RECENT DIVERSIFICATION STRATEGY AND ITS

RELATION TO FINANCIAL PERFORMANCE OF MAJOR

COMPANIES IN THE OIL INDUSTRY

by

Thomas Joseph Langan

B.S., University of Massachusetts, Amherst
(1975)
M.S.C.E., Massachusetts Institute of Technology
(1978)
M.S.O.E., Massachusetts Institute of Technology
(1978)

Submitted to the Department of

Management

in Partial Fulfillment of the

Requirements for the Degree of

MASTER OF SCIENCE

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 1983

Signature of Author: _____

Department of Management, May, 1983

Certified by: _____

Thesis Supervisor

Accepted by: _____

Jeffrey A. Barks
Director of Master's Programs

RECENT DIVERSIFICATION STRATEGY AND ITS

RELATION TO FINANCIAL PERFORMANCE OF MAJOR

COMPANIES IN THE OIL INDUSTRY

by

Thomas Joseph Langan

ABSTRACT

Recent diversification activities of major companies in
the petroleum industry are studied to determine if value has
been created for the companies' shareholders as a result of
these activities. Contemporary methods in financial economics
are employed to calculate the firms' all equity excess returns
for each year in the analysis period. These are related to the
firms' diversification strategies (represented by changes in
revenue sources and company structure) via a hypothesis testing
technique utilizing cross-classification tables.

As a result of testing several hypotheses, it is concluded
that diversification has had no significant effect on the equity
returns of the oil companies. Several widely criticized acqui-
sitions have not adversely affected the firms' stockholders,
as generally believed. The much greater size of oil-related
revenues compared to non-oil revenues is deemed responsible.
The oil companies may continue similar acquisitions and expect
relative impunity in the market. Diversification, however,
should still satisfy certain strategic and economic criteria
and not lead to serious repercussions from the public and
private sector.

Thesis Supervisor: Prof. Gordon Walker
                   Department of Management

Acknowledgements

A number of people were helpful in the development and completion of this work. Special thanks is due to Professors Gordon Walker, James Paddock, and Ben Ball of the Department of Management for their insight and assistance.

Table of Contents

List of Appendices

I. Introduction

During the past 30 years, an increasing proportion of U.S. companies have seen wisdom in pursuing a strategy of diversification. Between 1950 and 1970, for example, single-business companies comprising the Fortune 500 declined from 30% to 8% of the total. Among these diversifying companies are many of the major oil companies who, for several reasons including their size, wealth, and high visibility, have attracted attention to their diversification activities. It is these activities and their resultant effects on the value of twelve of the major oil companies which is of primary concern here.

Corporate diversification can occur via acquisition or internal development. The former is the more efficient of the two for large corporations because it can be carried out more swiftly and does not require the internal reorganization accompanying the latter. For the companies in this study, diversification has primarily occurred through acquisition, but this is not important because subsequent analyses for the effects of diversification are not dependent on the manner in which diversification was achieved.

The business literature discusses various types of possible gains or economies to diversifying corporations. Among these are operating gains, increased market power, and financial effects. It is generally assumed that these gains are only attainable through related diversification, but they can also be realized through unrelated diversification. A related-business diversifier uses its skills in a specific functional activity

or product market as a basis for branching out. An unrelated-business diversifier pursues growth in product markets where the main success factors are unrelated to each other. Both can create significant benefits for the corporation and its shareholders.

Value is created for the shareholders of a diversifying company when the diversification leads to increased returns on equity at correspondingly reduced systematic risk. (Systematic risk is that portion of total risk which cannot be reduced through simple portfolio diversification.) Before any diversification activity is engaged in by a firm, it should be justified as an action of potential benefit to the shareholders of the firm, considering all implications. It must increase the market value of the company without creating serious repercussions.

There are three principal methods of evaluating corporate diversification. These involve use of the Strategy Model, the Product/Market Portfolio Model, and the Risk/Return Model. The Risk/Return Model is used in this study because of its versatility in analyzing both related and unrelated diversification, its use of contemporary concepts in financial economics (and, therefore, its use of quantitative methods), and the availability of data necessary for the model. The financial orientation of the Risk/Return Model tells managers that diversification decisions should be evaluated as investment decisions. The same model can be used to evaluate these decisions

8

once they have been implemented.

The twelve major oil companies chosen for this study are:
The Atlantic Richfield Company; Exxon Corporation; Gulf Oil
Corporation; Mobil Corporation; the Shell Oil Company; the
Standard Oil Companies of California, Indiana, and Ohio; Sun
Company, Inc.; Tenneco, Inc.; Texaco, Inc.; and the Union Oil
Company of California. These companies were selected primarily
for their individual and combined sizes, as reflected in their
total revenues. Each is a large, vertically-integrated, virtu-
ally single-industry firm (except for Tenneco) and their
combined revenues comprise the vast majority of revenues for
the entire energy industry. Any conclusions derived from an
analysis of these firms can reasonably be applied to the energy
industry as a whole and, perhaps, to other large firms that
dominate some other industry.

The firms are categorized in each year of the study period
according to their degree of diversification, which is deter-
mined by their distribution of sales in different revenue seg-
ments. These categorizations are analyzed for any relation to
the firms' excess returns on equity. The same is done by com-
paring the firms' actual participation in different revenue
segments to their excess returns. This two-sided approach to
the problem should clearly indicate a relation, if any, between
the firms' diversification strategies and their returns on
stock.

Excess returns on equity is used as the basis on which to

examine the effect of diversification because it reflects the benefits or costs to the firms' stockholders of unanticipated (by the market) activities of the firms during a specific time period. Diversification is an example of such unanticipated activity. The excess returns for each firm are calculated on an annual basis from 1967 to 1981. This period of time and the annual basis was chosen because it provides sufficient data for the analysis to be statistically robust, includes the years of greatest activity in the oil industry, and contains most recent data which enables conclusions to be derived that more accurately reflect possible future trends.

The methodology for relating excess returns to the firms' diversification activities involves the use of cross-classification tables and a hypothesis testing technique which measures the success of a hypothesis by its superiority over a chance prediction. Through the testing of various hypotheses relating diversification to excess returns on equity, it will be determined if diversification has created value for oil industry shareholders. These results will also lead to a set of conclusions and recommendations that apply to major firms in the energy industry and, perhaps, to dominant firms in some other industry.

II. An Overview of Corporate Diversification

General

The issues and literature on corporate diversification[1] through merger, acquisition, and/or internal development are voluminous but relatively straightforward. Major points on the topic as they pertain to this study will be presented here to provide a sufficient overview of the subject and an introduction to subsequent sections.

There are many reasons and pressures leading companies to diversify. Among these are to mitigate the effects of a slow down in sales and earnings accompanying the mature phase of a business' life cycle; to exploit new product ideas developed through a successful R&D effort; to build on an existing franchise; competitive pressure; to smooth the swings of cyclical income streams; to more fully utilize the management skills of executives within the diversifying company; to attract and retain first-rate managers with new responsibilities and opportunities; and, U.S. antitrust laws which force growth oriented companies to search for diversification opportunities in other fields rather than use their money to expand either horizontally or vertically.

Companies can diversify through acquisition or internal development. Diversification through internal development relies on existing internal resources to establish a new business. Such a strategy of diversification requires an explicit planning process and special technological and organizational

---

1. Refs. 2, 4-6, 8-13, 17, 24.

capacities that can take several years to implement and can lead
to major internal rearrangements. On the other hand, diversifi-
cation through acquisition can occur swiftly and does not require
sustained planning nor does it necessarily lead to disruptive
reorganization. Thus it can save a company time and can cost
less because of such factors as patents, product image, exclusive
distribution, and special management and/or research and develop-
ment skills which can be very difficult to emulate through in-
ternal development within reasonable time and costs.

For the large corporations in this study, diversification
into new businesses has logically occurred through acquisitions.
Diversification within the main business in the form of horizon-
tal and/or vertical integration has also occurred via acquisi-
tions, but to some extent through internal development. This
"how" aspect of the companies' diversification is not of con-
cern here. It is more a question of what areas the companies
have diversified into (and the resultant effects) that is at
issue.

Important Considerations

The most important question facing a company adopting a
strategy of diversification is: How can value be created for
the company's shareholders through diversification? Put in a
different way, how can shareholders' interests best be served
(assuming this is the primary goal of the firm's managers and
that shareholders' interests are being served in the first

place) now that the firm has adopted a diversification strategy?

Before considering these questions, it is important to point out some misunderstandings about diversification as they relate to the economics of this strategy and its successful implementation.

- Acquisitive diversifying firms[2] generate higher returns through increased earnings and capital appreciation than their counterparts.

  (This idea gained support because acquisition companies can sustain high levels of growth in earnings per share, EPS, and, in the 1960's, the market considered this a good indicator of management's performance and a business' economic strength. It became clear, however, that this high EPS growth was merely accounting related and that capital productivity was a better indicator. This led to a fall in the market value of many acquisitive companies, implying analysts' uncertainty about the size and variability of the companies' future cash flows. The greater the uncertainty, the higher the discount rates applied to a company's future earnings and the less capital appreciation.)

- Unrelated diversification by firms offers shareholders a superior means of reducing their investment risk.

  (Investment risk consists of company-specific unsystematic risk, which can be diversified away, and systematic risk,

2. Arguments presented in this section for firms diversifying through acquisitions are meant to apply equally to firms diversifying through internal development.

which is common to all market securities and cannot be eliminated through diversification. Company unrelated diversification reduces unsystematic risk, but, since the investor can do this for himself through portfolio diversification, he need not have a company do it for him. In fact, investment in a mutual fund may be more attractive than investment in a diversified firm because of the firm's high management costs and its inability to move into or out of assets as quickly as can be done with a mutual fund.)

- Adding countercyclical businesses to a company's portfolio leads to stabilized earnings and thereby increased market value.

(Even if diversifying companies can identify countercyclical businesses, it is very difficult for them to construct balanced portfolios of businesses whose variable returns balance one another; and, if they could, the portfolios would eventually need rebalancing since the businesses grow at different rates. Also, the market may be more interested in growth and the productivity of invested capital than in earnings stability. Lastly, investors are unlikely to bid up the values of diversified companies since the benefits of stabilized income streams can simply be obtained through portfolio diversification.)

- Related diversification is safer than unrelated diversification.

(Successful related diversification depends on both the

quality of the acquired business and the organizational integration required to achieve the possible benefits of companies exchanging their skills and resources, i.e. synergy. Also, the businesses must be truly related and the merger must lead to a competitive advantage. Otherwise, related diversification cannot be justified as even comparable to unrelated diversification as a means of reducing risks or increasing earnings.)

- The benefits of diversification through acquisition will be realized if the acquired company has a strong management team. (This belief is why many companies try to limit their acquisition candidates to well-managed companies. But, whether pursuing related or unrelated diversification, the acquiring company's management skills and resources are critical to achieving the potential benefits of diversification, not the acquired firm's. It is the acquirer who must exploit the circumstances brought on by the transaction through effective use of the acquired company's core skills and resources.)

Value can be created for the shareholders of a company pursuing diversification when the diversification leads to increased returns (i.e., an income stream for the diversified company that is greater than could be realized from a portfolio investment in the original company and a similarly managed company in the "new" business) and reduced systematic risk (that is, a reduction in the variability of the income stream for the diversified company greater than that which could be realized from a portfolio in-

vestment as before). It is important to emphasize that most benefits of reducing unsystematic risk through diversification are as available to individual investors as they are to corporate investors. Diversifying companies will not create value for their shareholders by merely diversifying away unsystematic risk. In efficient capital markets, unsystematic risk is irrelevant in equity valuation since investors can diversify away unsystematic risk for themselves. Value can only be created for shareholders when the diversified company's risk/return trade-offs include benefits not available through simple portfolio diversification.

The principal ways in which diversifying companies can obtain returns[3] greater than those obtainable from simple portfolio diversification are:

- By acquiring a firm whose management has certain skills and industry knowledge that can be applied to the acquiring firm. (This is the realization of synergy in the case of related diversification. Management skills and resources critical to the success of a business are reinforced in the original firm by the merged partner, leading to higher profitability and value for the firm's shareholders.)

- Through investments in closely related markets that lead to reduced long-run average costs. (This related diversification can reduce average costs through economies of scale, rationalization of production and other managerial tasks, and technological innovation.)

3. Note: Returns and risk are directly related.

- Through business expansion in a competent area that can lead
  to the development of additional resources, which can be used
  to develop abilities necessary to outperform the competition.
  (In many industries, managers claim that companies must
  achieve a certain size before they can compete effectively.
  One of the ways of attaining this required size is by making
  closely related, diversifying acquisitions.)

- By diversifying into related product markets which can en-
  able a company to reduce systematic risks.
  (Diversifying into a related product market can help a com-
  pany reduce its technological, production, or marketing
  risks. If these reduced business risks can be translated
  into a less variable income stream for the firm, value is
  created for the shareholders.)

- Through diversification which permits cash to be transferred
  from units operating with a surplus to units operating with
  a deficit, thereby reducing the need for individual busi-
  nesses to obtain expensive working-capital funds from
  outside sources.
  (This is a case of unrelated diversification in which the
  widely diversified company has the opportunity to balance
  the working capital needs and surpluses of its divisions
  as the economy experiences a business cycle or as the divi-
  sions experience seasonal fluctuations. This type of work-
  ing capital management is an operating benefit distinct
  from the recycling of cash on an investment basis.)

- Through diversification allowing the company to direct investment funds from high net cash flow businesses to projected high growth businesses whose current net cash flow is zero or negative.

(This benefit of unrelated diversification can improve the long-run profitability of the corporation as a whole. It is a result of the U.S. tax code, which imposes double taxation of dividends via corporate profits taxes and personal income taxes. By reinvesting its surplus cash flow, the company defers taxes the stockholders would otherwise have to pay. Essentially, this is a case of cross-subsidization which has important implications. Diversified companies have access to information that is often unavailable to the investment community. This "inside" information is internally generated market data about each industry in which the company operates, and includes information about the competitive position and potential of each company in the industry. Thus, the diversified company can better assess the investment merits of particular projects and industries in which it is involved, enabling the company to choose the most attractive projects. This leads to a more efficient allocation of capital among the projects and industries by the company than the capital market.)

- Through unrelated diversification which pools risk and can lower a company's cost of debt, allowing the company greater leverage than a nondiversified equivalent firm.

(This reduces the company's total cost of capital because it enables the shareholders to shift some risk to the government, which shoulders part of the cost of debt capitalization in a business venture by allowing tax deductions on debt interest. This benefit can only be realized, however, if the firm aggressively manages its financial risks by raising its debt-equity ratio or by operating several high-risk, unrelated projects in its portfolio of businesses.)

An unrelated-business diversifier is a company pursuing growth in product markets where the main success factors are unrelated to one another. A related-business diversifier uses its skills in a specific functional activity or product market as a basis for branching out. In either case, diversification does offer potentially significant benefits to the corporation and its shareholders. When a company has the ability to export or import surplus skills or resources useful in its competitive environment, related diversification is an attractive strategy. When a company possesses the skills and resources to analyze and manage widely different businesses, unrelated diversification can be best. Lastly, when a company possesses both of these abilities, the best strategy to adopt depends on the personal skills and inclinations of the company's top managers.

A final point worth stressing concerns two major reasons why programs of diversification fail. Both reasons are related to a lack of comprehensive diversification plans by the diversi-

fying company. The first is that companies often tend to ac-
quire firms that are available, rather than firms which meet
strategic and economic criteria. Thus, chances for failure
are high. Second, there is the danger of overpaying for an
acquisition that seems particularly attractive. No matter
how attractive an opportunity is or how well it fits a company's
needs, there is a price beyond which the venture is no longer
worth considering. By adhering to the strategic and economic
logic presented herein, these major errors (making the wrong
acquisition or paying too much for the right one) can be
avoided and the diversifying firm can improve its competitive
position and create value for its shareholders.

An Analytical Framework

There are three principal methods of determining whether
or not the diversification activities of a firm have been bene-
ficial to the firm and its stockholders; i.e., whether or not
these activities have created value for the firm's investors.[4]
The first is well established and is known as the Strategy
Model. It focuses on the process of defining how a company
should compete in its economic environment and how its per-
formance can be measured. The model places heavy emphasis

4. Note: These methods are also applied in evaluating the bene-
   fits of diversification before it is undertaken. They help
   establish meaningful diversification guidelines and identify
   high-potential acquisition candidates. The discussion here-
   in of their use in an ex post evaluation of diversification
   is more in line with the analytical rather than prescriptive
   nature of this study on oil company diversification.

on the concept of strategy, commonly defined as "the determination of basic long-term goals of an enterprise and the adoption of courses of action and the allocation or resources necessary for carrying out these goals". The goal of the model is to facilitate a rational choice among strategic options facing a company. The options concern which opportunities to exploit, which strengths to build on, which risks to defend against, and what policies to pursue toward these ends. An option is viewed in terms of how well it fits with the company's skills and resources and the extent to which it furthers the attainment of corporate goals and objectives. Thus, application of the model favors closely related diversification. Any analysis of diversification must include an assessment of whether or not the area into which the firm has diversified is sufficiently similar to have warranted the action. The model suggests that only after a company's strengths and weaknesses in each functional area have been identified is its management in a position to evaluate the potential of diversification. Finally, it says the best approach to diversification is not to measure product-market attractiveness but to identify those organization strengths that may be transferred to other product markets and those weaknesses that need to be corrected. Because of its emphasis on related diversification and its qualitative evaluation process, the Strategy Model was not used to examine the diversification activities of the companies in this study.

The second method of evaluation employs the Product/Market Portfolio Model which, as the name implies, is concerned with the composition and management of a company's product/market portfolio. The model focuses on the strengths of a company's portfolio of products or businesses, where these strengths are defined in terms of market share and market growth. Emphasis is placed on the cash flow characteristics of a business. The model states that a company should evaluate the competitive situation and market growth within its business units and construct a cluster of businesses through which high cash flow can be achieved. The goal is to maximize the total strength of the company which, according to the model, is best achieved by balancing sources and uses of cash within the company. Diversification opportunities and decisions are evaluated in terms of the cash flow patterns they produce - how they evolve over time, the investment required to generate them, and their fit with the cash flows from existing products and businesses. Changes in the business portfolio should fill financial weak spots or build upon financial strengths.

The Product/Market Portfolio Model suggests guidelines for both related and unrelated diversification and therefore can be used to evaluate the benefits that construe from either activity. Successful related diversification should reduce relative costs or increase market share resulting in higher cash flow and return on investment. Successful

unrelated diversification should improve a company's cash flow balance by generating both investment funds and investment opportunities, leading to an improved financial and strategic position.

This model does not provide a satisfactory basis for comparing diversification strategies with similar product/market or cash use/cash generation characteristics, nor is it helpful in defining when the costs of further investment in a business outweigh the potential cash flow benefits. Neither the Strategy nor the Product/Market Portfolio Models can handle these issues. In light of these shortcomings, which are not present in the third model, and because of the difficulty in obtaining data on cash flows from the various businesses into which the sample companies have diversified, the Product/Market Portfolio Model was rejected as a means of analyzing diversification effects in this study.

The third method of diversification analysis involves the Risk/Return Model. This model was chosen for this study because of its use of contemporary concepts in financial economics. In contrast to the Strategy and Product/Market Portfolio Models, the Risk/Return Model reflects the interests of investors rather than managers. It leads managers to view their company as a portfolio of investments in capital assets by investors through the company's securities, and helps them construct an investment portfolio that creates real economic value for investors. This model can readily be ap-

plied in an analysis of corporate strategy, particularly in diversification. It helps assess the effect of diversification on the market value of a company.

In the Risk/Return Model, diversification analysis is accomplished through use of the Capital Asset Pricing Model (CAPM),[5] expresses algebraically as:

$$E(R_i) = E(R_f) + \beta_i (E(R_m) - E(R_f))$$

where R_i is the investment's risk adjusted rate of return, R_f is the risk-free rate, β_i is the systematic risk level of the security, and R_m is the rate of return on the market portfolio. $E(\ )$ denotes expected value.[6]

For the purposes of this study, R_i is the annual rate of return on a company's stock. R_f is the annual rate of return on U.S. Treasury Bills, which are assumed risk-free since they have the lowest probability of default and are the most liquid of all instruments in the capital market. $R_m - R_f$ is the difference between the annual rates of return earned by owning the risky market portfolio and owning the risk-free asset and, therefore, constitutes the market's risk premium. In theory, the market portfolio should include all risky assets, but, in practice and for this study, it is limited to stocks com-

5. For details on the development and applications of CAPM, see ref. 4.

6. Though CAPM is generally used in a predictive capacity, it can be used in an ex post analysis of returns, as is done in this study. In that case, expected values become realized (actual) values. This is of no consequence for R_f, however, since the realized value of R_f is the same as $E(R_f)$.

prising the Standard and Poor's 500. β_i (beta) is obtained by regressing the company's historical (previous 5 years) returns on stock against corresponding market returns. Thus, it measures the security's systematic risk which is of interest to investors because unsystematic risk can be eliminated through simple portfolio diversification. A beta less than 1.0 indicates the security's returns are less variable than the market's returns and therefore less risky. The opposite is true for a security with a beta greater than 1.0. Despite the fact that beta reflects historical relationships, it is useful for short-term (annual) forecasts because most assets' risk profiles have been shown to change slowly over time.

The financial orientation of the Risk/Return Model tells managers that diversification decisions must be evaluated as investment decisions via CAPM. The key issues to be considered prior to diversification are: What is the $E(R_i)$ associated with this decision? Does the decision have a positive net present value (equal to the sum of associated discounted cash flows less the initial investment)? What is the net effect of the decision on the market value of the company? Analogous questions can be considered after diversification. The point is that diversification decisions should meet at least one of the following conditions: either they should (1) reduce the level of systematic risk below that of a comparable portfolio of securities without reducing expected returns, or (2) increase returns above those of a comparable portfolio without increas-

ing systematic risk.

According to the Risk/Return Model, reduced systematic risk can be achieved by the diversifying company when:

1. Related diversification reduces the variability of a business's cash flow by increasing the size of the company such that it becomes the low cost producer or the dominant competitor within a business.

2. More effective project selection by the diversified company generates a faster growing or more stable cash flow than available in a comparable portfolio of businesses.

3. Diversification enables management to adopt high business risk strategies for individual businesses that have or lead to low systematic risk. (Less diversified companies would be less willing to employ such strategies because of their potentially high costs.)

Likewise, increased returns can be achieved by the diversifying company when:

1. Related diversification leads to more effective utilization of the company's key skills and resources, thereby reducing average costs.

2. Unrelated diversification creates a larger set of investment opportunities within the company, from which a greater proportion of high return projects are selected.

3. Aggressive financial management within the diversified company improves working-capital management and increases the firm's debt level.

These guidelines suggest that the benefits of corporate diversification are more limited than commonly perceived. Nevertheless, the Risk/Return Model suggests that a well-managed diversified firm can provide value for its investors through a more stable, better managed cash flow that ultimately leads to increased returns and/or reduced systematic risk which may not be attained through a comparable portfolio of securities; i.e., the diversified firm can have a greater net present value than the comparable portfolio.

Details on the application of the Risk/Return Model (and CAPM) in this study are presented in Section IV.

III. Company Data and Issues

Company Data

The companies chosen for this study are twelve of the largest firms in the energy industry. Their total revenues are all in the multi-billions of dollars and, combined, their energy revenues comprise the vast majority of revenues for the industry as a whole. The companies were selected for their size (each company is a large, upper level Fortune 500 corporation) and their combined revenues (representing such a large portion of the industry). Any conclusions that can be drawn from a study involving these firms can reasonably be applied to other large firms that dominate some other major industry.

The twelve-company sample is:

- Atlantic Richfield Company (ARCO)
- Exxon Corporation (XON)
- Gulf Oil Corporation (GULF)
- Mobil Corporation (MOBIL)
- Shell Oil Company (SHELL)
- Standard Oil Company of California (SOCAL)
- Standard Oil Company of Indiana (SOIND)
- Standard Oil Company of Ohio (SOHIO)
- Sun Company, Inc. (SUN)
- Tenneco, Inc. (TENN)
- Texaco, Inc. (TEX)
- Union Oil Company of California (UNION)

Appendix A contains a description of each company's current business and a historical overview of the company's

30

diversification and other activities from 1967 to 1981.[1] This
period of time is sufficiently long in that it contains enough
data for a statistically robust study and has well within it
the events of recent great significance in the energy industry -
the oil price shocks of 1973-74 and 1979. This means the per-
iod contains much data that can be considered independent of
these occurrences and, since the period also contains most
recent data, a better judgement can be made concerning the
effects of future company activities. More reliable recommen-
dations for future actions can also be given.

Appendix B gives each company's annual total sales from
1967 to 1981 and then identifies the proportion of these sales
that came from particular segments.[2] These segments are labeled
Energy I, Energy II, Non-Energy I, and Non-Energy II. The
businesses from which the revenues are derived in each of these
segments not only vary among the firms, but within each firm
through the years. Thus, the results of each firm's acquisitions
and divestments (along with its basic businesses) are reflected
in the firm's revenues.

In general, despite the inter-company differences, the re-
venues in each of the business segments are derived as follows:
Energy I - By far the largest segment for all companies
(except for Tenneco where Non-Energy II is just as large),
this segment contains oil and oil-related revenues that come
from oil exploration, production, transportation, refining,

1. Information obtained from ref. 21.
2. Compiled from ref. 23.

31

and marketing. Revenues from petroleum products and natural gas are also contained here because of their close relationship with oil.

Energy II - Any revenues generated by non-oil energy-related businesses are contained here. These can be through coal, nuclear, synthetics, shale oil, tar sands, solar, geothermal, and wind activities.

Non-Energy II - Revenues from any businesses that are not related to oil or other energy operations are in this category.

Appendix B more specifically describes the activities each company has in the business segments and gives the periods of time the company has been engaged in those activities. Appendix B also identifies the structural category applicable to each company in each year. This "structural category" is based on Rumelt's work[3] in which he classified four types of strategies of corporate diversification. These are the single product business, dominant business, related product business, and unrelated product business. All the companies in this study (except for Tenneco which falls in the last category) come under the dominant business category. In a dominant business, one product accounts for 70 to 95% of the firm's total sales. In an unrelated business organization, the firm has more than 30% of its sales outside its main business, but these other businesses have little or no relation to each other.

Rumelt further elaborated on the dominant business category

3. Ref. 11.

by dividing it into four subcategories - dominant vertical (DV), dominant constrained (DC), dominant linked (DL), and dominant unrelated (DU). DV represents vertically integrated firms. The company's other products are by-products of the dominant business. DC, DL, and DU characterize the degree of relatedness of the businesses into which the firm has diversified. A DC company's other products utilize the same technology or market channel as the dominant business, but diversification is constrained by a desire to exploit a particular advantage. The DL company's other businesses appear unrelated, but there are links of varying types among them, such as a common technology or a common distribution channel. A DU firm's businesses are totally unrelated to the dominant business and other businesses. All the oil companies in this study, except for Tenneco, fall in one or more of these categories throughout the period from 1967-1981. (Tenneco is an Acquisitive Conglomerate, AC, through this period. AC is a subcategory of the unrelated business category. An AC company's businesses are totally unrelated and there is no dominant business. The company is agressively engaged in acquiring other firms.) The particular category in each year for each company is indicated in Appendix B and summarized for all companies in Appendix C.

The manner in which the structural categories were assigned to each company is somewhat subjective, but this subjectivity is modified through qualitative and quantitative measures. Basically, the categories were decided upon by identifying the businesses each company is engaged in through both its segmented

sales information (Appendix B) and its history of acquisitions, divestments, and other activities (Appendix A). Each company's businesses, separate from its dominant business, were compared to the dominant business and each other. Based on these comparisons, the appropriate structural category was assigned to each company in a particular year; and, having done this for all years, each company was categorized throughout the period.

Issues to Examine

The basic issues to be explored here are simple but very important to both the managers and shareholders of these oil companies, other companies in the energy industry, and other large companies in any other major industry.

They are as follows:

- Has diversification by these oil companies been successful, i.e. has the stock market looked favorably upon the diversification activities of these companies, thereby indicating how beneficial and successful these activities have been?

- Have the companies' shareholders benefited with these activities, i.e. have managers' diversification decisions been self-serving or in the interests of the stockholders?

- Has energy diversification been worthwhile? Non-energy? Has one been more beneficial than the other?

- Is there a relation between the diversification activities of these companies and their financial performance such that recommendations can be made as to which activities the companies should pursue in the future (and to what extent) and which not?

• Is a change in financial performance a consequence of diversification or v.v., i.e. does poor financial performance lead these companies to diversify and/or change structure?

The means by which these and related issues shall be resolved is through examining the firms' stock returns throughout the period and searching for relationships between these returns and the companies' revenues. This analysis involves the use of the Risk/Return Model introduced in Section II and a methodology to be discussed in the next section.

IV. Methodology

Using the Risk/Return Model

Recent empirical research has shown that, on average, diversified companies (primarily through acquisitions) earn only normal or risk-adjusted rates of return on their investments in acquired companies. These rates of return are what would have been predicted via the Capital Asset Pricing Model (CAPM) prior to the acquisitions. This is a strong statement about the efficiency of the capital markets, but provides little apparent support for corporate diversification. An efficient capital market still allows for exceptional corporate performance and high value acquisitions, however. In fact, exceptional performances are expected, as are disastrous results. The important point for the diversifying corporation (or the individual investor) to remember is that slightly above average performance on a consistent basis leads to spectacular results. Thus, the challenge facing managers of diversifying companies is to identify and make only those acquisitions that have a greater value to the company's shareholders than the price paid for the acquisition, i.e. identify positive net present value acquisitions. The Risk/Return Model helps managers meet this challenge and, in this case, determines if their efforts have been rewarded.

Whether or not corporate diversification through acquisition has created real economic value for shareholders of acquiring firms has been the focus of numerous capital market studies. These studies[1] have attempted to test whether stock-

1. For example, the studies in refs. 2,9,17, and 24.

holders of acquiring firms have earned abnormal returns or
whether the separation of control from ownership in corpora-
tions has freed managers to view sales growth, rather than pro-
fitability, as their primary goal. The former notion is the
classic rationale for corporate diversification and the test
used herein is based on this notion. It is justified because
regardless of whether the gains from diversification take the
form of a tax gain, avoiding the costs of bankruptcy, diversifi-
cation economies, superior deployment of capital, or for some
other reason, gains from diversification should be reflected in
abnormal returns on the acquiring company's stock (unless the
market was fully capable of anticipating the consequences of
an acquisition or series of acquisitions long before they oc-
curred). Thus, a direct test of the benefits of diversification
is to examine the excess returns on acquiring firms' stocks.

Several measures of risk and return performance have been
developed[2]; measures which,respectively,estimate the degree to
which unsystematic risk has been reduced and the degree to which
actual rates of return exceed expected rates of return. The
measure used here, α, is an estimate of the degree to which as-
set returns exceed or fall below their associated market prices
of risk and is given by:

$$\alpha = (R_i - R_f) - \beta_i (R_m - R_f) \ ,$$

in which the terms on the right side of the equation are as de-

2. Presented in ref. 2.

38

fined in Section II, where CAPM is introduced. In this study, α is a measure of whether or not a company's stockholders have benefited from the company's diversification activities. It compares a firm's actual returns given by R_i with what the market would have predicted using CAPM prior to the occurrence of these diversification activities.[3]

α is calculated herein on an annual basis from 1967 to 1981 for each company in the sample. All the financial information pertinent to these calculations is contained in Appendix D, Exhibits 1-5. R_m, R_f, and $(R_m - R_f)$ are presented for each year from 1967-1981 in Exhibit 1. Exhibit 2 presents the observed annual rates of return on each firm's stock or equity and the associated risk premium. These are denoted as R_{oe} and $R_{oe} - R_f$, respectively, where R_{oe} (return on observed equity) is substituted for R_i in the previous equation. Exhibit 3 gives the levels of systematic risk pertaining to each company on an annual basis from 1967 to 1981.[4] These are denoted as β_{oe} (beta on observed equity), which is the standard β used in CAPM. Recall that β_{oe} is a measure of the sensitivity of a stock's price to overall market fluctuations. Normally (and in this case) β_{oe} is derived from a least squares regression analysis between weekly percent changes in the price of a stock and average week-

3. In that case, the market would have used expected values for R_f, R_m, and β_i. In this study, actual values for R_f and R_m are used. This was necessary because data on expected values prior to each period are not available. This is only important for R_m, however, because $E(R_f) = R_f$. Even so, since the best expected value of R_m is the actual value, the actual value is appropriate.

4. Based on data in ref. 25.

39

ly percent changes in the price of a stock and average weekly
percent changes in the price of all stocks in the S & P 500
over a period of five years. The five year period chosen for
each annual β_{oe} in Exhibit 3 was not necessarily the previous
five years for each company. An appropriate five-year period
was chosen such that the β_{oe} that appears is the one market
analysts would have used at the time to estimate the company's
annual return on stock; i.e., β_{oe} is based on the structure of
the company and state of the industry as it existed at the time.
It does not include the effects of any unanticipated changes in
structure or sources of revenue due to acquisitions or other
diversification activity by the company during the year. In
this sense, the β_{oe}'s given are expected values.

The equation for excess returns is now:

$$\alpha_{oe} = (R_{oe} - R_f) - \beta_{oe}(R_m - R_f) \qquad (1)$$

where "oe" denotes observed equity or stock. But excess return
on stock is not the most appropriate indicator of the benefits
or costs of diversification to a firm. This is because a firm's
stock represents its levered assets and, as such, is affected
by the firm's debt level through U.S. tax benefits. (Interest
payments on debt are tax deductible, which means the U.S. Gov-
ernment partially subsidizes corporate debt.) Consequently,
R_{oe} (and, therefore, α_{oe}) is influenced by the firm's chosen
debt-equity ratio (D/E). In order to separate out and elimin-
ate this influence of debt on excess returns so that relation-
ships (if they exist) can be more clearly inferred between the

firms' excess returns and their diversification activities, an all equity approach to the problem is taken. That is, the excess returns for the firms on an all equity basis (the same firms with no debt outstanding) are derived and subsequently related to diversification strategies.

To obtain the firms' excess returns on an all equity basis, β_{oe} is first unlevered[5]:

$$\beta_{ae} = \beta_{oe}/(1 + (1-t)D/E) \qquad (2)$$

where β_{ae} is the systematic risk level for the equivalent all equity, ae , firm, i.e., β_{ae} represents business risk only for the firm; t is the corporate tax rate (48% before 1979, 46% from 1979 on); and D/E is the firm's debt-equity ratio. D is the total debt of the firm (short-term + long-term); E is equity in the form of common stock (price per share x number of shares outstanding). Market rather than book values of D and E are used.

From CAPM, $\beta_{oe} = (R_{oe}-R_f)/(R_m-R_f)$ and $\beta_{ae} = (R_{ae}-R_f)/(R_m-R_f)$, so equation (2) becomes:

$$(R_{ae}- R_f) = (R_{oe}- R_f)/(1 + (1-t)D/E) \qquad (3).$$

Dividing equation (1) by the term 1 + (1-t) D/E and substituting the relations in (2) and (3), (1) becomes:

$$(R_{ae}- R_f) - \beta_{ae}(R_m- R_f) = \alpha_{oe}/(1 + (1-t)D/E) \qquad (4).$$

But, since the left side of equation (4) is equal to α_{ae},

5. Based on the formula presented in ref. 4, but equation (2) is an improved version.

(4) leads to:

$$\alpha_{ae} = \alpha_{oe}/(1 + (1-t)D/E) \qquad (5)$$

where α_{ae} gives the firm's excess returns on an all equity basis.
It is α_{ae} which should have a clearer relation to a firm's
diversification activities than α_{oe}.

Exhibit 4 presents the sample companies' annual average
debt-equity ratios from 1967 to 1981.[6] These averages are ob-
tained from year-beginning and year-end values, equally weighted.
This data clearly shows which firms have aggressively used debt.
Using this data with the values of t and data from the previous
Exhibits in equations (1) and (5), the values of α_{ae} for each
firm from 1967 to 1981 are determined. These values are pre-
sented in Exhibit 5. The corresponding values of α_{oe} are given
to indicate the effects of debt on the firms' excess returns.

Methodology for Relating Returns to Diversification

The methodology used herein for determining if there are
relations between the all equity excess returns of Exhibit 5
and the companies' diversification strategies is straightforward.
It is based on the statistical analysis procedure detailed in
ref. 7. The aspects of this procedure important to this study
are presented here.

The procedure focuses on prediction analysis of cross
classifications of qualitative variables. Such variables are

6. Derived from data in refs. 16 and 25.

42

represented by nominal or ordinal scales. A nominal scale describes objects or events by just one element of a set of mutually exclusive classes or states (e.g., from Appendices B and C: Energy I, Energy II,. . . or Dominant Vertical, Dominant Constrained, . . .). An ordinal scale orders or ranks variables in terms of the amount of the characteristic being measured (e.g., as will be shown: Superior, Stable, and Inferior for excess returns). Generally, the analysis involves predictions of the effects of one or more independent variables on a dependent variable. A hypothesis is formulated concerning some relation between the dependent variable and the independent variables (i.e. a prediction is made) and an analysis of the data results in a statement of the validity of the hypothesis through some statistical measures. The extent to which a hypothesis is successful in predicting events described by the dependent variable is evaluated, rather than its goodness of fit.

Event predictions may differ on several dimensions. The dimensions important to this study are accuracy, scope, and precision. Accuracy is the extent to which a prediction is correct (and error is minimized). Scope increases with the range of observations included in the data. Precision measures the degree to which a prediction specifies the uniqueness of the dependent variable - the more unique the predicted outcome, the more precise the proposition. Generally, there are tradeoffs among these dimensions; e.g., the greater a prediction's scope and precision, the more difficult it is to achieve pre-

diction accuracy. These tradeoffs need to be considered in an evaluation of prediction success.

The analysis methodology provides a unique measure, ∇_P, for each logically distinct hypothesis. The subscript P on the basic measure symbol ∇ (read "del") indicates the specific prediction to which the methodology is applied. ∇ is a measure of a prediction's success in matching data; i.e., it indicates how well a theory matches outcomes from a particular data sample. ∇ can take on any value from $-\infty$ to 1, depending on the hypothesis and the data. A ∇ of 1 means the data perfectly matches the prediction. $\nabla = 0.5$ means the hypothesis has a 50% better-than-chance probability of being correct based on what the data shows. (Conversely, $\nabla = -0.5$ means the hypothesis is 50% worse than chance.) Lastly, $\nabla = 0.0$ means the hypothesis is no better than chance in its predictive capability. A hypothesis with a ∇ of 20% or better is generally assumed to be successful.

The equation for ∇_P is:

$$\nabla_P = 1 - \frac{\sum_i \sum_j Pr_{i/j}}{\sum_i \sum_j Pr_i Pr_j}$$

where the summations are performed over each error cell in the cross-classification or contingency table (which shows the relations between the dependent variable and independent variables in the data). i denotes the row containing the error cell; j denotes the column. $Pr_{i/j}$ is the conditional probability associated with the error cell; Pr_i and Pr_j are the associated marginal probabilities. The term "error cell" refers to a parti-

cular cross-classification in the table that is contrary to the hypothesis being tested and, therefore, is in "error". The more data that appears in the error cells, the smaller will be the value of ∇_P and the less reliable the prediction. Note the formula for ∇_P contains adjustments for scope and precision. These adjustments are inherent in the denominator term $Pr_i \ Pr_j$.

To illustrate the analysis procedure using ∇_P, consider the following example based on the data in this study:

Let the hypothesis, P = 0, be : "Dominant vertical companies have had stable to superior all equity excess returns throughout the period from 1967 to 1981". The associated contingency table is as shown.

Structural Category

	DV	DC	DL	DU	AC	Σ
Superior (>5%)	8	12	27	22	5	74 i=1
Stable (-5% to 5%)	8	6	10	18	6	48 i=2
Inferior (<-5%)	8	13	16	17	4	58 i=3
Σ	24 j=1	31 j=2	53 j=3	57 j=4	15 j=5	180

α_{ae}

The error cell for this hypothesis is shaded and the appropriate value of ∇ is:

$$\nabla_0 = 1 - \frac{8/180}{(58/180)(24/180)} = -0.034 \ .$$

The hypothesis is not successful; the data indicates it is

3.4% worse than chance.

Note the limits on α_{ae} that determine if it is superior,

stable, or inferior have been somewhat arbitrarily chosen.

They are, however, based on the opinion that if there have

been real benefits (or costs) of diversification by the com-

panies, the value of α_{ae} should exceed 5% (or fall below -5%).

It is believed diversification or non-diversification has had

little effect, neither beneficial nor harmful, if α_{ae} falls

between -5% and 5%.

The next section is devoted to testing further hypotheses

related to the effects of diversification on the oil companies'

excess returns. Based on the results of these tests, conclu-

sions will be drawn on the companies' diversification strategies

from which recommendations for future actions might be made.

V. Analysis

Procedure

Utilizing the methodology presented in Section IV with
appropriate company data from the Appendices, the effects of
oil company diversification on the value of the firms will be
determined. Specifically, through the testing of several hy-
potheses relating the structure of the firms (and their areas
of diversification) to excess returns on equity, measures of
the benefits or costs of diversification to the firms' share-
holders will be obtained.

The hypotheses to be considered come in two groups - those
relating the companies' excess returns to their structural cate-
gories (summarized in Appendix C) and those relating excess
returns to the revenue segments Energy II and Non-Energy II,
found in Appendix B. By performing the analysis in this fashion,
both general and specific relations between excess returns and
diversification may be discovered. Diversification by these
companies is generally represented by their structural category.
A DV firm is one that is least diversified. DC, DL, and DU
symbolize increasing degrees of diversification. AC is the
extreme. Diversification is more specifically represented by
the revenue segments in which the companies are engaged. The
primary business segments of the companies are contained in
Energy I and Non-Energy I. The diversified segments appear in
Energy II and Non-Energy II.

In both groups, the hypotheses seek to uncover relations
between stable to superior excess returns or inferior excess

returns and diversification. They can take either a lenient or strict form. An example of the lenient form was given in Section IV where the hypothesis was: "DV companies have had stable to superior all equity excess returns . . .". The strict form of this is: "Only DV companies have had stable to superior all equity excess returns . . .". Generally, the strict form hypotheses are less successful than their lenient counterparts (i.e., have correspondingly lower values of ∇_p) because they have more error cells associated with them. (In the example cited, the extra error cells are $i = 1$ and $i = 2$ for $j = 2$ through 5. Thus, eight error cells are added to the single error cell at ($i = 3$, $j = 1$).) Only if these extra error cells have zero or very low conditional probabilities (i.e., contain few or no observations) will the strict form hypothesis be more successful than the lenient form.

Once the form of the hypotheses and how and to what they should be applied was decided, the major issue to be resolved was how should the data be viewed for analysis. Specifically, over what time periods should the excess returns be cumulated and the various hypotheses be tested? A number of possibilities were apparent. The hypotheses could be tested on an annual basis on the excess returns in each year, or over a period of years on the excess returns in each year in the period. The former basis has the advantage that the periods are all of equal length (yearly) and excess returns from different years are not mixed. This basis is believed to be inappropriate for this study, however, because the resulting data used for hypothesis

testing is too limited; i.e., it is not sufficiently robust. Each year yields only twelve data points (excess returns) for the twelve companies.

A multi-year period basis for testing the hypotheses is more statistically robust than the annual basis since it employs more data, but any number of periods could be selected if done at random. The periods used in this study were chosen after considering several others, based on different criteria. Among these were a period spanning all years in the study (1967 - 1981) and periods that spanned the pre-embargo, post-embargo/pre-price rise, and post-price rise years (1967-1972, 1973-1978, and 1979-1981, respectively). The first choice gives the most statistically robust results, while the second choice accounts for major changes in oil market conditions through the years. Both choices were used in analyses that yielded no conclusive results, but they were rejected as bases of analysis in favor of a basis that may not have yielded any more conclusive results, but is judged more appropriate. That basis is one in which the periods are chosen such that no company changes structural category in any year in a given period. This applies to the first group of hypotheses for studying the effects of diversification through structural category. For the second group in which diversification is reflected in participation in different revenue segments, a similar basis was used whereby the companies in a particular revenue segment (Energy II or Non-Energy II) are the same throughout each period. This basis results

in the following analysis periods for the two groups:

Structural Category

Span	DV	DC	DL	DU	AC
1967	GULF,SOCAL TEX	ARCO,XON, SHELL,SOIND	MOBIL,SUN	SOHIO,UNION	TENN
1968-70	SOCAL,TEX	ARCO,XON, GULF,SHELL	MOBIL,SOIND, SUN	same	same
1971-72	same	same	MOBIL,SOIND	SOHIO,SUN, UNION	same
1973	same	XON,SHELL	ARCO,GULF, MOBIL,SOIND	same	same
1974	same	SHELL	ARCO,XON, GULF,SOIND	MOBIL,SOHIO, SUN,UNION	same
1975-76	TEX	SHELL,SOCAL	same	same	same
1977-78	same	none	XON,GULF, SHELL,SOCAL, SOIND	ARCO,MOBIL, SOHIO,SUN, UNION	same
1979-81	same	none	XON,GULF, SHELL,SOCAL	ARCO,MOBIL, SOIND,SOHIO, SUN,UNION	same

Revenue Segment

Span	Energy II	Span	Non-Energy II	Span	Both
1967	ARCO,XON, SOHIO	1967-76	all except ARCO,GULF, SOCAL,TEX	1967-74	XON,SOHIO
1968-74	add GULF	1977-81	add ARCO, SOCAL	1975-76	add SUN
1975-76	add SUN			1977-78	add ARCO, SHELL,UNION
1977-78	add SHELL, UNION			1979-81	add SOIND
1979-81	add SOIND				

Span	Neither
1967	GULF,SOCAL, TEX
1968-76	SOCAL,TEX
1977-81	TEX

51

In both groups, hypothesis testing will determine if diversi-
fication results in stable to superior excess returns, inferior
excess returns, or neither of these to any significant extent.
Recall that this task is accomplished through the measure ∇_p
which indicates a successful hypothesis if it exceeds 20%.

Hypothesis Testing and Results

Let P = 1 and P = 2 denote hypotheses relating diversifica-
tion through changes in structural category to all equity excess
returns. P = 1 relates structural category to stable to superior
returns, while P = 2 relates the categories to inferior returns.
The lenient and strict forms are tested for both hypotheses.
The lenient form of P = 1 is: "_____ companies have had stable
to superior excess returns in each time period", where the blank
contains the terms DV, DC, DL, DU, and AC, successively. The
strict form is: "Only _____ companies have had stable to
superior excess returns in each time period". The lenient and
strict forms of P = 2 are the same except "stable to superior"
is replaced by "inferior". The results of the tests of these
hypotheses are as follows:

P = 1 (lenient form)

Structural Category

Span	DV	DC	DL	DU	AC
1967	S(.20)	N	N	N	S(1.0)
1968-70	N	N	N	N	N
1971-72	S(.25)	N	S(1.0)	N	S(1.0)
1973	S(1.0)	S(1.0)	N	S(1.0)	S(1.0)
1974	S(1.0)	S(1.0)	S(1.0)	N	S(1.0)
1975-76	N	S(.40)	N	N	N

52

1977-78 N	no data	N	S(.28)	N	
1979-81 N	no data	N	N	N	
Error cells (i,j)	(3,1)	(3,2)	(3,3) (3,4) (3,5)		

P = 1 (strict form)

Structural Category

Span	DV	DC	DL	DU	AC
1967	N	N	N	N	N
1968-70	N	N	N	N	N
1971-72	N	N	S(.20)	N	N
1973	N	N	N	N	N
1974	N	N	N	N	N
1975-76	N	N	N	N	N
1977-78	N	no data	N	S(.20)	N
1979-81	N	no data	N	N	N
Error cells (i,j)	(3,1) (1,2)to(1,5) (2,2)to(2,5)	(3,2) (1,1)(1,3) (1,4)(1,5) (2,1)(2,3) (2,4)(2,5)	(3,3) (1,1)(1,2) (1,4)(1,5) (2,1)(2,2) (2,4)(2,5)	(3,4) (1,1)(1,2) (1,3)(1,5) (2,1)(2,2) (2,3)(2,5)	(3,5) (1,1)to(1,4) (2,1)to(2,4)

P = 2 (lenient form)

Span	DV	DC	DL	DU	AC
1967	N	N	N	N	N
1968-70	S(.20)	N	N	N	N
1971-72	N	S(.44)	N	N	N
1973	N	N	S(.20)	N	N
1974	N	N	N	S(.20)	N
1975-76	N	N	N	N	N
1977-78	N	no data	N	N	N
1979-81	N	no data	N	N	N
Error cells (i,j)	(1,1)(2,1)	(1,2)(2,2)	(1,3)(2,3)	(1,4)(2,4)	(1,5)(2,5)

P = 2 (strict form)

Span	DV	DC	DL	DU	AC
1967	N	N	N	N	N
1968-70	N	N	N	N	N
1971-72	N	S(.44)	N	N	N
1973	N	N	S(.31)	N	N
1974	N	N	N	S(.31)	N
1975-76	N	N	N	N	N
1977-78	N	no data	N	N	N
1979-81	N	no data	N	N	N
Error cells (i,j)	(1,1)(2,1) (3,2)to(3,5)	(1,2)(2,2) (3,1)(3,3) (3,4)(3,5)	(1,3)(2,3) (3,1)(3,2) (3,4)(3,5)	(1,4)(2,4) (3,1)(3,2) (3,3)(3,5)	(1,5) (2,5) (3,1)to (3,4)

N means the hypothesis is not successful; the corresponding value of ∇ is less than +20%. S means the hypothesis is successful; the corresponding value of ∇ is given, and equals or exceeds +20%. The error cells in the contingency table that correspond to each hypothesis are indicated. The form of these contingency tables is the same as the one shown in Section IV. Only the distribution of data changes with each period analyzed.

No strong conclusions can be drawn from these results with regard to stating which structural category is more likely to result in stable to superior or inferior all equity excess returns. This is due to the fact that few hypotheses met with successful results. The most successes appeared when testing the lenient form P = 1 hypotheses, but these successes were evenly dispersed across all structural categories. Thus, again, no one category could be cited as being more profitable than another.

Also, no group of categories could be shown to be superior to another (e.g., the less diversified, DV and DC, to the more diversified, DU and AC). This latter fact is clear from the lack of bias in successes (in the lenient form $P = 1$ hypotheses and the others) moving from one structural category to another.

From the results of testing the hypotheses anlayzing diversification through changes in structural category, no clear case can be made for or against diversification by the oil companies. The results may be more explicit for the hypotheses relating diversification by participation in different revenue segments to all equity excess returns. Let $P = 3$ and $P = 4$ denote the appropriate set of hypotheses. $P = 3$ relates participation and non-participation in the revenue segments Energy II and/or Non-Energy II to stable to superior excess returns. $P = 4$ does the same, but relates them to inferior returns. (Recall that Energy II and Non-Energy II represent the diversified revenue segments of the firms.)

Both the lenient and strict forms of the $P = 3$ and $P = 4$ hypotheses are tested. The lenient form of $P = 3$ is: "Companies that have revenues derived from either/both/ neither of the Energy II and Non-Energy II revenue segments have had stable to superior excess returns in each time period". The strict form is identical, but begins with the word "only". The same is true for the lenient and strict forms of $P = 4$, except "stable to superior" is replaced by "inferior". The test results of these hypotheses are as follows:

P = 3 (lenient form)

Span	E II	Span	NE II	Span	Both	Span	Neither
1967	S(1.0)	1967-76	N	1967-74	S(.40)	1967	S(.20)
1968-74	N	1977-81	N	1975-76	N	1968-76	N
1975-76	N			1977-78	N	1977-81	N
1977-78	N			1979-81	N		
1979-81	S(.22)						

P = 3 (strict form)

Span	E II	Span	NE II	Span	Both	Span	Neither
1967	S(.38)	1967-76	N	1967-74	N	1967	N
1968-74	N	1977-81	N	1975-76	N	1968-76	N
1975-76	N			1977-78	N	1977-81	N
1977-78	N			1979-81	N		
1979-81	S(.20)						

P = 4 (lenient form)

Span	E II	Span	NE II	Span	Both	Span	Neither
1967	N	1967-76	N	1967-74	N	1967	N
1968-74	N	1977-81	N	1975-76	N	1968-76	N
1975-76	N			1977-78	S(.20)	1977-81	N
1977-78	S(.20)			1979-81	N		
1979-81	N						

P = 4 (strict form)

Span	E II	Span	NE II	Span	Both	Span	Neither
1967	N	1967-76	N	1967-74	N	1967	N
1968-74	N	1977-81	N	1975-76	N	1968-76	N
1975-76	N			1977-78	S(.20)	1977-81	N
1977-78	S(.20)			1979-81	N		
1979-81	N						

E II denotes Energy II; NE II denotes Non-Energy II. N and S mean the same as before. The corresponding ∇ value is given for

each successful hypothesis. (Recall that ∇= +20% means the hypothesis has a probability of success of 20% better than chance, based on the data.) The error cell in the contingency table for the lenient form P = 3 hypotheses is located at (i=3, j=1); for the strong form P = 3 hypotheses, the error cells are at (i=3, j=1), (i=1, j=2), and (i=2, j=2). The error cells for the lenient form P = 4 hypotheses are located at (i=1, j=1) and (i=2, j=1); for the strong form P = 4 hypotheses, they are at (i=1, j=1), (i=2, j=1), and (i=3, j=2). The general form of the contingency table is as shown, with only the distribution of data changing in each time period. X represents Energy II, Non-Energy II, Both, or Neither depending on the hypothesis being tested; Y is the particular span of years.

Contingency Table

Span Y

		X	Not X	
Superior (>+5%)				i=1
α_{ae} Stable (-5% to 5%)				i=2
Inferior (<-5%)				i=3
		j=1	j=2	

Similar to the results of the previous hypotheses relating structural category to excess returns, these results offer no clear proof that diversification by the oil companies into or not into businesses in the Energy II and/or Non-Energy II segments has led to either stable to superior or inferior excess returns. (Although a weak argument can be made that those com-

57

panies in the Energy II segment have benefited. This is based on the two successes for the strict form $P = 3$ hypotheses in the E II segment, modified by the one success for the strict form $P = 4$ hypotheses in the same segment. But this finding hardly leads to a generalization. Successes and failures of the hypotheses are otherwise evenly dispersed in the results.)

Clearly, these findings point to the same general conclusion as before: that diversification by the oil companies has neither been harmful nor beneficial to the companies' stock price performance, as measured by all equity excess returns. Thus, stockholders in these companies have neither experienced significant increases nor decreases in the value of their holdings due to the companies' diversification strategies from 1967 to 1981. The word "significant" is meant to have a two-fold meaning here. It implies that the firms' excess returns may have been affected by diversification, but, statistically speaking, they have not been appreciably nor consistently affected.

VI. Concluding Remarks and Recommendations

Conclusions

It is clear from the tests of the hypotheses in the previous section that the recent diversification strategies of major oil companies have generally not significantly affected their returns on equity. That is, diversification by these companies has neither been harmful nor beneficial to the firms' shareholders in a consistent or distinct manner. Diversification has not significantly increased nor decreased the value of the firms' stocks. This conclusion is based on a study of the firms' excess returns on equity, on an all equity basis. The analysis procedure is justified as it employs contemporary techniques in financial economics. The analysis sample is sufficiently wide-ranging in the degree of diversification of the firms so that the analysis contains comparisons between the least and most diversified companies in the industry.[1] No significant difference can be distinguished in the excess stock returns among these companies over time.

Perhaps the most obvious reason for these results is that the sheer size of the oil companies compared to their diversifying acquisitions has prevented these acquisitions from having significant effects on the stock returns of the companies. Specifically, the size of the revenues in the oil-related business, compared to the diversified areas,[2] has been so large as to pre-

1. Also, the size of the firms is generally the same in terms of total revenues, so size is not an important factor in the analysis.
2. See Appendix B for the contribution to total revenues from Energy I + Non-Energy I compared to those from Energy II + Non-Energy II, for each company.

clude the possibility that non-oil-related activities would af-
fect the companies' performances, as reflected in their excess
stock returns. This is true for all the companies from the
Dominant Verticals to the Dominant Unrelateds, and, to some ex-
tent, for the Acquisitive Conglomerate Tenneco, when acquisitions
are considered on an individual basis.

It is probable then, that for any company in the dominant
business category (where a single business accounts for 70-95%
of the firm's total revenues), a relatively minor diversifying
acquisition will not affect the firm's stock returns. Extend-
ing this, the same might be said for any firm making a diversify-
ing acquisition resulting in minor changes in revenues. This is
to be expected since a firm's stock price performance reflects
the market's assessment of its present and future cash flows.

Thus, the recent diversifying acquisitions by the oil com-
panies have not been as disastrous nor massive as many articles
have proposed[3] These articles point to the foundered efforts
of Exxon and Mobil to manage an electric company (Reliance)
and retailer (Montgomery Ward), respectively, and Sohio's take-
over of a second-rate, badly run producer of copper (Kennecott)
as typical examples. Yet, even these large, generally criticized
takeovers have had little effect from the analysis results on the
firms' stock performance because of their small size in compari-
son to the companies' main business. The companies' shareholders
may not have been served well by these and other acquisitions,

3. See, for example, refs. 3,18,20, and 22.

but they have neither been disserved by them.

As an aside, the issue of whether diversification by the oil companies has been a reactive rather than proactive strategy was investigated. That is, the possibility that diversification has been undertaken by the companies as a result of superior or inferior excess returns, rather than resulting in these returns, was considered. To determine this, a qualitative analysis was performed using the information in Appendix E combined with that in Appendix B. Appendix E was compiled using the data in Appendix D, Exhibit 5. It ranks the companies in each year of the study period according to their all equity excess returns, and bands them in groups of those companies obtaining superior, stable, or inferior returns.

After comparing the timing of various companies' diversification activities (represented by changes in structural category and/or entry into a new revenue segment) against the all equity excess returns performance of each company in the years just preceeding diversification, no relation is discernible between the two. Diversification was equally undertaken following superior excess returns as it was following inferior returns. More than likely, a detailed, quantitative analysis of the data (through hypothesis testing) would have yielded the same result as this qualitative analysis. Excess returns on equity seem to have no bearing on oil companies' decisions to implement diversification strategies. The factors which do compel these strategies are probably many, varying from taking advantage of chance

opportunities to fulfillment of long-range planning goals.

Recommendations

From the preceding remarks, it might be construed that be-
cause the oil companies have really not been adversely affected
by their largely criticized diversification activities, they
should continue with these efforts until they hit upon some "real
winners". This is an attractive strategy to implement from an
individual investor's point of view, but it is hardly a viable
or responsible position for the managers of major oil companies
to assume. They could hardly adopt this strategy without adverse
reaction from various sources (e.g. the Federal Trade Commission).
These managers must show they are acting in the best interests
of the firms' stockholders. They must also be ready to respond
to criticism from those who, on the one hand, see the oil com-
panies as using windfall energy profits to improperly expand into
non-energy enterprises, and those who, as anti-trusters inside
and outside the government, are rankled by oil company mergers
and energy-related acquisitions. Even so, the potential benefits
of diversification to the oil companies are real and should not
be overlooked.

Both energy-related and non-energy-related diversification
should continue by the oil companies, tempered by adequate ques-
tioning of the real justifications involved and adequate con-
sideration of the implications for the firms. As large and high-
ly profitable vertically integrated, virtually single-industry

firms, the oil companies are vulnerable to the rise of trouble-some events (e.g., the recent drop in oil prices). To alleviate the effects of these events and to provide for a more secure and profitable future, these companies need to change themselves through diversification, which must come largely via acquisitions, rather than internal development, because of the companies' enormous size and homogeneity. At the same time, certain non-profitable operating segments of the companies should be sold off, at values considerably higher than might ordinarily seem possible,[4] to help finance these acquisitions.

Note that it is not recommended the oil companies all become acquisitive conglomerates, with more businesses, markets, and technologies than the chief executive officer can reasonably understand. It is simply suggested that they build a more balanced and safer asset base by diversifying sensibly into sound, related or unrelated activities with cognate technologies, comprehensible markets, and comfortable manageability. Not only the oil companies, but the markets into which they diversify will benefit as a result. These markets will be helped by the influx of substantial capital sums, technological and commercial expertise, and the spirit of enterprise which has always been one of the oil companies' main characteristics.

To help silence some its critics and meet the challenges likely to come from the government and others, the oil industry needs to do a better job of explaining why diversification is

---

4. See ref. 8 for comparison between the existing market value of Mobil Oil Corporation and its "unbundled" value.

warranted. It should be made clear that, in the long run, oil operations alone cannot be expected to ensure adequate earnings for the companies' shareholders, let alone adequate energy supplies for their customers. The companies need to diversify wherever and whenever economically and strategically appropriate to help obtain adequate earnings (at no apparent cost in equity returns) and to help develop alternative energy sources.

List of References

1. Ball, B.C., Position Paper "Comparisons and Contrasts: Horizontal and Vertical Integration from the Strategic View - Coal and Petroleum", Ball and Associates, Cambridge, MA (1982).

2. Beattie, D.L., "Conglomerate Diversification and Performance: A Survey and Time Series Analysis", Applied Economics (1980), 12, ps. 251-273.

3. Beman, L., "Exxon's $600 Million Mistake", Fortune, October 1981, ps. 68-85.

4. Brealey, R. and Meyers, S., "Principles of Corporate Finance" (especially Chs. 9 and 30 on the Capital Asset Pricing Model and Mergers, respectively), McGraw-Hill (1981).

5. Copeland, T. and Weston, J., "Financial Theory and Corporate Policy" (especially Ch. 17 - Mergers and Acquisitions: Theory), Addison Wesley (1979).

6. Galbraith, J.R. and Nathanson, D.A., "Strategy Implementation: The Role of Structure and Process", ps. 28-35 and 45-47, West Pub. Co. (1978).

7. Hildebrand, D., Laing, J., and Rosenthal, H., "Prediction Analysis of Cross Classifications", John Wiley & Sons (1977).

8. Levitt, T., "Dinosaurs Among the Bears and Bulls", Harvard Business Review, Jan.- Feb. 1975, ps. 41-53.

9. Mueller, D., "The Effects of Conglomerate Mergers - A Survey of the Empirical Evidence", Journal of Banking and Finance (1977), ps. 315-347.

10. Quinn, J.B., "Strategic Change: Logical Incrementalism", Sloan Management Review, Fall 1978, Vol.20, No.1.

11. Rumelt, R., "Strategy, Structure, and Economic Performance", Harvard Press (1974).

12. Salter, M. and Weinhold, W., "Diversification via Acquisition: Creating Value", Harvard Business Review, July-Aug 1978, ps. 166-176.

13. Salter, M. and Weinhold, W., "Diversification Through Acquisition: Strategies for Creating Economic Value", Free Press (1979).

14. Uttal, B., "Exxon Has Its Eye on More Than Oil", Fortune, April 1977, ps. 166-168.

15. Annual Report of the Secretary of the Treasury on the State of Finances (Summary of Information pertaining to Treasury Bills issued during the fiscal year) and Statistical Appendix (Table 39) to same, 1967-81; also, Wall Street Journal Money Rates, 1975-81.

16. CRSP tapes compiled by the University of Chicago.

17. "Conglomerate Diversification and Performance", Applied Economics 12, Sept. 1980, ps.251-273.

18. "Curbs on Energy Development Are Main Culprit in Diversification", Oil and Gas Journal, April 1981, p. 27.

19. "Energy Role for Oil Companies", Petroleum Economist 47, Sept. 1980, ps. 366-367.

20. "How Metals Pan Out for Oil Companies", Business Week, April 1981, ps. 29-30.

21. Moody's Industrial Manual, 1982, Vols. 1 and 2.

22. "Oil Companies: Too Far Afield?", Barron's, Aug. 10, 1981.

23. Company Annual Reports, 1967-81.

24. "Strategic Growth Through Merger and Acquisition", Financial Executive 49, May 1981, ps. 23-26.

25. THE VALUE LINE Investment Survey - Ratings & Reports, Editions 3 pertaining to Petroleum (Integrated) Industry and Natural Gas Industry, 1971-82.

26. "Why Mining Looks Good to Big Oil", Business Week, March 1981, ps. 46-47.

Appendix A

Sample Companies' Present Business and
Diversification Activities from 1967-1981

ATLANTIC RICHFIELD COMPANY (ARCO)

Present Business

Arco, with its subsidiaries, is engaged in the explora-
tion for, and development, production, purchase, trans-
portation and sale of, petroleum; in the manufacturing.
transportation and marketing of refined petroleum pro-
ducts including petrochemicals; in the mining and sale
of coal; in mining, processing, and sale of primary
copper, aluminum, uranium, molybdenum, silver, and other
metals; and in the manufacturing and sale of copper,
copper alloy, aluminum, and other metal products. Oper-
ations are conducted principally in the United States.
The Company also obtains quantities of crude petroleum
from its interests in Indonesia, which it either sells
outside the U.S. or imports for use in its refineries.
It also sells certain of its refined products in Brazil
and elsewhere in world markets. Arco comprises one of
the large integrated enterprises in the petroleum in-
dustry.

Acquisitions, Divestments and Other Activities (1967-81)

On Apr. 17, 1967 acquired Nuclear Materials & Equipment
Corp., producer of uranium and plutonium bearing fuels.
Sold in 1971.

On Mar. 4, 1969, merged with Sinclair Oil Corp.

In April 1973, acquired R.N. Parsons & Son, Inc., Parsons
Transport Inc., Parsons Leasing Inc., and Parsons Termin-
al, Inc.

In Sept. 1974, Company sold United Kingdom marketing facilities and business formerly owned by ARCO Petroleum Ltd., a subsidiary company.

On Dec. 5, 1974, Company's 50% interest in American Chemical Co. was sold to Stauffer Chemical Co.

In May 1976, sold East Chicago, Ind. refinery and certain related assets to CF Petroleum Co. for $80 million plus other considerations.

In Aug. 1976, sold Atlantic Richfield Canada Ltd. to Petro-Canada for $340 million (Co. received about $66 million net).

In Sept. 1976 acquired the Observer, a British newspaper.

On Jan. 12, 1977, Anaconda Co. was merged into a wholly owned subsidiary of Atlantic Richfield pursuant to a Plan and Agreement of Reorganization dated July 26, 1976. In connection with the merger, Atlantic Richfield issued approximately 8.1 million shares of common stock valued at $420 million and paid approximately $97 million in cash. Atlantic Richfield had previously acquired on Mar. 31, 1976, 27% of Anaconda common stock in a cash tender offer for approximately $167 million.

In Apr. 1977, Arco Polymers Inc., subsidiary, acquired the La Porte, TX polypropylene facility and business of Diamond Shamrock Corp. for approximately $150 million.

In Oct. 1977, Company acquired the assets of Solar Technology International, Inc., Chatsworth CA, a developer and producer of photovoltaic cells which convert solar energy into electricity.

In Mar. 1978, Co. acquired a minority interest of Northrup, Inc.

In 1978, Co. expanded into international coal operations by purchasing an interest in R.W. Miller (Holdings) Ltd., a major Australian coal concern.

In Dec. 1979, acquired Swisher Coal Co. (renamed Beaver Creek Coal Co. in Feb. 1980).

In mid June, 1980, Co. purchased Halcon International Inc.'s interest in Oxirane Chemical Company and other joint ventures for approximately $270 million and the assumption of certain liabilities including approximately $380 million of long-term debt. Oxirane is now a wholly-owned subsidiary.

In Jan. 1980, formed ARCO Ventures Co., a new subsidiary.

In June 1980, acquired Wisconsin Centrifugal Inc. thru
an exchange of shares.

In Aug. 1980, sold remaining 60% interest in Colony Oil
Shale development project.

On Jan. 1, 1981, formed ARCO Alaska Inc., a new subsidiary.

On Dec. 31, 1981, the Anaconda Co. was merged into
Atlantic Richfield.

EXXON CORPORATION (XON)

Present Business

Exxon Corporation and its subsidiaries and affiliated companies operate in the United States and nearly 100 other countries. The principal business is energy, involving exploration for and production of crude oil and natural gas and petroleum products; exploration for and mining and sale of coal and uranium and fabrication of nuclear fuel. Exxon Chemical Company is a major manufacturer and marketer of petrochemicals. Exxon is also engaged in exploration for and mining of minerals other than coal and uranium. Reliance Electric Company, an affiliate, manufactures, markets, and services a broad line of industrial equipment. Exxon conducts extensive research programs in support of these businesses and provides capital to innovative new ventures, some of which are not related to these businesses.

The regional and operating organizations established to assist Corporation in its activities are as follows, with an explanation of the activities of each:

Divisions

Esso Middle East: Oil and gas interests in Egypt, Saudi Arabia, Qatar, Abu Dhabi, and Lebanon.

Exxon Chemical Company: Chemical interests worldwide.

Exxon Company, U.S.A.: Oil, gas, oil shale, and coal interests in the United States.

Exxon Enterprises Inc.: Advanced office systems; nuclear fuel; service station equipment; new business development outside the oil, chemicals, and minerals fields.

Exxon International Company: International trading in crude oil and petroleum products; marine transportation and technical services.

Exxon Minerals Company: Non-hydrocarbon mineral interests worldwide except Canada.

Affiliates

Esso Eastern Inc. (100%); Oil, gas, oil shale, and coal interests in the Far East, South and Southeast Asia, and Australia.

Esso Europe Inc. (100%):   Oil and gas interests in Europe and Africa.

Esso Exploration Inc. (100%):   Oil and gas exploration, principally in Africa, Europe, and Asia; and mobile marine drilling worldwide except in Canada and the United States.

Esso Inter-America Inc.:   Oil, gas, coal, and synthetic fuels interests in Central and South America and the Caribbean.

Exxon Production Research Company: Research on the exploration and production of oil, gas, coal, oil shale, and other hydrocarbon minerals.

Exxon Research and Engineering Company: Fundamental research; research and development of oil, gas, oil shale, and coal products and processes; engineering services worldwide.

Imperial Oil Limited (70%):   Oil and gas interests, chemicals, fabricated products, and mineral exploration in Canada.

Reliance Electric Company: Electrical, mechanical, electronic, weighing, and telecommunications components and systems worldwide.

Acquisitions, Divestments and Other Activities (1967-81)

In 1967, Humble Oil & Refining Co. (now Exxon Co., U.S.A., division), acquired from Standard Oil Co. of Cal. its service stations and related properties previously operated under Signal brand.

73

On Jan. 1, 1973 merged Humble Oil & Refining Co., Esso
Chemical Co., Inc., and Enjay Chemical Co., wholly-owned
subsidiaries. Their businesses are now being conducted
as operating divisions of Corporation. Humble Oil &
Refining Co. became Exxon Co., U.S.A. and Esso Chemical
Co., Inc. became Exxon Chemical Co., both divisions of
Corporation. Enjay Chemical Co.,became Exxon Chem. Co.
U.S.A., a division of Exxon Chemical Co.

In Dec. 1973, sold its interests in Esso Philippines
Inc. and Bataan Refining Corp. to the Philippine Govern-
ment for cash and assumption of liabilities.

In July, 1975 merged Creole Petroleum Corp. into Esso
Holdings, Inc., a subsidiary of Co.

In Aug. 1975 Exxon Nuclear Co., Inc., subsidiary, formed
a subsidiary, Exxon Nuclear International Inc., to fur-
ther Exxon Nuclear Co's. development of nuclear fuel
cycle products and services business outside the U.S.

In Oct. 1976, Exxon Nuclear Co., subsidiary, formed sub-
sidiary, Exxon Nuclear G.m.b.H., West Germany, to own
and operate nuclear fuel fabrication plant in Lingen,
West Germany.

In Jan. 1978, Exxon Minerals International, Inc., sub-
sidiary, acquired approximately 87% outstanding shares of
Compania Minera Disputada de las Condes S.A.

In April 1978, Chagrin Valley Co., acquired assets of
Nevamar division of Exxon Chemical Co. U.S.A., subsidiary,
for an undisclosed amount of cash.

In April 1979, EssochemPlastics N.V., Co., affiliate,
acquired U.S.I. Europe N.V., which owns and operates
a polyethylene plant in Europe.

Through a tender offer, effective Sept. 24, 1979, by
a wholly owned subsidiary, and a merger later in the year,
the corporation acquired all of the outstanding capital
stock of Reliance Electric Co. The total acquisition
cost, including capitalized expenses was $1.24 billion.

In Aug. 1980, Co. said its Exxon U.S.A. division com-
pleted its previously reported acquisition of Atlantic
Richfield Co.'s 60% interest in the Colony Shale Oil
Project for $300 million. Co. will pay an additional
$100 million if production begins by 1985.

In early 1981, Imperial Oil Ltd., a subsidiary, acquired
all outstanding shares of Byron Creek Collieries Ltd.

In Dec. 1981, Co. relinquished concessionary interests
in Libya.

GULF OIL CORP. (GULF)

Present Business

The Company is primarily an integrated petroleum company with secondary operations in the chemicals, minerals, and nuclear industries. Petroleum revenues are derived from the production of crude oil, natural gas, and natural gas liquids, as well as the refining and marketing of gasolines, distillates, and residual fuel oils. Petroleum revenues are also obtained from the transportation of crude and products by the Company's international tanker fleet. Chemicals revenues consist of petrochemicals, plastics, and a variety of industrial and specialty chemicals. Minerals revenues are derived from the sale of coal and uranium.

The Company and its domestic subsidiaries own reserves of crude petroleum in numerous fields in the Mid-Continent and Gulf Coast areas, and to a lesser extent in Arkansas, California, Illinois, Michigan, Indiana, and Kentucky.

Acquisitions, Divestments, and Other Activities (1967-81)

In Oct. 1967, acquired General Dynamics Corp.'s General Atomic division for an undisclosed sum. General Atomic Co., headquartered in San Diego, Cal., is engaged in nuclear research, production of nuclear fuel, and building of nuclear steam systems for electricity generating plants.

In 1971, Key International Drilling Company Ltd. (Keydril) was formed as an international offshore drilling contractor.

In Dec. 1973, formed Gulf Energy & Minerals Co., subsidiary, to "focus corporate effort on energy sources other than crude oil and natural gas", and a new unit, Gulf Oil Trading & Development Co., to coordinate Co.'s activities involving Mideast production countries.

During 1974, several new companies were created including Global Energy Operations and Management Co. to offer petroleum operating and management skills to foreign governments on a contract basis.

Also in 1976, Co. joined local interests to become a 35% participant in the newly formed Asia Polymer Corporation, which will manufacture low-density polyethylene in Taiwan.

On Sept. 19, 1977, Co. acquired Kewanee Industries, Inc. for an aggregate cash purchase price of $455 million.

In Apr. 1979, acquired a 30% equity interest in Taita Chemical Co. Ltd., Taiwan.

In Dec. 1979, acquired Amalgamated Bonanza Petroleum Ltd. for $2 million in cash and 1.65 million shares of common stock issued by Gulf Canada Ltd.

On Mar. 18, 1980, Woods Petroleum Corp. sold its Hartzog Draw oil and gas properties in Wyoming to Co. for $22.5 million.

In Apr. 1980, Co. sold 10 million shares of Gulf Canada Ltd. for an after-tax profit of $100 million, reducing Gulf's interest in Gulf Canada to 60%.

In June 1980, sold its 45% interest in Okinawa Seklyu Seisel refinery and in Aug., its 50% interest in Korea Oil Corp. a refining and marketing concern.

In mid-1981, Co. entered into a $120 million joint venture with Republic Steel Corp. to own and operate Republic's North River coal properties in AL.

Also in mid-1981, Co. acquired Kemmerer Coal Co. of Frontier, WY for $331 million. Kemmerer, a privately held company, produced 4,300,000 tons of coal in 1980 from an open-pit mine in Kemmerer WY. In addition to Kemmerer's coal reserves in Utah, Wyoming, and Colorado, Co. said the acquisition includes some natural gas production and reserves.

In Aug. 1981, subsidiary, Pittsburgh & Midway Coal Mining Co., acquired Kemmerer Co.,WY,for $330 million.

MOBIL CORPORATION (MOBIL)

Present Business

Company conducts its business through three principal operating subsidiaries: Mobil Oil Corp., Montgomery Ward & Co., Inc. (Wards), and Container Corp. of America (Container), each of which is directly or indirectly totally owned by Mobil Corp. Mobil Oil conducts an integrated international energy business in exploration, production, transportation, refining, and marketing of petroleum and natural gas products, and in the manufacture and marketing of chemicals.

Wards is one of the world's largest merchandising organizations, with 389 retail department stores in 42 states and a nation-wide catalog order business.

Container manufactures and sells corrugated and solid fiber shipping containers, folding cartons, composite cans, fiber drums, paper bags, plastic packaging, and paperboard in the form of container-board and bow-board.

In addition, W.F. Hall Printing Co., acquired in 1979, is engaged in printing, binding, and mailing catalogs for mail-order houses and other industrial companies, and magazines for publishers of periodicals. It also produces pocket size, paper covered, books.

Acquisitions, Divestments and Other Activities (1967-81)

In 1968, acquired assets of Goodling Electric Co., Inc.

In Nov. 1969, sold major portion of its retail fertilizer assets and business and subsequently completely withdrew from that business in the U.S.

In early 1971, acquired all stock of Aral Italiana, Italian subsidiary of Aral AG, a West German concern.

On Nov. 30, 1971, Mobil acquired three Italian firms known as Pastucol cos., which manufacture and market polyethylene film products.

In Sept. 1974, acquired majority interest in Marcor Inc.. At the time, Marcor conducted principal business through two wholly owned subsidiaries: Montgomery Ward & Co., Inc. and Container Corp. of America.

Mobil was incorporated in Mar. 1976 in the State of Delaware with the intent to operate primarily as a holding company. As a result, Mobil Oil became a wholly owned subsidiary of Mobil Corporation.

Prior to July 1, 1976, Mobil Oil had a 54% voting interest in Marcor. Pursuant to the Mobil/Marcor merger effective July 1, 1976, Mobil Oil owned 50.7% and Mobil Corporation owned 49.3% of Marcor.

In Feb. 1979, acquired W.F. Hall Printing Co. for approximately $50.5 million in cash.

In July 1979, acquired the oil and gas operations of General Crude Oil Co. for $792 million.

In Jan. 1980, sold 17.9% interest in Belridge Oil Co.

In Oct. 1980, acquired TransOcean Oil, Inc. for $715 million.

In 1981, Mobil Oil declared and paid as a dividend to Mobil its Container preferred stock holding.

SHELL OIL COMPANY (SHELL)

Present Business

Company is engaged, principally in the United States, in the exploration for, and development, production, purchase, transportation and marketing of, crude oil and natural gas, and the purchase, manufacture, transportation and marketing of oil and chemical products. In addition, the Company is engaged in exploration of crude oil and natural gas outside the United States, including several ventures with companies of the Royal Dutch/Shell Group. Also, the Company produces and markets coal and is in various stages of developing certain of its other coal and geothermal steam reserves, and is investigating other energy sources such as tar sands and solar energy.

Acquisitions, Divestments, and Other Activities (1967-81)

In Jan. 1974, Shell Canadian Exploration Co. was terminated as a division and all of the assets and liabilities of such Company were merged into Shell Oil Co.

In late 1974, acquired the assets of National Oil Co.

In July 1977, acquired Seaway Coal Co. of Cadiz, OH for $65 million.

In Dec. 1977, Co.'s division acquired the polybutylene business of Witco Chemical Corp. for an undisclosed amount of cash.

In Dec. 1979, acquired, through a wholly owned subsidiary, Belridge Oil Co., a producer of crude oil and natural gas from reserves in Kern County,CA, for $3.65 billion.

STANDARD OIL COMPANY OF CALIFORNIA (SOCAL)

Present Business

Standard Oil Company of California is a major international oil company which, through its numerous subsidiaries and affiliates, has activities in more than 90 countries. It engages in worldwide, integrated petroleum operations which consist of exploring for and developing crude oil and natural gas reserves; transporting crude oil, natural gas, and petroleum products by pipelines, oil tankers, and motor equipment; operating large refinery complexes for converting crude oil to finished products; and marketing at wholesale and retail the hundreds of products derived from petroleum.

In addition, the Company and its affiliates own or have interests in numerous plants located around the world which produce a wide range of chemicals and fertilizers for industry, farms, homes, and gardens. The Company also carries on real estate activities; explores for geothermal energy sources in the western U.S.; engages in minerals exploration, both domestic and foreign; and is devoting considerable effort to projects related to synthetic fuels and alternate energy utilizing sources such as shale oil, tar sands, and wind.

Activities of the Company and its affiliates are widely distributed geographically.

Acquisitions, Divestments, and Other Activities (1967-81)

On Mar. 31, 1967, sold Signal Oil stations to Humble Oil & Refining Co.

On May 1, 1967, Caltex properties in Europe and its world-wide marine operations, a joint operation of company and Texaco Inc., were divided and taken over by two parents. As a result, company is now conducting refining and marketing operations on a direct basis in Belgium, Denmark, West Germany, Italy, Luxembourg, Switzerland, The Netherlands, and United Kingdom, and on a joint basis in France, Spain, and Turkey.

In June 1975, Co. and AMAX Inc., announced the sale of 5.9 million common shares, or 20% of AMAX's stock, to Co. for $333 million in cash and securities.

The transaction was approved by AMAX shareholders. In addition to the 5.9 million shares purchased from AMAX, Co. bought another 500,000 AMAX shares in the open market.

STANDARD OIL COMPANY (SOIND)

Present Business

        Standard and its consolidated subsidiaries have a

large integrated petroleum and chemical company that con-

ducts operations on a worldwide basis. Its principal

wholly-owned subsidiaries and the businesses in which

they are engaged are:

Amoco Oil Co.: Refining, transporting, and marketing
of petroleum products and sale of fertilizers.

Amoco Production Co.: Exploration, development, and
production of crude oil and natural gas.

Amoco Canada Petroleum Co., Ltd.: Exploration, develop-
ment and production of crude oil and natural gas in
Canada.

Amoco International Oil Co.: Direction of overseas petro-
leum operations.

Amoco Chemicals Corp: Manufacture and sale of chemical
products.

Amoco Minerals Co.: Exploration, extraction, processing,
and marketing of mineral resources.

Acquisitions, Divestments, and Other Activities (1967-81)

In Jan. 1968, Amoco Chemical Corp., subsidiary, acquired
all stock of Avisun Corp. from Sun Oil Co. for $80 million.
Company also acquired Patchogue-Plymouth Co., manufactur-
ers of polypropylene carpet backing.

In early 1972, Company made an exchange offer, which ex-
pired May 31, 1972, to exchange 1.68 shares of common
stock for each Midwest Oil Corp. common share. As of
Dec. 31, 1972 Company had acquired 94.99% interest in
Midwest; remaining interest acquired April 15, 1974.

In Dec. 1978, formed new subsidiary, Amoco Container Co.

On Sept. 21, 1979, acquired Cyprus Mines Corp. for 5.1 million common shares and $117.2 million cash.

In 1980, acquired Empire Energy Corp. and Emerald Mines Corp.

On Aug. 7, 1981, Co. sold its 63% interest in Cyprus Mining Corp. to a subsidiary of Hudson's Bay Oil & Gas Co. for $171 million cash.

In 1981, acquired Harbert Corp. and several small chemical firms for $272 million cash and common stock.

THE STANDARD OIL COMPANY (SOHIO)

Present Business

The Company and its subsidiaries are engaged in all
branches of the oil industry, namely; exploring, producing,
transporting, refining, and marketing. The Company was
originally a refiner and marketer with entrance into
pipeline transportation and crude production in the late
1930s. Company's marketing activities are largely con-
centrated in the eastern portion of U.S. from Maine
through Virginia and in Ohio and surrounding area. In
addition to marketing the usual oil products such as
gasoline, kerosene, motor oils, industrial lubricants,
asphalt road oil, and fuel oils, the company handles
a general line of automobile tires, batteries, and
other automotive accessories. Manufacturing and market-
ing of chemicals and plastic products and production and
sale of coal, metals, copper, and other minerals are per-
formed by wholly-owned subsidiaries.

Acquisitions, Divestments and Other Activities (1967-81)

In Jan. 1967, Company merged its chemicals and plastics
wholly-owned subsidiaries into Vistron Corp.

In Apr. 1967, acquired Ankney Food Service, Inc., an
industrial catering and vending company of Dayton, OH.

In Aug. 1968, acquired Old Ben Coal Corp.

On Jan. 1, 1970, acquired all outstanding capital stock
of British Petroleum (Holdings) Inc. for 1,000 shares of
Special Stock. BP Oil Corp., major subsidiary of British

Petroleum (Holdings) Inc. has assets which include marketing and refining properties, Alaskan oil and gas leases, and other interests. Amalgamation of BP Oil Corp. properties with those of Sohio was effected on Jan. 1, 1970.

In 1971, sold assets of Fleet-Wing Corp. and Fremont Oil Co. Also sold Loma Products division. Merged BP Pipe Line Corp. into Sohio Pipe Line Co.

In May 1972, Company's interest in Hospitality Motor Inns was reduced to 49% through latter's sale of common stock to public. (Sold entire interest to Helmsley Enterprises, Inc. in Jan. 1979).

In June 1973, Company sold marketing properties in FL, GA, NC, and SC plus Port Arthur Refinery to American Petrofina, Inc.

In Jan. 1978, acquired BP Alaska, Inc. for cash. (Responsibility for BP Alaska, Inc. has been assumed by Sohio Natural Resources).

In Dec. 1979, acquired Webb Resources, Inc. and Newco Exploration Co.

In Oct. 1980, sold Pro Brush division to subsidiary of Rexall Drug Co.

In June 1981, merged Kennecott Corp. The Company acquired the outstanding common shares of Kennecott for $62 per share for a total cost of $1.77 billion.

In Sept. 1981, acquired certain Appalachian coal properties in Pennsylvania and West Virginia from U.S. Steel Corp.

SUN COMPANY, INC. (SUN)

Present Business

Sun Company, Inc. is an energy resources company with integrated petroleum operations primarily in the United States and Canada and has interests in mining and alternate energy. The Company is also engaged in certain non-energy activities. The company's exploration and production operations consist of natural gas and natural gas liquids and natural gas liquids marketing operations. Mining operations comprise coal and oil sands. Coal operations are conducted in the United States while oil sands operations, which produce a synthetic crude oil, are conducted in Western Canada. Alternate energy operations consist principally of geothermal and oil shale development. Refining and marketing includes the refining of crude oil and its derivatives, the marketing of a full range of refined petroleum products, and the transportation of crude oil and refined petroleum products. Such operations are conducted in the United States and Canada. Overseas refining and marketing activities consist principally of procuring crude oil for United States and Canadian refining operations and resales of purchased oil. Information about the Company's business segments and its operation in different geographic areas is as follows:

> Sun operates in the following industry segments: (1) energy-exploration and production; (2) energy mining and alternate energy; (3) energy-refining and marketing; and (4) non-energy.

Acquisitions, Divestments, and Other Activities (1967-81)

On Oct. 25, 1968, merged with Sunray DX.

In Oct. 1969, acquired assets of Waboo Inc., McAlester, OK., marketer of petroleum gas, for undisclosed terms.

In July 1970, acquired Southern Minerals Corp., Southern Petroleum Corp., & Southern Pipeline Corp., Corpus Christi, TX.

Also in July 1970, acquired Nonark Petroleum Co., (St. Louis), H.F. Nelson, Inc. (Winchester, Va.), Modern Oil Co. (Raleigh, N.C.), Public Oil Co. (Lex., N.C.) and Cheap Gasoline Inc. (Lex., N.C.)

In 1970, Co. increased ownership in Great Canadian Oil Lands Ltd. to 96.1%

In Dec. 1973, Sperry-Sun, Inc., subsidiary, acquired Reamco, Inc., a Louisiana based maker and marketer of specialized oil field equipment and services.

In Mar. 1974, sold South Central Oil Co., subsidiary, to Amtel, Inc.

In early 1974, Company organized a wholly-owned subsidiary, Sun Oil Trading Co., to buy, sell, and exchange foreign crude oil and products for its own account.

In July, 1974, Calvert Exploration Co. was merged into Sun Calvert Co., subsidiary.

In 1974, Company formed Sunoco Energy Development Co., subsidiary based in Dallas, TX, to develop a competitive position for Company in coal, oil shale, geothermal energy, and uranium in the U.S.

Also in 1974, Co. divested itself of Red Barn Chemicals, Inc., subsidiary.

In 1975, S.J.T., Inc. a joint venture owned 46.6% by Sun Ventures, Inc. subsidiary, acquired complete ownership of H.P. International, Inc. a Dallas based industrial distribution firm with subsidiaries in Houston, Dallas, and Fort Worth, TX.

In May 1976, Sun Ventures, Inc., subsidiary, increased its ownership in Audio-Magnetics Corp. from 29.2% to 83.8%.

In Aug. 1976, acquired Stop-N-Go Foods, Inc., Trotwood, OH.

In May, 1977, Sun Distributors Inc., subsidiary, acquired
Kar Products Inc.

In Jan. 1978, Co., through a newly formed wholly-owned
subsidiary, purchased in private transaction approxi-
mately 34% of common stock of Becton, Dickinson and Co.
for an aggregate cost of $293 million.

In Mar. 1978, Sun Distributors, Inc., subsidiary, acquired
Atlas Screw & Specialty Co., for $3.6 million.

In Apr. 1978, Co.'s unit, Sun Information Services Co.,
acquired more than 99% of stock of Weiland Computer Group,
Inc. for undisclosed amount.

In Oct. 1978, Co. subsidiary, Sun Carriers, Inc. ac-
quired Milne Truck Lines, Inc. and its affiliates.

In Feb. 1979, Co.'s Sun Information Services Co., ac-
quired computer division of Metridata Computing, Inc.
for approximately $3 million.

In Oct. 1979, acquired Elk River Resources, Inc. for
5.1 million shares of Co. common stock.

In Dec. 1979, through subsidiary acquired Catallactics
Corp. for cash.

In Jan. 1980, through subsidiary acquired Mr. Zip, Inc.
for cash and notes.

In Aug. 1979, formed Suncor Inc. through the amalgama-
tion of Sun Oil Co., Ltd. and Great Canadian Oil
Sands Ltd.

In Aug. 1979, acquired Carboline Co. for cash and notes.

In June, 1980, Co. through a wholly-owned subsidiary
acquired Viking Oil Ltd.

In late 1980 sold Duncan, OK refinery for $140 million
cash.

In Dec. 1980 Co. acquired the U.S. oil and gas proper-
ties of Seagram Co.'s Texas Pacific Oil Co. for $2.3 bil-
lion.

In Apr. 1981 Sun Information Services Co., a subsidiary, acquired the stock of Metropolitan Computer Center, Inc. The acquired Company became part of the unit's banking services division.

On Apr. 21, 1981, sold Sperry-Sun, Inc. to NL Industries, Inc. for $252 million cash.

In Nov. 1981 sold Corpus Christi, TX refinery and certain related assets for $265 million in cash.

In Dec. 1981 sold 25% of the outstanding common stock of Suncor Inc.

TENNECO INC. (TENN)

Present Business

The major businesses of Tenneco Inc. and its subsidiaries are oil exploration and production; processing and marketing of oil and chemicals; natural gas pipelines; manufacturing; and life insurance.

Tenneco's other businesses include its fiber, food, and land businesses. These businesses are engaged in the manufacture and sale of paperboard, corrugated shipping containers, folding cartons, molded pulp products and other packaging products, and agriculture and land management.

Acquisitions, Divestments, and Other Activites (1967-81)

In Apr. 1967, 10-Foam, Inc., subsidiary, acquired General Foam Corp.

In Aug 1967, acquired Kern County Land Co.

During 1967, Tenneco Chemicals, Inc., subsidiary of Tenneco Corp., purchased 84% of Butler Chemicals, Ltd., bringing total interest held to 96%.

In Dec. 1967, acquired Drott Manufacturing Corp.; Tenneco Holland, Inc., subsidiary of Tenneco Corp., acquired Gebr. Broere N.V.

In Jan. 1968, acquired 50% of Genset Corp.

In Sept. 1968, Tenneco Virginia Inc., subsidiary of Tenneco Corp., acquired Newport News Shipbuilding & Dry Dock Co.

In Nov. 1968, acquired Davis Manufacturing Inc.

In Dec. 1968, acquired Mechanex Corp. and the Eastern Corrugated Box Co.

In Mar. 1969, Tenneco Corp., subsidiary, acquired Motor
Condensator Co. Schloz KG, a German automotive parts
manufacturer.

In July 1969, acquired all outstanding capital stock of
Southeastern Aniline Co., Inc.

In Aug. 1969, acquired Tri-Co. Almonds, Inc. and Tri-Co. Co.

In Nov. 1969, acquired Qualitron Aero, Inc.

In Dec. 1969, through Moorgate Corp., acquired additional
shares of J.I. Case Co. common stock, bringing total
common ownership to 91% and preferred to 89%. In Aug.
1970, acquired balance of outstanding shares. Case now
operated as wholly-owned subsidiary of Tenneco Corp.

In Jan. 1970, acquired 3,060 acres of California farmland
from S.A. Camp Ginning Co.

In Feb. 1970, acquired Heggblade-Marguleas Co.

Also in Feb. 1970, acquired balance of stock of Tennessee
River Pulp and Paper Co. (49%) and the Corrinth and Counce
Railroad Co. (49%) for about $25 million cash. Both com-
panies will continue to operate as subsidiaries of Pack-
aging Corp. of America.

In Oct. 1970, acquired for J.I. Case Co., a majority in-
terest in Losenhausen Maschinenbau AG of Dusseldorf, Germany.

In Dec. 1971, sold 30,000 acres of agricultural row crop
development and undeveloped properties in Kern County,
CA for approximately $15 million.

In Mar. 1972, sold additional 25,000 acres of prime land
in North Kern County, TX for approximately $42 million.

In June 1971, Tenneco International Inc., subsidiary of
Tenneco Corp., purchased convertible loan stock of Al-
bright & Wilson Ltd., which, if converted in full before
Dec. 31, 1971, would increase its overall interest in
Albright & Wilson Ltd. to 50.6% of outstanding ordinary
stock.

In Aug. 1972, acquired David Brown Tractors Ltd. for
approximately $19 million. (Now operated as division of
J.I. Case Co., subsidiary).

In Oct. 1973, completed acquisition of Fritz Lange Metall-
warenfabrik, a West German manufacturer of automotive
exhaust systems.

In early 1974, formed a new Organic & Polymers division.

In Dec. 1974, Tenneco Oil Co., subsidiary of Tenneco Corp. acquired La Terre Co., Inc. whose assets consist primarily of oil and gas interests.

Also in Dec. 1974, AB Starlawerken, a Swedish manufacturer of automobile exhaust systems, was acquired as an operating unit of Walker Manufacturing.

Prior to year-end 1974, Tenneco International, Inc. increased its interest in Albright & Wilson, Ltd. 49.8%. In Aug. 1978, Co. increased its voting interest in Albright & Wilson, Ltd. common stock to 50.5%. In Sept. 1978, Co. acquired all the remaining stock of Albright & Wright, Ltd. for approximately $232 million.

In Dec. 1975, acquired 95% interest in Harmo Industries, Ltd.

On June 30, 1976, Tenneco International, Inc., subsidiary, transferred all the shares of its unit, Tenneco, Netherlands, Inc., to a subsidiary of British Petroleum Co. Ltd.

In June 1977, Co. acquired remaining 16% interest in Midwestern Gas Transmission Co.

In June 1977, a subsidiary of Co. acquired 40% interest in Poclain, S.A., a French construction machinery firm.

In 1977, acquired all outstanding common stock of Monroe Auto Equipment Co.

In Dec. 1977, acquired remaining 50% interest in Petro-Tex Chemical Corp. for approximately $35 million, giving Co. 100% ownership.

On Mar. 1, 1978, acquired full ownership of Philadelphia Life Insurance Co.

In Oct. 1978, Co. sold Caligen Goam Ltd. to British Vita Ltd. for approximately $4 million.

On May 2, 1980, acquired Southwestern Life Corp.

On Apr. 24, 1981, merged Houston Oil and Minerals Corp.

TEXACO INC. (TEX)

Present Business

     Texaco Inc., together with subsidiary and nonsubsidiary companies (those companies owned 50% or less), is engaged in the worldwide exploration for, and production, transportation, refining,and marketing of, crude oil and its products, including petrochemicals.

Acquisitiions, Divestments, and Other Activities (1967-81)

In 1966 and 1967, acquired approximately 97% of capital stock of Deutsche Texaco A.G. In Jan. 1967, interest was increased to 97.3%. In Jan. 1969, Deutsche Erdol A.G. and subsidiary transferred coal mining operations and related assets, liabilities and reserves to Ruhrkole A.G. (a company in which no interest is held), organized to consolidate operations of coal companies in Germany.

In Aug. 1971, acquired a two-thirds interest in Refineria Panama, S.A., which operates a 40,000 bbl. a day refinery at Los Minas Bay in Republic of Panama. During 1973, increased equity to 100%. Expansion to 100,000 bbl. a day completed in 1974.

In Aug. 1972, acquired 20% interest in Skandinaviska Raffinaderi Aktiebolaget Scanraff, a Swedish Corp. formed for purpose of building and operating a petroleum refinery.

In Jan. 1977, Texaco North Sea Norway A/S, subsidiary, acquired a 35% interest in two oil exploration blocks covering 131,000 acres in Norwegian sector of North Sea for undisclosed terms.

In Nov. 1979, Co. sold its interest in Elf France to Societe Nationale Elf Aquitaine, France.

In Nov. 1979, an agreement was announced to divide the assets and business, wherein Texaco will acquire full ownership of Texas U.S. Chemical, which in turn will retain its half interest in a butadiene manufacturing plant and divest its interest in a polymer plant.

In Jan. 1980, Co. announced that it received payment of approximately $623 million in exchange for its 17% capital stock interest in Belridge Oil Co. Co. received payment in accordance with the arrangement under which Shell Oil Co. acquired Belridge.

In June 1980, Co. sold a 14% stock interest in Seanraff refinery to Svenska Petroleum AB.

UNION OIL COMPANY OF CALIFORNIA (UNION)

Present Business

Company is engaged principally in petroleum, chemical, metal, and geothermal operations. Petroleum involves exploration, production, transportation, and sale of crude oil and natural gas, and the manufacture, transportation, and marketing of petroleum products. Chemicals involves the manufacture, purchase, transportation, and marketing of chemicals for industrial and agricultural uses. Metals primarily involves exploration, production, and marketing of molybdenum, columbium, and rare earths. Geothermal involves the exploration, production, and sale of geothermal resources. Other operations include the exploration, production, and sale of uranium; the development of oil shale resources; and real estate development sales.

The manufacturing, purchase, transportation, and sale of chemicals derived from petroleum and natural gas are conducted by company's chemical division. Principal products are ammonia, urea, dry ice, liquid carbon dioxide, ammonium phosphate, liquefied petroleum gas, industrial chemicals and carbons, fertilizers, farm chemical products, solvents, and polymer emulsions.

Products are distributed through owned, leased, and independent bulk stations, and directly from refineries. Retail distribution is effected through owned, leased,

and independent outlets.

Certain company products, principally lubricating oils, greases, and waxes are sold nationally and in many foreign countries on a limited basis.

Acquisitions, Divestments, and Other Activities (1967-81)

In Mar. 1967, acquired through a subsidiary, Southern Pacific Milling Co. for about $6 million cash.

In 1969, acquired 26% interest in Wolverine Pipe Line Co., and a partner's half-interest in American Mineral Spirits Co., Western, now part of the Union Chemicals Division.

Also in 1969, sold investments in Great Northern Oil Co. and Minnesota Pipeline Co.

In Apr. 1976, Union Oil Co. of Canada Ltd. (86% owned) sold refining and marketing facilities to Husky Oil Ltd. for $38 million.

In July 1977, Molycorp, Inc. was merged into Co. Molycorp also owned approximately 49% of Kawecki Berylco Industries, Inc. (sold Apr. 1978) and a 33% interest in Companhia Brasileira de Metalurgia e Mineracao, the world's largest producer of columbium from its mine in Brazil. In 1980, Molycorp increased its equity in Companhia Brasileira de Metalurgia to 47%.

In Dec. 1977, Molycorp entered into an agreement which terminated any interest Kennecott Copper Corp. had in Molycorp's Questa, New Mexico, molybdenum property.

In Feb. 1978, all of assets and operations of Collier Carbon and Chemical Corporation, previously a wholly-owned subsidiary, and Union's former Amsco Division were combined into a new Union Chemicals Division.

In Dec. 1978, acquired all assets of Silver Bell Industries, Inc.

In Dec. 1978, acquired Mancos Corp.

In June 1979, all of Company's energy mining operations (including Minerals Exploration Company) were consolidated into the new Union Energy Mining Division.

In Nov. 1980, Co. sold its Unicracking-HDS petroleum refinery process technology to Chinese Petroleum Corp. of Taiwan.

In May 1981, sold its 9.5% interest in Magma Power Co. to Natomas Co. for $41 million.

In July 1981, completed purchase of all outstanding shares of Union Oil Co. of Canada Ltd. at $65 per share.

In July 1981, Co. signed two joint venture agreements to explore for and develop geothermal energy resources on the island of Hokkaido in northern Japan.

Appendix B

Company Sales and Other Operating Revenues

Atlantic Richfield Company

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	2.77	2.95	3.34	3.44	3.66	3.83	4.49	7.17	7.75	8.92	11.4	12.7	16.7	24.2	28.2
Contribution by Segment:															
Energy I[1]	.920	.907	.900	.898	.904	.904	.914	.913	.921	.916	.772	.771	.752	.778	.795
Energy II[2]	.024	.034	.048	.051	.042	.040	.034	.022	.022	.024	.019	.019	.030	.065	.063
Non-Energy I[3]	.056	.059	.052	.051	.054	.056	.052	.065	.057	.060	.073	.086	.100	.083	.087
Non-Energy II[4]	—	—	—	—	—	—	—	—	—	—	.136	.124	.118	.074	.055
Structural Category	DC	DC	DC	DC	DC	DC	DL	DL	DL	DL	DU	DU	DU	DU	DU

1. 1967-81: Crude Oil, Petroleum Products, Natural Gas
2. 1967-74: Other Sales and Services; 1975-81: Coal, Other
3. 1967-81: Chemical Products
4. 1977-81: Metal Mining and Fabricating

99

Exxon Corporation

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	14.4	15.5	16.4	18.1	20.4	22.1	28.0	45.0	47.8	51.6	57.5	63.9	83.6	108.4	113.2
Contribution by Segment:															
Energy I[1]	.905	.902	.902	.909	.907	.901	.907	.911	.918	.908	.907	.900	.889	.887	.872
Energy II[2]	.034	.033	.033	.031	.035	.036	.033	.024	.023	.024	.024	.025	.026	.029	.032
Non-Energy I[3]	.057	.060	.061	.056	.053	.057	.056	.062	.054	.063	.062	.063	.069	.064	.063
Non-Energy II[4]	.004	.005	.004	.004	.005	.006	.004	.003	.005	.005	.007	.012	.019	.030	.033
Structural Category	DC	DC	DC	DC	DC	DC	DC	DL	DL	DL	DL	DL	DL	DL	DL

1. 1967-81: Crude Oil, Petroleum Products, Natural Gas, International Marine

2. 1967-77: Coal, Nuclear; 1978-81: Coal, Nuclear, Other

3. 1967-81: Chemicals

4. 1967-79: Minerals, Land Development, Other; 1980-81: Reliance Electric operations added

Gulf Oil Corporation

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	5.11	5.60	6.11	6.60	6.76	5.52	9.84	18.0	15.8	18.1	19.6	19.9	25.9	28.4	30.0
Contribution by Segment:															
Energy I[1]	.961	.957	.954	.954	.952	.936	.948	.947	.944	.936	.930	.903	.895	.897	.906
Energy II[2]	—	.003	.004	.004	.005	.006	.006	.003	.005	.006	.008	.011	.011	.012	.011
Non-Energy I[3]	.039	.040	.042	.042	.043	.058	.046	.050	.051	.058	.062	.086	.094	.091	.083
Non-Energy II[4]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Structural Category	DV	DC	DC	DC	DC	DC	DL	DL	DL	DL	DL	DL	DL	DL	DL

1. 1967-81: Crude Oil, Petroleum, Natural Gas
2. 1968-81: Coal, Nuclear, Minerals
3. 1967-81: Chemicals
4. No involvement.

101

Mobil Corporation

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	6.35	6.93	7.39	8.10	9.15	10.2	12.6	20.3	22.1	28.0	34.4	37.3	48.3	63.7	68.6
Contribution by Segment:															
Energy I[1]	.895	.900	.896	.898	.906	.911	.906	.920	.927	.855	.788	.785	.814	.846	.846
Energy II[2]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Non-Energy I[3]	.064	.060	.060	.050	.046	.046	.045	.043	.041	.037	.033	.035	.034	.030	.034
Non-Energy II[4]	.041	.040	.044	.052	.048	.043	.049	.037	.032	.108	.179	.180	.152	.124	.120
Structural Category	DL	DL	DL	DL	DL	DL	DL	DU	DU	DU	DU	DU	DU	DU	DU

1. 1967–81: Crude Oil, Petroleum Products, Natural Gas
2. No Involvement.
3. 1967–81: Chemicals
4. 1967–75: Other Products and Services; 1976–81: Retail, Paper, Other

Shell Oil Company

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	3.07	3.32	3.54	3.59	3.89	4.08	4.88	7.63	8.14	9.23	10.1	11.1	14.4	19.8	21.6
Contribution by Segment:															
Energy I[1]	.838	.818	.818	.831	.829	.816	.822	.823	.831	.810	.811	.799	.804	.810	.802
Energy II[2]	—	—	—	—	—	—	—	—	—	—	.003	.005	.007	.009	.010
Non-Energy I[3]	.142	.155	.151	.142	.139	.153	.148	.149	.148	.165	.165	.172	.166	.160	.165
Non-Energy II[4]	.020	.027	.031	.027	.032	.031	.030	.028	.021	.025	.021	.024	.023	.021	.023
Structural Category	DC	DC	DC	DC	DC	DC	DC	DC	DC	DC	DL	DL	DL	DL	DL

1. 1967-81: Crude Oil, Petroleum Products, Natural Gas

2. 1977-81: Coal, Geothermal

3. 1967-81: Chemical Products

4. 1967-81: Other (Pipeline Operations)

Standard Oil Company of California

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	3.96	4.32	4.56	4.96	5.73	6.48	8.48	17.9	17.5	20.2	21.8	24.1	30.9	41.6	45.2
Contribution by Segment:															
Energy I[1]	.96	.96	.96	.96	.96	.96	.957	.966	.964	.966	.965	.965	.964	.970	.971
Energy II[2]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Non-Energy I[3]	.04	.04	.04	.04	.04	.04	.043	.034	.036	.034	.034	.034	.034	.028	.027
Non-Energy II[4]	—	—	—	—	—	—	—	—	—	—	.001	.001	.002	.002	.002
Structural Category	DV	DV	DV	DV	DV	DV	DV	DV	DC	DC	DL	DL	DL	DL	DL

1. 1967-81: Crude Oil, Petroleum Products

2. Some involvement in alternate energy sources reported for 1977-81, but no revenues derived.

3. 1967-81: Chemicals

4. 1977-81: Corporate, Other (Real Estate)

104

Standard Oil Company of Indiana

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	3.56	3.94	4.24	4.55	4.89	5.40	6.38	10.0	11.0	12.5	14.1	16.1	19.9	27.5	31.3
Contribution by Segment:															
Energy I[1]	.875	.851	.851	.853	.848	.840	.838	.859	.862	.857	.862	.866	.781	.814	.827
Energy II[2]	—	—	—	—	—	—	—	—	—	—	—	—	.002	.005	.005
Non-Energy I[3]	.065	.089	.090	.086	.099	.111	.118	.106	.106	.112	.110	.108	.127	.104	.098
Non-Energy II[4]	.060	.060	.059	.061	.053	.049	.044	.035	.032	.031	.028	.026	.090	.077	.070
Structural Category	DC	DL	DL	DL	DL	DL	DL	DL	DL	DL	DL	DL	DU	DU	DU

1. 1967-81: Crude Oil, Petroleum Products, Natural Gas
2. 1979-81: Coal
3. 1967-81: Chemicals, Plastics, Fertilizers
4. 1967-78: Other Sales and Operating Revenues; 1979-81: Nonferrous Metals and Industrial Minerals added

105

Standard Oil Company of Ohio

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	0.72	0.77	1.22	1.37	1.39	1.65	1.76	2.42	2.72	3.16	3.80	5.49	8.22	11.3	13.8
Contribution by Segment:															
Energy I[1]	.781	.766	.806	.825	.829	.833	.828	.827	.827	.851	.869	.907	.921	.932	.843
Energy II[2]	.058	.057	.045	.047	.048	.047	.048	.047	.061	.047	.042	.029	.028	.024	.021
Non-Energy I[3]	.134	.147	.125	.103	.093	.088	.110	.109	.104	.100	.083	.060	.048	.042	.035
Non-Energy II[4]	.027	.030	.024	.025	.030	.032	.014	.017	.008	.002	.006	.004	.003	.002	.101
Structural Category	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

1. 1967-81: Crude Oil, Petroleum Products, Natural Gas
2. 1967-81: Coal
3. 1967-71: Chemicals, Plastics, Royalties; 1972-81: Chemicals
4. 1967-71: Inns and Food Services, Tankers, Other; 1972-81: Metals Mining, Industrial Products and Services, Corporate, Other

Sun Company, Inc.

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	1.52	1.58	1.62	1.74	1.82	1.92	2.29	3.80	4.47	5.43	6.44	7.49	10.7	13.2	16.0
Contribution by Segment:															
Energy I[1]	.880	.881	.877	.876	.871	.866	.866	.933	.910	.904	.902	.884	.898	.903	.878
Energy II[2]	—	—	—	—	—	—	—	—	.030	.023	.022	.024	.021	.022	.024
Non-Energy I[3]	.088	.082	.085	.089	.090	.088	.083	.054	.050	.058	.074	.071	.078	.067	.071
Non-Energy II[4]	.032	.037	.038	.035	.039	.046	.051	.013	.010	.015	.002	.021	.003	.008	.027
Structural Category	DL	DL	DL	DL	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

1. 1967-81: Crude, Condensate, Synthetic Crude, Refined Products, Natural Gas
2. 1975-79: Coal, Coke; 1980-81: Mining, Alternate Energy
3. 1967-79: Other Related Products and Services; 1980-81: Non-Energy
4. 1967-79: Shipbuilding and Repair; 1980-81: Corporate

Tenneco, Inc.

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	1.89	2.09	2.46	2.55	2.84	3.28	4.06	5.09	5.76	6.57	7.41	8.76	11.2	13.2	15.5
Contribution by Segment:															
Energy I[1]	.464	.437	.391	.394	.400	.372	.364	.434	.440	.440	.443	.425	.446	.495	.540
Energy II[2]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Non-Energy I[3]	.127	.116	.101	.096	.090	.085	.074	.072	.061	.066	.065	.092	.131	.124	.120
Non-Energy II[4]	.409	.447	.508	.510	.510	.543	.562	.494	.499	.494	.492	.483	.423	.381	.340
Structural Category	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC	AC

1. 1967-81: Integrated Oil (Crude Oil, Petroleum Products), Natural Gas, Pipelines
2. No involvement.
3. 1967-81: Chemicals
4. 1967-72: Machinery, Equipment, Shipbuilding, Packaging, Land Use, Other; 1973-80: Automotive added; 1981: Manufacturing, Fiber, Food, Land, Other

Texaco, Inc.

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	5.18	5.55	5.86	6.35	7.53	8.69	11.4	23.3	24.5	26.5	27.9	28.6	38.4	51.2	57.6
Contribution by Segment:															
Energy I[1]	.965	.963	.969	.968	.967	.969	.973	.983	.985	.985	.986	.984	.985	.988	.988
Energy II[2]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Non-Energy I[3]	.035	.037	.031	.032	.033	.031	.027	.017	.015	.015	.014	.016	.015	.012	.012
Non-Energy II[4]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Structural Category	DV	DV	DV	DV	DV	DV	DV	DV	DV	DV	DV	DV	DV	DV	DV

1. 1967-81: Crude Oil, Petroleum Products, Natural Gas
2. No Involvement.
3. 1967-81: Petrochemicals
4. No Involvement.

109

Union Oil Company of California

Year	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
Total Sales ($Billions)	1.62	1.76	1.90	2.04	2.20	2.32	2.86	4.73	5.35	5.63	5.84	6.20	7.85	10.2	10.9
Contribution by Segment:															
Energy I[1]	.865	.864	.867	.860	.860	.863	.860	.872	.880	.878	.871	.861	.858	.869	.858
Energy II[2]	—	—	—	—	—	—	—	—	—	—	.003	.003	.005	.007	.010
Non-Energy I[3]	.094	.097	.093	.102	.097	.095	.100	.096	.095	.093	.096	.109	.110	.103	.111
Non-Energy II[4]	.041	.039	.040	.038	.043	.042	.040	.032	.025	.029	.030	.027	.027	.021	.021
Structural Category	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU	DU

1. 1967–81: Crude Oil, Petroleum Products, Natural Gas, Natural Gas Liquids
2. 1977–81: Geothermal
3. 1967–81: Chemicals
4. 1967–81: Minerals, Other (Real Estate Development)

Appendix C

Company Structural Categories (1967-81)

	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
ARCO	DC					DC	DL			DL	DU				DU
XON	DC						DC	DL							DL
GULF	DV	DC				DC	DL								DL
MOBIL	DL						DL	DU							DU
SHELL	DC									DC	DL				DL
SOCAL	DV							DV	DC	DC	DL				DL
SOIND	DC	DL										DL	DU		DU
SOHIO	DU														DU
SUN	DL			DL	DU										DU
TENN	AC														AC
TEX	DV														DV
UNION	DU														DU

DV – Dominant Vertical

DC – Dominant Constrained

DL – Dominant Linked

DU – Dominant Unrelated

AC – Acquisitive Conglomerate

Note: Each bar means category stays the same in intervening years.

112

Appendix D

Financial Information (1967-81)

Exhibit 1: Annual Rates of Return (1967-81)

Market Portfolio: R_m^1, U.S. Treasury Bills(Risk Free Rate): R_f^2

Market Risk Premium: $R_m - R_f$

	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
R_m(%)	26.9	12.8	-9.8	1.3	15.8	17.8	-16.9	-26.8	37.7	26.3	4.8	7.4	21.8	32.7	-4.2
R_f(%)	4.8	5.5	6.1	7.5	4.2	3.9	5.9	6.9	6.8	5.6	4.7	6.5	9.6	12.1	13.5
$R_m - R_f$(%)	22.1	7.3	-15.9	-6.2	11.6	13.9	-22.8	-33.7	30.9	20.7	0.1	0.9	12.2	20.6	-17.7

1. R_m based on results for Standard and Poor's 500 firms; obtained from ref. 16.

2. R_f obtained from ref. 15.

Note: All rates are nominal, yield(not coupon), and observed(not expected). Observed and expected values are equivalent for R_f.

Exhibit 2: Company Annual Rates of Return (1967-81)

On Observed Equity: R_{oe}[1] (%)

Risk Premium on Observed Equity: $R_{oe} - R_f$ (%)

	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
ARCO	24.5	130.4	-25.7	-21.2	13.0	11.2	43.3	-14.4	2.3	31.5	-8.0	16.2	46.9	64.9	-23.0
	19.7	124.9	-31.8	-28.7	8.8	7.3	37.4	-21.3	-4.5	25.9	-12.7	9.7	37.3	52.8	-36.5
XON	12.7	22.3	-17.3	26.7	5.9	24.4	12.7	-26.3	45.7	27.6	-4.7	9.4	20.6	57.7	-15.3
	7.9	16.8	-23.4	19.2	1.7	20.5	6.8	-33.2	38.9	22.0	-9.4	2.9	11.0	45.6	-28.8
GULF	34.1	17.1	-25.2	10.4	-6.1	-0.6	-7.0	-19.4	26.2	50.6	-1.0	-5.3	59.5	32.8	-12.5
	29.3	11.6	-31.3	2.9	-10.3	-4.5	-12.9	-26.3	19.4	45.0	-5.7	-11.8	49.9	20.7	-26.0
MOBIL	-4.8	43.6	-18.5	31.9	-0.3	41.4	-25.2	-26.7	42.0	46.1	4.0	16.6	68.9	53.9	-36.2
	-9.6	38.1	-24.6	24.4	-4.5	37.5	-31.1	-33.6	35.2	40.5	-0.7	10.1	59.3	41.8	-49.7
SHELL	13.5	12.2	-34.6	13.2	4.9	22.0	29.2	-27.1	10.3	68.2	-10.9	1.4	77.6	122.4	-21.3
	8.7	6.7	-40.7	5.7	0.7	18.1	23.3	-34.0	3.5	62.6	-15.6	-5.1	68.0	110.3	-34.8
SOCAL	8.9	19.9	-22.2	13.1	10.8	45.0	-8.0	-31.4	41.6	48.3	0.4	28.0	27.4	84.8	-9.2
	4.1	14.4	-28.3	5.6	6.6	41.1	-13.9	-38.3	34.8	42.7	-4.3	21.5	17.8	72.7	-22.7
SOIND	16.2	17.8	-18.7	15.6	37.0	30.1	22.1	-12.7	2.5	46.6	-12.5	21.1	45.9	109.9	-31.8
	11.4	12.3	-24.8	8.1	32.8	26.2	16.2	-19.6	-4.3	41.0	-17.2	14.6	36.3	97.8	-45.3
SOHIO	18.4	5.4	19.3	-3.7	9.5	16.6	70.8	-20.1	16.7	14.1	-6.1	22.9	111.8	67.2	-39.6
	13.6	-0.1	13.2	-11.2	5.3	12.7	64.9	-27.0	9.9	8.5	-10.8	16.4	102.2	55.1	-53.1
SUN	36.5	25.7	-37.7	17.9	14.3	-7.5	40.7	-28.5	-17.9	85.2	-6.9	6.7	73.3	45.5	-1.7
	31.7	20.2	-43.8	10.4	10.1	-11.4	34.8	-35.4	-24.7	79.6	-11.6	0.2	63.7	33.4	-15.2
TENN	36.1	21.5	-23.3	10.2	12.5	19.7	-17.6	12.4	22.0	45.8	-11.9	5.2	36.6	41.5	-30.4
	31.3	16.0	-29.4	2.7	8.3	15.8	-23.5	5.5	15.2	40.2	-16.6	-1.3	27.0	29.4	-43.9
TEX	20.3	3.9	-23.2	20.6	3.4	14.4	-17.6	-22.8	21.3	28.0	7.5	-6.7	30.9	77.8	-25.7
	15.5	-1.6	-29.3	13.1	-0.8	10.5	-23.5	-29.7	14.5	21.4	2.8	-13.2	21.3	65.7	-39.2
UNION	13.2	14.5	-37.8	-0.8	-1.5	23.9	31.2	-17.2	9.0	50.3	-7.1	12.8	63.0	104.2	-13.8
	8.4	9.0	-43.9	-8.3	-5.7	20.0	25.3	-24.1	2.2	44.7	-11.8	6.3	53.4	92.1	-27.3

1. R_{oe} obtained from ref. 16.

Exhibit 3: Company Betas on Observed Equity[1] (1967-81)

	1967[2]	'68[2]	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
ARCO	1.00	1.00	1.00	1.09	1.19	1.15	1.10	.95	.90	.90	.90	.95	1.05	1.15	1.15
XON	.56	.56	.56	.51	.83	.85	.90	.95	.95	.95	.95	.95	.90	.85	.85
GULF	.63	.63	.63	.65	.89	.95	.90	.90	.90	.90	.90	.90	1.05	1.10	1.15
MOBIL	.61	.61	.61	.65	.97	.99	.95	.95	.95	.95	.95	.95	1.05	1.10	1.10
SHELL	.68	.68	.68	.71	.91	.86	.90	.95	.95	.95	.95	1.00	1.05	1.15	1.20
SOCAL	.71	.71	.71	.68	.67	1.01	1.00	1.05	1.05	1.05	1.05	1.00	1.00	1.05	1.05
SOIND	.77	.77	.77	.67	.87	.80	.85	.90	.90	.90	.95	.95	1.00	1.10	1.15
SOHIO	.51	.51	.51	.60	.62	.83	.90	.85	.85	.85	.90	.90	1.05	1.15	1.25
SUN	.54	.54	.54	.49	.47	.71	.75	.75	.80	.80	.85	.90	.95	1.00	1.15
TENN	.63	.63	.63	.77	.75	.94	.95	.90	.85	.90	.85	.90	1.05	1.10	1.15
TEX	.60	.60	.60	.58	.61	.91	.90	.95	.90	.90	.85	.85	.90	.95	.95
UNION	1.08	1.08	1.08	1.00	1.12	1.05	1.10	.95	.90	.90	.95	.90	1.10	1.20	1.25

1. This is the standard beta used in CAPM. It is obtained from a regression analysis of weekly percent changes in stock price on average changes in all stock prices (S&P 500) over a five-year period; values derived from data in ref. 25.

2. Data not available for these years; values necessarily assumed the same as in 1969.

116

Exhibit 4: Company Annual Average D/E Ratios[1] (1967-81)

	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
ARCO	.23	.22	.19	.28	.34	.30	.26	.30	.44	.56	.69	.76	.66	.58	.55
XON	.10	.11	.17	.19	.18	.17	.15	.20	.22	.20	.20	.20	.19	.19	.19
GULF	.12	.14	.22	.29	.37	.43	.42	.45	.46	.36	.32	.42	.48	.28	.25
MOBIL	.13	.16	.18	.21	.24	.22	.22	.43	.55	.54	.62	.64	.51	.35	.31
SHELL	.20	.20	.23	.30	.31	.32	.30	.32	.36	.31	.28	.33	.45	.56	.58
SOCAL	.10	.13	.15	.18	.22	.22	.20	.26	.29	.26	.24	.27	.25	.19	.16
SOIND	.16	.19	.26	.28	.26	.22	.20	.24	.30	.28	.30	.36	.30	.27	.30
SOHIO	.13	.11	.18	.40	.52	.43	.30	.40	1.03	1.95	2.62	2.54	1.75	1.03	.70
SUN	.26	.25	.33	.42	.41	.42	.42	.48	.64	.62	.50	.42	.32	.45	.61
TENN	1.50	1.32	1.44	1.53	1.35	1.24	1.38	1.58	1.45	1.12	.92	1.12	1.09	.88	1.16
TEX	.10	.11	.14	.15	.16	.17	.22	.34	.41	.40	.39	.49	.53	.37	.24
UNION	.40	.41	.60	.81	.90	.86	.73	.75	.90	.82	.61	.52	.46	.37	.30

1. Values based on data in refs. 16 and 25. Averages calculated using market values at beginning and end of year. D is total debt (long-term + short-term); E is equity in the form of common stock. Note: Long-term debt comprises most of total debt for each company.

Exhibit 5: Company Annual Excess Returns on Equity (1967-81)

On Observed Equity: $\alpha_{oe}(\%)$

On All Equity Basis: $\alpha_{ae}(\%)$

	1967	'68	'69	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
ARCO	-2.4	117.6	-15.9	-21.9	-5.0	-8.7	62.5	10.7	-32.3	7.3	-12.8	8.8	24.5	29.1	-16.1
	-2.1	105.9	-14.5	-19.0	-4.2	-7.5	54.8	9.2	-26.3	5.7	-9.4	6.3	18.0	22.2	-12.4
XON	-4.5	12.7	-14.5	22.4	-7.9	8.7	27.3	-1.2	9.5	2.3	-9.5	2.0	0.0	28.1	-13.8
	-4.3	12.0	-13.3	20.3	-7.3	8.0	25.3	-1.1	8.6	2.1	-8.6	1.9	0.0	25.5	-12.5
GULF	15.4	7.0	-21.3	6.9	-20.6	-17.7	7.6	4.0	-8.4	26.4	-5.8	-12.6	37.1	-2.0	-11.0
	14.5	6.5	-19.2	6.0	-17.3	-14.5	6.2	3.3	-6.8	22.2	-5.0	-10.3	29.4	-1.7	-9.6
MOBIL	-23.1	33.6	-14.9	28.4	-15.8	23.7	-9.4	-1.6	5.8	20.8	-0.8	9.2	46.5	19.1	-30.2
	-21.6	31.2	-13.7	25.6	-14.1	21.4	-8.5	-1.3	4.5	16.3	-0.6	7.0	36.3	16.1	-25.8
SHELL	-6.3	1.7	-29.9	10.1	-9.9	6.1	43.8	-2.0	-25.9	42.9	-15.7	-6.0	55.2	86.6	-13.6
	-5.8	1.6	-26.7	8.7	-8.5	5.3	37.8	-1.7	-21.7	37.0	-13.6	-5.1	44.5	66.6	-10.4
SOCAL	-11.6	9.2	-17.0	9.8	-1.2	27.1	8.9	-2.9	2.4	21.0	-4.4	20.6	5.6	51.1	-4.1
	-11.0	8.6	-15.8	9.0	-1.1	24.4	8.1	-2.6	2.0	18.4	-3.9	18.1	4.9	46.4	-3.8
SOIND	-5.6	6.7	-12.6	12.3	22.7	15.1	35.6	10.7	-32.1	22.4	-17.3	13.7	24.1	75.1	-24.9
	-5.2	6.1	-11.0	10.7	19.9	13.6	32.3	9.6	-27.7	19.5	-14.9	11.6	20.8	65.3	-21.5
SOHIO	2.3	-3.8	21.3	-7.5	-1.9	1.2	85.4	1.6	-16.4	-9.1	-10.9	15.6	89.4	31.4	-31.0
	2.2	-3.6	19.5	-6.2	-1.5	1.0	73.6	1.4	-10.6	-4.5	-4.6	6.7	45.8	20.1	-22.4
SUN	19.8	16.3	-35.2	13.4	4.6	-21.3	51.9	-10.1	-49.4	63.0	-11.7	-0.6	52.1	12.8	5.2
	17.3	14.4	-30.1	11.0	3.8	-17.4	42.5	-8.1	-37.2	47.8	-9.3	-0.5	44.5	10.3	3.9
TENN	17.4	11.4	-19.4	7.5	-0.4	2.7	-1.8	35.8	-11.1	21.6	-16.7	-2.1	14.2	6.7	-23.5
	15.2	6.7	-11.1	4.2	-0.2	1.7	-1.1	19.7	-6.3	13.7	-11.3	-1.3	8.9	4.6	-14.4
TEX	2.2	-6.0	-19.8	16.7	-7.9	-2.1	-3.0	2.3	-13.3	2.8	2.7	-14.0	10.3	46.1	-22.4
	2.1	-5.6	-18.5	15.5	-7.3	-2.0	-2.7	2.0	-11.0	2.3	2.3	-11.2	8.0	38.4	-19.8
UNION	-15.5	1.1	-26.7	-2.1	-18.7	5.4	50.4	7.9	-25.6	26.1	-11.9	5.5	40.0	67.4	-5.2
	-12.8	0.9	-20.4	-1.5	-12.7	3.7	36.5	5.7	-17.4	18.2	-9.0	4.3	32.0	56.2	-4.5

Appendix E

Company Annual Rankings According to All Equity Excess Returns

1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
SUN	ARCO	SOHIO	MOBIL	SOIND	SOCAL	SOHIO	TENN	XON	SUN	TEX	SOCAL	SOHIO	SHELL	SUN
TENN	MOBIL	SOIND	XON	SUN	MOBIL	ARCO	SOIND	MOBIL	SHELL	MOBIL	SOIND	SHELL	SOIND	SOCAL
GULF	SUN	TENN	TEX	TENN	SOIND	SUN	ARCO	SOCAL	GULF	SOCAL	MOBIL	SUN	UNION	UNION
SOHIO	XON	XON	SUN	SOCAL	XON	SHELL	UNION	TENN	SOIND	SOHIO	SOHIO	MOBIL	SOCAL	GULF
TEX	SOCAL	MOBIL	SOIND	SOHIO	SHELL	UNION	GULF	GULF	SOCAL	GULF	ARCO	UNION	TEX	SHELL
ARCO	TENN	ARCO	SOCAL	ARCO	UNION	SOIND	TEX	SOHIO	UNION	XON	UNION	GULF	XON	ARCO
XON	GULF	SOCAL	SHELL	XON	TENN	XON	SOHIO	TEX	MOBIL	UNION	XON	SOIND	ARCO	XON
SOIND	SOIND	TEX	GULF	TEX	SOHIO	SOCAL	XON	UNION	TENN	SUN	SUN	ARCO	SOHIO	TENN
SHELL	SHELL	GULF	TENN	SHELL	TEX	GULF	MOBIL	SHELL	ARCO	ARCO	TENN	TENN	MOBIL	TEX
SOCAL	UNION	UNION	UNION	UNION	ARCO	TENN	SHELL	ARCO	TEX	TENN	SHELL	TEX	SUN	SOIND
UNION	SOHIO	SHELL	SOHIO	MOBIL	GULF	TEX	SOCAL	SOIND	XON	SHELL	GULF	SOCAL	TENN	SOHIO
MOBIL	TEX	SUN	ARCO	GULF	SUN	MOBIL	SUN	SUN	SOHIO	SOIND	TEX	XON	GULF	MOBIL

Companies above the upper bar had superior annual all equity excess returns ($\alpha_{ae} > +5\%$).
Companies between the bars experienced stable all equity excess returns ($-5\% < \alpha_{ae} < +5\%$).
Companies below the lower bar had inferior all equity excess returns ($\alpha_{ae} < -5\%$).