continue to haunt the oilpatch. Traditional sources of external funds, the money center and regional banks, have retrenched to a point where only large clients or extremely low-risk projects are funded. The financial needs of the independent sector have begun to be fulfilled by sources not familiar to the industry. Professional money managers have increased their presence. Representing institutional investors such as pension funds, university endowments, and insurance company investment groups, these money managers approach today's oil and gas market with a unique viewpoint. Most see the market as a cyclical one and investing now should help to hedge their investments in industries that are counter-cyclical to the petroleum market.

4.2 Professionally Managed Money and the Independent Oil Industry

The practice of committing funds to professional money managers has been common in the world of institutional capital. Specialists receive funds to invest in certain sectors of the economy. These investment experts may deal in tax-exempt government securities, common stock mutual funds, and other traditional financial instruments. Often, the capital pools contract outside advisory firms to invest funds in unfamiliar areas or areas that they may not want invest directly. Advisory firms differ in their practices of investment but all serve as an intermediary between the funding source, and the user of the funds. In the petroleum industry, these advisory firms are few in number but large in the amount of financial clout they possess.

The main factor limiting the number of petroleum investment advisory firms is the specialized treatment necessary to cultivate and continue a relationship with the capital pool managers. One firm, Rotan Mosle, Inc., has walked away from this business because of their impression that relationships with institutional investors were more like education than money making. (Kindley, 1987) Other limitations include the laws controlling pension funds. These regulations are complex and investments must be structured to avoid problems with ERISA (Employee Retirement Investment Security Act of 1974). ERISA requires investments to be passive. Petroleum investments must be structured to convert pension fund participation from a working interest into a net profits overriding royalty interest. There is no clear answer for this grey area of conversion as legal and competitive forces have kept specific practices secret.

The motivation to work in the grey legal area of pension fund investment is monetary. Pension funds in the United States control more funds than any other group in the world except for OPEC. Estimates in 1987 placed the amount at over $2 trillion (Kindley, 1987). During the early 1980s, pension funds accounted for $1 billion invested in the petroleum industry. This shrank to $600 million in 1985. These figures involve all investment in the industry, stock holdings as well as investment in projects. The trend has quietly reversed: in 1986, $800 million of pension fund assets were petroleum industry assets (Kindley, 1987). The author sees fund investment increasing in the future, but access will be limited.

Advisory firms are a key in accessing pension managers as most money managers prefer to remain unassociated with the firms in which they invest. Therefore dealing with advisory firms may be necessary for petroleum companies to tap these funds. The author suggests that establishing relationships with these entities depends on communication using common terminology. If the advisory firm can avoid an educational role with its clients, a majority of effort would rest on developing the relationships with fund investors. The understanding and use of the leverage DCFROR concepts presented in this paper would be an excellent step in improving the petroleum firm's communication process. Another step is understanding the market of the advisory firm.

4.3 Institutional Funds and the Advisory Firm

Institutional investments range from $75 million annually by AT&T's pension fund to less than $5 million investments by institutional partnerships. The big investments find their way to the oil patch via advisory firms such as Chase Investors Management Corp. and Trust Company of the West (Kindley, 1987). These firms control over $1.6 billion in funds earmarked for petroleum and have placed almost half of that amount. Their targets are proven performers with strong balance sheets; funds were provided to firms with an average net worth of roughly $50 million. Apache Corporation and Sabine Corporation are examples of firms involved at this level. Bigger companies can swing lower rates through traditional bank financing or the public placement of debt instruments (Kindley, 1987).

Smaller advisory firms include Resource Investors Management Company (RIMCO) and funds are drawn into these firms through private placements with institutions. Private placements in this context involve a partnership agreement where the advisory firm details its investment plans for the funds raised through the offering. The firms market their placements with various capital pools and, after closing the placement, proceed to invest funds in accordance with their partnership agreement. The agreements may provide broad or specific guidelines for investment targets but the structure of the funding arrangements with petroleum companies is fairly typical. These funding arrangements have become known as mezzanine financing vehicles (Kindley, 1987).

4.4 Mezzanine Financing

The mezzanine financing of projects involves the middle ground between debt and equity funding. A mezzanine funding structure includes loans with an obligation of repayment and usually the granting of proceeds, an equity kicker, from the project by the borrower to the lender.

The additional income assigned to the lender is designed to enhance the yield of the loan and compensate the lender for the additional risk that more traditional lenders may not undertake (Toal, 1988). This is not to imply mezzanine financing is intended for marginal projects. This type of external funding intends to provide a competitive source of finance for stable firms with attractive projects.

Generally, the loan aspect of the package is a fixed-rate note linked to the prevailing interest rate for seven year Treasury bills and set roughly at 3.0 percent to 3.5 percent above Treasury bills. The equity kicker aspect is designed to provide the lender added benefit in the investment project so that his yield on the loaned funds will approach 15 percent or even higher (Toal, 1988). The equity kicker can take many forms, including net profits interest, overriding royalty interest, or even the right for the lender to convert the loan into equity of the borrowing firm. The ability to trigger the kicker has even been built into some structures where the borrower loses no revenue interest in the project if conditions do not meet a certain threshold but with the interest reverting to the lender if that threshold is surpassed. For instance, a petroleum drilling investment could be funded where the borrower does not provide a net profits interest to the lender unless the price of crude oil exceeds a predetermined level. The lender receives a upside to his loan and the borrower does not add to his downside risk.

The scale of this form of financing is far from small; since 1983 petroleum-oriented mezzanine lenders have raised $1.2 billion from institutional clients for placement. These pools have placed or committed $684 million of that amount as of July 1988 (Toal, 1988). Candidates for this vehicle vary as the lenders have market targets that differ according to their perception of opportunity in the petroleum industry. Examples include a Citicorp Mezzanine placement of $7.5 million with Plains Resources, Inc. which will use the funds to drill development wells on property it owns in the Kansas Hugoton Field and in other areas. Plains had tapped its own capital reserves when it recently bought its Hugoton properties for $4 million. The mezzanine lender in this case was targeting a growth company and provided funds that would not have been accessible through the commercial banking industry because of the company's financial structure (Toal, 1988).

4.5 The Analysis of Mezzanine Investment Projects

It is suggested that the proper analysis of mezzanine investment projects for decision-making purposes involves an additional step. This step comes between the evaluation of the zero leverage case and the leveraged case. The inclusion of the equity kicker to the zero leverage case will provide an answer to the attractiveness of the equity kicker. It is possible that a zero leverage case may meet minimum standards for economic performance, but with the inclusion of the equity kicker, those standards may not be met. In this instance, the borrower may need to discuss the structure with the potential lender and together develop an alternative structure.

The development of a cash-flow analysis illustrating this practice uses the most expected case from the hypothetical case study. The cash investment scenario requires adjustment at an intermediate step, the inclusion of a 5 percent ORRI for the equity kicker. This increases the royalty burden in the project from 80 percent to 85 percent. The leveraged analysis includes the three levels of loan size, 25 percent, 50 percent, and 75 percent of tangible assets, with an associated interest rate of 9 percent. The results are below:

Cash DCFROR	Cash Project with 5% ORRI	Leveraged Project with 5% ORRI 25%	50%	75%
18.90%	16.13%	18.40%	21.83%	27.63%

The intermediate step has a DCFROR greater than the firm's minimum rate of return of 15 percent; therefore, the project remains an attractive investment. The next step in calculating the leveraged project can assist in determining if this form of financing is more attractive than the leverage alternatives studied in the last chapter.

Cash DCFROR	Leveraged Project 25%	50%	75%
18.90%	21.44%	25.27%	31.80%

Comparing these results with the original leveraged DCFROR results of the same scenario, it can be seen the financing scheme involving a straight 12 percent rate and no ORRI kicker is the most favorable form of external financing.

4.6 Overview of Mezzanine Financing

The huge resources of institutions and the limited access to these resources underlines the need for independent petroleum firms to sharpen their analytical skills in mezzanine funding situations. Tapping these resources will depend on the firm communicating its needs, its projections, and its performance to an audience of financial experts. The future of the independent petroleum industry relies on its sources of external capital; the institutional market is the answer to this source of funds.

Chapter 5

SUMMARY AND CONCLUSIONS

5.1 Summary

The independent oil industry relies on external funds for most of its exploration and development activities. In the past, the typical approach to investment analysis has not included time value of money considerations nor the proper risk weighting of uncertain project parameters. The author realizes these aspects of analysis have become more widespread in their use by managers in this industry sector, but the use of these techniques in the analysis of externally funded projects has not become widely accepted. This work presents a recommended approach to the proper implementation of economic evaluation techniques for the analysis of externally funded investments projects. Also, this work covered a new source of external funds for this industry sector, mezzanine financing. The use of the techniques recommended will become more important as the industry increases its access to this new source of funds. The controlling forces behind these funds are financially adept and will require these practices.

The presentation of a case study to illustrate the economic impact of leverage created by external funds is preceded by the discussion of decision tree, probability tree, and sensitivity analysis. Hypothetical project assumptions are presented and a discussion of uncertainty and risk analysis follows using these assumptions. The ability to determine the inherent economic risk of a cash-funded project is crucial to determining what additional risk is introduced by external funds. The techniques of determining DCFROR values for leveraged projects involves the adjustment of net cash flow calculations to include the after-tax cost of loan interest payments, the infusion of capital to the project via the loan principal, and the subsequent repayment of the loan principal. The resulting leveraged cash flow figures are most useful in DCFROR calculations. The comparison of leveraged projects via DCFROR values is meaningful only when the project alternatives are structured with similar external funding. The use of leveraged net present value (NPV) calculations is meaningful only with the use of minimum rate of return values adjusted for the proportion of leverage present in each alternative. This involves the development of a cash-funded alternative which returns the cash minimum rate of return and then levering the project using various proportions of external funds. The DCFROR results of those cases will be the leveraged minimum rate of return for that specific proportion of leverage. This is an incredibly involved process, not recommended nor mentioned in the body of this work.

The economic evaluation of the case study illustrates the increase in leveraged DCFROR values as leverage increases when the after-tax 100% cash funded DCFROR is greater than the after-tax cost of borrowed funds. Converse is when the after-tax 100% cash funded DCFROR is less than the after-tax cost of borrowed funds, leveraged DCFROR values decrease. This stresses the importance of conducting 100% cash-funded analysis for projects proposed for external funding.

The discussion of institutional sources of external funds is directed towards the mezzanine loan market. This market fills the area between debt agreements and equity transfers. This practice normally involves the loan of funds at a rate of approximately 10% and the transfer of an interest in the production revenues in an amount designed to reward the lender for additional risk created by the project itself and/or the leverage created by the loan. This transfer of interest requires an intermediate step in the economic evaluation of a leveraged investment project. This step considers a scenario of 100% cash funding but includes the transfer of the revenue interest to the lender. This scenario isolates the impact of the transfer of interest, and if this scenario does not provide attractive DCFROR or NPV results, the project should not be externally funded as the loaned equity destroys attractive economic returns before the loan is granted.

The discussion of the institutional investment market is important as the independent oil industry has had little exposure to this arena. The funding capabilities of this market are immense and the future of many independent oil companies could hinge on their ability to tap this market. The role of the advisory firm in the transfer of funds from institutions to oil firms cannot be stressed enough. The advisors are in place to assist in the placement of funds and the recommendations are the key to any mezzanine arrangements. If one can convince the advisory firm of a proposal's economic merit, the institution should accept the project. Convincing the advisory firm of economic merit requires the communication of the economic and financial attributes of the proposal. The techniques presented provide the basis for this communication.

5.2 Conclusions

The future of the independent petroleum industry lies in its ability to attract external funds. The geologic quality of its investment alternatives will be most important, but the proper evaluation of these alternatives will be necessary to determine their quality and communicate this information to the sources of external funds. Specialists will control the majority of external funds from institutional investors, and borrowers must be prepared to deal with these specialists. Financial expertise must be cultivated by the independent industry in order to gain access to this market. The use of the techniques presented in this work will provide a strong foundation in leveraged project analysis.

Mezzanine funding vehicles bring an interaction between the financial and economic aspects of an investment alternative. The source and the use of funds will not be separable as has been the rule in project evaluation. This effect will increase as projects become involved in the issuance of corporate common stock, warrants, and other financial instruments included in the terms of external financial arrangements.

5.3 Topics for Further Research

The determination of leveraged minimum rates-of-return allows the use of NPV calculations in the comparison of equally leveraged investment alternatives. The study of how these minimum rates of return values could be determined involves determining the meaningfulness of the rates in the current financial condition of the individual firm. The firm must be financially sound to attract the funds involved in a leveraged project scenario. If it cannot attract the level of funds it needs, it is a meaningless investigation. Thus, the interaction of financial and economic traits of an investment alternative will be important and should be investigated.

Detailed studies of externally funded projects could include repayment schedules based on the production revenue schedule of a producing prospect. A trend towards setting loan repayment as a percentage of production revenues has been observed. Other repayment schemes include the development of a base payment that may be increased by the lender as certain events occur, such as a rise in prices above a given level. This creates a floor to the downside risk for the borrower but adds an upside for the lender. In these situations, the loan arrangements take on characteristics similar to joint ventures between partners. As stated above, mezzanine financing fills the middle ground between equity funding and traditional loans.

Other methods being developed for lending situations include the use of options and futures contracts to hedge the price of the project's production. The ability to lock the price of a product within a certain range reduces the economic risk of a project by limiting the variation of economic outcomes. This technique can be used in the crude oil market with the creation of a futures and options market for natural gas possible. The use of the financial markets will increase as the petroleum market becomes more widely recognized as a commodity market.

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