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OIL & GAS PROJECT FINANCE

TRAINING MANUAL

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CHAPTER 1

THE ROLE AND OBJECTIVE OF FINANCIAL MANAGEMENT

This training manual deals with project finance It covers a number of areas related to the analysis of investment projects by multinational oil companies

Chapter 1 provides background on the role and objective of financial management in a large multinational company Chapter 2 discusses capital project decision making Then, in Chapter 3 the details of project cash flow analysis are considered The principal methods of calculating project returns are discussed in Chapter 4 The analysis of project risk is the topic of Chapter 5 Financial statement analysis is covered in Chapter 6, and various issues in privatization are considered in Chapter 7

Finance is concerned with several important questions which all businesses must consider Examples of financial management questions include

1 Which new projects should be undertaken?
2 How should new projects be financed, that is, what are the costs and sources of funds?
3 What is the proper mix of the various sources of funds used to finance a company's activities, that is, what is the optimal capital structure?
4 Should a company's profits be retained in the company or distributed to its owners as dividends?
5 What is the nature of the trade-offs between risk and expected return that have to be made in financial management decisions?
6 How much inventory should be held?
7 Who should be granted credit?

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8 Is a merger or joint venture advisable?

9 How much cash - or access to cash - does the company need to meet its daily operating needs?

In order to understand the real world practice of finance, it is crucial to understand the objective of financial management Profit maximization is inadequate for handling many finance decisions for a couple of reasons (The words "profit, earnings and income" tend to be used interchangeably by many business managers The three words mean essentially the same thing Profit equals revenues minus costs)

1 Profit maximization does not have a time dimension

2 Profit maximization does not consider risk

Shareholder wealth maximization is, on the other hand, the primary objective guiding financial management decisions

1 Wealth maximization means maximizing the present value (value today) of all future benefits to be received by the owners of the company

2 The advantages of wealth maximization are that it is a conceptually clear guide for decisions, that it does consider risk, and that it is impersonal

Wealth maximization does not deny the existence of social objectives and obligations In many respects, these other objectives are consistent with shareholder wealth maximization and, in addition, the government may place regulations and laws on businesses (as well as individuals) whenever it feels that private and public goals are in conflict Many companies recognize their responsibilities to various constituencies, including stockholders, customers, employees, the community, and the environment

Maximization of shareholder wealth is a market concept Managers should attempt to maximize the market value of the company's stock, not their accounting or book value of the

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stock The three major factors that determine the market value of a company's stock are

1 the amount of the cash flows expected to be generated for the benefit of stockholders,
2 the timing of these cash flows, and
3 the risk of the cash flows

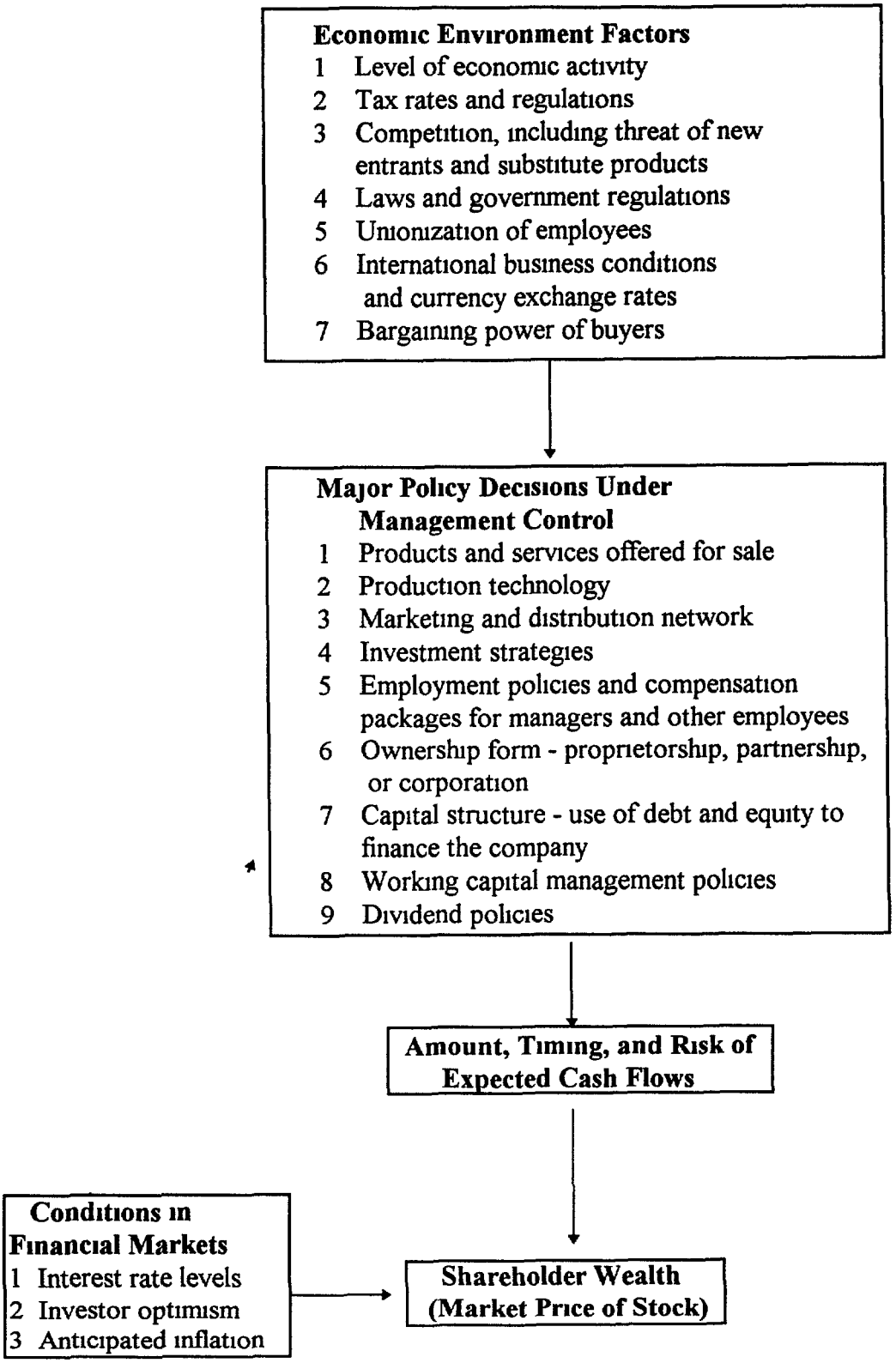
Management decisions affect these three factors In addition, economic environment factors and conditions in financial markets outside of management control affect the amount, timing, and risk of expected cash flows and, hence, the market price of the company's stock Examples of decisions under management control, economic environment factors, and conditions in financial markets that affect stock prices are summarized in Figure 1-1

Managers should formulate an overall competitive strategy that responds to the competitive forces which can influence an industry's structure and, ultimately, the market prices of individual companies in the industry The five competitive forces are

1 The threat of new entrants,
2 The threat of substitute products,
3 The bargaining power of buyers,
4 The bargaining power of suppliers, and
5 The rivalry among current competitors

The *cash flow concept* is one of the central elements of financial analysis, planning, and resource allocation decisions Companies need cash flows to pay creditors, employees, suppliers, and owners Cash, not net income, can be spent

Figure 1-1 Factors Affecting Stock Prices



A company raises funds externally by selling shares of stock to owners (equity) and by borrowing from creditors (debt) It may raise funds internally from cash flows from operations or by selling assets These funds are used to acquire assets which in turn are used to produce and sell products or services After paying for the cost of producing these products or services, any remaining cash flows can be used for reinvestment or distributed to owners and creditors These cash flows are discussed in more detail in Chapter 6

The valuation of debt and equity securities is based on the present value of the cash flows that these securities are expected to provide to investors By emphasizing cash flows rather than accounting-based measures of performance when making decisions, a manager is more likely to achieve the objective of shareholder wealth maximization The *net present value* of an investment is equal to the present value of the expected future cash flows generated by the investment minus the initial investment of cash, or

Net Present Value = Present value of future cash flows *minus* initial investment

The net present value of an investment represents the contribution of that investment to the value of the company and, accordingly, to the wealth of shareholders The net present value concept is the bridge between cash flows and the goal of shareholder wealth maximization

CHAPTER 2

CAPITAL PROJECT DECISION MAKING

I Risk and Return Concepts

This section develops the relationship between risk and return and presents methods for measuring risk Several important concepts are utilized when evaluating risky projects

1 *Risk* refers to the potential variability of returns from a project A project is considered *risk-free* if the monetary returns from a project are known with certainty

2 Probability distributions are the probabilities of every particular outcome These probability distributions may be objectively or subjectively determined

3 The expected return is a weighted average of the individual possible returns

$$\hat{r} = \sum_{j=1}^{n} r_j p_j$$

where $\hat{r}$ = expected return

r_j = return for the jth case, where there are n possible outcomes

p_j = probability of occurrence of the jth outcome

4 The standard deviation is an absolute measure of risk It is defined as the square root of the weighted average of the squared deviations of individual observations from the expected value

$$\sigma = \sqrt{\sum_{j=1}^{n} (r_j - \hat{r})^2 p_j}$$

If the outcomes are normally distributed, the actual outcome should be between ±

1 standard deviation of the expected value 68 26 percent of the time, and between ± 2 standard deviations of the expected value 95 44 percent of the time

5 The number of standard deviations, z, that a particular value of r is from the expected value of r is computed with the relationship

$$z = \frac{r - \hat{r}}{\sigma}$$

6 Risk often is an increasing function of time with early returns from a project being less risky than distant returns

Project risk analysis is discussed in more detail in Chapter 5 of this training manual

One of the key variables in capital budgeting decisions is the cost of capital The cost of capital can be thought of as what the company must pay for capital or the return required by investors in the company's securities It can also be thought of as the minimum rate of return required on new investments undertaken by the company The cost of capital is determined in the capital markets and depends on the risk associated with the company's activities

The weighted cost of capital is the discount rate used when computing the net present value of a project of *average risk* Similarly, the weighted cost of capital is the hurdle rate used in conjunction with the internal rate of return for a project of average risk The weighted cost of capital is based on the after-tax cost of capital where the cost of the next (marginal) sources of capital are weighted by the proportions of the capital components in the company's long-range target capital structure The weighted, or overall, cost of capital is obtained from the weighted costs of the individual components The weights are equal to the proportion of each of the components in the target capital structure

The general expression for calculating the weighted cost of capital, k_a, is

k_a = (equity fraction)(cost of equity) + (debt fraction)(cost of debt)

$$k_a = \frac{E}{B+E}(k_e) + \frac{B}{B+E}(k_d)(1-T)$$

$$k_a = \frac{E}{B+E}(k_e) + \frac{B}{B+E}(k_i)$$

where B = amount of debt and E = amount of equity

The appropriate component costs to use in determining k_a are the marginal costs or the costs associated with the next dollar of capital to be raised These may differ from the historical costs of capital raised in the past by the company

The required return, k, on any security may be thought of as consisting of a risk-free rate of return plus a premium for the risk inherent in the security, or

Required return = Risk-Free return + Risk premium

The risk-free rate of return is usually measured by the rate of return on risk-free securities such as short-term Treasury securities The risk-free rate increases with expectations of future inflation The risk-free rate depends on the overall supply and demand for funds in the economy

There are five major risk components which determine the risk premium on a security

1 *Business risk* arises from the variability of the company's operating income and is determined by the variability of sales revenues and expenses and by the amount of operating leverage the company uses

2 *Financial risk* arises from the additional variability of the company's net earnings associated with the use of financial leverage together with the increased risk of bankruptcy associated with the use of debt

3 *Marketability risk* refers to the ability to quickly buy and sell the securities Securities which are widely traded have less marketability risk than those which are less actively traded

4 *Interest rate risk* refers to the variability in returns on securities arising from changes in interest rates Increases in interest rates reduce the market price of the security Decreases in interest rates reduce the rate at which intermediate interest

payments can be reinvested

5 *Seniority risk* refers to the risk due to the priority of a security's claim in a company's capital structure

The cost of funds may increase with the amount of financing required The cost of funds obtained from a particular type of security increases the lower the security ranks in its claims on the company The cost of common equity is higher than that for debt The return required on unsecured debt is higher than that for secured debt The cost of capital to the company is equal to the equilibrium rate of return demanded by investors in the capital markets for securities of that degree of risk

Regardless of the specific source of financing used at a particular time, a weighted cost of capital dependent on the *component costs* and the *proportions* of the components in the target capital structure is used for capital budgeting decisions

II Foreign Exchange Risk

Just as international trade has altered the conduct of business, the global financial marketplace has opened new alternatives for financial managers This section introduces essential concepts for conducting business in a global market and then focuses on foreign exchange risk

There is a secular trend of greater scope for international trade and investment and of increasing numbers of companies engaging in various types of international financial transactions The complexity of international financial transactions varies widely

1 The simplest case would be companies that only import or export finished products or raw materials

2 At the other extreme are multinational corporations, which have direct investments in manufacturing and/or distribution facilities in more than one country The major U S multinational oil companies are good examples of this category

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3 Between these extremes are companies that maintain foreign branch sales offices, that have licensing arrangements, or that have joint ventures with foreign companies

There are special problems and risks facing companies engaged in international financial transactions First, companies doing business in different currencies are concerned with fluctuations in the exchange rates between currencies Second, there are different governmental regulations, tax laws, business practices, and political environments in foreign countries

The *exchange rate* is the number of units of one currency which may be exchanged for another currency If a U S company buys materials from a foreign supplier, the foreign company usually prefers payment in its own currency In order to pay for these goods, or to invest or repay loans, companies will have to exchange dollars for the foreign currency at some exchange rate For example, the exchange rate between the U S dollar and the British pound could be 2 4080 dollars per pound, or reciprocally, 0 4153 pounds per dollar

A *Eurocurrency* is a currency that is deposited in a bank located outside of the country of origin For example, Eurodollars are dollars deposited in a bank outside of the United States An example is dollars deposited in a German bank or a German branch of a U S bank The Eurocurrency market is an important alternative to domestic sources of funds for multinational funds The interest rate in the Eurodollar market is usually related to the London interbank offer rate, or LIBOR

The spot rate is the exchange rate for currencies being bought and sold for immediate delivery Forward exchange rates, on the other hand, are exchange rates for currencies being bought and sold for delivery at some future date, usually 30, 90, or 180 days from today

A forward contract is a contract for delivery of a specified amount of foreign currency at a future point in time at a price set at the present time If the forward rate is higher than the spot rate, the higher rates are termed premiums Premiums arise when the spot rate is expected to rise

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in the future Discounts (the forward rate is below the spot rate) occur when the spot rate is expected to decline in the future The premium between the spot rate and the forward rate can be expressed on an annual percentage basis using this equation

$$\textit{Annualized forward premium or discount} = \frac{(F - S_0)}{S_0}\left(\frac{12}{n}\right)100\%$$

where S_0 = spot rate

F = forward rate, and

n = number of months forward

In this formula, F and S_0 are expressed as direct quotes ($ per unit of foreign currency)

Exchange rates between currencies fluctuate over time, reflecting supply and demand considerations for the currencies The demand for a currency (like the British pound) comes from foreign buyers who must pay for their purchases from Britain, foreign investors who desire to make investments in Britain, and from speculators The supply of a currency (like the pound) comes from British importers who must sell pounds to pay for their imports, Britains who wish to invest abroad, and speculators

Exchange rates are affected by economic and political conditions that affect the demand and supply for a country's currency Government policies that limit imports (tariffs and quotas) and restrictions on foreign exchange transactions tend to reduce the supply of that country's currency on the foreign exchange market Political stability affects the risks perceived by foreign investors and companies that do business in a country

Foreign exchange risk occurs whenever a portion of the cash flows expected to be received by a company are denominated in foreign currencies There are three primary categories of foreign exchange risk that multinational companies must consider These are (1) transaction exposure (short-term), (2) economic (or operating) exposure (long-term), and (3) translation (accounting) exposure The value of a contract denominated in a foreign currency (either a future inflow or outflow) changes due to a change in the exchange rate

Most companies have contracts to buy and sell goods and services, with delivery and payment to occur at some time in the future If payments under the contract involve the use of foreign currency, additional risk is involved

III Common Stock Valuation

The value of a share of common stock can be calculated using the following equation

$$\text{Share Price} = \frac{\text{Annual Dividends}}{\text{Required Return - Growth}}$$

This equation can be rearranged to show what the required return consists of

$$\text{Required Return} = \frac{\text{Dividends}}{\text{Share Price}} + \text{Growth}$$

Investors presently require annual returns on investments in the major U S energy companies of about 15 percent per year In 1997, investors can earn about 7 percent on long-term bonds issued by the United States government Historically, investors in the common stocks of large companies in the U S have required, and earned, an annual return of about 7 percentage points higher than the return on long-term government bonds The primary reason investors require a higher return on stocks than bonds is because stock ownership has greater risks than bond ownership Therefore, in 1997 investors are requiring returns of about 14-15 percent As a result, these companies presently are requiring a minimum return on the capital expenditure projects in which they invest of about 15 percent For international projects with above average risk, the companies presently require returns above 15 percent per year

Table 2-1 shows selected financial data for some major energy companies This material is important in understanding how a company decides what rate of return it will require on new

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projects The first column to the right of the company name shows the dividend yield This figure is a percentage, and it is 3 1 percent for Chevron, for example It is calculated as follows

$$\text{Dividend Yield} = \frac{\text{Annual Dividend}}{\text{Stock Price}}$$

For Chevron, the dividend yield is calculated as follows 2 32/75 = 3 1% This level of dividend yield is not sufficient to provide an adequate return to investors, given the overall level of risk associated with common stock investments Therefore, additional expected returns must come from another source The only other source of additional returns besides the company's cash dividend payments to its investors, or owners, is an increase in the price of the company's stock One of the things which can cause the price of a company's stock to increase, or grow, is an increase, or growth, in the company's earnings Suppose investors require a total return on an investment in Chevron's stock equal to 15 percent With a 3 percent dividend yield, the only way a total return of 15 percent can be achieved is for the Chevron stock to increase by 12 percent

Table 2-1 Selected Financial Data for Major Energy Companies, July 1, 1997

Company	Dividend Yield	Annual Dividend	P/E Ratio	Stock Price
Exxon	2 6	$1 64	20	$63
Chevron	3 1	2 32	17	75
Mobil	3 0	2 12	18	70
Texaco	3 1	3 40	11	110
Enron	2 2	0 90	18	41

Chevron's management cannot cause the company's stock price to increase, however, all things being equal, Chevron's stock will have a greater chance of increasing in price if the company's earnings increase So, Chevron's management will require a minimum expected return on new projects of about 15 percent in an attempt to give investors a minimum total annual return

in the 15 percent range

IV Major Steps in Evaluating Capital Investment Projects

This section provides an overview of the capital investment evaluation process Capital investment decisions can be the most complex decisions facing a company's management *Capital budgeting* is the process of planning for purchases of assets whose returns are expected to continue beyond one year A *capital expenditure* is a cash outlay which is expected to generate a flow of future cash benefits Normally, a capital project is one with a life of more than one year Capital budgeting models are used to evaluate a wide variety of capital expenditure decisions, including

1. investments in assets to expand an existing product line or to enter a new line of business,
2. replacement of an existing capital asset,
3. expenditures for research and development,
4. investments in permanent increases in inventory or receivables levels,
5. investments in education and training, and
6. leasing decisions

The company's *cost of capital* is the overall cost of funds which are supplied to the company The cost of capital is also called the investors' required rate of return, because it is the minimum rate of return which must be earned on the capital invested in the company The required rate of return helps provide a basis for evaluating capital investment projects

Projects under consideration may be independent of each other or have some types of interdependencies An *independent project* is one whose acceptance or rejection has no effect on other projects under consideration Two projects are *mutually exclusive* if one or the other can be accepted, but not both A *contingent project* is one whose acceptance is contingent upon the adoption of one or more other projects

One additional complication is *capital rationing*, which occurs when the company has a limited total amount of dollars available for investment and the outlay for profitable investments exceeds this limit On the other hand, when the company has sufficient funds available to invest in all profitable projects, we say the company is operating without a funds constraint

The basic framework for capital budgeting is widely employed Economic theory demonstrates that the company should expand its output until marginal revenue equals marginal cost In capital budgeting, the company should invest in its most profitable projects first and should continue accepting projects as long as the last project's rate of return exceeds the marginal cost of funds to the company

Some practical problems are encountered when using this capital budgeting model All capital projects may not be known to the company at one time Changing markets, technology, and corporate strategies can make some current proposals obsolete and make new ones profitable Estimates of future costs and revenues can be made subject to varying degrees of uncertainty

The capital budgeting process can be broken into four steps

1 Generating capital investment project proposals
2 Estimating cash flows This step is discussed in detail in Chapter 3 of this training manual
3 Evaluating alternatives and selecting projects to be implemented This step is discussed in detail in Chapter 4 of this training manual
4 Reviewing or post-auditing prior investment decisions

The initial step in the capital budgeting process is generating capital investment project proposals The process of soliciting and evaluating investment proposals varies greatly among companies Investment projects can be classified as

1 projects generated by growth opportunities in existing product lines or new lines

2 projects generated by cost reduction opportunities

3 projects required to meet legal requirements and health and safety standards

The size of an investment proposal frequently determines who has authority to approve the project A very large outlay might require approval of the company president or board of directors, and successively smaller outlays can be authorized by lower and lower levels of management If an investment decision is critical and must be made fast, a lower level manager can approve it or it can by-pass the normal time-consuming review process to reach the appropriate responsible manager as fast as possible

Reviewing or post-auditing is a final step to review the performance of investment projects after they have been implemented While projected cash flows are uncertain and one should not expect actual values to agree with predicted values, the analysis should attempt to find systematic biases or errors by individuals, departments, plants, or divisions and attempt to identify reasons for these errors Another reason to audit project performance is to decide whether to abandon or continue projects that have done poorly

CHAPTER 3

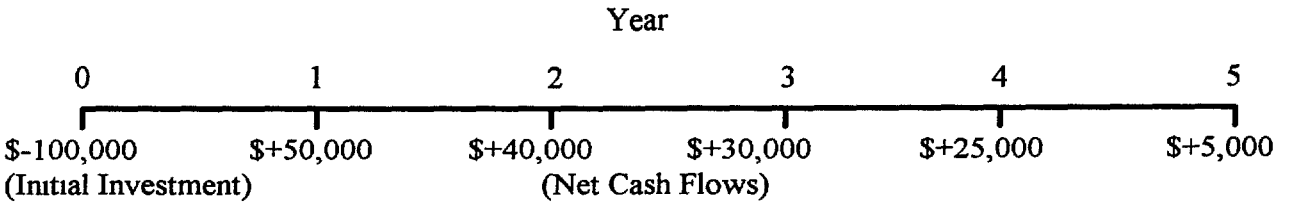
PROJECT CASH FLOW ANALYSIS

I Introduction

One of the most important steps in projects analysis is the estimation of the *cash flows* associated with the project Typically, a capital expenditure project requires an initial *cash outflow,* often termed the *initial investment* In addition, a project is expected to generate *cash inflows* over a number of future years

Figure 3-1 shows the estimated cash flows for a particular project After an initial investment of $100,000, the project is expected to generate a stream of net cash inflows over its anticipated 5-year life of $50,000 in year 1, $40,000 in year 2, $30,000 in year 3, $25,000 in year 4, and $5,000 in year 5 This type of project is called a *normal* or *conventional project* Notice that cash outflows are depicted as negative cash flows and cash inflows are depicted as positive cash flows *

Figure 3-1 Illustration of Estimated Cash flows for a Normal Capital Investment Project



Estimating the cash flows associated with investment projects is crucial to the capital budgeting process The cash flows associated with a project are the basis for evaluation rather

A normal project is a project with one cash flow sign change, it has an initial cash outflow followed by expected

than the project's accounting profits

The following basic principles should be applied in the cash flow estimation process

A Cash flows should be measured on an incremental basis. The cash flow stream for a project is the difference between the cash flows to a company with the project compared to the cash flows to a company without adopting the project

B Cash flows should be measured on an after-tax basis

C All the indirect effects of a project should be included in the cash flow estimates For example, increases in cash balances, receivables, and inventory necessitated by a capital project should be included in the project's initial investment

D Sunk costs should not be considered Since sunk costs result from previous decisions, they are not truly incremental costs

E Resources should be measured in terms of their opportunity costs The opportunity costs of resources are the cash flows they would generate if not used in the project under consideration

II Estimating the Initial Investment

The *initial investment* is the initial cash outlay for a project (usually at time zero) A four-step procedure for estimating the initial investment is

Step 1 The new project cost plus any installation and shipping costs associated with acquiring the asset and putting it into service

PLUS

Step 2 Any increases in net working capital initially required as a result of the new investment

PLUS

Step 3 The net proceeds from the sale of existing assets when the investment is a replacement decision

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cash inflows in each year of its economic life

PLUS or MINUS

Step 4 The taxes associated with the sale of the existing asset and/or the purchase of a new one

EQUALS

The initial investment

For new, or expansion, projects only steps 1 and 2 are applicable For replacement projects, which are usually more complex, all four steps may be applicable

If a project generates additional revenues and the company extends credit to its customers, an additional initial investment in accounts receivable is required Moreover, if additional inventories are necessary to generate the increased revenues, then an additional initial investment in inventory is required, too This increase in initial working capital - that is, cash, accounts receivable, and inventories - should be calculated *net* of any automatic increases in current liabilities, such as accounts payable or wages and taxes payable, that occur because of the project As a general rule, replacement projects require little or no net working capital increase New, or expansion projects, on the other hand, normally require investments in additional net working capital

Some projects require outlays over more than one year before positive cash inflows are generated In these cases, the initial investment for that project will be equal to the present value (at time 0) of this series of outlays, discounted at the company's cost of capital For example, the initial investment of a project requiring outlays of $100,000 in year 0, $30,000 in year 1, and $20,000 in year 2, assuming a cost of capital of 10 percent, equals $143,790, computed as follows

YEAR	CASH OUTLAY	PRESENT VALUE of INITIAL INVESTMENT
0	$ 100,000	$ 100,000
1	30,000	27,270
2	20,000	16,520
		$ 143,790

The concept of present value is discussed in further detail in Chapter 4

III Estimating the Annual Operating Cash Flows

The expected future net operating cash flows (NCF) are easily computed The after-tax net operating cash flow is

$$NCF = \Delta OEAT + \Delta Dep - \Delta NWC$$

where $\Delta OEAT$ (change in earnings after tax) = $\Delta OEBT(1 - T)$

ΔDep = change in depreciation

ΔNWC = increase in the net working capital investment

$\Delta OEBT$ = change in earnings before tax

T = tax rate

and

$$\Delta OEBT = \Delta R - \Delta O - \Delta Dep$$

where $\Delta R = R_W - R_{WO}$ (revenues with project - revenues without project)

$\Delta O = O_W - O_{WO}$ (operating costs with project - operating costs without project)

$\Delta Dep = Dep_W - Dep_{WO}$ (depreciation with project - depreciation without project)

Based on these definitions, two useful expanded versions of the basic NCF equation are

$$NCF = (\Delta R - \Delta O - \Delta Dep)(1 - T) + \Delta Dep - \Delta NWC$$

$$NCF = [(R_W - R_{WO})-(O_W - O_{WO})-(Dep_W - Dep_{WO})] (1 -T) + (Dep_W - Dep_{WO}) - \Delta NWC$$

Throughout this training manual we stress the importance of cash flows in the practice of financial management Cash flow relates to the actual cash generated or paid by the company Only cash can be used to acquire assets, and only cash can be used to make valuable distributions to investors In contrast, the accounting system focuses primarily on a matching over time of the historic, cost-based revenues and expenses of a company, resulting in a bottom-line earnings figure But accounting earnings often are misleading because they do not reflect the actual cash inflows and outflows of the company For example, an accountant records depreciation expense on an asset each period over the depreciable life of that asset Depreciation is designed to reflect the decline in value of that asset over time However, depreciation itself results in no cash outflow The entire cash outflow occurred when the asset originally was purchased

Traditional financial ratio analysis can be a useful tool to an analyst trying to evaluate a company's performance However, many of the key performance measures, such as return on sales, assets, and equity, rely on accounting income concepts Accounting income is not the relevant source of value in a company - cash flow is Only cash can be spent Accounting income, in contrast, does not reflect the actual cash inflows and outflows in a company

The cash flow estimation for a proposed new project is shown in Table 3-1 The project requires an initial investment of $10 million For simplicity, we assume that the entire $10 million investment is equipment which is depreciated, or expensed at a rate of $1 million per year over the estimated 10-year economic life of the project That is, no working capital investment is included in the initial investment

An annual expected cash inflow of $2 8 million from the operations of the proposed project is calculated in Table 3-1 The figures shown are summary numbers only, and for a major project involving a large initial investment, detailed and careful analysis is required to estimate the cash flows

Revenues, which is equal to price multiplied by quantity, is estimated to be $12 million in year 1, the first year of the project's operations The cash expenses necessary to achieve these

revenues are estimated to be $8 million Then, after subtracting depreciation of $1 million, earnings before taxes equal to $3 million are calculated Using a 40% tax rate, earnings after taxes equal to $1 8 million

Table 3-1 Project Analysis Example

Initial investment $10 million
Estimated economic life 10 years

Estimation of Annual Cash Flows

(Dollars in Thousands)

Estimated revenues	$12,000
Estimated cash expenses	8,000
Depreciation	1,000
Earnings before taxes	3,000
Taxes @ 40%	1,200
Earnings after taxes	1,800
Plus Depreciation	1,000
Cash Flow	2,800

Summary of Estimated Cash Flows

Year	Cash Flow
0	<$10 0MM>
1-10	2 8MM

Next, in order to calculate cash flow, depreciation has to be added to earnings after taxes Recall that the $10 initial investment was spent in year 0 In Table 3-1 we are estimating the operating cash flow for year 1 We subtract a portion of the initial investment, $1 million, as depreciation in year 1 because it is a tax-deductible expense, but it is not a year 1 cash flow Therefore, in order to calculate the year 1 cash flow, we add depreciation back to earnings after taxes as follows

Cash flow = Earnings after taxes + Depreciation
= $1 8 million + $1 million
= $2 8 million

For simplicity, we assume that the year 1 operating cash flow remains constant for the entire economic life of the project Obviously, in actual practice, a spreadsheet would be created, and estimates of each year's revenues and expenses would be made Both changes in capacity of the project as well as changes in prices of materials, supplies, labor and products would have to be considered

In Chapters 4 and 5 we use this example project further to calculate returns in order to determine whether or not the project is acceptable The remainder of this section covers several specific topics related to cash flow estimation

Estimating the Terminal Year Cash Flows

There are two potential cash flows at the end of a project's life Cash inflow due to the incremental salvage must be included at the end of the project The incremental salvage is the difference between the salvage with the project and without the project There will be taxes due or saved when an asset is sold for more or less than book value Book value is the installed cost of the asset less accumulated depreciation There are four possible tax situations

Case 1 Sale of an asset for book value No tax consequences

Case 2 Sale of an asset for less than book value The loss is treated as an operating loss to offset operating income The tax saving is the marginal tax rate times the amount of the loss

Case 3 Sale of an asset for more than book value but less than original cost The gain is taxed as operating income, with taxes due equal to the marginal tax rate times the amount of the gain

Case 4 Sale of an asset for more than original cost The part of the gain that represents a

recapture of depreciation is treated as an operating gain and the gain in excess of original cost is treated as a capital gain

The recovery of book value is tax-free, only gains and losses from book value result in tax savings or obligations

The second potential cash flow at the end of a project's life involves the recovery of working capital In the last year of a project that has required working capital investments, the working capital is assumed to be liquidated and returned to the company as cash At the end of a project's life, all net working capital additions required over the project's life are recovered - not just the initial net working capital outlay occurring at time 0 Hence, the total accumulated net working capital is normally recovered in the last year of the project This *decrease* in net working capital in the last year of the project *increases* the net cash flow for that year, all other things being equal No tax consequences are associated with the recovery of net working capital

Interest Charges and Net Cash flows

Often the purchase of a particular asset is tied closely to the creation of some debt obligation such as the sale of mortgage bonds or a bank loan Nevertheless it is generally considered *incorrect* to deduct the interest charges associated with a particular project from the estimated cash flows This is true for two reasons

First, the decision about how a company is financed overall is usually made independently of the decision to accept or reject one or more projects Instead, the company seeks some combination of debt and common stock that is consistent with management's wishes concerning the trade-off between financial risk and the cost of capital In many cases, this will result in a debt and common stock combination whose cost of capital is at or near its minimum Because investment and financing decisions normally are made independently of one another, each new project can be viewed as being financed with the same proportions of debt and common stock used to finance the company as a whole

Second, when a discounting framework is used for project evaluation, the discount rate, or cost of capital, already incorporates the cost of funds used to finance a project Thus, including interest charges in cash flow calculations essentially would result in a double counting of costs

Depreciation

Depreciation is defined as the systematic allocation of the cost of an asset over more than one year It allows a company to spread the costs of fixed assets over a period of years to better match costs and revenues in each accounting period The annual depreciation expense recorded for a particular asset is simply an allocation of historic costs and does not necessarily indicate a declining market value For example, a company that is depreciating an office building may find the building's market value *appreciating* each year

IV Examples of Estimating Project Cash Flows

Problem 1 - Net Investment

Deep Wells currently uses drilling equipment it purchased several years ago The equipment which was purchased for $600,000, currently has a book value of $250,000 The company is considering replacing the old equipment with newer, more powerful model The new equipment will cost $1,000,000 and will require an additional $50,000 for delivery and installation The new equipment also will require the company to increase its investment in working capital by $10,000 The new equipment will be depreciated on a straight-line basis over 5 years to a zero balance Determine the company's initial investment in the new equipment

Problem 2 - Expected Cash Inflows (See Problem 1)

If Deep Wells purchases the new equipment, revenues are expected to increase by $200,000 (due to increased capacity) and operating expenses are expected to decrease by $20,000 After 5 years the equipment will be completely depreciated and is expected to be sold for $70,000 Compute the net cash flows for the investment in the equipment (Assume that the original equipment is

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being depreciated at a rate of $50,000 per year)

Solutions

Problem 1

Step 1	$1,000,000	asset cost
	+ 50,000	delivery and installation
Step 2	+ 10,000	increase in working capital
	$1,060,000	

Problem 2

Depreciable base = installed cost = $1,050,000

Depreciation Schedule

Year	Depreciation rate	Depreciation amount
1-5	20%	$210,000

Recapture of depreciation (with sale of new equipment at the end of year 5)

$70,000 gain on sale

After-tax cash flow = $70,000(1 - 0 4) = $42,000

Net Cash Flows

NCF1 = [$200,000 - (-$20,000) - ($210,000 -$50,000)] (1 -0 40) + ($210,000 - $50,000)

= $196,000

NCF2 = same as NCF1

= $196,000

NCF3 = same as NCF1

= $196,000

NCF4 = same as NCF1

= $196,000

NCF5 = NCF1 + after-tax gain on sale of furnace + return of net working capital

= $196,000 + $42,000 + $10,000

= $248,000

CHAPTER 4

METHODS OF CALCULATING PROJECT RETURNS

This chapter deals with the principal methods that are used to calculate expected returns from investment projects The first major topic discussed is the time value of money, which is used in calculating project returns

I The Time Value of Money

Many business managers make frequent use of the time value of money Any decision involving investing or financing where cash flows occur at different points in time requires an understanding of the time value of money This important topic is one of the most valuable that you will cover in this project finance training manual

In borrowing or lending money, the amount due can be calculated using simple interest or compound interest The principal is the amount of money borrowed or invested, the term of a loan is the length of time or number of periods the loan is outstanding, and the rate of interest is the percent of the principal the borrower pays the lender per time period Simple interest is the interest paid on the principal sum only

$I = PV_0 \times i \times n$

where I = simple interest in dollars

PV_0 = principal amount at time 0,

i = interest rate per time period, and

n = number of time periods

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For simple interest, the present value of the loan is

$$PV_0 = \frac{I}{i \times n}$$

The future value (amount due at time n) using simple interest is

$$FV_n = PV_0 + I$$

$$FV_n = PV_0 + (PV_0 \times i \times n) = PV_0\,[1 + (i \times n)]$$

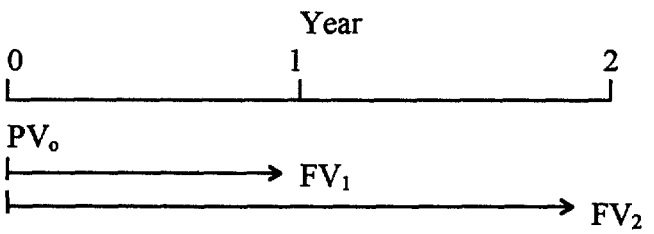
Compound interest is due not only on the principal but on prior interest which has not been paid (or withdrawn) The amount of interest due each period is the interest rate times the principal amount at the beginning of the period For one period, the future (compound) value is

$$FV_1 = PV_0\,(1 + i)$$

and for two periods, the future value is

$$FV_2 = FV_1\,(1 + i)$$

$$FV_2 = PV_0\,(1 + i)(1 + i) = PV_0\,(1 + i)^2$$



In general, the future value at the end of year n for a sum compounded at interest rate i is

$$FV_n = PV_0\,(1 + i)^n$$

In Table I in the Appendix of this training manual, compound value interest factors ($FVIF_{i,n}$) show the future value of $1 invested for n years at interest rate i

$$FVIF_{i,n} = (1 + i)^n$$

The future value of a lump sum can also be written as

$$FV_n = PV_0\,(FVIF_{i\,n})$$

Present value calculations find the amount at time zero, or present value (PV_0), that is

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equivalent to some future amount FV_n The present value of a future amount received in n years discounted at interest rate i is

$$PV_0 = FV_n \frac{1}{(1+i)^n}$$

Table II in the Appendix includes present value interest factors ($PVIF_{i,n}$) which show the present value of $1 discounted at interest rate i for n periods

$$PVIF_{i,n} = \frac{1}{(1+i)^n}$$

Using $PVIF_{i,n}$, the present value of amount FV_n is

$PV_0 = FV_n (PVIF_{i,n})$

Example

What is the present value of receiving $1,000 ten years from now if the appropriate discount rate is 15%?

Using Table II in the Appendix, the PVIF value for 10 periods and 15% is 0 247 Therefore,

$PV_0 = FV_{10} (PVIF_{0\ 15\ 10}) = 1{,}000(0\ 247) = \$247$

This means that the present value of receiving money 10 years from now discounted at 15% per year is about one-quarter of the actual money received

Example

Suppose someone gave you $247 today How much will this amount be worth in 10 years if the interest rate is 15% per year and you do not withdraw any principal or interest during the 10-year period? If you said about $1,000, you are understanding the time value of money If you

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did not say $1,000, reread the previous example

The present value interest factor is the reciprocal of the future value interest factor

$$PVIF_{i,n} = 1/FVIF_{i,n}$$

When i appears in the numerator, the interest rate is referred to as the compound interest rate or the growth rate On the other hand, when i appears in the denominator, the interest rate is called the discount rate

II Capital Budgeting Decision Criteria

Three capital budgeting decision criteria are widely known and used in calculating project returns These are the net present value (NPV), internal rate of return (IRR), and the payback period

A Net Present Value

The *net present value* (NPV) of an investment project is defined as the present value of the stream of the expected future net cash inflows from a project minus the project's initial investment

The net present value is

NPV = PVNCF - INV

$$NPV = \sum_{t=1}^{n} \frac{NCF_t}{(1+k)^t} - INV$$

where

NPV = net present value

NCF_t = expected cash inflow in period t

n = expected project life

k = cost of capital

INV = initial investment

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The *NPV decision rule* is to accept a project when the NPV is greater than zero (because the present value of the project's expected cash inflows exceeds the project's initial investment) and to reject a project when its NPV is less than zero (the present value of the expected cash inflows is less than the initial investment)

The NPV method is superior to other methods because it accurately accounts for the time value of a project's expected cash inflows over its entire life It is relatively easy to use because positive NPVs increase the wealth of the company's owners while negative NPVs have the opposite effect

A disadvantage of the NPV method is that the NPV is not as easily understood by untrained persons as the payback or internal rate of return

What causes some projects to have positive or negative NPVs? When product and factor markets are not perfectly competitive, it is possible for a company to earn above-normal profits and invest in positive NPV projects Some examples of conditions that allow above normal profits include

a buyer preferences for established brand names,
b ownership or control of favored distribution systems,
c patent control of superior product designs or production techniques,
d exclusive ownership of superior natural resource deposits,
e inability of new companies to acquire necessary factors of production (management, labor, equipment),
f superior access to financial resources at lower costs (economies of scale in attracting capital),
g economies of large-scale production and distribution arising from capital intensive production processes and high initial start-up costs, and
h access to superior labor or managerial talents at cost which are not fully reflective of their value

Notice that some of these conditions apply to the oil industry

Example (NPV calculation for a project)

Initial investment $10 million

Estimated economic life 10 years

Expected annual cash flow $2 8 million If the company requires a 20 percent after-tax rate of return, should it undertake this new investment?

Solution

$$NPV = \sum_{t=1}^{10} \frac{28}{(1+0\ 2)^t} - 10$$

$$= 11\ 74 - 10 = \$1\ 74 \text{ million}$$

Since NPV > 0, this is an acceptable project

Note The value of $11 74 million can also be calculated by multiplying the annual expected cash inflow of $2 8 million by 4 193, the present value of an annuity interest factor , PVIFA, for 10 years and 20% The values in Table IV of the Appendix are the sums of each year in Table II For example, look at the value of 1 626 in Table IV for 15% and 2 periods It is the sum of the values, 0 870 and 0 756, in Table II for 15% and periods 1 and 2

B Internal Rate of Return

One of the most common methods used to calculate the return on investment for a capital expenditure project is the internal rate of return (IRR) method, or discounted cash flow (DCF) method, as it is often called The *internal rate of return* (IRR) is defined as the rate of discount that equates the present value of expected cash inflows for a project with the present value of the initial investment In other words, the IRR is the discount rate which makes a project's NPV equal zero The algebraic definition of the IRR is

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$$\sum_{t=1}^{n} \frac{NCF_t}{(1+r)^t} = INV$$

where r = IRR

The *IRR decision rule* is to accept a project when its IRR exceeds the cost of capital (k), or hurdle rate set by the company, and to reject a project when its IRR is less than the hurdle rate Like the NPV method, the IRR method takes account of the magnitude and timing of a project's expected cash inflows over its entire life

One occasional difficulty with the IRR is that an unusual cash flow pattern can result in multiple internal rates of return Most projects have only one cash flow sign change The initial investment is a cash outflow, or negative cash flow It is usually followed by a series of annual cash inflows, or positive cash flows However, if a project has more than one cash flow sign changes, multiple internal rate of returns can occur In such a case, NPV should be used

When two or more mutually exclusive projects are acceptable using the IRR and NPV methods, and if the two methods disagree on which is best, the NPV method is generally preferred Both the NPV and IRR methods will always agree on accept/reject decisions (i e , if NPV > 0, then IRR > k, and if NPV < 0, then IRR < k), even if the NPV and IRR do not rank the projects the same Different rankings result from the implicit reinvestment rate assumptions of the two methods the NPV method assumes that cash inflows over the project's life are reinvested by the company at the cost of capital k while the IRR method assumes that cash inflows are reinvested at the calculated IRR Please note that this paragraph applies to mutually exclusive projects

Example (IRR calculation of a project)
Initial Investment $10 million
Estimated economic life 10 years
Expected annual cash flow $2 8 million If the company requires a 20 percent after-tax rate of return, should it undertake this new investment?

Solution

The IRR is the discount rate which causes NPV to be equal to zero Therefore,

$2 8 million(PVIFA) = $10 million

PVIFA = 3 6

Look at Table IV in the Appendix Moving across the 10 period row, a value of about 3 6 is reached at about 24% Therefore, 24% is the discount rate which causes the NPV to be equal to zero, the IRR is about 24% Because the IRR is greater than the hurdle rate of 20%, the project is acceptable Notice that both the IRR and NPV methods show that the project is acceptable

C Payback Period

The *payback period* for an investment project is the number of years required for the cumulative expected cash inflows from a project to equal the initial investment If the expected cash inflows are equal in each year, the payback period is simply the ratio of the initial investment to the annual cash inflows

$$\text{Payback} = \frac{\text{Initial investment}}{\text{Annual expected cash flow}}$$

When the expected cash inflows are not equal, interpolation can be used in the final period to get a more accurate payback period

The advantages of the payback method are that it is simple, it provides a measure of project liquidity, and, in a sense, it may also be a measure of risk On the other hand, the payback period is not a true measure of profitability and, therefore, is not a good criterion for decision making The payback period ignores expected cash inflows after the payback is reached and it ignores the time value of money of the cash inflows occurring within the payback period

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Example (Payback calculation of a project)

Initial Investment $10 million

Estimated economic life 10 years

Expected annual cash flow $2 8 million

What is the payback period?

Solution

$$\text{Payback} = \frac{\$10 \text{ million}}{\$2\ 8 \text{ million per year}} = 3\ 6 \text{ years}$$

The calculated payback of 3 6 years tells little, if anything, about whether the project is acceptable Nevertheless, payback is easy to calculate and it adds to the overall information about a project For example, with this project the NPV and IRR methods showed that it is acceptable But suppose that the company's management also desires payback to occur in three years or less, because of the perceived risk of this project In this case, the project may not be accepted because of the risk Also, note that it might be easier to simply change the hurdle rate to 25% because of risk

III Examples of Calculating Project Returns

Net Present Value Problem

Yellowfield Oil & Gas is considering expanding its drilling operations In order to expand, the company must purchase some specialized drilling equipment The initial investment in the equipment amounts to $25 million If the company expands its operations, net cash flows are expected to increase by $5 5 million per year for the entire useful life of the equipment (18 years) Because oil and gas exploration is a relatively risky process, the company requires a 20% after-tax rate of return on all drilling equipment investments of this type Should Yellowfield expand its drilling operations?

Solution

NPV = Present Value of expected cash inflows - initial investment

NPV = \$5,500,000($PVIFA_{20\%,18}$) - \$25,000,000

= \$5,500,000 (4 812) - \$25,000,000

= \$1,466,000

Because the project's NPV > 0, the project is acceptable

Internal Rate of Return Problem

The International Oil Producing Company uses a project's internal rate of return as one of its methods for evaluating projects The company is considering investing in new storage system that is expected to generate cash inflows of \$1,500,000 per year for ten years The investment in the process requires an initial investment of \$6,741,000 If the company requires a 16% hurdle rate on this project, should it be undertaken?

Solution

$PVAN_0 = PMT(PVIFA_{r\,n})$

$PVIFA_{r\,10} = PVAN_0/PMT$

= \$6,741,000/\$1,500,000 = 4 494

Looking across the n = 10 row in Table IV in the Appendix we see that PVIFA = 4 494 when r = 18% The IRR for the project is 18%, which is greater than the required rate of return, or hurdle rate Therefore, the new storage system is an acceptable project

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CHAPTER 5

PROJECT RISK ANALYSIS

I Introduction

This chapter deals with project risk analysis Assessing the risks associated with proposed projects is extremely important for international oil companies There are risks associated with almost any oil industry operation, including geologic and engineering risks Also, if oil is discovered and produced, there is the risk of whether oil prices will rise or fall

In addition, oil companies have to assess the potential political risks of the countries in which they are considering investments Each company assesses risk and takes steps to reduce risk in a different manner Overall, however, for all companies, the higher the perceived risk of a project, the higher the required return on the project will be We often hear company managers talk about a risk-adjusted discount rate, which is a discount rate that reflects the risk associated with a particular project

The following sections of this chapter deal with scenario analysis and range estimating, simulation analysis, and sensitivity analysis These techniques may provide additional information about a project to a company's management Ultimately, the decision of whether or not to undertake a particular project involves weighing the possible benefits, that is, the initial investment and the perceived risks

II Scenario Analysis and Range Estimating

This section covers scenario analysis and range estimating This technique involves

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estimating different cases, or scenarios, for the operating results of a project A simple scenario analysis involves estimating the so called "best case" scenario, in which operations run better than expected and the so called "worst case" scenario, in which operations run worse than expected The following example shows a detailed scenario analysis

Example (Scenario analysis and range estimating for a project)

Initial investment $10 million

Estimated economic life 10 years

Expected annual cash inflow $2 8 million

The company expects that there is a chance for revenues to be 10% less than what they expect them to be under the most likely scenario and expenses to be 10% more Similarly, a better performance is possible with 10% more revenues and 10% less expenses

Estimation of Annual Cash Flows (Dollars in Thousands)

	Worst Case	Most Likely	Best Case
Estimated revenues	$10,800	$12,000	$13,200
Estimated cash expenses	8,800	8,000	7,200
Depreciation	1,000	1,000	1,000
Earnings before taxes	1,000	3,000	5,000
Taxes @ 40%	400	1,200	2,000
Earnings after taxes	600	1,800	3,000
+ Depreciation	1,000	1,000	1,000
Cash Flow	1,600	2,800	4,000

Calculation of IRR in each case (see Table IV in the Appendix)

The worst case scenario $10 m /$1 6 m = 6 25, which corresponds to an IRR of 9 5%

The most likely case scenario $10 m /$2 8 m = 3 571, which corresponds to an IRR of 24%

The best case scenario $10 m /$4 m = 2 5, which corresponds to an IRR of 36%

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Refer back to the IRR example in Chapter 4 if you are having difficulty with the IRR calculations

In this example, the company expects the annual cash flow to be in a range of $1 6 million to $4 million corresponding to an internal rate of return range of 9 5% to 36% The expected values for annual cash inflow and IRR are $2 8 million and 24%, respectively This information, along with other information about the proposed project, will be used in making the decision of whether or not to undertake the project Notice that in the scenario analysis the company did not attempt to determine the probability of the worst and best cases occurring

III Simulation Analysis

Computers have made it both feasible and relatively inexpensive to apply simulation techniques to capital budgeting decisions The simulation approach, sometimes called Monte Carlo simulation, generally is more appropriate for analyzing larger projects A simulation is a financial planning tool that models some event When simulation is used in project analysis, it requires that estimates be made of the probability distribution of each cash flow element (revenues, expenses, and so on) If, for example, a company is considering introducing a new product, the elements of a simulation might include the number of units sold, market price, unit production costs, unit selling costs, the purchase price of the machinery needed to produce the new product, and the cost of capital These probability distributions then are entered into the simulation model to compute the project's net present value probability distribution

Recall that net present value is defined as follows

$$NPV = \sum_{t=1}^{n} \frac{NCF_t}{(1+k)^t} - INV$$

where NCF is the expected cash inflow in period 1, and INV is the initial investment In any period, NCF_t may be computed as follows

$$NCF_t = [q(p) - q(c + s) - Dep](1 - T) + Dep - \Delta NWC$$

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where q is the number of units sold, p, the price per unit, c, the unit production cost (excluding depreciation), s, the unit selling cost, Dep, the annual depreciation, ΔNWC, the increase in net working capital, and T, the company's marginal tax rate Using the NCF equation, it is possible to simulate the net present value of the project Based on the probability distribution of each of the elements that influence the net present value, one value for each element is selected at random

Assume, for example, that the following values for the input variables are randomly chosen q = 2,000, p = $10, c = $2, s = $1, Dep = $2,000, ΔNWC = $1,200, and T = 40%, or 0 40 Inserting these values into the NCF equation gives the following calculations

$$
\begin{aligned}
NCF_t &= [2{,}000(\$10) - 2{,}000(\$2 + \$1) - \$2{,}000](1 - 0\ 40) + \$2{,}000 - \$1{,}200 \\
&= (\$20{,}000 - \$6{,}000 - \$2{,}000)0\ 60 + \$2{,}000 - \$1{,}200 \\
&= \$8{,}000
\end{aligned}
$$

Assuming that the initial investment is equal to the purchase price of the machinery ($10,000, in this example), that the expected cash inflows in each year of the project's life are identical, except for year 5, when $6,000 of NWC is recovered, that k = 10%, and that the project has a 5-year life, the net present value of this particular iteration of the simulation can be computed as follows

$$
\begin{aligned}
NPV = {} & \$8{,}000/(1+0\ 10)^1 + \$8{,}000/(1+0\ 10)^2 + \$8{,}000/(1+0\ 10)^3 + \$8{,}000/(1+0\ 10)^4 + \\
& \$14{,}000/(1+0\ 10)^5 - \$10{,}000 \\
= {} & \$8{,}000 \times 3\ 170 + \$14{,}000 \times 0\ 621 - \$10{,}000 \\
= {} & \$24{,}054
\end{aligned}
$$

In an actual simulation, the computer program is run a number of different times, using different randomly selected input variables in each instance Thus, the program can be said to be repeated, or iterated, and each run is termed an iteration In each iteration, the net present value for the project would be computed accordingly Figure 5-1 illustrates a typical simulation

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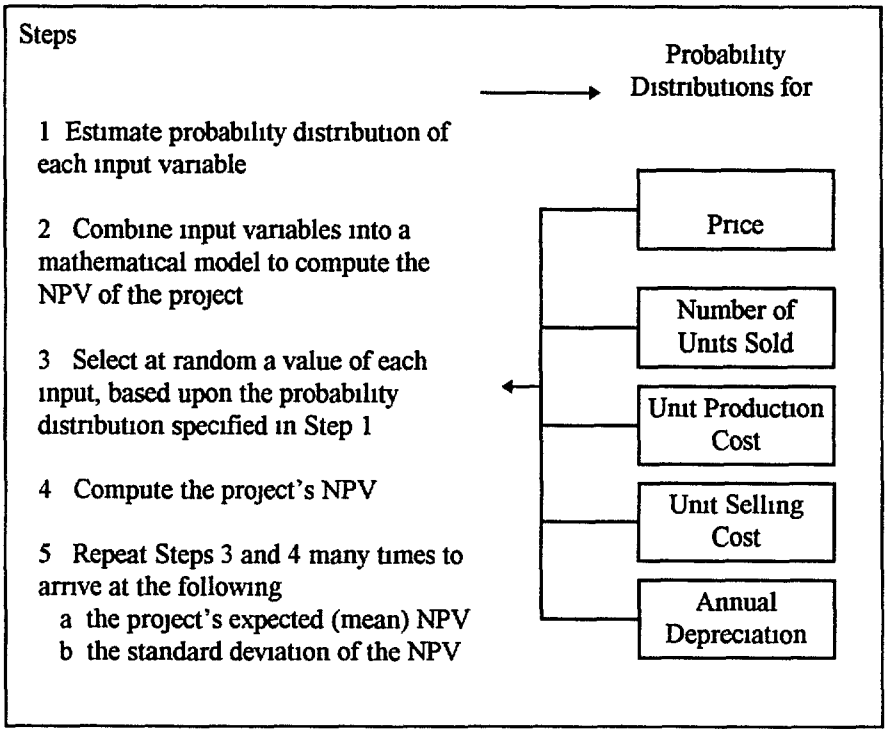
approach

The results of these iterations then are used to plot a probability distribution of the project's net present values and to compute a mean and a standard deviation of returns This information provides the decision maker with an estimate of a project's expected returns, as well as its risk Given this information, it is possible to compute the probability of achieving a net present value that is greater or less than any particular value

Figure 5-1 An Illustration of the Simulation Approach



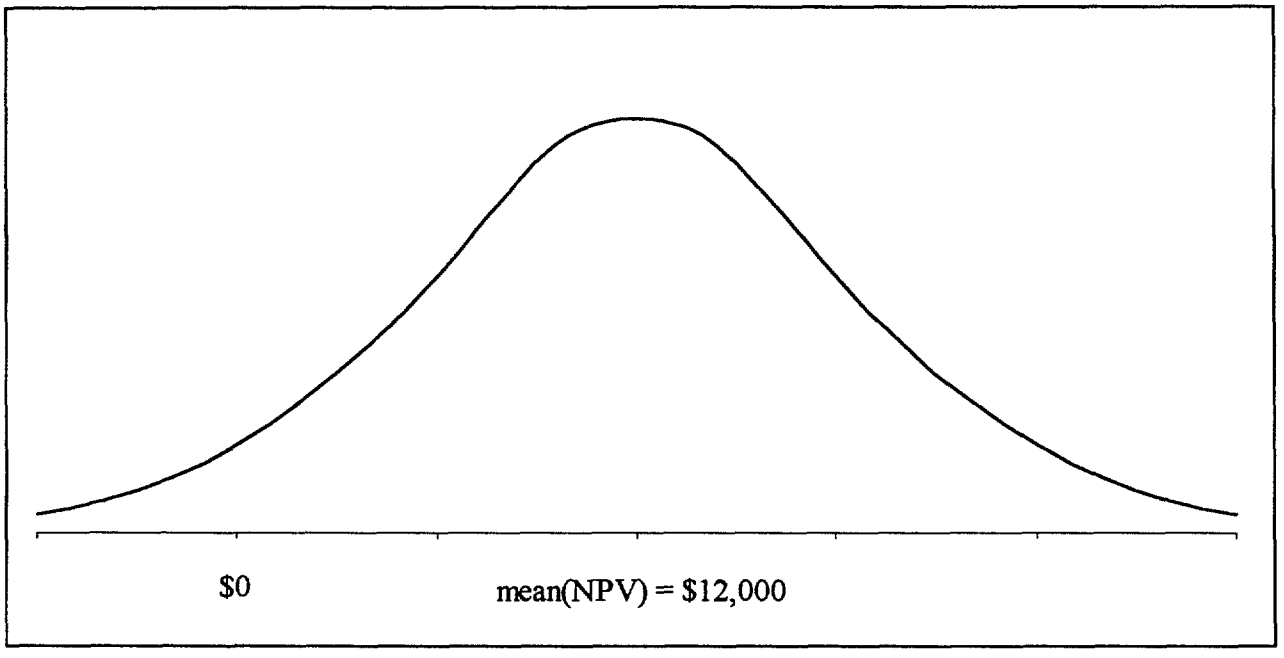
For example, assume that the simulation for the project previously illustrated results in an expected net present value of $12,000, with a standard deviation of $6,000 The probability of the project having a net present value of $0 or less now can be found The value of $0 is -2 0 standard deviations below the mean

$$z = \frac{\$0 - \$12,000}{\$6,000} = -2\ 0$$

where z = the number of standard deviations

It can be seen from Table V in the Appendix that the probability of a value less than -2 0 standard deviations from the mean is 2 28 percent Thus, there is a 2 28 percent chance that the actual net present value for this project will be negative Figure 5-2 shows the probability distribution of this project's net present value The area under the curve to the left of value $0 represents the probability that the project will have a net present value of $0 or less

Figure 5-2 Probability Distribution of a Project's NPV



The simulation approach is a powerful one because it explicitly recognizes all of the interactions among the variables that influence a project's net present value It provides both a mean net present value and a standard deviation that can help the decision maker analyze trade-offs between risk and expected return Unfortunately, it can take considerable time and effort to gather the information necessary for each of the input variables and to correctly formulate the model This limits the feasibility of the simulation technique to very large projects In addition, the simulation examples illustrated assume that the values of the input variables are independent of one another If this is not true - if, for example, the price of a product has a large influence on the number sold - then this interaction must be incorporated into the model, introducing even more complexity

IV Sensitivity Analysis

Sensitivity analysis is a procedure that calculates the change in net present value, given a change in one of the cash flow elements, such as product price In other words, a decision maker can determine how sensitive a project's return is to changes in a particular variable

Because sensitivity analysis is derived from the simulation approach, it also requires the definition of all relevant variables that influence the net present value of a project The appropriate mathematical relationships between these variables must be defined, too, in order to estimate the expected cash flow from the project and compute the net present value Rather than dealing with the entire probability distribution for each of the input variables, however, sensitivity analysis allows the decision maker to use only the "best estimate" of each variable to compute the net present value

The decision maker then can ask various "what if" questions in which the project's net present value is recomputed under various conditions For example, the best estimate of a product's price might be $10 The net present value of the project could be computed using this input together with best estimates of all the other variables The next step would involve asking a question like "What if we cannot charge more than $8 per unit?" The net present value could be recomputed using the $8 price and the best estimates for each of the other input variables to determine the effect of the $8 price on the NPV

Sensitivity analysis can be applied to any variable to determine the effect of changes in one or more of the inputs on a project's net present value This process provides the decision maker with a formal mechanism for assessing the possible consequences of various scenarios

It often is useful to construct sensitivity curves to summarize the impact of changes in different variables on the net present value of a project A sensitivity curve has the project's net present value on the vertical axis and the variable of interest on the horizontal axis For example, Figure 5-3 shows the sensitivity curves for two variables, sales price and cost of capital for a

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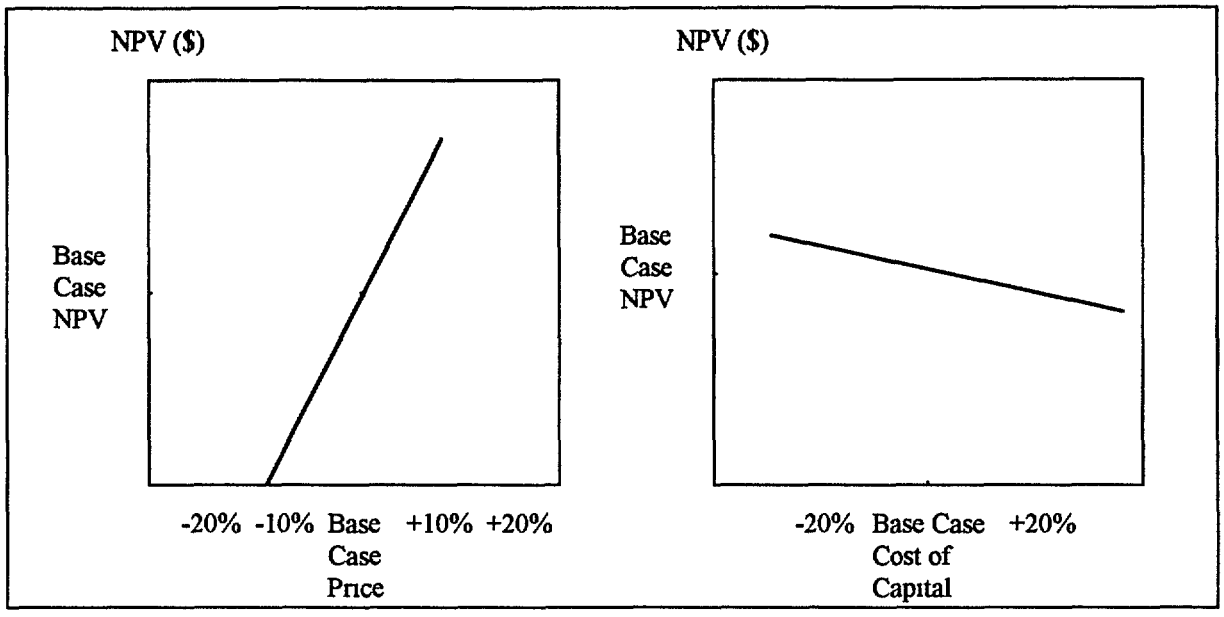
project

Figure 5-3 Illustrative Sensitivity Curves



The steep slope of the price-NPV curve indicates that the net present value is very sensitive to changes in the price for which the product can be sold If the product price is approximately 8 percent below the base case (or initial analysis) estimate, the net present value of the project drops to $0, and the project becomes unacceptable for further price declines In contrast, the relatively flat cost of capital-NPV curve indicates that the net present value is not very sensitive to changes in the company's cost of capital Similar curves could be constructed for project life, salvage value, units sold, operating costs, and other important variables

Example

Simulation Approach

Meridian Oil & Gas, Inc uses a simulation approach in its analysis of new investment projects By simulating the expected cash inflows for an oilfield equipment project under consideration, the company has determined that the project's expected net present value is $55,000 with a standard deviation of $20,000 Compute the probability that this project will yield a negative net present value Also, compute the probability that the project's net present value is less than $30,000 (Assume that the project's net present value is normally distributed)

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Solution

Probability of a negative net present value

$$z = \frac{\$0 - \$55{,}000}{\$20{,}000} = -2\ 75$$

from Table V

$$P(z < -2\ 75) = 0\ 0030 \text{ or } 0\ 3\%$$

This calculation says that the probability of the project's net present value being negative is less than one percent It is important to realize that this conclusion depends directly on the data used and is only as good as the input data

Probability of a net present value less than $30,000

$$z = \frac{\$30{,}000 - \$55{,}000}{\$20{,}000} = -1\ 25$$

from Table V

$$P(z < -1\ 25) = 0\ 1056 \text{ or } 10\ 56\%$$

This calculation says that the probability of the project's net present value being less than $30,000 is approximately 10 percent

CHAPTER 6

FINANCIAL STATEMENTS OF INTERNATIONAL ENERGY COMPANIES

I Introduction

This chapter is an introduction to the financial statements of international energy companies The three principal corporate financial statements - the balance sheet, the income statement and the statement of cash flows - are presented and discussed

The chapter shows the 1996 financial statements for Chevron, one of the international energy companies with operations in Central Asia The financial statements of Chevron are representative of other large, international energy companies

II The Balance Sheet

The balance sheet shown in Table 6-1 contains information on Chevron's assets, liabilities, and stockholders' equity The monetary amounts provide a "snapshot view" of the company's financial health on December 31, 1996 Chevron's assets are recorded on the balance sheet at the price the company paid for them (that is, at historic cost) The liabilities are amounts the company owes its creditors, and the stockholders' equity value is the difference between total assets and total liabilities

Table 6-1 Chevron Corporation 1996 Balance Sheet

Millions of Dollars	1996
ASSETS	
Cash and cash equivalents	$892
Marketable securities	745
Accounts and notes receivable	4,035
Inventories	
Crude oil and petroleum products	669
Chemicals	507
Materials, supplies and other	255
	1,431
Prepaid expenses and other current assets	839
TOTAL CURRENT ASSETS	7,942
Investments and advances	4,463
Properties, plant and equipment, at cost	46,936
Less accumulated depreciation, depletion and amortization	25,440
	21,496
Other assets	953
TOTAL ASSETS	$34,854
LIABILITIES AND STOCKHOLDERS' EQUITY	
Short-term debt	$2,706
Accounts payable	3,502
Accrued liabilities	1,420
Other taxes payable	1,279
TOTAL CURRENT LIABILITIES	8,907
Long-term debt	3,650
Other liabilities	6,674
TOTAL LIABILITIES	19,231
Common stock	2,943
Retained earnings	15,408
Treasury stock and other	(2,728)
TOTAL STOCKHOLDERS' EQUITY	15,623
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$34,854

II Balance Sheet Analysis

Chevron's balance sheet at the end of 1996 shows approximately $35 billion in assets Current assets, which consists mainly of cash, accounts receivable and inventories are about $8 billion Net fixed assets, which consists of properties, plant and equipment, less accumulated

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depreciation, depletion and amortization, are about $21 5 billion The remaining assets, about $5 5 billion, are primarily investments and advances

The other side of the balance sheet shows the company's various liabilities For Chevron, at the end of 1996, total current liabilities were about $9 billion This total includes short-term debt, accounts payable, as well as accrued liabilities and total taxes owed Chevron's long-term debt and other liabilities equal about $10 billion

Subtracting total liabilities of about $19 billion from the total assets of about $35 billion gives a stockholders' equity value of about $16 billion The stockholders' equity value on the balance sheet is called "book value " Often, if a company earns an adequate percentage return on its book value, the total market value of its stockholders' equity will be greater than book value

In analyzing a company's financial statements, financial analysts are interested in the rate of return a company earns on its stockholders' equity For Chevron, the return on stockholders' equity for 1996 is calculated as follows

$$\text{Return on stockholders' equity} = \frac{\text{Net income}}{\text{Stockholders' equity}} = \frac{\$2\ 6\ \text{billion}}{\$15\ 6\ \text{billion}} = 16\ 7\%$$

For Chevron in 1996, this indicates that the company earned approximately 17% after taxes on the stockholders' equity As a very general rule, a return on stockholders' equity greater than 15% is considered adequate

III The Income Statement

The income statement shown in Table 6-2 indicates Chevron's performance during the year ended December 31, 1996 The company's total costs and expenses, which include the cost of sales, other operating expenses, interest expenses, and taxes, are deducted from the revenues generated to arrive at the company's net income, or earnings after taxes The statement also

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shows how the company's earnings are distributed between dividend payments to stockholders and earnings reinvested in the company Chevron's net income in 1996 was approximately $2 6 billion, of which about one half was paid to Chevron's stockholders in the form of dividends (part of their overall return, along with any increases in the market value of Chevron's stock, for investing in Chevron's common stock) The remaining net income was reinvested back into the company

Table 6-2 Chevron Corporation 1996 Statement of Income

Millions of dollars, except per-share amounts	1996
REVENUES	
Sales and operating revenues	$42,782
Other income	1,111
TOTAL REVENUES	43,893
COSTS AND OTHER DEDUCTIONS	
Purchased crude oil and products	22,826
Operating expenses	6,007
Selling, general and administrative expenses	1,377
Exploration expenses	455
Depreciation, depletion and amortization	2,216
Taxes other than on income	5,908
Interest and debt expense	364
TOTAL COSTS AND OTHER EXPENSES	39,153
INCOME BEFORE INCOME TAX EXPENSE	4,740
INCOME TAX EXPENSE	2,133
NET INCOME	$ 2,607
NET INCOME PER SHARE OF COMMON STOCK	$3 99
WEIGHTED AVERAGE NUMBER OF SHARES OUTSTANDING	652,769,250
CASH DIVIDENDS PAID	$ 1,358

IV Income Statement Analysis

In its 1996 Annual Report to its stockholders, Chevron stated that 1996 was the best year in its history The company had total revenues of approximately $44 billion in 1996 Its total costs and other expenses were about $39 billion, included in the costs of $39 billion was nearly $6 billion in taxes paid to different government entities (other than income taxes)

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Subtracting the costs and expenses from revenues gives income before income tax expenses of about $4 7 billion After paying income taxes of about $2 1 billion, Chevron's net income after taxes for 1996 was approximately $2 6 billion

In 1996, ownership of Chevron was divided into about 653 million shares Thus, the net earnings, or income, attributable to each share of Chevron stock in 1996 was about $4 00 This figure is called "earnings per share, or EPS "

V The Statement of Cash Flows

The statement of cash flows, together with the balance sheet and the income statement, constitute a major portion of a company's financial statements The statement of cash flows shows the effects of a company's operating, investing and financing activities on its cash balance The principal purpose of the statement of cash flows is to provide relevant information about a company's cash receipts and cash payments during a particular accounting period The statement of cash flows provides a more complete indication of the sources and the uses of a company's cash over time

Chevron's statement of cash flows for 1996 is shown in Table 6-3 For Chevron in 1996, net income was $2 6 billion After adding depreciation, depletion, and amortization (called "DD and A" by many energy industry people) of $2 2 billion and making other adjustments, net cash provided by operations of $5 8 billion was calculated

Next, Chevron's investing activities are listed The company used a total of $2 6 billion for investing activities Its total capital expenditure projects in 1996 used $3 4 billion, and the company also generated about $0 8 billion from the sale of certain assets, in 1996

Next, Chevron's financing activities are listed The company used a total of $2 9 billion for financing activities The company paid about $1 36 billion in dividends to its stockholders,

and the remainder was used primarily to repay the principal portion of some of the debt owed to Chevron's creditors

Table 6-3 Chevron Corporation 1996 Statement of Cash Flows

Millions of dollars	1996
OPERATING ACTIVITIES	
Net income	$2,607
Adjustments	
Depreciation, depletion and amortization	2,216
Dry hole expense related to prior years' expenditures	55
Distributions greater than (less than) equity in affiliates' income	61
Net before-tax losses (gains) on asset retirements and sales	207
Net foreign exchange (gains) losses	(10)
Deferred income tax provision	359
Net decrease (increase) in operating working capital	641
Other	(339)
NET CASH PROVIDED BY OPERATING ACTIVITIES	5,797
INVESTING ACTIVITIES	
Capital expenditures	(3,424)
Proceeds from asset sales	778
Other	44
NET CASH USED FOR INVESTING ACTIVITIES	(2,602)
FINANCING ACTIVITIES	
Net (repayments) borrowings of short-term obligations	(1,179)
Proceeds from issuance of long-term debt	95
Repayments of long-term debt and other financing obligations	(476)
Cash dividends paid	(1,358)
Other	(4)
NET CASH USED FOR FINANCING ACTIVITIES	(2,922)
EFFECT OF EXCHANGE RATE CHANGES ON CASH AND CASH EQUIVALENTS	(2)
NET CHANGE IN CASH AND CASH EQUIVALENTS	271
CASH AND CASH EQUIVALENTS AT BEGINNING OF YEAR	621
CASH AND CASH EQUIVALENTS AT YEAR-END	$ 892

Overall For Chevron in 1996, its cash balance increased by $271 million to a total of $892 million at the end of 1996 Cash of $892 million can be considered a large number, in an absolute sense, yet it represents about 2 5% of the total assets on Chevron's balance sheet at the end of 1996

CHAPTER 7

ISSUES IN PRIVATIZATION

I Goals of Privatization

State Owned Enterprises (SOEs) are often considered to be inefficient and a political medium of lowering unemployment Since the early 1980s, privatization has become an important economic tool for transforming SOEs into private companies, especially in most of the Organization for Economic Cooperation and Development (OECD) countries By the end of the 1980s, the failure of centrally planned economies of the Soviet Union and its satellites, and the Latin American debt crisis led most of the international organizations, such as the World Bank, to prescribe privatization as a remedy for many of the problems these emerging economies were facing

Governments and international organizations consider privatization a powerful economic vehicle for

- reducing the role of the state in the economy,
- reducing the budget deficit,
- raising cash through the sale of SOEs,
- reducing debt through debt-equity swaps,
- developing domestic capital markets,
- attracting both domestic and foreign capital,
- increasing productive and operating efficiency of SOEs,
- increasing competition, and
- increasing exports by improving quality

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The above list contains the most commonly cited goals by governments and international organizations and is not meant to be exhaustive The set of goals in each country depends on each government's needs and preferences Some objectives other than those listed above can be given higher priority in certain cases

II Methods of Privatization

There are several methods of privatization Which method to use depends on the needs and preferences of each government If a government needs the revenues from the sale of public assets fairly quickly, certain strategies are preferred over others If, on the other hand, establishing a controlled transition to a competitive market structure is a priority, a more gradual approach may be chosen Alternatives available to governments include the following

- Public offering of shares is more acceptable politically because some control of the enterprise can be retained This option is available, however, only if the state enterprise to be sold is attractive enough to draw offers Also, if equity markets do not exist or are not sophisticated enough, public offering becomes less practical
- Private sales of shares is often easier if the enterprise is in good enough shape to attract buyers However, because control of the enterprise is relinquished, private offerings are less appealing politically
- Sales of public assets allow some separation of valuable components from loss-making enterprises Fragmented sales break up public assets and extend the process of reaping benefits from privatization
- New private investment in SOEs dilutes the state equity share and allows investment for undercapitalized enterprises This method does not eliminate state control
- Leases and management contracts provide the experienced private sector management to improve company performance without relinquishing public sector ownership

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- Management/employee buyouts are direct and simple methods of transferring public assets to private parties, provided that employees can afford significant numbers of shares

III Financial Implications of Privatization

While the benefits of privatization are clear, the financial strategies followed by governments determine success or failure For example, most of the emerging market economies mentioned in Section I went further, and at a faster speed, than the developed countries of OECD they took as examples The transfer of public assets from state to private control has significant economy-wide implications For privatization to succeed, governments must understand the financial implications and make adequate preparations These include creation of capital markets and re-organization of a country's fiscal system The failure to address these issues delayed economic improvement in many emerging markets Most suffered from volatile growth (as measured by the growth rate of the gross domestic product, GDP), high unemployment, negative investment and budget deficits before their economies began to improve

Some of the reasons for the failure, or the absence, of necessary preparations are identified and discussed further below

- Some countries did not have the financial conditions necessary for successful privatizations
    - Financial markets did not exist so that when stock exchanges were created people did not respond because they were not familiar with investing in stocks
    - Frequently, stocks could not be valued accurately because of the absence of adequate accounting procedures
- The lack of private property rights caused potential investors to delay action
- Neither product nor labor markets functioned according to market signals
- The efforts of bureaucrats and politicians to protect the status quo created barriers to successful implementation

A list of economy-wide impacts of privatization, which governments need to consider before the privatization process is initiated, is provided below These are the major financial implications of privatization

1 A shift from economy-wide reliance on debt financing towards greater reliance on private equity
2 A shift from central government debt to debt issued by privatized SOEs
3 A greater role for market-based credit assessment of debt issuers
4 Transfer of responsibility for investment appraisal and undertaking out of the public and into the private sector
5 Significant new issues of equity into the equity market

There are other issues worth considering further An interesting question concerns the effects of privatization on the public sector borrowing requirement (PSBR) and the public sector's cash flow position Governments usually include reducing the budget deficit and PSBR in the list of reasons for privatization in addition to transferring resources to services such as health, education and welfare and the inability to finance future capital requirements of SOEs

Although privatization reduces both PSBR and the budget deficit, it does not affect the long-term resource position of the government as both are cash flows and no indication of "real resource position" of the government The budget deficit is usually reduced by privatization because of the accounting practice of recording public asset sales as negative outlays Either public accounting practices should be brought in line with those of the private sector or the published figure for the budget deficit/surplus should be appropriately adjusted for the proceeds of public asset sales

Privatization may not lead to a change in the balance of assets and liabilities, but it will lead to a change in the overall level of debt, assuming proceeds are applied to debt reduction However, this is probably not significant if the net worth of the government does not change

After all, lenders are mostly interested in a government's capacity to service its debt Debt service is usually not affected by privatization as returns to government decrease along with its assets and debt

Although privatization alters government's cash flow, this would be important only if governments were cash-constrained This is rarely the case as governments have the power to tax or to print money (although this is inflationary) Also, governments are much less risky in terms of not being able to repay their borrowings Therefore, selling public assets hardly seems to be necessary for a government to improve its cash flow as it can borrow fairly easily

A dilemma governments usually face with privatization is the trade-off between financial efficiency and economic efficiency According to the former, governments usually desire to improve their cash position and, therefore, maximizing the price of the public asset to be sold becomes a significant option On the other hand, economic concerns require the improvement of allocative and productive efficiency which can ideally be reached under competitive market conditions However, as the highest price will generally be offered by the closest and largest competitor of the public enterprise for sale and/or for SOEs which will be allowed to maintain their monopoly privileges after transfer to the private sector, market conditions are likely to be less than competitive A solution for this dilemma is regulating the privatized SOE The success of regulation, however, depends on the structure of the regulatory agency The independence of this agency is a must

IV Equity and Debt Considerations

It is important for SOEs to become financially attractive to prospective buyers Usually, public firms have higher debt-to-equity ratios than private firms which renders them less attractive The government can improve the debt-to-equity ratio before the sale, or the new owners can take care of it once they have full control and they decide what best suits their needs The latter is probably the more sensible option as the financial corrections of the government will

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most likely be different than what the new owners would like New owners would have to incur additional cost to restructure the financial system to fit their needs

Public enterprises may also have highly contingent, uncertain liabilities such as agreements to purchase assets at other than market prices and contingent liabilities arising from legal proceedings If these are not dealt with before privatization, the value of the firm will be uncertain If the market discounts risk, the price obtained at sale will be reduced accordingly If the government is less risk-averse, or if it has at its disposal means to reduce the uncertainty, it will be efficient for the government to take over these liabilities when it sells the company

Another issue is the ability of the capital market to supply the necessary funds It is important to recognize that privatization does not alter the aggregate amount of capital to be raised, assuming that the proceeds are applied to debt reduction, but it changes the balance between debt and equity This would not be of any particular significance if the supply of both debt and equity capital were perfectly elastic However, at least with equity, this is probably not the case Equity capital is not homogeneous, because companies differ as to risk and return profiles they offer Unless equity is internationally mobile, there will be limits to the willingness of investors to take equity positions in specific types of investments and the supply of equity will be inelastic Even international mobility may not guarantee that equity capital is freely available at the going price Therefore, lower prices (to offer higher returns) may be necessary to induce private investment

Overall, if the government can affect the price it receives for the companies it is selling, through its impact on the equity market, it will have to determine just how much equity to offer in privatized companies over some time period If it attempts to offer companies with what it thinks are the ideal debt/equity ratios, it will be selling more equity, and depressing the price it receives This is only likely to be a problem if the privatization program involves a large but temporary peak in equity offerings This problem can be avoided either by phasing privatization over a longer period or by selling companies with their debt structure intact and relying on the new owners to lessen the debt/equity ratio as circumstances permit The problem with the latter

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option is that it means selling less equity and more risky equity, and may therefore not really be a solution to the problem at all

V Problems and Conflicts in the Privatization Process

By its very nature the privatization process creates problems and conflicts within the host government Any country undertaking the privatization process has realized the need to stimulate the local economy by private ownership of industrial assets, but this realization alone cannot eliminate the conflicts that arise as the implications of the new order become apparent The resolve of the country's leaders will be tested as beliefs of a lifetime must be modified or ignored For this reason, it is absolutely essential that the privatization effort have support from the highest levels of government

Political leaders, though convinced of the need for private ownership, enter the process thinking that all, or at least a major portion of the ownership, will vest in its local citizenry This immediately clashes with the goal of capital inflows to a government in return for the state-owned assets, when the political leaders must face the realization that the local citizens do not have the cash reserves needed to acquire the assets Decisions must be made on whether to guarantee some minimum local ownership, and if so, how Direct legislation may be used to limit the percentage of foreign ownership, particularly in industries considered vital to national defense Another method of achieving the same results is for a government to require a local partner In the case of Russia, the government issued equity or Privatization Coupons to each citizens in an attempt to distribute some minimum percentage of ownership domestically The idea was that each citizen could trade their coupons for a variety of stock and build a portfolio, or people could pool their coupons and buy an entire company This mechanism allowed employees to gain control of a number of the Russian Oil Associations, and then sell newly issued stock to Western investors to raise capital Unfortunately, a black market developed in the Coupons as many people traded their coupons for food The Eastern European Countries also employed variations of this attempt at mass privatization through an equity voucher or coupon system, with differing degrees of success

A second inherent conflict the host government must face is the perceived loss of control Although in a legal and military sense the weakest country is more than a match for the largest multinational corporation, previously authoritarian governments fear the loss of detailed control of business activities on their territory, and the implications for loss of control in other areas of society The most common and effective solution to this problem in the energy sector is the establishment of an independent regulatory agency Such an independent regulatory authority, chartered in the long-term interest of the country with its strategic political philosophy, can protect the sovereignty of the government and prevent business abuse of the citizenry At the same time, this agency, properly constituted, can create a stable energy industry that will attract foreign private investment and lead to a competitive position on the world energy market The key to successful control by a regulatory agency is stable, predictable, and technically correct regulations that are free from influence by short-term shifts in the political winds, and that inspire confidence of continuity in the investing oil & gas companies, both domestic and international

Another problem for the host government is valuation of the state-owned companies to be privatized Most governments have unrealistic views of the value of their state-owned enterprises An appraisal of the assets has little meaning unless it is consistent with the earning power of those assets Historical costs, Book Values, are usually fraught with problems because of the failure to conform to world accounting standards, and are frequently made meaningless by currency fluctuations In a pure economic sense, "what is a company worth that has never made a profit, and has no reasonable expectation of making a future profit without massive financial and operational changes?" An open bidding process is one way to establish a market price, but great care must be taken to insure unfettered bidding A perception that a local company or a foreign corporation with the right political contacts has an "IN" (an unfair advantage) will discourage foreign participants and lead to unsatisfactorily low bids Chile and Argentina are two countries that successfully used the bidding process, but these two countries also imposed few, if any, controls on foreign ownership Assumptions about the economic value of services the previously state-owned company will deliver to future customers, combined with cash-flow analysis may be the best method of evaluation

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Other problems include the question of whether to proceed gradually or to go for the "Big Bang" theory and try to do it all at once The Eastern European Countries, relying on their pre-World War II private enterprise experience, went for the mass privatization method and saw a sharp drop in industrial output, and also severe problems in company evaluations China and Vietnam have moved more slowly toward privatization and have avoided these short-term problems, but unlike Eastern Europe, these Asian Countries did not begin the process in the wake of revolutionary political change

VI Examples of Petroleum Privatization

In the early 1990s, all around the world, governments began to move towards privatizing their petroleum industries This is a very significant change considering the size of the state-owned oil companies in some of these countries Russia and Latin America provide the most relevant examples Russia is the world's largest producer of oil and gas, and possesses the largest gas reserves in the world Oil and gas SOEs were privatized under separate rules during the economic transition There are now 11 private, albeit vertically integrated, oil and gas companies in Russia Petroleos de Venezuela S A (PDVSA), the national oil company of Venezuela, is the fifth largest producer and fourth largest refiner in the world as of 1994 Petroleos Mexicanos (Pemex), Mexico's state oil company is the world's third largest producer, and tenth largest refiner, again, as of 1994 Other national oil companies in Latin America usually rank in the top 40 largest producers and top 50 largest refiners in the world

Almost all of these state-owned companies are, or used to be, fully integrated That is, they performed the full range of operations from exploration to marketing Governments usually consider them as major employers, and significant sources of national income For example, in the case of Venezuela, oil revenue accounts for 75 percent of exports and 25 percent of gross domestic product The Venezuelan government's take (through taxes and royalties) on PDVSA's revenues ranges from 70 to 80 percent

National oil companies (NOCs) are occasionally asked to provide public services, such as building the infrastructure for clean drinking water, sanitary sewage systems, roads and electricity This is especially true in the case of remote areas where they may be operating Moreover, domestic prices for petroleum products are heavily subsidized For example, until early 1996, gasoline was sold at 13 U S cents per gallon in Venezuela, about $1 00 less than the U S price and $2 00-3 00 less than European prices As a result, consumers enjoy prices significantly lower than their international prices, but companies receive less than their potential revenues which, in turn, prevents them from improving their efficiency All of these circumstances created overstaffed and inefficient NOCs that would not be able to compete in a rapidly globalizing world economy They were not able to update the technology they employed, and they had no incentive to improve themselves as governments continued to tax the revenues heavily

Case Study PDVSA - New Private Investment

PDVSA's plans included increasing production capacity to 5 5 million barrels a day by 2005 from 2 1 million barrels a day in 1990 This plan required $55 billion in investment capital Venezuela needed the new and advanced technology, in addition to capital, that foreign companies could provide to enhance production in marginal fields and to develop new fields As a result, in the early 1990s, the Venezuelan Congress passed a law allowing multinational energy companies back into the country 20 years after the nationalization of the petroleum industry Production of oil in Venezuela increased to around 2 8 million barrels a day in 1995, and to 3 1 million barrels in early 1997

Although the complete privatization of PDVSA is currently not an option, the company president stated that "it would be very healthy to have 15 percent of shares in the capital market " In 1997, PDVSA issued bonds worth $20 million in local currency These bonds were marketed heavily towards individual investors PDVSA offered 100 percent guarantee and comparable returns to Central Bank bonds and commercial papers The company also provided the option of buying them back at 100 percent of their face value every three months if an investor chooses so Although small in size, with this offering, PDVSA aimed to raise public interest in investing in the

energy sector The experiment was considered successful, and the company plans to offer more bonds in the future

Like many NOCs, PDVSA operates many mature, high cost fields In 1992, Venezuela auctioned more than 125 marginal fields to international bidders By March 1993, there were 14 active service contracts with multinationals Production from the fields covered by these contracts is expected to reach 300,000 barrels a day in 1998 and 450,000 barrels a day in 2003

In 1996, under association agreements, PDVSA awarded licenses for exploration and production in eight potentially promising oil regions with a total estimated 7 billion barrels of medium and light oil in place PDVSA expects that these contracts will bring in $11 billion in investment and that production will increase by 500,000 barrels a day within a decade

The third round of bidding for marginal fields in June 1997 attracted more than $2 billion (double the government's expectations) from 91 companies representing 15 countries 20 fields with about 3 billion barrels of proven oil reserves were on the auction block The fields which occur in Venezuela's Orinoco Belt, require advanced technology to enhance production capacity from the current level of 66,000 barrels of heavy oil a day to 600,000 barrels a day in 10 years Contracts are expected to generate about $6 billion in investment

The June 1997 auction was significant for the diversity of companies The top two bidders were Lasmo P L C from the U K and Spain's Repsol S A China National Petroleum Company placed two of the highest bids This indicates how globally competitive the world crude oil business has become

Under Venezuelan association agreements, the interested companies are required to pay a fee of $50,000 per site for a PDVSA data package on the field and an additional $100,000 fee to enter bids The foreign company, after earning the contract, is expected to assume all risk associated with exploration If no oil is found, the company also assumes all the losses If oil is found, PDVSA and the Venezuelan government join in to take their share For example, if the

foreign company earns $100 million a year, the state takes half of that through the Profits Participation Tax, and another $16 7 million in royalties The remaining profits ($33 3 million) are taxed at the petroleum tax rate of 67 7% (the same as what PDVSA pays), leaving the company with $11 1 million Finally, PDVSA can take up to 35 percent of that amount which would leave the company with $7 2 million

Venezuela attracts strong interest despite its steep taxes and fees, because of its resource base and, more importantly, its resource position in Latin America and lower political risk relative to other producing countries Other countries may not be as successful in attracting foreign capital if they imitate Venezuela's strategy of high taxes and fees India, for example, failed in its efforts of inviting foreign companies to invest in its upstream businesses, because incentives were not sufficient In other words, expected returns were not sufficient to justify the risks

Case Study Mexico - SOE Asset Sales

In Mexico, the state petroleum company, Petroleos Mexicanos (Pemex), is taxed at about 75 percent providing significant revenues for the government Although the privatization of Pemex is not even a topic of discussion, foreign companies are now allowed to make equity investments in petrochemical operations formerly belonging to Pemex However, political disputes have delayed Mexico's petrochemical privatization program

The first step taken by Mexico was to reduce the number of petrochemical products reserved for Pemex from 70 to 34 in 1986 and then to 20 in 1989 While Mexico initiated this step, the North American Free Trade Agreement (NAFTA) reinforced Mexico's strategy The "basic" petrochemicals remain in Pemex's control and include products like ethylene "Secondary" products are now open to private investment Ammonia is the most common of these Chemical plants that produced secondary products were scheduled for auction to private bidders

Initially, there was no restriction on the amount of ownership in an existing petrochemical plant that foreign private investors could take Rising concern about job losses associated with

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privatization and foreign ownership caused labor unions, and ultimately Mexico's Congress, to force a halt in the program The Congress restricted foreign ownership to 49 percent of equity An attempt to place assets scheduled for privatization into trusts in which investors could buy stock also is on hold, partly because of reluctance on the part of potential investors

There are no equity ownership limits on new, "greenfield" petrochemical projects, and several are underway with one near completion

Case Study YPF-A - Privatization and Initial Public Offering (IPO)

A more significant example of petroleum privatization is the sale of Yacimientos Petroliferos Fiscales (YPF), the national oil company of Argentina in 1993 Although YPF-A (not to be confused with YPF-B, Bolivia's NOC) is not as large as PDVSA or Pemex, it was ranked 37th in the world in production and 50th in refining in 1994 However, as discussed earlier, these lower rankings are partially due to the inefficiency of the state in running YPF-A The production of oil has been declining in the 1980s, but, in 1995, production increased to 700,000 barrels a day from 483,000 barrels a day in 1990 By 2000, one million barrels a day is expected to be produced Privatization and opening up to international investment not only allowed the enhancement of recovery from existing fields but also increased overall drilling activity by 66 percent between 1993 and 1994 Aside from oil production, natural gas development is a key ambition for Argentina, which hopes to play a significant role in the evolving "Southern Cone" gas grid

Argentina's privatization efforts was brought about by the poor state of the country's economy YPF-A, which had more than 50,000 employees and generated more than $4 billion in annual revenues, emerged as an organization whose privatization was necessary to help the government solve the country's economic problems

Congress authorized the sale of up to 58 5 percent of YPF-A stock, but the government would like to sell an additional 20 percent Under the privatization plan, individual shareholders are not allowed to own more than 5 percent of the new company The state will continue to own

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20 3 percent of YPF-A, oil and gas producing provinces 11 2 percent, and YPF-A employees 10 percent The state share, however, will eventually be sold at some future date

YPF-A initially put about 35 percent of its stock on the market in the U S and Argentina and was able to sell $2 billion of its $6 billion in assets About 126 million shares were sold for about $16 a share versus original expectations of $17-20 a share The current price of a YPF-A share is around $32 YPF-A now has about 5,800 employees All of the upstream services YPF-A used to provide are now carried out by over 130 new companies that were created after privatization YPF-A also established itself as an international player by acquiring a U S independent crude oil exploration and production company, Maxus Petroleum, in 1994

Thanks to privatization and other free-market oriented reforms, Argentina's economy started to grow at rates higher than the Latin American average of 3 7 percent Unemployment and inflation are tamed Overall, Argentina now presents itself as one of the established emerging markets This is especially true in the case of energy sector The natural gas pipeline projects between Argentina and Chile as well as Argentina and Brazil, and onshore and offshore exploration and production ventures are very attractive prospects for energy companies all over the world

A remaining problem is YPF-A's large share (65 to 70 percent) of marketed natural gas production YPF-A retains strong influence down the gas "value chain" (production through end use), discouraging critical investments in Argentina This illustrates the common problem with privatization, the monopoly or near monopoly of the former SOE Control of YPF-A's market power is politically difficult in Argentina

Case Study Gazprom - Privatization and Initial Public Offering

After the break-up of the Soviet Union, Russia has undertaken a series of reforms in its efforts to transform its centrally planned economy to a market-based economy Much of Russia's industry has been privatized or is currently being privatized One of the flagship industries in Russia, the petroleum industry, is currently going through the privatization process, but at a

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slower pace than other sectors In November 1992, 11 vertically integrated oil companies from former oil producing associations of the Soviet Union were established by a presidential decree The gas sector and Gazprom were to remain intact for the time being

In 1993, however, Gazprom was converted into a state-owned joint stock company Privatization was initiated in April 1994 Company shares were divided among Gazprom employees and other domestic investors As in privatization of the oil industry, the government was to hold on to 40 percent of the shares for at least three years Only nine percent of the company stock was initially allocated for foreign investment Gazprom's approval was required for the sale of shares, even between private individuals

The changes are important, because Gazprom is the world's largest gas producing company The company produces 90 to 95 percent of Russia's gas (about 25 percent of total world production) from about 100 of the largest fields in the country Gazprom owns almost 20 percent of world's gas reserves The company also owns and operates almost 90,000 miles of gas pipeline grid and runs 26 trading houses and marketing joint ventures in 13 European countries

In October 1996, another presidential decree ordering a new gas pricing system was issued A new scheme that differentiates gas prices by geographic regions to reflect transportation costs was introduced in February 1997 In April 1997, another presidential decree ordering further reform of Gazprom was signed Under this decree, the government continues to retain its 40-percent equity stake in Gazprom indefinitely, but the company loses its monopoly right to develop new gas deposits Also, Gazprom has to offer equal access and competitive rates on its pipeline network to all producers Finally, the company is required to ensure transparency of its finances with detailed annual reports The results of these decrees on the monopoly status of Gazprom are yet to be seen

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APPENDIX

Table I - Future Value Interest Factor

Table II - Present Value Interest Factor

Table III - Future Value of an Annuity Interest Factor

Table IV - Present Value of an Annuity Interest Factor

Table V - Normal Distribution

TABLE I

Future Value Interest Factor (FVIF) ($1 at i% for n years), $FVIF = (1 + i)^n$, $FV_n = PV_0(FVIF_{i,n})$

PERIOD	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	24%	28%	32%	36%	40%
0	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000
1	1 010	1 020	1 030	1 040	1 050	1 060	1 070	1 080	1 090	1 100	1 110	1 120	1 130	1 140	1 150	1 160	1 170	1 180	1 190	1 200	1 240	1.280	1.320	1 360	1 400
2	1 020	1 040	1 061	1 082	1 102	1 124	1 145	1 166	1 188	1 210	1 232	1 254	1.27[illegible]	1 300	1.3[illegible]2	1.346	1 369	1 392	1 416	1 440	1.538	1 638	1 742	1 850	1 960
3	1 030	1 061	1 093	1 1[illegible]5	1 158	1 191	1 225	1 260	1 295	1 331	1.368	1 405	1 443	1 48[illegible]	1.521	1.561	1 60	1 643	1 685	1 728	1 907	2 067	2.300	.313	44
4	1 041	1 082	1 126	1 170	1 216	1 262	1 311	1.360	1 412	1 464	1.518	1.574	1 630	1 689	1 749	1 811	1 8 4	1 939	2 005	2 074	2.364	2 684	3 036	3 4 1	3 84
5	1 051	1 104	1 159	1 217	1 276	1.338	1 403	1 469	1.539	1 611	1 685	1 762	1 842	1 925	2 011	2 100	2 192	2.288	2.386	2 488	2 932	3 436	4 007	4 653	5 378
6	1 062	1 126	1 194	1 26[illegible]	1.340	1 419	1.501	1.587	1 677	1 772	1 870	1 974	[illegible]082	2 195	2 313	2 436	2.565	2.700	2.840	2 986	3 635	4 398	5 290	6 3 8	7 530
7	1 0[illegible]	1 149	1 230	1.31[illegible]	1 407	1.504	1 606	1 714	1 828	1 949	2 076	2.211	2.353	2.502	2 660	2 8[illegible]6	3 001	3 185	3 379	3 583	4.508	5 629	6 983	8 60	10 [illegible]41
8	1 083	1 172	1 [illegible]6	1 369	1 4[illegible]	1 594	1 718	1 851	1 993	2 144	2 305	2 476	2.658	2 853	3 059	3 278	3.511	3 9	4 0[illegible]1	4 300	5.590	7 206	9 217	11 703	14 758
9	1 094	1 195	1 305	1 4 3	1.551	1 689	1 838	1 999	2.172	2.358	2.558	2 773	3 004	3 [illegible]52	3.518	3 803	4 108	4 435	4 785	5 160	6 931	9 2[illegible]3	1 166	15 917	20 661
10	1 105	1 219	1 344	1 480	1 629	1 791	1 967	2 159	2 367	2.594	2 839	3 106	3.395	3 07	4 046	4 411	4 807	5 234	5 695	6.19[illegible]	8.594	11 806	16 060	21 647	28 9[illegible]5
11	1 116	1 43	1 384	1 539	1 710	1 898	2 105	2 332	2.580	2.853	3 152	3 479	3 836	4.2[illegible]6	4 652	5 117	5 624	6.1 6	6 777	7 430	10 657	15 112	21 199	[illegible]9 439	40 496
1	1 127	1 268	1 4 6	1 601	1 796	2 012	2 252	2.518	2.813	3 138	3 498	3 896	4.335	4 818	5.350	5 926	6.580	7 [illegible]88	8 064	8 916	13 15	19 343	27 983	40 037	56 694
13	1 138	1 294	1 469	1 66[illegible]	1 886	2 133	2 410	2.720	3 066	3 452	3 883	4 363	4 898	5 492	6 153	6 886	7 699	8 599	9 596	10 699	16.386	24 759	36 937	54 451	79 372
14	1 149	1 319	1 513	1 732	1 980	2 261	2 79	2.937	3.342	3 [illegible]97	4 310	4 887	5.[illegible]35	6 261	7 076	7 988	9 007	10 147	11 420	12.839	20 319	31 961	48 757	74 053	111 120
1	1 161	1 346	1 558	1 801	2 079	397	2 759	3 172	3 642	4 177	4 785	5 474	6 [illegible]54	7 138	8 137	9 266	10.539	11 974	13.590	15 407	25 196	40 565	64 359	100 712	15 [illegible]568
16	1 173	1 373	1 605	1 873	2 183	2 540	2 952	3 4[illegible]6	3 970	4 595	5 311	6 130	7 067	8 137	9.358	10 748	12.330	14 1[illegible]9	16.172	18 488	31 243	51 923	84 954	136 969	21 79
1	1 184	1 400	1 6[illegible]3	1 948	2 292	2 693	3 159	3 00	4 328	5 054	5 895	6.866	7 986	9 2 6	10 761	12 468	14 426	16.672	19 244	22 186	38 741	66 461	112 139	186 78	304 914
18	1 196	1 428	1 702	2 026	2 40	2 854	3 380	3 996	4 717	5 560	6 544	7 690	9 024	10 5 5	12.375	14 463	16 879	19 673	22 901	26 623	48 039	85 071	148 0[illegible]5	253.338	426 879
19	1 [illegible]08	1 457	1 754	2 107	2 527	3 026	3 617	4 316	5 142	6 116	7 263	8 613	10 19	12 0[illegible]6	14.232	16 777	19 748	[illegible]3 14	27 252	31 948	59 [illegible]68	108 890	195 591	344.540	597 630
[illegible]	1 2[illegible]0	1 486	1 806	2 191	2 653	3 207	3 870	4 661	5 604	6 7[illegible]8	8 062	9 646	11.5[illegible]3	13 743	16.367	19 461	23 106	27 393	32 429	38 338	73 864	139 380	257 916	468 574	836 683
4	1.270	1 608	033	2.563	3 225	4 049	5 072	6 341	7 911	9 850	12.[illegible]39	15 1[illegible]9	18 [illegible]90	23 1	28 6.5	35 [illegible]36	43 297	53 109	65 03	79 497	174 631	374 144	783 025	1 603 00	3 14 [illegible]0
25	1 282	1 641	094	2 6[illegible]6	3 386	4 29	5 427	6 848	8 623	10 835	13.585	17 000	21 231	26 462	32.919	40 874	50 658	62 669	77 388	95 396	21[illegible]42	478 905	1 033.59	2 180 08	4 499 88
30	1 348	1 811	2 427	3 243	4 322	5 743	7 61	10 063	13 268	17 449	22 892	29 960	39 116	50 9[illegible]0	66 12	85 850	111 065	143 371	184 675	237.376	634 820	1 645.50	4 142 07	10 143 0	24 [illegible]01 4
40	1 489	2 [illegible]08	3 26	4 801	7 040	10 286	14 9 4	21 725	31 409	45 259	65 001	93 051	132 82	188 884	[illegible]67 864	378 721	553 869	750 378	1 051 67	1 469 77	5 455 91	19 426 7	66 520 8	219.56	700 038
[illegible]0	1 645	692	4 384	7 107	11 467	18 420	29 457	46 902	74.358	117 391	184 56[illegible]	289 002	450 736	00	331 083 66	1 670 70	2,[illegible]66 22	3 927.36	5 988 91	9 100 44	46 890 4	229 350			
60	1 81	3 281	5 892	10.5[illegible]0	18 6[illegible]9	32 988	57 946	101 57	176 031	304 482	524 057	897 597	1,530 05	2,595 9[illegible]	4,384 00	7,3 0[illegible]0	12,335 4	20 555 1	34 105 0	56 347 5	402 99[illegible]				

*These [illegible]terest fa[illegible]tors [illegible]ed 1 000 000

TABLE II

Present Value Interest Factor (PVIF) ($1 at i% for n years), $PVIF = \frac{1}{(1+i)^n}$, $PV_0 = FV_n(PVIF_{i,n})$

PERIOD	1%	2[illegible]	3%	4%	5%	6%	7[illegible]	8[illegible]	9%	10[illegible]	11[illegible]	12%	13%	14[illegible]	15%	16%	17%	18[illegible]	19%	20%	24[illegible]	28%	32%	36%	40%
0	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000
1	0 990	0 980	0 9 1	0 9[illegible]	0 95	0 943	0 93	0 9 6	0 917	0 909	0 901	0 893	0 885	0 8	0 8 0	0 862	0 855	0 847	0 840	0 833	0 806	0 [illegible]81	0 758	0 735	0 714
	0 980	0 961	0 943	0 9 5	0 907	0 890	0 8 3	0 8	0 842	0 8 6	0 81	0 97	0 83	0 769	0 756	0 743	0 731	0 718	0 706	0 694	0 6[illegible]0	0 610	0 574	0 541	0 10
3	0 9 1	0 94	0 91	0 889	0 864	0 840	0 81[illegible]	0 [illegible]94	0 72	0 1	0 751	0 71	0 693	0 67	0 6[illegible]8	0 641	0 624	0 609	0.593	0 79	0 24	0 477	0 435	0 398	0 364
4	0 961	0 924	0 889	0 85	0 823	0 79	0 763	0 3	0 708	0 683	0 659	0 636	0 613	0 59[illegible]	0 5[illegible]	0.[illegible]	0 534	0 516	0 499	0 48	0 4 3	0 373	0 329	0 [illegible]92	0 260
5	0 951	0 90[illegible]	0 863	0 8[illegible]	0 784	0 747	0 713	0 681	0 6[illegible]0	0 6 1	0 593	0 6	0 543	0 19	0 49	0 4 6	0 456	0 437	0 419	0 402	0 341	0 291	0 250	0 1	0 186
6	0 94	0 888	0 838	0 790	0 746	0 70	0 666	0 630	0 596	0 64	0.[illegible]3	0 507	0 480	0 456	0 43	0 410	0 390	0 3 0	0 352	0 33	0 27	0 227	0 189	0 158	0 133
	0 933	0 8 1	0 813	0 760	0 711	0 66	0 6 3	0.[illegible]83	0 547	0 513	0 48	0 45	0 4	0 400	0 3 6	0 3[illegible]4	0 333	0 314	0 296	0 79	0 [illegible]9	0 1 8	0 143	0 116	0 095
8	0 923	0 853	0 789	0 731	0 677	0 62	0 58	0.[illegible]40	0.502	0 467	0 434	0 404	0 3 6	0 3 1	0 327	0 305	0 [illegible]85	0 266	0 49	0 233	0 179	0 139	0 108	0 08[illegible]	0 068
9	0 914	0 837	0 766	0 703	0 64	0.[illegible]9	0 44	0.500	0 460	0 4 4	0.391	0 361	0 333	0 308	0 284	0 263	0 43	0 2[illegible]5	0 209	0 194	0 144	0 108	0 082	0 0[illegible]3	0 048
10	0 905	0 8[illegible]0	0 744	0 6 6	0 614	0 5 8	0 508	0 463	0 4[illegible]2	0.386	0 3 2	0 32[illegible]	0 [illegible]95	0 0	0 247	0 [illegible]97	0 [illegible]08	0 191	0 176	0 162	0 116	0 085	0 062	0 046	0 035
11	0 896	0 804	0 2[illegible]	0 6[illegible]0	0 585	0 5 7	0 475	0 429	0 388	0 3[illegible]0	0 31	0 287	0 61	0 3	0 15	0 195	0 178	0 162	0 148	0 135	0 094	0 066	0 047	0 034	0 025
1	0 887	0 88	0 701	0 625	0 557	0 497	0 444	0 397	0.3 6	0 319	0 86	0 257	0 231	0 208	0 187	0 168	0 152	0 13	0 1 4	0 112	0 076	0 052	0 036	0 025	0 018
13	0 8 9	0 773	0 681	0 601	0 530	0 469	0 415	0 368	0 3 6	0 290	0 258	0 229	0 [illegible]04	0 18	0 163	0 14	0 130	0 116	0 104	0 093	0 061	0 040	0 027	0 018	0 013
14	0 870	0 58	0 661	0 [illegible]7	0 [illegible]05	0 44	0 388	0 340	0 299	0 [illegible]63	0 232	0 205	0 181	0 160	0 141	0 1 5	0 111	0 099	0 088	0 0 8	0 049	0 03	0 021	0 014	0 009
15	0 861	0 743	0 6[illegible]	0 5	0 481	0 417	0 36	0 31	0 2	0 239	0 [illegible]09	0 183	0 160	0 140	0 123	0 108	0 095	0 084	0 074	0 06[illegible]	0 040	0 025	0 016	0 010	0 006
16	0 8 3	0 728	0 623	0 34	0 458	0 394	0 339	0 29	0 252	0 18	0 188	0 163	0 141	0 1 3	0 107	0 093	0 081	0 071	0 062	0 054	0 032	0 019	0 012	0 00	0 005
1	0 844	0 714	0 605	0 513	0 436	0 371	0 317	0 2 0	0 31	0 198	0 170	0 146	0 1 5	0 108	0 093	0 080	0 069	0 060	0 052	0 045	0 026	0 015	0 009	0 00	0 003
18	0 836	0 00	0 87	0 494	0 416	0 3[illegible]0	0 [illegible]96	0 250	0 21	0 180	0 153	0 130	0 111	0 09	0 081	0 069	0 059	0 0 1	0 044	0 038	0 021	0 012	0 00	0 004	0 00
19	0 828	0 686	0 0	0 47[illegible]	0 39[illegible]	0 331	0 2 6	0 3	0 194	0 164	0 158	0 116	0 098	0 083	0 0 0	0 060	0 051	0 043	0 037	0 031	0 017	0 009	0 005	0 003	0 002
20	0 8[illegible]0	0 673	0 4	0 4 6	0 3 7	0 31	0 58	0 1	0 1 8	0 149	0 1 4	0 104	0 087	0 0 3	0 061	0 051	0 043	0 03	0 031	0 0 6	0 014	0 007	0 004	0 002	0 001
4	0 88	0 6[illegible]	0 49	0 390	0 310	0 47	0 19	0 158	0 1 6	0 10	0 08	0 066	0 053	0 043	0 03[illegible]	0 0 8	0 023	0 019	0 01	0 013	0 006	0 003	0 001	0 001	0 000
	0 780	0 610	0 478	0 37	0 295	0 [illegible]33	0 184	0 146	0 116	0 092	0 074	0 059	0 04	0 038	0 030	0 024	0 020	0 016	0 013	0 010	0 00	0 00[illegible]	0 001	0 000	0 000
30	0 42	0 5	0 41	0 308	0 231	0 174	0 131	0 099	0 07	0 05	0 044	0 033	0 0 6	0 0[illegible]0	0 015	0 012	0 009	0 007	0 005	0 004	0 00	0 001	0 000	0 000	0 000
40	0 67	0 453	0 30	0 08	0 14	0 09	0 0[illegible]7	0 046	0 03	0 02[illegible]	0 01	0 011	0 008	0 00	0 004	0 003	0 002	0 001	0 001	0 001	0 000	0 000	0 000	0 000	0 000
50	0 608	0 37	0 [illegible]8	0 141	0 087	0 054	0 034	0 021	0 013	0 009	0 005	0 003	0 00	0 001	0 001	0 001	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000
[illegible]0	0 5[illegible]0	0 305	0 1 0	0 09	0 054	0 030	0 017	0 010	0 006	0 003	0 002	0 001	0 001	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000

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TABLE III

Future Value of an Annuity Interest Factor (FVIFA) ($1 per year at *i*% for *n* years),

$$\text{FVIFA} = \frac{(1+i)^n - 1}{i}, \quad \text{FVAN}_n = PMT(\text{FVIFA}_{i,n})$$

PERIOD	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	24%	28%	32%	36%	40%
1	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000
2	2 010	2 020	2 030	2.040	050	2 060	2 0 0	080	2 090	2 100	2 110	120	2 130	2 140	2.150	2 160	2.170	2 180	2 190	2 200	2 240	2 280	2.320	2 360	2 400
3	3 030	3 060	3 091	3 12	3 152	3 184	3 215	3 246	3 278	3.310	3.342	3 374	3 40	3 440	3 473	3.506	3 539	3.572	3 606	3 640	3 778	3 918	4 062	4 10	4 360
4	4 060	4 12	4 184	4 246	4 310	4.3 5	4 440	4 506	4.573	4 641	4 10	4.779	4 850	4 921	4 993	5 066	5 141	5 215	5 291	5 368	5 684	6 016	6 362	6.725	104
5	5 101	5 204	5 309	5 416	5.526	5 637	1	5 86	5 985	6 105	6 228	6.353	6.480	6 610	6 742	6 877	7 014	7 154	7 297	7 442	8 048	8 700	9 398	10 146	10 846
6	6 15	6 308	6 468	6.633	6 802	6 9	7 153	7.336	7.523	7 716	913	8 115	8.3 3	8.536	8 754	8 977	9 207	9 44	9 683	9 930	10 980	12 136	13 406	14 799	16 3 4
7	7 214	7 434	7 662	7 898	8 142	8 394	8 654	8 923	9 200	9 487	9 783	10 089	10 405	10 730	11 067	11 414	11 772	12 142	12 523	12 916	14 615	16 534	18 696	1 1 6	3 853
8	8 86	8 583	8 892	9 214	9 549	9 897	10 260	10 63	11 028	11 436	11 859	1 300	12 75	13 233	13 727	14 240	14 773	15 327	15 902	16 499	19 123	22 163	25 678	29 3	34 395
9	9 369	9 5	10 1 9	10 583	11 027	11 491	11 978	12 488	13 021	13.579	14 164	14 776	15 416	16 085	16.786	17 518	18 285	19 086	19 923	20 799	24 71	29 369	34 895	41 435	49 153
10	10 462	10 950	11 464	12 006	1 5 8	13 181	13 816	14 487	15 193	15 937	16 722	17 549	18 420	19 337	20 304	21.321	22 393	23 521	24 709	25 959	51 643	38 59	47 062	5 35	69 814
11	11 567	12 169	12 808	13 486	14 207	14 972	15 784	16 645	17.560	18.531	19.561	20 655	21 814	23 044	24.349	25 733	27 200	28 75	30 404	32 150	40 38	50 399	63 102	78 998	98 739
12	12 683	13 412	14 192	15 026	15 917	16.8 0	17 888	18 9 7	20 141	21.384	22 713	4.133	25 650	27 271	29 002	30 850	32 824	34 931	37 180	39.580	50 985	65 510	84.320	108.43	139 35
13	13 809	14 680	15 618	16 627	17 713	18 882	20 141	21 495	22 953	24.523	26 21	8 029	29 985	32.089	34.352	36 786	39 404	42 219	45 244	48 497	64 110	84 853	112.303	148 475	195 929
14	14 947	15 974	17 086	18 292	19 599	21 051	22.550	4 215	26 019	27 975	30 095	32.393	34 883	37 581	40.505	43 672	47 103	50 818	54 841	59 196	80 496	109 612	149 240	202 926	275.300
15	16 09	17 293	18 599	20 024	1 579	23 76	25 129	27 15	29 361	31 772	34 405	37 80	40 41	43 842	47 580	51 660	56.110	60 965	66 261	72 035	100 815	141 303	197 99	276 979	386 420
16	17 58	18 639	20 157	21 825	23 657	25 673	7 888	30 3 4	33 003	35 950	39 190	42 753	46 672	50 980	55 717	60 925	66 649	72 939	79 850	87 442	126.011	181 868	262 356	377 692	541 988
17	18 430	20 01	21 762	23 698	25 840	8 213	30 840	33 750	36 9 4	40 545	44.501	48 884	53 739	59 118	65 075	71 673	78 979	87 068	96 022	105 931	157 253	33 791	347 310	514 661	759 784
18	19 615	21 412	23 414	25 645	28 132	30 906	33 999	3 450	41.301	45 599	50.396	55 750	61 725	68 394	75.836	84 141	93 406	103 740	115 266	128 117	195 994	300 252	459 449	700 939	1 064 0
19	20 811	22 841	25 117	27 671	30 539	33 60	3 379	41 446	46 018	1 159	56 939	63 440	70 49	8 969	88 212	98 603	110 285	123 414	138 166	154 740	244 033	385.323	607 472	954 977	1 491.58
20	22 019	24 29	26 870	29 778	33 066	36 86	40 995	45 762	51 160	57.27	64 203	79 05	80 94	91 025	102 444	115.380	130 033	146 628	165 418	186 688	303 601	494 213	802 863	1,298 82	2 089 21
24	26 973	30 422	34 426	39 083	44 502	50 816	58 117	66 65	76 790	88 497	102 174	118 15	136.831	158 659	184 168	213 978	248 808	289 494	337 010	392 484	723 461	1,322 66	2 443 82	4 450 00	8 033 00
25	28 243	32 030	36 459	41 646	47 727	54 865	63 249	73 106	84 701	98.347	114 413	133.334	15 6 90	181 871	212 793	249 214	292.105	342 603	402 042	471 981	898 092	1 06 80	3,226 84	6 053 00	11 247
30	34 85	40 568	47 575	56 085	66 439	79 058	94 461	113 283	136 308	164 494	199 021	41.333	293 199	356 787	434 745	530.321	647 439	790 948	966 712	1 181 88	2 640 92	5,873 23	12 940 9	28 172 3	60 501 1
40	48 886	60 40	75 401	95 026	120 080	154 6	199 635	259 05	337 88	44 593	581 826	76 091	1 013 0	1,342.03	1 779 09	2,360 76	3 134.52	4 163 21	5,529 83	7,343 86	9 278 8	69 377	207 8 4	609 890	
50	64 463	84 572	112 797	15 667	209 348	290 336	406.529	5 3 700	815 084	1 163 91	1 668	2 400 09	3 459 51	4 994.52	7,217 72	10 435 6	15 089 5	21 813 1	31,515 3	45 497 2	195,3 3	819 103			
60	81 670	114 05	163 053	23 991	355 584	533 128	813 520	1 253 1	1 944 79	3 034 82	4 5 07	7 471 64	11 761 9	18,535 1	29,220 0	46 057 5	72,555 0	114 190	179 495	281 733					

*These i te est factors eed 1 000 000

TABLE IV

Present Value of an Annuity Interest Factor (PVIFA) ($1 per year at *i*% for *n* years),

$$\text{PVIFA} = \frac{1 - \frac{1}{(1+i)^n}}{i}, \quad \text{PVAN} = PMT(\text{PVIFA}_{i,n})$$

PERIOD	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	24%	28%	32%	36%	40%
1	0 990	0 980	0 9 1	0 962	0 9 2	0 943	0 93	0 9 6	0 917	0 909	0 901	0 893	0 885	0 877	0 870	0 862	0 855	0 84	0 840	0 833	0 806	0 781	0 758	0 3	0 714
2	1 9 0	1 942	1 913	1 886	1 8 9	1 833	1 808	1 83	1 7 9	1 36	1 13	1 690	1 668	1 647	1 626	1 605	1 585	1 566	1 547	1 5 8	1 4 7	1 392	1 332	1 6	1 294
3	941	2 884	2 829	2 77	2 3	2 6 3	2 624	2	31	2 48	2 444	40	361	2 322	2 283	2 246	2 10	2 174	2 140	2 106	1 981	1 868	1 766	1 6 4	1 589
4	3 902	3 808	3 1	3 630	3 546	3 46	3 387	3 31	3 240	3 1 0	3 10	3 03	9 4	2 914	2 855	2 798	2 743	2 690	2 639	2 89	2 404	241	2 096	1 966	1 849
5	4 8 3	4 713	4 80	4 45	4.329	4 21	4 100	3 993	3 890	3 91	3 696	3 60	3 1	3 433	3 352	3 274	3 199	3 127	3 058	2 991	2 4	2.532	2 345	2 181	2 035
6	5 95	5 601	417	5 42	5 076	4 917	4 766	4 6 3	4 486	4 35	4 31	4 111	3 998	3 889	3 784	3 685	3.589	3 498	3 410	3 326	3 020	2 59	2 534	2 399	2 168
7	6 8	6 472	6 30	6 002	5 786	5 582	389	5 906	5 033	4 868	4 1	4 64	4 4 3	4 288	4 160	4 039	3 929	3 81	3 706	3 605	3 24	2 937	2 678	2 455	2 263
8	7 652	7 3 5	7 020	6 33	6 463	6 10	5 971	5 4	5 535	5 335	5 146	4 968	4 799	4 639	4 48	4 344	4 207	4 078	3 954	3 837	3 421	3 076	2 786	2.540	2.331
9	8 566	8 16	7 786	7 435	7 108	6 80	6 15	6 4	5 995	5 7 9	5.53	5 328	5 13	4 946	4 772	4 607	4.451	4 303	4 163	4 031	3 566	3 184	2 868	2 603	2.379
10	9 471	8 983	8 530	8 111	7 722	7 360	0 4	6 10	6 418	6 14	5 889	5 650	5 426	5 16	5 019	4 833	4 659	4 494	4 339	4 193	3 68	3 269	2 930	2 650	2 414
11	10 368	9 78	9 53	8 60	8 306	7 88	7 499	7 139	6.805	6 495	6 20	5 938	5 68	5 453	5 234	5 029	4 836	4 656	4 486	4 327	3 776	3 335	2 9 8	2 683	2 438
12	11 25	10 5 5	9 954	9 385	8 863	8 384	7 943	7 536	7 161	6 814	6 49	6 194	5 918	5 660	5 4 1	5 197	4 988	4 793	4 611	4 439	3 851	3 38	3 013	2 08	456
13	1 134	11 348	10 63	9 986	9 394	8 853	8 358	7 904	7 487	7 103	6 7 0	6 424	6 1	5 842	5 583	5 342	5 118	4 910	4 715	4.533	3 91	3 427	3 040	2 770	2 469
14	13 004	12 106	11 296	10 563	9 899	9 29	8 74	8 44	7 786	7 367	6 98	6 628	6 302	6 002	5 724	5 468	5 229	5 008	4 80	4 611	3 96	3 459	3 061	740	4 8
15	13 86	1 849	11 938	11 118	10 380	9 712	9 108	8 5 9	8 061	7 606	7 191	6 811	6 46	6 142	5 847	5.575	5 324	5 092	4 876	4 675	4 001	3 483	3 0 6	2 750	2 484
16	14 718	13 78	12 561	11 652	10 838	10 106	9 447	8 8 1	8 312	8 4	7 3 9	6 974	6 604	6 65	5 954	5 669	5 405	5 162	4 938	4 730	4 033	3 503	3 088	2 58	2 489
17	1 6	14 992	13 166	1 166	11 74	10 47	9 63	9 122	8 544	8 022	7 549	7 120	6 729	6.373	6 047	5 749	5 4 5	5 222	4 990	4 775	4 0 9	3 518	3 097	2 63	2 492
18	16 398	14 99	13 754	12 659	11 690	10 8 8	10 059	9 3	8 756	8 201	7 0	50	6 840	6 467	6 1 8	5 818	5 534	5 273	5 033	4 812	4 080	3 529	3 104	2 6	2 494
19	1 996	1 6 8	14 3 4	13 134	12 085	11 1 8	10 336	9 604	8 950	8 365	7 839	366	6 938	6 550	6 198	5 877	5 584	5.316	5 0 0	4 844	4 097	3 539	3 109	2 7 0	2 496
20	18 046	16 3 1	14 8	13 90	12 46	11 4 0	10 94	9 818	9 128	8.514	7 963	7 469	7 025	6 623	6 259	5 929	5 628	5 353	5 101	4 870	4 110	3 546	3 113	2 770	2 49
24	1 43	18 914	16 936	15 4	13 799	12 50	11 469	10 29	9 07	8 985	8 348	7 784	7 283	6 835	6 434	6 073	5 746	5 451	5 182	4 937	4 143	3 562	3 121	2 777	2 499
25	2 0 3	19 3	17 413	1 6	14 094	12 83	11 654	10 6	9 8 3	9 0	8 422	7 843	7.330	6 873	6 464	6 097	5 766	5 46	5 195	4 948	4 147	3 564	3 129	2 6	2 499
30	5 808	29 39	19 600	17 292	15 3 3	13 63	12 409	11 258	10 274	9 4	8 694	8 05	7 496	7 003	6.566	6 177	5 829	5 517	5 35	4 979	4 160	3 69	3 124	2 7 8	2 500
40	3 83	2 3	3 11	19 93	17 159	15 046	13 33	11 9	10 757	9 79	8 9 1	8 244	7 634	7 105	6 64	6 33	5 871	5 548	5 58	4 997	4 166	3 571	3 125	2 7 8	2 500
50	39 196	31 4 4	5 730	1 482	18 256	1 62	13 801	1 233	10 962	9 915	9 042	8 304	7 675	7 133	6 661	6 46	5 880	5.554	5 26	4 999	4 167	3 571	3 125	2 778	2 500
60	44 9	34 61	7 676	29 6 3	18 929	16 161	14 039	12 3	11 048	9 96	9 0 4	8 324	7 68	140	6 665	6 249	5 882	5 555	5 63	5 000	4 167	3 5 1	3 125	2 8	2 500

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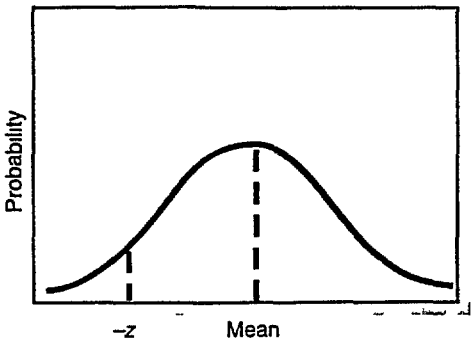
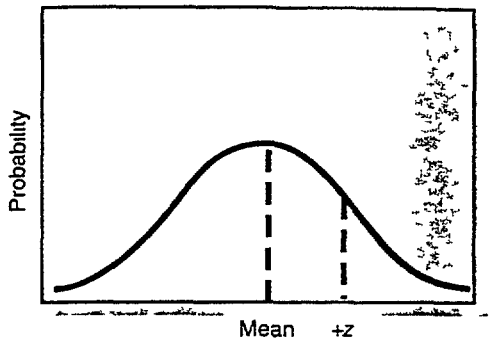
TABLE V

Normal Distribution (Area of the Normal Distribution that is to the Right of +z *or* the Left of −z Standard Deviations from the Mean)





z*	00	01	02	03	04	05	06	07	08	09
0 0	5000	4960	4920	4880	4840	4801	4761	4721	4681	4641
1	4602	4562	4522	4483	4443	4404	4364	4325	4286	4247
2	4207	4168	4129	4090	4052	4013	3974	3936	3897	3859
3	3821	3783	3745	3707	3669	3632	3594	3557	3520	3483
4	3446	3409	3372	3336	3300	3264	3228	3192	3156	3121
5	3085	3050	3015	2981	2946	2912	2877	2843	2810	2776
6	2743	2709	2676	2643	2611	2578	2546	2514	2483	2451
7	2420	2389	2358	2327	2296	2266	2236	2206	2177	2148
8	2119	2090	2061	2033	2005	1977	1949	1922	1894	1867
9	1841	1814	1788	1762	1736	1711	1685	1660	1635	1611
1 0	1587	1562	1539	1515	1492	1469	1446	1423	1401	1379
1 1	1357	1335	1314	1292	1271	1251	1230	1210	1190	1170
1 2	1151	1131	1112	1093	1075	1056	1038	1020	1003	0985
1 3	0968	0951	0934	0918	0901	0885	0869	0853	0838	0823
1 4	0808	0793	0778	0764	0749	0735	0721	0708	0694	0681
1 5	0668	0655	0643	0630	0618	0606	0594	0582	0571	0559
1 6	0548	0537	0526	0516	0505	0495	0485	0475	0465	0455
1 7	0446	0436	0427	0418	0409	0401	0392	0384	0375	0367
1 8	0359	0351	0344	0336	0329	0322	0314	0307	0301	0294
1 9	0287	0281	0274	0268	0262	0256	0250	0244	0239	0233
2 0	0228	0222	0217	0212	0207	0202	0197	0192	0188	0183
2 1	0179	0174	0170	0166	0162	0158	0154	0150	0146	0143
2 2	0139	0136	0132	0129	0125	0122	0119	0116	0113	0110
2 3	0107	0104	0102	0099	0096	0094	0091	0089	0087	0084
2 4	0082	0080	0078	0075	0073	0071	0069	0068	0066	0064
2 5	0062	0060	0059	0057	0055	0054	0052	0051	0049	0048
2 6	0047	0045	0044	0043	0041	0040	0039	0038	0037	0036
2 7	0035	0034	0033	0032	0031	0030	0029	0028	0027	0026
2 8	0026	0025	0024	0023	0023	0022	0021	0021	0020	0019
2 9	0019	0018	0018	0017	0016	0016	0015	0015	0014	0014
3 0	0013									
3 05	0011									
3 10	0010									
3 25	0006									
3 50	00023									
4 00	00003									
5 00	0000003									

*Absolute values of z

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GLOSSARY

After-tax cash flow (ATCF) - Earnings after tax plus non-cash charges, such as depreciation and deferred taxes

Amortization - The systematic allocation of the of an intangible asset over its expected economic life or some other period of time for financial reporting purposes, tax purposes, or both (see depreciation)

Annuity - The payment or receipt of a series of equal cash flows per period for a specified amount of time In an *ordinary annuity*, payments are made at the end of each period, in an *annuity due*, payments are made at the beginning of each period

Balance Sheet - A financial statement that lists a company's assets, liabilities, and stockholders' equity at a point in time

Beta - A measure of systematic risk It indicates the volatility of a security's returns relative to the returns of a broad-based market portfolio of securities

Beta risk - The risk contribution of a project to the systematic risk of a company

Business risk - The variability in a company's operating earnings (EBIT)

Capital budgeting - The process of planning for purchases of assets whose cash flows are expected to continue beyond one year

Capital expenditure - The amount of money spent to purchase a long-term asset, such as a piece of equipment This cash outlay generally is expected to result in a flow of future cash benefits extending beyond one year in time

Capital gains yield - The expected percentage increase in the price of the stock

Capital markets - Financial markets in which long-term securities are bought and sold

Capital rationing - The process of limiting the number of capital expenditure projects because of insufficient funds to finance all projects that otherwise meet the firm's criteria for acceptability or because of a lack of sufficient managerial resources to undertake all otherwise acceptable projects

Capital recovery problem - An annuity amount necessary to recover a capital investment

Capitalization of cash flow - A method of determining the present value of an asset that is expected to produce a stream of future cash flows This involves discounting the stream of expected future cash flows at an appropriate rate

Cash flow - The actual amount of cash collected and paid out by a company

Common stock - Shares in the ownership of a company Common stock represents a residual form of ownership in that dividends are paid out only after more senior financial obligations, such as interest on debt, are fulfilled

Compound interest - Interest that is paid not only on the principal but also on any interest earned but not withdrawn during earlier periods

Contingent project - A project whose acceptance depends on the adoption of one or more other projects

Cost of capital - The equilibrium rate of return demanded by investors in the securities issued by a firm

Depreciation - The systematic allocation of the cost of a tangible asset over its expected economic life or some other period of time for financial reporting purposes, tax purposes, or both (See amortization)

Discount rate - The rate of interest used in the process of finding present values (discounting)

Dividend - The amount of money paid to the owner of stock in a company

Divisional cost of capital - A risk-adjusted discount rate for investments being evaluated by a company's various divisions It reflects both the differential required returns of equity investors, estimated from the security market line, and a division's differential debt capacity

Exchange rate - The rate at which a currency can be converted into another currency

Expected market return - The return investors expect to earn on stocks with an average beta of 1 0

Expected return - The benefits (price appreciation and distributions) an individual anticipates receiving from an investment

Expected value - A statistical measure of the mean or average value of the possible outcomes Operationally, it is defined as the weighted average of the possible outcomes with the weights being the probability of occurrence

Financial analysis - The utilization of a group of analytical techniques, including financial ratio analysis, to determine the strengths, weaknesses, and direction of a company's performance

Financial forecasting - The projection and estimation of a company's future financial statements

Financial ratio - A statistical yardstick that relates two numbers generally taken from a firm's income statement, balance sheet, or both at a specific point in time

Fixed costs - Costs that do not vary as the level of a firm's output changes

Future (terminal) value - The value at some future point in time of a present payment (or a series of payments) evaluated at the appropriate interest (growth) rate

Hurdle rate - The minimum acceptable rate of return from a project For projects of average risk it is usually equal to the company's cost of capital

Income statement - A financial statement that indicates how a company performed during a period of time

Initial investment - The initial cash outlay required at the beginning of an investment project

Interest - The return earned by or the amount paid to an individual who forgoes current consumption or alternative investments and "rents" money to a business, bank, the government, some other form of institution, or another individual

Interest rate parity - The theory that the percentage differential between the spot and the forward rate for a currency quoted in terms of another currency is equal to the approximate difference in interest rates in the two countries over the same time horizon

Interest rate risk - The variation in the market price (and hence in the realized rate of return or yield) of a security that arises from changes in interest rates

Internal rate of return (IRR) - The discount rate that equates the present value of net cash flows from a project with the present value of the net investment It is the discount rate that gives the project a net present value equal to zero The IRR is used to evaluate, rank, and select from among various investment projects

Marginal cost of capital - The weight after-tax cost of the next dollar of capital a company expects to raise to finance a new investment project

Marketability risk - The ability of an investor to buy and sell an asset (security) quickly and without a significant loss of value

Market value - The price at which a stock trades in the financial marketplace

Multinational corporation - A company with direct investments in more than one country

Net present value (NPV) - The present value of the stream of net cash flows resulting from a project, discounted at the firm's cost of capital, minus the project's net investment It is used to evaluate, rank, and select from among various investment projects

Net working capital - The difference between a company's current assets and current liabilities The term *net working capital* is used interchangeably with *working capital*

Nominal interest rate - A market rate of interest stated in current, not real terms Nominal interest rates reflect expected inflation rates

Opportunity cost - The rate of return that can be earned on funds if they are invested in the *next best* alternative investment

Optimal capital budget - The level of capital spending at which a company's investment opportunity curve just intersects its marginal cost of capital curve

Optimal capital structure - The capital structure that minimizes a company's weighted cost of capital and, therefore, maximizes the value of the firm

Payback (PB) period - The period of time required for the cumulative cash inflows from a project to equal the initial cash outlay

Present value - The value today of a future payment (or a series of future payments) evaluated at the appropriate discount rate

Required return - The return (yield) an individual demands from an investment as compensation for postponing consumption and assuming risk Required return is often used interchangeably with the term "hurdle rate "

Risk - The possibility that actual future returns will deviate from expected returns, the variability of possible returns from a project

Risk-adjusted discount rate - A discount rate that reflects the risk associated with a particular project In capital budgeting, a higher risk-adjusted rate is used to discount cash flows for riskier projects, whereas a lower risk-adjusted rate is used to discount cash flows for less risky projects

Risk-free rate of return - The return required by an investor in a security having no risk of default, equal to the sum of the real rate of return and an inflation risk premium

Risk premium - The difference between the required rate of return on a risky investment and the rate of return on a risk-free asset, such as U S Treasury bills Components include maturity risk, default risk, seniority risk, and marketability risk

Sensitivity analysis - A procedure used to evaluate the change in some objective, such as net present value, to changes in a variable influencing that objective, such as product price, one of the cash flow elements

Simulation - A financial planning tool that models some event, such as the cash flows from an investment project, often for the purpose of assessing the risk associated with the project It is also called Monte Carlo Simulation

Systematic risk - That portion of the variability of an individual security's return that is caused by factors affecting the market as a whole This also is called nondiversifiable risk

Term structure of interest rates - The pattern of interest rate yields for debt securities that are similar in all respects except for their length of time to maturity The term structure of interest rates usually is represented by a graphic plot called a yield curve

Unsystematic risk - Risk that is unique to a company This also is called diversifiable risk