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GRADUATE COLLEGE

THE PIPELINE SEGMENT OF THE DOMESTIC PETROLEUM INDUSTRY: STRUCTURE AND CONDUCT

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

JOHN PIERCEY

Norman, Oklahoma

1978

THE PIPELINE SEGMENT OF THE DOMESTIC PETROLEUM INDUSTRY:

STRUCTURE AND CONDUCT

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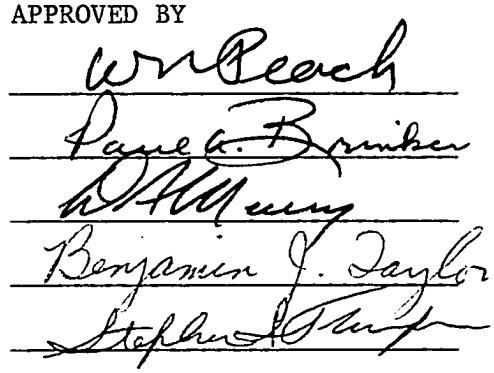

DISSERTATION COMMITTEE

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THE PIPELINE SEGMENT OF THE DOMESTIC PETROLEUM INDUSTRY: STRUCTURE AND CONDUCT

CHAPTER I

THE PIPELINE SEGMENT OF THE DOMESTIC PETROLEUM INDUSTRY: INTRODUCTION

The modern petroleum industry is slightly over a century old, a century of spectacular growth that has been accompanied by technological and organizational innovations unrivaled in the modern era of multinational corporations. The industry now ranks as one of the world's largest (if not the largest). Its present size is incomprehensible to mortals who in their lifetime rarely deal with money in excess of a few thousand dollars.

In 1976 eight of the world's ten largest industrial corporations were petroleum companies. The combined worldwide sales of the eight companies in 1976 was $212 billion. The world's largest industrial corporation, Exxon, had sales totaling $48.6 billion in 1976. The worldwide sales of the twenty largest companies operating in the United States totaled $224.2 billion and seventeen of these companies were ranked in the top fifty industrial corporations in the United States.[1]

The petroleum industry's century of growth unleashed economic and political power which nations have abetted and combatted throughout the century. The actions of the Organization of Petroleum Exporting Countries (OPEC) since the early seventies has demonstrated petroleum's influence over the non-communist world.

Since the early part of this century governments outside the United States have tended to participate directly in the formation and ownership of petroleum companies. The British Petroleum Company and the Royal Dutch/Shell Group are the best known early examples of this participation. In 1976 of the twenty largest petroleum companies headquartered outside the United States, eight were wholly owned by their respective governments and three were partially owned. Of the nine remaining companies, four were subsidiaries of Exxon and two were joint ventures with U.S. companies.[2]

Within the United States, the petroleum industry has not experienced direct government participation. Rather it has grown and developed within an environment where the government tended to react to industry developments. The U.S. experience has been one of investigation and intervention. Since the late nineteenth century these activities have been like an ocean tide, rising and falling over the century but never discontinuing. Indeed, governmental actions and public policy have been marked by schizophrenia--seeking to encourage competition in the domestic market but by diplomatic effort and tacit approval encouraging cartelization outside the United States.[3]

The domestic petroleum industry has a controversial history. Since the rise of the Standard Oil empire during 1865-1878 and its

subsequent stock transfer in 1911, the industry's history has been marked by charges of concentration of economic and political power in first the Standard Oil group and later the eight or so largest companies. By virtue of early vertical integration of the industry, companies have allegedly been able to partially distort the functioning of the political and economic system.

Public archives contain many documents presenting evidence of collusion, restraint of trade, and monopoly. They also contain counterevidence of competition. The current explosion of investigations, antitrust activity, and governmental intervention has no historical parallel in terms of sheer volume and public awareness. In terms of substance, however, there are numerous parallels. Much of what is occurring (outside the issue of horizontal integration into other sources of energy) is little more than a rerun of the past with only a change in the participants. The allegations and the defense in recent hearings and investigations are somewhat more sophisticated perhaps but the theme remains remarkably the same as it was in the early stages of the development of the industry.

Domestic petroleum transportation, primarily pipelines, has not escaped attention or controversy during this century. Indeed in many investigations and court cases, pipelines have been at the center of the controversy. The ownership and control of pipelines by a few companies has been considered a central instrument used to prevent successful entry and competition within any other segment of the domestic industry.

The major purpose of this study is to contribute to the literature on the pipeline segment of the domestic petroleum industry. The

study of pipelines in the United States is also a study of vertical integration within the industry. For this reason the study of pipelines provides an indirect means of understanding the functioning of other segments of the domestic industry.

Pipelines serve a variety of purposes within the modern industry, many of which lie outside the scope of the present study. For example, the transmission of natural gas from production to distribution point involved nearly 263,000 miles of pipeline in 1975, and is a field of inquiry within itself.[4] The recent growth of offshore pipelines systems is also another example warranting separate study.

This study examines primarily the interstate network of pipelines operating in the United States. It focuses on those lines that carry crude oil and refined petroleum products. Only peripheral attention is given to the intrastate system, the other transport modes, and the other three stages of the industry (production, refining, and marketing).

The volume of pipeline literature is relatively large and is growing rapidly as a result of the renewed interest in the petroleum industry brought on by the "energy crisis." Serious nongovernmental analysis of petroleum pipelines, however, has been lacking in recent years. The primary literature in this regard has essentially been confined to the work of Wolbert published in 1952, Cookenboo published in 1955, and Johnson published in 1967.[5]

The secondary literature on pipelines has largely been a byproduct of the study of vertical integration and is much larger. The work of McLean and Haign published in 1954, De Chazen and Kahn published

in 1959, and the recent work edited by Edward J. Mitchell, published in 1976 are among the more significant examples of this literature.[6]

Wolbert's examination of pipelines focused on the legal aspects of the developments of pipelines through the year 1951. Cookenboo's period of inquiry was similar to that of Wolbert's. Cookenboo, however, examined the structure and performance of pipelines and is cited as the individual responsible for formulating the theory of the pipeline firm and the associated production and cost functions. Cookenboo was also the first to consider joint venture pipelines and their public policy potential.

The work of Arthur M. Johnson culminated in Petroleum Pipelines and Public Policy, published in 1967. This work, a historic industry study, stands out as the most comprehensive study of petroleum pipelines through the year 1958. The research for this work financed by petroleum pipeline companies, was partially based upon company records. Only 80 of the more than 474 pages of text covered the post 1940's period.[7]

Because the work of the major authors did not extend beyond the 1950's, this study's primary focus is on the period 1957-1975. The previous work is used to provide the framework and perspective from which this study takes off.

Methodology

In organizing this study an eclectic approach was adopted. This approach combined elements of an "industry study," transportation economics, and industrial organization. The latter is the methodological approach relied upon in organizing the empirical sections.

The development of industrial organization as a discipline of

applied economics is generally attributed to the seminal work of Edward S. Mason and Joe S. Bain.[8] Students of industrial organization have traditionally organized their inquiries around a specific analytical schema. This methodology hypothesizes a causal relationship (also a sequential one) where structure determines behavior which in turn determines performance.

Much of the recent analysis in this area has been of an econometric nature which revolves around the testing of the structure/performance hypothesis, a hypothesis first outlined in its present context by Bain in 1951.[9] A priori independent variables (structural variables--concentration, entry barriers, degree of product differentiation, etc.) are tested for their explanatory (or predictive) influence over a dependent performance variable (usually some profit measure).

The Industrial Organization approach has enjoyed a high level of acceptance but is not without its detractors. Its acceptance has recently moved into the antitrust field. For example, the Federal Trade Commission has made the structure, conduct, and performance methodology a central part of their suit against the eight largest oil companies. The Senate has witnessed the introduction of several bills which also utilize parts of this method.

Much of the substantial criticism of industrial organization is to be found in the work of Demsetz and Williamson.[10] Aside from these, much of the criticism has been aimed at the procedures and data used in the analysis. Part of the criticism has centered around the somewhat mechanical approach that Bain describes as ". . . specifying very few structural independent variables and then put the experiment in the

'computer mills' [italics his] to see what would fall out."[11] Criticism has been leveled at the quality of data used in testing the relationship. There appears to be a serious question of whether the data used from readily available public sources, primarily the triennial census of business, has maintained a degree of quality that is still useful.[12]

The practical problems associated with the use of four or five digit SIC are well known. But the problem to a larger degree lies beyond problems of specification of models and mechanical data collection. It rests in the area of the corporate entity which since the 1950's has changed dramatically. This change--by merger, acquisition, legal segmentation (subsidiaries)--has manifested itself in the modern multi-national corporation.[13]

This evolution of legal entities combined with a seeming distaste for examining the "trees" in favor of the "forest" has often led to misplaced emphasis and conclusions.[14] This seems to have been the case in some of the past analysis of pipeline operations.

While this study uses the industrial organization methodology it does depart from the traditional analysis in that it is an intra-industry examination using both cross-sectional and times-series data. It also provides a detailed examination of cooperation and interdependency among pipeline operations and the public policy constraints within which companies have operated. The extent of the examination requires that the "performance" part of the analytical schema be left to others. It is the intent, however, to provide the basis from which the performance analysis can take place.

Data Sources and Organization

Four sets of primary petroleum pipeline data were initially required for this study. These were aggregate data on all pipelines operating in the United States, disaggregated data on interstate and intrastate pipeline companies and systems, and pipeline ownership data. The quality and quantity of intrastate data (beyond mileage) proved to be a limiting factor. The importance of these lines relative to interstate pipeline was such that the problems were felt to be minor.

Aggregate data on all pipelines in the United States by state was obtained from the Bureau of the Mines' triennial survey of petroleum pipelines. The most recent survey was for the year 1974. Disaggregated data on intrastate lines came primarily from the Directory of Pipeline Companies and Pipeline Contractors,[15] an annual publication. Data on individual interstate pipeline companies was obtained from both published and unpublished public documents prepared by the Interstate Commerce Commission (ICC) as a part of their regulatory function. These data represent the majority of this study's empirical analysis.

Ownership data, an essential part of the work, was obtained for the years 1956-1959 from the Oil Record.[16] For the years 1973-1976, data was obtained from the ICC and the Association of Oil Pipelines. Data on the intervening years came from a range of sources, primarily the Oil and Gas Journal, Pipe Line News, and Moody's Industrial Manual(s). The differing sources were used to cross check each source of information.

The quantity and quality of the primary data on interstate pipeline companies proved to be much better than that available on other

phases of the petroleum industry. The manner in which it is published or made available did present problems. These largely revolved around the fact that while company data is published each year, no historical times-series are published (other than limited aggregate data). In addition, the volume of available annual data was extensive. For example, in 1975, 104 companies reported to ICC and 89 separate series of operating and financial data was published for each company. This meant that manipulation of the data by hand was impossible. Selected annual data on all companies reporting to the ICC over the 1957-1975 period was thus coded from each separate publication for data processing. The method used was similar to a "building block" approach used in other areas. By this it is meant that the data on each company, including ownership, was identified in such a manner that any number of alternative aggregations could be accomplished. Only a limited amount of this data, however, is contained in this study.

As noted the identification of pipeline ownership and changes in ownership is an important part of the empirical work. The procedure followed in developing this information is as follows: (1) ownership of the pipeline was identified for the beginning period (1957 or date of entry if before 1975), if a change had occurred the date and substance of the change was researched and inserted into the data base; and (2) ownership was traced to the parent and reported as such; intermediate ownership forms, while noted, were not included in the data base. For example, most of Exxon's interstate pipeline holdings are made and held through its wholly owned pipeline subsidiary, Exxon Pipeline Company. Rather than show these interests as being held by the pipeline company

as do most publications, the ultimate parent, Exxon, is recorded. Another example is that of Phillips Petroleum. Phillips, through a non-pipeline subsidiary, Phillips Investment Company, holds an equity in a pipeline operation. This is, however, shown in the data base only as Phillips Petroleum Company. The ultimate owner or owners are obviously the important ones and are thus shown without reporting the intermediate owners.

Secondary information was obtained from a host of sources. Much of it was obtained as a result of a series of interviews conducted in the early research stage of the study. In 1974 an interview was held at the Tulsa office of the Oil and Gas Journal as to potential sources and types of pipeline material available. In the same year two trips were made to Washington, D.C.

During these two trips, information was obtained from contacts with the following:

Interviews with the staffs of the

--Federal Trade Commission, Bureau of Competition and Bureau of Economics

--Select Committee on Small Business, House of Representatives

--Subcommittee on Antitrust and Monopoly, Senate

--Special Subcommittee on Integrated Oil Operations, Senate

Interview with Williams John Lamont, Law Offices of Lobel, Novins, and Lamont. Mr. Lamont was formerly a staff attorney with the Department of Justice.

Interview with Richard Levy, then a consultant to the Bureau of Competition, Federal Trade Commission.

A search of public documents, Interstate Commerce Commission.

A follow-up trip to Washington occurred in 1975. This, combined with continued correspondence, proved invaluable in obtaining additional information. In the latter stages of this study, Joe Bohannon, formerly Manager of Planning and Tariffs, Williams Pipeline Company, provided more up-to-date industry information.

Study Outline

This study of domestic pipeline is divided into two major sections. The first provides an overview of petroleum pipeline's historic and present role within the domestic petroleum industry. The second section addresses the structure and conduct of pipeline companies and systems.

The overview begins by examining the evolution of public policy between 1865-1959. This provides a perspective concerning the substance of the controversy surrounding the ownership of pipelines by major petroleum companies as well as the regulatory constraints within which companies have had to operate.

This is followed by two chapters which define the modern transportation requirements of the domestic petroleum industry in terms of magnitude and location, the dominant modes used, and the comparative cost structure of the competitive modes. Pipelines, which are shown to be the least cost transport mode, are examined in terms of the growth by type and location. The relative importance of interstate vs. intrastate lines is also evaluated.

Chapter V examines the theory of the pipeline firm, i.e., the production function and cost functions, and introduces the functions of pipelines within the vertically integrated structure of their owners'

total operations. This in effect reintroduces elements of the pipeline controversy.

Chapter VI is the first of the chapters which specifically addresses the current structure and conduct of pipelines.[17] Chapter VI traces ownership patterns which developed between 1957-1975 as well as the number of pipeline firms in the interstate market by type of service provided. Chapters VII-VIII examine the issue of cooperation and interdependency among companies. This is accomplished by considering the implications of pipeline joint ventures, as well as other lesser forms of cooperation.

Chapter IX looks at concentration within interstate pipelines. This combines a cross-sectional and time-series analysis. The time series seeks to address long-run concentration trends. Regional concentration is examined briefly as are entry/exit trends resulting from mergers, acquisitions, and new company entry.

Chapter X returns to the issue of public policy which is initially addressed in Chapter II. As Chapter II outlined the public-policy impact prior to 1959, Chapter X examines public policy since that time. Chapter XI offers a summary and conclusion.

CHAPTER I

[1]Fortune, August, 1977, pp. 225-240; "The 1977 Fortune Double 500 Directory," Fortune, pp. 4-23.

[2]Fortune, August, 1977, pp. 226-235.

[3]A recent example of this occurred in 1975 when the Justice Department gave legal clearance to the major U.S. oil companies to take part in international cooperation aimed at reducing the importing nations' dependence on foreign oil (Tulsa World, April 1, 1975, p. B13); a year earlier, M.A. Adelman, in a paper presented to the American Economics Association, labeled the same companies as ". . . agents of that monopoly, the members of the Organization of Petroleum Exporting Countries (OPEC)" ("Politics. Economics, and World Oil," American Economic Review, Vol. LXIV (May, 1974), p. 58.).

[4]Gas Facts: 1975, Arlington, Virginia: American Gas Association, p. 50.

[5]George S. Wolbert, Jr., American Pipelines (Norman, OK: University of Oklahoma Press, 1952); Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition In The Oil Industry (Cambridge: Harvard University Press, 1955); Arthur M. Johnson, Petroleum Pipelines and Public Policy, 1906-1959 (Cambridge: Harvard University Press, 1967); several dissertations in this area were recently completed, see "Titles of Doctoral Dissertations," American Economic Review, vol. 67 (December, 1977), pp. 1022-43.

[6]John G. McLean and Robert Wm. Haigh, The Growth of Integrated Oil Companies (Norwood, Massachusetts: Plimpton Press, 1954); Melvin G. De Chazeau and Alfred E. Kahn, Integration and Competition in the Petroleum Industry (New Haven: Yale University Press, 1959); Edward J. Mitchell, ed., Vertical Integration in the Oil Industry (Washington, D.C.: American Enterprise Institute, 1976).

[7]Johnson, Petroleum Pipelines and Public Policy, p. ix and xii.

[8]James W. McKie, "Market Structure and Function: Performance versus Behavior," in Industrial Organization and Economic Development, ed. by J. W. Markham and G. F. Papanek (New York: Houghton, Mifflin Company, 1970), p. 3; Joe S. Bain, Industrial Organization, 2nd ed.

(New York: John Wiley and Sons, Inc., 1968).

[9]Richard E. Caves in the Foreward of Joe S. Bain, Essays on Price Theory and Industrial Organization (Boston: Little, Brown and Company, 1972), p. vi.

[10]Harold Demsetz, The Market Concentration Doctrine (Washington, D.C.: American Enterprise Institute, 1973); Oliver E. Williamson, Markets and Hierarchies: Analysis and Antitrust Implications (New York: The Free Press, 1975).

[11]Joe S. Bain, Essays on Price Theory and Industrial Organization, p. 171.

[12]U.S. Federal Trade Commission, The Quality of Data as a Factor in Analyses of Structure-Performance Relationships (Washington, D.C.: Government Printing Office, 1971), pp. 35-36.

[13]Here reference can be made to the mainstream economist growing awareness that orthodox microtheory has limited capacity to address important phenomena, e.g., the complex modern corporation and the growing utilization of joint ventures. Williamson addresses this issue in Markets and Hierarchies, pp. 1-5, in a chapter he calls "Toward A New Institutional Economics" where he acknowledges his indebtedness to John R. Commons. Williamson, as do most others, largely ignores that intellectual heritage to be found in the work of Veblen, Ayers, and others labeled as "institutionalist," see William M. Dugger, "Institutional and Neoclassical Economics Compared," Social Science Quarterly, vol. 58 (December, 1977), pp. 449-61.

[14]See R. A. Gordon, "Rigor and Relevance in a Changing Institutional Setting," American Economic Review, vol. 66 (March, 1976), pp. 1-13.

[15]Midwest Oil Register, Directory of Pipeline Companies and Pipeline Contractors (Tulsa: Midwest Oil Register, 1953-75).

[16]Petroleum Industry Projects, The Oil Record (Washington, D.C.: Petroleum Industry Projects, 1957, 1958, 1959).

[17]This should not be interpreted as implying that that which has preceded Chapter VI is only background. The opposite is the case. To evaluate the modern functioning of the pipeline segment of the petroleum industry it is necessary to evaluate the evolution of regulation, the spatial character of the transportation requirements, the complementary nature of transport modes, and the economics of the pipeline firm.

CHAPTER II

THE GOVERNMENT'S ROLE IN THE PIPELINE SEGMENT OF THE PETROLEUM INDUSTRY: THE EVOLUTION OF PUBLIC POLICY AND REGULATION

The ownership, control, and operation of pipelines by major petroleum companies has a controversial history. The controversy has its origins in the early 19th century development of the petroleum industry. Pipelines along with railways were the principal tools used to develop the early Standard Oil combination, a combination which at one time held a virtual monopoly over production, refining, and marketing.[1]

The denial of access to the least cost transportation mode to those outside the "group" is the essence of the pipeline controversy which persists to the present. It has been alleged that the ownership and control of pipelines by first, the Standard group, and later, the top eight petroleum companies has allowed these companies to control other stages of the domestic petroleum industry.

This chapter considers the controversy surrounding pipelines between 1865 and 1959. It examines the evolution of public policy and pipeline regulation which developed as a reaction to a continued controversy. The ultimate purpose of the chapter is to evaluate the

public policy developed prior to 1959 and to assess its impact on the structure of the pipeline segment of the industry.

The Origins of the Controversy and Public Policy: 1865-1919

Between 1865 and 1879 the Standard Oil combination was developed. By 1879 the combination controlled between 80 and 90 percent of the industry. The success of this development was largely due to the combination's rapid expansion into the field of transportation. In a ten year period, between 1869 and 1879, the combination bought or controlled almost every transportation facility which existed in the oil regions of the United States.[2]

In 1906, the Standard Oil Company of New Jersey, the successor to the original combination was charged with a violation of the Sherman Act. It was alleged as a part of the Standard Oil case that the absolute control of pipeline transportation and the preferential rates and rebates from railroads gave Standard Oil control over the crude oil market.[3]

Independent producers could not gain access to either pipelines or railroads at a cost similar to those who controlled the pipelines and railroads. They were thus forced to sell crude at the wellhead at a price offered by Standard Oil, join the group, or abandon the oil business. The independent refiner could not move crude oil to refineries at a rate competitive with Standard Oil. What pipelines there were, were owned and operated strictly for the convenience of Standard Oil.[4]

In 1911, five years after the case was filed, Standard Oil Company of New Jersey was broken into 34 individual companies. The relief ordered under both Sections 1 and 2 of the Sherman Act, required Standard

to transfer its stocks in 37 subsidiaries to its stockholders. Further, both subsidiaries and stockholders were enjoined from combining with each other or with Standard Oil of New Jersey to bring about further Sherman Act violations.[5]

The dissolution achieved under the decree was aimed primarily at legal corporate interrelationships and left unaltered the existing physical relationships between Standard's various pipelines and refineries. The lines laid to serve particular refineries continued doing so, with relatively minor short run changes in these relationships.[6]

The year 1906 was also significant because it represents the beginnings of federal intervention into the interstate pipeline segment of the petroleum industry. Prior to 1906, there was no federal legislation applicable to pipelines. The original Interstate Commerce Act passed in 1887 contained no pipeline provisions.

In 1906, Congress passed the Hepburn Act.[7] This act, among other purposes, extended limited provisions of the original Interstate Commerce Act to interstate pipelines. This congressional action had the purpose of eliminating the abuses resulting from the behavior of Standard Oil. The Hepburn Act stands out, not only as the beginning, but the end of comprehensive pipeline legislation enacted by Congress. It was not until 1914, however, that the constitutionality of the Hepburn Act was upheld by the U.S. Supreme Court.[8]

One of the most controversial aspects of the extension of the ICC Act to pipelines was that pipelines were not covered by the commodity clause. The commodity clause prohibits a common carrier from owning the commodities being shipped by the carrier. Attempts were made during the

debate over the bill and after the passage of the Hepburn Act to extend the clause to pipelines but were unsuccessful. To many, this failure allowed many of the early abuses to continue.[9]

The ICC's jurisdiction over pipelines as a result of the Hepburn Act extended primarily to the following matters: (1) the pipeline's duty to provide and furnish transportation upon reasonable request by any party (i.e., to function as a common carrier); (2) to establish reasonable through routes with other common carriers and to establish just and reasonable rates and charges; (3) to prohibit any discrimination or disadvantage to any shipper, locality, or territory; (4) the requirement that each pipeline file with the Commission all rates and charges, classifications, regulations, and practices for the transportation between all points on its system; (5) not to demand nor collect any different compensation for transportation unless specified in its filed tariff; and (6) it provided the authority for the Commission to review all pipeline rates and if they were found to be unjust, unreasonable, discriminatory, or preferential to suspend such rates and to determine and prescribe a just and reasonable rate.[10]

The Act prohibited a pipeline from entering into any agreement with any other pipeline, the pooling or dividing of traffic, service, or earnings except those specifically approved by the Commission. The Act required pipelines to file an annual periodic and special report as required and it allowed the Commission to prescribe a uniform system of accounts and rates of depreciation for pipeline property. The authority was given to the ICC or any other authorized agent, accountant, or examiner at all times to inspect the accounts, books, records, and

correspondence of every pipeline covered by the Act and to provide a basic and annual evaluation of pipeline property.[11]

The Act did not give the Commission jurisdiction over pipeline facilities for operation, construction or abandonment. Nor did it give them jurisdiction over the issuance of securities, formation of interlocking directorates, mergers, or consolidations with other pipelines.[12]

The legislative and judicial action taken between the period 1906 and 1914 was largely aimed at the Standard Oil Company of New Jersey. This was the intent of the extension of the Hepburn Act to pipelines. The basic question that evolved out of this period: could common carrier status applied to pipelines owned by integrated oil companies achieve the results of forcing these pipelines to share transportation savings with competitors and ultimately the public?[13]

In 1907 the Interstate Commerce Commission issued a report to Congress which concluded that it would probably be necessary to divorce the function of transportation of crude oil from that of production and distribution. With this report, the ICC discounted the potential importance of the statute that it itself had the responsibility of enforcing. The Commission apparently felt that enforcement would be impossible without the extension of the commodity clause or the same remedy by divorcing pipelines from integrated oil operations. The Bureau of Corporations, the forerunner of the Federal Trade Commission, reached a different conclusion in the same year when they insisted that pipelines could be regulated.[14]

Between 1906 and 1919, the petroleum industry experienced rapid change as a result of the discovery of major new crude oil fields,

Production shifted from the northeastern part of the United States to the Midwest and Southwest (primarily Texas). It was primarily during this period that new companies, such as Gulf, Shell, Texaco, Phillips, Sun, and Cities Service successfully entered the industry. It was these new entries, combined with Standard Oil of New Jersey and its former subsidiaries, that were to emerge as the dominant companies over the next 60 years.[15]

As production became further removed from ultimate consumers, the role of transportation became more critical. The rapid change occurring during this period opened a new era for not only the industry, but also for pipeline transportation as well. The emerging companies soon found themselves in a position of having to cope with pipeline regulations whose initial purposes were centered on the Standard Oil Companies. As a general rule, the major newcomers opposed the extension of common carrier status to pipelines. They maintained that their pipeline facilities were in-house facilities built to carry their own oil from producing fields to their refineries.

The owners of oil pipelines had several alternative courses of action available to them in regard to how to adjust their pipeline operations to the provisions of the Hepburn Act. Among these alternatives were: (1) they could rearrange their pipeline operations into legal entities that did not involve interstate commerce; (2) they could avoid regulation by withdrawing from pipeline operations entirely; (3) they could accept the formal applications of the law, but structure compliance in such a way that it would negate the statute's practical impact; (4) they could attack the statute through both court and legislative action;

(5) the major operators could ignore the statute completely and leave the next move up to the government; and (6) the law could be accepted and complied with in terms of its obvious intent.[16]

Over the course of the next 35 years, petroleum companies with major pipeline operations were to use all but one of these alternatives. In no instance did a major oil company withdraw from the pipeline business. The alternative that ultimately proved successful was the acceptance of the formal application of the law but with compliance structured in ways that the statute's actual impact was minimized.

The initial reaction of the Standard Oil companies was to rearrange their corporate organization in such a way that they gave the appearance of operating only intrastate pipelines. The Supreme Court, in its pipeline decision, rejected this attempt to avoid the impact of the legislation by reorganization. Standard Oil's attempt to reorganize their pipeline interests was to prove a major innovation.[17] Companies since that time have looked to reorganization into new legal entities as a means of coping with regulation.

As noted, the Supreme Court decision, rendered June 22, 1914, struck down a combination of managerial strategies, the passivity of the Interstate Commerce Commission, and the complications of a legal process which had taken eight years in which to uphold the constitutionality of the Hepburn Act.[18] The Court decision was not definitive in that the statute's provisions should apply to any corporation engaged in the interstate transportation of crude oil. Part of the Court decision created uncertainty which resulted in further interpretation of the applicability of the federal regulatory statute as applied to pipeline operations.

In evaluating the period between 1906 and 1914, the Interstate Commerce Commission was found to be relatively passive with regard to its new responsibilities. Johnson in summarizing the period concluded:

> The chief change that had been brought about in the pipeline sector of the oil industry as a result of public policy since 1906 was an increasing segregation into corporate entities of pipeline activities conducted by integrated and semi-integrated companies. Although formally subject to either or both state and federal regulations as common carriers, these pipeline companies in practice continue to serve the needs of their owners.[19]

Regulatory Activities: 1919-1931

Between the time that the Hepburn Act was upheld and 1932, the emerging major companies, large enough to compete with many of the former members of the Standard Oil group, followed the pattern of behavior established by the Standard companies as they attempted to integrate both upstream and downstream.[20] It was during this period that charges of monopolization of the industry through the ownership and control of pipelines were extended from a single focus on the Standard group to the major companies (usually the eight largest) involved in the industry. As the industry grew and became more complex, so did the complexity of the alleged abuses. The major complaint, however, still centered on the independent and small producers being denied access to a major's crude oil pipeline.[21]

Being denied access, the small producer was forced to sell his product to the gathering line in the producing field. Sale was at the posted price offered by the owners of the gathering line. Access was allegedly limited by three means. The first was by charging excessive rates. Tariffs were set as high as the traffic would bear. The rate generally set was equal to or slightly below the tariff posted by the

railroad companies.[22]

The second means of denying access was through the minimum tender requirement for shipment on those common carriers. As a general rule, the minimum tender for the industry through 1933 was 100,000 barrels.[23]

The third complaint revolved around pipeline proration. When supply was greater than purchasers' requirements, buyers and pipeline companies could effectively discriminate by use of the common purchaser statute which required equitable distribution of the purchase of crude oil. The effect of this was that by prorating the oil between the shipper-owner and the outside shipper reduced to a greater degree the amount that the individual independent producer should ship since the law required transportation furnished by the carrier shall be apportioned among all shippers ratably.[24]

As the interstate pipeline market expanded and complaints of abuse also increased, the ICC continued to remain passive in regard to its role as regulator of common carrier pipelines. Although the ICC was given its authority in 1906, its only significant action before 1919 was to require pipeline companies to file tariffs. This was largely a formal requirement since the ICC would not challenge tariffs unless a formal complaint was filed by an outside shipper.[25]

It was not until 1920, 14 years after passage of the Act, that the ICC prescribed minimum reporting requirements. In addition to the requirement of filing tariffs, the ICC prescribed a classification of investments in pipelines, as well as for operating revenue and expenses. This action was prompted by the year-early order that all companies

subject to ICC jurisdiction submit a report for 1918 and each year thereafter. This report became known as the "P" form which was designed to reveal information about the ownership, management, and operation of oil pipelines.[26]

These reporting requirements along with the ICC legal authority to examine company records reinforced what was becoming standard industry practice of separating interstate pipelines operations from the parent company (usually in the form of a wholly-owned subsidiary). This management strategy was to succeed in limiting the access of the ICC to broader company records and accounts.[27]

In 1920 the first formal complaint against a pipeline was filed with the ICC. The Brundred Brothers Case was also the first adversary pipeline action to be heard by the ICC.[28] The complaint alleged that the minimum tender required by the Prairie Pipeline Company was unjust and unreasonable. In this instance, the Company required a minimum shipment of 100,000 barrels. The Brundred Brothers charged that this was a discriminatory requirement which effectively discriminated against all small producers. The case was decided in 1922 after a two year delay and at considerable expense to the small operator. The ICC ruled in favor of the Brundred Brothers. The minimum tender was reduced to 10,000 barrels. The reduction was, however, limited to this one pipeline.[29]

The reporting requirements order in 1919 and 1920 and the Brundred Brothers case represented the majority of the ICC action between the time the Act was held constitutional (1914) and 1931. The lack of activity on the part of the ICC was in part inherent since the

Commission adopted a practice of relying on complaints filed by shippers and producers. In addition and unlike some other regulatory agencies, the cost associated with the filing of the complaint was not absorbed by the ICC but by the company filing the complaint.[30]

Between the years 1906 and 1931, the ICC failed to aggressively pursue its responsibility as the regulator of interstate pipelines. This passive role occurred during the time that interstate pipeline mileage increased from 24,666 miles in 1905 to 115,710 miles in 1931.[31] In summary, even by 1931 the impact of federal regulation on the rates and practices of interstate companies had been minimal. During this period, a number of states, particularly Texas, Kansas, and Oklahoma attempted to regulate pipeline. Their impact was also minimal.[32]

The lack of significant activity is attributable to three interrelated factors: (1) the lack of complaints; (2) the long period required to litigate complaints; and (3) the relatively large expense the plaintiff was required to bear. The small producer and refiner was thus faced with the probability of long litigation which at best would be expensive and at worst, they could lose the case.

Regulatory Activities: 1931-59

The major innovation on the part of the ICC through the year 1919 was the requirement that pipeline companies file an annual report. In terms of the final establishment of a uniform system of accounts, this was not accomplished until January of 1935. It was only in 1936, 30 years after the passage of the Hepburn Act, that a system of depreciation of accounts became effective.[33]

In part, these delays could be explained by the fact that many

of the sections contained in the Hepburn Act were permissive and not requiring action. For example, it gave the Commission the authority to prescribe a uniform system of accounts and to prescribe rates and depreciations. It gave the Commission the authority to require a basic and annual evaluation of each pipeline's property.

The valuation of a carrier's property was and is the key element of tariff rate regulation. Valuation was basic to the determination of whether pipeline rates were "unjust," "unreasonable," "justly discriminatory," or "unduly preferential." The ICC's bureau of evaluation did not begin the process of evaluating pipelines until 1934. Even then, the basic valuation program was not completed until 1940. At that time some 52 companies and one lessor were valued as of December, 1934.[34]

The development of valuations was a cooperative effort on the part of the ICC's Bureau of Valuation and the American Petroleum Institute. In regard to this cooperation, Johnson was to comment: ". . . the regulatory body had probably worked more closely with pipeline companies in establishing valuations than with any other transportation media subject to the ICC's jurisdiction."[35]

Many have attributed the six year time lag between the beginning of the valuation program in 1934 and its completion in 1940 to the lack of staff and financial resources, as well as the "press of other matters." Congress bears part of the responsibility for the long delay since a time when many members were instigating investigations concerning the anticompetitive aspects of pipeline operations, the majority of Congress was reluctant to provide the necessary appropriations to speed the valuation process.[36]

By 1940, the Interstate Commerce Commission had valuation dockets on each company for only the year ending December, 1934. In 1948, the ICC ordered the 55 companies who had submitted earlier valuations and ten new companies to submit data on their valuations and original costs to set a new base date of December 31, 1947. This process was completed in approximately 1952 when the Bureau of Valuations began to issue annual valuation reports on all pipeline companies. In 1954, the reports were brought up to date and have continued to be updated annually since that time.[37]

Thus, by 1954, 48 years after the passage of the Hepburn Act, valuation dockets on pipeline companies in the United States were available for only the years 1934, 1947, and 1954. This lack of basic information became critical as valuation was to be important in two later landmark cases--one determined by the Department of Justice and the other by the Interstate Commerce Commission.

Prior to 1934, the ICC had accepted tariffs filed by pipeline companies as being reasonable and fair in the absence of formal complaints. In 1934, however, the ICC began an investigation of pipeline rates and gathering charges. The ICC acting without a formal complaint began an investigation of the long standing charge that tariffs charged by shipper/owner pipelines were excessive to the point of denying access to the pipelines.[38]

This investigation, the Reduced Pipeline Rates and Gathering Charges Case, culminated in a tentative decision in 1940.[39] The decision gave pipeline companies 60 days to show cause as to why the order reducing minimum tenders to 10,000 barrels and adjusting rates to achieve an

8 percent return on the Commission's valuation of investment should not become effective. The case was important because it marked the first time that the Commission had addressed these two critical issues.

The 8 percent set by the Commission placed a maximum that could be charged on the entire system. This distinction is important because those companies operating only a single pipeline from point A to B had limited flexibility in establishing tariffs. The tariff would have to be set in such a fashion so that net income would yield a maximum of only 8 percent return on investment. In cases where a pipeline company operated a multi-pipeline and multi-terminating system, the 8 percent was an overall average return. This allowed those companies considerable flexibility in charging tariffs on certain segments of the system that would yield a higher return, as well as the corollary of being able to charge anything below that rate on other segments.

For reasons that are not quite clear the Reduced Pipeline Rates and Gathering Charge Case remained open until 1948. Two possible explanations for this delay were (1) the outbreak of the war and (2) the valuation process previously discussed was taking such a long time. When a decision was initially issued (in 1940) there were valuation dockets for only the year 1934 and they had just become available.[40]

Although the ICC had instituted its own investigation of excessive rates, it was not until 1944 that the Commission ruled upon an outside complaint brought by a shipper that alleged excessive rates. In the Minnelusa Case, the Minnelusa Oil Company charged that the pipeline company was charging rates which violated the ICC provisions that rates could not be "unreasonable, unjustly discriminatory and unduly

prejudicial."[41] In issuing their decision, the ICC found the rates to be unreasonable and reaffirmed the 8 percent maximum rate of return first applied in the Reduced Pipeline Rates and Gathering Charges Case of 1940.

That tariffs charged prior to 1940 were excessive is one area where students of the petroleum industry generally agree. Wolbert states the issue by commenting that "nominal profits derived from pipeline transportation, reflected by dividends paid, were generally enormous prior to 1940."[42] Wolbert illustrated the point by noting statistics on typical pipelines owned by the larger oil companies during this period. Between January 1, 1929, and June 30, 1938, for example, Humble Pipeline Company (a wholly-owned subsidiary of Standard Oil of New Jersey) had a total investment of little over $101 million. During the same period of time, the pipeline company paid out $138 million in dividends. The Shell Pipeline Company in this same period of time had investments in pipelines of approximately $56 million and at the same time had paid out dividends in excess of $101 million.[43]

The pipeline issues of the pre-World War II period were primarily concerned with crude oil transportation. The reason for the emphasis was the fact that product pipelines were relatively unimportant. It was only in the latter part of the 1930's that product pipelines began to expand. In 1938, the Interstate Commerce Commission faced its first major case concerning a gasoline pipeline. In the Petroleum Rail Shippers Case, the Commission addressed a charge that an unreasonable rate was being charged by a gasoline pipeline company.[44] The final decision, effective June 11, 1941, drew upon the results of the Reduced Pipeline

Rates and Gathering Charges Case tentatively decided in 1940. In the case, the Commission established for product pipelines a 10 percent rate of return on valuation. The two percent differential between this rate and the crude oil rate was justified on the part of the Commission as a result of higher risk and uncertainty in the transportation of refined products by pipeline.[45]

Uncertainty Created by the Supreme Court Ruling of 1914

In the pipeline cases decided in 1914, the United States Supreme Court upheld the pipeline provisions of the Hepburn Act and its applicability to pipelines engaged in the interstate transportation of oil. The Court supported the position that the purpose of the Hepburn Act was to deal with practices like those of the Standard Oil Group which resulted in the independent producers having to sell their oil prior to transportation.

In the Court's opinion it made no difference that the company had never carried oil for others prior to the Act, i.e., it had not held itself out to be a common carrier. The Court, however, made one exception in that it held that one of the defendents, the Uncle Sam Oil Company, was not within the scope of the Act because it carried on its own line oil produced in its own field to its own refinery, i.e., it was a plant facility which by chance crossed an interstate boundary. This exception was to create uncertainty in the late 1930's and 1940's as to the ICC's ultimate jurisdiction.

On the surface, the U.S. Supreme Court ruling of 1914 seemed to resolve the issue of the ICC's jurisdiction. The Uncle Sam exception opened the door to additional challenges to ICC's regulatory authority

over pipelines. The Supreme Court was to ultimately rule on three challenges based on the Uncle Sam exception. Rather than clarify the issues, the decisions created additional uncertainty.

Each of the cases were appeals of ICC's orders that the pipeline companies in question comply with certain provisions of the Hepburn Act. The first case involved a crude pipeline which connected a producing field to a single refinery.[46] The company argued that its operation was the same as in the Uncle Sam instance. The Supreme Court rejected the company claim and upheld the ICC. The Court noted that the company, unlike Uncle Sam, did not own the producing wells but purchased the oil in the field. In its original order the ICC had not requested full compliance with the Act but only partial. After the ruling the Company did proceed to file tariffs.[47]

The second and third case involved the Champlin Petroleum Company and its product pipelines.[48] The Champlin cases were viewed by the ICC as a test case of the limits of their authority concerning refined product pipelines which were being operated as private carriers/plant facilities.[49] In 1941 the ICC ordered Champlin to file information necessary to begin the valuation process. The company appealed this order based upon the argument that it had never operated as a common carrier, published tariffs, or been asked to ship for others (which was not physically possible since it connected to only its one refinery). The company did, however, have a pricing formula which included, explicitly, transportation costs less charges borne by the purchaser between the terminal and the bulk plant. The Supreme Court ruled that the company must comply with the reporting requirements of ICC but did not rule upon whether the

pipeline was for other purposes of the Act a common carrier. The decision was 5-4 with the minority seeing no difference between Champlin and the Uncle Sam exception. The minority also reopened the issue of a common carrier definition by noting that the company had never carried products for others.[50]

After the ruling, the ICC in 1948 ordered Champlin to comply with other provisions of the Act. Champlin again appealed the ruling to the federal courts based upon essentially the same grounds as before. The company, however, had revised its pricing formula by eliminating the explicit transportation charge. The Supreme Court, in 1951, ruled for the company and stated that the ICC had exceeded its authority in requiring Champlin to file tariffs. The Court ruled that Champlin would have to comply with the reporting provisions. The Court had ruled that Congress had not intended to subject private carriers to the same provisions as common carriers. In a dissenting opinion, Justice Hugo Black pointed out that the Court had pulled back from the 1914 ruling and the Valvoline ruling. Congress, in his opinion, had intended to include the ICC's powers to all interstate pipelines.[51]

The Champlin rulings set the precedence that an interstate product pipeline could operate as a private carrier but also be covered by some provisions of the ICC act. Only common carriers were required, however, to file tariffs and have the rates approved. The precedence in reality was to have no effect on future product lines or on crude pipelines. In the crude case, rarely was a pipeline built to only serve the owner's own wells. Refined product pipelines, built after the ruling, were largely joint-venture lines or lines built by common carrier companies.[52]

Congressional and Executive Branch Activities through 1959[53]

Between 1915 and 1951, pipelines and pipeline companies were the subject of a series of investigations which were conducted by both the Congress and the agencies of the Executive Branch. Between the years 1931 and 1951, for example, there was a bill introduced in every Congress except the 80th either requiring divorcement of pipelines or seeking application of the commodity clause.[54] In 1933, President Roosevelt recommended emergency legislature for divorcement of pipelines. The National Industrial Recovery Act had a pipeline provision which required divorcement from their integrated owners. The Act was ruled unconstitutional by the Supreme Court.[55]

While members of Congress were active in terms of investigation and proposed legislation, Congress as a whole continued the practice of not providing the Interstate Commerce Commission with the appropriations necessary to speed the collection of necessary data for effective regulation of common carrier pipelines. While the majority of Congress did not feel compelled to pass new legislation, Congressional and Executive pressures may have been the primary motivation behind actions taken by the Interstate Commerce Commission particularly in 1934. This also seems to have applied to the action taken by the Department of Justice in 1940.[56]

Justice Department activities were largely motivated by the hearings held before the Temporary National Economic Committee of the Congress of the United States during the late 30's.[57] The TNEC investigations provided Justice attorneys an opportunity to familiarize themselves with the petroleum industry and to assess the practices of the

industry and its vulnerability to antitrust action. The Great Depression had accelerated the criticisms and investigations of the petroleum industry and pipelines in particular. The acceleration reached a peak in 1940 when the Department of Justice filed a comprehensive antitrust action against the industry.[58]

In September, 1940, the Justice Department filed suit against 22 integrated oil companies, their subsidiaries, affiliates, and their trade association, the American Petroleum Institute. The suit charged violations of Sections 1, 2, and 3 of the Sherman Act and Sections 2 and 3 of the Clayton Act. Among other charges, these companies were charged with conspiring to fix prices and control transportation, distribution, and sales. The case became known as the Mother Hubbard Case. Among the various remedies sought were divestiture of transportation and marketing.[59]

Simultaneously with the filing of the Mother Hubbard Case, Justice filed three cases against three pipeline companies.[60] These companies were considered as representative of the 59 pipeline companies which Justice felt were in violation of the rebates provision of the Elkins Act. The violation centered on the payment of pipeline dividends to parent companies. The Elkins Act Cases were brought to clarify the law with respect to instances where pipeline companies were owned by the major oil companies. The government sought both injunctions prohibiting dividends, as well as triple damages for what the government considered to be illegal rebates.[61]

In the Mother Hubbard Case, the major companies' pipeline ownership, both jointly and individually, allegedly represented illegal

control over crude markets. The government contended that the major companies had conspired to force independent producers to sell at the wellhead rather than use pipelines as common carriers. This was essentially the same charge that had been brought against Standard Oil of New Jersey in 1906.[62]

The government claimed that the pipeline companies had achieved this result through three means. First, pipeline companies had failed to provide common carrier terminals; second, pipeline companies had charged excessive rates; and third, excessive minimum tenders were established and these tenders effectively prohibited the small producer from using these lines. The Justice staff sought several economic objectives in both the Mother Hubbard and the Elkins Cases. The first objective was to force pipelines to operate as common carriers in fact, as well as in form. The second objective was to force a reduction in rates which would allow independent producers to seek their own market via pipelines.[63]

The advent of World War II prevented a trial of the Mother Hubbard Case and was considered to have forced the settlement rather than the litigation of the Elkins Cases.[64] The Mother Hubbard Case was postponed until after the end of World War II. It became evident to some after the filing of the Mother Hubbard Case that the comprehensive charges and large number of defendants made it nearly impossible to handle as a single case. It was argued that the case should be replaced with individual suits. It was this line of reasoning that led to the case's dismissal in 1951. Justice attempted after 1951 to bring to trial, parts of the case in a series of antitrust suits. This series of

suits attacked almost all the Mother Hubbard issues except pipelines. The Mother Hubbard Case was the most ambitious undertaking of the Department of Justice's Antitrust Division. It was also considered one of its biggest failures.[65]

The Pipeline Consent Decree

Almost immediately after the filing of the Mother Hubbard and Elkins Act Cases, the Justice Department made an offer to negotiate a settlement of the pipeline issues. The first offer was made in December, 1940, three months after the cases were filed.[66] The particular facts surrounding the negotiations between Justice and the defendant oil companies were never fully disclosed. As noted, the fact that the U.S. was shortly to enter World War II did accelerate the negotiations of a consent decree. In addition, the threat of damages amounting to three times the dividends paid stimulated the companies' interest. Congress' favorable attitude towards pipeline divorcement caused the oil companies to consider the negotiations as an opportunity to dispose a troublesome issue.[67]

In the negotiations, the Justice staff initially took the position that dividends paid to the owners of pipelines represented illegal rebates. The petroleum industry united in opposition to this and pushed for a consent decree that would relate only to payments in excess of a "reasonable rate of return."[68] As early as the first meeting, the Justice Department indicated that they were not interested in divorcement of pipelines as much as they were in requiring pipelines to conform more closely to the common carrier role specified by Congress. That Justice was interested in assuring that pipeline companies did in fact behave as

common carriers was an indication that they considered that the Interstate Commerce Commission had failed its regulatory responsibility.

In early 1941, a basic understanding was reached which would underlie the remaining negotiations. This understanding was that the pipeline part of the Mother Hubbard and the Elkins Act Cases would be settled on the basis of a certain percent return on the latest Interstate Commerce Commission valuation. The rate of return would be one that would not be considered a rebate, concession, or any other form of discrimination.[69]

The bombing of Pearl Harbor and the movement of the nation into a wartime situation prompted the parties to accelerate their attempts to reach an agreement. The formal conclusion of the negotiations took place in District Court on December 23, 1941, when the government entered its complaint in the form of the United States vs. the Atlantic Refining Company.[70] The consent decree accepted by the Court settled the pipeline issues of both the Mother Hubbard and Elkins Act Cases.

The hastily concluded negotiations generated a considerable furor. While the Court accepted the decree on December 23, 1941, several members of Justice's negotiation team refused to sign the final decree.[71] The decree was signed by higher members of the Justice Department. The decree was also signed by 20 major oil companies, 52 of their pipeline companies and seven affiliates.

The decree had five major provisions. The first prevented payment in the form of "earnings, dividends, sums of money, or other valuable considerations derived from transportation or other common carrier services" in excess of seven percent of the valuation of the common

carrier property. The second, defined valuation as the latest prepared by the Interstate Commerce Commission. The third provision was that excessive earnings could not be included in the future valuation base. Fourth, excessive earnings could be used to retire existing debts but otherwise their use was restricted (i.e., frozen in terms of both payout and in terms of the future valuation base). This restriction would continue until the sale, dissolution, transfer or divorcement of the carrier from its owner. The fifth provision was the "...knowing violation of the decree's provisions would subject the violator to a penalty of three times the amount of the prohibited payment."[72]

The consent decree was found to be riddled with ambiguities.[73] While the provisions of the decree placed a limitation on the payout of dividends to the parent company, it left both rates and earnings unregulated. The ambiguities were to present problems for both companies and the Justice Department. From the pipeline companies' perspective, they had three ways of interpreting the meaning of the consent decree. First, clarification could be sought directly and formally from the Justice Department. As it was indicated, members of the Justice Department staff had opposed the decree in the first place, and there was some feeling in the industry that this would be a major problem in receiving favorable interpretations from the Department. The second approach was to seek formal clarification in the Court. The third approach was for each company subject to the decree to interpret the decree as it saw fit. They would then report to the Department what they had done or proposed to do in attempt to clarify their interpretation as it was encountered.[74]

The third approach was adopted by almost all companies. There were only a limited number of companies who approached Justice during the war years concerning interpretations. One of these was significant and played a major role in the determination in future financing methods of pipeline companies. The precedence that was established by Justice and the Court was a move by the owners of the Great Lakes Pipeline Company to refinance that pipeline operation.[75]

The Great Lakes Pipeline Company (a joint venture) had been included in the government's Elkins Act Case. Before the final consent decree was issued, the shipper/owners of the company withdrew 82 percent of their original investment in the pipeline company. After the decree was signed, the owners of Great Lakes proposed to refinance their operation. The recapitalization approved by Justice allowed the Great Lakes owners to borrow indirectly against the equities but did not allow them a greater share of future profits than if the recapitalization had not taken place.

Both the Justice Department and the Federal District Court approved the substitution of debt for equity within the approved terms of the consent decree. The importance of this strategy by Great Lakes demonstrated that the equity structure of the pipeline companies could be altered. This represented a major innovation and a significant method on the part of pipeline companies to avoid partially or wholly the constraints of a seven percent payout.[76]

Another problem of interpretation of the consent decree was the result of the fact that pipeline companies did not have the valuation data required by the decree. Since only the 1934 ICC valuations were

available, the companies had to provide their interpretation of this part of the Act. The Justice Department accepted these reports for their files but did not specifically acknowledge the correctness of the methods used.

Another issue arose concerning the interpretation of the seven percent restriction as applied to interest payments made to the parent company on funds loaned to the pipeline company. This issue was complicated by the fact that while Justice was issuing opinions to individual pipeline companies, they were not publicizing or distributing these opinions to the remainder of the companies covered by the consent decree. The Justice Department's unpublicized opinion expressed to one company was that all payments of any kind in excess of seven percent were prohibited.[77]

During World War II, certain members of Congress expressed dissatisfaction with the negotiations which developed the consent decree, as well as the Justice's enforcement of the decree. In 1944, the Federal Bureau of Investigation conducted an investigation of pipeline companies in part in response to Congressional pressures. They focused on the companies' accounting procedures. The investigation produced no public charges.[78]

The decree, as interpreted by most companies, was considered to have stopped expansion out of profits. Earnings in excess of seven percent were frozen both in terms of payments to the parent company, as well as for investment in carrier property. This was the case since the investment of excess funds could not be used in future valuations for the purposes of determining the seven percent payable. The companies'

response to the limitation was to rely on debt financing for pipeline expansion in the post-war period. This resort to debt financing was to create a controversy which has continued to exist since that time.[79]

The shift to debt financing, as well as the industry's approach to the consent decree, led the companies to claim the right of payment of dividends up to seven percent on total valuation and not just their equity share of it. This position was taken after the Justice Department raised the issue of whether dividends could be paid on the debt element of valuation, or if dividends could be paid only on the equity investment. The Department of Justice's interpretation of Paragraph 3 of the decree meant that the seven percent return could only apply to the owner's equity contribution to valuation. The companies took the opposite position; that they had the right to pay dividends on total valuation.[80]

Between 1942 and 1957, 31 opinions were issued by Justice, both oral and written. These opinions were not distributed or disseminated by Justice to all companies but were issued only to the individual company. The chief value of these opinions was that they provided protection for the companies from "knowingly violating the decree."[81]

The requirement that each party to the decree file an annual report with the U.S. Attorney General kept Justice informed as to each individual company's interpretation of the decree. Justice, however, was in a position where it could do little about these companies' explanations or interpretations unless it was prepared to take the company to court. From the time of the signing of the decree through 1957, the Department of Justice did not force the issue of interpretation in the

courts. The policy of inaction gave increased validity to the procedures adopted by the pipeline companies in complying with the decree itself.

The practices of the pipeline companies under the consent decree, as well as the practices of the Department of Justice, ultimately led to a series of Congressional probes in 1957. The anti-trust subcommittee of the House Committee on the Judiciary, headed by Congressman Celler, sought to probe the consent decree practices of the Department of Justice. One special area of the Congressional probe was the enforcement of the oil pipeline consent decree.[82] Before the public hearings began in October of 1957, Justice brought four court proceedings involving the pipeline decree. These four cases involved Arapahoe Pipeline Company (a joint venture), the Service Pipeline Company (a subsidiary of Standard Oil Company of Indiana), Tidal Pipeline Company and its owner, Tidewater Oil Company, and Texas Pipeline Company.[83]

The Arapahoe Case was aimed against payment of dividends to shippers/owners greater than seven percent of their "paid-in investment or their equity"; the Service Pipeline Company Case involved a charge that the company had violated part of the decree by its method of calculating valuation. It was alleged in the Tidal Case that the company had included in its valuations (for consent decree purposes), all properties used for common carrier purposes whether they owned the property or not. In the fourth case, the Texas Pipeline Company was challenged for following a valuation procedure similar to that of Tidal. The difference was that the alleged excessive dividends had been paid to the Tidal Pipeline Company's parent while the Texas Pipeline Company had not

actually paid the dividends.

Before the cases went to trial, the case against the Texas Pipeline Company was dropped. The company agreed to transfer to surplus the funds which had been classified by the Justice Department as excessive earnings. The remaining three cases, however, were placed before a federal court in March, 1958.[84]

As noted, the issue in the Service Pipeline Case was one of determining the valuation base. Service Pipeline held the position that it could include common carrier property completed in the year of the valuation report, as well as deduct common carrier facilities which were retired from use in the same year. The Federal District Court ruled that action taken by Service Pipeline Company and its parent Standard of Indiana, had not violated the decree.

The decision indicated that the Government's case was not without merits, but the Court also took into account the fact that the pipeline company had adopted this procedure very early in its filing of its annual reports to the Attorney General. The defendants had made complete and full disclosures over a long period of time. This combined with the fact that Justice had waited so long to test the issues, and had accepted the annual reports filed by the company, had the effect of prejudicing their case.[85]

The Court dismissed the motion against the Tidal Pipeline Company for essentially the same reason used in dismissing the Service Pipeline Case. In this case, the government argued that Tidal's inclusion of property not owned but used in their common carrier operation for valuation purposes was not allowed. Tidal, on the other hand, argued

that the decree was based on the latest ICC valuation which did include all property employed in common carrier service.

With the dismissal of the Tidal and Service Pipeline Cases and the settlement of the Texas Pipeline Case, only the Arapahoe Pipeline Case remained to be decided. It was this case that was the most important. The Arapahoe Pipeline Company was a joint venture company. Its financial structure was 90 percent debt and 10 percent equity. The government argued that in the calculation of the seven percent return for dividend purposes, the part attributable to loans from third parties must be deducted before the calculation was performed. The Department regarded this case as a test case which, if won, would apply to all parties to the decree. The Court disagreed with this opinion and ruled that it would only apply to the Arapahoe Pipeline Company. At this point, given the importance of the case to the pipeline industry, 12 companies entered the case as parties to Arapahoe.[86]

In arguing the case, the Department of Justice took the position that the decree was intended to prevent discrimination among shippers and that dividends could constitute illegal rebates. They argued that the seven percent dividend was allowed but this could only be calculated based on equity investments and not debt. They also took the position that loans made by shippers/owners after the decree were not to be included in the valuation but were entitled to interest and principal payments. The carriers, on the other hand, argued that the decree authorized a seven percent payment of dividends based on the ICC total valuation which included property financed out of debt. The carriers also argued that the Great Lakes Case, allowed by both the Department of

Justice and the Court, supported this interpretation.[87]

The District Court and ultimately the Supreme Court ruled in favor of the pipeline companies. The District Court ruling noted that companies had been making full disclosure of their practices for 16 years and the Department of Justice in not taking any action had in effect upheld this practice. The Court also indicated that the Department of Justice was attempting to rewrite the decree, an unwarranted action. The ruling stated that dividends could be computed on total valuation including debt as ordered in the original consent decree. Defendant common carriers were permitted to pay seven percent dividends based on this calculation.[88]

The impact of the Arapahoe Case on the consent decree was a major one. The head of the Justice Department's antitrust division some years later in testimony before Congress was to voice the opinion that the Arapahoe ruling ended altogether the usefulness of what was originally considered a limited device.[89]

Government Investigation, Intervention, and Regulations 1865-1959: A Summary Evaluation

That the control of pipelines could be a lethal weapon was demonstrated early in the history of the petroleum industry. After the Hepburn Act was passed, allegations persisted that major petroleum companies' ownership of pipelines assisted in the development of a non-competitive petroleum industry. The shipper/owner control of pipelines was allegedly the most effective means of minimizing the threat of successful entry and growth of small independent companies in the other stages of the industry (production, refining, or marketing).

There developed during the period three major charges: (1) independent producers, refiners, and marketers were denied access to pipelines; (2) shipper/owner pipelines resulted in inequality of competition even if access was obtained; and (3) concentrated control of the pipeline segment of the industry by a few major oil companies created, if not monopoly, at least oligopoly. The third charge was the result of the first two. The denial of access was considered the most serious, but each of the charges revolved around the unique feature of the ICC regulation of pipelines compared to the other regulated modes, i.e., the absence of the application of the commodity clause.

Denial of access was allegedly achieved by five means. First, tariff rates were excessive. They were generally set equal to the rate charged by competing carriers (railroads initially). Second, access was denied by setting minimum tender high enough that all but the major companies were excluded. Third, partial access was denied through proration when production exceeded pipeline capacity. The fourth means was the result of a considerable time lag between input into the pipeline and output in instances where access was obtained. For the shipper/owner, the time lags were minimized after the initial filling of the pipeline. What they entered into the pipeline they could, in most cases, simultaneously take delivery of at their terminal facilities.

Wolbert illustrated the dilemma of the small shipper with an example of a shipper attempting to get a 2,000 barrel/day contract with a "common carrier." In this case, the shipper was required to give 30 days' notice that it wanted to ship 2,000 barrels/day; secondly, it required a fill-up where if the pipeline took 15 days to deliver, then

the fill-up would be 30,000 barrels for its share of the pipeline. Thus, a time lag of 45 days was required along with a large oil stock investment. For the small refiner this could be a considerable investment, as well as a potential disruption of its refinery scheduling.[90]

The fifth charge centered around the provision of terminal facilities, facilities not covered by ICC regulations. On shipper/owner lines, terminal facilities were by industry practice privately owned. The outside shipper was therefore required to construct his own terminal facilities or make arrangements with the privately owned terminal operators. It is of interest that common carriers identified as "independent pipeline companies" were eager to provide facilities to all shippers.

The government's response to the allegations and charges was to extend, through the Hepburn Act, ICC regulatory authority to interstate pipelines. The Hepburn Act did not place pipelines under all provisions of either the Interstate Commerce or the Elkins Act. The Hepburn Act was passed in 1906, the same year the antitrust suit against Standard Oil of New Jersey was filed. The Act was the Congressional response to the abuses of the Standard Oil of New Jersey.

Pipeline transportation experienced dramatic growth during the period between 1905 and 1931, interstate mileage increased from 24,666 miles to 115,710 miles. During these formative years, the Interstate Commerce Commission took an extremely passive role resulting in virtually no impact on the development of pipelines. The impact of ICC regulation was essentially confined to reporting requirements and legal separation of pipeline operations from the parents.

Public opinion, as expressed in Congressional and Executive

activities, peaked in 1906, during the Great Depression, 1940-41, and 1957-58. Calls for divestiture reached a peak during the first two terms of the Roosevelt Administration.

Students of the industry in reviewing this period were to reach the following conclusions:

1. Crude oil pipelines were constructed by major integrated companies primarily for their own use. ICC regulation did not change this.[91]

2. Common carrier status was initially only a pyrrhic victory for the independent since tariff rates tended to match railroad rates.[92]

3. Tariffs charged to the shipper/owner were paper transfers between the parent company's subsidiaries. The parent company's refinery subsidiary or department was furnished crude at a lower price than that of a competitor. Access to pipeline transportation was considered a critical determinant of one's competitive position.[93]

4. Outside shippers used crude lines to a very limited degree. It was due largely to abuses committed when the structure of the industry was in its formative years.[94]

A central issue arose and that was; could federal regulation of pipelines as common carriers ensure that the shipper/owner pass on transportation savings to non-owners/shippers and ultimately the public? Tariff rates and tenders did decline between 1934 and 1959. There was little doubt that ICC regulation brought about the reduction in the tender requirements. Did rate reduction occur because of ICC and Justice activities? Here there is some disagreement and several authors were to conclude:

1. Active intervention by the ICC, the Department of Justice, and the tax laws were considered to have produced lower tariffs, according to De Chazeau and Kahn.[95]

2. ICC was considered to have achieved three things: (a) valuation and systemized accounting procedures; (b) lowering of the minimum tender requirements; and (c) rate reduction, according to Wolbert.[96]

3. An analysis of rates of returns by Cookenboo for the period 1937-1953 partially challenged the position that ICC and Justice had produced rate reductions. Cookenboo concluded that 12 years after the consent decree, average transportation rates charged by all reporting ICC carriers were about the same as they were in 1941. He did note that the rate of return before taxes for all reporting companies decreased about 53 percent from 1947 through 1953, indicating that net earnings for all pipeline companies had on the average been driven down to the seven percent level. He poses the question, "has rate regulation achieved its purpose?". In a sense it has since the high profits of the 20's and 30's no longer exist. He indicated, however, that factors other than the consent decree were at work in driving down earnings. The primary responsibility for the decline was the result of an increase in the federal corporate income and excess profit tax. Cookenboo noted that in 1953, earnings before federal taxes amounted to 14.6 percent compared to seven percent after taxes. Actual rates were no longer lower than before the consent decree.[97] Cookenboo correctly emphasized the importance of the corporate income and excess profit taxes. Also important were the federal taxes of initially 4.0 percent and eventually 4.5 percent levied on oil pipeline total revenues which began during the

Great Depression and continued until 1958. Also a factor during this period was the temporary loss of consolidated return advantages. When these tax changes are combined with the emergence of the economics of the large diameter pipeline, the likelihood that ICC regulation was the primary explanation of the observed rate decline is further minimized.

In summary, the historical evidence does not indicate that interstate pipeline transportation and company behavior was significantly constrained or altered by governmental activities. Wolbert in commenting on the behavior of companies during the period concluded that, ". . . the record of major companies in the absence of any regulation is not calculated to reassure the worried independent operator."[98] Johnson concluded that, "On balance it seems warranted to conclude that neither federal regulation nor antitrust action between 1906 and 1959 substantially altered the development of the pipeline sector of the integrated oil industry."[99] Johnson also concluded that the consent decree consumed a far larger share of managerial thought and time than the ICC ever had.

CHAPTER II

[1]Oil was discovered in 1859 in Pennsylvania. By 1878 Standard Oil had risen to supremacy. See U.S., Congress, Joint Economic Committee, The Energy Outlook for the 1980's, by W. N. Peach. Joint Committee Print (Washington, D.C.: Government Printing Office, 1973), pp. 6 and 28.

[2]U.S., Congress, Senate, The Energy Industry: Organization and Public Policy. Background papers prepared for the Special Subcommittee on Integrated Oil Operations, U.S. Senate, 93rd Congress, 2nd Session (Washington, D.C.: Government Printing Office, 1974), p. 1.

[3]Ibid.; the Standard Oil group of companies legal evolution was a response to both growing public hostility as well as management difficulties. In 1881 the combination of 39 companies were concentrated in the Standard Oil trust. As of the result of litigation the trust was dissolved and the holding company, Standard Oil of New Jersey, was formed in 1899.

[4]De Chazeau and Kahn, Integration and Competition in the Petroleum Industry, pp. 75-81.

[5]U.S., Congress, Senate, The Energy Industry: Organization and Public Policy, p. 49.

[6]Johnson, Petroleum Pipelines and Public Policy, pp. 82-83.

[7]34 U.S. Stat. 584 (1906).

[8]The Pipe Line Cases, 234 U.S. 548 (1914).

[9]E. V. Rostow and A. S. Sachs, "Entry into the Oil Refining Business: Vertical Integration Re-examined," Yale Law Journal, vol. 61 (June-July, 1952), pp. 856-914.

[10]U.S. Federal Trade Commission, Bureau of Competition and Bureau of Economics. Report to the Federal Trade Commission on the Structure, Conduct and Performance of the West Coast Petroleum Industry, (September, 1975), pp. 85-86.

[11]Ibid. [12]Ibid.

[13]Johnson, Petroleum Pipelines and Public Policy, p. 57.

[14]Ibid., pp. 55, 57.

[15]U.S., Congress, Senate, The Energy Industry, pp. 1-2.

[16]Johnson lists these six alternatives in reference to Standard's management (see Petroleum Pipelines and Public Policy, p. 69). Standard's example in this matter was to be followed by other companies.

[17]Ibid., pp. 69-81. [18]Ibid., p. 80. [19]Ibid., p. 115.

[20]De Chazeau and Kahn, Integration and Competition in the Petroleum Industry, pp. 81-83; Johnson, Petroleum Pipelines and Public Policy, pp. 119-143.

[21]Wolbert, American Pipelines, pp. 12-13. [22]Ibid., pp. 13-21.

[23]Ibid., p. 24; Johnson, Petroleum Pipelines and Public Policy, p. 243.

[24]Wolbert, American Pipelines, pp. 41-43.

[25]Johnson, Petroleum Pipelines and Public Policy, p. 196.

[26]Ibid. [27]Ibid., p. 115.

[28]Brundred Brothers v. Prairie Pipe Line Co., 68 I.C.C. 458, 461, 463 (1922).

[29]Wolbert, American Pipelines, p. 133.

[30]Robert C. Fellmeth, The Interstate Commerce Omission (New York: Grossman Publishers, 1972), pp. 11-12.

[31]Pipeliner (September 21, 1946), p. 173.

[32]Johnson, Petroleum Pipelines and Public Policy, p. 206.

[33]Ibid., p. 199. [34]Ibid., p. 240. [35]Ibid., p. 444.

[36]Ibid., pp. 391-92. [37]Ibid., pp. 393-94.

[38]A formal complaint preceded this action. The complaint by crude oriented refiners and railroads alleged (in the Mid Continent area) that "rate reduction" would limit these refineries' ability to compete with market oriented refineries. The complaint in this instance was not against high tariffs but low ones. The complaint also noted that companies (owning the pipelines) had lost (temporarily as it turned out) tax advantages as a result of the transportation tax and the benefit of

consolidated returns. The ICC rejected the complaint but went on to set in motion the larger investigation (see Johnson, Petroleum Pipelines and Public Policy, pp. 241-43).

[39]243 I.C.C. 115 (1940).

[40]Johnson, Petroleum Pipelines and Public Policy, pp. 250, 398-399.

[41]Wolbert, American Pipelines, p. 135; Johnson cites the Minnelusa Case (258 I.C.C. 41 (1944)) as the first case decided by the ICC brought by a "bona fide shipper over the defendant pipelines." (Petroleum Pipelines and Public Policy, p. 395).

[42]Wolbert, American Pipelines, p. 15.

[43]Ibid. [44]243 I.C.C. 589 (1941).

[45]Wolbert, American Pipelines, pp. 133-134; Johnson, Petroleum Pipelines and Public Policy, p. 396; also see D. Philip Lockin, Economics of Transportation, 6th ed. (Homewood, Illinois: Irwin, 1966), p. 611.

[46]Valvoline Oil Co. v. United States, 308 U.S. 141 (1939).

[47]Johnson, Petroleum Pipelines and Public Policy, pp. 400-01.

[48]Champlin Refining Co. v. United States et al., 329 U.S. 29 (1946); United States et al. vs. Champlin Refining Co., 341 U.S. 290 (1951).

[49]Johnson, p. 401. [50]Wolbert, pp. 126-128.

[51]Johnson, pp. 401-405.

[52]The second Champlin decision allowed two major refined product pipelines operating in the mid-continent area to remain private carriers. The first was Champlin's 600 miles (1973) of pipeline. The second is the product pipeline network of Standard Oil of Indiana. This network extends some 2,357 miles (also 1973). Champlin was chosen over Standard of Indiana as the test case because of its pricing formula which was more vulnerable than Standard's.

[53]The cooperation between the Industry and the Government during the Second World War is discussed in detail in Johnson, Chapter 17-18. The significance of the War years to this paper are found in the (1) cooperation among the companies in developing the pipeline strategy of the War and the disposition of the wartime pipelines; and (2) the War gave the industry the opportunity to bring forth the technological advance of the large diameter pipelines (the Big Inch Pipeline, 1,400 miles of 24 inch crude line, and the Little Big Inch Pipeline, 20 inch product pipeline paid for and operated by the U.S. Government which were financed and tested without industry expense). Johnson in

commenting on the industry meeting that set the strategy of the war, "In it lay the genesis of the big-inch pipelines that were to help win the war and revolutionize postwar American pipelining." (Johnson, p. 317). The disposition of the two big inch lines were to create considerable concern to industry leaders after the War.

[54]Johnson, pp. 217, 268-269.

[55]Wolbert, American Pipelines, pp. 103-4; see Schechter Poultry Corp. v. United States, 295 U.S. 495, 55 Sup. Ct. 837, 79 L.ED. 1570 (1935); also see The Energy Industry: Organization and Public Policy, pp. 31-32.

[56]Johnson, p. 285. [57]Ibid.

[58]United States v. American Petroleum Institute, Civ. No. 8524, D. D. C. Sept. 30, 1940.

[59]The Energy Industry: Organization and Public Policy, pp. 52-53.

[60]U.S. v. Phillips Petroleum Company and Phillips Pipeline Company, Civ. No. 182, D.C., Delaware, Sept. 30, 1940; U.S. v. Standard Oil Company (Indiana), Civ. No. 183, D.C., Northern District of Indiana, Hammond Division, Sept. 30, 1940; U.S. v. Great Lakes Pipe Line Co., Cov. No. 183, D.C., Delaware, Sept. 30, 1940.

[61]Johnson, pp. 289-291.

[62]The Energy Industry: Organization and Public Policy, pp. 50-53.

[63]Johnson, p. 292. [64]The Energy Industry:, p. 53.

[65]Ibid. [66]Johnson, p. 290.

[67]The Government estimated that the penalties could run as much as $1.6 billion (Johnson, p. 291.)

[68]The industry approach to the negotiations indicated a strong desire to keep implementation in the hands of the ICC (Johnson, p. 291); the tentative decision of the ICC in the Reduced Pipeline Rates and Gathering Charges case had established the "fair-return-on-fair-value" doctrine (see Lockin, Economics of Transportation, pp. 609-611).

[69]Johnson, p. 293.

[70]United States v. Atlantic Refining Co., Cov. No. 14060, D.D.C., December 23, 1941.

[71]Johnson, p. 299.

[72]Ibid., pp. 300, 409; also see Wolbert, American Pipelines, pp. 147-159.

[73]Wolbert, American Pipelines, p. 147.

[74]Johnson, pp. 332-333, 409-412. [75]Ibid., p. 334.

[76]At that time Great Lakes agreed to include the interest paid on long-term debt as a part of the seven percent allowable (Ibid., pp. 334-335).

[77]Ibid., p. 337. [78]Ibid.

[79]See for example U.S., Congress, House, Hearings on Anticompetitive Impact of Oil Company Ownership of Petroleum Pipelines, Select Committee on Small Business, 92d Congress, 2d Session (Washington, D.C.: Government Printing Office, 1972).

[80]Johnson, p. 411. [81]Ibid.

[82]See U.S., Congress, House, Report of the Antitrust Subcommittee (Subcommittee No. 5) on Consent Decree Program of the Department of Justice, House Committee on the Judiciary (Washington, D.C.: Government Printing Office, 1959); Congress had previously served as the motivating force behind executive branch and ICC actions. The Celler hearings were no exception. As is often the case the Justice Department was of little assistance to the hearings pleading potential prejudice to their pending cases. The majority report of the Celler committee was critical of not only the Justice Department but the ICC as well. The ICC's valuation process and close working relationship with the industry came under sharp attack (the ICC subsequently suspended the arrangement). The Committee was critical of the Justice's and ICC's lack of cooperation as well as the Justice Department's administration of the decree. The majority recommended a reappraisal of federal regulatory policy over pipelines and amending the Elkins Act to prohibit dividends based upon transportation charges paid by shipper-owners and non-owners. As is the case in the case in the hearings of the 1970's, the minority members criticized the document as a political tool and at that time as a means of embarrassing the Eisenhower administration (Johnson found the minority report to be the "more balanced one" (Johnson, p. 451).).

[83]Johnson, p. 441; United States v. The Atlantic Refining Company et al., Civ. No. 14060, D.D.C., March 25, 1958.

[84]Johnson, p. 452. [85]Ibid., pp. 455-456.

[86]Ibid. [87]Ibid.

[88]United States v. Atlantic Refining Co. et al., 360 U.S. 19 (1959).

[89]Testimony of Bruce Wilson in Hearings on Anticompetitive Impact of Oil Company Ownership of Petroleum Pipelines, p. 204.

[90]Wolbert, American Pipelines, p. 46.

[91]De Chazeau and Kahn, Integration and Competition in the Petroleum Industry, p. 512.

[92]Wolbert, p. 20.

[93]De Chazeau and Kahn, pp. 512-513.

[94]Wolbert, pp. 43-44.

[95]De Chazeau and Kahn, pp. 513-514.

[96]Wolbert, p. 132.

[97]Cookenboo, Crude Oil Pipelines and Competition in the Oil Industry, pp. 96-112.

[98]Wolbert, p. 22.

[99]Johnson, pp. 474-478.

CHAPTER III

THE DOMESTIC PETROLEUM INDUSTRY: AN OVERVIEW OF TRANSPORTATION REQUIREMENTS

Traditional studies of the petroleum industry have divided the industry into four integrated operating stages; crude production, refining, transportation, and marketing.[1] Sequentially, and for this paper's purpose, the operating stages are divided into five operating stages by subdividing transportation into two parts; crude oil transportation and refined product transportation. As was stated in the first chapter, primary attention is placed on the two transportation functions and only peripheral attention is given to the other three stages of the industry. Likewise, little focus is placed on other means of transporting the industry's products other than to address the competitive and complementary aspects of these modes and their growth relative to pipelines.

In general terms, two sets of petroleum supply and demand relationships have determined the character of petroleum transportation in the United States. The demand for and supply of transportation services are derived from these intermediate and final goods markets. The size and location of the intermediate market, which is defined as crude oil

production, crude imports, and refining, has determined the size and location of the crude oil transportation system. The size and location of the final goods market, defined as refining, product imports, and final consumers, has determined the size and location of the refined products transportation system.

The two markets are examined in this chapter from an historical perspective. The growth of these markets are also examined in static terms when in reality market conditions in both are determined simultaneously. The markets are examined as if they were separate when for the most part they are part of the fully integrated operations of petroleum companies. It is informative at this point to ignore the integrated character and look to the growth and geographic nature of the petroleum markets as if they were separate and distinct.

This chapter demonstrates the nature of the demand for transportation services as well as the geographic character of this demand. It provides a beginning for comprehending the significance of transportation in the vertically integrated operation of petroleum companies.

Also, the process of defining more clearly the modern significance of the problems caused by disequilibrium conditions in petroleum markets is begun in this chapter. John Blair, in The Control of Oil summarizes the problems of disequilibrium by stating:

> Although attempts to stabilize the price of any commodity can be upset by only a relatively small amount of uncontrolled product, certain characteristics of oil make it particularly vulnerable to market disruption. For one thing, large-scale storage is difficult and expensive. As a liquid it must be contained, usually in steel storage tanks; but steel is costly and the tanks must be constantly painted to prevent rust. Hence, it is an industry axiom that oil, once produced, must move. Moreover, oil is a fungible commodity ("any unit of which can replace another unit.") . . . quality differentials that are recognized by both buyers and sellers make

> it possible for oil from any source to compete directly with oil from any other source. Finally, oil's relatively low short-run elasticity of demand with respect to price means that any excess of total production will not, as a consequence of a lower price, be absorbed by a corresponding increase in comsumption.[2]

Although Blair was considering crude oil, his statement applies equally to refined petroleum products.

The Intermediate Market

The supply of crude oil available to the United States market has grown rapidly since the end of World War II. From 1950 the supply of crude oil has grown at an average annual rate of 4.6 percent. As Table 1 illustrates, the mix of the available supply has undergone dramatic change. In 1950, the ratio of domestic production to total crude supply was 93 percent. In 1975, it had decreased to 67 percent. The average annual rate of growth in domestic production over the twenty-five-year period was 2.2 percent compared to 37.9 percent for net crude imports. Domestic production has been declining in recent years.

Domestic Production

The decline in domestic production (down 9 percent since 1973) has and will continue to alter historically established transportation patterns. Offshore production, Alaskan production, and crude imports are also altering transportation patterns.

The historical growth in domestic crude oil production, both in magnitude and geographic location, has determined the present magnitude and location of the crude transportation system. Even though domestic production is declining in relative importance, it remains, when combined with the location of domestic refineries, a key element in understanding

TABLE 1

DOMESTIC CRUDE OIL PRODUCTION, NET CRUDE OIL IMPORTS, AND CRUDE RUNS TO STILLS, UNITED STATES, SELECTED YEARS, 1950-1975
(MILLIONS OF BARRELS)

Year	Total Supply of Crude Oil	Domestic Production[1]	Net Imports	Crude Runs to Stills
1950	2,116.5	1,973.6	142.9	2,094.9
1955	2,758.2	2,484.4	273.8	2,730.2
1957	2,939.9	2,616.9	323.0	2,890.4
1960	2,943.4	2,574.9	368.5	2,952.5
1965	3,299.4	2,848.5	450.9	3,300.8
1970	3,995.0	3,517.0	478.0	3,968.0
1973	4,544.2	3,360.9	1,183.3	4,537.2
1974	4,470.7	3.202.6	1,268.1	4,428.7
1975	4,552.8	3,056.8	1,496.0	4,541.4

SOURCE: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products and Natural Gas Liquids," Annual Summaries.

[1]Includes lease condensate.

the significance of crude pipelines. Domestic crude production has been historically concentrated in relatively few areas of the United States and this concentration has not been subject to rapid change. In Tables 2 and 3, historical data by geographic area is presented. Table 2 defines the important producing areas using the Petroleum Areas for Defense (PAD's) delineation.[3] Figure 1 presents similar data for 1950 and 1975 and also defines the five PAD's. Table 3 lists the important producing states. The data shown in the tables and figure represent the percent of domestic production accounted for by each area in selected years.

As the data indicates, PAD 3 has been and is the major producing area in the United States and has grown in relative importance since 1950. In 1950, it accounted for 59 percent of the domestic supply of crude oil. In 1975, it was producing almost 67 percent of the domestic crude. From 1950 through most of the 1960's the mid-continent area (PAD II) was the second leading producing area. Beginning in 1970, however, PAD V's production has been higher. PAD's I, II and V have, overall, been declining in relative importance. Because PAD V includes Alaska, its relative importance will grow once the Trans-Alaskan pipeline is completed. PAD IV may also grow in importance if recent discoveries prove significant.[4]

Domestic production is more concentrated than the data in Table 2 would suggest. Five states in 1950 accounted for almost 81 percent of the total domestic production. These same 5 states accounted for 82 percent of the total in 1975. Texas has historically been the major producing state, followed by Louisiana, California, and Oklahoma (not in

TABLE 2

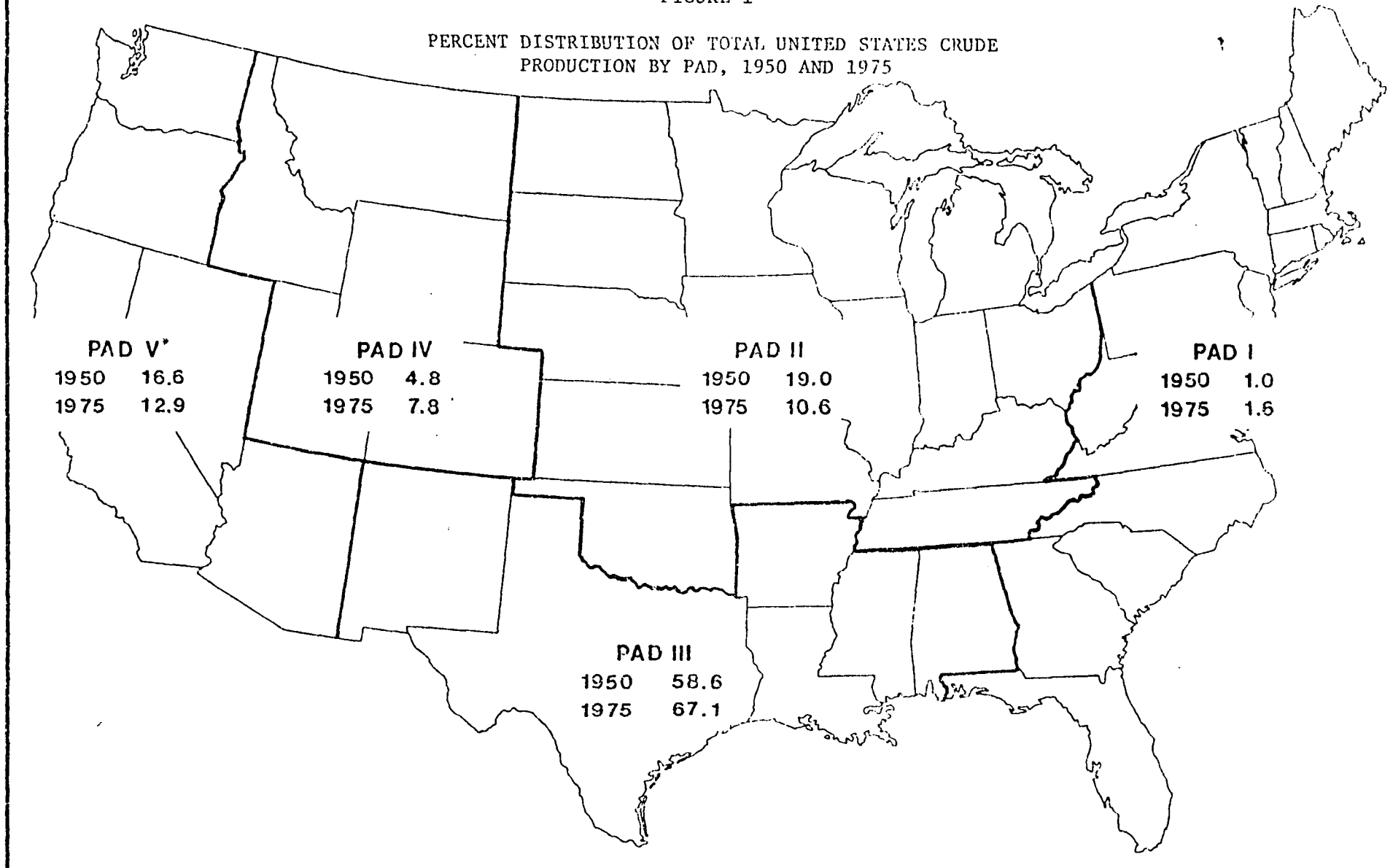
PERCENT DISTRIBUTION OF TOTAL UNITED STATES CRUDE OIL PRODUCTION, BY PAD DISTRICT, SELECTED YEARS, 1950-1975

	PAD District				
Year	I	II	III	IV	V
1950	1.0	19.0	58.6	4.8	16.6
1955	0.6	18.9	59.4	6.8	14.3
1957	0.5	18.9	60.1	7.5	13.0
1960	0.4	18.8	59.2	9.7	11.9
1965	0.4	16.6	63.4	8.1	11.5
1970	0.3	12.1	67.5	7.0	13.0
1973	1.2	10.5	68.8	7.3	12.2
1974	1.4	10.4	68.0	7.9	12.3
1975	1.6	10.6	67.1	7.8	12.9

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products and Natural Gas Liquids," Annual Summaries.

FIGURE 1

PERCENT DISTRIBUTION OF TOTAL UNITED STATES CRUDE PRODUCTION BY PAD, 1950 AND 1975



SOURCE: Table 2, p. 62.

*Includes Alaska

order of importance).

The relative importance of Texas has declined slightly over the period while Louisiana (both on and offshore) has risen. California and Oklahoma have been declining as major producing areas. Given the known reserves and recent discoveries, little change in this pattern is expected in the near term. Alaska will, however, replace Texas as the major producing state.[5] Table 3 shows the historical concentration of crude production in these states.

The significance of this concentration of production in small areas is that, by and large, there has been a large geographic disparity between the supply of crude oil and the demand for refined products. For example, PAD I, since 1950, has never produced more than 1.6 percent of the total crude production in the United States and for most years produced less than one percent of the total; and PAD II has been declining in relative importance since 1950. Its relative position has fallen by 44.2 percent in 25 years. Both PAD I and PAD II represent concentrations of population and industrial capacity. Together they represented 71 percent of the population of the United States in 1975. In the same year they produced only 12.2 percent of the total domestic crude production. PAD III in contrast had only 11.9 percent of the total population but produced 67 percent of the domestic crude oil.[6] This disparity has greatly increased the length and importance of the transportation of crude oil.

Imports of Foreign Crude Oil

It is common knowledge that the demand for refined petroleum products has grown at a faster rate than domestic crude production. The

long run response to this growth has come in the form of increased imports of foreign crude oil. Crude oil imports, however, have not risen in sufficient quantity to supply the total demand. Domestic refinery capacity has not expanded sufficiently to make the United States "refinery self-sufficient." For this reason, the United States is importing both crude and refined products.

Imports by Country of Origin

As Table 1 indicated, the U.S. imported approximately 1.5 billion barrels of crude oil in 1975. This was ten times the number of barrels imported in 1950 and represented 33 percent of the new crude supply in 1975. The growing dependency on foreign crude is a development of the 1970's. Crude imports did not rise above 10 percent until after 1957. In 1970, crude imports were still a rather modest 12 percent and did not exceed 15 percent until 1972.

Since 1950, the United States has imported crude oil from all major producing areas outside the United States. The major countries and areas from which the United States has imported crude oil is shown in Table 4. During 1960-1975 Canada, Venezuela, and the Middle East have been the major suppliers. As the data indicates, the percent of total imports supplied by each area has fluctuated considerably over the time period. Through the early 1970's, these three areas annually accounted for over 80 percent of total imports.

During 1957-75 the United States imported a total of 11.3 billion barrels of crude oil. Nearly 35 percent of this was imported in the years 1973-1975. Two countries, Canada and Venezuela, have supplied 51 percent of the cumulative total.[7] Five countries, Saudi Arabia, Nigeria,

TABLE 3

PERCENT OF TOTAL UNITED STATES CRUDE OIL PRODUCTION, SELECTED STATES, SELECTED YEARS, 1950-1975

	States					
Year	Texas	Louisiana	California	Oklahoma	Wyoming	All Others
1950	42.0	10.6	16.6	8.3	3.1	19.4
1955	42.2	10.9	14.3	8.2	4.0	20.2
1957	41.0	12.6	13.0	8.2	4.2	21.0
1960	36.0	15.6	11.9	7.5	5.2	23.8
1965	35.1	20.9	11.1	7.1	4.8	21.0
1970	35.5	25.8	10.6	6.4	4.6	17.1
1973	38.5	24.7	10.0	5.7	4.2	16.9
1974	39.4	23.0	10.1	5.6	4.4	17.5
1975	40.0	21.5	10.6	5.3	4.2	18.4

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," Annual Summaries.

TABLE 4

PERCENT DISTRIBUTION OF UNITED STATES CRUDE OIL IMPORTS, BY MAJOR COUNTRY/AREA OF ORIGIN, SELECTED YEARS, 1950-1975

Year	Total Imports[1] (Million Barrels)	Percent of Total Imports				
		Canada	Venezuela	Middle East[2]	Africa[3]	All Others
1950	178	-	60.1	23.7	*	16.2
1955	285	5.9	49.4	35.6	*	9.1
1957	373	14.7	52.0	29.3	*	4.0
1960	372	11.0	46.5	23.9	*	18.6
1965	452	23.9	34.9	23.7	*	17.5
1970	483	50.7	20.3	21.1	*	7.9
1973	1,184	30.8	10.6	24.7	24.1	9.8[4]
1974	1,269	22.8	9.2	28.5	28.1	11.4[4]
1975	1,498	14.6	9.6	27.3	32.6	15.9[4]

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," Annual Summaries.

[1]Reported to Bureau of Mines.

[2]Includes Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates; Iran and Saudi Arabia, the primary exporters, accounting for 87 percent of the Middle East total in 1975.

[3]Includes Algeria, Angola, Congo, Egypt, Gabon, Libya, Nigeria, and Tunisia; Algeria and Nigeria: the primary exporters, accounting for 75 percent of the African total in 1975.

[4]Indonesia is the remaining primary exporter, accounting for 6 percent of total imports in 1973, 8 percent in 1974, and 9 percent in 1975.

*Percent is included in all others until 1973.

Indonesia, Iran and Kuwait, supplied an additional 34.8 percent.[8]

Imports by Receiving PAD's

As was the case with sources of foreign crude, the relative pattern of where this foreign crude is received in the United States has changed since the 1950's. These changes have been most pronounced since 1970 (see Table 5). In 1960, the East Coast (PAD I) of the United States received 65.7 percent of the nearly 372 million barrels of crude oil imported that year. In 1975, only 30 percent of the crude oil imported into the United States was going to the East Coast. As a percent of the total, PAD's II and III had become more important receiving areas while both PAD I and V had declined. PAD IV has remained relatively insignificant as an importing area for obvious reasons. PAD III's import totals have risen most dramatically since 1960, increasing from less than 1 percent (PAD II experienced a similar rise.) to 29 percent in 1975.

The reasons for these shifts are examined in the following section. It is sufficient at this point to note that the increase in imports to PAD's II and III are partially the result of declining production as well as increased concentration of refinery capacity in these PAD's. Where imports originated as well as where they are received impacts the type, magnitude, and direction of crude oil transportation requirements. The more pronounced changes that have occurred since 1970 both in origin and receipt of imports are important and have altered heretofore rather stable transportation patterns.

TABLE 5

RECEIPT OF FOREIGN CRUDE OIL BY PAD DISTRICT
AS A PERCENT OF TOTAL CRUDE OIL IMPORTS,
SELECTED YEARS, 1960-1975

Year	Imports (Million Barrels)	PAD DISTRICT[1]				
		I	II	III	IV	V
1960	372	65.7	6.3	0.8	--	27.2
1965	452	57.2	9.1	--	1.1	32.6
1970	483	43.7	23.9	--	3.6	28.7
1973	1,184	39.4	22.0	12.3	1.4	25.0
1974	1,269	33.8	19.8	22.8	1.3	22.3
1975	1,498	30.1	18.9	29.2	1.1	20.7

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," Annual Summaries.

[1]Percentage may not equal one hundred due to rounding.

Final Goods Market

Supply and demand in the intermediate petroleum markets are derived from final consumer demand for refined petroleum products. In the previous section, the crude production side of the intermediate market was outlined. In this section, the brief description of these two markets is completed by discussing the growth in demand for petroleum products; the distribution of this demand by major type of product; the distribution of the total demand by geographic area; and the growth in refinery output and the geographic location of refineries.

Domestic Demand for Refined Petroleum Products

In 1950 the domestic demand for refined products was approximately 2.4 billion barrels. By 1975, demand had increased to nearly 6 billion barrels. The demand for refined products increased at an average annual rate of 6 percent during the 25 year period. In 1973 demand temporarily peaked at 6.4 billion barrels, due to the recession of 1974-75. Domestic demand in 1975 was thus some 6 percent below the pre-recession peak. Domestic production has, as indicated earlier, not increased sufficiently to meet this demand. Table 6 illustrates this point (column two). The table also indicates that neither domestic refinery capacity nor output has expanded sufficiently to meet the demand.

An examination of Table 6 reveals the extent of the change in the composition of new supply. In 1950 domestic production represented 90.8 percent of total demand. Crude oil production accounted for 83.1 percent while natural gas liquids totaled 7.7 percent. By 1975 domestic production of crude and natural gas liquids represented only 61.3

TABLE 6

TOTAL DOMESTIC DEMAND FOR REFINED PRODUCTS AND NEW SUPPLY OF OILS, UNITED STATES, SELECTED YEARS, 1950-1975 (MILLIONS OF BARRELS)

Year	Domestic Demand Total[1]	New Supply[4]			
		Domestic Production		Net Imports	
		Crude Oil[2]	Natural Gas Liquids	Crude Oil	Refined Products[3]
1950	2,375.1	1,973.6	182.0	142.9	56.1
1955	3,087.8	2,484.4	281.4	273.8	47.5
1957	3,218.6	2.616.9	295.0	323.0	44.4
1960	3,535.8	2,574.9	340.0	368.5	221.7
1965	4,125.5	2,848.5	441.6	450.9	381.5
1970	5,364.5	3,517.0	606.0	478.0	675.0
1973	6,317.3	3,360.9	634.4	1,183.3	926.3
1974	6,078.2	3,202.6	616.1	1,268.1	805.8
1975	5,957.5	3,056.8	596.0	1,496.0	597.9

SOURCE: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," Annual Summaries.

[1]Includes products refined and processed from crude oil, including still gas, liquified refinery gas and natural gas liquids.

[2]Includes lease condensate.

[3]Excludes imports of unfinished oils and plant condensate.

[4]New supply will not equal domestic demand primarily because of annual changes in stocks, processing gains, and imports of unfinished oils and plant condensate.

percent of the total. Crude oil production had fallen to 51.3 percent. Natural gas liquids had increased slightly in relative importance, rising to 10 percent of the total demand.

Net imports of both crude and refined products rose from 8.4 percent of the total in 1950 to 35.1 percent of domestic demand in 1975. Net import of crude oil rose from 6.0 to 25.1 percent while imports of refined products rose from 2.4 to 10.0 percent.

During the time that the distribution of the supply of oils was undergoing significant change, the demand by major type of refined product has remained fairly stable (shown in Table 7). In 1950 gasoline was the major product produced from crude oil. It remains so to this date. Gasoline consumption in 1975 represented 41.2 percent of the total. This compares to only a slightly higher percentage (41.9 percent) in 1950.

Gasoline, fuel oil (distillate and residual), liquefied gas, jet fuels, and "all others" have risen while kerosene and residual fuel oils have shown pronounced relative declines.[9]

Imports as Suppliers of Refined Petroleum Products

As Table 6 indicated, imports of refined products have risen sharply in importance during 1950-1975. What Table 6 does not indicate is the source of these imports; the type of product imported, and the receiving areas of the United States.

As was the case in the import of crude oil, the East Coast of the United States has, historically, been the major importing area. In 1975, 85.7 percent of the gross import of refined products (excluding unfinished oils and plant condensate) went to PAD I. This was, as

TABLE 7

PERCENT DISTRIBUTION OF TOTAL DOMESTIC PETROLEUM DEMAND BY MAJOR TYPE OF REFINED PRODUCT, SELECTED YEARS, 1950-1975

Year	Gasoline[1]	Distillate Fuel Oil	Residual Fuel Oil	Liquefied Gas	Jet[2] Fuel	Kerosene	All Others
1950	41.9	16.6	23.3	3.6	---	5.0	9.6
1955	43.1	18.8	18.0	4.8	2.0	3.8	9.5
1957	43.3	19.1	17.0	5.1	2.3	3.5	9.7
1960	42.7	19.4	15.8	6.4	2.9	3.7	9.1
1965	41.7	18.2	13.4	7.4	4.9	2.2	12.2
1970	39.7	17.3	15.0	6.8	6.6	1.8	12.8
1973	38.8	17.9	16.3	6.5	6.0	1.2	13.3
1974	39.5	17.7	15.8	6.4	6.0	1.1	13.5
1975	41.2	17.5	14.9	6.1	6.1	1.0	13.2

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Statements," Annual and December.

[1]Includes aviation gasoline.

[2]Reported with gasoline and kerosene prior to 1952.

column three of Table 8 indicates, only slightly lower than the share of the total for 1960-1970. PAD V has been the next largest importing area. During the period, 5 to 7 percent of all imports went to the West Coast of the United States. In relative terms, PAD's II-IV have not been important markets for imported refined products. These three PAD's never represented more than 8.4 percent of the imports during the years shown in Table 8.

In 1975, the United States Bureau of Mines reported that 59 countries exported refined products to the United States.[10] The Western Hemisphere was the principal exporting area. As was the case for countries exporting crude oil to the United States, refined products exports have been concentrated in few countries. The principal countries from which the United States has imported refined products is shown in Table 9.

The Central America/Caribbean region supplied about half of all refined imports during 1957-75. The Netherland Antilles has been the principal exporting country in this region. In relative importance, the Netherland Antilles has declined from a supplier of over one-half of all imports in 1957 to 18 percent in 1975. The Virgin Islands and the Bahamas have grown in importance since 1967 and accounted for 21.8 percent of total imports in 1975.

In cumulative terms, Venezuela exported over 3.3 billion barrels of refined products to the United States during 1957-75. This represented 34.3 percent of the cumulative total. Venezuela has declined in relative importance from 40.6 percent of the total in 1957 to only 16.7 percent in 1975. Venezuela remained the second major exporter in

TABLE 8

RECEIPT OF FOREIGN PETROLEUM PRODUCTS BY PAD DISTRICT AS A PERCENT OF TOTAL PETROLEUM PRODUCTS IMPORTED INTO THE UNITED STATES, SELECTED YEARS, 1960-1975

Year	Imports[1] (Million Barrels)	PAD DISTRICT				
		I	II	III	IV	V
1960	294.1	88.1	0.5	6.0	---	5.3
1965	448.7	87.6	1.3	4.1	0.2	6.8
1970	764.1	89.2	2.5	2.8	0.4	5.0
1973	1,010.0	86.4	2.9	4.5	0.6	5.5
1974	885.2	85.2	3.5	4.9	0.7	5.7
1975	672.2	85.7	5.1	2.4	0.9	5.9

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," Annual Summaries.

[1]Reported to the Bureau of Mines; includes receipts from Puerto Rico.

TABLE 9

PERCENT DISTRIBUTION OF UNITED STATES REFINED PRODUCT IMPORTS[a] BY MAJOR AREA/COUNTRY OF ORIGIN
1957-1975

Year	Total Imports (Million Barrels)	Central America & Caribbean			Venezuela	Canada	Europe	Rest of World
		Total[d]	Netherland Antilles	Trinidad and Tobago				
1957[b]	200.4	51.6	50.6	1.0	40.6	1.5	0.1	6.2
1958	237.1	53.6	49.9	3.7	40.4	0.5	0.8	4.7
1959	278.3	45.8	42.6	3.2	40.7	0.7	0.6	12.2
1960	276.1	45.8	40.1	5.7	45.5	1.1	---	7.6
1961	293.0	45.7	36.7	9.0	44.4	1.2	0.2	8.5
1962	316.2	42.5	33.7	8.8	46.9	1.5	0.3	8.8
1963	333.2	44.8	33.1	11.8	43.8	1.5	0.2	9.7
1964	355.5	49.9	33.7	11.0	44.2	1.9	0.1	3.9
1965	415.0	46.2	30.9	10.9	47.3	2.4	0.2	3.9
1966	456.8	44.1	27.3	11.6	46.4	2.9	2.3	4.3
1967	479.1	47.0[c]	27.3	12.1	41.4	2.6	3.7	5.3
1968	536.7	48.3	26.1	12.3	36.0	3.0	8.3	4.4
1969	602.8	49.0	26.2	12.6	33.6	3.0	10.1	4.3
1970	724.8	48.3	23.2	10.8	35.0	4.8	8.9	3.0
1971	760.9	51.8	19.9	8.7	33.2	4.7	6.5	3.8
1972	847.0	50.9	18.0	8.7	29.4	7.3	7.6	4.8
1973	1,010.0	48.2	20.8	6.8	27.2	7.3	10.5	6.8
1974	885.2	54.0	20.7	7.7	25.2	7.6	7.8	5.4
1975	672.2	60.6	18.0	6.7	16.7	9.2	6.0	7.5

TABLE 9 CONTINUED

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Minerals Yearbook, 1958-1973, and Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," 1974 and 1975, Annual Summaries

[a]Excludes unfinished oils and plant condensates.

[b]For years 1957-60 totals are net imports.

[c]For years 1961-75 totals are gross imports.

[d]Includes Puerto Rico.

[e]The Virgin Islands and the Bahamas have, since 1967, become major exporting countries; in 1975 imports from the Virgin Islands were 16.0 percent of U.S. total imports and the Bahamas were 5.8 percent of the total.

1975. Both Canada and Europe (primarily Italy) rose in relative importance during the period. Canada has never supplied, however, more than 9.2 percent of the total. Europe since 1967 and until 1975 surpassed Canada as a source of refined product imports.[11]

In 1957 the major refined product imported into the United States from these countries was residual fuel oil. This product alone accounted for 86.5 percent of the total. Fuel oils of all types (residual and distillate) accounted for 90.8 percent of the total. Residual fuel oil was still the major imported product in 1975. It, however, had declined to approximately 66.4 percent of the total. Fuel oils of all types still accounted for 74.9 percent of all imported products. On a cumulative basis, fuel oils have accounted for over 85 percent of all refined products imported into the United States during 1957-1975.[12]

Domestic Refineries as Suppliers of Refined Petroleum Products

Refinery capacity in the United States did not maintain an overall growth rate during the period 1950-1975 sufficient to supply the domestic demand for refined products. Domestic refiners have declined in relative importance as a source of domestic supply to those refineries outside the United States (but primarily in the Western Hemisphere).

Comparing crude runs to stills (column 5, Table 1) and domestic demand for finished products (column 2, Table 6), domestic refinery inputs represented 88.2 percent of total demand in 1950. In 1975 refinery inputs were 76.2 percent of total demand and had been as low as 71.8 percent in 1973. In 25 years domestic refineries have declined 12.0 percent in relative importance. The reasons that domestic refinery capacity has failed to respond sufficiently to changes in demand are not

altogether clear.

John M. Blair found in a study of concentration of refinery capacity that the growth in domestic refinery capacity had undergone three distinct stages in the past quarter century.[13] In the 1952-59 period, capacity grew at a higher rate than demand (3.71 percent to 2.85 percent), resulting in excess capacity of 600,000 barrels/day (b/d). In 1959-66, the refinery capacity growth rate dropped to an annual rate of 1.28 percent while demand rose at an annual rate of 2.68 percent. Excess capacity at the beginning of the second period turned into a short fall of 500,000 barrels/day at the end. During the third period, 1966-72, capacity increased at a more rapid rate of 4.22 percent. Demand, however, was increasing at a rate of 4.68 percent and thus there was an increase in the gap between capacity and demand.

Blair did not attribute this growing gap to an inability to raise the necessary capital for construction, even though the minimum optimal new refinery (150,000 b/d) would cost $250-$400 million.[14] He indicated that capital was being raised by the major companies to increase foreign capacity by 1.72 million b/d. Blair also did not attribute the gap to environmental barriers. He did, however, attribute the lack of sufficient growth to what he considered ". . . the majors' position at the refining stage has enabled them to eliminate excess capacity by the simple expedient of not building new refineries."[15] Regardless of the reasons, new refinery capacity has, in part, been exported in recent years and the United States is now much less self-sufficient in capacity.

The significance of this decline is more clearly understood by

comparing the domestic refinery output mix by product to the import mix by product.

Taking 1973 and 1975 for illustration purposes and using the ratio of domestic output to domestic demand by product (listed in Table 7) the following demonstrates the dependency on foreign sources for selected major products:

	Ratio: Domestic Output/Domestic Demand				
Year	Gasoline	Distillate Fuel Oil	Residual Fuel Oil	Fuel	Kerosene
1973	97.8	91.1	34.4	81.0	100.0
1975	97.7	93.2	50.8	87.0	96.0

This examination indicates that the gap between domestic demand and domestic refinery output has been largely concentrated in fuel oils (primarily residual fuel oils). It will be recalled that of the cumulative total for imports (1957-75), over 85 percent were fuel oils.

A major factor in the reliance on foreign sources for fuel oils is due to the factor that typically, United States refineries have been gasoline oriented. For example a "typical" U.S. refinery converts 65 percent of each barrel of crude oil to gasoline. The European version converts only 35 percent to gasoline. In addition, most U.S. refineries run only "sweet crude" while "sour crude," is the type now in most plentiful supply. Units must be revamped so they can process sour crude as well as undergo modifications to meet environmental emission standards.[16] Only recently have domestic refiners chosen to alter refineries to run "sour crude" and increase the yield of fuel oils.[17]

Location of Domestic Refineries

The location of refineries in the United States has historically played a pivotal role in determining the transportation networks for moving crude oil and refined products. Since domestic refineries remain the dominant supplier of refined product demand (76 percent in 1975), their geographic location and concentration determines not only the direction of flow of domestic crude and crude imports but the direction of the flow of refinery output to ultimate consumers.

The decision as to where refineries should be built in the United States has historically been a choice among: locating near the source of crude oil (crude oriented); locating near final markets (market oriented); and combined with either 1 or 2, locating near an accessible transportation system (i.e., near a port or waterway). Crude oriented refineries minimize crude transporting distances. Market oriented refineries minimize refined product transporting distances. The third choice combines one of the distance minimizers while maximizing the availability of new supplies of crude.[18]

In 1953, Cookenboo found that of the total refinery capacity in the United States, 19.2 percent were crude oriented, 81.2 percent were either market oriented or located near major ports and waterways. He also found that the less integrated companies tended to have relatively small refineries which were more likely to be crude oriented and also service a very limited close-by market.[19]

Since 1953, two trends have emerged in refining. First, new refinery capacity built, both for net addition to capacity and for replacing smaller inefficient units, has not been crude oriented. In

1975, less than 10 percent of the refinery capacity still maintained an appearance of locating near the source of crude production.

The second trend in refining has been a combination of declining numbers of refiners and refineries combined with increases in average refinery capacity.[20] In 1953 there were 351 refineries and approximately 255 refining companies.[21] By 1961 the number of refineries had fallen to 311, while the number of companies had fallen to 175.[22] As of January 1, 1976, there were 284 refineries in the 48 states and only 148 separate companies. Average refinery capacity had increased from 23,350 b/d in 1953 to 53,754 b/d in 1976.[23]

Unlike the trend in the number and size of refineries, the trend in the overall geographic location of refineries has shown a rather stable pattern. Refineries, like crude production, have been historically concentrated in small areas of the United States. The location pattern, in relative terms, was well established by 1950. This is shown in Table 10 and also in Figures 2 and 3.

In Table 10 total operating capacity during the 1950-75 period is shown along with the distribution of this capacity among PAD's. With the exception of PAD's I and III, the distribution of refinery capacity between II, IV, and V has remained fairly stable. PAD I is the only district that has shown a marked decline in relative terms. PAD III is the only PAD that has shown a marked gain in relative importance.

Refinery capacity is more concentrated than Table 10 indicates. As is illustrated in Table 11, refineries in nine states accounted for 89 percent of the total operating capacity in 1950. By 1975 some dispersion had occurred, but the same 9 states continued to represent 79 percent

TABLE 10

PERCENT DISTRIBUTION OF TOTAL UNITED STATES OPERATING REFINERY CAPACITY BY PAD DISTRICT, SELECTED YEARS, 1950-1975

Year	Total Operating Capacity[1] (Millions of Barrels Per Day)	PAD District[2]				
		I	II	III	IV	V
1950	6.2	16.7	26.5	35.9	3.7	17.1
1955	8.1	16.2	28.0	36.7	3.5	15.5
1957	8.8	16.3	28.2	37.0	3.4	15.1
1960	9.5	16.1	28.8	36.3	3.4	15.3
1965	10.2	14.3	32.0	34.3	3.8	15.6
1970	11.9	12.4	27.1	40.6	3.5	16.3
1973	13.4	11.9	27.2	41.1	3.4	16.4
1974	14.2	11.8	27.3	41.7	3.6	15.6
1975	14.7	11.0	27.3	42.3	3.7	15.7
1976	14.9	11.3	27.8	41.7	3.7	15.5

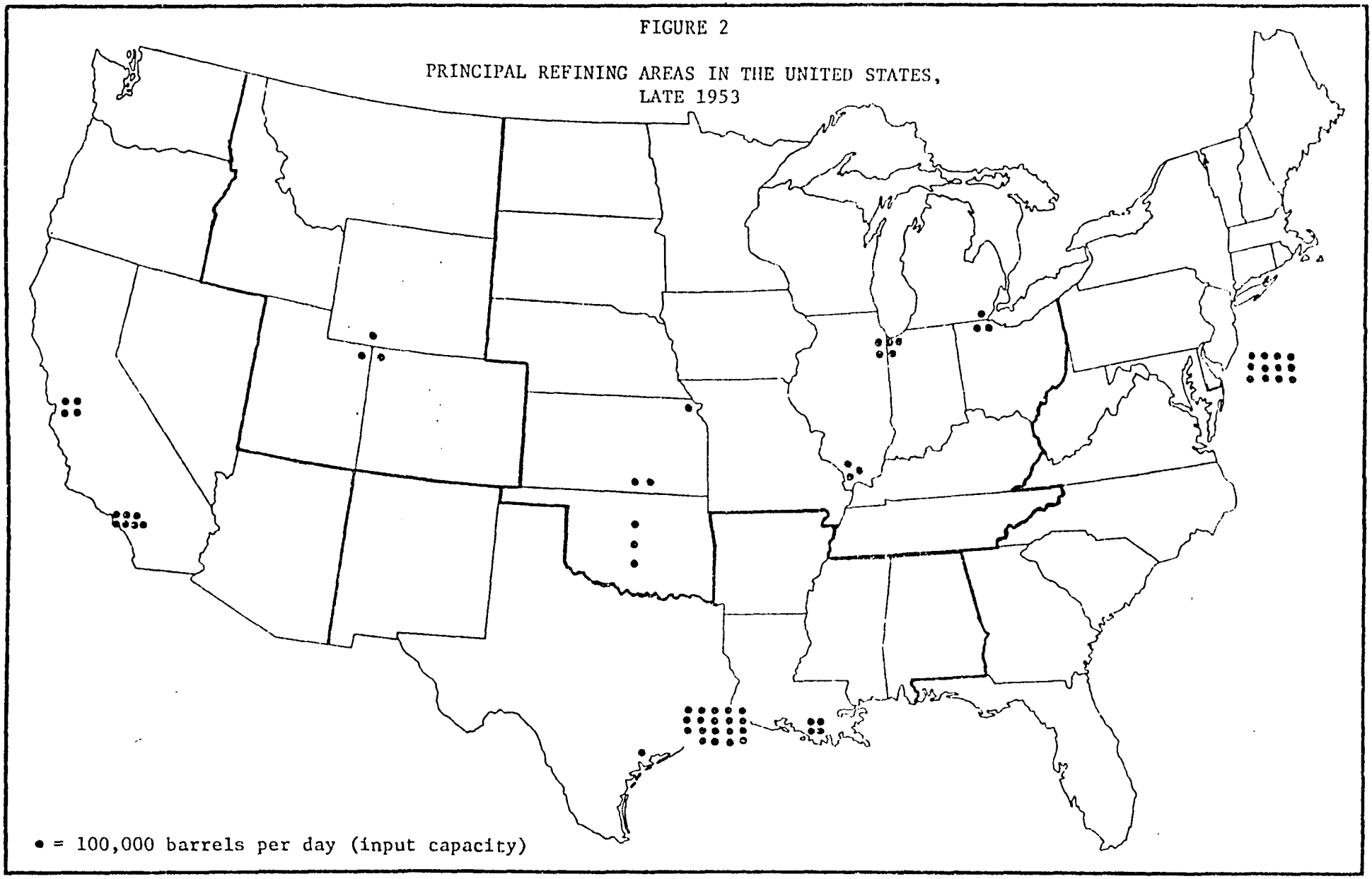
SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States," annual.

[1]Operating crude oil throughput capacity as of January 1 of each year, excluding Puerto Rico.

[2]Percentages may not equal one hundred due to rounding.

FIGURE 2

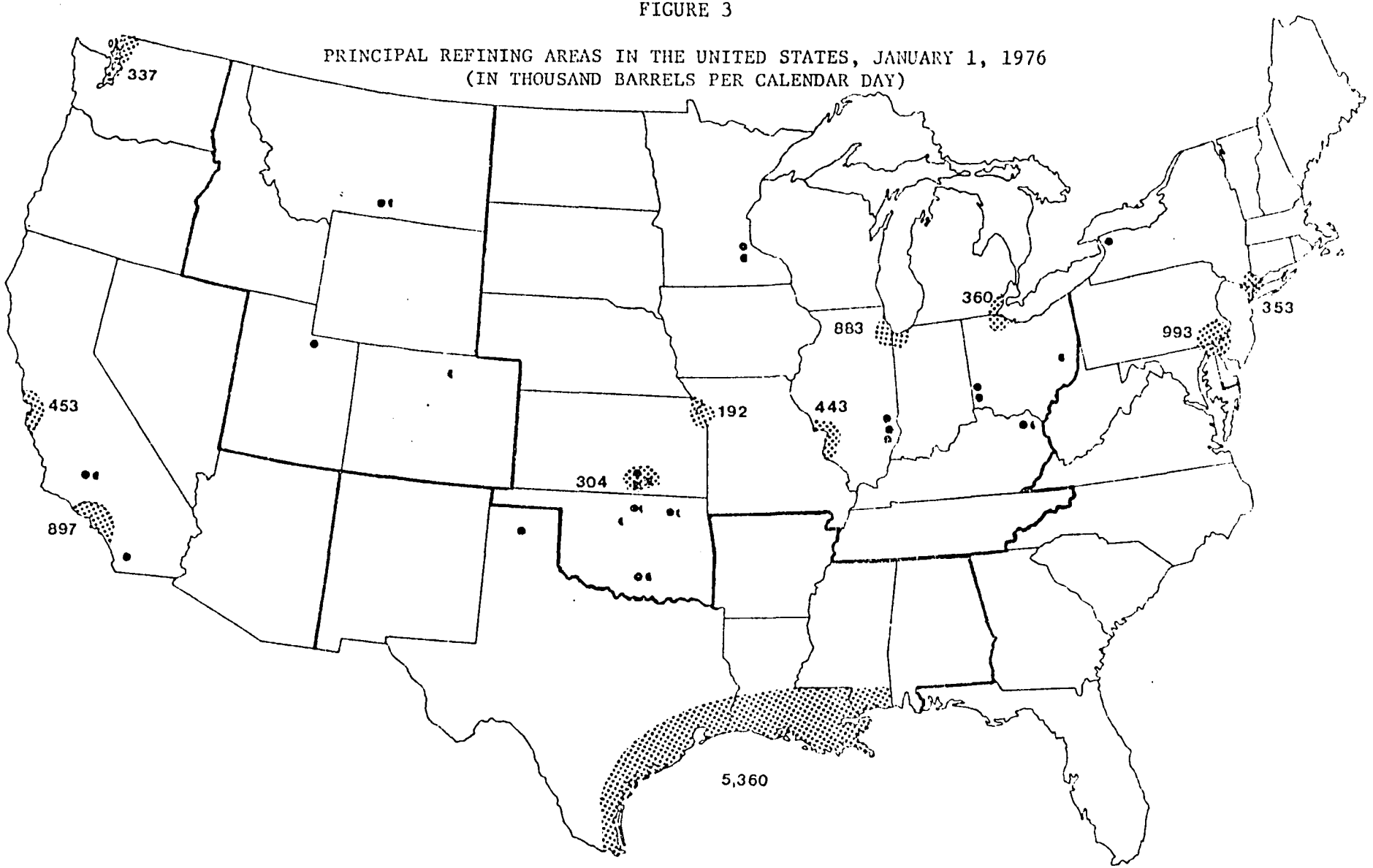
PRINCIPAL REFINING AREAS IN THE UNITED STATES,
LATE 1953



SOURCE: Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition in The Oil Industry (Cambridge: Harvard University Press, 1955), p. 47.

FIGURE 3

PRINCIPAL REFINING AREAS IN THE UNITED STATES, JANUARY 1, 1976
(IN THOUSAND BARRELS PER CALENDAR DAY)



SOURCE: U.S., Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in The United States and Puerto Rico, January 1, 1976," p. 3.

of the total capacity. The principal refining centers in the United States are defined in Figure 2 for 1950, and Figure 3 for 1975. As the Figures indicate little change has occurred over the period. The major centers are still located near ocean ports. The greatest concentration is found on the Gulf Coast of Texas and Louisiana, with 36 percent of the total capacity in 1975. The seven coastal centers (two on the East Coast, three on the West Coast, and two on the Gulf of Mexico), had a total capacity of slightly over 8.4 million b/d and represented 56 percent of the total operating capacity as of January, 1976.

The Demand for Petroleum Transportation Services: Summary

The examination of the intermediate and final goods markets have identified the demand for crude and refined product transportation services in both quantity and geographic terms. Before examining the transport modes which have supplied these services, the findings of this chapter are summarized.

Table 1 showed the growth in the supply of crude petroleum and the rapid increase in imports. It also defined the physical magnitude of the transportation required to move crude oil from producing areas to refineries. In 1950, 2.1 billion barrels of crude oil were shipped to refineries. In 1975, 4.6 billion barrels were shipped to refineries. Converted to short tons, 317.5 million tons were transported in 1950. In 1975, 683 million tons of crude oil were moved to refineries. Table 6 showed that there was rapid growth in the demand for products and therefore rapid growth in the demand for refined product transportation. In 1950, 2.4 billion barrels of petroleum products were moved by some

transport mode to the ultimate consumer. By 1975, nearly 6 billion barrels were shipped to consumers.

In 1975 the petroleum transportation system in the United States was moving, on average, 12.5 million barrels of crude to refineries each day and 16.3 million barrels of petroleum products were moving to consumer markets. Combined, nearly 29 million barrels a day were being moved by the transportation system.

The complexity of the transportation system has been amplified by the large disparity between the geographic location of crude production, refineries, and final consumer markets. The geographic disparity and resulting complexity is not a recent development. It has existed at least since 1950. It has, after a long period of relative stability, become more pronounced in the 1970's as domestic production has declined and imports of crude and refined products have risen sharply.

The location of crude production in remote areas removed from population concentrations is an accident of nature. The concentration of refineries in certain areas is, on the other hand, a function of presumably rational decisions of petroleum company executives. The concentration of crude production and refineries in some parts of the United States, and not others, is an important variable in the analysis to follow. It is also relevant to an understanding of the energy problems confronted in the United States today.

The supply and demand disparity in the intermediate market is summarized in Table 12 for the year 1975. The supply and demand disparity in the final goods market is summarized in Table 13 for the same year. Although the data are for 1975, they represent a pattern that has

TABLE 11

PERCENT DISTRIBUTION OF TOTAL UNITED STATES OPERATING REFINERY CAPACITY, SELECTED AREAS, SELECTED YEARS, 1950-1976[1]

Year	Texas		California	Louisiana Gulf Coast	Illinois and Indiana	New Jersey and Pennsylvania	Kansas and Oklahoma	All Other
	Total	Gulf Coast						
1950	29.0	23.2	17.3	7.3	12.4	14.5	8.5	11.0
1955	28.3	23.8	15.3	7.9	11.8	12.5	7.8	16.4
1957	27.4	23.8	14.3	8.3	11.6	11.8	7.9	18.7
1960	26.7	22.9	13.7	8.0	11.3	12.1	7.7	20.5
1965	26.9	23.2	13.3	9.2	11.2	11.0	7.4	21.0
1970	27.2	23.8	13.7	11.6	10.9	9.7	7.2	19.7
1973	26.2	22.9	13.0	13.4	11.8	9.2	6.3	20.1
1974	26.7	23.3	12.5	13.3	12.0	9.2	6.3	20.0
1975	26.9	23.5	12.8	13.2	11.8	8.4	6.5	20.4
1976	26.1	22.5	12.2	13.5	11.8	8.7	6.7	21.0

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States," annual.

[1]Operating crude oil throughput capacity as of January 1 of each year; excluding Puerto Rico.

TABLE 12

DOMESTIC REFINERY DEMAND AND SOURCES OF SUPPLY,
UNITED STATES AND BY PAD, 1975
(MILLIONS OF BARRELS)

	Total	PAD Districts[3]				
		I	II	III	IV	V
Crude Inputs to Domestic Refineries	4,541.4	513.8	1,245.6	1,919.8	155.4	706.8
Sources of Crude Inputs:						
Domestic Production	3,052.0	49.1	324.5	2,048.1	237.6	392.7
Net Imports	1,496.0	451.5	282.7	434.9	16.1	310.8
Net Receipts from other PAD's[1]	---	12.9	619.6	(537.3)	(109.1)	13.9
Ratio:[2]						
Domestic Production/ Refinery Input (Percent)	67.2	9.6	26.1	106.7	152.9	55.6
Net Imports/ Refinery Input	32.8	87.9	22.7	22.7	10.4	44.0
Net Receipts/ Refinery Inputs	---	2.5	49.7	(28.0)	(70.2)	2.0

SOURCE: Calculated from data published by the U.S. Bureau of Mines in Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Liquids: 1975," February, 1977.

[1]Net receipts may also include foreign crude.

[2]Input sources may not add to refinery inputs because of changes in stock during the year along with minor discrepancies in data reported by Bureau of Mines.

[3]Data in parentheses indicate shipments to other PAD's exceed incoming shipments.

TABLE 13

DOMESTIC DEMAND FOR REFINED PRODUCTS AND SOURCES OF SUPPLY,
UNITED STATES AND BY PAD, 1975
(MILLIONS OF BARRELS)

	Total	PAD DISTRICTS[4] I	II	III	IV	V
Domestic Demand, Refined Products[1]	5,957.5	2,206.8	1,557.3	841.5	167.4	809.1
Sources:						
Domestic Refinery Output[2]	4,995.5	560.1	1,359.4	2,141.0	175.8	758.6
Net Imports	586.6	561.0	29.7	(19.4)	5.7	9.6
Net Receipts from Other PAD's[3]	---	1,085.7	168.2	(1,280.7)	(14.1)	40.9
Ratio:						
Refinery Output/ Domestic Demand (Percent)	83.9	25.4	87.3	254.5	105.0	93.8
Net Imports/ Domestic Demand	9.8	25.4	1.9	(2.3)	3.4	1.2
Net Receipts/ Domestic Demand	---	49.2	10.8	(152.9)	(8.4)	5.0

SOURCE: Calculated from data published by the U.S. Bureau of Mines in Mineral Industry Surveys, "Crude Production, Petroleum Products, and Natural Gas Liquids: 1975," February, 1977.

[1]Consistent consumption data for the five PAD's were not available to this writer. Domestic demand was therefore assumed to equal refinery output plus net imports and net receipts. This understates actual consumption.

(Continued)

TABLE 13 CONTINUED

[2]Excludes liquefied gases and miscellaneous products not shown by Bureau of Mines as refinery outputs.

[3]Net receipts are the sum of net movement by tanker and barge plus net movement on Ohio River and Great Lakes, plus net movement by pipelines. The use of this method allows for only an approximation of net receipts by PAD.

[4]Data in parentheses indicate outbound shipments exceed inbound shipments.

largely existed over the past quarter century. Tables 12 and 13, in addition, summarize the transportation services demanded within geographic areas as well as interdistrict demand. Using this data along with information already presented, conditions in each PAD are summarized.

PAD I: East Coast

The East Coast of the United States has been and is nearly completely dependent upon outside sources for both crude oil and refined products. Since 1950 it has never produced more than 1.6 percent of the U.S. production, and in 1975 produced only 9.6 percent of its refinery inputs. Since 1960 foreign crude imports to this PAD have, however, declined from 66 percent of the U.S. total to only 30 percent in 1975. Relative refinery capacity has shifted to the Gulf Coast, Venezuela, the Caribbean, and Central America. PAD I is the largest consumer market, consuming 37 percent of the U.S. total in 1975. In relative terms, refinery inputs declined from 16.7 percent of the U.S. total in 1950 to 11.3 percent in 1976. Refinery output in PAD I was only 25.4 percent of total PAD demand in 1975. The physical location of major refinery centers remained the same as in 1953. Since 1960, PAD I has imported from 89-86 percent of total imported foreign products. Given the dependency of the PAD, low cost transportation is essential. Transportation has shifted somewhat from crude to refined products and away from coastal tanker movement from PAD III to I (relatively) and to greater international tanker movement.

PAD II: Mid-Continent Region

The Mid-Continent Region experienced the most dramatic decline

as an independent region. Unlike PAD I, PAD II has historically been a major domestic producing region. In relative terms, PAD II declined from 19 percent of U.S. production in 1950 to 10.6 percent in 1975. It has in recent years experienced an absolute decline. Canadian crude has been the major source of foreign crude. The announced curtailment by Canada will amplify this PAD's transportation problems. PAD III has been the principal region from which non-Canadian crude is imported. PAD II has maintained its refinery capacity at approximately 27-28 percent of the U.S. total and has become the major crude oil importing region (combining foreign and inter PAD imports). Refinery centers have not experienced major shifts in the past 25 years. PAD II is the largest geographic market and second largest consumer market. Some 88 percent of the refined products consumed in the region are from its own refineries. The growing dependency of the PAD has precipitated transportation shifts since at least 1970 and this has generated major pipeline construction.

PAD III: Southwest

The Southwest Region has historically been the major producing, refining, and inter-PAD exporter. Louisiana has grown in relative importance as a producer while Texas experienced only a marginal decline. Refinery capacity increased from 36 percent of the U.S. in 1950 to 42 percent in 1976. The increase in refinery capacity combined with increased PAD II demands has made PAD III the second largest importer of foreign crude. PAD III will become the major importer of foreign crude.

PAD IV: Mountain States

PAD IV, like III, is self-sufficient in production and refining.

Largely land locked, it has not been nor is it likely to be a major importing area. Although the region has been growing in relative importance as a producing area, it is removed from principal consuming and refining markets necessitating long distance transportation. Its principal export market is PAD II followed by PAD V.

PAD V: West Coast

Historically, PAD V has depended upon production and refining within the District and has been a separate and distinct market from the rest of the United States. PAD V remains a segregated market and is a major importer of crude oil (principally from foreign countries with a small amount coming from PAD IV). PAD V, because of Alaskan reserves, will become crude self-sufficient by 1980. It has historically been refinery self-sufficient. Only 1.2 percent of its demand was supplied by foreign refined products. The Alaskan production will exceed projected future demand in PAD V and the district will, like PAD III, become a net exporter to other parts of the United States. These developments have set in motion a debate as to the means of transporting the excess.

[1]Supra, n. 6, p. 13.

[2]John M. Blair, The Control of Oil (New York: Pantheon Books, 1976), p. 77.

[3]In this and succeeding chapters, the geographic markets (larger than state) are those defined and published by the U.S. Bureau of Mines. While the Federal Energy Administration (now the Department of Energy) and others have used differing delineations, the Bureau of Mines offers consistent boundaries for historical comparisons.

[4]The Tulsa Tribune, May 4, 1977, p. 10F.

[5]U.S., Federal Energy Administration, Initial Report on Oil and Gas Reserves and Productive Capacity, (June, 1975), p. 91.

[6]U.S., Department of Commerce, Bureau of The Census, Current Population Reports: Population Estimates and Projections, Series P-25, No. 646 (Washington, D.C.: Government Printing Office, February, 1977).

[7]Imports from Canada come into the United States by pipeline. The announced phased curtailment of Canadian exports will cause considerable change in the direction of flow of crude into PAD II (Business Week, February 10, 1975, p. 46). While the decline in PAD II production increased pipeline construction designed to ship foreign crude from the Gulf, the Canadian announcements and the Alaska surplus have, since 1975, spawn a group of alternative pipeline routes, most of which are still on the drawing board.

[8]The oil embargo, other OPEC activities, and decisions of the major international oil companies have altered the historical patterns. One sign of this is the decline in imports from Canada and Venezuela. Another is the sudden rise in imports from Africa, accounting for nearly 33 percent of the total in 1975. OPEC members supplied 78 percent of the U.S. crude imports in 1975 (see U.S., Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids," Final Summary: 1975 (February 24, 1977), p. 27.

[9]The type of refined product consumed and its percent of total is important to this study because not all products can be shipped by pipeline. Since the early 1950's it has been common practice to "batch" some refined products on the same line (such as gasoline, kerosene, and jet fuel). Other products such as LPG, heavy fuel oils, and asphalt present special technological problems as does the batching of crude oil with refined products. Since the mid-seventies advances have been made in batching but as a general rule crude oil, LPG, heavy fuel oil batching with the major products have been minor occurrences.

[10]Bureau of Mines, Final Summary: 1975, p. 27.

[11]The Venezuela decline may be the result of that country's nationalization of foreign companies. Unlike crude imports (78% coming from OPEC members) only 20.4 percent of the 672 million barrels of refined product imports in 1975 came from OPEC members.

[12]Compiled from Bureau of Mines, Annual Summaries, 1957-75.

[13]Blair, Control of Oil, pp. 131-136.

[14]Blair was referring to the major companies (Ibid., p. 131). An initial investment of this magnitude is the major entry barrier for the smaller or new company (see Bain, Industrial Organization, pp. 245-247 and 255-269).

[15]Blair, p. 132. The industry viewpoint is opposite that of Blair. For other reasons for not expanding see Business Week, September 12, 1977, p. 69-72.

[16]See the International Petroleum Encyclopedia: 1974 (Tulsa: Petroleum Publishing Company) pp. 140, 168-169.

[17]Ibid.; also a factor is the offshore capacity of U.S. owned refineries (in Central America and the Caribbean) which is "sour crude" and fuel oil oriented.

[18]Cookenboo, Crude Oil Pipelines and Competition In The Oil Industry, pp. 41-55.

[19]Cookenboo found that only 11.6 percent of the majors' capacity was crude oriented while 43.4 percent of the independents' refinery capacity was crude oriented (Ibid.). The location of independents' refineries reduced their need for crude trunk lines as well as placing their refineries in competition with the larger companies' crude pipelines and also increased the risk associated with declining production and competition from refined product pipelines.

[20]According to Blair this has increased refinery concentration and refinery entry barriers (Blair, The Control of Oil, pp. 131-136). The two trends also increased the transportation requirements.

[21]Cookenboo, pp. 58-59, 64.

[22]Blair, p. 131.

[23]As of January 1, 1976, the top twenty companies (ranked in terms of total capacity) owned 127 refineries, 83.2 percent of total capacity, and had an average refinery capacity of 101,104 b/d. The remaining 126 companies (in the 50 states) owned 160 refineries, 16.8 percent of total capacity, and had an average refinery capacity of 16,000 b/d (all data calculated from Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico, January 1, 1976" (July 14, 1976), pp. 1-17.).

CHAPTER IV

THE PETROLEUM TRANSPORTATION SYSTEM

> The extent to which transportation, both in its quantitative and its qualitative aspects, has been of paramount importance in developing and shaping large sectors of contemporary economic society is enormous.[1]

Petroleum transportation constitutes a major part of the broader transportation system in which it falls. Pipelines alone moved 510 billion ton-miles of intercity freight in 1975. As Table 14 illustrates, this was nearly 25 percent of all intercity freight moved. Pipelines were second only to railroads in that year. The petroleum tonnage moved intercity in 1975 is understated because railroads, motor carriers, and water carriers also transport petroleum.

The principal means by which crude and refined products are transported are examined in this chapter. Pipelines are established as the dominant transport mode. The reasons behind this development and the complementary nature of the other modes are outlined. The growth in pipeline mileage is examined, as is the geographic distribution of this mileage.

Transportation of Crude Oil[2]

The movement of crude oil to refinery begins at the site of the

TABLE 14

TOTAL TON-MILES OF INTERCITY FREIGHT TRANSPORTED IN THE UNITED STATES AND PERCENT DISTRIBUTION AMONG FREIGHT CARRIERS, SELECTED YEARS, 1940-1975

Year	Total Ton-Miles (Billions)	Percent Distribution[1]				
		Railroads	Motor Carriers	Inland Waterways	Pipelines (Oil)	Airways
1940	618	61.3	10.0	19.1	9.6	---
1945	1,027	67.3	6.5	13.9	12.3	0.01
1950	1,062	56.2	16.3	15.4	12.2	0.03
1955	1,274	49.5	17.5	17.0	15.9	0.04
1960	1,314	44.1	21.7	16.8	17.4	0.06
1965	1,638	43.2	21.9	16.0	18.7	0.12
1967	1,764	41.4	22.0	16.0	20.5	0.15
1968	1,838	41.2	21.6	15.9	21.3	0.16
1969	1,895	40.8	21.3	16.0	21.7	0.17
1970	1,932	39.7	21.3	16.5	22.3	0.18
1971	1,931	38.4	22.3	15.9	23.2	0.19
1972	2,052	38.1	22.9	16.1	22.8	0.19
1973	2,216	38.8	22.8	15.4	22.9	0.19
1974	2,219	38.8	22.3	16.0	22.8	0.18
1975	2.070	36.8	21.3	17.1	24.6	0.19

SOURCE: Data for 1940-73 from James T. Kneafsey, Transportation Economic Analysis (Lexington, Mass.: D.C. Heath and Company, 1975), p. 118; data for 1974-75 from Energy Research and Development Administration, Transportation Energy Conservation Data Book. Washington, D.C.: Government Printing Office, Edition I.5, p. 16.

[1]Percentage may not equal one hundred due to rounding.

oil well. Small flow lines carry oil from the wellhead to small volume storage tanks. These lease tanks accumulate the production of contiguous wells and usually have the capacity to hold several days' production. The tanks not only accumulate crude for quantity shipment but are also used to remove water sediment and gas from the crude. At intervals the tanks are gauged to determine the amount of impurities still present in the oil. Once the tanks have the quantity and quality necessary, valves connecting the lease tanks with gathering lines are opened.

Gathering lines are normally larger than flow lines and connect adjacent fields or parts of a large field with field storage tanks. Field storage tanks are also connected to lease tanks by tank trucks. The field tanks, like lease tanks, accumulate sufficient quantity and quality of crude which are then shipped via trunk lines to refineries. In today's new fields or marginal fields, gathering operations are more likely performed by tank trucks. In new offshore areas, the gathering operation is performed initially by barge.[3]

In some instances crude oil of a specific gravity or sulfur content are accumulated to ship in a separate run with a minimum of intermingling with preceding and succeeding runs. As a general rule most trunk line movement of crude is by "common stream." This method in many cases eliminates the time delays and shippers may draw specified quantities immediately from the common flow.[4]

As indicated, small diameter flow lines are used to accumulate sufficient quantities from many wells. It is only at the gathering stage and trunk line stage that truck, railroads, barges, and ocean tankers may be considered competing modes. They are theoretically competitive

only under ideal geographic conditions. In actual practice the alternative transporting modes are more likely to be complementary or noncompeting. A case in point is foreign crude petroleum imports which are shipped by the only means available, the ocean-going tanker. Once reaching port, the transportation is completed by pipeline or barge. Another example is that of inland and coastal barge movement which is limited to only certain segments of the United States. Pipelines will deliver to the inland ports for movement to refineries.

Pipelines have been the dominant mode for moving crude oil from domestic producing areas to domestic refineries since before World War II (see Table 15). They are the principal means of shipping Canadian crude into United States; shipping crude to ports for coastal movement (particularly when crude moves from PAD III to PAD I); and for moving foreign crude from United States ports-of-entry to refineries. Water carriers are second in relative importance. Waterway carriers' share of the market was in the 16-19 percent range until 1973 when because of imports, they carried 25.9 percent of the crude tonnage. Railroads, excluding the war years, have not been an important carrier of crude. Trucks have maintained a fairly constant 6.5-7.0 percent because of their increased gathering function in marginal fields.[5]

The data in Table 15, prepared by the Association of Oil Pipe Lines, is of limited use in comparing the relative importance of the modes since it uses tons carried and not ton-miles. For example, one ton of crude oil carried by each of the four modes results in a distribution of 25 percent for each. In an extreme case it could have gone 400 miles by pipeline and 50 miles by the remaining three. Using

TABLE 15

TOTAL RECEIPTS OF CRUDE OIL AT DOMESTIC REFINERIES, AND PERCENT OF TOTAL CARRIED BY EACH MODE OF TRANSPORTATION, SELECTED YEARS, 1941-75

Year	Total Tons Carried (Million tons)	Method of Transportation As A Percent of Total[3]			
		Pipelines	Water Carriers[1]	Trucks[2]	Railroads
1941	212.8	73.4	21.7	1.4	3.4
1950	318.3	72.6	21.2	4.7	1.4
1956	421.7	77.7	16.0	5.8	0.5
1957	421.4	76.0	17.6	5.9	0.5
1958	402.2	76.3	16.9	6.4	0.3
1959	429.7	76.2	17.0	6.4	0.4
1960	432.3	76.0	17.1	6.4	0.4
1961	441.8	75.4	17.7	6.4	0.5
1962	452.0	74.9	17.9	6.8	0.4
1963	468.1	75.2	17.8	6.9	0.2
1964	479.4	75.6	16.7	7.5	0.3
1965	489.9	74.9	16.8	8.1	0.2
1966	518.6	74.1	17.9	7.7	0.2
1967	549.6	73.6	18.8	7.4	0.2
1968	574.8	74.1	18.6	7.1	0.2
1969	592,9	74.4	18.5	6.9	0.2
1970	615.3	74.3	18.9	6.6	0.1
1971	616.3	74.6	18.6	6.6	0.1
1973	680.6	73.0	25.9	NA	NA
1975	681.2	67.4	31.0	NA	NA

SOURCE: Data for 1941-1971 from Association of Oil Pipe Lines, Washington, D.C.; data for 1973 and 1975 estimated by author.

[1]Includes ocean tankers and inland barges.

[2]Estimated by Association of Oil Pipe Lines.

[3]Percentage may not equal one hundred due to rounding.

[4]NA - Not Available

this logic, it is likely that the importance of pipelines and more recently water carriers are understated.

Pipelines are the major transportation mode for several reasons. Among these are: (1) crude oil is low in value relative to its weight and requires rapid transportation of large quantities; pipeline offers the lowest unit cost for large quantity and distance (as later sections on cost comparisons and technical economies of scale will show); (2) tied to (1) is the fact that there is no "back haul" problem associated with pipelines; (3) pipelines, particularly the newer and fully automated and computerized systems, produce a more or less constant flow which is essential to efficient refinery operation (where the height of the fixed costs require a certain level of operation below which costs/losses grow dramatically as output declines); and (4) pipelines have historically served more than just a transporting function to integrated companies (Integrated companies, as Chapter VI shows, are the principal owners of pipelines.).[6]

Transportation of Refined Products

The transportation of refined products presents the opposite problem of crude oil in several respects. In the first place, while crude oil is, initially accumulated in small quantity from many wells for ultimate large shipment to refineries, refined products are processed in large quantities and must be dispersed in smaller quantities along routes to final consumers. Refineries do not normally have storage facilities for more than a few days of output and must daily move large quantities.[7]

A second major difference is that refined products, unlike crude

oil which can be shipped in a "mixed stream" (i.e., treated as a homogeneous), are heterogeneous and must be treated as such in shipping. A third problem is that the physical means for carrying crude are not immediately available to ship refined products. For example, a tank truck, a pipeline, ocean tanker, or barge which unloads a shipment of crude must undergo extensive cleaning (time consuming and costly) before it can carry refined products without contamination.[8]

Table 16 presents data on tons of refined products carried over the 1941-73 period, along with the modes used. The data in this table is also limited because it also uses tons carried rather than ton-miles. Nevertheless, it does illustrate the relative growth in the use of pipelines and trucks and the diminishing importance of water carriers and railroads, particularly railroads.

Shipment by pipeline has shown the greatest increase. At least 32 percent of the major product movement is by cross country truck lines. Their importance, in distance terms, is clearly understated for they are the principal means of mass shipment to primary terminals. Trucks, smaller pipelines, and barges deliver products from primary terminals either directly to markets or to secondary terminals.[9]

Tank trucks are of importance because of their role as local distributors. Trucks have the principal hauling responsibility within cities and for relatively short and small quantity hauls. Rail movement has diminished for the most part since 1950. It appears to have stabilized at less than 3 percent. Rail movement is now normally limited to movement into remote areas served only by truck.[10] The relative stability in water carrier shipments in the range of 27 percent since 1966 is

TABLE 16

TOTAL REFINED PRODUCTS CARRIED IN DOMESTIC COMMERCE AND PERCENT OF TOTAL CARRIED BY EACH MODE OF TRANSPORTATION, 1941-73

Year	Total Tons Carried (Million tons)	Method of Transportation as a Percent of Total[3]			
		Pipelines	Water Carriers[1]	Trucks[2]	Railroads
1941	208.3	6.9	51.0	12.4	29.8
1950	413.0	12.7	44.8	31.7	10.7
1956	593.3	19.1	38.8	35.7	6.3
1957	598.5	20.2	37.7	36.3	5.8
1958	615.0	20.5	37.5	36.8	5.2
1959	644.6	21.2	36.8	37.1	4.9
1960	656.8	21.3	37.2	36.9	4.6
1961	668.6	22.6	36.5	36.7	4.2
1962	706.7	23.2	35.2	37.8	3.8
1963	727.9	23.2	34.7	38.5	3.6
1964	776.5	25.4	31.1	40.1	3.4
1965	832.9	26.5	29.0	41.5	3.0
1966	886.8	27.6	27.1	42.5	2.8
1967	938.8	29.2	26.3	41.9	2.6
1968	988.6	30.4	25.7	41.3	2.5
1969	1,029.8	30.9	26.1	40.5	2.5
1970	1,070.5	31.1	26.7	39.7	2.4
1971	1,103.6	31.4	27.4	39.0	2.2
1973	1,318.5	31.8	25.1	41.0	2.1

SOURCE: Data for 1941-1971 from Association of Oil Pipe Lines, Washington, D.C.; data for 1973 from Energy Research and Development Administration, Transportation Energy Conservation Data Book. Washington D.C.: Government Printing Office, Edition I.5, p. 20.

[1]Includes ocean tankers and inland barges.

[2]Estimated by the Association of Oil Pipe Lines.

[3]Percentage may not equal one hundred due to rounding.

attributed largely to the rise in imports. Their importance will continue to rise as imports increase.

Pipelines have historically only carried light petroleum products (gasoline, jet fuel, kerosene, and distillant fuel oils) and liquefied petroleum gases (LPG). These products, as Table 7 indicates, constitute the majority of products consumed in the United States.

Pipelines, during the 1957-1975 period, have been segmented into refined product, crude and LPG carriers. Normally a pipeline system will ship "batches" of gasoline, jet fuel, fuel oil, etc., but will not batch LPG on the same line. Recently, however, pipelines have successfully "batched" shipments of refined products, LPG and crude along the same pipeline with minimum contamination problems.[11] The traditional practice, however, has been shipments via separate systems.

Intermodel Competition: Cost Comparisons

Transportation cost comparisons between the alternative modes are tenuous at best. As illustrated, the various modes have, historically, been more complementary than competitive. Nevertheless, intermodel cost comparisons are useful for they established, in general terms, what additional costs are incurred when an owner of crude or refined products must, for whatever reason, shift from one mode to another.

Transportation costs vary according to the quantity to be shipped, length of haul, and terrain/spatial area to be traversed. A precise specification of these conditions would automatically eliminate one or more of the modes from the analysis. Under *ceteris paribus* conditions, however, pipelines offer the lowest per barrel mile costs of any of the

modes. The only alternative mode that approaches the per barrel mile costs is the ocean tanker (see Tables 17 and 18).

Ocean tankers have limited relevance to the domestic transportation market. The major exception is movements from PAD III to PAD I and coastal movements on the West and Gulf Coast. In crude movement between III and I, ocean carriers have historically been a non-competing mode because no crude pipelines cross into I from III. Ocean carriers compete with pipelines in the movement of refined products primarily between PAD III and PAD I. Large super tankers, which offer the lowest per unit costs, however, have largely been excluded from the U.S. market because there are no ports or deep-sea terminals which can service these carriers.[12]

Several studies have presented cost comparisons of the alternative modes. Post World War II comparisons are most relevant for our purposes. Tables 17 to 19 present the available data on transportation costs by mode. Tables 17 and 18 represent a synthesis of several sources of cost information. The data in the tables support a thesis, accepted in the petroleum industry, that pipelines offer the lowest average and marginal costs. Tankers approach these costs but tank truck and railroad tank cars do not. Tank truck and tank cars, according to Table 17, have similar costs which suggest that they are competitive. The data on transportation method actually used, however, indicated that railroads are relatively insignificant.

Table 17 indicates similar costs for barges and pipelines. Barges are fairly limited in the regions of the United States that they can service. The table also indicates that an average barge had a

TABLE 17

COMPARISON OF ENERGY TRANSPORTATION COSTS

Mode	Capacity[1]	Costs	
		Cents Per Ton Mile[2]	Cents/Million BTU/ 100 Miles[1]
Pipeline			
Gas	1000-1500 MMscfd.	-	1.5-2.0
LNG	500-1500 MMscfd.	-	1.5-3.0
Oil	300-1200 Thousand barrels/day	0.17-0.60	0.3-0.8
Barges	12,000 barrels[3]	0.15-0.60	-
Tanker-oil	100-300 thousand deadweight tons	-	0.5
Tank Trucks	100-130 barrels[3]	3-5	-
Rail Tank Cars	12,000 barrels[3]	2-7	-

[1]Unless noted otherwise data on capacity and costs for million BTU is from U.S. House of Representatives, Energy Facts prepared for the Subcommittee on Energy of the Committee on Science and Astronautics, 93rd Congress, 1st Session, Committee Print, Washington, D.C.: U.S. Government Printing Office, 1973.

[2]Data on costs per ton-mile from Organization for Economic Cooperation and Development, Special Committee for Oil, Pipelines in the United States and Europe and their Legal and Regulatory Aspects. Paris, France, 1969.

[3]Data on capacity for barges, tank trucks, and rail tank cars calculated from U.S. National Petroleum Council, U.S. Petroleum and Gas Transportation Capacities: 1967, Washington: National Petroleum Council, 1967.

TABLE 18

TRANSPORTATION COST COMPARISONS,
SELECTED MODES AND AREAS,
1952 AND 1971
(dollars per barrel)

	Pipeline	Tanker	Railroad
1952			
Crude Oil			
Scurry County, Texas/			
New Jersey	$0.780	0.655	2.83
Chicago	0.425	--	1.40
Toledo	0.558	--	2.33
Houston	0.255	--	1.29
Gasoline			
Houston/			
Lynchburg, VA	1.12	1.05	3.18
Pittsburg	0.40	0.66	3.15
1971			
Gasoline			
Port Arthur/			
New York	0.29	0.33	--

SOURCE: Data for 1952 from John G. McLean and Robert Wm. Haigh, The Growth of Integrated Oil Companies, Norwood, Massachusetts: Plimpton Press, 1954; data for 1971 from U.S. House of Representatives, Anti-Competitive Impact of Oil Company Ownership of Petroleum Product Pipelines, Hearings before the Subcommittee on Special Business Problems of the Select Committee on Small Business, 92nd Congress, 2nd Session, Washington, D.C.: U.S. Government Printing Office, 1972.

TABLE 19

AVERAGE REVENUE PER TON-MILE FOR SELECTED COMMON CARRIERS, SELECTED YEARS, 1950-1970
(cents per ton mile)

Year	Rail (Class I)	Truck (Class I)	Oil Pipelines
1950	1.33	5.01	0.31
1955	1.37	5.80	0.32
1960	1.40	6.31	0.31
1965	1.27	6.46	0.28
1970	1.43	7.50	0.27

SOURCE: TAA, Transportation Facts and Trends, Ninth edition, July, 1972, p. 8.

capacity of approximately 12,000 barrels in 1967. Its carrying capacity compared to demand is thus quite limited (as are trunks and rail cars). Movement of petroleum oils by barge is also much less dependable because barges are affected by weather conditions and seasons of the year.[13]

Table 19 compares average revenues per ton-mile for selected years, 1950-1970, for rail, truck, and pipeline. While the data is not strictly comparable, it does indicate as did Tables 17 and 18 the substantial price differences between the three modes. Pipelines are unmistakably the lowest cost means of transportation over land. They are, when combined with the lack of weather restrictions, superior to barges. In addition, large diameter lines can, as indicated in Table 18, effectively compete with ocean tankers for movement of refined products between PAD III and PAD I. This as Chapter III noted is a significant market.

While the cost data is dated and fragmented, it does represent an industry concensus. Table 20, based on data published by the Interstate Commerce Commission for regulated carriers, traces the historical trend in average revenue and costs per barrel delivered out of the system as well as per barrel mile. While unadjusted for price changes (inflation), the average revenue and cost data summarizes the difficulties facing other modes in attempting to compete with a mode which demonstrates a downward sloping average cost curve. This data also emphasizes that the modes used in the petroleum transportation system generally complement each other.

Growth in Pipeline Mileage

There are three types of petroleum pipelines: (1) crude oil

TABLE 20

SELECTED PHYSICAL AND FINANCIAL OPERATING RATIOS,
COMPANIES REPORTING TO THE ICC,
ANNUALLY, 1957-1975

Year	Average Miles Barrel Shipped		Average Revenue Per 1000 Barrel Miles[1]			Average Expense Per 1000 Barrel Miles[1]			Gross Income Per 1000 Barrel Miles[1]		
	Crude	Product	Total	Crude	Product	Total	Crude	Product	Total	Crude	Product
1957	256	298	0.62	-	-	0.33	-	-	0.29	-	-
1958	268	277	0.62	-	-	0.33	-	-	0.28	-	-
1959	272	269	0.61	-	-	0.32	-	-	0.28	-	-
1960	267	269	0.60	-	-	0.33	-	-	0.28	-	-
1961	268	264	0.60	-	-	0.32	-	-	0.28	-	-
1962	264	261	0.60	-	-	0.32	-	-	0.29	-	-
1963	270	260	0.59	-	-	0.31	-	-	0.28	-	-
1964	267	283	0.57	0.51	0.72	0.33	0.29	0.42	0.24	0.21	0.30
1965	280	337	0.52	0.48	0.59	0.29	0.28	0.32	0.22	0.20	0.27
1966	281	354	0.50	0.46	0.55	0.28	0.27	0.29	0.21	0.19	0.26
1967	270	397	0.47	0.46	0.48	0.26	0.27	0.25	0.20	0.18	0.23
1968	269	373	0.46	0.45	0.48	0.27	0.27	0.27	0.19	0.17	0.21
1969	263	367	0.48	0.46	0.49	0.28	0.28	0.27	0.20	0.18	0.22
1970	270	357	0.49	0.46	0.52	0.27	0.27	0.28	0.21	0.19	0.24
1971	271	363	0.50	0.47	0.55	0.29	0.27	0.31	0.22	0.19	0.25
1972	277	346	0.50	0.45	0.55	0.29	0.27	0.31	0.21	0.18	0.24
1973	283	338	0.50	0.45	0.57	0.29	0.27	0.33	0.21	0.18	0.25
1974	283	344	0.55	0.49	0.64	0.33	0.31	0.36	0.23	0.18	0.28
1975	272	364	0.65	0.60	0.71	0.36	0.34	0.38	0.29	0.26	0.33

SOURCE: Calculated from data published by the Interstate Commerce Commission in Transportation Statistics In The United States: Part 6, Pipelines (Washington, D.C.: Government Printing Office, Annual).

[1]For the years 1957-63, data was not published separately.

gathering lines; (2) crude oil trunk lines; and (3) product trunk lines. Product trunk lines are subdivided into (1) carriers of gasoline, kerosene, aviation fuels, fuel oils; and (2) "exclusive" carriers of liquefied petroleum products (LPG).[14]

The distinction between crude gathering and trunk lines has not been given a precise definition in pipeline literature. A gathering line, in functional terms, is vaguely defined as a pipeline which "connects the individual wells to the trunk lines." The Bureau of Mines and the Interstate Commerce Commission apparently allow reporting companies to define segments of crude lines according to each individual company's definition.

Pipelines are classified as either interstate or intrastate carriers. This dichotomy has importance for this study for interstate carriers are the focal point of this study's empirical analysis. Interstate carriers are also significant for they largely resolve the inter-district disparity in both the intermediate and final goods markets.[15]

Pipeline mileage data is compiled by the Bureau of Mines and by the Interstate Commerce Commission (ICC). The data published by the Bureau of Mines is compiled and published triennially. The data is generated partially by means of a questionnaire sent to all known inter- and intrastate owners of oil pipelines and from data prepared by the ICC. Data is provided on pipeline mileage in place as of January 1 of the anniversary date of the survey. Data is segmented by type of line (crude, product, and so forth), diameter, and location. Similar data is provided on pipelines constructed and removed during the three-year interval. The data represents net mileage in place but not necessarily

in operation.

The Interstate Commerce Commission mileage data comes from annual reports filed by interstate common carriers regulated by the Commission. The mileage reported to the Commission is operating mileage only and does not necessarily represent all mileage owned. Data is segmented by type and state as of December 31, of the reporting year. While diameter information is supplied by the carriers in their annual reports, the information is not published by the Commission.

From these two primary sources, mileage data has been compiled. The data allows comparisons of total mileage, by type and geographic market, in the interstate and intrastate pipeline markets. The data has limitations which prevent precise valuation of the importance of interstate versus intrastate pipelines.[16] They do, however, provide benchmarks for comparisons.[17]

Growth in Total Pipeline Mileage in Place in the United States: 1931-1974[18]

In 1931 the Bureau of Mines reported 111,660 miles of pipeline were in place in the United States. By 1974, the total had almost doubled, with 222,355 miles in place. Table 21 shows the mileage growth during the 43 year period. In 1931 nearly all the mileage was used to carry crude oil. By 1974, product pipelines mileage represented 34.6 percent of the total. The growth in product pipelines combined with increased use of large diameter pipe is the principal pipeline development of the post World War II period.

Crude trunk line mileage showed little net change from 1959 through the early 1970's. Construction activity has increased since

1971, and has largely centered on the new lines built to carry imported crude from the Gulf Coast to refineries in PAD II.

Gathering line mileage in place has been declining since 1965 after peaking at 77,041 miles. Since that time sc 7,700 miles of gathering lines have been removed. The decline in gathering lines has not been offset entirely by increases in diameter. In 1950 nearly 80 percent of the gathering lines in the United States had a diameter of 4 inches or less. In 1974, 75 percent of the mileage had similar diameters. Of the remaining 1974 mileage, 22 percent was between 6-8 inches and only 2.4 percent was over 10 inches. There has been a shift to larger lines, but only a marginal shift.

The decline in gathering line mileage indicates a decline in the role played by pipeline in this, the first phase of the transportation system. With the growth in marginal wells and depleting fields, tank trucks have assumed a growing significance as a gatherer of crude for delivery to field storage tanks and to small crude-oriented refineries.[19]

Crude trunk lines, after experiencing a decline of 1,558 miles between 1965 and 1968, has expanded both in mileage and average diameter. The diameter change is significant in that it accounts for the largest response to a substantial increase in the demand for crude transportation services. This is illustrated in Table 22. In 1950 the weighted mean diameter was 9.3 inches, in 1974 it had increased to nearly 12 inches.

From 1950 to 1974, product pipeline mileage increased in the United States by almost 56,000 miles [see Table 23]. This increase was nearly ten times the net change in crude trunk mileage. The growth in

TABLE 21

TOTAL PIPELINE MILEAGE IN PLACE IN THE UNITED STATES, SELECTED YEARS, 1931-1974

Year	Total Mileage	Crude Lines		Product Trunk Lines
		Gathering	Trunk	
1931	111,660	53,640	58,020	([1])
1941	127,351	53,170	65,180	9,001
1950	152,814	60,560	71,373	20,881
1956	188,540	73,526	78,594	36,420
1959	189,982	75,182	70,317	44,483
1962	200,543	76,988	70,355	53,200
1965	210,867	77,041	72,383	61,443
1968	209,478	74,124	70,825	64,529
1971	218,671	71,132	75,143	72,396
1974	222,355	69,266	76,250	76,839

SOURCE: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude-Oil and Refined-Products Pipeline Mileage in the United States," (Jan. 1, 1974), Triennial Survey.

[1]Included in Crude Trunk Mileage.

TABLE 22

PERCENT DISTRIBUTION OF CRUDE TRUNK LINE MILEAGE,
UNITED STATES, BY DIAMETER SIZE,
SELECTED YEARS, 1950-1974

Year	Total Mileage	Crude Trunk Lines by Size as a Percent of Total Crude Trunk Mileage[1]				
		2-6	8-12	14-20	22-30	32 and Over
1950	71,373	22.8	70.5	4.7	2.0	---
1953	75,228	21.2	66.4	8.4	3.9	---
1956	78,594	20.5	61.5	10.8	7.2	---
1959	70,317	18.5	58.4	15.4	6.9	---
1962	70,355	18.1	58.3	15.7	7.8	---
1965	72,383	17.7	58.1	16.3	7.6	0.2
1968	70,825	15.9	57.9	17.8	7.9	0.4
1971	75,143	17.4	54.8	17.7	8.1	1.9
1974	76,250	17.8	54.6	17.5	8.0	2.0

SOURCE: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys and Information Circulars, "Crude-Oil and Refined-Product Pipeline Mileage in the United States," (Triennial Surveys).

[1]Percentage may not equal one hundred due to rounding.

TABLE 23

PERCENT DISTRIBUTION OF PRODUCT TRUNK LINE MILEAGE
UNITED STATES, BY DIAMETER SIZE,
SELECTED YEARS, 1950-1974

Year	Total Mileage	Product Lines by Size as a Percent of Total Product Mileage[1]				
		2-6	8-12	14-20	22-30	32 and Over
1950	20,881	42.4	57.6	---	---	---
1953	27,236	33.8	62.0	3.9	---	---
1956	36,420	29.8	64.5	5.8	---	---
1959	44,483	29.1	61.3	9.3	0.3	---
1962	53,200	30.5	61.3	7.9	0.2	---
1965	61,443	29.0	60.2	8.0	0.5	2.2
1968	64,529	29.5	59.2	8.6	0.4	2.2
1971	72,396	27.9	61.0	8.1	1.1	1.9
1974	76,839	26.4	59.4	9.1	2.4	2.6

SOURCE: U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys and Information Circulars, "Crude-Oil and Refined-Products Pipeline mileage in the United States," (Triennial Surveys).

[1]Percentage may not equal one hundred due to rounding.

mileage was paralleled by an increase in large diameter lines. In 1950 42.4 percent of the mileage in place had a diameter of six inches or less. In 1974, only 26.4 percent was as small as six inches. The mean diameter in 1950 was 7.5 inches. In 1974 it had increased to ten inches. The difference in diameter size between crude and product trunk lines suggests a greater throughput capacity for crude lines. In 1975 crude throughput on ICC lines exceeded product throughput by 19.3 percent. The number of barrel miles was 15.8 percent higher in the same year.[20]

Interstate and Intrastate Pipeline Mileage

Growth in Interstate Pipelines

Total operated mileage for companies reporting to ICC is shown in Table 24 for selected years 1931-1956 and annually, 1957-1975. This mileage data is comparable with the triennial data shown in Table 21.[21]

In 1931 ICC carriers operated 93,090 miles of oil pipelines. Of this mileage, 44.9 percent were gathering lines and 53.6 percent were crude trunk lines. Product lines represented only 1.5 percent of the total (1,400 miles). By 1975 ICC carriers operated 172,680 miles of pipelines. Of this total, only 23.2 percent were gathering lines. Crude trunk lines represented 33.1 percent. Product lines had increased to 66,620 miles and represented 38.6 percent of the total mileage. This growth is shown in Table 24.

Column three confirms a trend noted earlier. Interstate companies have reduced their role as a gatherer of crude oil in favor of intrastate operations and tank trucks. Gathering line mileage peaked at 52,077 miles in 1957 and has declined since that time.

TABLE 24

PIPELINE MILEAGE OPERATED BY INTERSTATE PIPELINE COMPANIES, IN THE UNITED STATES, SELECTED YEARS, 1931-1975

Year	Total	Crude Lines		Trunk Lines	Other[a]
		Gathering	Trunk		
1931	93,090	41,803	49,887	1,400	
1941	105,435	41,858	57,502	6,075	
1950	128,589	47,593	64,622	16,374	
1956	142,686	51,336	61,885	29,465	
1957	145,236	52,077	61,379	31,780	
1958	144,354	49,787	61,702	32,865	
1959	149,159	49,567	61,860	37,732	
1960	151,968	49,401	62,059	40,508	
1961	153,467	49,656	62,251	41,560	
1962	155,053	48,063	61,702	45,288	
1963	156,812	47,226	58,648[b]	45,358[b]	5,580
1964	159,583	46,886	60,039	47,235	5,423
1965	161,412	46,640	60,795	48,627	5,350
1966	163,155	47,352	60,108	50,079	5,616
1967	165,478	47,456	60,893	51,475	5,654
1968	169,307	46,886[b]	61,807	53,431	7,183
1969	170,824	45,993	61,887	56,096	6,848
1970	175,735	46,587	63,040	59,335	6,783
1971	174,722	45,759	60,946	61,525	6,492
1972	173,532	42,893	59,757	64,701	6,181
1973	170,691	41,655	57,435	64,919	6,682
1974	173,341	41,577	57,602	68,609	5,553
1975	172,680	40,040	57,200[c]	66,620	8,820[d]

SOURCE: Interstate Commerce Commission, Transport Statistics in the United States: Part 6, Pipe Lines. (Annual).

[a]Includes mileage owned in undivided interest and mileage owned by others but excludes "owned" mileage operated by others [included in other columns].

[b]Prior to 1968 gathering lines included mileage held in undivided interests and owned by others; prior to 1963 crude and product trunk lines included mileage held in undivided interests and owned by others.

(Continued)

TABLE 24 CONTINUED

[c]In 1975 the ICC in error included the Lakehead Pipeline Company's 2,542 miles of crude trunk line under the gathering column.

[d]In 1975, 88 percent of "other" mileage was in undivided interests, of which 4,268 was crude trunk mileage, 2,987 was product, and 487 was gathering line mileage.

Crude trunk lines have shown virtually no mileage growth since 1957. Total barrels terminated on these lines, however, increased by 64 percent and totaled nearly 3.6 billion barrels in 1975. From independent sources it is estimated that a total of 4,268 miles of crude lines, in 1975, were in undivided interest lines. This mileage is included in column six. Combined with column four, crude trunk mileage in 1975 stood at 61,468 miles. This was only 89 miles more than in 1957. It seems reasonable and is supported by the increase in throughput and total diameter increase that much of this mileage represents larger diameters than in 1957.

Interstate products lines showed dramatic growth. Including undivided interest mileage, product mileage increased by 37,827 miles from 1957 and totaled 69,607 miles in 1975. The growth has been continuous since 1931.

Mileage operated by ICC carriers as a percent of total United States in-place mileage declined slightly during the 1931-1973 period. This is shown in Table 25. In 1931, 83.4 percent of the pipeline mileage in place in the United States was operated by ICC carriers. As of January 1, 1974, ICC mileage was only 76.8 percent of the total. The relative decline is largely explained by the decline in ICC gathering lines as a percent of the total (shown in column three). ICC gathering lines represented only 60 percent of the total in 1974 compared to 79 percent in 1931. Crude trunk mileage has also declined from a peak of 90.5 percent in 1950 to only 75.3 percent in 1974. [If undivided interest in crude lines are included, the percent rises to approximately 80.]

TABLE 25

PIPELINE MILEAGE OPERATED BY INTERSTATE PIPELINE COMPANIES AS A PERCENT OF TOTAL MILEAGE IN PLACE, SELECTED YEARS, 1931-1974

Year	Total Mileage	Crude		Product
		Gathering	Trunk	
1931	83.4	77.9	86.0	--
1941	82.8	78.7	88.2	67.5
1950	84.1	78.6	90.5	78.4
1956	75.7	69.8	78.7	80.9
1959	78.5	65.9	88.0	84.8
1962	77.3	62.4	87.7	85.1
1965[a]	76.5	60.5	84.0	79.1
1968	80.8	63.2	87.3	82.8
1971	79.9	64.3	81.1	85.0
1974	76.8	60.1	75.3	84.5[b]

SOURCE: Calculated from data contained in Tables 21 and 24. ICC data is operated mileage and Bureau of Mines mileage is mileage in place. In addition, ICC mileage is as of the end of the year and Bureau of Mines mileage is as of the first of the year. Thus, for example, ICC mileage is for December 31, 1973 and the Bureau's mileage is for January 1, 1974.

[a]Beginning in 1963, ICC mileage by type as a percent of total is understated because undivided interest mileage and mileage owned by other are not shown by ICC as to whether they are trunk, gathering, crude or product. From independent sources, undivided interest mileage in 1973 totaled 5,336 miles of which 3,248 were crude lines and 2,088 miles were product. The addition of this mileage in 1973 brings the product percent to 87.1% and the crude mileage to 79.6%.

[b]The inclusion of the product mileage of the undivided lines, American Oil, and Champlin lines raises the total interstate percentage to 90.9.

The growth in product mileage has largely been concentrated in the interstate market. In 1941 only 67.5 percent of the lines were interstate. By 1974 interstate lines represented almost 91 percent of the total product mileage in place in the United States. Carriers regulated by the ICC operated 87.1 percent of the product mileage.[22]

Growth in Intrastate Pipelines

Since 1906 much of the analysis of pipelines has neglected intrastate operations. Within the literature, it is not possible to determine the relative importances of intrastate lines. This void can be attributed to the fact that public data on intrastate lines are either unavailable, scattered among many states, or extremely limited (i.e., not shown by company, diameter, etc.). The lack of attention is also due to their relatively small size compared to interstate operations.

Using Tables 21 and 24, total intrastate mileage can be derived. This mileage has increased considerably since 1931. It has never, however, totaled more than 24 percent of all mileage. In 1931 intrastate mileage (or at least mileage not operated by ICC carriers) totaled 18,570 miles. This mileage was distributed as follows: (1) crude gathering, 11,837 miles and 64 percent of total intrastate lines; (2) crude trunk lines, 6,733 miles and 36 percent of the total. In January, 1974, intrastate mileage totaled 51,664 miles. This was an increase of 178 percent.

The 1974 intrastate mileage was distributed approximately as follows: (1) crude gathering lines, 27,473 miles and 53.2 percent of the intrastate total; (2) crude trunk lines, 14,723 miles and 28.5

percent of the intrastate total; and (3) product trunk lines, 9,470 miles and 18.3 percent of the total. The 9,470 miles of intrastate product lines includes the mileage of American Oil and Champlin which actually operate interstate but do not report to the ICC. Removing this mileage lowers the total intrastate product mileage to approximately 6,513 miles.

In total there were 48,707 miles of pipelines in the intrastate market as of January, 1974. How much of this mileage is operating is unknown. Given that the majority of the mileage is in gathering lines (56.4 percent of the adjusted total) the intrastate system seems relatively inconsequential with the exception of the West Coast where virtually all mileage is intrastate.

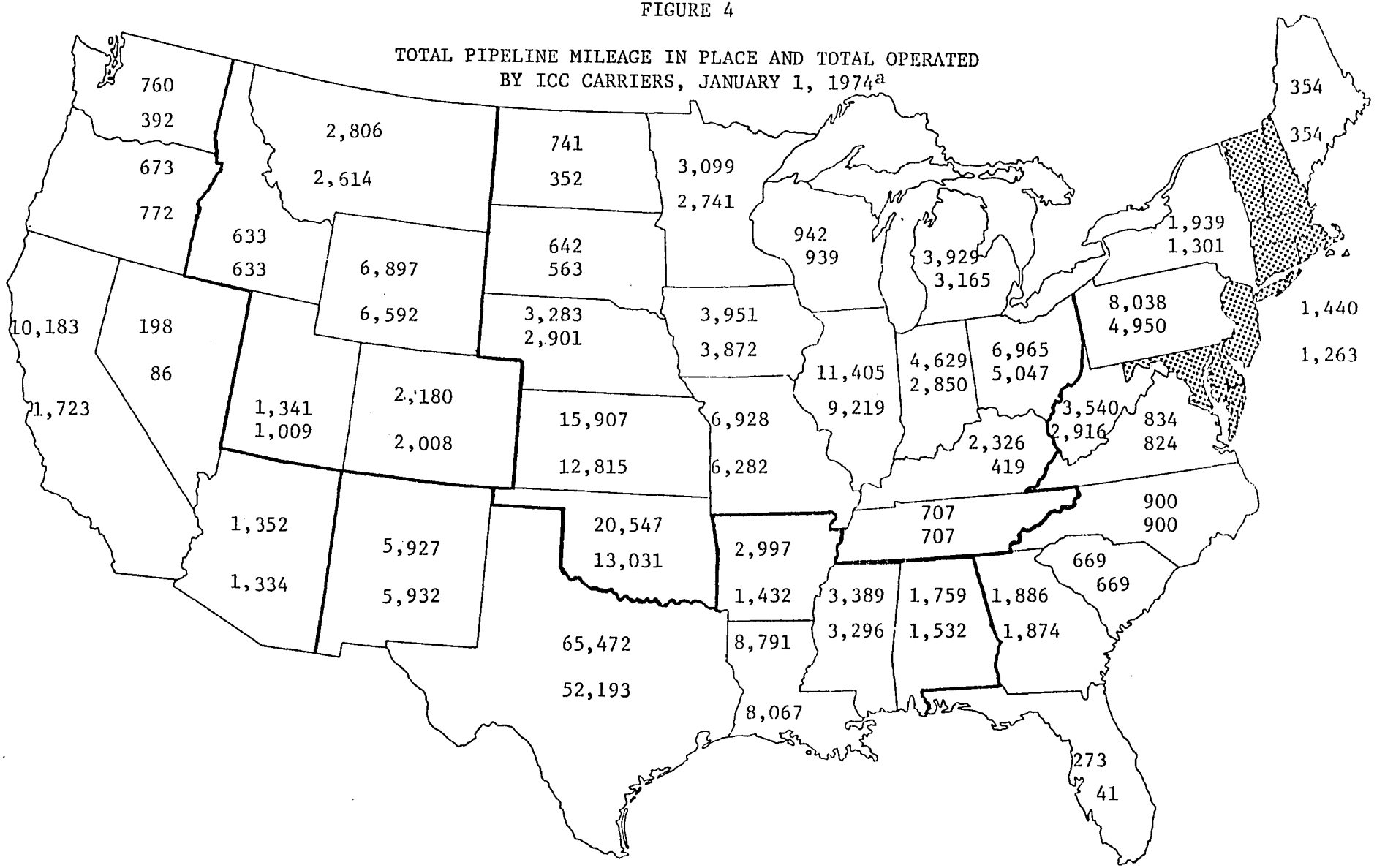
The Geographic Distribution of Intra- and Interstate Pipeline Mileage[23]

Pipelines are distributed among the various states and PAD districts in accordance with: (1) location of production; (2) location of refineries; and (3) location of major consumer markets (minor markets are served by the alternative modes). As shown earlier, crude production and refineries have been concentrated in a few states, the major consumer markets have also been concentrated but in different spatial areas. Because of the greater disparity between consuming markets and refinery locations, product pipelines are more widely dispersed than are crude gathering and trunk lines.

The distribution of total pipeline in the United States, as of January 1, 1974, is shown by state in Figure 4. This includes total and interstate mileage. The year 1974 is used for the regional

FIGURE 4

TOTAL PIPELINE MILEAGE IN PLACE AND TOTAL OPERATED
BY ICC CARRIERS, JANUARY 1, 1974[a]



SOURCE: See Table 21, p. 116 and Table 24, pp. 120-121.

[a]Upper number is mileage in place; lower number is ICC mileage.

comparison since it is the latest Bureau of Mines data. While Figure 4 illustrates a wide dispersion of total mileage among the various states and PAD's, the more meaningful comparisons are to be found in Figures 5-8 and Tables 26-28.

Geographic Distribution of Crude Gathering Lines

During the period 1957-73 gathering line mileage in the United States declined by 8.1 percent. Lines operated by ICC carriers experienced a much greater reduction, declining 19 percent. The reduction was, as Table 26 indicates, experienced by four of the five PAD districts. PAD IV was the only district experiencing mileage growth. The sharpest decline occurred in PAD II. This coincided with PAD II's relative decline as a producing district.

Table 26 also confirms the greater relative decline in the importance of gathering lines operated by ICC carriers. The exception is in PAD IV where 95.6 percent of the mileage is operated by ICC carriers. The opposite holds true in PAD V where all mileage is intrastate mileage. The largest decline in gathering line mileage was in PAD's I-III. In each of these PAD's, gathering lines operated by ICC carriers experienced a greater reduction than the total. As a result almost 50 percent of PAD I and II mileage in 1973 was intrastate. The majority of PAD III mileage in 1973, 71 percent, remained ICC-operated mileage (although in 1957 the percentage was 82.4).

Gathering lines in 1957 were largely concentrated in PAD's II and III, 84 percent of in place lines. In 1973, 82.6 percent of the lines were in the same two PAD's. This same trend holds true for ICC lines. The gathering lines in-place in PAD's I and II represent lines

serving some of the oldest producing fields in the United States. This is particularly true in PAD I. As indicated, PAD I's crude production in 1973 was only 1.2 percent of the total. Its gathering lines in the same year represented 9.3 percent of total mileage.

Figure 5 shows gathering mileage by state in 1973. The upper figure is mileage in place, the lower figure is ICC-operated mileage. Three states, Texas, Oklahoma, and Kansas, accounted for almost 55 percent of the total 1973 gathering lines. Combined with California and Louisiana, the total for the five states rises to 66.2 percent.

Most of the intrastate mileage was also concentrated in these five states. There were 27,473 miles of intrastate lines in 1973. Texas, Oklahoma, and Kansas accounted for 59 percent of these lines. Including California and Louisiana, this total increases to almost 70 percent.

Figure 5 also shows the large number of states that neither produce nor gather crude oil. In 1973, 30 states were shown by the Bureau of Mines to be producing states. In the same year 28 states had gathering lines. Only Missouri and South Dakota were producing oil without having gathering lines in place (the combined production of the two states was only 335,000 barrels).[24]

Geographic Distribution of Crude Trunk Lines

During 1957-73 crude trunk mileage in place in the United States increased by 8.7 percent. Mileage operated by ICC carriers showed almost no change during that period. PAD I experienced the only decline. Total mileage in PAD I declined by 18.6 percent while ICC-operated mileage dropped by 59 percent. This PAD's sharp decline in ICC-mileage

TABLE 26

TOTAL CRUDE GATHERING LINE MILEAGE AND INTERSTATE GATHERING LINE MILEAGE BY PAD, 1957 AND 1973

	Gathering Line Mileage		ICC as a Percent of Total
	Total	ICC	
PAD I			
1957	7,659	6,313	82.4
1973	6,446	3,381	52.4
Percent Change	-15.8	-46.4	--
PAD II			
1957	30,284	17,396	57.4
1973	25,263	13,107[a]	51.9
Percent Change	-16.6	-24.6	--
PAD III			
1957	32,817	27,046	82.4
1973	31,915	22,679[b]	71.1
Percent Change	-2.7	-16.1	--
PAD IV			
1957	2,078	1,322	63.6
1973	3,151	3,014	95.6
Percent Change	51.6	128.0	--
PAD V			
1957	2,527	0	0
1973	2,491	0	0
Percent Change	-1.4	--	--
Total, United States			
1957	75,365	52,077	69.1
1973	69,266	42,181	60.9
Percent Change	-8.1	-19.0	

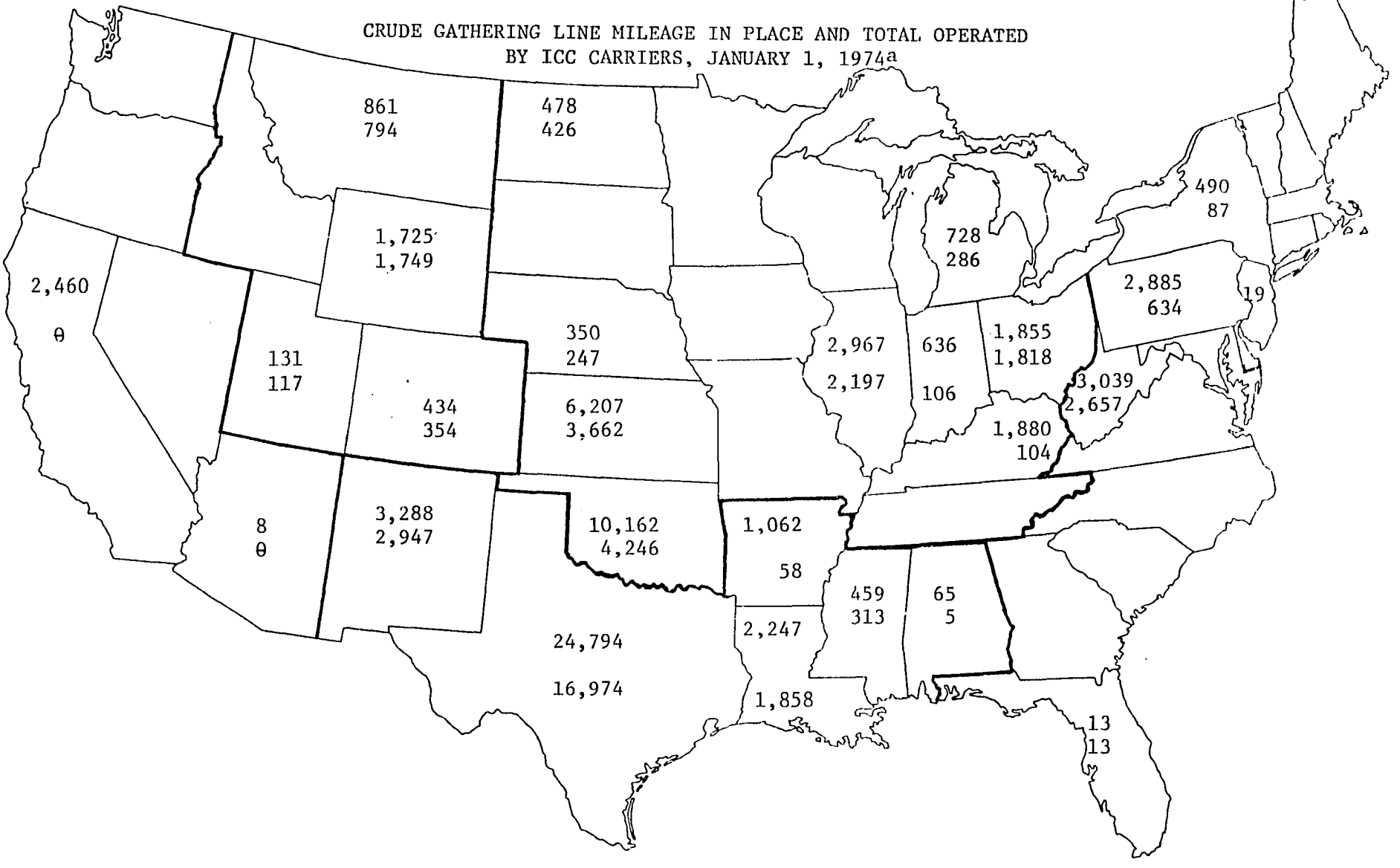
SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude-Oil and Refined-Products Pipeline Mileage in the United States," Triennial Surveys and from the Interstate Commerce Commission, Transport Statistics in the United States: Part 6, Pipelines. Annual

[a]Includes 374 miles of leased lines and 150 miles of undivided interest lines.

[b]Includes 22 miles of leased mileage.

FIGURE 5

CRUDE GATHERING LINE MILEAGE IN PLACE AND TOTAL OPERATED BY ICC CARRIERS, JANUARY 1, 1974[a]



SOURCE: See Table 26, p. 129.

[a]Upper number is mileage in place; lower number is ICC mileage.

explains the lack of growth in total ICC mileage. The trends by PAD districts are shown in Table 27. Mileage growth occurred in PAD's II-V. PAD IV's growth paralleled the growth in its gathering line mileage.

The majority of the trunk lines in the United States are concentrated in PAD's II and III, as is the domestic production and refinery capacity. Throughout 1957-1973 approximately 81 percent of the crude trunk mileage has been contained in these two PAD's. An even higher percentage (87) of the ICC-operated lines are in PAD's II and III.

Interstate crude lines have never been important in PAD V. Only one line runs from III to V and only one line moves crude from PAD IV to V. In 1957, 98.7 percent of the mileage was intrastate. In 1973, 85 percent of the crude mileage in PAD V was intrastate mileage.

The opposite holds true for PAD's II-IV. In these, the major trunk line areas, ICC-operated lines have dominated the market. More than 85 percent of the lines are operated by interstate carriers. The relative importance of these lines has declined slightly during 1957-73. In 1957, 96.2 percent of the PAD II lines were operated by ICC carriers. In 1973 the percent had fallen to 86 percent. In 1957, 92.3 percent of PAD III mileage was ICC-operated mileage. In 1973 this had dropped to 87 percent.

In 1957 only 4.4 percent of the trunk lines were in PAD I. In 1973 this had fallen to 3.3 percent. In 1957 the Bureau of Mines showed less mileage in place than was reported operated by ICC carriers. Disregarding this discrepancy, ICC carriers operated all the trunk lines in PAD I. In 1973 only 53 percent of the lines were operated by ICC carriers. During the same period, however, refinery capacity in PAD I

TABLE 27

TOTAL CRUDE TRUNK MILEAGE AND INTERSTATE CRUDE TRUNK MILEAGE BY PAD, 1957 AND 1973

	Trunk Line Mileage		ICC as a Percent of Total
	Total	ICC	
PAD I			
1957	3,068	3,231[a]	100.0
1973	2,498	1,325	53.0
Percent Change	-18.6	-59.0	----
PAD II			
1957	25,278	24,309	96.2
1973	26,488	22,742[b]	85.9
Percent Change	4.8	6.4	----
PAD III			
1957	31,746	29,299	92.3
1973	35,127	30,406[c]	86.6
Percent Change	10.6	3.8	----
PAD IV			
1957	5,039	4,476	88.8
1973	6,799	6,119	90.0
Percent Change	34.9	36.7	----
PAD V			
1957	4,998	64	1.3
1973	5,338	803[d]	15.0
Percent Change	6.8	Over 100%	----
Total, United States			
1957	70,129	61,379	87.5
1973	76,250	61,395	80.5
Percent Change	8.7	0.03	----

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude-Oil and Refined-Products Pipeline Mileage in the United States," Triennial Surveys and from the Interstate Commerce Commission, Transport Statistics in the United States: Part 6, Pipelines. Annual.

[a]Mileage reported operated by ICC exceeds the Bureau of Mines estimate of in-place mileage.

(Continued)

TABLE 27 CONTINUED

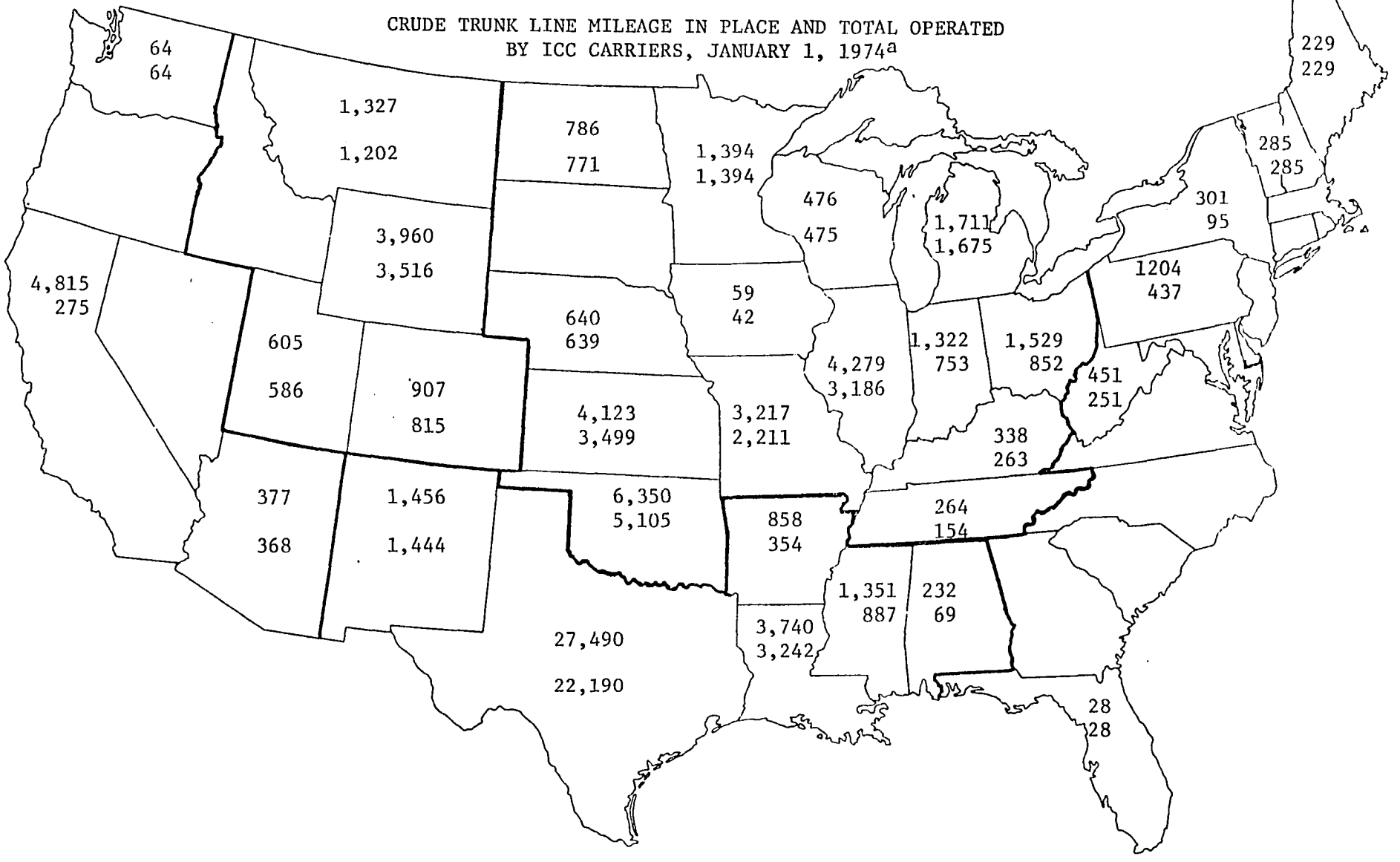
[b]Includes 42 miles of leased lines and 1681 miles of undivided interest lines.

[c]Includes 374 miles of leased lines and 1827 miles of undivided interest lines.

[d]Includes 17 miles of undivided interest lines.

FIGURE 6

CRUDE TRUNK LINE MILEAGE IN PLACE AND TOTAL OPERATED BY ICC CARRIERS, JANUARY 1, 1974[a]



SOURCE: See Table 27, pp. 132-133.

[a]Upper number is in place mileage, lower number is ICC mileage.

increased by approximately 54 percent.

Figure 6 illustrates that crude trunk lines in PAD I are largely confined to the Northeastern states. The mileage shown for the states of Vermont, New Hampshire, and Maine comprise a pipeline that transports foreign crude from South Portland, Maine to Montreal, Canada. This line does not supply U.S. refineries. The removal of this mileage leaves only West Virginia, Pennsylvania, and New York with crude trunk lines serving refineries in the Northeast.

The unmistakable conclusion is that crude trunk lines are relatively minor suppliers to eastern refineries. This is supported by noting that 88.3 percent of total refinery receipts of crude oil in 1975 came by tanker.[25]

Figure 6 also indicates that outside PAD I, crude trunk lines are the major means of transporting domestic crude oil. Only four states in PADS II-V did not have trunk mileage in 1973. Two of these states, Idaho and South Dakota, did not have refineries. The other two states, Nevada and Oregon, had refineries, one in each state, but neither were in operation as of January, 1974.

Data on refinery receipts of crude by transportation method emphasizes the importance of crude trunk lines. In 1975, pipelines delivered the following percentage of refinery receipts:

> PAD I, 10.3% of total, 12.0% of domestic crude;
> PAD II, 97.9% of total, 97.3% of domestic crude;
> PAD III, 67.2% of total, 86.6% of domestic crude;
> PAD IV, 91.0% of total, 90.0% of domestic crude;
> PAD V, 49.9% of total, 73.7% of domestic crude; and for the U.S., 67.3% of total, 87.4% of domestic crude.[26]

As was the case with gathering lines, only 15 percent of PAD V's trunk lines are in the interstate market, In California, all trunk line

mileage is intrastate.

Geographic Distribution of Product Lines

From 1957 to 1973 product pipeline mileage in the United States increased 72.7 percent. The growth occurred in all five districts. Unlike crude pipelines, product lines operated by ICC carriers experienced greater mileage growth than intrastate lines. The percent of total mileage operated by these carriers increased in all PAD's. This is shown in Table 28.

The greatest present and historical concentration of product mileage is in PAD II, the greatest land mass, and applies to both total and interstate mileage. PAD III has the next largest concentration of mileage and experienced the greatest growth during between 1957 and 1973. Approximately 74 percent of the 1973 total U.S. mileage was in PAD II and III. This is only slightly higher than the refinery capacity (69 percent). While crude lines were relatively unimportant in PAD I, this is not the case in terms of product lines. In 1973 there were 10,928 miles of product lines in PAD I. These lines, as Figure 6 indicates, serve each state in PAD I (with the exception of Vermont and New Hampshire).

Product pipeline mileage is concentrated in the interstate market. Only in PAD V does the percentage fall below approximately 85 percent. Even in PAD V 65 percent is in the interstate system. The wide dispersion among states supports the significance of pipelines as the dominant mode for moving refined products from refinery centers to bulk terminals located in the population centers of the United States.

TABLE 28

TOTAL REFINED PRODUCT TRUNK LINE MILEAGE AND INTERSTATE TRUNK LINE MILEAGE BY PAD, 1957 AND 1973

	Trunk Line Mileage		ICC as a Percent of Total
	Total	ICC	
PAD I			
1957	6,772	4,942	73.0
1973	10,928	10,391[a]	95.1
Percent Change	61.4	110.3	--
PAD II			
1957	22,089	15,078	68.3
1973	35,250	29,892[b]	84.8
Percent Change	59.6	98.2	--
PAD III			
1957	10,495	7,965	75.9
1973	21,293	19,206[c]	90.2
Percent Change	102.9	141.1	--
PAD IV			
1957	2,332	2,144	91.9
1973	3,907	3,927[d]	100.0
Percent Change	67.5	83.2	--
PAD V			
1957	2,795	1,651	59.1
1973	5,461	3,568	65.3
Percent Change	95.4	116.1	--
Total, United States			
1957	44,483	31,780	71.4
1973	76,839	66,984	87.2
Percent Change	72.7	110.8	--

SOURCE: Calculated from U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Crude-Oil and Refined-Products Pipeline Mileage in the United States," Triennial Surveys and from the Interstate Commerce Commission, Transport Statistics in the United States: Part 6, Pipelines. Annual.

[a]Includes 95 miles of undivided interest lines and 2 miles of leased lines.

(Continued)

TABLE 28 CONTINUED

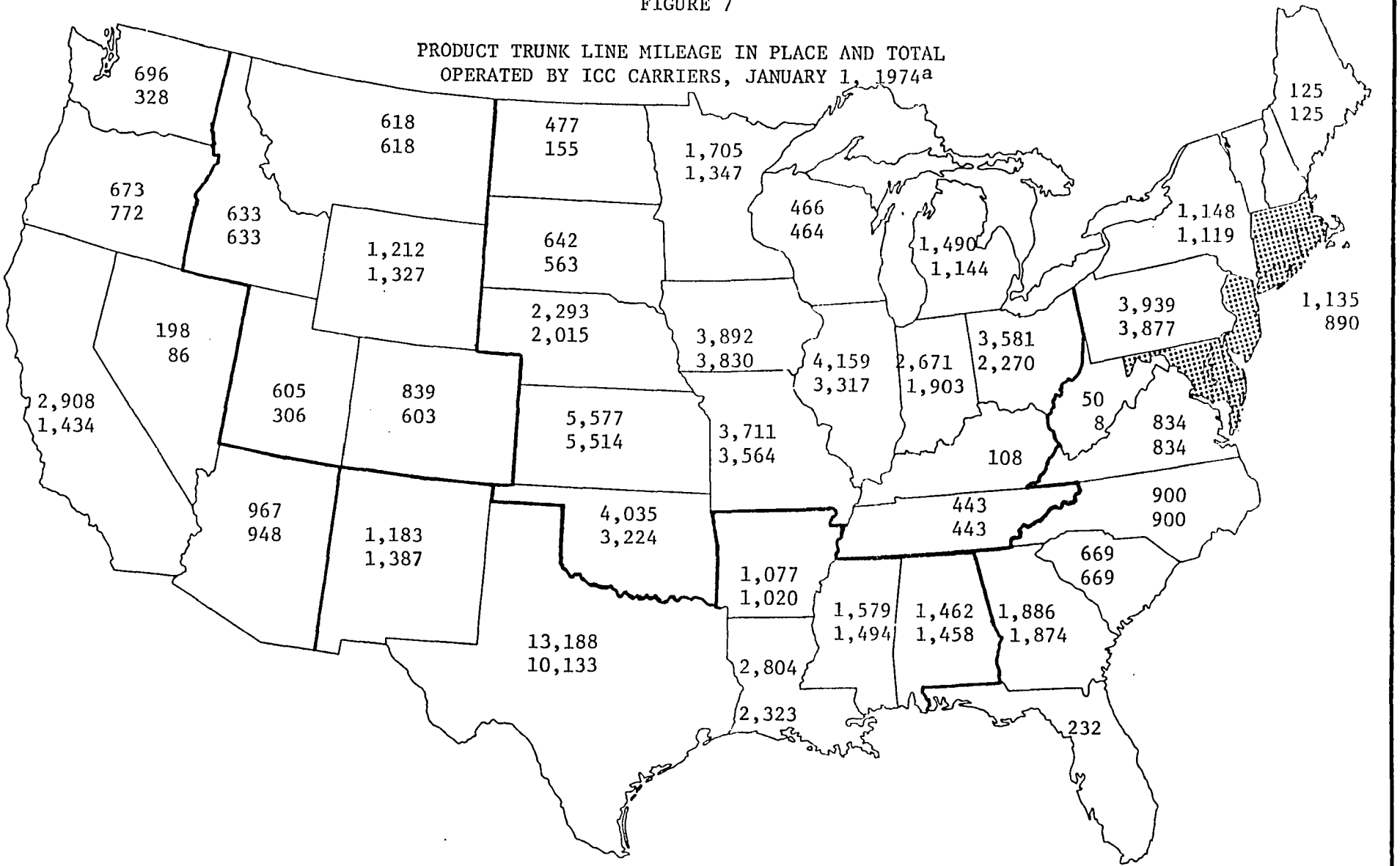
[b]Includes 136 miles of undivided interest lines.

[c]Includes 1390 miles of undivided interest lines.

[d]Includes 440 miles of undivided interest lines; the ICC reported more operating miles in Wyoming than shown by the Bureau of Mines.

FIGURE 7

PRODUCT TRUNK LINE MILEAGE IN PLACE AND TOTAL OPERATED BY ICC CARRIERS, JANUARY 1, 1974[a]



SOURCE: See Table 28, pp. 137-138.

[a]Upper number is mileage in place, lower number is ICC mileage.

The Petroleum Transportation System: Summary

The domestic petroleum transportation system in 1975 was handling an average of 29 million barrels of crude and refined products each day. The principal mode used was the pipeline, as it had been since at least the 1950's. A comparison of costs indicated that pipelines offer the lowest per unit cost. The closest mode was the ocean going tanker, which can only serve a limited, but important market.

The intermodal cost comparisons demonstrated why access to interstate pipelines remain a debated issue. The geographic concentration of refinery capacity combined with the access (or lack of access) to pipelines largely defines a petroleum company potential market.

An examination of the growth in pipeline mileage found that there were in 1974, 222,355 miles in place in the United States, nearly double the 1931 mileage. The principal pipeline development since World War II has been the shift to large diameter lines and the rapid growth in refined product mileage.

Gathering lines, particularly ICC lines, have been declining in recent years. Other modes, as well as intrastate pipelines, have been increasing their share of this market. Interstate pipelines, primarily trunk lines, represent the major means of moving both crude and products to markets. The intrastate system was found to be relatively unimportant, overall. It is, however, significant in PAD V and for gathering lines. The dispersion of product lines among the lower 48 states signifies a greater importance than Table 16 would indicate.

[1]James T. Kneafsey, Transportation Economic Analysis. (Lexington, Massachusetts: D. C. Heath and Company, 1975), p. 7.

[2]For a more detailed discussion of petroleum transportation see National Petroleum Council, U.S. Petroleum and Gas Transportation Capacities: 1967 (Washington, D.C.: National Petroleum Council, 1967); Pipelining is Everybody's Business (Tulsa: The Petroleum Publishing Company, 1965); U.S., Department of Interior, Office of Oil and Gas, Vulnerability of Total Petroleum Systems by Maynard M. Stephens (Washington, D.C.: Department of Interior, 1973).

[3]Vulnerability of Total Petroleum Systems, pp. 16-20.

[4]See U.S., Department of Justice, Second [Third and Fourth] Report [s] of the Attorney General Pursuant to Section 2 of the Joint Resolution of July 28, 1955, Consenting to an Interstate Compact to Conserve Oil and Gas (Washington, D.C.: Government Printing Office, 1957, 1958, and 1959).

[5]Ibid., Third Report, pp. 79-86.

[6]Supra, pp. 158-169.

[7]The largest refinery in the United States as of January 1, 1976, Exxon's Baton Rouge refinery, had a capacity of 455,000 b/d (Bureau of Mines, "Petroleum Refineries in the United States and Puerto Rico, January 1, 1976," p. 7).

[8]Vulnerability of Total Petroleum Systems, p. 58.

[9]Ibid. [10]Ibid., pp. 58-62.

[11]Interview with Joe Bohannon, Williams Pipeline Company, August 18, 1975.

[12]Numerous deep sea terminals have been proposed, primarily off the northeast coast, Louisiana, Texas, and California. As of February, 1978 none were in operation.

[13]In 1978 Congress was considering levying a use tax on the inland water way system. If levied, the cost differential between barges and pipelines will increase.

[14]This breakdown is not based upon modern technological constraints but upon historical industry practice.

[15]Intrastate pipeline movement was recently estimated to account for less than 5 percent of the total pipeline market (U.S., Federal Energy Administration, Petroleum Market Shares: Report on Indices of Market Structure in the Petroleum Industry (Washington, D.C.: Federal Energy Administration, January, 1976), p. 31).

[16]The major limitation is the reporting of in-place vs. operating mileage. Others includes: (1) the Bureau of Mines does not report ownership data; (2) the ICC does not publish diameter data; and (3) the latest triennial survey of the Bureau available for the present study was January 1, 1974 which limited the comparison to year end 1973 rather than 1975.

[17]See footnote 15.

[18]There are two aspects to be considered in evaluating mileage growth. The first is the absolute change in total mileage by type and location. The second is capacity changes which are shown by the shifting distribution of mileage by diameter. A shifting diameter distribution to large sizes of pipeline implies a more than proportional shifting in throughput capacity. It is possible given diameter changes, that mileage may decrease while capacity is rising (see Chapter V).

[19]The increasing use of tank trucks was noted as early as 1958 (Department of Justice, Third Report of the Attorney General, pp. 79-86).

[20]Calculated by the author from data published by the ICC in Transportation Statistics in the United States: Part 6, Pipelines, 1975 (Washington, D.C.: Government Printing Office, released in 1977).

[21]In 1963 the ICC discontinued the practice of reporting "other" mileage by type (i.e., product, crude, or gathering). "Other" mileage is defined by ICC as mileage owned in "undivided interest" lines and mileage owned by others but excludes "owned" mileage operated by others. An "undivided interest" pipeline is a contractual joint venture without corporate identity. The "undivided interest" pipeline is discussed in later chapters.

[22]As Chapter II noted, two interstate product pipeline networks, Champlin and American Oil (a subsidiary of Standard Oil of Indiana), are outside the jurisdiction of the ICC. American Oil operated 2,357 miles of product lines in PAD II in 1973; Champlin operated 600 miles in PAD II in 1973. [Also see footnotes 1 and 2, Table 25.]

[23]The delineation of market boundaries is a necessary initial step in the construction and interpretation of concentration ratios utilized in a later chapter; the delineation allows a more meaningful comparison of the relative importance of intra-and interstate lines and the competition between these lines; the delineation provides an additional perspective on how the transportation problems of the petroleum industry are resolved; and finally, the delineation more clearly outlines the substitutability between pipelines and other transport modes.

[24]Bureau of Mines, "Crude Petroleum, Petroleum Products, and Natural Gas Liquids: 1973," p. 7.

[25]Ibid., 1975, p. 15. [26]Ibid.

CHAPTER V

THE ECONOMICS OF THE PIPELINE FIRM: THE THEORY AND THE ROLE OF INTEGRATION

Petroleum pipelines operate separately from the rest of the domestic petroleum industry from only a legal perspective. From an economic perspective "there is probably no single point in the oil process where the tendency toward vertical integration has been more pronounced than with respect to the ownership and operation of crude oil trunk and products pipe lines."[1] Overwhelmingly pipelines have been conceived, financed, and operated by the petroleum interests they served.[2]

Pipelines in the first stage of the industry's development evolved as an instrument of monopoly on the part of Standard Oil of New Jersey and then in the second stage, epitomizing vertical integration, they became "... an instrument of competition among large companies, and a possible threat to the survival of small."[3] The issue in terms of the modern industry is thus in their functioning as a unit in a vertically integrated industry. Stigler in discussing the concept of vertical integration outlined the economic interest in pipelines:

> Vertical integration loses its innocence if there is an appreciable degree of market control at even one stage of the production process. It becomes a possible weapon for the exclusion of rivals by increasing the capital requirements for entry into the combined integrated production process or it becomes a possible vehicle of price discrimination.[4]

This chapter's purpose is to examine the reasons behind petroleum companies' integration into petroleum pipelines. It also explores the economic behavior of pipeline firms on a theoretical level. Several theses are developed in this chapter. Among these are: (1) the competitive model is inappropriate for the study of pipeline transportation; (2) pipelines are a classic example of natural monopoly and therefore have potential market power from the supply side; (3) theoretically, pipelines have market power as a factor input and initial empirical analysis of price elasticity provides limited support for this thesis; and (4) pipelines are operated primarily as "cost minimizers" although they may also have a dual role of profit maximization on outside shipments (nevertheless, pricing appears to be independent of demand influences).

Demand for Pipeline Transportation Services

The demand for crude oil, transportation, refining, and marketing are jointly determined. As a factor input the demand for pipeline services is derived from the final consumer demand for refined petroleum products. There are in effect two derived demand functions for petroleum transportation services. The first, for crude oil, can theoretically be obtained by summing the demand functions of individual refineries in the United States. The second, for refined products, can theoretically be obtained by summing the demand functions of

individual consumers in the United States.

The issue is what demand function does the individual transportation firm face as well as what form does the market demand function take? One cannot turn to the petroleum literature for explicit answers to these issues, particularly in relation to the firm, for they have largely been ignored. The emphasis has been on the supply function of the firm and the market.[5]

Market Demand

The interest in the derived demand for pipeline transportation services concerns the shape of the demand curve and its price elasticity.[6] More specifically, the interest is in the possibility that the demand curve is inelastic, which if the case results in market power accruing to this factor.

The Marshallian theory of joint demand offers what Milton Friedman calls "in some ways the most useful tool of orthodox economic theory for understanding the circumstances under which the demand curve will be inelastic."[7] Friedman cited four conditions which would result in an inelastic demand for one of a number of jointly demanded factors. These are: (1) the more essential the given factor is in the production of the final product, (2) the more inelastic the demand for the final product, (3) the smaller the fraction of total cost accounted for by the factor in question, and (4) the more inelastic the supply of co-operating factors.[8]

With respect to pipeline operations, condition (1) is satisfied because pipeline transportation is essential to the production of refined products and the other transport modes do not presently

represent close substitutes. Condition (2), the more inelastic the demand for the final product has empirical support in terms of the short-run demand for gasoline[9] and according to Blair in terms of the short-run demand for crude oil.[10]

With regard to condition (3) limited recent empirical evidence supports a conclusion that transportation costs are not a substantial part of the total cost of refined products. In 1965, the estimated unit costs for one barrel of gasoline was $5.88. These costs were distributed as follows: (1) crude production, $1.24; (2) crude transportation, $0.14; (3) refining, $1.18; (4) wholesaling, $1.51 and (5) retailing, $1.81.[11] Embodied in the wholesale and retail components are additional transportation costs not estimated. These costs should not be substantial. Condition (3) was satisfied with respect to crude transportation in 1965 and likely was satisfied with regard to refined product transportation. This, however, is not a clear cut conclusion because the specification of condition (3) by Friedman is vague in the sense of knowing what a "smaller fraction" actually means. While the 1965 costs appear to meet the criteria, does the cost of 15-33 percent quoted by McLean and Haigh for 1952 or the nearly 33 percent quoted in 1977 for Alaskan crude represent a small fraction?[12]

Condition (4), the more inelastic the supply curve of the other factors (crude production and refining) would intuitively appear to be correct in the short run. The history of the domestic and international industry also supports the position that the supply of co-operating factors are comparatively unresponsive to changes in price.[13] Theoretically then it seems reasonable to conclude that the four conditions are

satisfied. The demand for pipeline services should be inelastic and pipeline firms therefore should possess some control over the price at which they sell their services.

To empirically test for the correctness of this conclusion in terms of interstate pipelines, a simple demand function was specified and elasticities estimated.[14] Using the following formulation:

(1) TO = F (RARBM) where

TO = total barrels delivered out of the interstate system (and TOC = crude, TOP = product),

RARBM = Average revenue per barrel mile in constant dollars (and RARBMC = crude, RARBMP = product), the constant dollars were calculated using the GNP implicit price deflator;

Using ordinary least squares (OLS), the elasticity of demand, TO, with respect to price, RARBM, was tested using

(2) $TO = \alpha + \beta\ (RARBM)$, and

(3) $\ell n\ TO = \ell n\ \alpha + \beta\ \ell n\ (RARBM)$.

The regression results are listed on page 149. Combining the crude and product markets together does not yield an inelastic demand (-1.04 and -1.06) but rather an almost unitary elasticity. Separating the crude and product markets, the initial results indicate that there is an inelastic demand for crude pipeline transportation but apparently not for refiner product pipeline transportation. In log form, the demand for product pipelines appears to be elastic. The implications of this difference is examined in Chapter IX. The limited empirical results shown thus provide only limited support to a conclusion that the response to price changes is comparatively small.[15]

Demand Variable	Time Period	Equation Form	T-Statistic α	T-Statistic β	Elasticity	R^2
TO	1957-75	linear	28.55	-14.97	-1.037	0.93
TO	1957-75	ℓn	3.62	-28.08	-1.062	0.98
TOC	1964-75	linear	28.17	-12.65	-0.797	0.94
TOC	1964-75	ℓn	4.44	-13.11	-0.841	0.94
TOP	1964-75	linear	8.92	-4.53	-0.992	0.67
TOP	1964-75	ℓn	-1.37	-6.76	-1.34	0.82

The Pipeline Firm's Demand

Spatial conditions in both the crude and refined product transportation market normally means that few transport sellers will be in that market. Given this factor and the complementary nature of the other modes, pipeline firms do not operate in a competitive market.[16]

The competition model is inappropriate because each pipeline firm faces a downward sloping demand curve and cannot be considered a price taker. The more appropriate model of market behavior is generally the oligopoly model and in some cases the monopoly model.[17] The price behavior prior to 1934 support this hypothesis for pipeline rates were established equal to or slightly below the rate of the nearest competing mode.[18] The extent of the interdependency implied in the oligopoly model is examined in Chapters VI-VIII.

The Supply of Pipeline Transportation Services

The pipeline firm must choose among various input combinations to produce certain levels of output (i.e., the transportation service). The development of a pipeline production function gives mathematical expression to the relationship between various quantities of inputs and quantities of output. Understanding the properties of the pipeline

production function and costs functions derived from these properties is essential in evaluating firms' behavior. Cost functions underlie the decisions of the firm under varying demand conditions. The theoretical development of production and costs provides a foundation for a fuller understanding of the decision making/allocation process of the petroleum industry. It provides a basis for evaluating alternative public policies that have been employed in the past and that are now being proposed.

Modern pipeline companies are not homogeneous in respect to the type of pipelines operated or the exact type and quantity of inputs used. Some companies operate only a single line running from point A to B with little variation in pipe diameters. Other companies operate several systems serving multiple points with large variation in pipe diameter as well as other inputs. Each pipeline firm, however, faces similar technical and engineering/physical constraints and can be described using a single production function where only the absolute values change and not their relative position. The development of this function is relatively straight forward for it lends itself to the use of engineering estimates. The functions discussed are engineering production functions.

Following the pattern used by previous authors,[19] the behavior of product and cost curves are examined using the following assumptions: 1000 mile line, crude trunk line, 5 percent terrain variation, and fourth inch wall thickness. Under these assumptions, the production function can be defined as:

(1) $Q = f(x_1, x_2, x_3)$; where

x_1 = variable inputs in every time period (i.e., manpower, fuel, communication system, office, site improvements, etc.);

x_2 and x_3 = fixed inputs (i.e., capital equipment) in the short run; and

Q = barrel throughput.

The separation of the fixed inputs into two groups departs from the traditional analysis. It is useful, given the importance of pumping equipment (i.e., horsepower), which is a quasi-fixed capital input.[20]

The introduction of the quasi-fixed input (x_2) entails the introduction of the intermediate-run where x_1 and x_2 (pumping equipment) are variable, but x_3 (pipeline diameter) remains fixed. The development of the intermediate-run analysis was first introduced by Cookenboo in the early 1950's and is generally accepted in pipeline literature.[21]

From (1), the time periods are defined as:

(2) short-run; $Q = f(x_1, \bar{x}_2, \bar{x}_3)$

(3) intermediate-run; $Q = f(x_1, x_2, \bar{x}_3)$, and

(4) long-run; $Q = f(x_n)$ where all inputs are variable per unit of time.

Although Cookenboo specified three periods, he essentially dropped the short run (2) and considered only the intermediate (3) and long-run (4). Cookenboo's intermediate run becomes analogous to the short-run in most theoretical development (i.e., the long-run cost curve of the pipeline form is the envelope of the intermediate-run curves).

Under ceteris paribus conditions, using two factors of production (x_2 and x_3) and a hydraulic formula, (1) becomes

(5) $Q^{2.735} = (x_2)(x_3^{4.735})/0.01046$, and by letting $1/0.01046 = k$, (5) reduces to

(6) $Q = (x_2^{.37})(x_3^{1.73})k$; and therefore

(7) $Q = x_2^{\alpha} x_3^{\beta} k$, where α and β are constant and equal 2.1.

Equation 7 is homogeneous, exhibits increasing returns to scale ($\alpha + \beta = 2.1$), and produces convex isoquants.[22]

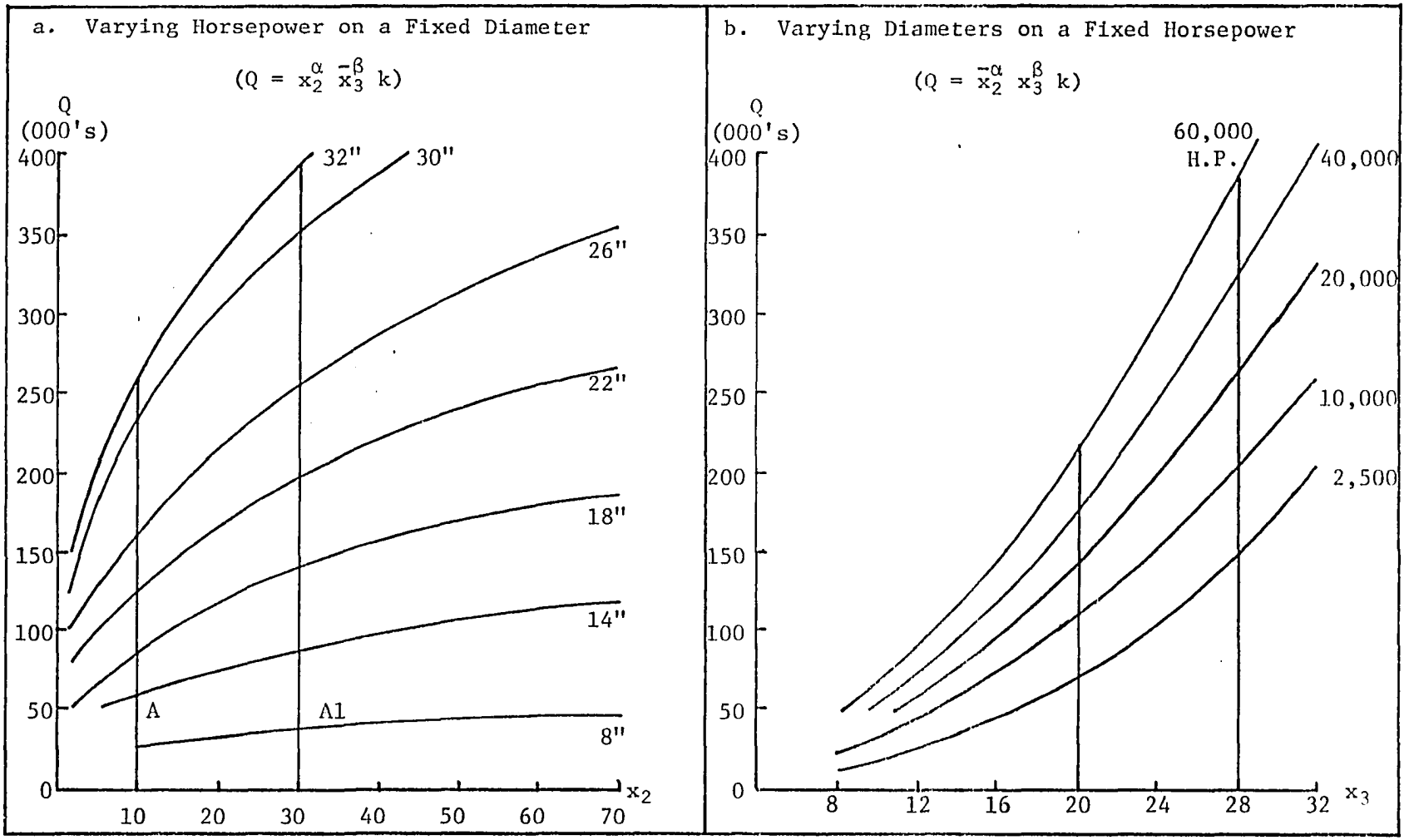
By holding x_3 in equation 7 constant, the behavior of the production process can be examined in the intermediate run. Figure 8A illustrates the throughput effects of varying horsepower on a fixed diameter pipe. (Again this is analogous to the usual physical productivity curves except the short-run is replaced by the intermediate run.) As more horsepower is added to a specific line diameter, the curves exhibit decreasing returns, i.e., there is a less than proportionate increase in throughput (AP and MP decrease throughout the range of throughputs). The reduction of horsepower below designed capacity (from point A to A_1 in Figure 8A) produces a sharp reduction in throughput in the large diameter pipe but relatively minor reductions in smaller pipelines.

Because pumping stations represent a fixed cost, a reduction below point A represents idle capital equipment with only minor reduction in variable costs. Offsetting rising average and marginal costs attributed to horsepower throughout a proportion of the range of throughputs is the fixed cost associated with a given pipe size. AFC will be declining throughout the range. In the intermediate run, ATC initially falls, levels off, and then rise as horsepower continues to be added.

By holding horsepower constant and allowing pipe diameter to vary, the opposite case is exhibited and is shown in Figure 8B. In this instance, there are increasing returns throughout the range of

FIGURE 8

PIPELINE PRODUCTION FUNCTION
(PHYSICAL PRODUCTIVITY CURVE)



SOURCE: Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition in The Oil Industry (Cambridge: Harvard University Press, 1955), p. 16 and 19.

throughputs. AP and MP rises while AC and MC fall. Horsepower (x_2) and line diameter (x_3) are thus offsetting forces and the behavior of total and marginal costs depends on the relative magnitude of both. By varying x_2 and x_3 in fixed proportions, Cookenboo found that output increased by more than a proportionate amount (Figure 9A).[23]

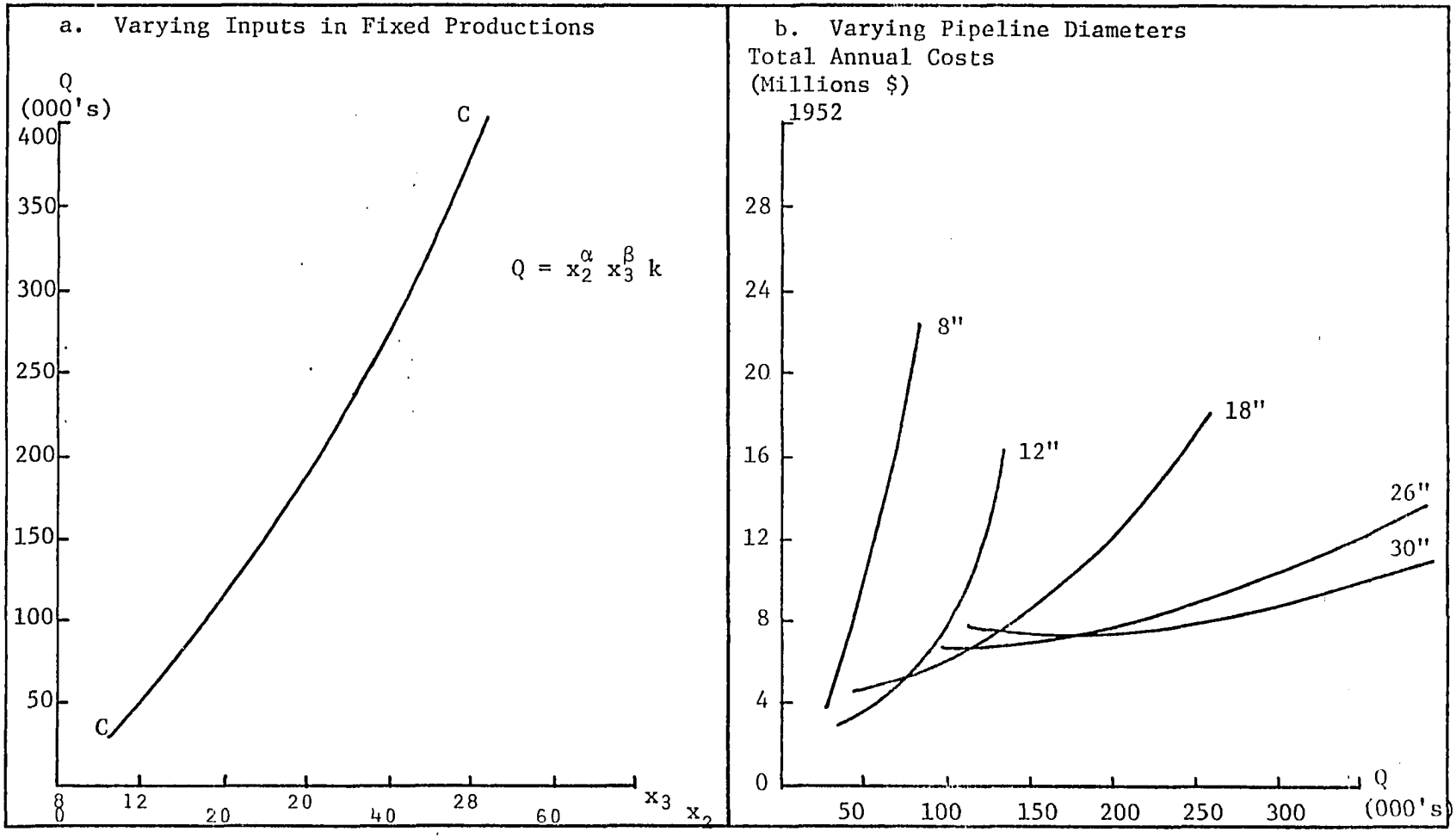
The cost curves derived from equation (7) are illustrated in Figures 9B-10B. Figure 9B illustrates the behavior of total costs under varying diameters. Figure 10A illustrates the behavior of costs for an 18 and 30 inch line in the short and intermediate-run. In Figure 10B both diameter and horsepower are varied and produce a family of cost curves from which long-run costs can be derived. Figure 9B demonstrates that for the smaller diameter pipelines, total cost rises dramatically as output is increased by adding horsepower; with the larger diameter pipe, total costs do not rise as dramatically as horsepower is increased.

The importance of this relationship is shown in Figure 10A where costs in the short- and intermediate-run for an 18 and 30 inch line are compared. The 18 inch line is designed for an optimal capacity of 150,000 barrels per day and the intermediate-run curve is the familiar U-shaped average cost curve. In the case of the 30 inch line the average cost curve, while still U-shaped, is elongated. In both examples, short-run costs are always above the intermediate-run costs and is the result of the fact that any quantity below design capacity has the same fixed costs which must be spread over a smaller output.

The short-run cost curve becomes non-existent at the point of optimal capacity design, where by definition the output cannot be increased without increasing horsepower and therefore pumping stations.

FIGURE 9

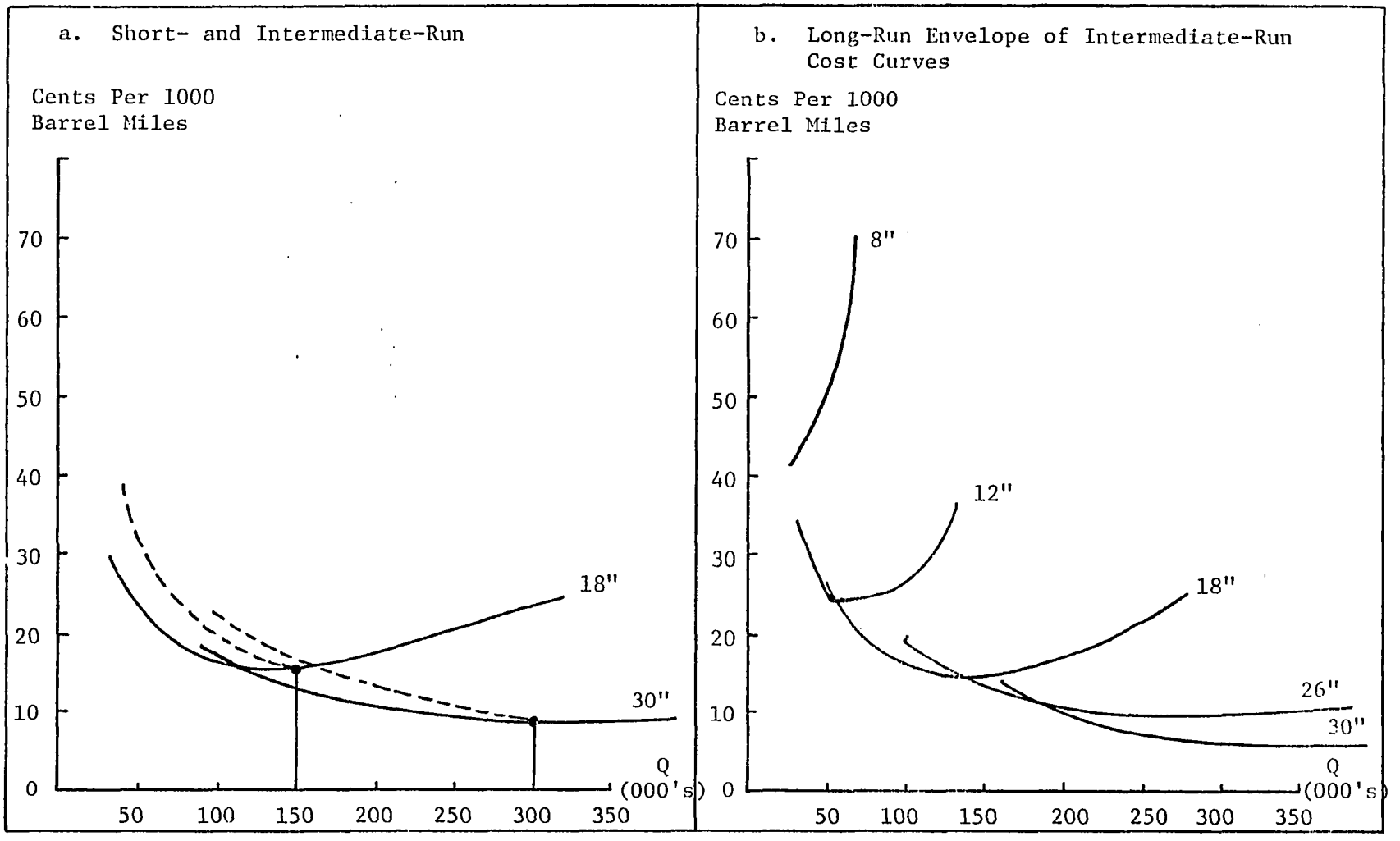
TOTAL COST CURVES



SOURCE: Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition in The Oil Industry (Cambridge: Harvard University Press, 1955), p. 21 and 25.

FIGURE 10

AVERAGE COST CURVES



SOURCE: Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition in The Oil Industry (Cambridge: Harvard University Press, 1955), p. 29 and 26.

Also, once a pipeline is designed and constructed variable costs in the short run are relatively unimportant because the only significant variable cost is generally power.[24]

The 30 inch line has significant advantages over the 18 inch line. It can, in both the short run and the intermediate run, vary output without an appreciable rise in average cost when compared to the 18 inch line. The 18 inch line is competitive with the larger line in only a very narrow range of throughput.

In Figure 10B, average total cost curves for each combination of horsepower and diameter shown in Figure 9B are displayed. The envelope of these intermediate curves is the long run cost curve. The curve is a decreasing cost curve and demonstrates economies of scales. In the long run there are marked returns to scale if larger and larger throughputs are used. The slope of the long-run average cost curve is the result of the fact that the same horsepower applied to a large diameter line produces a more than proportionate increase in throughput. Only if the price of one or both factors increases significantly with the amount of the factor used to offset these increasing returns will long-run average cost curve turn up.[25]

In actual practice, Cookenboo found that the price of horsepower declined with quantity used and the price of line diameter did not fluctuate dramatically with quantity used (at least not sufficiently to offset the physical relationship).[26] These conditions generally prevailed through at least 1968. There is some indication that once diameters exceed some size, long-run costs may turn up as larger diameter lines require payment of a premium price per ton of steel.

Pipelines and Vertical Integration

Overview

As emphasized, pipelines have historically been owned and operated primarily by integrated oil companies and have represented both upstream and downstream integration efforts of parent companies. This ownership of pipelines by companies engaged in production, refining, and marketing has resulted in additional functions and objectives being assigned to pipelines. Pipelines have been used and are being used to achieve overall objectives of integrated corporations that extend beyond the function of transportation. Vertical integration, particularly with regard to petroleum, is a topic that has generated much research and controversy. The modern day controversy surrounding vertical integration in petroleum (and therefore pipelines) is only a variant of a very early industry development. DeChazeau and Kahn state the issue succinctly:

> The significant facts are that they [Rockefeller Group] consistently sought and came very close to achieving a complete monopoly over the American Petroleum Industry, and that vertical integration played a critical role in that achievement . . . .
>
> The key was transportation control . . . .
>
> In the case of pipelines, ownership was necessary both to achieve the advantages of the lower costs they made possible, and to assure their fullest utilization as a bulwark of monopoly.[27]

To give these statements and the controversy a modern context, one need only to replace the Rockefeller Group (Standard Oil of New Jersey prior to 1911) with the eight to twenty major petroleum companies of 1977.

The place that pipelines have played in vertical integration efforts exceeds the relative amount they represent of the total investment of the industry. As of December 31, 1957, DeChazeau and Kahn

found that the average U.S. gross investment dollar in petroleum was distributed as follows: 59.3 cents to production; 18.5 cents to refining; 10.7 cents to marketing; 1.5 cents to others; and only 10 cents to transportation. Of the 10 cents invested in transportation, 7.2 cents were in pipelines.[28]

An examination of selected companies' annual reports for 1975 and 1976 indicates a similar investment pattern by companies in plant, equipment, and properties. Two of the major companies, Texaco and Shell, showed more than 50 percent in producing properties and from 2.9% (Texaco) to 5.7% (Shell) in pipelines. Both companies represent sizable domestic pipeline operations but yet these operations are only a small percentage of their total investments.[29]

Non-Transportation Functions of Pipelines

The best description of the added role given pipelines within integrated firms is found in the major study by John McLean and Robert Haigh, The Growth of Integrated Oil Companies, published in 1954. Although the work is a quarter of a century old, it is relevant to the modern period and remains one of the few studies of the petroleum industry where the authors had direct and cooperation access to integrated company records. Seven companies--Gulf, Texaco, Sinclair, Ohio Oil, Atlantic Refining, Standard Oil Company of Indiana, and Standard Oil Company of Ohio--formed the core of this case study of integration in the petroleum industry.[30]

Crude Oil Gathering Lines

As specialized carriers, crude oil pipelines, both gathering and

trunk lines are fixed in location and under most circumstances fixed in the direction of the flow of crude. Both, it is argued, have a high element of risk because the throughput (supply) is certain to deplete over time.[31] Gathering lines have a higher risk since they serve a narrow group of wells within a field or adjacent fields while trunk lines can draw from a larger number of fields. Gathering lines, however, require a smaller investment than trunk lines and under present technological conditions are more flexible than in the early fifties.

McLean and Haigh found that the seven companies engaged in gathering operations for three primary reasons: to reduce gathering charges below those charged by outside companies; to gain access to a supply of crude--many refining companies used gathering lines to integrate upstream without actually integrating into production; and for expediency, to insure that oil was getting to trunk line terminals and refineries.[32]

None of the companies cited profits from gathering as a major reason for engaging this activity. Ohio Oil Company (now Marathon) was one of a few companies which found that operating gathering and trunk lines was profitable. This company built a substantial business in transportation for other companies and always sold crude at the wellhead and before the oil crossed state lines.[33]

Records supplied by the seven companies for 1940-52 indicated that the companies had earned only negligible profits on this transporting activity. Records also showed that companies that were net purchasers of crude oil for their refineries (own production was insufficient) gathered more than they produced. Companies with higher

production ratios had a lower gathering ratio and thus, gathering activities declined as net buying diminished.[34]

The importance of gathering activity by integrated companies has diminished sharply since the work of McLean and Haigh, particularly in the interstate market. As noted in Chapter IV, gathering mileage in the interstate market declined from 52,077 miles in 1957 to 42,582 miles in 1975, an 18.2 percent decline. The shift away from the interstate and integrated company gathering was addressed in the third report of the U.S. Attorney General, pursuant to the resolution creating the Interstate Compact to Conserve Oil and Gas.

The Attorney General report found a large and growing field of gathering by trucks and means other than major refiners' pipeline companies. In Texas, for example, it was estimated that 350-400 gatherers were handling 390,000 barrels daily. None were found to report to any regulatory agency and generally these gatherers were purchasing the oil for resale at the crude trunk line terminals or refineries.[35]

Integrated companies, it was concluded, were partially withdrawing from the gathering of crude oil and farming the function out to numerous small companies. It was also concluded that the change could only take place with the active aid of the major integrated pipelines since the small operator could not function without assurances that the crude would be repurchased at the trunk line terminal (especially when the interstate line remained the only trunk line carrier).

The reasons offered for the withdrawal were: (1) most large companies found that the gathering line operations were not profitable; (2) the small gatherers provided a flexibility in serving new fields

without a large pipeline investment; (3) there was apparently a cost advantage to repurchase at the trunk terminal; and (4) the arrangement minimized the regulation of purchasing arrangements since the integrated companies were not dealing directly with the lease operator.[37]

Crude Oil Trunk Lines

McLean and Haigh summarized the importance of crude trunk line ownership: "Ownership of a pipeline outlet from a producing region is second only to ownership of proven and developed acreage as a means of assuring a crude supply."[38] De Chazeau and Kahn emphasized this by noting that ". . . for the refiner not located in the field, crude oil availability is economically inseparable from access to pipelines; and the competitive margin within which he must live will be vitally affected by the tariff he has to pay for transport."[39]

Crude oil pipelines were built by integrated companies for the following reasons: (1) to reduce costs, refiners who owned lines minimized transportation costs and insured that costs were comparable with or lower than competitors; (2) to integrate downstream (i.e., outlets for production); (3) to serve as a principal tool in the overall strategy of integrated companies to smooth out supply and demand conditions whose erratic past behavior had plagued the integrated companies since before 1900 (McLean and Haigh noted that all of the companies considered pipelines subordinate and supporting to other phases of their business.); (4) to serve as purchasing agents and for trading purposes (i.e., exchanges); and (5) to generate additional profits on shipments by non-owners once trunk lines became common carriers.[40]

None of the seven companies (except Ohio Oil) were in trunk

line activities for the profits earned from outside shippers. Integrated companies did not look upon pipelines as a principal source of profits to their overall profit picture.[41]

Refined Product Trunk Lines

With the rapid post World War II growth, pipelines are now the major carrier of certain products. Pipelines did not become important carriers of refined products in the United States until the late 1930's. Tuscarora Pipeline Company converted a crude line to carry products in 1931; the line was not only converted but the direction of flow was also reversed. Product lines' growth was limited until after World War II because of technological restraints.[42]

Product lines, like any line, are fixed investments. Unlike crude lines, product lines have few inherent risks since the flow from refinery to market is relatively continuous and subject to less rapid change in location. Once the technology permitted the shipment of heterogeneous products by pipeline, large companies integrated rapidly into product lines. And once the issue of common carrier status was resolved, the lines were operated in a similar fashion to crude lines.

McLean and Haigh found six major reasons for the integration: pipelines were a means of reducing costs; product lines enabled refineries to extend their market; companies could close down marginal refineries and continue to serve existing markets; pipelines could assure a continuous supply to several geographic markets and also could extend the companies into new markets; common carrier status provided an additional source of profits (although the importance of profits was secondary to the support role to refining and marketing); and

finally, product line ownership enhanced the integrated companies' overall supply and demand strategy.[43]

Importance of Crude and Product Lines to Supply and Demand Srrategies of Integrated Companies

> The fact that the construction of pipelines reduced the costs of transporting crude oil [and refined products] must not be permitted to obscure the essentially strategic character of these decisions to integrate.[44]

The integrated petroleum industry is a high fixed cost industry. This characteristic combined with the bulk of crude oil relative to its price gives rise to the necessity of operating at a capacity level which, while rising over the long-run, requires the minimization of erratic shifts in supply relative to a fairly inelastic demand (in the short run). The cheapest place to store crude oil is in the well, the cheapest means of handling refined products in the short-run is to move them to ultimate consumers, regardless of price.

The integrated companies, individually, have not normally been able to expand production, marketing, and refining and also maintain supply and demand equilibrium at prevailing prices. Production, refining, and marketing also take place in many geographic regions and increase the probability of supply and demand disequilibrium. This disequilibrium, on an individual company basis, places pressure on prices to either rise or fall in a manner inconsistent with prevailing prices of integrated firms within these existing geographic markets and has historically given rise to active "spot markets."

Under individual company disequilibrium conditions, the crude and refined markets would potentially be chaotic encouraging entry in some markets and exits in others. These conditions parallel to some

extent the early industry problems associated with erratic behavior of crude oil prices which were subject to major swings as new and larger fields were discovered. This problem, as many have indicated, was solved by government regulation of production.[45]

The well established integrated firms which entered the 1930's were seeking strategies which would reduce the complexity of disequilibrium in the various markets. Ownership of the means of transportation by these integrated companies was a principal step in this direction, at least for those which had the financial means to do so. Pipelines thus emerged not only as the least cost transportation method but their ownership allowed the various owners an evolving tool to reduce the problems of short-run disequilibrium (principally with the combined use of exchange agreements).

That pipelines and exchanges have contributed to efficiency and short-term price stability seems to be a point of agreement. The issue is: to whom have the benefits of efficiency accrued and has short-run price stability been at a level comparable to that achieved through the workable competition model?

Pipeline Companies of Integrated Parents: Profit Maximizers or Cost Minimizers

As integrated units, the question arises as to the pricing motives of pipeline companies. There is little evidence that suggests that these companies are profit maximizers in the traditional sense. As the previous sections indicated, rarely have pipeline companies been looked upon by their petroleum parents as profit centers but rather as a means of minimizing transportation costs and balancing flows

throughout each company's market.

Through the late 1930's the pricing policy of shipper owned pipeline companies were used as an exclusion device and therefore generated large earnings.[46] These earnings were largely illusionary since they represented paper transactions between affiliated companies.

In the Spahn Report conducted for the House of Representatives in 1933, 60 percent of the large companies were found to have carried no outside oil on their gathering lines. Fifty percent of the large companies carried no outside oil on their trunk lines and those with outside shippers were found typically to be members of other large integrated units.[47] The TNEC questionnaire which covered the period 1929 through 1938 found that less than 10 percent of the crude and less than 20 percent of the products belonged to non-affiliated shippers.[48] Professor Spahn voiced an opinion that, under a facade of common carriers, pipeline companies owned by major oil companies were in fact plant facilities of their owners.[49]

In the late 1930's tariffs began to fall. This decline was attributed to changes in federal tax policy, the consent decree, the Reduced Pipeline Rates and Gathering Charges Case, and the economies of large diameter pipe.[50] None of these factors suggested that pricing policies had any stronger relationship to demand influences than before the 1930's. There were indications, that continue to persist, that cost-minimization was, and is, the primary motivation. Cost-minimization is a goal pursued independent of demand influences[51] and applied to affiliated companies' shipments and not to non-owner shipments. Modern pricing policy while influenced by rate of return regulation is more a

function of the outside shipper.

Cost minimization is consistent with the operation of plant facilities but not consistent to the operation of common carriers. The extent to which shipper-owned pipelines carry for outside shippers since the 1930's is not clear-cut. This uncertainty is a result of a void in the public data collected on pipeline companies.

Limited information for 1950-1974 suggests that the Spahn findings still apply. For example, Wolbert found that the percent of outside shipments remains significantly lower than originally expected of a transportation service rendered by legal common carriers;[52] in the Fourth Attorney General's Report it was estimated that non-owner shipments represented 15 percent or less of the total volume on single owner lines and perhaps 25 percent on joint venture lines;[53] and in the unpublished work by John Wilson, based on questionnaires sent to the major companies, the indications were that the pattern remains essentially the same as it was in the 1930's.[54]

The prospectus on two major pipeline companies, the Exxon Pipeline Company and the ARCO Pipeline Company, reveals the following: 78.2 percent of ARCO revenues from 1969 operations came from affiliated companies; the remaining 28.1 percent came from non-affiliated companies. This pattern remained, with slight variation, the same from 1970-73, where in 1973, 77.3 percent of the revenues came from affiliated companies. In the case of Exxon Pipeline Company for the same period 1969-73, revenues coming from affiliated companies ranged from 87.8 percent in 1969 to a low of 83.8 percent in 1973. In the five-year period the maximum amount of operating revenue coming from non-affiliated companies

was 16.2 percent in 1973.[55]

As Chapter VII explains, the major pipeline development of 1957-1975 is the development of joint-venture pipelines. In comment on this development Simon Whitney in a study for the 20th Century Fund, stated

> Most big recent lines have been built as joint ventures rather than by a single company. Although continued expansion of the pipeline system can be interpreted to mean that current regulation permits a high enough return to induce new investment, it may also mean a line is usually built not as a means of earning money directly but as a unit in integrated petroleum structure.[56]

As noted the Fourth Attorney General Report estimated that perhaps as much as 25 percent of joint-venture shipments came from non-participants in the pipeline. There was no indication that joint-venture operations departed from the pricing behavior of single owner lines.

The modern extent to which pricing policy is used as an exclusion/penalty device cannot be answered without a detailed analysis of outside shipments in terms of both volume and shippers. The issue, however, is quite different if the outside shippers are other major integrated companies with whom the pipeline companies' parents have extensive exchanges and corresponding pipeline relationships than if the outside shippers are smaller companies with no corresponding relationships.

The developments since the 1930's do not indicate that pipeline firms are profit maximizers or common carriers in the normal construed manner. The advent of joint venture lines do not alter these conclusions. Joint venture lines, in fact, point to the continued resistance in the industry to common carrier status. McLean and Haigh posed the question of why should a company participate in a joint venture instead of just requesting space on a "common carrier line." Among the answers

given the following demonstrated the industry position: "It was generally expected in the industry that if a company planned to use any very substantial part of the capacity of a line, it should bear a share of the capital investment in the line."[57]

Supply/Demand/Vertical Integration: A Summary

The notion that the market demand function for pipeline transportation is inelastic has limited theoretical and empirical support. In addition, there is a high probability that individual pipeline firms possess some control over prices because they do not operate within the constructs of a competitive model. This is also an implication drawn from the behavior of the production and cost functions.

While companies rarely face situations that conform exactly to the theoretical behavior defined, the important point is that the cost relationships defined do hold for firms operating pipelines. Pipelines have high fixed costs and total operating costs are relatively fixed irrespective of throughput. Because of this it is extremely important that a pipeline operates at or near the designed throughput and emphasizes the necessity of having assured throughput agreements.

The decreasing long run cost curves demonstrate that companies must be able to predict the initial and potential throughput, i.e., the demand that the pipeline will be facing over a relatively long period of time. The economies of scale also demonstrated that it is optimum for both the firm and society that oil be conglomerated in very large quantities for it is only under these conditions that the lowest costs are obtainable. The presence of increasing returns to scale raises monopoly and regulatory questions and signifies the importance of access

to pipelines as well as the actuality or wiseness of competition between pipelines.

Given that integration has been a way of life on the part of large companies and that pipeline investments have epitomized vertical integration, the issue is has pipeline ownership since 1957 evolved as an instrument of competition among companies? How important and pervasive are the modern day economies of vertical integration into pipelines? Are they justified on a cost basis? Have pipelines, particularly through joint ventures, evolved into instruments of cooperation among large companies and therefore posed possible threats to the survival of small companies?

As the discussion of vertical integrated indicated, pipelines have an importance that extends beyond their transport function. De Chazeau and Kahn, for example, concluded that pipelines were important in the determination of domestic crude prices as well as the actual pattern of buying and selling crude. This importance is illustrated in the following statements:

> . . . the pipeline was responsible also in part for the pattern of market forces that governed the price behavior of crude oil. It brought the market to the well of the producer . . . .
>
> Next to prorationing [as a primary explanation of price stability], the most important such influence is the vast network of pipelines, that creates something like a single crude-oil market in this country east of the Rockies . . . [combined] with intercompany exchanges of crude and products.[58]

Finally, there is little reason to conclude that pipelines operate as profit maximizers or in a competitive environment. Nor is there reason to believe that they in reality function as common carriers. The question then is one of determining the modern results of

integration into pipelines. Has this integration served as a means of increasing the market power of the integrated petroleum parent or group of parent companies? It is this question that is addressed in the remainder of this study.

CHAPTER V

[1]McLean and Haigh, The Growth of Integrated Oil Companies, p. 181.

[2]Association of Oil Pipe Lines, "Statement of Jack Vickrey on Behalf of the Association of Oil Pipe Lines, Before the Senate Special Subcommittee on Integrated Oil Operations, Committee on Interior and Insular Affairs, December 12, 1973," (Washington, D.C.: Association of Oil Pipe Lines, 1974), p. 19a; also see Chapter VI, this paper.

[3]De Chazeau and Kahn, Integration and Competition In The Petroleum Industry, p. 338.

[4]George Stigler, The Organization of Industry (Homewood, Illinois: Richard Irwin, 1968), p. 303.

[5]This is not unusual since most microeconomic textbooks concentrate on production and cost functions. This is largely due to the emphasis on the competitive model where the demand curve faced by the individual firm is perfectly elastic (see for example James M. Henderson and Richard E. Quandt, Microeconomic Theory: A Mathematical Approach, 2nd ed. (New York: McGraw-Hill, 1971), Chapter 3.)

[6]Milton Friedman, Price Theory: A Provisional Text, Revised ed. (Chicago: Aldine Publishing Company, 1972), p. 148 and 153.

[7]Ibid., p. 155.

[8]Ibid., p. 153.

[9]Four independent studies found the short-run price elasticity for gasoline in the range of -.06 to -.16 (Blair, The Control of Oil, p. 324).

[10]Blair, The Control of Oil, pp. 323-324.

[11]Federal Energy Administration, Office of Transportation Programs, Pricing Distortions of Petroleum Products (Washington, D.C.: Federal Energy Administration), p. 2.

[12]McLean and Haigh, p. 183; tariffs filed for the Trans Alaska Pipeline system in 1977 were in the $6 range which was more than one-third of the OPEC price for crude oil (see Tulsa World, June 18,

1977, p. 20C), this tariff was over 30 times the average revenue per barrel for all ICC pipelines in 1975 (see Table 20, page 113, this paper).

[13]Blair, p. 324.

[14]Additional empirical work is required on the specification of the demand equation and the price variable in particular, the results shown thus should be treated as preliminary.

[15]The demand equation was re-specified using barrels terminated and average cost per barrel delivered out of system (irrespective of distance), the resulting elasticities differed only slightly from those shown in the text.

[16]In the competitive model, the firm does not face the market demand function. While the competitive conditions are much less persuasive, the likelihood of bilateral monopoly is much greater (where a demand function does not exist); for additional comments see Henderson and Quandt, p. 105 and 244-249.

[17]James T. Kneafsey found that the competitive model was inappropriate for transportation in general (James T. Kneafsey, Transportation Economic Analysis (Lexington, Mass.: Lexington Books, 1975), pp. 33-34).

[18]Supra, p. 48.

[19]This section is based upon the original analysis of Leslie Cookenboo, Jr. in Crude Oil Pipelines and Competition in the Oil Industry (Cambridge: Harvard University Press, 1955), pp. 8-31; the same results are shown or implied in McLean and Haigh, The Growth of Integrated Oil Companies, Johnson, Petroleum Pipelines and Public Policy; and for refined product pipelines in Joseph E. White, "Economics of Large Diameter Liquid Pipelines," Pipe Line News, vol. 41 (June, 1969), pp. 14-23.

[20]Cookenboo, pp. 8-21.

[21]White, p. 14.

[22]Cookenboo, p. 23.

[23]Ibid., pp. 18-19.

[24]Ibid., p. 31; De Chazeau and Kahn, p. 69; and in recent testimony before Congress the President of Kaneb Pipe Line Company indicated that the total operating costs (variable costs) remained low with labor costs, for example, equal to only 10-15% of gross revenue (Statement of Richard C. Hulbert before the Senate Subcommittee on Antitrust and Monopoly, Hearings on the Structure, Conduct, and Performance of the Petroleum Industry, August 7-9, 1974 (mimeograph)).

[25]The Association of Oil Pipelines illustrated the economies of scale with the following example:

Diameter	Pipe Cost Factor	Capacity Factor
4"	1	1
8"	2	6
12"	3	15
16"	4	28
20"	5	48

(Association of Oil Pipelines, "Statement of Jack Vickrey . . .," p. 28); they also noted that a pipeline would have to operate at 60% of design capacity to break even (Ibid., p. 20).

[26]Cookenboo, p. 24.

[27]De Chazeau and Kahn, pp. 75-77. [28]Ibid., p. 15.

[29]Shell Oil Company, Annual Report; Texaco, Incorporated, Annual Report; these data understate their pipeline investments since they do not consolidate all investments in pipelines, nevertheless the pattern is similar to 1957; the 10 largest companies total transportation assets ranged from 7 to 15% of the total assets in 1974 (see Forbes, January 15, 1976, p. 21).

[30]McLean and Haigh, p.i.

[31]The emphasis on risk has received much attention. This attention has focused on risk and uncertainty confronted a "pipeline" not a "pipeline firm." A distinction that overstates the element of risk since a firm can operate in a multi-plant environment with varying risk associated with varying line segments; see also McLean and Haigh, p. 190.

[32]McLean and Haigh, pp. 415-416. [33]Ibid., p. 420.

[34]Ibid., pp. 415-421.

[35]U.S. Department of Justice, Third Report of the Attorney General . . ., pp. 80-83.

[36]Ibid. [37]Ibid., pp. 84-86.

[38]McLean and Haigh, p. 201.

[39]De Chazeau and Kahn, p. 512.

[40]McLean and Haigh, pp. 194-207 and p. 227.

[41]Ibid. [42]Johnson, pp. 363, 254-263.

[43]McLean and Haigh, pp. 207-224, 227.

[44]De Chazeau and Kahn, p. 81.

[45]Joe S. Bain, Industrial Organization, 2nd ed., pp. 626-629; also see John Blair, The Control of Oil, pp. 152-183.

[46]De Chazeau and Kahn, pp. 512-513; also see Supra, p. 29.

[47]Johnson, p. 220.

[48]Wolbert, American Pipelines, p. 44.

[49]Johnson, p. 219-221.

[50]Supra, pp. 49-50.

[51]Kneafsey, pp. 47-56.

[52]Wolbert, p. 45.

[53]U.S., Department of Justice, Fourth Report of The Attorney General . . ., pp. 44-45.

[54]John Wilson, "Market Structure and Interfirm Integration in The Petroleum Industry," Appendix B (mimeograph).

[55]Prospectus, ARCO Pipe Line Company (Smith, Barney & Co., November 1, 1974), p. 6; Prospectus, EXXON Pipeline Company (Morgan Stanley & Co., October 17, 1974), p. 7.

[56]Simon N. Whitney, Antitrust Policies (New York: Twentieth Century Fund, 1958), p. 123.

[57]McLean and Haigh, p. 421.

[58]De Chazeau and Kahn, p. 132 and 183-185; Price determination and the problems of potential excess supply (i.e., distressed oil) has entered a new era since 1973. The emergence of price control via the Federal Energy Administration (and from 1977, the Department of Energy) and OPEC has necessarily reduced if not eliminated the role of pipelines in crude oil price determination. It has not affected the domestic buying and selling patterns. For a discussion of these developments see John Blair, The Control of Oil.

CHAPTER VI

STRUCTURE AND CONDUCT, PART I: NUMBER OF SELLERS AND OWNERSHIP PATTERNS

The term "structure" refers to those characteristics of the organization of the pipeline segment that have a strategic influence on the nature of competition and pricing within not only pipelines but the entire petroleum market. The elements thought relevant in the study of market structure are (1) number and size distribution of buyers and sellers; (2) entry barriers; (3) presence or absence of product differentiation; (4) cost structure; (5) the presence of regulations; and (6) the environment in which the market functions (legal, institutional, and physical).[1]

Certain aspects of the structure of the pipeline segment were defined in previous chapters (i.e., regulation, physical environment, cost structure, and entry barriers). This chapter examines the number of sellers of pipeline transportation services, the services offered, and the ownership of pipeline companies. The study of ownership patterns introduces elements of market conduct. Market conduct refers to those patterns of behavior that companies have followed in adjusting to the

markets in which they operate (again within both pipelines and the entire petroleum market).[2]

Because of extensive vertical integration, this chapter begins the explicit analysis of shipper/owner relationships. Given the long history of vertical integration, how have petroleum companies organized and operated their pipeline investments? To what extent have a small number of major companies dominated petroleum pipeline transportation? Or to rephrase the question, have major petroleum companies dominated pipeline transportation during the period under study? To answer these questions requires an evaluation of the presence and magnitude of both non-major petroleum companies and companies with only investments in pipeline transportation. It also requires that "major" companies be defined.

The analysis of pipeline companies takes place on the national level. This may be less than satisfactory since physical market segmentation impedes the functioning of a national market. A pipeline running from Louisiana to Illinois does not directly compete with one running to New York. Although it may be of value to do a more extensive evaluation of the spatial aspects of buyers and sellers, it will be argued that the pipeline segment of the domestic petroleum industry does not have the degree of segmentation as it initially appears to have, especially for a small group of companies.

Vertically Integrated Petroleum Companies

In The Control of Oil, John Blair comments:

> In domestic oil monopoly power does not stem from a simple, highly concentrated, oligopolistic structure but rather from an amalgam of a moderately high level of concentration, an extraordinary maze of

> interlocking corporate relationships, an extreme degree of vertical integration, and governmental intervention to limit supply.[3]

A major part of this and similar arguments can be examined within the context of a study of domestic pipelines. The significance of pipelines to the monopoly argument has its origins in a persistent charge that a small group of vertically integrated companies have used their control over pipelines to monopolize the remainder of the industry.[4]

To address the domestic monopoly issue raised by Blair and others and the pivotal role (if any) that pipelines have played requires that a major part of the study of pipelines revolves around an analysis of how petroleum companies have organized and operated their pipeline investments. To do this requires that the petroleum companies be identified and that a clarification be made as to the identity of the small group of integrated companies.

Traditionally, domestic petroleum companies have been classified as "major" and "independents" or as "integrated" and "non-integrated."[5] The primary criteria for determining these companies has been the degree of vertical integration and relative size (measured by total sales, assets, and so forth). A firm is vertically integrated when its activities span two or more of the following stages: exploration and production, transportation, refining, wholesale and retail marketing. A fully integrated company would be engaged in each of these activities. The definition implies nothing about self-sufficiency in any of the stages.[6]

The "major" label has commonly been used to denote a fully vertically integrated company. The term is used in this paper for the purpose of consistency of comparison with other works as well as for denoting relative size and control. A degree of consistency is useful in the

development of concentration measures where the intent is to measure the presence of "major" companies in pipeline transportation activities.

Perhaps the simplest definition of the differences between a major company and all other companies is found in the Temporary National Economic Committee (TNEC) Study:

> The petroleum industry is characterized by a relatively small number of enterprises constituting probably two-thirds of the investment of the entire industry. The remainder of the industry is made up of thousands of small producers and marketers and several hundred refining companies. The largest units are commonly referred to as "major companies."[7]

In this context the reference was to domestic operations and not international operations.

Numerous authors have used varying definitions and criteria for delineating major companies. Regardless of the method used, the end results have been essentially the same group of domestic and international companies. Listed below is a 1976 delineation of domestic and international companies. Although the "lesser majors" and leading "independents" groups are somewhat limited in number, the listing represents a concensus group of companies.[8]

Domestic		International	
"Top Eight"	"Lesser Majors"	"Seven Sisters"	Leading "Independents"
Exxon	Getty	Exxon	Compagnie Francaise Petrole
Mobil	Phillips	Mobil	Continental
SoCal	Signal	SoCal	Marathon
Stan. (Ind.)	Union	Texaco	Amerada Hess
Texaco	Continental	Gulf	Occidental
Gulf	Sun	Royal Dutch Shell	
Shell	Amerada Hess	BP	
ARCO	Cities Service		
	Marathon		

The commonality of the delineation is a function of the relative stability of the major companies over a long period of time. This is shown in Table 29 and Figure 11.

In Table 29 the major companies as of 1930, 1938, and 1955 are listed. With two exceptions (Signal and Amerada Hess) the companies of 1930 are the same as listed above (allowing for acquisitions and mergers). The commonality does, however, tend to break down once the 16th or so company is defined. Thereafter, the delineation does depend on the definition and criteria used.

To quantify the extent of the involvement of major companies in domestic pipeline activities, both annually and over 1957-75, a more specific delineation of the twenty major companies was developed. Using the criteria of domestic integration and size, measured by total sales, the twenty largest domestic petroleum companies in each year were defined and are shown in rank order in Figure 11. It is this group of major companies that is used in the remaining analysis.

Four companies presented special problems and are excluded from the group. The first, the Signal Companies, does not meet the criteria of integration. Occidental Petroleum, which ranks high in terms of assets and sales, has largely concentrated its operations in the international market.[9] The third company, Champlin Petroleum, is a wholly-owned subsidiary of Union Pacific. It may in fact belong in the group but because of the lack of consistent data is omitted.[10] The final company omitted is Tenneco. Its diversification is such that it distorts its actual importance in petroleum activities. For example, in 1975 the company's total revenue was $5.6 billion of which only 21.6 percent came from petroleum production, refining, and marketing.[11]

TABLE 29

MAJOR DOMESTIC OIL COMPANIES, SELECTED YEARS, 1930-1955

Company	Year of Incorporation	Rank 1930	Rank 1938	Rank 1955
Standard Oil (NJ)*	1882	1	1	1
Socony-Vacuum*[a]	1882	2	2	2
Standard Oil (IN)*	1889	5	3	3
Texas Corporation	1926[e]	6	4	5
Standard Oil (CA)*	1926[e]	7	5	6
Gulf Oil	1922[e]	3	6	4
Cities Service	1910	12	7	10
Shell Union Oil Corp.[b]	1922	4	8	8
Consolidated Oil Corp.[c]	1919	9	9	7
Phillips Petroleum	1917	18	10	9
Tidewater Associated Oil	1926	8	11	15
Atlantic Refining Co.*	1870	11	12	11
Pure Oil Co.	1914	13	13	17
Union Oil Co.	1890	10	14	12
Sun Oil Co.	1901	14	15	13
Ohio Oil Co.*	1887	19	16	18
Continental Oil Co.*	1920	15	17	14
Standard Oil (Ohio)*	1870	16	18	19
Mid Continent Pet.[d]	1917	-	19	16
Skelly Oil Co.	1919	17	20	20

SOURCE: Data for 1930 is for crude runs to stills (Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition in the Oil Industry (Cambridge: Harvard University Press, 1955), p. 44); data for 1938 is for total assets (U.S., Congress, Investigation of Concentration of Economic Power, Hearings before the Temporary National Economic Committee, 76th Congress, 2nd Session (Washington: Government Printing Office, 1940), Part 14A, p. 7,708); data for 1955 is for total assets (Melvin G. De Chazeau and Alfred E. Kahn, Integration and Competition in the Petroleum Industry (New Haven: Yale University Press, 1959), pp. 30-31).

*Original members of Standard Oil group

[a]Successor by 1955, Socony-Mobil

CONTINUED

TABLE 29 (CONTINUED)

[b]Successor by 1955, Shell Oil

[c]Successor by 1955, Sinclair Oil

[d]Successor by 1955, Sunray Mid-Continent Oil Co.

[e]Texas Corp. originally incorporated in 1902, Standard Oil (CA) in 1879, and Gulf in 1907.

With only small variation, the defined group of companies are consistent with those found in the literature during 1957-75. The differences are generally confined to companies ranked 16 to 20. The use of other criteria such as production, refinery capacity, and gasoline sales tends to change companies' relative positions but have only a marginal impact on concentration measures.

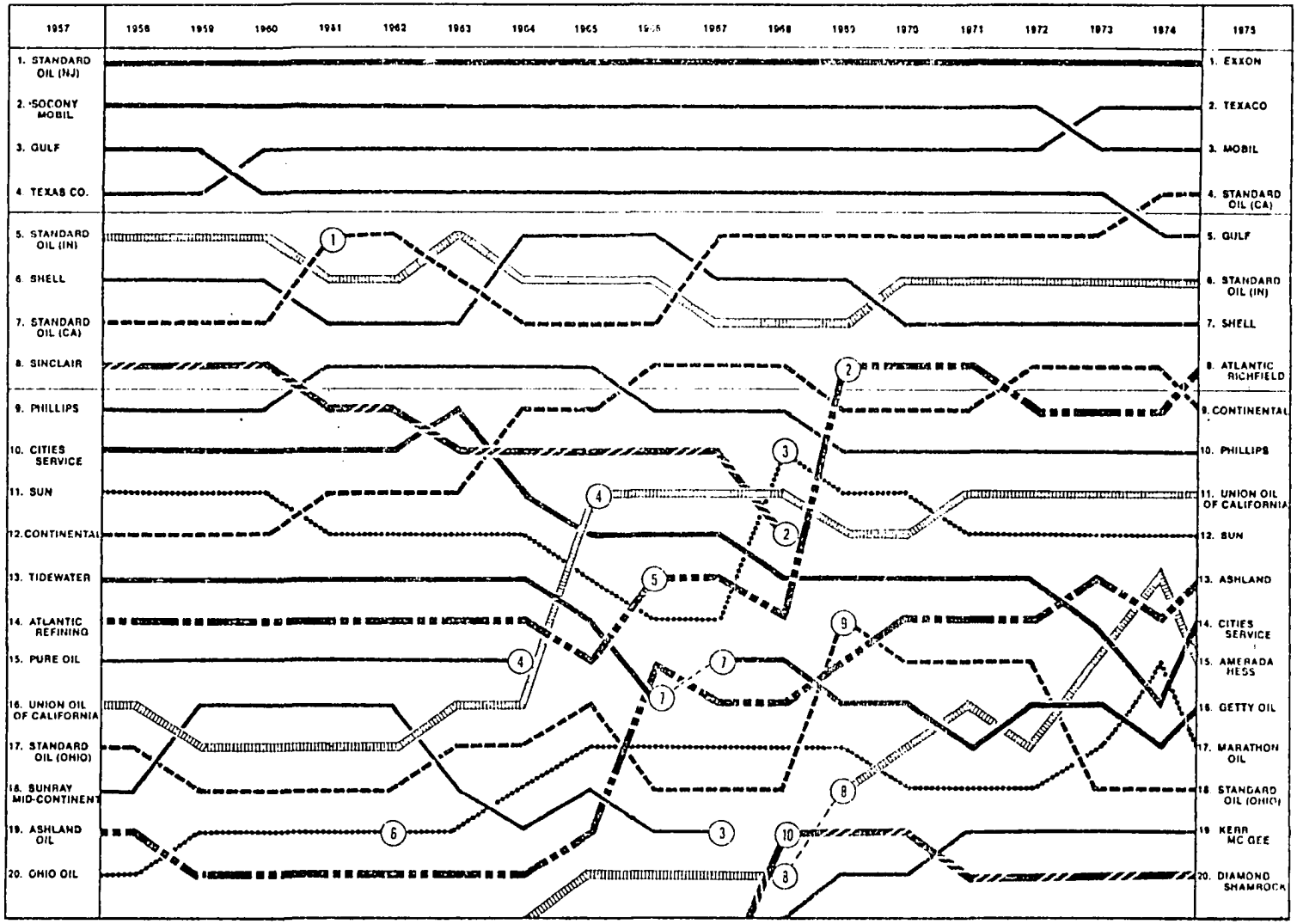
Figure 11 indicates the modern degree of stability within the industry. Exxon continues to be the largest oil company, as it has since the 19th century. The next three companies, Mobil, Gulf, and Texaco changed relative positions but remained in the top four until 1975 when Standard Oil of California emerged as the fourth largest in terms of total sales. The next three, Standard Oil of Indiana, Shell Oil, and Standard Oil of California, also remained relatively stable as the 5th, 6th and 7th largest companies throughout most of the period. The eighth largest company has shifted among several companies. Since 1969, the eighth position has been an exchange between Atlantic Richfield and Continental Oil.

Below the tenth position and after 1963, the stability tends to disappear. As Figure 11 indicates there is a strong cursory correlation between upward movement and mergers and acquisitions activity. In fact, the reason there are three newcomers in the top twenty group is the result of mergers between the companies comprising the top twenty in 1957.

Total assets for these companies in 1957 and 1976 are shown in Appendix A. An examination of the distribution of assets between companies reveals an interesting fact about the stability of companies and

Figure 11

Major Domestic Oil Companies, Annually, 1957 - 1975



Source: ranking by total sales from **FORTUNE**, annual; merges and acquisitions from **Moody s Industrial Manual,** annual.

(1) Standard Oil (CA) acquired Standard Oil of Kentucky; (2) Sinclair acquired by Atlantic Richfield; (3) Sunray DX merged into Sun Oil; (4) Pure Oil acquired by Union Oil of California; (5) Richfield Oil and Atlantic Refining merged; (6) Ohio Oil completes acquisition of Plymouth Oil and changes name of company (Ohio Oil) to Marathon Oil; (7) Assets of Tidewater Oil (other than those acquired by Phillips) merged into parent. Getty Oil; (8) Amerada Petroleum and Hess Oil and Chemical merged; (9) British Petroleum's U.S. operations sold to Standard Oil (Ohio) in exchange for 25 percent interest in Standard; B.P.'s interest to increase to over 50% in early 1980's; and (10) Shamrock Oil merged with Diamond Alkali.

the contrast between the top company, Exxon, and the 19th company. In 1957 Exxon's assets were 23.74 times as great as the 19th company. In 1975 Exxon's assets were 23.66 times as large as the 19th company. During this period Exxon's assets increased by 277 percent.

Also contained in Appendix A is a list of international major/minor petroleum companies and government owned companies. These companies are included to facilitate a comparative analysis of joint venture participation patterns. The international majors, the "seven sisters," is a distinction that first gained wide recognition in a Federal Trade Commission study entitled The International Petroleum Cartel, published in 1949. This listing of international majors includes five domiciled in the U.S.[12] The listing of the international minors are as defined by Munkers and Sturgeon, in their study of joint-venture activity outside the United States and includes 18 companies.[13]

Sellers of Pipeline Transportation Services

In the absence of vertical integration, petroleum transportation as Chapter III suggests would be subdivided into two separate industries. The first would be comprised of sellers of crude transportation services who supply a common group of refineries. The second would be sellers of refined product transportation to a common group of wholesalers, bulk stations, retailers, and so forth for distribution to ultimate consumers.

While the separation has a theoretical basis, vertical integration blurrs the distinction between buyers and sellers. The differences can partially be maintained, however, by the introduction of a third group of sellers; those who transport both crude and refined products, i.e., the all-phase company. The all-phase company was a logical

development of refiners which integrated both upstream and downstream and have become the focal point of the investments of integrated firms. The separation by services provided is used because of its usefulness for public policy evaluation as well as for clarity of analysis.

Pipeline companies can provide a number of services and also function as either a single plant, i.e., single one-direction lines, or a multi-plant operation, where separate pipeline networks are operated.[14] The non-integrated services a pipeline company can provide are: crude oil gathering; crude oil trunk line shipping; crude oil tank storage and terminating services; product trunk line shipping; and product storage and terminating services.

If a company provided all five services it would, because of short-run technological constraints, be a multi-system, multi-terminus company. This applies only in the short run for there are no technological restrictions preventing the conversion of trunk lines to carry products other than those they were originally designed to carry. In addition, by converting pumping stations, the direction of flow can also be changed. Gathering lines, however, do not lend themselves to conversion.

There are instances where conversions have occurred but have been the exception rather than the rule. Lines once dedicated to a particular use have continued to perform the service throughout the period under examination. One notable exception has been the Williams Pipeline Company (formerly the Great Lakes Pipeline Company). This company has recently converted small segments of their traditionally refined products operation to include both crude and liquid fertilizers. In addition, they

have successfully batched refined products and crude oil over the same line.

For purposes at hand, companies are classified as: crude gatherers; crude gatherers and trunkline shippers; crude trunk line shippers; refined product shippers; and all-phase companies--those which perform all functions. This classification conforms to the historical pattern of companies reporting to the ICC and differs from the initial classification system only in that storage and terminating services are omitted. These services are not examined.

Storage and terminating services are apparently a function of who owns the pipeline. As a rule, the more independent or the less attached a company is to integrated petroleum companies the greater the likelihood that these services are offered to non-owner shippers. The general non-availability of these services on shipper/owner lines (including their joint ventures) has been a controversial issue.[15]

In 1957, 82 companies were reporting to the ICC. Of these, 80 were common carriers (see Table 30). Twenty four were all-phase companies, 27 offered refined product transportation, and 29 companies provided crude oil transportation. Of the 29 crude companies, 6 performed gathering services only, 7 provided both gathering and trunk-line services, and 16 companies operated only trunk lines. By 1975 the number of firms reporting to ICC had increased to 104. Two of these firms, although reporting as common carriers, were specialized carriers and are excluded from the analysis. One was a coal slurry pipeline and the other carried anhydrous ammonia exclusively.[16]

In the 19 year span, the number of ICC carriers increased by 22.

TABLE 30

DISTRIBUTION OF PIPELINE COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION, BY TYPE OF SERVICE PROVIDED, 1957 AND 1975

Type of Service	Number of Companies 1957	1975
All Phase	24	25
Refined Products	27	40
Crude Oil, Total	29	37
Gathering only	6	4
Gathering and Trunk Line	7	10
Trunk Line only	16	23
Total	80[a]	102[b]

SOURCE: Compiled from data in Appendix B.

[a]Excludes two companies which were relieved from filing by the Interstate Commerce Commission. Also excludes Utah Oil Refining Company which merged into Service Pipeline Company in June, 1957.

[b]Excludes Black Mesa Pipeline Company (a coal slurry pipeline); Gulf Central Pipeline Company (an anhydrous ammonia pipeline); and Lion Oil Company (granted temporary relief from filing).

Refined product carriers increased by 13, the largest gain in companies.[17] This was consistent with the product mileage growth. Also consistent with mileage changes, the number of gathering companies declined (by two). Companies operating crude trunk lines, however, increased from 33 to 43 companies. The all-phase companies demonstrated the greatest stability. As Table 25 indicated, approximately 77 percent of the total United States pipeline mileage in 1974 was operated by these companies. It was only in the area of crude gathering that the ICC reporting companies had failed to operate at least 80 percent of the total pipeline mileage.

Given the magnitude and location of the transportation requirements of the petroleum industry and the dominance of pipelines, the number of firms operating in the interstate market is relatively small. The actual short-run competitive potential is more narrowly defined in terms of services provided and geographic location of existing facilities. For example in 1975 only 65 companies transported refined products and only 58 carried crude oil.

Pipeline Companies: Evolution of Ownership Patterns

Types of Ownership

Pipeline investments in interstate operation have taken primarily six organizational forms, five of which are examined here. The five are: (1) unaffiliated pipeline companies, i.e., the "pure independents"; those companies classified as "parent" pipeline companies; (2) subsidiaries of non-petroleum parents; (3) subsidiaries of petroleum companies; (4) pipeline departments, i.e., a division or department of a parent company; and (5) corporate joint ventures. The sixth form of

pipeline investment is the joint-venture system. Unlike the other five it is not a corporate entity but is a contractual arrangement. It is discussed in detail in the next chapter.

The distribution of carriers reporting to the ICC in 1957 and 1975 are shown by type of ownership and by type of service in Table 31. The table indicates that the independent pipeline companies are few in number. Only three companies, two of which transported products, operated over the entire period. Like the independents, subsidiaries of non-petroleum parents have been a relatively insignificant ownership form. Only three were operating in 1957, two of which transported crude oil. In 1975, however, their numbers had increased to 12 companies, 11 of which transported refined products.

Until recently, the dominant ownership form was the subsidiary of a petroleum parent. In 1957, 36 companies, 45 percent, were wholly owned by petroleum companies. In 1975 the number had risen to 39, but the percent of total had dropped to 38. The majority of the petroleum subsidiaries throughout the period were all-phase companies. Pipeline departments at one time were a significant means of controlling investments in pipelines. By 1957 they had declined to six, and by 1975 only five departments were reporting to the ICC. Two were departments of top twenty petroleum companies.

The ownership form experiencing the largest increase has been the corporate joint venture. In 1957 there were 32 corporate joint ventures. These were about equally divided among crude and product carriers. By 1975 the corporate joint venture had become the largest ownership form. The greatest increase in the number of joint ventures occurred in crude transportation.

TABLE 31

DISTRIBUTION OF PIPELINE COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION, BY OWNERSHIP FORM, 1957 AND 1975

	Type of Ownership				
	Independents[a]	Non-Petroleum Subsidiaries	Petroleum Subsidiaries	Pipeline Depts.	Joint Venture Companies
All Phase					
1957	1	0	19	1	3
1975	0	1	22[b]	0	2
Crude					
1957	0	2	10	2	15
1975	1	0	9	1	26
Product					
1957	2	1	7	3	14
1975	2	11[c]	8	4	15
Total					
1957	3	3	36	6	32
1975	3	12	39	5	43

SOURCE: Compiled from data in Appendix B.

[a]Not owned by another corporation.

[b]Includes Pasco Pipeline Company, a wholly owned subsidiary of Pasco, Inc. On December 30, 1975, stockholders of company voted to liquidate and dissolve company; as of July, 1976, stock in pipeline company was pledged to Rosley and Company.

[c]Of the eleven companies, four were wholly owned subsidiaries of railroad holding companies, and three were wholly owned by natural gas transmission companies.

Ownership Patterns: Petroleum Company Investments

The majority of the pipeline companies reporting to the ICC are affiliated in varying degrees with integrated companies. Of the 80 companies reporting in 1957, 72 were affiliated with petroleum parents. Of the 102 companies reporting in 1975, 86 were affiliated with petroleum parents. It is in the affiliation between petroleum parents and their pipeline investments that the unique characteristics of the corporate structure of the pipeline segment of the industry are found.

The pipeline interests of the integrated petroleum parent are almost entirely confined to separate legal entities. In 1975 in only three cases were integrated parents operating interstate pipelines directly through a division or department. This legal separation which took place long before 1957 was a response to ICC regulation as well as the threat of divorcement (i.e., divestiture).[18]

Industry reasons for separation of pipeline investments from the parent were outlined in a speech by J. K. Spangler in July 8, 1970.[19] Spangler cited several reasons for this separation: the first was due to ICC's supervision powers over carrier books and their audit powers; second, the State of Texas has long had a statuatory prohibition against a corporation engaging in both production and transportation; and third, its was a reaction to a strong divorcement movement in the 1930's.[20]

By separate incorporation, the integrated companies insulated ICC jurisdiction activities "thereby fence off the pasture to be so closely grazed"[21] and also overcame Texas' statuatory prohibitions. Separate incorporation reached a high mark in the 1930's when a strong

divorcement movement was encountered in Congress and in the Roosevelt administration. The industry apparently felt that arm's-length dealings might lessen the thrust for divorcement and was to some degree a preparation for this possibility.[22]

The divorcement issue, until the 1970's, was muted by declining tariffs (See Table 20) and by the increasing use of joint ventures, both corporate and contractual.[23] The use of joint ventures, as indicated in Chapter VII, also minimized the legal liabilities raised by extensive cooperation.

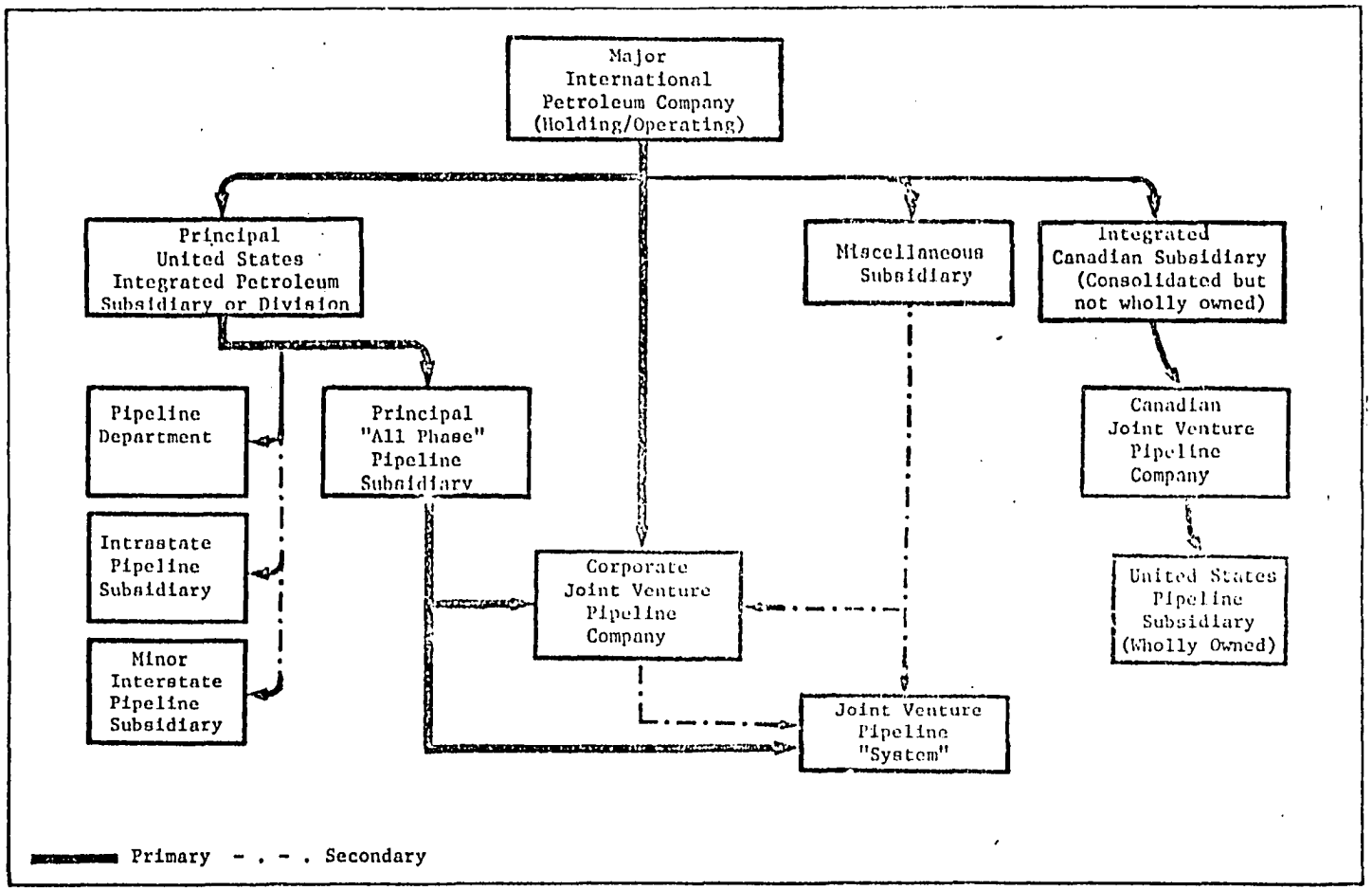
The advantages of separate incorporation have apparently outweighed the disadvantages. The principal disadvantage, the double tax bite of 15% on dividends, has been avoided by consolidating returns in cases where the pipeline interests were 80 percent owned.[24]

In Figure 12, a typical modern organizational chart is outlined. The bolder lines indicate the major means by which the parent holding or operating company's pipeline investments are organized. The thinner black lines and dotted lines indicate minority organizational methods. The major integrated company will typically have pipeline investments allocated in this fashion.

The focal point of investments and control of pipelines is found in the principal pipeline subsidiary. It is without exception an all-phase pipeline company. Its significance is increased by the fact that it generally holds the interests in corporate joint venture companies in which the parent company participates. Participation in corporate joint ventures and joint-venture systems is not confined, however to the principal pipeline subsidiary. In many instances, the parent will

FIGURE 12

TYPICAL ORGANIZATION OF DOMESTIC PIPELINE INVESTMENTS
BY MAJOR PETROLEUM COMPANIES



SOURCE: Compiled by author from data in Appendix B.

participate directly or indirectly through a subsidiary other than its principal domestic operating subsidiary or division.

Pipeline departments and intrastate subsidiaries are now found primarily in the state of California.[25] In addition, minor interstate pipeline subsidiaries have all but disappeared with the consolidation movement that has occurred over the 19 year period.

On the right hand side of Figure 12, the organization of Canadian operations are shown. The Canadian companies are relevant for they are the dominant means by which Canadian crude comes into the United States. There are three pipelines that cross into the United States. All three are corporate joint ventures indirectly controlled primarily by the eight major companies through their Canadian subsidiaries (See Appendix B).

The three Canadian corporate joint ventures are: Trans Mountain Pipeline Co., Ltd.; Interprovincial Pipeline Co., Ltd.; and Montreal Pipeline Company. Their respective U.S. subsidiaries are: Transmountain Pipeline Co., Lakehead Pipeline Co., and Portland Pipeline Company. Transmountain crosses into the state of Washington. Lakehead, and its parent, is the largest crude pipeline company in North America and crosses into PAD II and PAD I.[26] Portland Pipeline Company receives imports on the East Coast of the United States for shipment to Montreal refinery centers; it has no output terminals in the United States.

Ownership Patterns: Investments by Independents

As noted, the "pure" independent, those unaffiliated with another company(s) has been rare in domestic pipeline operations. Broadening the definition to include subsidiaries of non-petroleum

parents does not greatly increase the total. Though their numbers are small, a closer examination of these companies is important since to have a competitive industry one must have an adequate number of truly independent and self-motivated sellers.

It has often been stated that oil companies are in pipeline activities because outside investors have not come forth to take the risks "inherent" in pipeline activities.[27] To properly evaluate this contention it is necessary to analyze the outside interests that have made pipeline investments. From a public policy evaluation and decision-making perspective (particularly in relation to divestiture and regulation), the performance and behavior of independent companies are necessary elements in evaluating the necessity of shipper/owner relationships.

In 1957 only eight companies were unaffiliated with petroleum parents. Two of the eight were wholly owned subsidiaries of Buckeye Pipeline Company. These companies are shown in Table 32. By 1975 there were 15 pipeline companies and one pipeline department unaffiliated with petroleum parents. Five were operating in 1957, nine were new entries, and two companies' entries were the results of acquisitions and expansion of in-place pipelines. The 16 entities are shown in Table 33. The three companies operating in 1957 that did not survive through 1975 (New York Transit, Northern, and Augusta) were either merged or acquired by one of the unaffiliated companies shown in Table 33.

The characteristics of these companies are in contrast to the pipeline companies affiliated with petroleum companies. The contrast

TABLE 32

INDEPENDENT COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION, 1957[1]

Pipeline Company and Parent Company	Service Provided
Buckeye Pipeline Company (Publicly Traded)	All Phases
Cooperative Refinery Association (Farmland Industries)	Crude
New York Transit, Inc. (Buckeye Pipeline Company)	Crude
Northern Pipeline Company (Buckeye Pipeline Company)	Crude
Augusta Pipeline Company (Publicly Traded)	Products
Kaneb Pipeline Company (Kaneb Services, Inc.)	Products
Southern Pacific Pipeline Company (Southern Pacific Co.)	Products
Texas Eastern Transmission Corp. Products Division (Publicly Traded)	Products

SOURCE: Compiled from data in Appendix B.

[1]Not owned or controlled by company or companies whose principal business involves production, refining or marketing petroleum products.

TABLE 33

INDEPENDENT COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION, 1975[1]

Pipeline Company and Parent Company	Service Provided
Buckeye Pipeline Company (Pennsylvania Company)	All Phases
Cheyenne Pipeline Company (Nielson Enterprise, 33.3%; Gesli Investment Co., 33.3%; and Ecodor Investment Co., 33.3%)	All Phases
Bell Fourche Pipeline Company (individuals)	Crude
CRA, Inc. (Farmland Industries)	Crude
Allegheny Pipeline Company	Products
Trans-Ohio Pipeline Company	LPG
Products Division (Texas Eastern Transmission Corp.)	Products
Airforce Pipeline Company (Southern Railway)	Products
Calnev Pipeline Company[2] (Union Pacific Railroad)	Products
Hydrocarbon Transportation, Inc. (Northern Gas Products Company)	Products
Jet Lines, Inc. (individuals)	Products
Kaneb Pipeline Company (Kaneb Services, Inc.)	Products
Mapco, Inc. (publicly traded)	LPG

TABLE 33 CONTINUED

Pipeline Company and Parent Company	Service Provided
Okie Pipeline Company[3] (Kock Industries)	LPG
Santa Fe Pipeline Company (AT & SF Railway System)	Products
Southern Pacific Pipeline Company (Southern Pacific Company)	Products
UCAR Pipeline, Inc. (Union Carbide Corp.)	Products
Williams Pipeline Company[4] (Williams Companies)	Products

SOURCE: Compiled from data in Appendix B.

[1]Not owned or controlled by company or companies whose principal business involves production, refining or marketing petroleum products.

[2]Pipeline is operated by Champlin Petroleum Company (wholly owned by Union Pacific Railroad); Champlin is an integrated petroleum company and in 1970 ranked among the top twenty petroleum companies in terms of crude production and refinery capacity.

[3]Kock Industries is privately held with large energy related investments.

[4]Williams Pipeline until 1974 was primarily a products pipeline; it now carries crude oil.

was in terms of one or more of the following factors: services offered, spatial aspects; integration; or innovation. The independent pipeline company, with the exception of Buckeye[28] and its former subsidiaries, has not engaged to any great degree in the trunk-line transportation of crude oil. Only four companies offered this service in 1975. The modern significance of the independent is to be found in its ownership and operation of product and LPG lines.[29] As Table 33 indicates, 14 of the companies offered non-crude transportation services.

In addition to a concentration in non-crude services, many of the carriers are specialized in that they transport LPG (exclusively) to a specific market (e.g., the rural farm market); they are single terminal lines serving airports (military and civilian, notably Air Force and Jet Lines, and part of South Pacific Pipeline Company's mileage); they carry light hydrocarbons (Santa Fe Pipeline Company) or petrochemicals (UCAR Pipeline).

Unaffiliated companies also have had a propensity to offer storage and terminating services to all shippers. This is also in contrast to the practice of pipeline affiliates of petroleum companies. In the latter case, terminating and storage facilities are normally owned and operated by a petroleum company and not by the pipeline company. The offering of storage and terminating services by unaffiliated companies is important because in the planning and construction of these facilities there is an attempt to maximize the pipeline's ability to reach the largest number of potential shippers. This attempt to maximize access is in contrast to pipelines not offering these services which inherently restricts/limits access by non-owner shippers.[30]

The independent pipeline company in 1975 by and large did not operate (interstate) in the major refining and producing area of the United States (PAD III). None of the crude companies operated in PAD III and only two of the 14 non-crude companies had lines extending into PAD III (Santa Fe and Texas Eastern's Product Division). The largest independents operate primarily in PAD II. These are Buckeye, Hydrocarbon Transportation, Kaneb, Mapco, Okie, and Williams. In addition, the Southern Pacific Pipeline Company is the only interstate carrier which carries refined products across state boundaries in PAD V.

Twelve of the pipeline operations shown in Table 33 are wholly-owned subsidiaries. Seven of these operations represent horizontal integration efforts (five by railroads and two by natural gas companies). Three operations (CRA, Inc., Okie Pipeline Company, and UCAR Pipeline, Inc.) are examples of vertical integration efforts by their respective parents.

By most standards, the non-petroleum parent companies are large corporations. Southern Pacific, Union Pacific and the Pennsylvania Company are among the largest railroad holding companies. Other examples of size are the Williams Companies (sales of over $880 million in 1975) and Mapco, Inc. (sales of over $340 million in 1975).[31] The most recent independent pipeline entry (Okie Pipeline Company) is owned by Kock Industries. A privately owned corporation, Kock Industries sales were estimated by Forbes to be in excess of $2 billion in 1974. Forbes also estimated that the company was transporting and distributing 800,000 barrels of crude each day (none apparently in the interstate market). The company owned (in 1974) some 10,000 miles of pipeline of which only a small portion involved in the interstate transportation

of petroleum. The company operates primarily in PAD II.[32]

Pipelines unaffiliated with integrated petroleum companies have primarily operated in markets that were to some extent ignored or abandoned by the integrated companies. One example, already noted, was in intrastate gathering of crude oil, another was in the interstate product market in PAD V. These examples are relatively insignificant compared to the independent's role in PAD II. It is in this geographic area that the independent carriers are concentrated. The concentration is primarily in the farm market.

The farm petroleum market was estimated in 1977 to be a $3.3 billion market.[33] Farm cooperatives capture approximately 40 percent of this market. Much of the market is served by either co-op pipelines or other independents' pipelines. In several respects the co-op success in the farm petroleum market is a result of lack of interest and mistakes by the major oil companies.[34] For example, in the 1920's the cooperatives were born largely to purchase fuel in large quantities and make deliveries directly to the farmers, a service that the oil companies had refused to provide. The largest cooperative, Farmland Industries, built its own refinery in the 1940's and found that the majors refused to sell it crude. For this reason Farmland began to integrate into the drilling, production, and transportation of crude oil and refined products.

In the 1960's the major oil companies began a push into the midwestern farm market but when the oil shortage hit in the 1970's, companies such as Gulf, Arco, Cities Service, and Mobil pulled out of the farm market.[35]

The independent pipeline companies' modern significance is also attributed to the innovatives, innovations that were required to establish a foothold in pipeline transportation. Among the major innovations were: (1) Texas Eastern Transmission Corporation was the first pipeline company to deliver Gulf Coast products to the upper Midwest and Northeast. They were also the first private company to operate a large diameter (20 inch) products pipeline; (2) Mapco's Mid-America system was the first large scale LPG carrier connecting a large number of west Texas and New Mexico natural gasoline plants and the Midwest; (3) Santa Fe's subsidiary, Gulf Central, and part of Mapco's sytem were the first to transport anhydrous ammonia by pipeline; (4) a subsidiary of Southern Pacific, Black Mesa, was the country's largest coal slurry pipeline (in 1974, it was the only one in operation); (5) Kaneb Pipeline Company was originated in 1953 to transport products from seven landlocked refineries in Kansas that lacked meaningful pipeline outlets of their own; (6) the largest independents, Buckeye and Williams, were formerly owned by major oil companies and have progressively expanded their operations. In addition, Williams was the first company to "batch" crude and refined products on a large scale; and (7) the independents have offered storage and terminating facilities to non-owner shippers.[36]

Summary

In 1957, 82 companies were operating the nearly 143,000 miles of interstate pipelines. In 1975, 104 companies were operating approximately 173,000 miles of interstate lines. Over the 19 year span the number of ICC carriers increased by 22. More than half of the net gain was in product carriers. Along with the entry of new product carriers

came greater attempts to differentiate pipeline activities in terms of services offered, petroleum products carried, and markets served. This was most apparent in terms of the independent carriers (which increased in number from 8 to 16).

Five ownership patterns were delineated and examined in terms of the organization of major petroleum companies' pipeline investments and non-petroleum investments. In 1957, 72 pipeline companies were affiliated with petroleum companies. In 1975 affiliated companies had increased to 86. The focal point of major petroleum companies' investments in pipelines was found to reside in an "all-phase" pipeline subsidiary. The pipeline operations of the majors were also found to be almost always confined to separate legal entities. The separation occurred because of ICC regulatory jurisdiction, Texas statutes, and the threat of divestiture.

Independents' entry into pipeline activities has largely been a result of their concentration in specialized services, markets, and innovations. The markets they service are to a degree those ignored or withdrawn from by petroleum companies. With few exceptions, the independents are not actively involved in the interstate transportation of crude oil. The quantification of the independents' share of both the product and crude transportation is to be found in Chapter IX.

To this point, the independents have been narrowly defined to include only unaffiliated companies and companies affiliated with non-petroleum parents. This definition has excluded non-major petroleum companies' investments in pipelines. The definition is broadened in the remaining chapters to include all companies not controlled by the

major oil companies. The major ownership form, the joint venture (corporate and system) has thus far been given only cursory attention. Joint ventures are the topic of Chapter VII.

CHAPTER VI

[1]James W. McKie, "Market Structure and Function: Performance versus Behavior," in Industrial Organization and Economic Development, ed. by J. W. Markham and G. F. Papanek (Boston: Houghton Mifflin Co., 1970), pp. 9-10.

[2]Joe S. Bain, Industrial Organization, p. 12 and pp. 302-303. Market behavior and conduct are often interchanged in the literature (see James T. Kneafsey, Transportation Economic Analysis, p. 9).

[3]John M. Blair, The Control of Oil, p. ix.

[4]Supra, p. 15. [5]Blair, p. x.

[6]De Chazeau and Kahn, Integration and Competition In The Petroleum Industry, pp. 19-25.

[7]U.S. Congress, TNEC Hearings, Part 14-A, p. 7,706.

[8]Blair, p. xi.

[9]U.S., Federal Trade Commission, Concentration Levels and Trends in the Energy Sector of the U.S. Economy, by Joseph P. Mulholland and Douglas W. Webbink (Washington, D.C.: Government Printing Office), 1974, pp. 235-239.

[10]Ibid. [11]Nation's Business, p. 55.

[12]U.S., Congress, Senate, The International Petroleum Cartel (Reprint), A Staff Report To The Federal Trade Commission Submitted To The Subcommittee On Monopoly of The Select Committee on Small Business; U.S. Senate, 82d Congress, 2d Session, August 22, 1952 (Printed for the use of the Select Committee on Small Business, 94th Congress, 1st Session, April 22, 1975 (Washington, D.C.: Government Printing Office), p. 21.)

[13]James I. Sturgeon, "Joint Ventures In The International Petroleum Industry: Exploration and Drilling," (unpublished Ph.D. dissertation, University of Oklahoma, 1974), pp. 197-198.

[14]Many authors have confused or ignored the difference between a pipeline and a pipeline company especially in addressing the issue of risks and pricing.

[15]See for example U.S., Congress, House, Anticompetitive Impact of Oil Company Ownership of Petroleum Products Pipelines.

[16]See footnotes, Table 29.

[17]The grouping of product pipelines together in recent years has become somewhat misleading because of the increasing number of specialized firms which transport liquefied petroleum gas (LPG) exclusively. In 1957 no firms were reported as LPG carriers. In 1975 four firms carried LPG exclusively (Dixie, Mapco, Okie and Trans-Ohio Pipeline Company). These firms accounted for 11.4 percent of the total product pipeline mileage.

[18]Johnson, Petroleum Pipelines and Public Policy, p. 220.

[19]J. K. Spangler, "Corporate Structure and Financing Oil Pipelines," July 8, 1970 (Mimeographed).

[20]Ibid., p. 5. [21]Ibid., p. 4. [22]Johnson, p. 220.

[23]Spangler, pp. 5-6. [24]Ibid., p. 4.

[25]Intrastate pipelines are unregulated in the state of California. For the implication of this see U.S., Federal Trade Commission, Bureau of Competition and Bureau of Economics, Report To The Federal Trade Commission on The Structure, Conduct, and Performance of the West Coast Petroleum Industry (September, 1975), pp. 41-51.

[26]Lakehead also reenters Canada in PAD I. This apparently has lessened the impact of the Canadian curtailment of exports to the United States on Lakehead's operation.

[27]For the industry view on the lack of non-petroleum investments, see Association of Oil Pipe Lines, "Statement of Jack Vickrey on Behalf of the Association of Oil Pipe Lines, Before the Senate Special Subcommittee on Integrated Oil Operations, Committee on Interior and Insular Affairs, December 12, 1973." (Washington, D.C.: Association of Oil Pipe Lines, 1974), pp. 19a-25.

[28]Buckeye Pipeline Company is a former member of the original Standard Oil of New Jersey "Trust." (see Arthur M. Johnson, "Lessons of The Standard Oil Divestiture," in Vertical Integration In The Oil Industry, ed. by Edward J. Mitchell (Washington, D.C.: American Enterprise Institute, 1976), pp. 212-213).

[29]In relation to the total refined product market, LPG constitutes only a small part (6.1 percent in 1975, see Table 7).

[30]U.S., Congress, House, Anticompetitive Impact of Oil Company Ownership of Petroleum Products Pipelines, pp. 13-20, 106-112.

[31]Fortune, May, 1976, pp. 324, 334.

[32]Forbes, July 15, 1974, pp. 24-29.

[33]Business Week, February 7, 1977, p. 54.

[34]Ibid., p. 63.

[35]Ibid.

[36]Statement of Richard C. Hulbert, President, Kaneb Pipe Line Company before the Subcommittee on Antitrust and Monopoly Committee on the Judiciary, United States Senate, August 6, 1974 (Mimeographed) p. 6; also see Johnson, Petroleum Pipelines and Public Policy, p. 317 and pp. 481-485.

CHAPTER VII

STRUCTURE AND CONDUCT, PART II

PIPELINE JOINT VENTURES

A joint venture can be broadly defined as the sharing of costs, profits, or both by two or more legal entities in one or more activities.[1] In an analysis of the international petroleum industry, it was found that joint ventures took two forms. The first was the "jointly owned subsidiary"; a company owned by two or more legal or political entities. The second was the "contractual joint venture." The contractual venture takes many forms but in no instance is a separate legal enterprise formed and in all cases the contract has a limited life.[2]

There are three theoretical types of joint ventures: the vertical, the horizontal, and the conglomerate.[3] The vertical venture involves firms in the same industry forming a venture to operate in another stage of the industry. Most pipeline ventures fall into this group. The horizontal venture involves firms in the same industry forming a venture to engage in the same activity in the same or another geographic area. The conglomerate venture involves firms forming a venture to enter a new industry.

Joint ventures are common in international commerce and are a dominant part of international petroleum activities.[4] They have not

been, until recently, a significant part of domestic industrial organization with the exceptions of steel, chemicals, and petroleum.

While joint ventures are common in all stages of the international petroleum industry, venture activity in the domestic industry has historically been on a smaller scale. In the domestic industry, joint ventures are found in production (on and off shore), and both crude and product pipelines. They are not found in domestic refining, marketing or transmission of natural gas.[5]

Joint ventures are not a recent development in the international or domestic petroleum industry. One of the first international ventures, the Turkish Petroleum Company, was formed in 1912. The first joint venture in which important American and foreign oil companies were united in one operation, Iraq Petroleum Company, Ltd., was the successor to the Turkish Petroleum Company. The American companies became participants in 1928. In the United States, the first known joint venture pipeline was put into service in 1927.[6]

Joint Ventures and Competition

The competitive impact of inter-industry firms engaging in joint ventures activities has received limited rigorous empirical or theoretical attention--this despite the fact that joint ventures are a common and growing part of the foreign and the domestic economy. The analysis that has taken place has been generated by three primary issues: (1) a "suspicion that firms that are partners in significant joint ventures cannot at the same time be arm-length competitors";[7] (2) often "it [a joint venture] is the offspring of two or more giant corporations, each with vast financial resources, which--for one reason or another--want to

conduct jointly through it an enterprise in a field in which they have a common interest";[8] and (3) the common interest and the necessity of working together for the benefit of the joint enterprise presents an opportunity for cooperation of other policies of mutual interest to the potential competitors.[9]

Much of the focus of the joint-venture literature has centered on either international ventures or on the antitrust implications of domestic ventures. The antitrust literature has focused on the legality of joint ventures. More specifically, the issue has been on the standing of joint ventures under the Sherman Act. Does the collaboration required to participate in a joint venture result in restraint of trade; a result prohibited under section 1 of the Act? Do joint ventures exclude competition and therefore violate section 2 of the Sherman Act? The concensus is that joint ventures are neither illegal per se nor do they have absolute immunity under antitrust laws. This is based on the historical case-by-case approach to antitrust law as well as a concern for substance over form.[10]

In addition to the Sherman Act, joint ventures have generated uncertainty in relation to two other sections of antitrust legislation. The first is in relation to the Anti-Merger Act of 1950.[11] The second is in relation to existing law which prevents interlocking directorates between certain competing corporations.[12] The joint venture presents a dilemma because it involves characteristics common to mergers. When a merger occurs it combines all the assets of two existing firms. A corporate joint venture on the other hand combines only parts of the assets of the participating firms and places them in a new entity.[13] A

merger undergoes greater antitrust scrutiny than have joint ventures.[14] Joint ventures have also escaped scrutiny in terms of interlocking directorates since to disallow interlocks would eliminate intra-industry participation in joint ventures.

Joint ventures raise economic questions concerning the allocation of resources and market power, questions that are central to both antitrust and industrial organization theory. There are five major economic advantages that justify the formation of joint ventures. These are: (1) overcoming capital barriers, i.e., capital requirements so high that only a few firms are potential entrants separately; (2) natural monopoly cases, i.e., separate operations would result in inefficient use of resources; a joint operation would achieve maximum scale economies; (3) risk is so great that few or no industries or firms would be willing or able to assume the risk separately; (4) augmentation of technological activities, i.e., a reduction of duplicative research or increased appropriability of new knowledge; and (5) external economies which accrue indiscriminately to firms in a given industry rather than primarily to the investing firms (this justification is a function of the other four).[15]

The major anti-competitive effects have been alluded to and are reciprocals of the pro-competitive outcomes. Among these are: (1) external economies flowing discriminately to only the participating firms; (2) a reduction in entry, an increase in concentration and market power; and (3) a reduction in output below the socially optimum level (i.e., monopoly pricing).

Domestic Joint Venture Pipelines

As was the case in the international petroleum industry, there are two forms of joint-venture pipelines in this segment of the domestic industry. The first are "corporate joint ventures," i.e., jointly owned subsidiaries. The second, the joint-venture "system," is a contractual venture. The majority of the pipeline joint ventures can be classified as vertical ventures.

A corporate joint venture is ". . . the creation of a new business entity by two or more corporate partners."[16] The characteristics of the corporate joint-venture pipeline company departs little from those found in other industries. The joint-venture pipeline system, however, is a unique organizational form and is largely a product of pipeline regulation.[17]

The pipeline system is often referred to as an undivided interest pipeline where the participants in the system are tenants in common. A system can be described as a series of separate pipelines bundled together with the owners filing separate tariffs and maintaining separate terminals, storage facilities, and shipping practices. The system is a relatively new development in comparison to the corporate joint venture. The first known pipeline system began operation in 1942 some 15 years after the first corporate joint venture was started.[18]

Characteristics of Domestic Joint Venture Pipelines

Joint-venture pipelines have been justified by the petroleum industry using economic arguments largely identical to those stated earlier. These center around the height of the capital requirements, the risks involved, and the economies of scales.[19] The justifications

seemingly contradict the purpose of ICC regulation which was to have pipelines function as common carriers and not as private facilities of the shipper/owner(s).

As indicated in Chapter II, the historical argument against regulation has revolved around the position that pipelines are plant facilities built to serve the needs of their owners. Thus while pipelines may in form serve as common carriers, the attitudes and practices of the industry continue to support the plant facility argument. For example, in recent testimony before Congress, a Standard Oil of Ohio spokesman justified the joint venture because "no single company could supply the oil through to operate a large pipeline at near capacity."[20] A Cities Service spokesman offered a related argument when he noted that

> petroleum pipelines have been built by oil companies because they alone have the sources of supply in established markets necessary for the line's successful operation and because they have been the only investors willing to venture the requisite risk capital.[21]

Joint ventures have been used by major shippers to encourage the small but substantial shipper to participate and therefore bear the full costs, including risk, of this type of operation.[22] This again seems to defy the regulatory intent of a pipeline serving as a common carrier. Tying a small but substantial shipper to a line on an economic basis prevents the shipper from jumping to another common carrier when a better deal comes along. This tie limits the potential of "upsetting the scheduling and most efficient operation of the line."[23]

While the merits of the pro-joint venture arguments are examined in a latter section, a somewhat related question, the motivation for the selection of one form of venture over the other by potential participants, requires attention. When a venture is in the conceptual and

planning stage, potential participants must choose between the competing organizational forms. Each form has advantages and disadvantages; the weighing of each will vary with the special circumstances of the venture under consideration. The complexity of the choice rises with the number of participants and their characteristics (i.e., majors vs. independents, preferences of individual companies, and so forth).

Prior to 1957 nearly 71 percent of the pipeline ventures were corporate joint ventures. This suggests that the advantages of this form outweighed its disadvantages. Since 1957, however, 22 systems have been formed compared to only 11 corporate joint ventures which suggests a slight shift in both advantages and preferences.

Characteristics of the Corporate Joint Venture Pipelines

A joint venture pipeline corporation is a new corporation formed to construct, own, and operate a pipeline or pipelines. The participants' equity in the corporation is evidenced by the percent of shares subscribed to and participation is generally proportionate to the expected volume throughput (as well as refinery capacity or crude production). A corporate joint venture pipeline company is initially financed with approximately 10 percent equity and 90 percent debt.[24] This financing has historically been obtained by throughput guarantees on the part of the participating owners.

As a general rule, the corporate joint venture offers the following advantages to participants: (1) it is insulated from other parts of the owner's business; (2) leverage can produce a higher rate of return on equity; (3) the proportionate debt of a minority owner does not have to be shown on the minority owner's balance sheet; (4)

there is a joint advantage of leverage financing which allows a minority owner to leverage his financing to a higher degree than would be possible otherwise; (5) the corporate joint venture eases staffing problems since new staffs can be hired; and (6) a participant may not have a going pipeline organization; the joint venture minimizes startup costs and the administrative costs of having to establish a separate regulated common carrier company.[25]

The corporate joint venture has four significant disadvantages. First, there is an added tax which must be paid on 15 percent of dividends paid out by stock companies. Second, corporate laws require that directors act in concert and thus the minority owner(s) has few options if there is a disagreement with the majority stockholders. Third, the formation of a corporate joint-venture pipeline operation runs a greater risk of antitrust review.[26]

The fourth disadvantage is the "free-rider effect." A free rider is defined as a participant in a venture who by error or design subscribes for a percentage in excess of actual use. The free rider receives the benefits of the leveraged rate of return without having its own affiliates bear the full percentage costs in terms of tariffs paid to the pipeline company. The possibility of having free riders gave rise to the "readjustment clause," now a common feature of corporate joint ventures. The readjustment clause requires that after a specified period of time, the percent ownership in the pipeline is reevaluated and altered based upon the usage of the line by the partners over the period.[27]

In addition to the advantages and disadvantages of the corporate

form from the participants' vantage, there are two additional characteristics of interest from the vantage of a non-participant. The first has to do with the "stock transfer restriction" and the second with the provision of services other than shipping. The stock transfer restriction is common to most corporate joint venture pipelines. This restriction gives preferential rights of purchase to the existing owners if one of the participants wishes to sell its percentage. An example of this type of clause is found in the Colonial Pipeline Company's ownership agreement. In this agreement, a participant cannot sell to an outsider without giving the other owners a first, second, and third right to purchase.[28]

As noted in Chapter VI it is a common practice among non-independents to provide only pipeline shipping services and not to provide terminal or storage facilities to non-owners. This practice is also common to joint ventures of both forms. The owners of the pipelines, as a general rule, have their own private terminal and storage facilities, facilities which are not a part of the pipeline company. In many cases (see Chapter VIII) these facilities will also be joint ventures.

Characteristics of the Joint Venture System

Normally under the system form, one participant becomes the contractor for the remaining partners to construct, operate, and maintain the pipeline. There usually is an attempt to insure that the contractor (and often the operating agent) has no legal involvement in the business affairs of the other owners.[29]

Each participant in a system publishes separate tariffs and

accepts tenders through its capacity in the line. The partner's capacity is almost always a function of the percent ownership. To illustrate this, assume a 100,000 b/d pipeline system with five owners each holding a 20 percent interest. Each owner under this arrangement would publish tariffs and accept tenders from itself or outside shippers up to an amount of 20,000 b/d. This would be the maximum tender each owner could accept.

The system ownership agreement usually provides for the design, construction, operation, and expansion of the pipeline. The costs of construction, maintenance, and operating (except fuel and power) are paid on the basis of the percent ownership. Fuel and power costs are paid based upon a proration among the owners of that proportion of each owner's use of the line to the total use of the line.

The joint venture system when first introduced was considered a major organizational innovation and offered advantages over both the corporate joint venture and the single owner pipeline operation.[30] Like the corporate venture, participants enjoy the economies of scale of a large pipeline which they might not justify themselves but unlike the corporate venture each owner exercises full control over tenders, tariffs, and other requirements on his share of the line. Also if an owner has throughput greater than his share of the line can accommodate, he must offer it to the other owners as though they were operating a separate pipeline. Another innovation was that each owner reports to the ICC only his share of the line as though it were a part of his wholly owned facility and the share reported to the ICC may be included in an owner's total valuation base for consent decree purposes.[31]

Additional advantages of the system when compared to the corporate joint venture are: it does not incur costs in terms of income tax or miscellaneous administrative expenses; it allows depreciation and other charges to be written off against the parent's total records; the tax liability on the 15 percent of dividends paid by stock companies is eliminated; and it is less vulnerable to antitrust review than are corporate joint ventures because separate tariffs are filed.[32]

The system also prevents the free-rider effect since costs are prorated based upon percent ownership except for fuel and power. Only an extremely limited return, the revenue on the small amount that the participant did transport, would be paid to those with excess capacity. Participation in excess of usage poses a severe economic disadvantage under the system form and a potential advantage in a stock company.

A system organization usually allows a participant to force or refrain from being involved in an expansion. Normally, the ownership agreement does not require an owner to finance additional expansion if he elects not to participate. Under the stock ownership form the directors must act in concert in making a decision to expand. The small owner in this instance has few options if he disagrees with those pushing for an expansion.

As noted, neither the corporate joint venture nor the pipeline system normally provides common carrier terminals or storage facilities. A non-owner's access to a pipeline system is restricted to a greater degree than in the corporate case because each owner has separate tariffs and often differing requirements and terminal locations for receipt of tenders from outside shippers.

The world's largest pipeline system, the Trans Alaskan Pipeline System, provides common carrier storage facilities. This was not the result of a change in industry practice but a result of an amendment to Section 28 of the Minerals Leasing Act. This section provides that oil pipelines constructed persuant to a right-of-way permit through public lands granted by the Secretary of the Interior should be maintained as common carriers. The act was amended to make clear that storage facilities constructed persuant to a right-of-way permit must also be operated as common carriers.[33]

Empirical Analysis of Joint Venture Pipelines

Joint Ventures' Share of the Interstate Pipeline Transportation Market

An exact measurement of joint ventures' share of the interstate market is not possible, given the available published data. This is because pipeline systems' operating data is incorporated on a prorated basis (based on percentage owned) into the operating statistics of each participant. Data on corporate joint-venture pipelines, since they are separate legal entities, is readily available. This data allows for a partial evaluation or joint ventures' share of the short-term and 1957-1975 market.

In 1957 there were 50 identified joint-venture pipelines operated in the United States. Of these, 45 were operating in the interstate market and 5 were in the intrastate market. Of the 45 interstate operations, 32 were corporate joint ventures and 13 were systems. By 1975 the number of identified joint ventures nearly doubled and totaled 92.[34] Of these, 78 were operating in the interstate market and 14 were

intrastate operations. Of the 78 interstate operations, corporate joint ventures continued to be the most common (43). Joint-venture systems did, however, experience the greatest net gain in the number of new lines. There were 35 systems in the interstate market in 1975.

Including systems, joint-venture pipelines accounted for 26.8 percent of the total operating interstate mileage in 1957. Approximately 90.6 percent of the 38,945 miles were operated by corporate joint ventures. Joint ventures' share of the refined product trunk line mileage was 43.6 percent compared to only 24.0 for crude lines. Joint-venture gathering lines represented 19.7 percent of the total gathering mileage.

By 1975 total joint venture mileage had increased 18.6 percent from 1957 and totaled 46,204 miles. System mileage had increased by 112 percent but still only accounted for 16.8 percent of the total joint-venture mileage (system mileage totaled 7,742 miles in 1975). Joint venture's share of the total mileage in 1975 remained about the same (27 percent) as it was in 1957 but the composition of the share had changed considerably. Product mileage declined to 26.6 percent while crude trunk line mileage increased its share by slightly more than 7 percent. Thirty one percent of the crude trunk line mileage operated in 1975 was operated by joint venture pipelines. Gathering lines remain at about the same percentage level as in 1957.

Table 34-35 provide annual data on corporate joint venture mileage and their share of the market. As indicated, corporate joint-venture mileage has been declining as a percent of total since 1966. This is explained by the decline in the product lines' share which

TABLE 34

PIPELINE MILEAGE OPERATED BY JOINT VENTURE PIPELINE COMPANIES, ANNUALLY, 1957-1975

Year	Total[a]	Trunk Lines		Gathering Lines
		Crude	Product	
1957	35,293	12,196	12,757	10,259
1958	36,882	12,943	13,371	10,487
1959	37,663	12,924	14,219	10,440
1960	37,843	13,059	14,160	10,541
1961	39,348	13,271	14,622	11,372
1962	40,749	13,720	15,976	10,970
1963	42,980	14,064	17,593	11,240
1964	44,399	14,020	19,046	11,250
1965	44,976	14,268	19,410	11,296
1966	45,749	14,284	19,622	11,841
1967	40,001	14,747	13,422[b]	11,830
1968	40,235	15,613	13,960	11,660
1969	41,494	15,915	14,210	11,369
1970	41,659	15,940	14,458	11,258
1971	41,838	15,783	15,331	10,724
1972	41,287	15,244	16,976	9,067
1973	39,303	15,306	15,827	8,170
1974	40,394	14,942	17,044	8,408
1975	38,462[c]	14,913	15,538	8,011

SOURCE: Compiled from data published by the Interstate Commerce Commission in Transportation Statistics In The United States: Part 6, Pipelines (Washington, D.C.: Government Printing Office, Annual).

[a]Includes mileage (other) not shown separately.

[b]Decline from 1966 result of sale of Great Lakes Pipeline Co.

[c]Decline from 1974 result of change of ownership and reorganization of Cherokee Pipeline Company from a corporation to a system.

TABLE 35

PIPELINE MILEAGE OPERATED BY JOINT VENTURE PIPELINE COMPANIES AS A PERCENT OF TOTAL ICC MILEAGE, ANNUALLY, 1957-1975

Year	Total[a]	Trunk Lines		Gathering Lines
		Crude	Product	
1957	24.6	21.0	42.2	20.0
1958	25.8	22.2	42.9	21.3
1959	25.4	21.9	39.7	21.2
1960	25.1	22.1	37.0	21.5
1961	25.8	22.4	36.8	23.2
1962	26.6	23.3	37.6	23.1
1963	27.7	24.0	38.9	24.1
1964	28.1	23.3	40.3	24.3
1965	28.1	23.5	39.9	24.6
1966	27.2	24.0	34.9	25.6
1967	24.4	24.2	26.1[b]	25.2
1968	24.6	25.3	26.2	24.9
1969	24.6	25.7	25.6	24.7
1970	24.2	25.3	25.5	24.1
1971	24.6	25.9	26.6	23.3
1972	24.4	25.5	27.6	21.1
1973	23.7	26.7	25.6	19.6
1974	23.9	26.0	26.0	20.2
1975	22.9[c]	26.1	24.4	20.0

SOURCE: Calculated from data published by the Interstate Commerce Commission in Transportation Statistics In The United States: Part 6, Pipelines (Washington, D.C.: Government Printing Office, Annual)

[a]Includes mileage (other) not shown separately.

[b]Decline from 1966 result of sale of Great Lakes Pipeline Co.

[c]Decline from 1974 result of change of ownership and reorganization of Cherokee Pipeline Company from a corporation to a system.

more than offset the rise in crude trunk lines.

The mileage data does not adequately reflect the growth in joint ventures or their actual share of the transportation market. There are two reasons for this. First, the change in the mileage data represents net change and not total new entries over the 19 year period. For example, one of the oldest and largest corporate joint-venture pipeline companies, Great Lakes Pipeline Company, was sold in 1966 to the Williams Companies.[35] Great Lakes at the time of the sale operated 6,229 miles of refined-product trunkline mileage. The second reason is that there is not necessarily a correlation between mileage and either throughput capacity (as indicated in Chapter IV) or revenue generating capacity. This is illustrated in Table 36 and 37 where corporate joint-venture market shares measured in terms of barrel input/output and operating revenue/expense are shown.

On average, the reliance on mileage tends to understate corporate joint ventures' importance to the interstate market. The statistics shown below further illustrate this point.

	Corporate Joint Ventures Mean[1] Market Share			
	Mileage	Total Input	Operating Revenue	Gross Income
Crude Trunklines	25.1	28.1	29.0	32.9
Product Trunklines	29.1	36.8	42.6	45.0

[1]Mean for 1964-75; statistics are calculated from data in Tables 35-37.

These statistics indicate that the use of mileage as the market share measure for crude pipelines can understate the share by as much as 7.8 percent (in terms of gross income). The difference is even greater for product trunklines, where a mileage measure is 15.9 percent lower than the share of total gross income.

The averages emphasize the importance of joint-venture pipelines and even this is understated because systems are not included. The inclusion of 1975 system mileage increases the total share shown in Table 35 by nearly 4 percent. Assuming the same relationship between mileage and operating/financial measures, joint ventures now represent about 40 percent of the interstate market.

This section has demonstrated that joint ventures are now the dominant organizational form in domestic pipeline transportation. Their rise to predominance occurred largely over 1957-75 though they were well established by 1957. Joint venture pipelines do not yet represent the majority of pipeline mileage but they appear to be approaching and in some years have exceeded 50 percent of the market in terms of throughput/revenue operating income. The post-World War II development of joint-venture activity is as significant to the structure of pipeline transportation, if not more so, than the separation of pipelines from the parent companies. Joint ventures' share of the domestic market are such that the implications of joint activities cannot be ignored.

Control of Joint Venture Pipelines

Traditional concentration measures have commonly been used to

TABLE 36

SELECTED PHYSICAL OPERATING DATA OF JOINT VENTURE PIPELINE COMPANIES
AS A PERCENT OF TOTAL ICC, ANNUALLY, 1957-1975

Year	Total Input		Originated		Total Output		Terminated	
	Crude	Product	Crude	Product	Crude	Product	Crude	Product
1957	22.3	40.2	18.6	33.7	22.3	39.9	14.7	44.2
1958	23.3	36.6	20.4	30.9	23.3	36.5	16.7	40.8
1959	23.6	37.3	21.3	33.1	23.9	37.2	17.3	42.0
1960	23.4	35.1	20.7	29.8	23.5	35.1	16.9	39.6
1961	24.5	34.0	22.6	29.0	24.5	32.4	18.2	38.0
1962	25.1	34.6	23.4	30.3	24.9	34.5	18.1	38.3
1963	25.8	34.1	24.4	30.3	25.7	33.7	18.9	37.6
1964	25.4	37.4	24.9	36.4	25.4	37.0	19.1	41.2
1965	25.8	40.7	25.1	39.9	25.8	40.7	19.6	43.3
1966	26.0	36.4	25.2	36.5	26.0	36.5	20.0	39.5
1967	25.4	35.9	24.6	35.8	25.2	35.6	20.0	38.2
1968	26.5	37.3	26.0	37.0	26.4	37.3	21.3	40.0
1969	27.2	36.7	25.8	36.9	27.1	36.6	22.0	39.2
1970	28.6	36.3	27.2	36.5	28.6	36.3	23.3	38.5
1971	29.6	36.4	28.7	36.3	29.5	36.3	24.1	38.7
1972	30.3	36.5	29.8	35.9	30.3	36.5	25.1	39.0
1973	32.1	36.7	31.3	36.2	31.9	36.9	24.4	39.3
1974	30.5	36.3	29.7	35.4	30.5	36.2	23.9	37.9
1975	29.7	34.8	29.6	34.5	29.7	34.9	24.3	36.4

SOURCE: Calculated from data published by the Interstate Commerce Commission in Transportation Statistics In The United States: Part 6, Pipelines (Washington, D.C.: Government Printing Office, Annual).

TABLE 37

SELECTED FINANCIAL OPERATING DATA OF JOINT VENTURE PIPELINE COMPANIES
AS A PERCENT OF TOTAL ICC, ANNUALLY, 1957-1975

Year	Operating Revenue[1]			Operating Expense[1]			Gross Income[1]		
	Total	Crude	Product	Total	Crude	Product	Total	Crude	Product
1957	29.3	-	-	24.5	-	-	34.8	-	-
1958	31.9	-	-	26.1	-	-	38.8	-	-
1959	32.6	-	-	26.9	-	-	39.1	-	-
1960	32.0	-	-	26.2	-	-	38.7	-	-
1961	31.9	-	-	27.3	-	-	37.1	-	-
1962	32.3	-	-	29.0	-	-	35.8	-	-
1963	32.8	-	-	28.6	-	-	37.5	-	-
1964	34.2	27.1	45.9	32.1	23.8	45.8	37.0	31.6	46.2
1965	37.4	28.4	50.5	33.1	24.3	47.0	42.9	34.2	54.7
1966	34.4	27.5	43.9	29.9	23.9	39.0	40.3	32.8	49.4
1967	34.0	27.0	42.8	30.2	24.3	38.5	39.0	30.9	47.6
1968	34.4	28.7	41.5	31.6	26.0	39.3	38.3	32.8	44.2
1969	33.8	28.3	40.5	31.2	25.8	38.4	37.4	32.1	43.2
1970	34.0	29.1	40.1	31.4	26.3	38.4	37.2	33.0	42.1
1971	35.0	30.1	40.8	32.4	27.6	38.6	38.4	33.6	43.5
1972	35.4	30.9	40.5	34.0	28.5	40.4	37.4	34.3	40.6
1973	36.7	32.6	41.0	35.3	29.5	41.9	38.6	37.2	40.0
1974	35.6	30.1	41.4	33.8	28.4	40.1	38.3	32.8	43.2
1975	35.4	28.5	42.3	33.1	27.5	39.3	38.2	29.9	45.7

SOURCE: Calculated from data published by the Interstate Commerce Commission in Transportation Statistics In The United States: Part 6, Pipelines (Washington, D.C.: Government Printing Office, Annual).

[1]For the years 1957-1963, data was not published separately.

evaluate the extent of competition in a given industry. The assumption has been that the lower the level of concentration, the greater the probability that firms in the industry are independent competitors. The presence of joint ventures in the market if ignored reduces the value of traditional concentration measures.[36] The traditional measures need not lose their usefulness if the control of joint ventures is considered and if measures of market share incorporate the ventures.

The question of who controls the joint venture has obvious importance to the investing companies. It is also important to non-owner/shippers and for public policy considerations. Control, as the term is used here, means the ability on the part of a participant or a subset of participants to direct the management and decisions of the venture. From a public policy perspective, the implications of the control of joint ventures by a small number of the same petroleum companies is much different than if the control is randomly distributed among many petroleum companies. The same applies to participation patterns considered in the next section. Does a small group of companies consistently come together to participate in joint activities?

The control characteristics of the interstate joint ventures operating in 1957 and 1975 are shown in Tables 38 and 39. By comparing 1957 and 1975 an evaluation can be made of the changes resulting from entries during 1957-75. Table 38 compares the control of corporate joint ventures for the years 1957 and 1975. The determination and class of the controlling petroleum companies were derived from their rankings as shown in Chapter VI, Figure 11.

In 1957 the top four companies controlled only six corporate

TABLE 38

CONTROL CHARACTERISTICS OF CORPORATE JOINT VENTURES, 1957 AND 1975

Control By[a]	Total Ventures		Crude Ventures		Product Ventures	
	1957	1975	1957	1975	1957	1975
Top 4 Petroleum Companies	6	8	3	5	3	3
Top 8 Petroleum Companies	14	22	8	12	6	10
Top 12 Petroleum Companies	18	30	11	18	7	12
Top 20 Petroleum Companies	27	35	15	21	12	14
Others	5	8	3	7	2	1
Total	32	43	18[b]	28[c]	14	15

SOURCE: Compiled from data in Appendix B.

[a]Control implies that participants as defined can either individually or collectively (within their classification) vote a majority of the shares.

[b]Includes three all-phase companies.

[c]Includes two all-phase companies.

TABLE 39

CONTROL CHARACTERISTICS OF JOINT VENTURE SYSTEMS, 1957 AND 1975

Control By[a]	Total Systems		Crude Systems		Product Systems	
	1957	1975	1957	1975	1957	1975
Top 4 Petroleum Companies	7	6	3	3	4	3
Top 8 Petroleum Companies	11	19	7	11	4	8
Top 12 Petroleum Companies	12	27	7	16	5	11
Top 20 Petroleum Companies	13	32	7	20	6	12
Others	0	3	0	1	0	2
Total	13	35	7	21[b]	6	14

SOURCE: Compiled from data in Appendix B.

[a]Control implies that participants as defined can either individually or collectively (within their classification) vote a majority of the stock.

[b]Includes one all-phase company.

joint ventures (18.6 percent). In 1975 this group controlled eight corporate ventures (still only 18.6 percent). The top eight companies, however, controlled 44 percent of the ventures in 1957 and 51 percent of the ventures in 1975. Few corporate ventures are controlled by companies not ranked in the top twenty. In 1957 only five of the 32 ventures were controlled by companies outside the top 20. In 1975 only eight of the 43 ventures were controlled by the non-top 20. Seven of these were crude operations. Product joint ventures have almost entirely been controlled by top twenty firms.

Turning to the control characteristics of joint-venture systems, a similar pattern is found and is shown in Table 39. In 1957 all joint venture systems were controlled by the top 20 petroleum companies and in 1975, 32 of the 35 systems were controlled by the top 20 companies. The number controlled by top 8 companies declined in percentage terms from approximately 85 percent in 1957 to 54 percent in 1975. The control patterns for both crude systems and product systems are quite similar. Both tables indicate an increase in the control of joint venture by companies other than the top 20 but this remains a minority occurrence.

Participation Patterns

A competitive market structure implicitly assumes that companies are separate, independent, and free of influence through inter-corporate relationships. The act of participating in a joint venture binds otherwise independent participants together for the furtherance of the joint activity. The effects of joint ventures on a market structure depend in part upon the frequency of the joint activities relative to the total

activity.

The growing number of joint-venture pipelines and their present market share implies a large degree of interdependence and cooperation. The development and operation of these lines have required detailed and close cooperative planning. Planning that extends from producing/import terminals to refineries and from refineries to consumer markets. Planning on this scale requires an extensive inter-company flow of information on both current and future demands since pipelines are not merely designed for current capacity needs.

Interlocking relationships resulting from joint ventures pipelines provide opportunities for collective rather than independent decision making, opportunities which extend beyond the individual venture. The issue then is not confined to the circumstances surrounding individual ventures but rather upon the implications of the totality of interlocking relationships. John Wilson clarifies this by noting:

> It is not necessarily the case that any single one of the thousands of joint venture arrangements which constitute so much of the petroleum industry in itself undermines workable competition between the joint venture partners. Nor would it be correct to conclude merely from their existence that joint venture interties are necessarily collusive arrangements consciously aimed at restraining competitive conduct. Rather, it is the totality of all of the individual partnerships which constitutes the petroleum industry's unique form of structural integration. Regardless of the specific motives which may justify any individual combination, because of the extensive and widespread nature of mutual intercorporate interests it cannot be presumed that the competitive result will be the same as if the proprietary and commercial interests of each firm were independent of and competitively opposed to the self interests of the other market participants. Whether or not one believes that certain combinations constitute collusive restraints of trade, when the entire mosaic is viewed in context, the extent to which these interlocks dominate the industry's structure is undeniable.[37]

The magnitude of the interdependency and cooperation in pipeline

transportation is given empirical significance by evaluating the frequency of interlocking ownership arrangements. This is accomplished by the use of an expanded version of a matrix methodology developed by Walter Mead.[38] Using this methodology, the total number of interlocking ownership arrangements in 1957 and 1975 were derived and are summarized in Table 40. The interlocks are distributed by type (corporate, system, and intrastate) and by service offered.[39]

The 50 joint ventures operating in 1957 produced 238 ownership ties. By 1975 ownership interlocks had increased by 166.8 percent and totaled 638. The change in interlocking ownership arrangements was approximately double the 84 percent increase in the number of joint-venture operations and is the result of a rise in the average number of participants per venture.

The majority of the interlocks (over 60 percent) involved corporate joint ventures and was the case throughout the period. Crude joint ventures involved the largest number of participants in both 1957 and 1975. In 1975 there were 310 interlocking ownership ties in crude joint-venture pipelines. The greatest increase in interlocking arrangements, however, resulted from the increase in joint-venture product pipelines, primarily corporate pipeline ventures. This narrowed the difference in number of interlocks involving crude and product transportation.

The number of interlocking ownership arrangements is not particularly meaningful without knowing the companies involved and the magnitude of this involvement. In Tables 41 and 42 the total interlocks are distributed among the participating companies as of 1957 and 1975.

TABLE 40

NUMBER AND PERCENT DISTRIBUTION OF INTERLOCKING OWNERSHIP ARRANGEMENTS IN DOMESTIC JOINT VENTURE PIPELINES, 1957 AND 1975

	1957		1975		Percent Change 1957-75
	Number	Percentage Distribution	Number	Percentage Distribution	
Corporate, Total	145	60.9	397	62.5	173.8
Crude	81	34.0	158	24.9	95.1
Product	64	26.9	239	37.6	273.4
Systems, Total	80	33.6	192	30.2	140.0
Crude	47	19.7	152	23.9	223.4
Product	33	13.9	40	6.3	21.2
Known Intrastate	13	5.5	46	7.3	253.8
Total, Crude (Interstate)	128	53.8	310	48.8	142.2
Total, Product (Interstate)	97	40.7	279	43.9	187.6
GRAND TOTAL	238	100.0	635	100.0	166.8

SOURCE: Calculated from data contained in Appendix C.

Participating petroleum companies are ranked as they were in Figure 11 with the exception that companies ranked 21-25 are included. Two other classes of companies are also included, the first, "all other petroleum companies," includes all petroleum companies who participate in joint ventures but are not among the top 25. The second, "non-petroleum," includes participants whose involvement in the petroleum industry is primarily through pipeline transportation.

In 1957 the 238 interlocks did not appear to have produced unique patterns of participation [Table 41]. Of the 25 companies shown all but two had at least one tie with another company with frequency of the interlocks ranging from zero to 39. Participation by companies ranked below 25 or classified as non-petroleum was limited. Of the 238 interlocks only 52 (21.8%) involved non top 25 companies and only three participants were classified as non-petroleum participants.

A more complex pattern of participation has evolved since 1957 with the entry of 42 new joint ventures [see Table 42]. Participation by companies outside the top 25 increased significantly both in terms of other petroleum companies and also non-petroleum companies. In 1975 these companies accounted for about 26 percent of the total interlocks compared to 22 percent in 1957.

The second major change that Table 42 illustrates is the relatively limited participation by companies ranked 19-25. In 1975 they had only 23 interlocks with companies larger than themselves (3.6 percent) compared to 29 in 1957 (or 12.2 percent). One explanation is that mergers and acquisitions occurring over the period push five

TABLE 41

TOTAL NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE DOMESTIC TRANSPORTATION OF CRUDE OIL AND REFINED PRODUCTS BY PIPELINES, 1957

	1. STANDARD OIL (NJ)	2. SOCONY MOBIL	3. GULF	4. TEXAS CO.	5. STANDARD OIL (IN)	6. SHELL	7. STANDARD OIL (CA)	8. SINCLAIR	9. PHILLIPS	10. CITIES SERVICE	11. SUN	12. CONTINENTAL	13. TIDEWATER	14. ATLANTIC REFINING	15. PURE OIL	16. UNION OIL OF CALIFORNIA	17. STANDARD OIL (OHIO)	18. SUNRAY MID-CONTINENT	19. ASHLAND OIL	20. OHIO OIL	21. SKELLY OIL	22. RICHFIELD OIL	23. PLYMOUTH OIL	24. AMERADA PETROLEUM	25. KERR MC GEE	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. STANDARD OIL (NJ)																												
2. SOCONY MOBIL	0																											0
3. GULF	3	1																										4
4. TEXAS CO.	1	1	3																									5
5. STANDARD OIL (IN)	1	1	1	1																								4
6. SHELL	4	0	4	4	3																							15
7. STANDARD OIL (CA)	1	0	1	0	0	0																						2
8. SINCLAIR	0	0	5	6	1	3	0																					15
9. PHILLIPS	0	0	0	3	1	1	0	2																				7
10. CITIES SERVICE	0	0	3	9	0	2	0	5	3																			22
11. SUN	0	0	4	0	0	0	0	0	0	1																		5
12. CONTINENTAL	1	0	1	1	0	1	0	3	1	2	1																	11
13. TIDEWATER				1				1		1																		3
14. ATLANTIC REFINING					1	1																						2
15. PURE OIL			7	2	1	3		7	1	6	3	1		1														32
16. UNION OIL OF CALIFORNIA	2		1	1		1	1	1	1	1		2																11
17. STANDARD OIL (OHIO)			3			1				2	3				4													13
18. SUNRAY MID-CONTINENT				1				1	1	1		1				1												6
19. ASHLAND OIL					1	1		2							1		2											7
20. OHIO OIL			1		1			1				1			1													5
21. SKELLY OIL				1				1	1	1	1	2				1		1										9
22. RICHFIELD OIL	1		1			1	1																					4
23. PLYMOUTH OIL					1	1								1	1													4
24. AMERADA PETROLEUM																												
25. KERR MC GEE																												
ALL OTHER PETROLEUM CO	4	3	4	4	3	7	1	1	4	6	0	2	1	1	1	1	0	1	3			1	1					49
NON PETROLEUM						1		1				1																3
GRAND TOTAL	18	6	39	34	13	24	3	26	12	21	8	10	1	3	8	3	2	2	3			1	1					238

SOURCE: Compiled from data in Appendix C. Included inter and intrastate joint ventures and both corporate and system forms of ventures.

TABLE 42

TOTAL NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE DOMESTIC TRANSPORTATION OF CRUDE OIL AND REFINED PRODUCTS BY PIPELINES, 1975

	1. EXXON	2. TEXACO	3. MOBIL	4. STANDARD OIL (CA)	5. GULF	6. STANDARD OIL (IN)	7. SHELL	8. ATLANTIC RICHFIELD	9. CONTINENTAL	10. PHILLIPS	11. UNION OIL OF CALIFORNIA	12. SUN	13. ASHLAND	14. CITIES SERVICE	15. AMERADA HESS	16. GETTY OIL[1]	17. MARATHON OIL	18. STANDARD[2] OIL (OHIO)	19. KERR MC GEE	20. DIAMOND SHAMROCK	21. PENNZOIL	22. CHARTER	23. AMERICAN[3] PETROFINA	24. MURPHY OIL	25. TESORO PETROLEUM	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. EXXON																												*
2. TEXACO	3																											3
3. MOBIL	3	7																										10
4. STANDARD OIL (CA)	3	1	0																									4
5. GULF	4	9	3	2																								18
6. STANDARD OIL (IN)	4	5	4	2	4																							19
7. SHELL	7	10	4	4	7	7																						39
8. ATLANTIC RICHFIELD	2	6	4	3	7	5	7																					34
9. CONTINENTAL	3	5	4	1	6	3	5	4																				31
10. PHILLIPS	2	6	3	1	3	5	4	6	3																			33
11. UNION OIL OF CALIFORNIA	3	9	6	0	8	4	6	9	5	3																		53
12. SUN	1	3	2	1	4	1	3	0	2	1	4																	22
13. ASHLAND	0	1	0	0	0	2	2	2	0	1	2	1																11
14. CITIES SERVICE	2	13	5	0	7	3	5	6	6	5	9	4	0															65
15. AMERADA HESS	1	0	1	0	0	0	0	1	0	1	1	0	0	0														5
16. GETTY OIL[1]	0	1	2	0	0	1	0	2	0	1	0	2	0	1	0													10
17. MARATHON OIL	1	7	4	0	3	2	5	3	4	1	7	3	1	4	1	0												46
18. STANDARD[2] OIL (OHIO)	2	5	2	0	6	2	2	2	1	2	7	5	2	3	1	0	1											43
19. KERR MC GEE			1									1				1												3
20. DIAMOND SHAMROCK		2								3																		5
21. PENNZOIL																												0
22. CHARTER						1	1	1		1			1															5
23. AMERICAN[3] PETROFINA	1	1	1		1											1		3										8
24. MURPHYOIL							1		1																			2
25. TESORO PETROLEUM																												0
ALL OTHER PETROLEUM CO.	5	11	9	3	6	8	14	5	8	4	10	9	9	7	0	7	7	1	7	0	1	1	1	3	0			136
NON PETROLEUM	1	1	4	0	1	1	2	1	2	1	1	1	1	1	0	3	0	0	2	0	3	0	1	0	0	3		30
GRAND TOTAL	48	103	59	17	63	45	57	42	32	24	41	26	14	16	2	12	8	4	9	0	4	1	2	3	0	3	0	635

SOURCE: Compiled from data in Appendix C. Includes inter and intrastate ventures, both corporate and systems. Also includes the Trans Alaskan Pipeline System which was not (in 1975) in operation.

[1]Includes Skelly; [2]Includes British Petroleum; [3]Includes Canadian Petrofina

companies into the top 25 in 1975 and these companies have shown a smaller propensity to engage in joint activities.

Mergers and acquisitions also resulted in the surviving company inheriting the interlocking ownership ties that existed prior to the merger. For example, in 1957 Union Oil of California had 11 interlocks with larger companies. In 1975 it was interlocked 53 times with larger companies and most of the new interlocks were the result of the acquisition of Pure Oil Company.

Three additional changes occurred over the nearly 20 year period. First, the completeness and frequency of the interlocks between the larger companies in 1975 is significant. To illustrate this consider that for each company in the top 12 to be linked together one time requires 66 interlocks (one each in each row and column). In 1957 this requirement was some 28 interlocks short (i.e., 28 blanks among the top 12). In 1975 the top 12 companies fell short of this requirement by only three (the top 8 by only one in 1975 compared to 9 in 1957).

The second change of note is the much stronger cursory correlation between company size and frequency or interlocks in 1975 compared to 1957 (bottom row). While the pattern is not uniform, there is a definite tendency for interlocks to vary directly with firm size. The major exception to this observation is Standard Oil of California. Standard Oil of California has historically had a much smaller asset base east of the Rocky Mountains than the other major companies. This was especially true prior to the company's acquisition of Standard Oil of Kentucky (which operated primarily in PAD I).

The final change that emerges from Table 42 is the cursory correlation between the frequency of interlocks with larger companies and the historical patterns of cooperation or ties within the petroleum industry. This is illustrated by the higher frequency of interlocks of Marathon and Standard Oil of Ohio with companies larger than themselves (both were original members of the Standard Oil Trust). This is in contrast to the frequency of interlocks for Ashland, Getty, Kerr McGee, and Diamond Shamrock.

Participation Patterns: The Top Eight Petroleum Companies

Joint participation by an industry's dominant firms is more important than participation by smaller firms. Collective action by small firms may be justified on competitive grounds assuming that the resulting combinations continue to have no influence over prices and output. Collective action by the dominant firms may not be justified on the grounds that they already are in a position to influence prices and output.

Because joint ventures among the dominant petroleum firms carry a higher probability of producing anti-competitive effects, their involvement in joint ventures are examined in greater detail. This is accomplished by examining the distribution of pipeline investments, the number and type of ventures, and the number of ownership interlocks the participation produces.

Distribution of Pipeline Investments

Using ICC valuation dockets filed for the year ending December 31, 1972, the total market value of pipeline investments of the twenty

largest petroleum companies were derived and are shown in Table 43. The investment totals represent only interstate investments. They do include the prorated interests in corporate joint ventures and are standardized by expressing the dollars in terms of cost of reproduction less depreciation (market value of the investment).[40]

The market value of the total investment of these twenty companies was slightly more than $3.8 billion in 1972. Of this total investment, 45.4 percent was in corporate joint ventures. The remaining 54.6 percent of the total investment was made through wholly owned subsidiaries. Investments via wholly owned subsidiaries do not entirely represent wholly owned pipelines since investments in joint-venture systems are embodied in these data. The amount of the system investment can not be directly measured since it is not reported as a separate investment.

In Figure 13 the percentage distribution of each company's investment dollar between corporate joint ventures, joint-venture systems, and wholly owned lines is presented. Care should be exercised in using this figure since the system percentage share is only an approximation.[41]

The data in Table 43 and Figure 13 adds additional support to the contention that joint-venture pipelines in 1975 represent as much as one-half of the interstate market. Figure 13 also indicates that even with the rapid growth in pipeline systems, the twenty companies, with only two exceptions, still have a concentration of their investment in subsidiaries and corporate joint ventures.

Figure 13 does not on the surface indicate any uniformity in

TABLE 43

TOTAL NET INVESTMENTS IN INTERSTATE PIPELINE COMPANIES, TWENTY PETROLEUM COMPANIES, IN THE UNITED STATES, 1972 (MILLIONS OF DOLLARS)

Company	Market Value of Investments[1]		
	Total	Subsidiaries[2]	Corporate Joint Ventures
Exxon Corporation	455.6	253.9	201.7
Gulf	393.4	152.2	241.2
Texaco	368.9	169.8	199.1
Shell	326.5	163.3	163.2
Standard Oil (IN)	323.1	234.5	88.6
Mobil	307.9	221.2	86.7
Atlantic Richfield	266.4	180.3	86.1
Phillips	181.3	129.9	51.4
Continental	171.9	70.4	101.4
Standard Oil (CA)	171.0	95.4	75.6
Cities Service Co.	153.5	27.4	126.1
Union Oil of CA	144.0	43.6	100.4
Standard Oil (Ohio)	139.6	55.3	84.3
Sun	133.9	75.4	58.5
Marathon Oil	116.9	88.1	29.8
Ashland	68.4	60.2	8.2
Diamond Shamrock	31.6	31.6	--
Clark Oil & Refining	21.6	--	21.6
Amerada-Hess	19.8	19.8	--
Getty Oil[3]	13.1	7.2	5.9

SOURCE: Calculated from data published by the Interstate Commerce Commission in Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1972. Pipeline investments were assigned to the above companies based on the ownership data shown in Appendix B. Joint venture investments were prorated to these companies based on the percent owned by the participants.

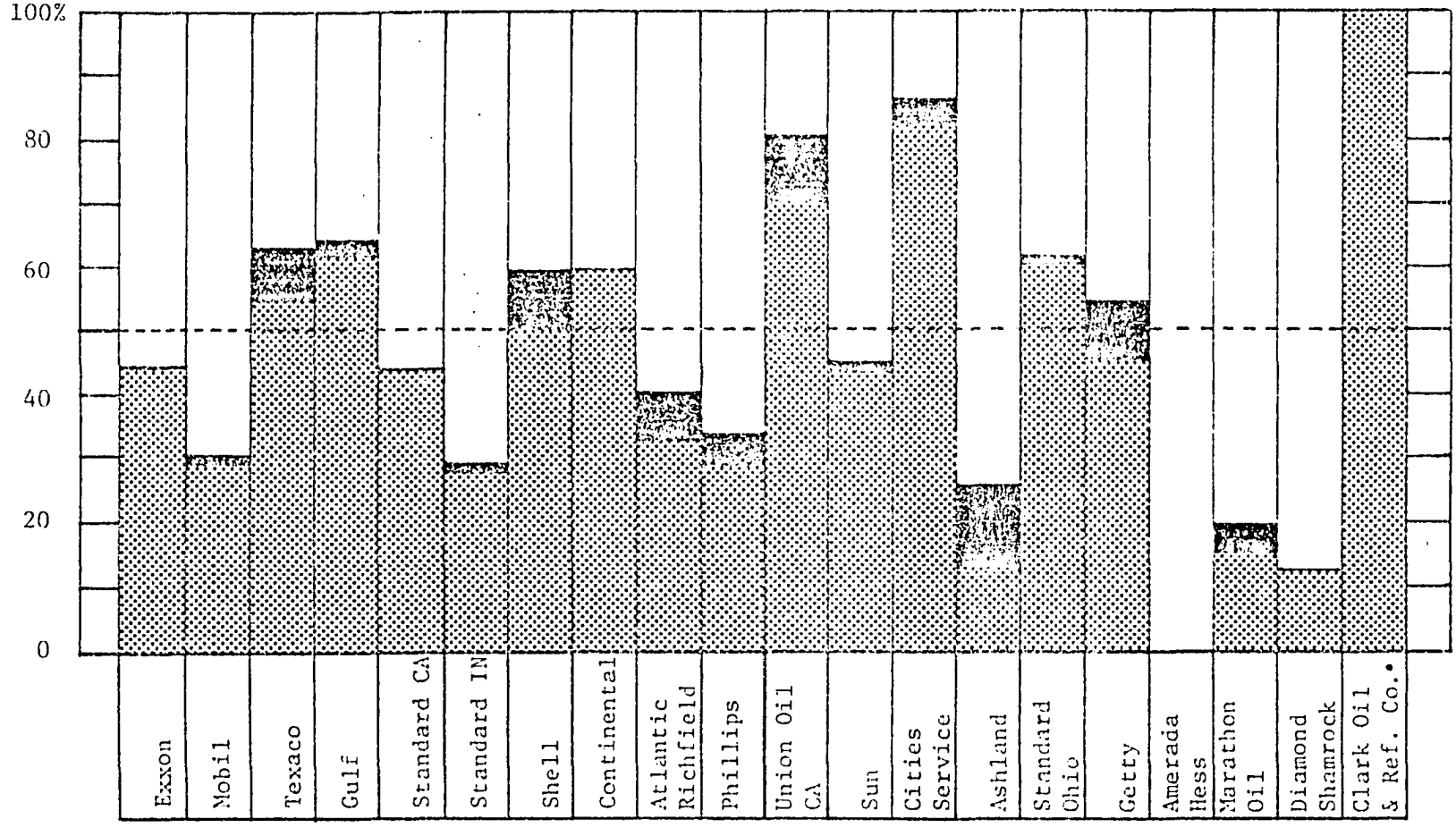
[1]Market value of investments (net investment) is defined by the Interstate Commerce Commission for valuation purposes as the cost of reproduction less depreciation (and excluding land).

[2]Includes investments in joint-venture systems.

[3]Includes the pipeline investments of Skelly Oil Co.

FIGURE 13

PERCENT DISTRIBUTION OF NET PIPELINE INVESTMENTS, BY TYPE OF ORGANIZATION,
TWENTY PETROLEUM COMPANIES,
DECEMBER 31, 1972



SOURCE: Data for corporate joint ventures from Table 43; system investments are estimates; and wholly owned percent is a residual.

• All investments are via corporate joint ventures which in turn hold system investments.

☐ Wholly owned; ⊠ Corporate joint ventures; ▌joint venture systems.

the distribution of pipeline investment. This gives at least superficial support to the contention that the historical selection of the type of investment (i.e., corporate joint venture pipeline, system pipeline, or wholly owned pipeline) has been a function of a variety of factors--the weighting of each a function of the individual project. In terms of major recent projects, however, the selection has almost always been a joint venture.

While Figure 13 indicates a broad divergence in the investment distribution, only Amerada Hess (in 1972) held no joint-venture investments. On the other extreme, all of Clark Oil and Refining Company's interstate investments were in corporate joint ventures. Through its participation in corporate joint ventures, Clark also held an interest in a crude joint-venture system. The inclusion of the estimate of system investments had the greatest impact on Diamond Shamrock and Ashland. The system investment by Standard Oil (IN), Mobil, Standard Oil (Ohio), and Sun were only 1.1 to 0.8 percent of their total investment. Only four of the twenty companies, however, had no system investments in 1972.

Overall size of parent company did not (in 1972) appear to be a major factor in determining the distribution of the investment. While, a priori, one could reasonably expect an inverse relationship between size of parent company and investment in joint ventures, the 1972 experience does not support this hypothesis.

Number of Ventures with Top Eight Participants:
1957 and 1975

Tables 44-45 indicate that each of the eight companies increased

their participation over the period. There was also a wide range of participation in both 1957 and 1975 (from 1 to 15 in 1957 and from 6 to 28 in 1975) with no uniformity among companies. This is consistent with the distribution of investments, as shown in Figure 13. Texaco participated in the largest number of ventures in both 1957 and 1975 and also joined the largest number of new ventures over the period (13). Shell was second in number of ventures participated in (1975) and was the second most active joiner.

The top eight companies as a group have participated in more corporate ventures (63.6 percent of the interstate ventures participated in 1957 and 60 percent in 1975) than systems. In 1957 they participated in more crude ventures than product ventures but by 1975 more than half of the participation was in product ventures. The eight companies' preference for corporate ventures and until recently a preference for crude ventures does not appear to be overly significant. What is significant is that, excluding intrastate activities, the eight companies have been present in all types of ventures.

The ownership tables in Appendix B indicate that the eight companies do participate in joint ventures in which they individually or collectively do not control but the lack of control is an exception rather than a rule. The top eight companies have with one exception participated only in ventures controlled by the top 20 companies. The issue of control may be significant in explaining the top eight's historical selection of corporate joint-venture participation over system participation.

TABLE 44

NUMBER OF JOINT VENTURES THE TOP FOUR PETROLEUM COMPANIES PARTICIPATED IN, 1957 AND 1975

	Exxon		Texaco		Mobil		Standard (CA)	
	1957	1975	1957	1975	1957	1975	1957	1975
Joint Venture Participation, Total	5	10	15	28	3	12	1	6
Corporate, Total	5	7	8	13	2	9	1	4
Crude	3[1]	3[1]	3	3	0	3	1	3
Product	2	4	5	10	2	6	0	1
Systems, Total[2]	0	2	7	14	1	3	0	2
Crude	0	1[3]	4	8	0	2	0	1
Product	0	1	3	6	1	1	0	1
Intrastate[4]	0	1	0	1	0	0	0	0

SOURCE: Compiled from data in Appendix B.

[1]All three are through its Canadian subsidiary, Imperial Oil, Ltd.

[2]Includes one intrastate system.

[3]Trans Alaska Pipeline System

[4]Excludes Alaskan non-regulated pipelines.

TABLE 45

NUMBER OF JOINT VENTURES THE SECOND FOUR PETROLEUM COMPANIES PARTICIPATED IN, 1957 AND 1975

	Gulf		Standard (IN)		Shell		ARCO[3]	
	1957	1975	1957	1975	1957	1975	1957	1975
Joint Venture Participation, Total	13	17	5	10	11	23	14	19
Corporate, Total	9	10	3	7	6	11	8	11
Crude	6	6	2	3	4	5	5	8
Product	3	4	1	4	2	6	3	3
Systems, Total[1]	4	7	2	3	4	9	6	8
Crude	1	3	1	3	3	7	3	4
Product	3	4	1	0	1	2	3	4
Intrastate[2]	0	0	0	0	1	3	0	0

SOURCE: Compiled from Appendix B.

[1]Includes one intrastate system in 1975.

[2]Excludes Alaskan non-regulated pipelines

[3]Data for 1957 is for Sinclair.

Interlocking Ownership Arrangements

In 1957 the eight major oil companies collectively controlled 55 percent of the known inter-, intrastate joint-venture pipelines. In 1975 the eight majors collectively controlled 53 percent of the known joint ventures. This factor, while significant, understates the influence and pivotal role played by the companies. This influence is more clearly illustrated by examining the interlocking ownership arrangements involving these companies.

In Table 46 the interlocking patterns displayed in Tables 41 and 42 are summarized. In 1957 the eight companies had 163 ownership ties with themselves and other companies and of the total interlocks only 31.5 percent did not involve a top eight company. Between 1957 and 1975 the number of interlocks increased by nearly 167 percent. Total interlocks involving top eight companies (434) continued to represent about the same percentage (68.3) as in 1957.

The interlocking relationships among only the eight majors increased from 45 in 1957 to 127 in 1975 (20 percent of the total), a 182 percent increase. Reflecting the limited joint-venture participation by and with non-petroleum companies, the eight majors had only two interlocks in 1957 and eleven in 1975 with these companies.

Considering the number of petroleum companies operating in the United States, their participation in joint ventures without one of the eight majors was limited. Only 74 of the 1957 interlocks and 182 of the 1975 interlocks involved only smaller petroleum companies. The joint venture mechanism offers the greatest potential for non-major entry into pipeline transportation. The lack of significant

TABLE 46

INTERLOCKING OWNERSHIP ARRANGEMENTS AMONG THE TOP EIGHT PETROLEUM COMPANIES AND OTHER COMPANIES IN JOINT VENTURE PIPELINES, 1957 AND 1975

Interlocking Ownership Arrangements	1957 Number	1957 % of all Interlocks	1975 Number	1975 % of all Interlocks	Percent Change 1957-75
TOP 8 COMPANIES WITH:					
Top 8 Companies	45	18.9	127	20.0	182.2
Other Petroleum Co's	116	48.7	290	46.6	155.2
Non-Petroleum Co's	2	0.8	11	1.7	450.0
Sub-Total	163	68.5	434	68.3	166.3
INTERLOCKS WITHOUT TOP 8 PARTICIPANTS					
Other Petroleum Co's	74	31.1	182	28.7	146.0
Non-Petroleum Co's	1	0.4	19	3.0	1800.0
TOTAL, ALL INTERLOCKS	238	100.0	635	100.0	166.8

SOURCE: Calculated from data in Tables 41-42.

participation indicates underutilization and also the need for the consideration of regulatory review of participation which was suggested by Cookenboo in 1955.[42]

Interlocks by Type and Product Carried

While there has been rapid growth in total interlocking ownership arrangements (see Table 47-48), the eight majors had a well established pattern of interlocks prior to 1957. Since then, the pattern has become more complex. Between 1957-75 the number of crude interlocks involving the eight majors more than doubled but the percent of total declined from 75 to 62 percent. The largest increase in crude interlocking ownership, occurred among companies ranked 9th and below. Crude interlocks involving these companies increased 232 percent during the period.

The opposite pattern occurred in product interlocks. Product joint ventures increased sharply during the period as did product interlocks. Interlocks involving the eight companies experienced the greatest growth. This growth came primarily from corporate joint ventures and not systems. In 1957 the eight majors had only 16 product ownership ties among themselves. In 1975 this had increased to 66 ties representing nearly 24 percent of the total product interlocks and exceeded the number of crude ownership ties.

In 1957 the eight companies had a total of 65 interlocks with other companies (67 percent of the total). By 1975 the number had increased to 216 and the percent of total had risen to 77 percent. Interlocks with non-petroleum companies were unimportant in both 1957 and 1975. Of the 30 total 1975 interlocks involving non-petroleum

TABLE 47

INTERLOCKING OWNERSHIP ARRANGEMENTS AMONG THE TOP EIGHT PETROLEUM COMPANIES AND OTHER COMPANIES IN CORPORATE JOINT VENTURE PIPELINES, 1957 AND 1975

Interlocking Ownership Arrangements	1957 Number	1957 % of Total	1975 Number	1975 % of Total	Percent Change
CRUDE					
Top 8 Companies with:					
Top 8 Companies	19	23.5	32	20.2	68.4
Other Petroleum Co's	40	49.4	61	38.6	52.5
Non-Petroleum Co's	1	1.2	3	1.9	200.0
Subtotal	60	74.1	96	60.8	60.0
Interlocks without Top 8 Participant					
Other Petroleum Co's	20	24.7	48	30.4	140.0
Non-Petroleum Co's	1	1.2	14	8.9	--
Total, All Interlocks	81	100.0	158	100.0	95.1
PRODUCT					
Top 8 Companies with:					
Top 8 Companies	8	12.5	58	24.3	625.0
All Other Petroleum Co's	32	50.0	117	49.0	265.6
Non-Petroleum Co's	0	--	7	2.9	--
Subtotal	40	62.5	182	76.2	355.0
Interlocks without Top 8 Participants					
Other Petroleum Co's	24	37.5	52	21.8	116.7
Non-Petroleum Co's	0	--	5	2.0	--
Total, All Interlocks	64	100.0	239	100.0	273.4

SOURCE: Compiled from data in Appendix C.

TABLE 48

INTERLOCKING OWNERSHIP ARRANGEMENTS AMONG THE TOP EIGHT PETROLEUM COMPANIES AND OTHER COMPANIES IN JOINT VENTURE PIPELINE SYSTEMS, 1957 AND 1975

Interlocking Ownership Arrangements	1957 Number	1957 % of Total	1975 Number	1975 % of Total	Percent Change
CRUDE					
Top 8 Companies with:					
Top 8 Companies	10	21.3	20	13.2	100.0
Other Petroleum Co's	26	55.3	77	50.7	196.2
Non-Petroleum Co's	0	0			
Subtotal	36	76.6	97	63.9	169.4
Interlocks without Top 8 Participants					
Other Petroleum Co's	11	23.4	55	36.1	400.0
Non-Petroleum Co's	0		0		
TOTAL, ALL INTERLOCKS	47	100.0	152	100.0	223.4
PRODUCT					
Top 8 Companies with:					
Top 8 Companies	8	24.2	8	20.0	N.C.
Other Petroleum Co's	17	51.5	25	62.5	47.1
Non-Petroleum Co's	0		1	2.5	--
Subtotal	25	75.7	34	85.0	36.0
Interlocks without Top 8 Participants					
Other Petroleum Co's	8	24.3	6	15.0	-25.0
Non-Petroleum Co's	0		0		
TOTAL, ALL INTERLOCKS	33	100.0	40	100.0	21.2

SOURCE: Compiled from data in Appendix C.

companies, more than half involved crude pipelines.

A second development of the period was that the rapid growth in product interlocks was primarily confined to corporate joint ventures dominated by the eight majors. The opposite pattern emerged when interlocks not involving the eight majors are examined. In this case, the greatest growth has come from crude system interlocks.

Participation Patterns: A Summary

This section has demonstrated that one result of the development of joint ventures is the development of a complex maze of interlocking ownership participation patterns. Extensive ownership ties were well established in 1957, since that time interlocks have increased 167 percent.

The eight major companies have been and are the dominant influence. One or more of these companies was represented in 68.3 percent of the 1975 interlocking ownership arrangements and are interlocked extensively with themselves. Standard Oil of California stands out as the one company with few interlocks. This was explained by its concentration (domestic) on the West Coast (PAD V). While the eight companies participate with companies ranked 9th or below, they rarely interlock with non-petroleum pipeline interests. Either by choice or chance the eight majors have a higher percentage of their interlocks resting in corporate joint ventures. One of the characteristics of the corporate form (as earlier noted) was the limited influence of minority owners.

The right hand column of Table 42 illustrated that four companies are heavily interlocked with larger companies. These are: Union Oil, Cities Service, Marathon, and Standard Oil (Ohio). The latter

three companies are by virtue of a long standing participation in joint ventures. The three companies represent 47 percent of the interlocks involving the 9th-20th companies. Adding Union Oil raises the total to 63 percent. Union Oil's involvement is more the result of the acquisition of Pure Oil in the 1960's than its active participation.

Product interlocks experienced the greatest gain from 1957. This greatly enhanced the ability of the participating companies to deal with short-run disequilibrium without resorting to sale or purchase or on the spot market. This participation, as Chapter VIII indicates, may also increase the propensity to engage in exchanges. The eight major companies were central to the growth of product ownership interlocks.

International Petroleum Joint Ventures and Domestic Pipeline Joint Ventures: A Comparison

> Outside the United States, Mexico, and Russia, the operation of the 7 international petroleum companies are combined through various inner-company holdings and subsidiary and affiliated companies. These holdings constitute partnerships in various areas of the world. Each of the companies has pyramids of subsidiary and affiliated companies in which ownership is shared with one or more of the other large companies. Such a maze of joint ownership obviously provides opportunity and even necessity for joint action. With decision-making thus concentrated in the hand of a small number of persons, a common policy may be easily inforced.[43]

This statement, in reference to the international petroleum industry in 1949, also applies to the 1970's.[44]

Two recent studies evaluated joint-venture activities in the international petroleum industry (outside the United States). The period of the evaluation, 1957-72, provided an opportunity to compare the international ventures with those found in the United States. The empirical work focused on production, refining, and crude pipeline

transportation. The authors did not examine refined product pipelines, other transportation modes, or the refined products market. Ten major geographic areas of the world outside of the United States and the Communist countries were included in the analysis.

The authors, following a classification system first used in the International Petroleum Cartel, divided companies in the international industry into the international majors and international minor petroleum companies [see Appendix A]. In addition the joint venture participation of three other groups was examined. These were: local private capital, local government, and non-host government companies (minor government-owned petroleum companies).[45] Participation by the latter three groups have historically been the result of host country requirements and the tradition of governments outside the United States to own outright or investment directly in petroleum companies.[46]

The joint ventures found to be active in 1972 resulted in 6,419 direct ownership interlocks between the international majors, minors, and the other participants. This was slightly more than 10 times the number of domestic U.S. pipeline interlocks found to exist in 1975 [see Table 49]. The seven international majors had 916 direct ownership interlocks among themselves in 1971 compared to the 127 interlocks resulting from joint venture pipeline participation of the eight majors operating in the United States [see Table 50].

Although the magnitude of the international ownership interlocks is much greater, the pattern of participation is similar to those found in U.S. domestic pipelines. This is particularly the case now that British Petroleum Company is a part of the U.S. market through its

TABLE 49

JOINT VENTURES OF INTERNATIONAL MAJOR OIL COMPANIES
WITH INTERNATIONAL MINORS AND OTHER GROUPS

	EXXON	SHELL	TEXACO	MOBIL	GULF	STANDARD OIL (CA)	British Petroleum		MINORS	ALL OTHER PETROLEUM	NON PETROLEUM	GRAND TOTAL
EXXON												
SHELL	186											186
TEXACO	32	45										77
MOBIL	59	46	31									136
GULF	21	22	23	14								80
STANDARD OIL (CA)	19	98	100	31	15							263
British Petroleum	33	44	22	37	25	13						174
INTERNATIONAL MINORS	339	139	116	185	95	101	243		1088			2306
ALL OTHER PETROLEUM	80	79	43	61	76	32	43		827	357		1598
NON PETROLEUM	81	57	66	60	52	51	70		821	340		1599
GRAND TOTAL	850	530	401	388	263	197	356		2740	697		6419

SOURCE: Based upon data in James I. Sturgeon, "Joint Ventures in the International Petroleum Industry: Exploration and Drilling" (unpublished Ph.D. Dissertation, University of Oklahoma), pp. 159-160.

TABLE 50

JOINT VENTURES OF MAJOR INTERNATIONAL
OIL COMPANIES WITH EACH OTHER

	EXXON	SHELL	TEXACO	MOBIL	GULF	STANDARD OIL (CA)	British Petroleum	TOTAL
EXXON								
SHELL	186							186
TEXACO	32	45						77
MOBIL	59	46	31					136
GULF	21	22	23	14				80
STANDARD OIL (CA)	19	98	100	31	15			263
British Petroleum	33	44	22	37	25	13		174
TOTAL	350	255	176	82	40	13		916

SOURCE: James I. Sturgeon, "Joint Ventures in the International Petroleum Industry: Exploration and Drilling" (unpublished Ph.D. dissertation, University of Oklahoma), p. 166.

merger agreement with Standard Oil Company of Ohio.[47] One pattern that does differ in comparison with domestic pipeline joint ventures is the fact that participation by local private capital, local government, non-host government, and others represents 49.8 percent of the total international interlocks. This is a much higher total than was found in domestic pipelines.

While there was not a strong preference for one form of joint venture over another in domestic pipelines, the authors found that the major oil companies in the international arena preferred to establish joint subsidiaries rather than use contractual arrangements.

The international ventures produced a consistent set of partnerships which involved Standard Oil of California and Texaco, Exxon and Shell, Shell and British Petroleum, and Exxon and Mobil. These were the most prominent partnerships found in the 10 areas of the world outside the U.S. and the communist companies.[48]

In 1949 the dominant mode of petroleum transportation was the water carrier (primarily ocean tankers). This continues to be the case. Pipelines in 1949 were used primarily to move crude to crude-oriented refineries or to water terminals. Of the 12 major systems operating in 1949, only one was owned by a single company; the others were joint ventures.[49] A similar pattern was found to exist in 1972.

In 1972 crude pipelines operating outside the United States were found to have several important characteristics.[50] First they were not necessarily independent money-making enterprises since they were likely to only be one unit in an integrated industrial structure. Second, the ownership of the pipeline operations in the 10 areas were

identical with no major exceptions to the companies which owned the producing operations. Although separate, the partners in the producing joint ventures were usually the same partners in the pipeline joint ventures serving the areas. Third, although the analysis was concentrated on pipeline mileage, mileage was not found to be a good representation of capacity. For example, the Canadian and Central American mileage, 10,693 miles, represented 31 percent of the 10 study areas mileage but only 6 percent of the crude transported.

The consistent and close relationship between crude oil control and crude pipeline mileage control produced similar patterns of concentration. For example, in South America the international majors controlled 76 percent of the crude production and also 76 percent of the crude pipeline mileage. In Africa the 7 majors controlled 50 percent of production and 48 percent of the pipeline mileage. In Europe they controlled 74 percent of the production and 75 percent of the pipeline mileage. The fourth characteristic was the lack of common carrier status on the part of the international pipelines; the lines were built to serve the needs of the shipper/owners.[51]

In 1971 there were 119 crude pipelines operating in the 10 geographic regions. The ownership of 116 was identified. Of the 116, 73 were joint ventures and 38 were single owner pipelines.[52] This reliance on joint ventures was somewhat higher than that found in the United States. Including product pipelines, there were 56 one-owner pipelines in the U.S., 43 joint venture companies and 35 systems in 1975. The 73 international crude joint ventures had an average of 3.7 participants.[53] This compared to the average of 3.9 for U.S. crude

TABLE 51

NUMBER OF JOINT VENTURES AND INTERLOCKING OWNERSHIP TIES IN PETROLEUM PIPELINE OPERATIONS, SELECTED COMPANIES, AS OF JUNE, 1972

	EXXON	SHELL	TEXACO	MOBIL	GULF	STANDARD OIL (CA)	British Petroleum		MINORS	ALL OTHER PETROLEUM	NON PETROLEUM	GRAND TOTAL
EXXON												
SHELL	15											15
TEXACO	6	6										12
MOBIL	11	12	10									33
GULF	6	4	3	1								14
STANDARD OIL (CA)	4	5	9	6	4							28
British Petroleum	11	13	6	10	2	2						44
INTERNATIONAL MINORS	32	38	17	25	13	12	23		63			223
ALL OTHER PETROLEUM	19	9	13	21	22	4	11		57	14		170
NON PETROLEUM	9	5	6	8		6	2		14	30		80
GRAND TOTAL	113	92	64	71	41	24	36		134	44		619

SOURCE: Based upon data in John Munkirs, "Joint Ventures in the International Petroleum Industry: Production and Pipelines" (unpublished Ph.D. dissertation, University of Oklahoma), p. 218.

joint ventures and 5.0 for product ventures.

The 73 international pipeline joint ventures produced 619 interlocks between the international majors, the international minors and other groups. As Table 51 indicates, the 7 majors were interlocked with themselves 148 times, 142 times with the minors, and 54 times with other groups. The 7 international majors had a higher number of pipeline interlocks with themselves in the international market than they did in the U.S. pipeline market. The percentage distribution of the interlocks was similar with one major exception, the 7 majors participated in 55 percent of the total international crude pipeline interlocks whereas in the U.S. the same 7 accounted for 49 percent of the crude pipeline total.

The 7 international majors participated in 55 joint ventures and controlled 49 percent of these. This was similar to the control pattern found in the United States. With the exception of South America, the international major oil companies seldom operated in one owner systems. This was quite the opposite of the pattern in the U.S.

The Royal Dutch Shell group had more international pipeline interlocking ties than any of the other 6. This was not the case in the U.S. where Texaco had more interlocks than any of the other companies. The most active minors in international pipeline operations were Arco and Phillips. Tenneco and Occidental, on the other extreme, participated in no joint ventures during the period. This parallels the pattern in the U.S. where Occidental participated in no joint ventures and Tenneco was involved in only one venture.

The international minors were found to own and participate in

smaller pipelines that connected to the major trunk lines. This gave the majors a larger say in the operation of the minors' pipeline operation. Governments have long participated in pipeline operations outside the U.S. They owned 14 lines in 1971. This represented 7,659 miles and were located primarily in the Middle East.[54]

In summary, international joint venture pipeline operations were quite similar to those within the United States. The major differences were: (1) crude pipelines are less important as a transportation mode outside the United States; (2) pipelines are more likely to be joint ventures outside the U.S. and the control of these by the international majors was slightly higher; (3) international pipelines were not operated as common carriers in either form or fact but served only their shipper/owners; and (5) international pipelines were fully integrated into a larger unit (which in many cases were also joint ventures) and were not operated as profit centers.

In summarizing the overall findings concerning international joint ventures, the authors concluded that the 7 international majors were the primary force in the world's petroleum industry. They controlled 77 percent of the oil production, 60 percent of the pipeline mileage, and 60 percent of the refinery capacity outside of the U.S. and communist bloc countries in 1972. The international minors controlled 19 percent of the oil production, 32 percent of the pipeline mileage, and 40 percent of the refinery capacity in the 10 areas. Collectively the international majors and international minors controlled 96 percent of the oil production, 92 percent of the pipeline mileage, and nearly 100 percent of the refinery capacity in the 10 areas. Much,

if not most, of the control was through joint ventures.[55]

They found that joint-venture participation required cooperation. Cooperation, in turn, demanded planning and a sophisticated communications network. Joint ventures thus provided a means of achieving a most sought-after goal--that of order in organizations. Cooperation, planning, and order in organization may, the authors felt, work to the benefit of the ultimate consumer. However, it may also work to the vested interest in pecuniary gain of the select participants in the industry.[56]

[1]John Munkirs, "Joint Ventures in the International Petroleum Industry: Production and Pipelines," pp. 1-2.

[2]Ibid.

[3]Michael Bergman, "The Corporate Joint Venture Under The Antitrust Laws," New York University Law Review, Vol. 37 (June, 1962), pp. 713-733.

[4]James I. Sturgeon, "Joint Ventures in the International Petroleum Industry: Exploration and Drilling," p. 214.

[5]Of the 287 refineries operating as of January 1, 1976, in the United States, only one was identified as a joint venture (Quintana-Howell Joint Venture with an operating capacity of 30,000 b/d); see Bureau of Mines, "Petroleum Refineries in the United States, January 1, 1976.

[6]U.S., Congress, Senate, The International Petroleum Cartel (Reprint), pp. 47-49; Arthur M. Johnson, Petroleum Pipelines and Public Policy, p. 139.

[7]U.S., Congress, Senate, Market Performance and Competition in the Petroleum Industry, Hearings before the Special Subcommittee on Integrated Oil Operations, U.S. Senate, 93rd Congress, 2nd Session, Statement of Walter J. Mead (Washington, D.C.: Government Printing Office, 1974), vol. III, p. 1,006.

[8]Paul Rand Dixon, "Joint Ventures: What Is Their Impact on Competition?", The Antitrust Bulletin, VII (May-June, 1962), p. 398.

[9]The International Petroleum Cartel (Reprint), p. 29.

[10]Bergman, p. 714.

[11]Clayton Act Sec. 7, 64 Stat. 1125 (1950), 15 U.S.C. Section 18 (1964); Blair, The Control of Oil, pp. 378-381.

[12]15 U.S.C. Sec. 19; Blair, pp. 136-151.

[13]Lewis Bernstein, "Joint Ventures in the Light of Recent Antitrust Developments: Anti-Competitive Joint Ventures," Antitrust Bulletin Vol. 10, (1965), p. 25.

[14]The question of joint ownership of pipelines has never been litigated (see U.S., Congress, House, Anti Competitive Impact of Oil Company Ownership of Petroleum Pipelines, p. 65).

[15]U.S., Congress, Senate, Market Performance and Competition in the Petroleum Industry, pp. 1006-1007; Jules Blackman, "Joint Ventures and The Antitrust Laws," New York University Law Review, vol. 40 (October, 1965), p. 652; Sanford V. Berg and Phillip Friedman, "Joint Ventures, Competition and Technological Complementarities: Evidence From Chemicals," Southern Economic Journal (January, 1977), pp. 1330-1337.

[16]Bergman, p. 712.

[17]The formation of the first system, the Bayou system, proved to be a means of avoiding the Texas statute which prohibited a producing company from investing in more than one pipeline company (systems are always named, but the name simply identifies the physical facilities and does not represent a separate organization) see Johnson, p. 319.

[18]Ibid., pp. 318-319.

[19]Association of Oil Pipelines, "Statement of Jack Vickrey on Behalf of The Association of Oil Pipelines, Before The Senate Special Subcommittee on Integrated Oil Operations, Committee on Interior and Insular Affairs, December 12, 1973," pp. 19a-38.

[20]Tulsa Daily World, September 14, 1975, p. 4G; also see November 1, 1975.

[21]Tulsa Tribune, October 31, 1975, p. 2C.

[22]J. K. Spangler, "Corporate Structure and Financing Oil Pipelines," July 8, 1970, p. 12.

[23]Ibid., pp. 12-13.

[24]Debt/Equity ratios of this magnitude minimize the impact of the consent decree (Supra, pp. 36-45); The Average debt/equity ratio of all joint ventures companies reporting to the ICC over the 1957-75 period was 2.33 compared to 0.78 for all non-joint venture companies during the same period; of the 43 interstate corporate joint ventures, all but 13 were under the jurisdiction of the consent decree; the debt/equity ratio and throughput guarantees are central to the public debate over joint venture pipelines (see U.S., Congress, House, Anticompetitive Impact . . .).

[25]Spangler, pp. 6-14. [26]Ibid.

[27]Ibid., p. 13; For an example of a readjustment clause see U.S., Congress, House, Anticompetitive Impact . . ., pp. A138-A139.

[28]Anticompetitive Impact . . . , pp. A139-A140.

[29]Spangler, pp. 12-13. [30]Johnson, p. 318.

[31]Spangler, p. 12; this means that the owners of the Trans Alaska Pipeline System can spread the system's debt across their entire domestic pipeline network; of the eight participating owners, at least five are parties to the consent decree; given the cost of the Trans Alaska System ($7.7 billion as of June, 1977), it would have been most unusual for the participants to have formed a corporate joint venture--under the system form, depreciation of the pipeline (for tax purposes) is consolidated into the parent's balance sheet (via its pipeline subsidiary); the magnitude of the cost of the Trans Alaska system is illustrated by noting that the total assets of the 104 pipeline companies reporting to the ICC in 1975 was $9.3 billion (these assets included part of the debt of the Trans Alaska system).

[32]Spangler, p. 13.

[33]Sec. 28, 30 U.S.C. 185 as amended by Public Law 93-153.

[34]Identified by this writer; no attempt was made to include offshore ventures.

[35]Great Lakes Pipeline Company at the time it was sold had been in operation 35 years and was a party to the consent decree (see Supra, pp. 36-45); the circumstances behind its being sold, the former participants' influence over Williams Pipeline Company, and the impact of the construction of Explorer Pipeline Company (a new joint venture pipeline which included five of the eight original participants in Great Lakes) is a study in itself; for additional information see U.S., Congress, House, Anticompetitive Impact . . ., and Brief of Complainants, Midcontinent Petroleum Shippers, before the Interstate Commerce Commission in the matter of American Petrofina Company of Texas, et al. v. Williams Brothers Pipe Line Company, et al. (I.C.C. Docket No. 35720).

[36]For example David J. Teece calculated pipeline concentration for the years 1951, 57, 64, and 71 and treats joint ventures as separate companies. From this he concludes that concentration had declined (David J. Teece, "Vertical Integration In The U.S. Oil Industry," in Vertical Integration In The Oil Industry, ed. by Edward J. Mitchell (Washington, D.C.: American Enterprise Institute, 1966). p. 161 and 164; see Chapter IX for additional comments on concentration.

[37]John Wilson, "Market Structure and Interfirm Integration in the Petroleum Industry," p. 12. (mimeographed)

[38]Walter J. Mead, "The Structure of the Buyer Market for Oil Shale Resources," Natural Resources Journal, vol. 8 (October, 1968), pp. 617-620.

[39]The matrices used to compile Table 40 are found in Appendix C of this paper.

[40]Valuation dockets were not available for several small companies and one large company (Explorer Pipeline Company). In these cases, net carrier property investments published by the ICC were used (see footnotes, Table 43).

[41]The system investment was estimated by calculating each company's average net investment per mile (in subsidiary pipeline companies) and multiplying the average by the total system mileage owned. This approach has a downward bias since systems are generally large diameter trunk lines built after 1957.

[42]Cookenboo attached great potential to the non-major's use of the joint-venture mechanism to enter interstate pipeline operations. He advocated "a compulsory joint-venture system embracing all companies, large or small, which are willing to pay a share of the initial outlay." (Leslie Cookenboo, Jr., Crude Oil Pipe Lines and Competition in The Oil Industry, Chapter IV and p. 168.)

[43]The International Petroleum Cartel (Reprint), p. 29.

[44]John Munkirs, "Joint Ventures in the International Petroleum Industry: Production and Pipelines," and James I. Sturgeon, "Joint Ventures in the International Petroleum Industry: Exploration and Drilling."

[45]Munkirs, pp. 11-13.

[46]Supra, p.

[47]For details on the merger agreement see Moody's Industrial Service, Inc., Moody's Industrial Manual, vol 2 (New York: Moody's Investors Service, Inc., 1977), pp. 2882-2883; also see "For Sohio; It Was Alaskan Oil--or Bust," Fortune, August, 1977, pp. 172-183.

[48]Sturgeon, p. 230.

[49]The International Petroleum Cartel (Reprint), pp. 27-29.

[50]Material on pipelines operating outside the United States comes from John Munkirs, "Joint Ventures In The International Petroleum Industry: Production and Pipelines," Chapter V, pp. 171-209.

[51] *Ibid.* [52] *Ibid.*, p. 176. [53] *Ibid.*

[54] *Ibid.*, p. 187. [55] Sturgeon, p. 231.

[56] *Ibid.*, p. 232.

CHAPTER VIII

STRUCTURE AND CONDUCT, PART III: OTHER FORMS OF COOPERATION AND INTERDEPENDENCY

Joint ventures are the major form of cooperation within the pipeline segment of the industry. The close cooperation needed to plan, construct, and operate these pipelines raises important questions concerning the elimination or lessening of competition between the owners and also their effect on non-owner companies. By definition, a certain amount of competition in transportation is eliminated among joint owners.

Cooperation and interdependency does not end with joint ownership. This chapter considers the other major forms of cooperation. Three principal forms of cooperation are examined and are found to be an outgrowth of joint ventures, the characteristics of pipeline transportation, and ICC regulation.[1]

Phantom Pipeline Companies

It was initially assumed that pipeline companies reporting to the ICC were in fact operating companies, as well as legally separate companies. This is not the case. In 1957 of the 80 relevant companies reporting to the ICC, 19 were not operating companies (24 percent of the

total). By 1975 there were 102 relevant companies reporting to the ICC, 29 were not operating companies, 28 percent of the total [see Table 52].[2] The term "not operating" means the legal entity reporting to the ICC did not operate the pipeline facilities. Thus, the term "Phantom Pipeline Companies" was appropriate for nearly 28 percent of the pipeline companies reporting to the ICC in 1975.

The majority of the nonoperating companies have been corporate joint ventures. With a few exceptions, these companies have been operated by either the majority stockholder or the stockholder with the largest individual block of stock. The majority stockholder has historically been a major petroleum company and with only one exception (in 1975) the operating agent has been a major's principal pipeline subsidiary.

Over time there has evolved three standard means of staffing a joint venture pipeline company. The first requires a complete and full-time staff to operate the pipeline facilities. In 1957, 58 percent of the joint venture companies were fully staffed but by 1975 only 42 percent of the companies were fully staffed. The second form of staffing, the "bare bones" staff, involves two salaried officers but no other personnel and in the third case, no personnel is required.[3] In both instances an agent operates the pipeline facilities. The agent normally is the largest stockholder and is always a participant in the venture.

Each joint venture company, regardless of its staffing plan has a board of directors, a requirement of incorporation. Each board has nominal control over tariffs, budgeting, and financing whether the company operates the pipeline or not.

TABLE 52

OPERATING CHARACTERISTICS OF PIPELINE COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION, 1957 AND 1975

	Total		All Phase Companies		Crude Companies		Product Companies	
	1957	1975	1957	1975	1957	1975	1957	1975
Operating Companies	61	73	22	24	19	22	20	27
Non-Operating Companies	19	29[4]	2	1	10	15	7	13[4]
"Shell" Companies[1]	6	5	0	0	2	4	4	1
Joint Ventures operated by others, total[2]	13	23	2	1	8	11	3	11
Operated by major stockholder[3]	13	17	2	1	8	11	3	5
Operated by subsidiary of major petroleum company	13	22	2	1	8	11	3	10

SOURCE: Compiled from data in Appendix B.

[1]"Shell" companies are those companies whose function is to hold interest in and report operating data on joint venture systems operated by others. In 1957, one of these "Shells" was a corporate joint venture; in 1975, 2 were corporate joint ventures.

[2]Company's pipelines are operated by others.

[3]Owns at least 50% of stock in instances where there are only two participants; for companies with more than two participants, major stockholder is one with largest block of voting stock.

[4]Includes Calnev Pipeline Company which is operated by Champlin Petroleum Company.

Table 52 contains a group of companies designated as "shell" companies; companies incorporated to hold an interest in a joint venture system. The primary reason for incorporation is to comply with ICC regulatory and reporting requirements. The ICC requirements can be complied with without resorting to the use of a separate corporation but as noted the separation limits the jurisdiction of the ICC. Table 53 lists the five "shell" companies reporting to the ICC in 1975 and designates the system, the percentage participation, and the system's operating agent. Two of the five "shell" companies are joint venture corporations (Paloma and Southcap Pipeline Companies).

With the exception of two of the participants in Paloma and Southcap, the "shell" companies owners' involvement in interstate pipeline transportation is primarily through participation in systems. Acorn Pipeline Company, for example, participated (6.9%) in the Rancho Pipeline System in 1975. Acorn, a wholly owned subsidiary of the Charter Company, represents Charter's involvement in interstate operations. Crown Central Pipeline and Crown Rancho Pipeline Company, wholly owned subsidiaries of Crown Central Petroleum Company, represent the parent's involvement in interstate pipeline transportation. With the exception of Union Oil of California participation in the Southcap Pipeline Company, major petroleum companies have not found it necessary in recent years to use the "shell" company as a means of reporting system operations. The obvious reason for this is that each has at least one pipeline subsidiary functioning in the interstate market and this subsidiary holds and reports the system interest.

As previously explained a joint venture system, although it is a

TABLE 53

"SHELL" COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION, DECEMBER 31, 1975[1]

Reporting Company	Pipeline System and Operating Agent	Percent Participation
Acorn Pipeline Co.	Rancho Pipeline System (Shell Pipeline Company)	6.9
Crown Central Pipeline Company	Crown-Shell-Baytown Feeder line (Shell Pipeline Company)	65.7
	Bayou Pipeline System (leased to Plantation Pipeline Co.)	29.2
	East Texas Main Line System (Texas Pipeline Co.)	21.2
	New Hope System[2] (Texas Pipeline Company)	50.0
	Texas-Empire-Tidal[2] (Texas Pipeline Company)	20.0
Crown Rancho Pipeline Corp.	Rancho Pipeline System (Shell Pipeline Company)	6.4
Paloma Pipeline Co.[3]	Ship Shoal Pipeline System (Shell Pipeline Company)	17.5
	Whitecap Pipeline System (Pure Transportation Company)	13.3
Southcap Pipeline Co.[3]	Capline Pipeline System (Shell Pipeline Company)	20.6

SOURCE: Appendix B.

[1]"Shell" is defined as a company who does not operate a pipeline but only reports data for share of pipeline system owned but operated by others.

[2]System operated during the period but current status unknown.

[3]Company is a joint venture.

separate physical operation, is a contractual venture and is not reported to the ICC as a complete entity. The reporting is accomplished by each participant and thus each system has an operating agent. The characteristics of these agents are displayed in Table 54. As was the case with corporate pipeline operations, the system's operating agent is usually the major participant and, with one exception, the pipeline subsidiary of a major petroleum company.

The 1975 operating agents for 55 pipeline corporations and systems are shown in Table 55. The 54 interstate operations involved 27,485 miles of pipeline in 1975, 16 percent of the interstate total. As Chapter VI pointed out, the all phase pipeline company is the key to the major oil company interstate pipeline operation. Table 55 adds a new dimension to their role since these pipeline companies are the operating agents for 50 of the 54 interstate pipelines. Also significant is that in only one instance is a system operated by an "independent" pipeline company (Buckeye).

Shell and Texas Pipeline Company were found to be the most active operating agents. Each company operated nine pipelines, in addition to their wholly owned networks. Arco and Continental Pipeline companies were the next most active operating agents. In total there were 22 companies operating the 55 pipelines, one of which was a short intrastate system operating in California (the Venture System).

The operation of both corporate and sytem joint ventures by a participation is a logical extension of the economies of scale argument used to justify the creation of joint ventures. The use of the agent eliminates the need for separate staffing and spreads an existing

TABLE 54

OPERATING CHARACTERISTICS OF JOINT VENTURE PIPELINE SYSTEMS,[a] 1957 AND 1975

Operating Agent	Total Systems		All Phase Systems		Crude Systems		Product Systems	
	1957	1975	1957	1975	1957	1975	1957	1975
Major Participant[b]	11	27	0	1	7	17	4	9
Minor Participant	0	5	0	0	0	2	0	3
Pipeline Subsidiary of Major Petroleum Company	11	30	0	1	7	18	4	11
Others[c]	1	2	0	0	0	1	1	1
Joint Venture Systems, Total	13	35	0	1	7	20[d]	6[e]	14[f]

SOURCE: Compiled from data in Appendix B.

[a]All pipeline systems have operating agents.

[b]Major stockholder as defined in Table 52.

[c]Trans Alaska Pipeline System will be operated by Alyeska Pipeline Service Company; Bayou System is leased to a non-owner company, Plantation Pipeline Company.

[d]Includes two systems which may be inactive, one of which does not indicate the operating agent.

[e]Operating agents for two systems are unknown.

[f]Four companies are either inactive or intrastate; operating agent for one system is unknown.

TABLE 55

COMPANIES REPORTING TO THE INTERSTATE COMMERCE COMMISSION WHICH OPERATED OTHER COMPANIES AND SYSTEMS, AS OF DECEMBER 31, 1975

Operating Agent and Company/System Operated	Type of Service[1]	Mileage[2]
SHELL PIPELINE CO.		
Butte Pipeline Co.	C	373
Four Corners Pipeline Co.	C,G	910
Wolverine Pipeline Co.	P	569
Capline System	C	650
Capwood System	C	57
Crown-Shell Baytown System	P	14
Ozark System	C	441
Rancho System	C	460
Ship Shoal System	C	107
TEXAS PIPELINE CO.		
Kaw Pipeline Co.	G	1,410
Texaco-Cities Service Pipeline Co.	C,P,C	1,904
Texas-New Mexico Pipeline Co.	C.G	4,200
Basin System	C	517
East Texas Main Line System	C	117
New Hope System[3]	P	42
Port Arthur Products System	P	---
Texas-Empire-Tidal System[3]	C	64
Evangeline System[3]	P	196
ARCO PIPELINE CO.		
Blacklakes Pipeline Co.	C	255
Tecumseh Pipeline Co.	C	206
Cushing-Chicago System	C	711
Casa Products System	P	249
Groves To Nederland, TX System[3]	P	23
CONTINENTAL PIPELINE CO.		
Lake Charles Pipeline Co.	P	12
Pioneer Pipeline Co.	P	303
Yellowstone Pipeline Co.	P	749
Cherokee System	C,P,G	2,358

TABLE 55 CONTINUED

Operating Agent and Company/System Operated	Type of Service[1]	Mileage[2]
SOHIO PIPELINE CO.		
Harbor Products System	P	81
Neale System	C,G	120
Paline System	C	190
MARATHON PIPELINE CO.		
Platte Pipeline Co.	C	1,258
East Cameron Block 321 System	C	32
Wood River-Patoka System	C	55
GULF REFINING		
Laurel Pipeline Co.	P	451
West Texas Gulf Pipeline Co.	C	582
Mesa System	C	80
PURE TRANSPORTATION CO.		
Arapahoe Pipeline Co.	C,G	1,416
Chicap Pipeline Co.	C	235
White Cap System	C	44
AMOCO PIPELINE CO.		
West Shores Pipeline Co.[4]	P	326
Wyco Pipeline Co.	P	731
EXXON[5]		
Dixie Pipeline Co.	LPG	1,298
Jay Pipeline System	P	9
BUCKEYE PIPELINE CO.		
L & L System	P	96
CHEVRON PIPELINE CO.		
El Paso-Warfield Products System	C	255
CITIES SERVICE PIPELINE CO.		
Badger Pipeline Co.	P	331
DOME PIPELINE CORP.		
Sarnia System	C,P	13
KOCK OIL CO.		
Chase Transportation Co.	P	478

TABLE 55 CONTINUED

Operating Agent and Company/System Operated	Type of Service[1]	Mileage[2]
MOBIL PIPELINE CO.		
Olympic Pipeline Co.	P	391
PHILLIPS PIPELINE CO.		
Borger Denver System	P	319
PLANTATION PIPELINE CO.		
Bayou Pipeline System	P	256
SHAMROCK PIPELINE CO.		
Saal Product System	P	181
SUN PIPELINE CO.		
Mid-Valley Pipeline Corp.	C	1,004
UNION OIL OF CALIFORNIA		
Venture Pipeline System (Intrastate system)	C	17
WEST EMERALD PIPELINE CO.		
ATA Products System	P	296

SOURCE: Compiled from data in Appendix B.

[1]C = crude trunk lines, G = gathering lines, P = product trunk lines, LPG = liquefied petroleum gases.

[2]Company mileage as of December 31, 1974, system mileage as of December 31, 1975.

[3]System may no longer be in operation.

[4]May be operated by another Standard Oil of Indiana subsidiary (American Oil, Inc.)

[5]Sources only indicated Exxon, agent could be pipeline subsidiary or Exxon, USA Division.

overhead to larger outputs. Along with the possible increase in the efficiency of the operations has come an increase in the influence of the largest stockholder or participant since they are, with a few exceptions, the operating agent and a major petroleum company.

Physical Connections Between Pipeline Companies And Systems

Little attention has been given to the fact that legally separate pipelines and pipeline companies are not necessarily physically separate. Some authors have been quick to point out that a pipeline running from Texas to Chicago, for example, does not compete with one running from Texas to New Jersey.[4] A more likely scenario is that one company has a line running part way which in turn is connected to two other companies which run to Chicago and New Jersey. Although a hypothetical example, it does illustrate that petroleum pipelines in the United States are more often physically tied together than separate. The physical tie is accomplished at terminal points where one pipeline terminates on one side of a storage tank and the other begins on the other side of the tank. Regardless of how is has occurred, pipelines both intra- and interstate have coalesced into a semi-national network. The network is not national since the West Coast of the United States has historically operated as a separate part of the domestic petroleum industry.[5]

The interconnecting of trunk lines has increased petroleum transportation's capacity and efficiency. It has also served to increase the interdependency and, in some cases, dependency of pipeline companies and systems. A crude oil pipeline company with upstream connections

with a partially or wholly owned gathering network and downstream terminals at several refineries is more independent than a pipeline company that offers a connecting service without major connections to either producing areas or refineries. The same thing is encountered by product pipeline companies linked to only one refinery and a small consumer market or only connects to another line without having a refinery/consumer market link. Although these examples are extremes, they do illustrate that as pipelines continue to coalesce, companies can find themselves in a position where they are only a small part of a larger network.[6]

The flexibility and efficiency resulting from physical ties between pipeline companies is illustrated by three actual cases:

1. Portal Pipeline Company - This company (a joint venture) operated a total of 763 miles of crude gathering and trunk lines in 1975. It connects to the Minnesota Pipeline Company which operates 364 miles of crude trunk lines. Minnesota in turn has connections with the Lakehead Pipeline Company. Lakehead operates over 2,500 miles of crude trunk lines. Thus, via connections and joint tariffs, crude oil gathered and shipped on the Portal lines could be transported at least four times the total length of the Portal lines[7];

2. Texoma Pipeline Company - This company (a joint venture) is an example of the PAD II's response to declining crude production within the PAD. Texoma's crude trunk lines originate at the Gulf Coast and run to Cushing, Oklahoma. Cushing has developed into a major intersection of many pipelines. Through its terminals at Cushing, Texoma has the potential to reach nearly every refinery center in the Mid-Continent

and Upper Midwest area[8]; and

3. Colonial Pipeline Company - This company (a joint venture), the largest pipeline operating in the United States, connects major refineries in PAD III with the major consumer markets in PAD I. To a large degree, it parallels the older and somewhat smaller Plantation Pipeline Company which serves a similar market area. In 1970, it was reported that through interconnections the two operated in tandem and thus refined products could reach all terminal facilities on both lines. Plantation, in turn, leases an older system (Evangeline) which along with Plantation connects to the same refining areas in PAD III, as does Colonial.[9]

The ICC publishes data on the movement of petroleum in such a manner that the linkage and associated degree of interdependency can be empirically examined. The ICC publishes, by company, data on barrel input and output subdivided by source. Input is divided into barrels received from connecting ICC carriers and barrels originating on company lines. Output is divided into barrels terminated on company lines and barrels delivered to connecting ICC carriers. The data is limited in that input and output to intrastate lines are incorporated in varying degrees as originating and terminating on the ICC carrier lines.[10]

Aggregate data for all companies reporting to the ICC indicates that crude pipelines have a higher degree of interconnects than do product pipelines. In 1975, 39 percent of the interstate crude input came from connecting ICC carriers. This compared to only 14 percent for refined products. Since one company's input from connecting carriers are another company's (or companies') output, the aggregate percentage of

of output delivered to connecting carriers should be by definition equal the aggregate input percentage (allowing for transfer from storage facilities and minor in-transit/storage facilities losses).

The average percentage of crude received from connecting carriers during 1957-75 was 35.8 percent while the average percentage delivered to connecting carriers was 35.3 percent. The average percentage of refined products received from connecting carriers during 1957-75 was 15 percent but the average percentage delivered to carriers was a much higher 19.6 percent. The 4.6 percent difference is too high to be explained by transfer from storage and losses. The discrepancy may be a difference in interpretation of the reporting form but regardless of the reason, the output percentage indicates a higher degree of product interconnects.

As has been the case with other facets of pipeline operations, interconnects were well established by 1957. Somewhat surprising, however, is the small decline in percentage of crude oil received and delivered to connecting carriers from 40 percent in 1957 to a low of 32 percent in 1967. Since that time, the percentage has risen to nearly the 1957 level. A similar pattern is noted for refined product interconnects but only on the input side. In 1957 nearly 20 percent of input came from connecting product carriers, compared to 13.8 percent in 1975. On the output side, the percentage has been very stable after 1958 at 19 to 20 percent.

The degree to which a company is physically tied to another company or companies would intuitively affect that company's decision making process. A completely independent pipeline company in physical

terms would be one where 100 percent originated on its own lines and 100 percent was terminated on its own lines. The completely dependent company would be one where 100 percent was received from connecting carriers. Between these two extremes would be varying degrees of interdependency and one would not expect to find companies operating in the interstate market that were completely dependent upon other pipelines.

In Table 56 pipeline companies are distributed by degree of interdependency for the years 1957 and 1975 and confirms that the interdependency in 1975 was less than it was in 1957. The data also indicates that the majority of companies are relatively independent (more than 51 percent originates on their lines). The greatest degree of independence is found in the refined product pipelines, especially those of all phase companies. There is currently little difference on the other end of the scale where the crude lines by type of companies are about the same.

Of greater interest is the question of physical ties between groups of companies. For example, do major petroleum companies' pipelines have greater interconnects than other companies? Are the independent pipeline operations more dependent than other pipeline companies? Table 57 addresses these issues by comparing averages for 1957-75. The standard deviations for these averages are also presented to measure their stability.[11]

From the crude input side, the top eight companies were found to be the least dependent companies with an average of 74 percent of the input originating on their own networks. This degree of independence

TABLE 56

DISTRIBUTION OF PIPELINE COMPANIES BY PERCENT ORIGINATING AND TERMINATING ON COMPANY LINES, 1957 AND 1975

Type of Company	25% or Less		26 - 50%		51 - 75%		76 - 100%		Average Percentage	
	Originating	Terminating	O	T	O	T	O	T	Originated	Terminated
All Phase, Crude										
1957	5	3	4	3	7	8	8	10	62	67
1975	4	1	6	3	5	10	12	13	61	67
Crude Companies										
1957	12	18	3	1	5	0	8	9	54	37
1975	10	13	3	4	2	1	18	15	63	53
Total Crude										
1957	17	21	7	4	12	8	16	19	60	60
1975	14	14	9	7	7	11	30	28	61	63
All Phase, Product										
1957	3	3	0	2	0	3	19	14	89	77
1975	1	4	0	2	3	8	22	12	89	73
Product Companies										
1957	2	3	1	1	3	2	18	18	69	91
1975	5	4	3	1	4	5	25	27	83	86
Total Product										
1957	5	6	1	3	3	5	37	32	80	83
1975	6	8	3	3	7	13	47	39	86	81

SOURCE: Compiled from data published by the Interstate Commerce Commission in Transport Statistics in the United States: Part 6, Pipelines. 1957 and 1975.

TABLE 57

AVERAGE PERCENT ORIGINATING AND TERMINATING ON COMPANY LINES,
BY CLASS OF COMPANY, 1957-75

Class of Company	Crude Oil				Refined Products			
	Originating		Terminating		Originating		Terminating	
	Mean ($\bar{x}$)	Standard Deviation (S.D.)	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
All	64	2.8	64	2.5	84	2.8	80	1.1
Top 4[a]	74	2.3	69	2.3	85	5.7	76	4.2
Top 8[a]	74	2.5	71	2.2	85	5.2	78	3.5
Top 20[a]	66	2.6	63	2.2	86	4.0	78	2.4
Unaffiliated Pipeline Co's	43	40.6	61	19.9	87	6.3	77	7.8
Subsidiaries of Non-Petroleum Co's	12	6.7	73	26.0	80	8.1	94	3.1
All Independents[b]	47	15.2	74	5.9	78	3.6	88	4.0
Joint Ventures	61	4.9	49	4.4	79	8.0	87	2.8
All Phase	64	1.9	70	2.1	89	1.1	72	2.5
Crude	65	5.5	48	5.9	--	--	--	--
Product	--	--	--	--	79	5.8	88	1.8

TABLE 57 CONTINUED

SOURCE: Compiled from data published by the Interstate Commerce Commission in Transport Statistics in The United States: Part 6, Pipelines, 1957 and 1975.

[a]Companies are ranked as shown in Figure 11, p. 184 ; all pipeline holdings (including prorated joint venture holdings) are included.

[b]All pipeline operations of all companies not ranked within the top 20 petroleum companies (also includes their prorated joint venture interests).

was consistent throughout 1957-75 (with a standard deviation of only 2.5 percent). The input control exercised by the eight companies was considerably higher than that of major petroleum companies ranked 9-20. "Independents," all pipeline activities of non-major companies, were very dependent upon other carriers for their input, averaging .53 percent of the total throughout the 19 years. The dependency was not, however, stable year-in year-out as the standard deviation was 15.2 percent. Two classes of companies, the subsidiaries of non-petroleum companies and the unaffiliated pipeline companies, were in a more precarious position in terms of input control. To a large extent these companies were little more than connecting carriers and were dependent upon having throughput contracts with large shippers.

On the crude output side, the variation in means were not nearly so great across classes of companies. The most significant difference shown in Table 57 was the much lower average for crude joint ventures and crude companies in general. In each of these cases, slightly more than one half the volume was delivered to a connecting carrier. The top eight companies had a slightly higher average of crude terminated on their lines than companies ranked 9-20; they did, however, deliver more to connecting carriers than they received (an average of 29 percent compared to 26 percent on the input side). The terminating percentages for the majors varied very little over the years suggesting little change in prevailing patterns of the 1950's.

The refined product side of Table 57 does not show the contrasts that the crude side did. While the "independent" operations had a lower degree of independence, the mean of 78 percent originating on their

lines was high enough to render the differences insignificant. In addition the independents terminated on their lines by far the largest amount of output compared to any of the others. The top 4, 8, and 20 companies had their relatively largest interconnects on the refined products output side. This seems consistent with the increase in the majors' participation in refined product joint ventures.

The Phantom Pipeline: The Exchange Agreement

A form of cooperation has emerged in the petroleum industry that has a definite transportation and pricing function. The exchange of petroleum products, both crude oil and refined products, by two or more companies is now a standard industry practice.[12]

Exchanges are a form of barter that eliminates cash purchases and sales. In its simplest form, a two company trade, a company trades crude or product at one location in return for an equal volume of crude or product at another location. The terms of the trade can have many variations, the simplest involves an equal trade in terms of the dollar value, kind, and grade of petroleum product being traded. Other exchanges may include a "place differential" where the differential is a function of the supply and demand conditions in each locale and the relative transportation costs. Exchanges may also include a grade or kind differential which compensates for relative market value differences.[13] More complicated exchanges involving more than two companies do occur, one of which is illustrated below.

The exchange serves a definite transportation role and the mechanism has been labeled the "phantom pipeline" by one source.[14] Exchanges, as a transportation technique, have historically been linked

to the ownership of pipelines. Two examples illustrate this: (1) A two-company exchange occurs when Company A {crude oil/product} is more suitable for Company B's {refinery/pipeline/market} and where B's {crude oil/product} is more suitable for A's {refinery/pipeline/market}.[15] (2) A three-company exchange example: "A's production in West Texas delivered to gatherer B; B's production in Montana delivered to C; and C, in turn, will deliver equivalent oil to A at some other point."[16]

The motivation for engaging in exchange activities, however, has not been merely to minimize transportation costs but rather to minimize short-term fluctuations in the price of {crude oil/products}.[17] As indicated earlier in this paper, short-run disequilibrium in both the crude oil and refined products markets can quickly impact prevailing prices.[18] Exchanges are thus aimed at minimizing or eliminating "spot" shortages or surplus and thus have become an integral part of vertical integration in much the same fashion as have pipelines, particularly joint venture pipelines.[19]

Exchanges have played a central role in dealing with what the industry calls "distressed cargoes." In the pre-World War II era, companies would purchase "distressed cargoes" to avoid "violent fluctuations" in prices. The concern over these cargoes was described by McLean and Haigh:

> A large company could occasionally absorb these cargoes in its own operations and market them over a period of time in an orderly manner. If, however, these distress cargoes passed into the hands of cut-price jobbers, price wars were sometimes precipitated all along the line to the retail level.[20]

This potential impact on prices led one author to conclude that the crude oil exchanges were transactions whose "principal common

denominators are reciprocity in pipeline use and insulation of the oil transported against competitive pricing." He added that "The functioning structure of the business of gathering and purchase of crude oil, by virtue of these extensive contracts [exchanges] makes each pipeline a gathering arm of all integrated refiners who have pipelines."[21]

The reasons cited by various authors for what now is a prevailing industry practice of engaging in both product and crude exchanges is strikingly similar to those put for owning pipelines. For example: (1) balancing production, refining and marketing activities; (2) getting products to markets which could not be reached on a competitive basis from its own refineries; (3) developing a new market; (4) reducing costs of moving product to refinery and market; and (5) shutting down inefficient refineries via the use of exchanges until other arrangements were made.[22] In addition the development between 1957-75 of joint venture refined product pipelines has allowed companies to establish pipeline connections between major refineries enabling them to shift products from one refinery area to another to stabilize conditions where supplies exceed demand or supplies fall below demand. This facilitated the ease of systematically engaging in refined product exchanges.[23]

The question of how pervasive exchanges are within the industry remains largely unanswered because of the lack of data. There are indications that on the refinery input side of the exchange business, exchanges have tied up a considerable share of refiners' crude oil supply in complicated and longer term agreements not easily altered.[24] On the output side, information on 41 refiners for the year 1974

indicated that exchanges represented 38% of average daily runs (4.8 million b/d). Exchanges of the 20 majors represented 85% of the 1974 total but is not particularly significant on a one year basis and without knowing who exchanges with whom.[25] The existence of these exchanges and their volume suggests, however, that they achieve in a more flexible way the same results joint venture refineries would. This then explains perhaps why joint venture refineries are not used in the U.S. to the extent they are in the international industry.

Exchange agreements are considered to have anticompetitive consequences. These consequences depend upon who barters with whom and more importantly if exchanges are used to stabilize implicit cartel arrangements among the majors. If the majors only barter among themselves, then the independent and small company is cut off from much of the barter market; and would therefore have a more difficult time competing at the prevailing price. The use of exchanges under a cartel arrangement would be aimed at guaranteeing "fair" market shares, stabilizing the shares, and preventing price cutting, i.e., cheating on the implicit arrangements. Finally, the question arises as to why exchange agreements are preferred to allocation {crude oil/refined products} rather than reliance on selling for monies and using the pricing mechanism to allocate.[26]

The potential anticompetitive effects of exchanges are matters for empirical study, study that faces significant constraints in obtaining meaningful data. The analysis would require data on where, when, and with whom exchanges take place over a long period. Data would also be required on where, when, and for whom is outside {crude

oil/products} carried on shipper owned pipelines. The latter research would help establish the reciprocity between pipelines and exchanges.

Cooperation in the Pipeline Segment of the Petroleum Industry: A Summary

This chapter and the preceding one has demonstrated the extent of the cooperation found in pipeline transportation. This cooperation extends beyond pipelines into other segments of the industry both domestically and internationally. Pipelines in the United States are a pivotal link in this cooperation and interdependency.

The cooperation via joint venture pipelines, exchange agreements, physical interconnects, and the operation of pipelines by existing staffs certainly seems to have increased the efficiency of the industry. This cooperation has had the effect of reducing the physical segmentation of the petroleum industry's markets. For many companies cooperation has greatly extended their refining and marketing horizons.

The participants in this cooperation are dominated by 8 to 12 majors and the lack of involvement below that level is significant. The evolution of this involvement is such that the benefits of cooperation seem inherently limited to these companies and thus violates a justification of joint activity, i.e., that the outcomes accrue indiscriminately to all firms in the industry. Certainly the empirical analysis supports the discrimination premise.

The justifications offered for engaging in joint activities are not convincing in light of the financial resources and size of the participants and the existence of common carrier provisions. In reality the reasons given for joint activity appear to be to a large extent

after-the-fact justifications of practices that are both a reflection of an evolution of cooperation found in the Old Standard Oil "Trust" and within the international industry and also a rejection among the majors of common carrier status that extend beyond form.

The pervasiveness of the demonstrated cooperation does little to support the competitiveness of the industry. While the foundations of oligopoly are essentially based upon the interdependency resulting from game theory--responses to independent actions--interdependency in pipelines goes considerably beyond this. In Chapter IX this cooperation is examined by analyzing the final element in the structure of pipelines and that is the level of concentration and control.

CHAPTER VIII

[1]The forms of cooperation discussed in this chapter, while major ones, nevertheless do not exhaust the list. Other forms found in the research for this paper include cooperation with parent companies, joint venture terminal facilities, leasing of pipelines, and the interchange of corporate personnel. The cooperation between parent and subsidiary in and of itself is normal except for the factor that the major's pipeline subsidiary, as a section of this chapter indicates, operates joint venture pipelines for other companies. This practice establishes a direct albeit minor link between companies, a practice normally prohibited by antitrust law.

[2]The companies excluded from this analysis are those described in the footnotes of Table 30, p. 188.

[3]J. K. Spangler, "Corporate Structure and Financing Oil Pipelines," July 8, 1970 (mimeographed).

[4]U.S., Congress, Senate, Market Performance and Competition in the Petroleum Industry, Hearings before the Special Subcommittee on Integrated Oil Operations, U.S. Senate, 93rd Congress, 2nd Session (Washington: Government Printing Office, 1974), Part V, Statement of Professor Stewart C. Myers, pp. 1634-1635.

[5]As has been noted, PAD V has historically been an independent petroleum market; for additional comments see U.S., Federal Trade Commission, Bureau of Competition and Bureau of Economics, Report to The Federal Trade Commission on The Structure, Conduct and Performance of The Western States Petroleum Industry (Washington, D.C.: Federal Trade Commission, September, 1975).

[6]A good illustration of this is found in the relationship between the newer pipeline, Explorer to that of Williams Pipeline Company (see U.S., House, Anticompetitive Impact of Oil Company Ownership of Petroleum Product Pipelines, pp. 6-31, 112-125, A55-57; also see Brief of Complainants, MidContinent Petroleum Shippers, before the Interstate Commerce Commission in the matter of American Petrofina Company of Texas, et al. v. Williams Brothers Pipe Line Company, et al. (I.C.C. Docket No. 35720), July 27, 1973).

[7]Pipe Line News, November, 1962.

[8]Tulsa World, December 5, 1976, p. G6.

[9]Anticompetitive Impact . . ., pp. A75-84; also see Pipe Line News, July, 1970, p. 27.

[10]The Intrastate market is relatively insignificant, see Supra, pp. 125-143.

[11]In comparing classes of companies one would not expect the percentage originating on these lines to equal the percentage terminating as it should for all companies in the interstate market.

[12]U.S., Department of Justice, Fourth Report of the Attorney General Pursuant to Section 2 of the Joint Resolution of July 28, 1955, Consenting to an Interstate Compact to Conserve Oil and Gas (Washington, D.C.: Government Printing Office, 1959), p. 46; also see U.S., Federal Energy Administration, National Information Center, Petroleum Market Shares (Washington, D.C.: Federal Energy Administration, December, 1976), p. 34.

[13]McLean and Haigh, The Growth of Integrated Oil Companies, p. 426.

[14]Federal Energy Administration, Petroleum Market Shares, p. 34.

[15]Federal Trade Commission, Report . . . of The Western States Petroleum Industry, p. 57.

[16]Department of Justice, Fourth Report of The Attorney General, p. 46.

[17]The authors of Petroleum Market Shares were one of few to cite transportation costs as the main reason for engaging in exchanges (p. 34); neither the Justice Department (Fourth Report . . ., pp. 46-47), the FTC (Report . . . of The Western States Petroleum Industry, pp. 57-58) or McLean and Haigh (pp. 425-439) singled out transportation as the main reason for exchanges.

[18]See Supra, pp. 164-165; also see McLean and Haigh, pp. 425-439.

[19]Petroleum Market Shares, p. 34.

[20]McLean and Haigh, p. 430.

[21]Fourth Report . . ., pp. 46-47.

[22]McLean and Haigh, pp. 425-439; at the time of the McLean and Haigh analysis, companies viewed exchanges as a temporary tool and hoped to reduce their use. The reason was the fear of legal criticism on the

grounds that they involved misrepresentation of products (Ibid., p. 437).

[23]Anticompetitive Impacts . . ., pp. 129-135 and A93; crude exchanges were considered to be most extensively used on the West Coast of the United States. The reason for the above normal usage was to avoid the loss of the intrastate status of their West Coast pipelines (see Report . . . of The Western States Petroleum Industry, pp. 42-45 and footnote p. 57).

[24]Fourth Report . . ., p. 47.

[25]Petroleum Market Shares, p. 35.

[26]Market Performance and Competition in the Petroleum Industry, Part III, statement of Professor Stephen Breyer, pp. 442-447.

CHAPTER IX

STRUCTURE AND CONDUCT, PART IV: CONCENTRATION TRENDS

Interest in concentration ratios, i.e., the share of market accounted for by the 4, 8, and 20 largest companies, has been a central part of the structure/conduct/performance analytical schema. The traditional approach has depended heavily upon the hypothesis that the greater the concentration/control the greater the probability of excess/monopoly profits and therefore the less optimal the allocation of scarce resources.

This chapter examines concentration in the pipeline segment of the domestic petroleum industry. The present interest in pipeline concentration, however, is not strictly a traditional one since the concern is over the control of pipeline transportation by major petroleum companies. There are several reasons why the traditional analysis is not strictly applicable. First, as Chapter V revealed, pipelines have natural monopoly characteristics which means the competitive model is inconsistent with efficiency arguments. Clearly the fewer the firms, the lower the respective costs of providing transportation services. Related to this is the presence of "regulation" and the existence of "administered prices" at least in the short-run. This factor is complicated by the presence of shipper/owners where buyers and sellers are the

same. Market shares held by unaffiliated/non-petroleum companies are quite different than those held by petroleum affiliated pipelines.

The impact of concentration in pipelines is thus not necessarily related to pipeline performance per se but rather to performance in the other segments of the industry. In other words, do the "majors" have substantial power which impedes the functioning of the other stages of the industry, i.e., where does the sale of crude oil take place, what does this do to entry barriers to refining, and to the barriers to expanding into potential end use markets?

The purpose of this chapter is to examine in a quantitative fashion the control of pipelines by the major companies, as defined in Chapter VI. In examining the majors' position in this segment of the industry it should be reemphasized that 1957-75 produced a major shift towards dependency on imports of both crude oil and refined products and also an export of relative refinery capacity. These factors are often ignored in the analysis of concentration in the domestic petroleum industry. Given that the majors are for the most part multinational corporations their foreign operations cannot be ignored. This is especially the case since their domestic pipeline activities are related to overall corporate policies, policies which require the balancing of crude and product imports from foreign subsidiaries with the domestic production and refining along with the minimizing of the cost of serving domestic geographic markets.

This chapter examines concentration in terms of: (1) the national market; (2) the impact of joint ventures on market share measures; (3) the relevant markets in terms of measures used and geographic markets; and (4) a brief examination of the entry/exit of

companies. Unless otherwise noted, aggregate concentration ratios (4, 8, and so forth) are derived, based upon the size of the parent petroleum company and not the size of the pipeline company or interest.

Concentration Trends at the National Level

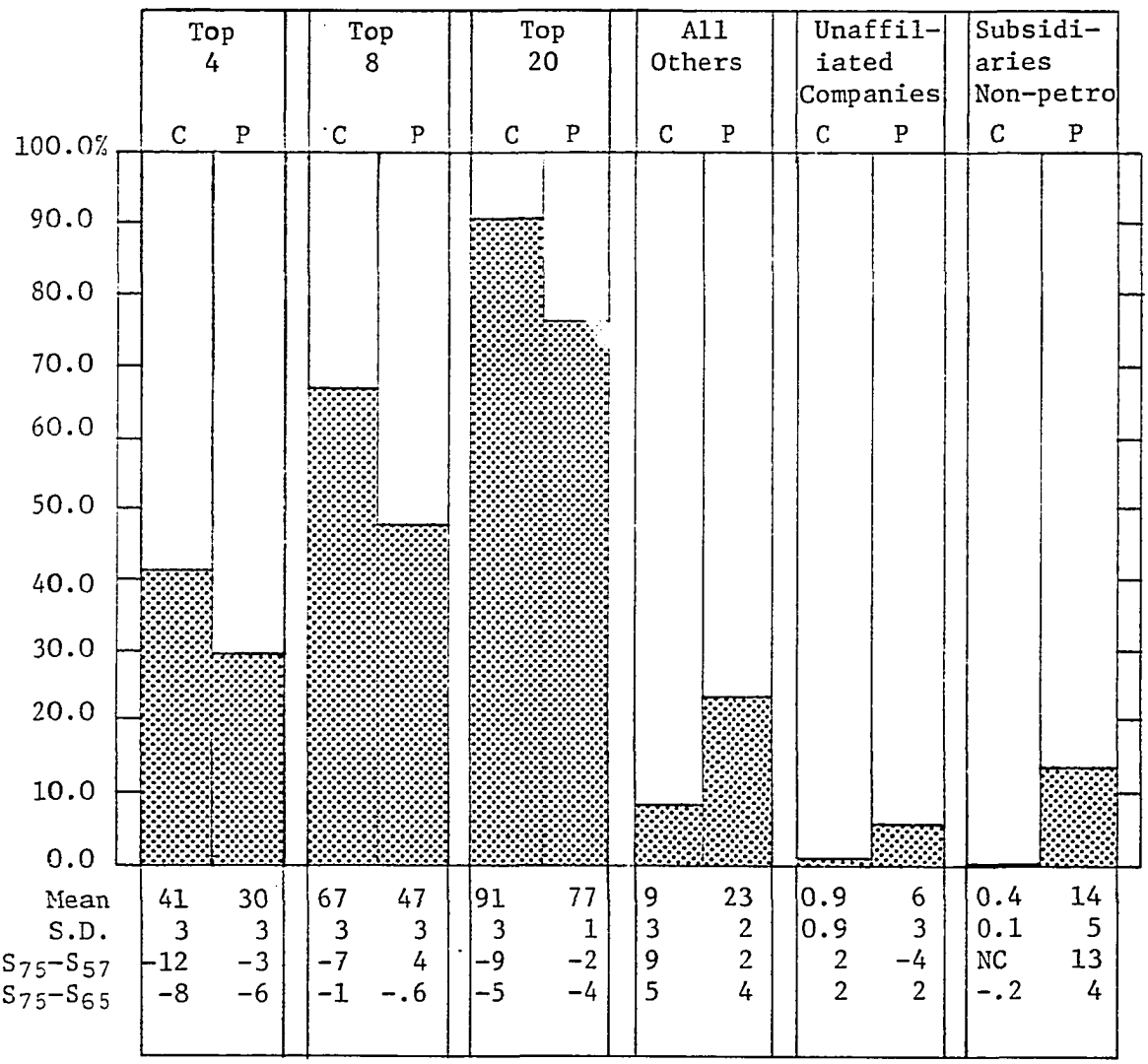
There is an inclination to argue that aggregate national measures are not particularly good indicators of market concentration. While the section on regional concentration gives credence to this argument, the quantity and quality of the national data is such that it does provide an indication of the relative involvement of the majors in pipeline ownership and control. In addition as has been noted, the interstate data is essentially PAD I-IV data with little influence from PAD V where nearly all the market is intrastate.

In Figure 14, the national market shares for originating crude and products of the 4, 8, and 20 majors are shown along with three other classes of companies. These shares are averages for 1957-75. The figure illustrates that the majors have relatively greater control over the crude market with the top 4 controlling an average of 41 percent and the top 8 controlling 67 percent. In the crude market, companies outside the top 20 have been insignificant especially the non-petroleum affiliated pipelines. The opposite is true for products where nearly 24 percent of the long-term share has been held by non-20 companies. An examination of annual shares indicates that there has been an erosion in the major's share of both markets, especially for the top 4 companies. The decline has been less in the products market.

Concentration measures are sensitive to the beginning and ending

FIGURE 14

LONG-RUN CONCENTRATION RATIOS, FOR CRUDE AND REFINED PRODUCTS ORIGINATING ON COMPANY LINES, MAJOR PETROLEUM COMPANIES AND OTHERS, 1957-1975[1]



	Top 4		Top 8		Top 20		All Others		Unaffiliated Companies		Subsidiaries Non-petro	
	C	P	C	P	C	P	C	P	C	P	C	P
Mean	41	30	67	47	91	77	9	23	0.9	6	0.4	14
S.D.	3	3	3	3	3	1	3	2	0.9	3	0.1	5
$S_{75}-S_{57}$	-12	-3	-7	4	-9	-2	9	2	2	-4	NC	13
$S_{75}-S_{65}$	-8	-6	-1	-.6	-5	-4	5	4	2	2	-.2	4

SOURCE: Calculated from data published by the Interstate Commerce Commission in Transportation Statistics in the United States: Part 6, Pipelines, Annual.

[1]Includes prorated joint venture participation; S = percent share, C = crude, P = product, S.D. = standard deviation.

period of analysis as well as the measure used. In Figures 15-16, the period is extended back to the late 1930's and two alternative measures are used, share of crude trunk line mileage and crude pipeline output (throughput). In addition the companies as defined at the beginning of the time period are traced through to 1975. Both figures illustrate a decline in control but on a smaller scale than from 1957-75. The trend shown in Figure 16 is a more modest decline (with fewer companies in 1975 than in 1938) and demonstrates that the companies' capacity has been increasing to offset the mileage erosion. Given the market's growth over the 35 years the companies have maintained a fairly stable and dominant position in crude pipelining.

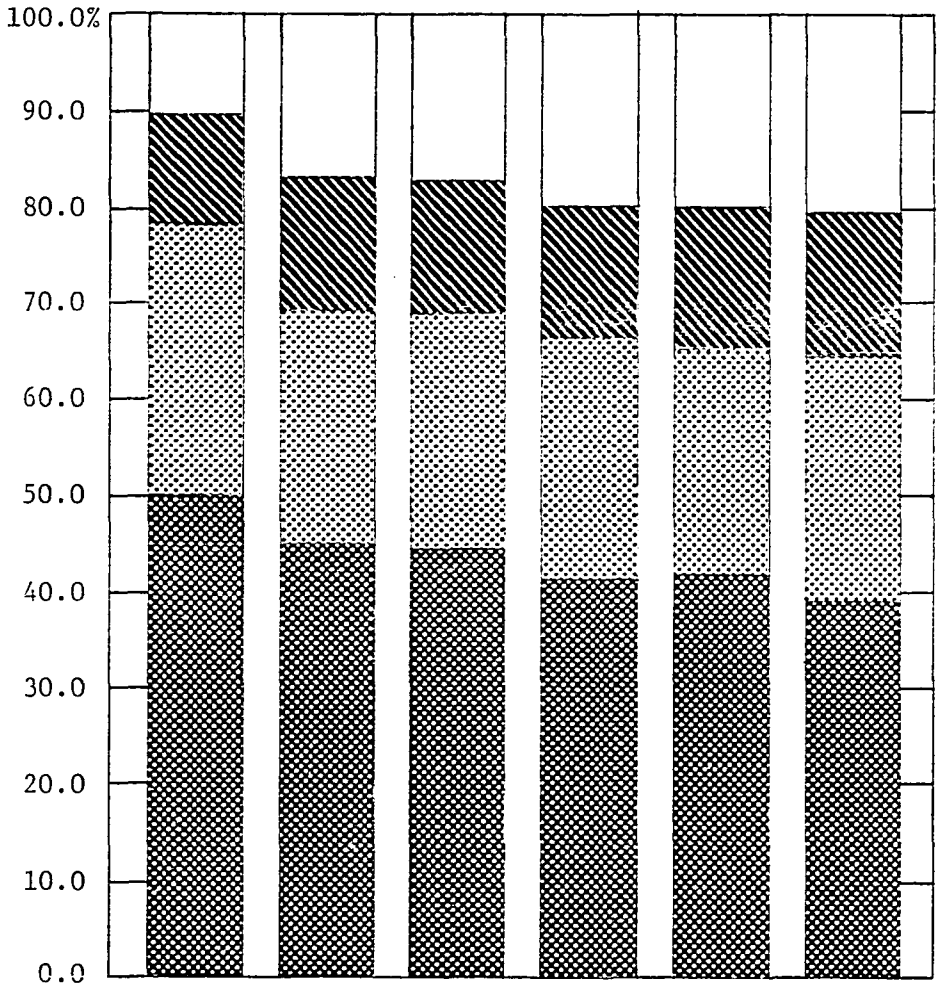
Turning to the shares of the individual majors one can get a better indication of the changes that have been occurring. Again using long-run averages and crude/product originating on companies' lines, market share for the twenty petroleum companies are shown in Figures 17-18. As was the case in the previous figures, joint venture interests of the companies are included by prorating their participation.

Figure 17, for crude oil, demonstrates Exxon's predominance (17.2 percent) as well as the rapid decline in shares after the eighth company, Atlantic Richfield. The figure also indicates that the top 8 decline in market share shown in Figure 14 was experienced by all but two companies (Shell and Standard of Indiana) with Gulf experiencing the greatest loss (its share in 1975 was 4.7 percent less than in 1957). The next ten companies fared considerably better with 6 experiencing increasing shares of the crude market.

Figure 18, for refined products originating on company lines,

FIGURE 15

CONCENTRATION RATIOS FOR CRUDE TRUNK LINE MILEAGE,
14 MAJOR PETROLEUM COMPANIES,
SELECTED YEARS, 1938-1975[1]



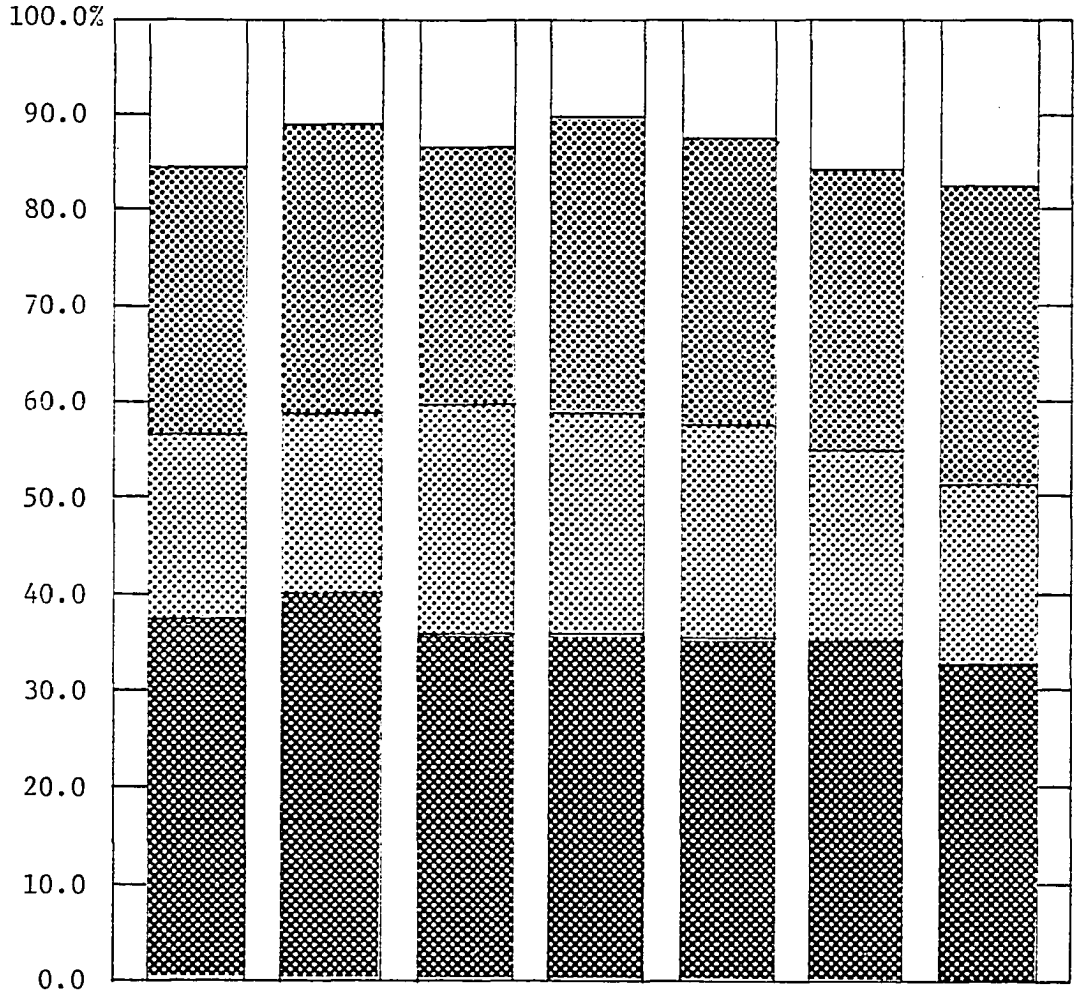
Year	1938	1957	1960	1965	1970	1975
TOP 4	50.3	45.5	44.4	41.1	41.8	38.0
TOP 8	78.7	68.8	68.1	66.1	65.3	64.2
TOP 14	89.0	82.9	82.1	80.3	80.1	79.6

SOURCE: Data for 1938 from U.S., Congress, Investigations of Concentration of Economic Power, Hearings before the Temporary National Economic Committee, 76th Congress, 2nd Session (Washington, D.C.: Government Printing Office), Part 14A, p. 7,723; data for 1957-75 calculated from data published by the ICC in Transportation Statistics in the United States: Part 6, Pipelines, annual.

[1]14 major companies as of 1938, for years 1957-75 includes the same companies or their successors.

FIGURE 16

CONCENTRATION RATIOS FOR CRUDE THROUGHPUT
19 MAJOR PETROLEUM COMPANIES, SELECTED YEARS,
1940-1975[1]



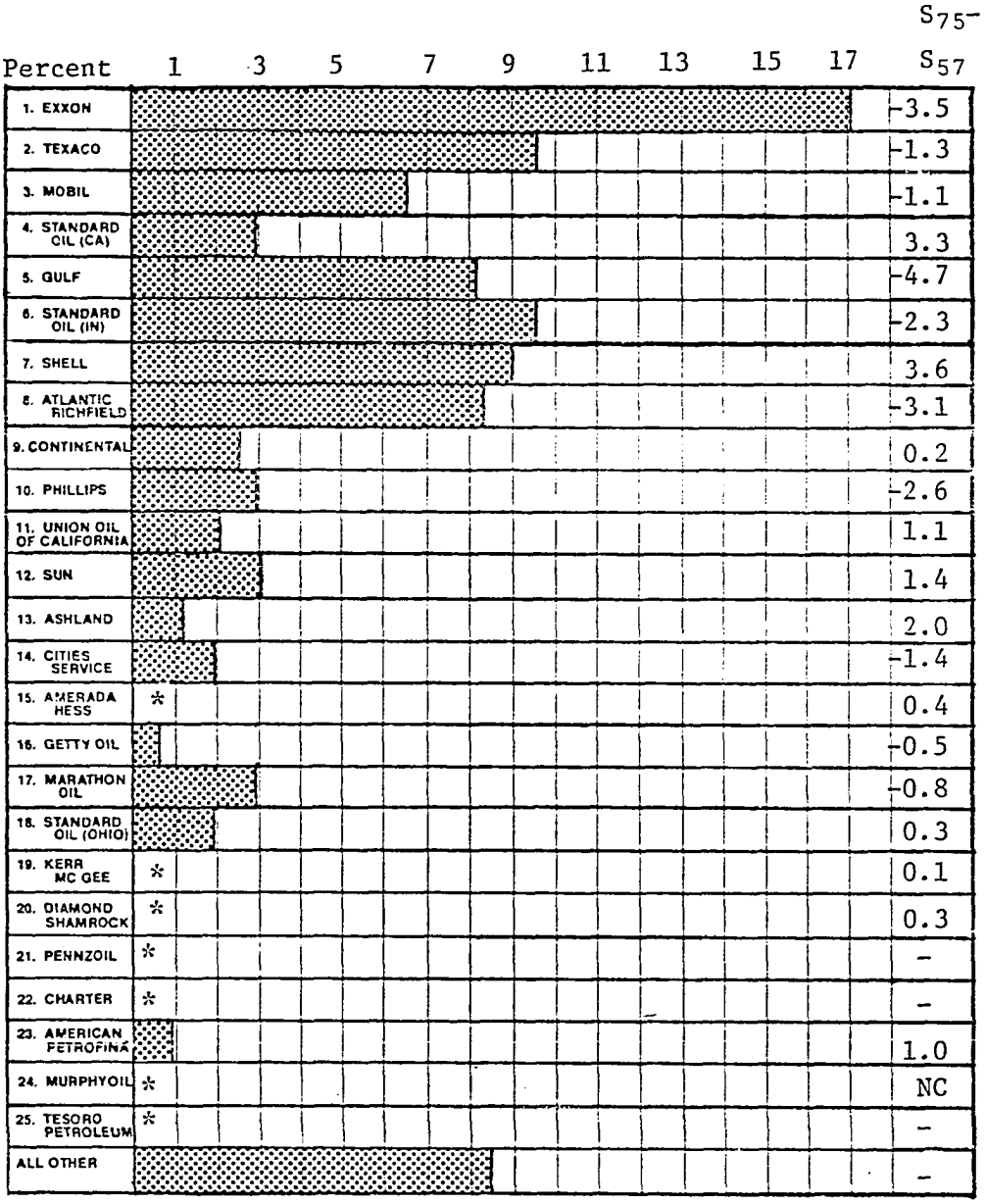
Year	1940	1948	1957	1960	1965	1970	1975
TOP 4	37.4	40.0	35.7	35.7	35.2	34.3	31.8
TOP 8	56.8	58.5	59.0	58.4	57.2	54.2	51.0
TOP 19	84.4	88.3	86.1	89.2	87.1	84.3	82.3

SOURCE: Data for 1940 and 1948 from Leslie Cookenboo, Jr., Crude Oil Pipelines and Competition in the Oil Industry (Cambridge: Harvard University Press, 1955), pp. 34-35; data for 1957-75 from data published by the ICC in Transportation Statistics in the United States, Part 6, Pipelines, annual.

[1]19 major companies as of 1940, for years 1957-75 includes the same companies or their successors; for years 1957-60 includes only 18 companies, for 1965 only 17 companies, and for years 1970-75 only 16 companies.

FIGURE 17

AVERAGE PERCENT SHARE OF TOTAL CRUDE ORIGINATING ON ICC LINES, TWENTY FIVE MAJOR PETROLEUM COMPANIES, 1957-1975[1]



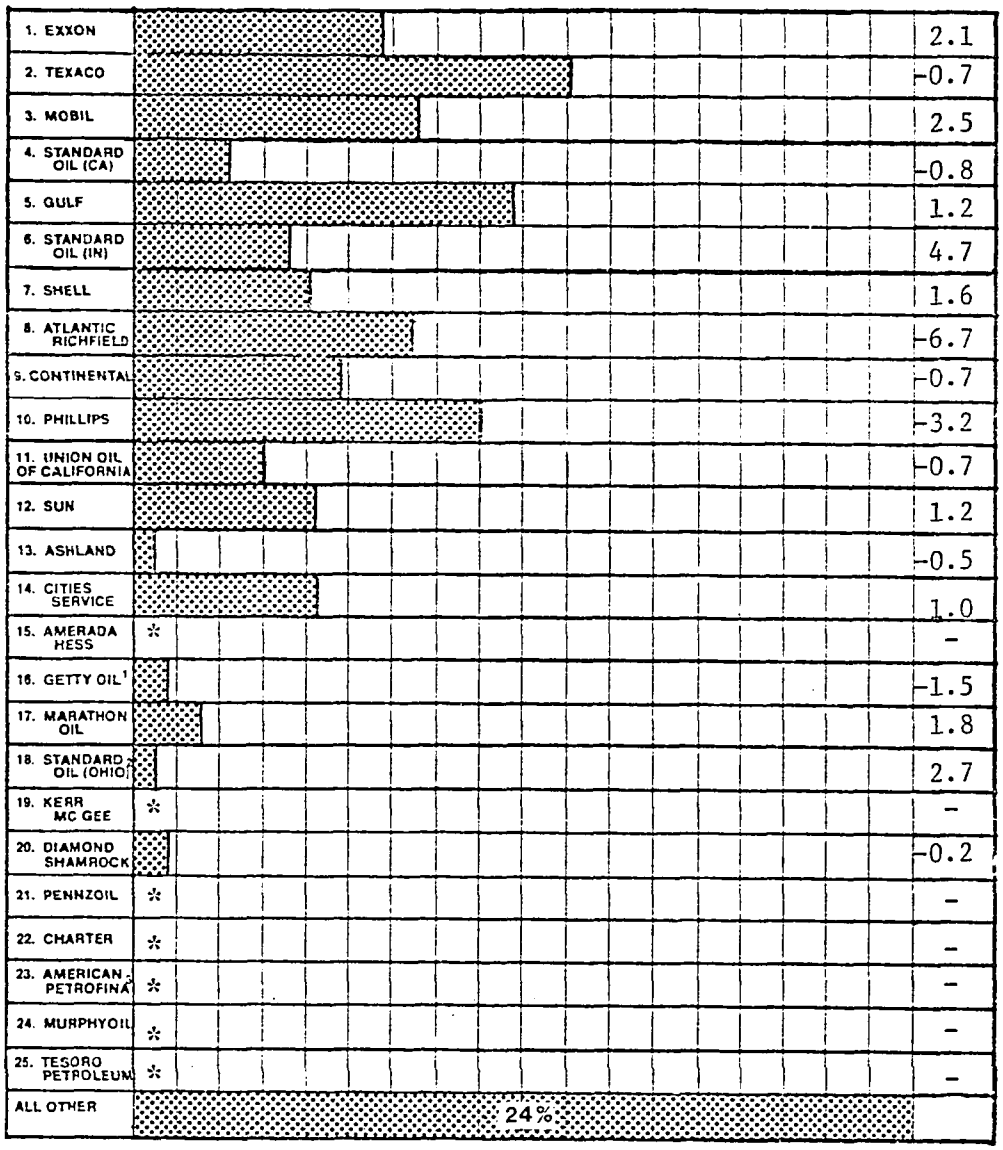
SOURCE: Calculated from data published by the ICC in Transportation Statistics in the United States: Part 6, Pipelines, annual; data for certain companies reflects merges and acquisitions (see Figure 11).

[1]Includes prorated joint venture participation; S = percent share.

*Less than one half of one percent.

FIGURE 18

AVERAGE PERCENT SHARE OF TOTAL PRODUCTS ORIGINATING ON ICC LINES, TWENTY FIVE MAJOR PETROLEUM COMPANIES, 1957-1975[1]



SOURCE: Calculated from data published by the ICC in Transportation Statistics in the United States: Part 6, Pipelines, annual; data for certain companies reflects merges and acquisitions (see Figure 11).

[1]Includes prorated joint venture participation; S = percent share.

*Less than one half of one percent.

demonstrates a smaller divergence in shares across companies as well as a different picture in terms of declines in shares. Five of the top eight companies increased their market position over the period as did five of the next ten companies. This is to a large extent a reflection of the sharp increase in these companies' participation in joint ventures. In viewing the Figure it should be recalled that Standard Oil of Indiana operates a large private product system not reflected in its market share. Also Standard of California's relatively low share (as well as its share of crude) is consistent with its PAD V concentration. Atlantic Richfield's decline of 6.7 percent is a special case since its beginning share is that of Sinclair. With the merger of Atlantic and Sinclair the company was required to sell off part of the Sinclair assets (which were subsequently purchased by British Petroleum).

Thus far the market share measures have been physical measures. This raises the question as to their appropriateness as well as what they are indicating. Table 58 compares 19 differing long-term average concentration ratios for the 8 majors. This also provides an opportunity to examine in more detail the control by companies that includes six of the international majors (i.e., 6 of the seven sisters).

The eight majors control via these measures ranges from a low of 38.4 percent of product mileage to a high of 67.3 percent of originating crude. Although their share of the market, by any definition, is substantial, the concentration ratios by traditional definitions would be considered as moderate (i.e., below Bain's 70 percent threshold).[1] In addition, between 1957 and 1975 their control has eroded in all but three areas (all product related). A closer look indicates that the

TABLE 58

EIGHT MAJOR PETROLEUM COMPANIES, AVERAGE PERCENT SHARE OF THE PIPELINE TRANSPORTATION MARKET, 1957-1975, SELECTED VARIABLES

Variable	Average Percent Share	Standard Deviation	$Share_{75}$-$Share_{57}$	$Share_{75}$-$Share_{65}$
Mileage:				
Total	52.1	3.1	-8.2	-0.1
Crude Trunk	63.4	2.3	-2.9	2.9
Product Trunk	38.4	2.1	-5.1	-1.9
Gathering	51.0	3.4	-6.2	2.4
Crude Input				
Total	57.9	2.5	-3.3	-0.7
Originated	67.3	2.7	-7.0	-0.9
Crude Output				
Total	57.9	2.5	-3.2	+0.4
Terminated	63.9	2.6	-6.9	2.3
Product Input				
Total	47.2	1.8	1.3	-0.8
Originated	47.4	3.0	4.0	-0.6
Product Output				
Total	47.3	1.8	1.4	-0.7
Terminated	45.7	1.7	-0.8	-1.1
Operating				
Revenue	53.1	3.8	-10.7	-3.1
Expense	53.2	3.8	-11.2	-4.3
Income	53.0	4.0	-9.9	-1.6
Net Income	54.3	7.0	-11.2	-2.7
Total Assets	49.4	4.7	-9.0	-2.4
Net Assets	47.1	5.0	-10.3	-1.0
Debt	50.0	4.4	-8.0	-2.3

SOURCE: Calculated from data published by the Interstate Commerce Commission in Transportation Statistics in the United States: Part 6, Pipelines, annual.

erosion occurred primarily between the years 1957-1964 with only modest declines between 1965-1975. One significant facet shown in Table 58 is the divergence between the shares of assets and debt held and the higher share of operating and net income.

Joint Ventures' Impact on Concentration Measures

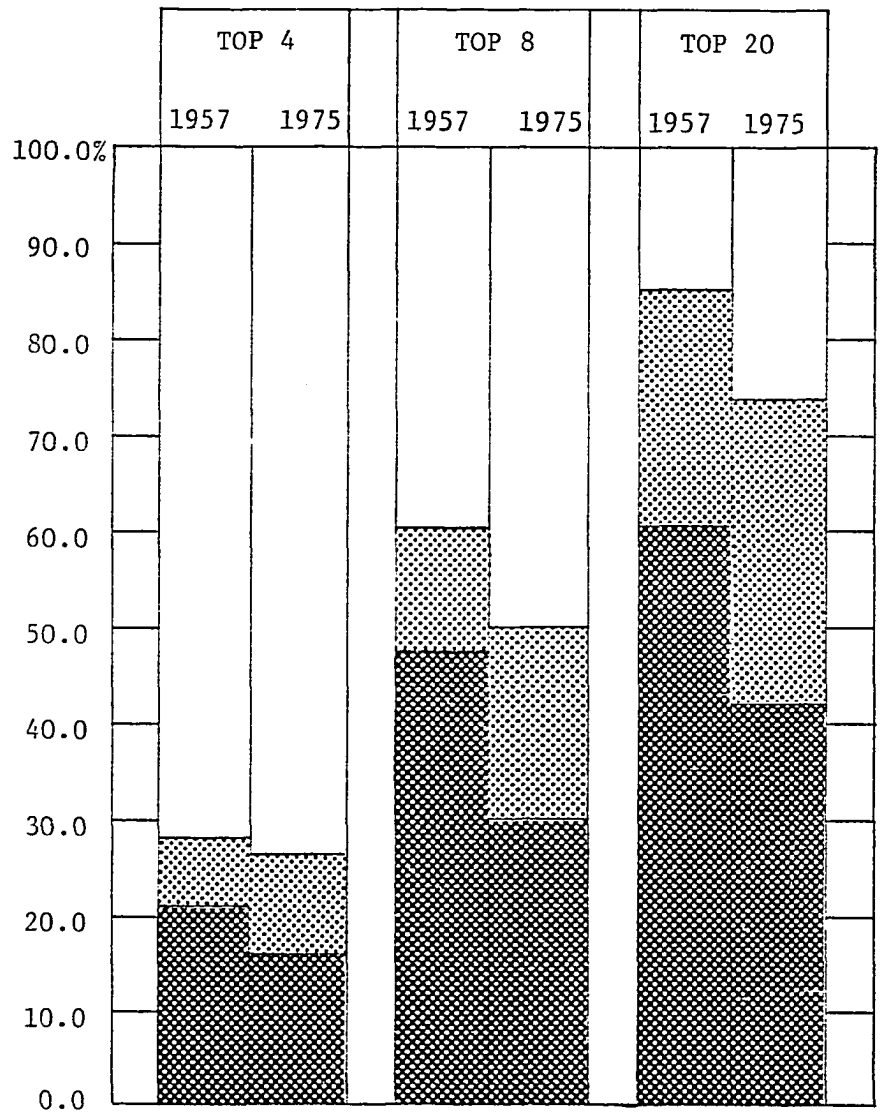
Concentration measures in this and other segments of the petroleum industry are influenced in no small way by joint ventures. The ratios shown to this point have included the prorated interest in joint ventures held by the individual companies. Although it does enhance the usefulness of the measures, there is still the risk that control is understated since the subscribed share may be less than actual control (in the sense of decision making).

The impact on concentration ratios of prorating the joint ventures to their participants is shown in Figure 19 and Table 59. Table 59 also compares concentration measures used by Teece which treated joint ventures as separate companies.[2] The measures shown in Table 59 are not the ranking of the majors, as previously the case, but rather ranks pipeline holdings in rank order of the holdings.

By using prorated shares, the crude market is more concentrated than shown by Teece. In addition the decline shown for the Top 20 companies is not shown with proration. On the product side, concentration is in some years overstated by not considering joint ventures and for the Top 4 companies the sharp decline between 1957-71 does not exist with joint ventures included. The presence of the large product independents in the ratio also overstates the concentration since the independent functions to a greater extent as common carriers.[3]

FIGURE 19

CONCENTRATION RATIOS FOR TOTAL REVENUES, WHOLLY OWNED SUBSIDIARIES AND JOINT VENTURES OF MAJOR PETROLEUM COMPANIES, 1957 AND 1975



Wholly Owned	21.1	15.2	46.9	29.6	60.6	49.6
Total Share	27.8	26.0	60.1	49.6	85.5	73.6

SOURCE: Calculated from data published by the ICC in Transportation Statistics in the United States: Part 6, Pipelines, 1957 and 1975.

TABLE 59

JOINT VENTURES" IMPACT ON CRUDE AND PRODUCT TRUNKLINE MILEAGE MARKET SHARES, SELECTED YEARS, 1957-1971[1]

	TOP 4		TOP 8		TOP 20	
	Without Proration	With Proration	Without Proration	With Proration	Without Proration	With Proration
1957						
Crude	42.2	47.4	58.6	70.0	86.9	90.6
Product	40.5	35.4	62.5	57.2	87.1	85.1
1964						
Crude	42.3	44.0	58.4	67.1	87.6	91.8
Product	31.4	29.9	52.8	52.4	84.4	87.1
1971						
Crude	40.1	43.4	58.1	67.7	84.6	90.7
Product	31.1	34.1	51.1	56.3	85.7	86.8

SOURCE: Data without proration from David J. Teece, "Vertical Integration in the U.S. Oil Industry," Vertical Integration In The Oil Industry, ed. Edward J. Mitchell (Washington, D.C.: American Enterprise Institute, 1976), p. 164; data with proration calculated from data published by the Interstate Commerce Commission in Transportation Statistics in the United States: Part 6, Pipelines, 1957, 1964, and 1971.

[1]Market shares of top 4, 8, and 20 companies are derived from rankings in each year. Rankings without proration treats joint ventures as separate entities. Rankings with proration were derived by adding joint venture shares to their respective owners.

In Figure 19, market shares of the major petroleum companies are compared for the years 1957 and 1975 using total revenues. The figure illustrates as have previous ones the decline in market shares but also illustrates the moderating effects exerted by the large increase in joint participation on the part of each class of companies.

The Relevant Market: A Regional View

One overriding conclusion has emerged from the national comparison of concentration and that is the erosion in shares held by the major companies in all but the product market. Does this lead to the conclusion that the level of competition has increased? Perhaps, but there are countervailing arguments that are best addressed using regional measures of concentration. Before examining concentration by PAD it is worthwhile to note that the following interrelated factors may have a significant influence on the declining trend: (1) the decline in U.S. production in recent years; (2) the majors' withdrawal somewhat from gathering activities; (3) the dramatic rise in imports of both crude and products; (4) the growth in the LPG market (dominated by the independents); (5) the export of relative refinery capacity; and (6) the expansion of pipelines to carry foreign crude to PAD II.

Tables 60-62 compare pipeline and refinery shares by PAD for the year ending December 31, 1972. The data on pipelines is limited because it lumps both crude and product investments together and thus has only partial usefulness. Table 60 demonstrates that the individual major companies are not necessarily concentrated or operating in the same markets, although eight of the top 12 majors have pipeline investments in each PAD. Comparing refinery shares by PAD indicates that only one

TABLE 60

PERCENT DISTRIBUTION OF INTERSTATE NET PIPELINE INVESTMENTS, SELECTED COMPANIES, IN THE UNITED STATES AND IN PAD DISTRICTS, 1972[1]

Company	PERCENT OF TOTAL NET INVESTMENT					
	Total United States	PAD I	PAD II	PAD III	PAD IV	PAD V
Exxon Corp.	9.1	9.5	3.6	16.2	3.8	1.0
Gulf Oil	7.8	11.0	4.6	11.5	1.5	2.3
Texaco, Inc.	7.4	9.0	4.9	10.2	3.3	3.9
Shell Oil Co.	6.5	5.0	4.8	8.8	3.9	9.3
Standard Oil Co. Ind.	6.4	6.1	6.8	5.3	19.3	0.1
Mobil Oil	6.1	7.9	2.7	9.5	1.5	7.4
Atlantic Richfield Co.	5.3	5.3	5.7	5.0	3.9	6.3
Williams Companies	4.7	--	12.2	--	--	--
Phillips Petroleum	3.6	3.3	4.1	3.4	5.3	--
Continental Oil	3.4	3.1	2.9	1.6	24.3	1.7
Standard Oil Co. CA	3.4	4.1	(2)	4.8	12.4	8.9
Pennsylvania Co.	3.4	11.7	4.7	--	--	--
Cities Service Co.	3.1	5.7	2.5	3.5	(2)	--
Union Oil Co. of CA	2.9	1.6	3.4	2.3	4.7	5.0
Standard Oil Co. Ohio	2.8	5.2	2.7	2.9	--	--
Sun Oil Co.	2.7	2.8	2.8	3.2	--	--
Mapco, Inc.	2.4	--	4.6	1.5	--	--
Marathon Oil	2.3	--	4.1	0.8	4.9	4.7
Southern Pacific Co.	2.3	--	--	0.4	(2)	47.0
Texas East. Trans. Corp.	2.2	2.8	2.4	2.5	--	--
Ashland Oil	1.4	--	2.0	1.5	--	--
Diamond Shamrock	0.6	--	0.2	1.2	1.6	--
Clark Oil & Refining Co.	0.4	--	0.9	(2)	--	--
Amerada-Hess Corp.	0.4	--	--	1.0	--	--
Getty Oil Co.[3]	0.3	--	0.3	0.3	0.7	--
All Others	9.0	5.7	17.3	2.8	8.7	2.1

SOURCE: Compiled from data in Appendix E.

[1]Net investment, as the term is used here, is an estimate of current market value and is defined by the Interstate Commerce Commission as the cost of reproduction less depreciation (and excluding land).

[2]Less than 0.3% of the total in that PAD District. Unless designated otherwise, a dash in the column indicates no known investment in that PAD.

[3]Includes Skelly Oil Company.

TABLE 61

PERCENT DISTRIBUTION OF OPERATING REFINERY CAPACITY, SELECTED 20 COMPANIES, IN THE UNITED STATES[1] AND IN PAD DISTRICTS, 1973

COMPANY	Percent of Total Operating Capacity					
	Total United States	PAD I	PAD II	PAD III	PAD IV	PAD V
Exxon Corp.	8.7	15.8	--	14.2	8.9	3.9
Shell Oil Co.	7.9	--	6.7	9.9	--	12.7
Standard Oil Co. Ind.	7.5	4.5	14.8	5.6	16.2	--
Texaco, Inc.	7.4	5.3	5.3	10.6	4.1	5.1
Standard Oil Co. CA	6.7	5.3	--	5.2	8.9	22.9
Mobil Oil	6.7	8.9	7.0	5.6	--	8.8
Gulf Oil	6.0	10.1	2.4	8.8	--	3.5
Atlantic Richfield Co.	5.5	11.0	3.2	3.6	--	11.8
Union Oil Co. of CA	3.4	--	3.9	2.0	--	9.9
Sun Oil Co.	3.4	9.9	6.7	1.0	--	--
Phillips Petroleum	2.8	--	2.2	3.0	5.7	5.0
Standard Oil Co. Ohio	2.7	6.0	7.4	--	--	--
Continental Oil	2.6	--	3.6	1.7	16.3	1.9
Ashland Oil	2.5	4.2	7.5	--	--	--
Marathon Oil	2.2	--	6.6	1.0	--	--
Cities Service Co.	1.9	--	--	4.5	--	--
Getty Oil Co.[2]	1.5	8.4	1.9	--	--	--
American Petrofina Co.[3]	1.4	--	0.6	2.9	--	--
Champlin Oil Co.[4]	1.0	--	1.3	1.0	--	1.3
Coastal States Petrochemical	0.9	--	--	2.3	--	--
All Others	17.3	10.6	18.9	17.1	49.1	13.2

SOURCE: Compiled from data in Appendix E.

[1]Excluding Puerto Rico.

[2]Includes Skelly Oil Co.

[3]Includes American Petrofina of Texas and Cosden Oil and Chemical Co.

[4]A wholly-owned subsidiary of Union Pacific Railroad.

TABLE 62

CONCENTRATION RATIOS, INTERSTATE PIPELINE NET INVESTMENTS AND OPERATING REFINERY CAPACITY, BY PAD DISTRICTS, 1973[1]

	PAD I	PAD II	PAD III	PAD IV	PAD V
Major Petroleum Co's.					
TOP 4					
Pipelines	37.4	15.8	47.4	10.1	14.6
Refineries	40.1	14.7	39.2	13.0	21.3
TOP 8					
Pipelines	57.9	33.1	71.3	49.6	32.9
Refineries	60.9	39.4	63.5	30.8	68.7
Total Majors[2]					
Pipelines	79.6	57.9	92.9	91.3	50.9
Refineries	94.4	79.2	74.8	60.1	85.8
All Companies					
TOP 4					
Pipelines	41.2	29.6	47.4	61.3	72.6
Refineries	46.9	36.7	43.5	50.6	57.3
TOP 8					
Pipelines	66.2	48.3	71.3	79.1	92.5
Refineries	75.5	62.0	64.4	81.3	80.1
TOP 20					
Pipelines	95.4	83.7	96.7	95.6	97.9
Refineries	94.4	90.7	88.8	94.4	91.9

SOURCE: Compiled from data shown in Tables 60-61 and Appendix E.

[1]As of January 1, 1973.

[2]The 20 largest majors do not operate in each and every PAD therefore there are less than 20 companies included in each of the PAD totals.

company, Texaco, has refineries in each PAD and is apparently the only company marketing in all fifty states.

Table 62 summarizes the data in Tables 60-61 by comparing concentration ratios in each PAD using both the measure of majors and pipeline shares in rank order. The most noteworthy results shown are the small presences of the top 4 and 8 majors in PAD's II, IV, and V in both pipeline investments and refinery capacity (except for V). PAD V refinery capacity held by the 8 majors is the main difference and is explained by the fact that the pipeline investments in PAD V are primarily intrastate. One recent study using 1967 pipeline capacity found the intrastate crude shares held by eight of twelve majors represented 98.9 percent of the total.[4] On the interstate side, Table 60 indicates that 47 percent is held by South Pacific which operates product lines.

Table 62 also confirms that PAD II was in 1972 the least concentrated market in both refinery capacity and pipeline investments. It also represents the independent pipeline operators' major market.[5] PAD's I, III, and V have the highest concentration ratios via the major companies. PAD IV as Chapter III emphasized is a minor market. Chapter III also demonstrated the importance of PAD III as a producing and refinery center and PAD I and PAD V as major consumer markets which coincides with the majors' concentration in these markets.[6]

Entry/Exit of Pipeline Companies: 1957-1975

As Figure 14 demonstrates the 20 majors' share of the crude originating market was 9 percent less in 1975 than in 1957. Their share of the product originating market was 2 percent less in 1975 than in

1957. Figure 14 also illustrates that the offsetting gains in the crude market were made by petroleum companies below the Top 20. The offsetting gains in the product market, however, were made by non-petroleum pipeline subsidiaries.

On the crude side, the changes were predominantly the result of mergers, acquisitions and increased participation in joint-venture lines. During the period no pipeline company or operation was found in either the crude or product market to have gone out of business because of financial losses. Many companies below the top 20 have acquired crude facilities from the majors. For example, America Petrofina's entry has been via acquisition of existing majors' facilities. Complete entry of new capacity (other than via joint ventures) has virtually been non-existent.

On the product side, the picture is somewhat different, as indicated in Chapter VI.[7] The major change was the sale of Great Lakes to Williams Pipeline Company. Other than this, a large amount of the entry has come in the area of companies serving specialized and PAD II markets.

Concentration Trends: A Summary

This chapter has demonstrated the substantial control held by the majors over interstate pipelines. Concentration ratios have, with the exception of product lines, been declining over 1957-1975. Much of the erosion occurred between 1957-1964. Joint ventures were shown to have a substantial impact on concentration measures, an impact that should not be ignored.

Regional concentration ratios demonstrated the need to improve

the data in this area for the majors are much more dominant in the significant crude, refining, and consumer PAD's. PAD I, III, and V are highly concentrated markets, a factor not apparent using only national measures.

Entry/exit activity has primarily been a result of acquisitions, mergers, and new joint ventures. The crude market changes have been the result of gains by smaller petroleum companies. Product gains have come via non-petroleum pipeline subsidiaries.

CHAPTER IX

[1]Joe S. Bain, Industrial Organization, pp. 438-452.

[2]David J. Teece in Vertical Integration in The Oil Industry, p. 164.

[3]Supra, pp. 197-205.

[4]Report to The Federal Trade Commission on The Structure, Conduct and Performance of The West Coast Petroleum Industry, p. 17.

[5]Supra, pp. 197-205.

[6]The influence of foreign operations of the majors is demonstrated by the concentration in PAD I. In 1973, 86.4 percent of the refined products imported into the U.S. went to this PAD. Of the U.S. total, 75.4 percent came from central and South America (see Chapter III). The refinery capacity in these exporting areas were controlled (66.1 percent by the top 4 companies) by the majors (see Appendix E, Table 6).

[7]Supra, pp. 197-205.

CHAPTER X

THE POLITICAL, LEGAL, AND REGULATORY ENVIRONMENT, 1959-1977

The legal and regulatory environment in which pipeline companies have had to operate since 1959 has largely been free of statuatory or judicial restraint that differed from the environment prior to 1959. The series of cases culminating in the second Champlin decision was the last ruling on the ICC's pipeline jurisdiction. The Arapahoe decision culminated in a resolution of questions concerning the pipeline consent decree, as well as its effectiveness.

After 1959 the interest of various governmental entities shifted from a focus on crude oil pipelines to the operation of product pipelines and joint ventures pipelines. The issues, however, remained the traditional ones concerning the shipper/owner relationship and the denial of access to non-owners, non-members of the "group." The period between 1959 and 1971 was largely uneventful in terms of Congressional activities. Although Congress did not suspend its investigations of the petroleum industry, it did move from an emphasis on pipelines into other areas. The Hepburn Act of 1906 remained the major legislation concerning interstate pipelines.

The public advent of the energy crisis in 1972 produced a series of congressional hearings and agency investigations unmatched in the history of the petroleum industry. This activity in reference to pipelines culminated (but did not end) in 1977 when the ICC's role as the regulator of interstate pipelines ended and the Department of Energy role began. The purpose of this chapter is to review the developments since 1959. Much of this review focuses on the post-1972 developments and on the substance of the pipeline issues that continue to create controversy.

Activities of the Department of Justice: 1959-77

In 1962 the Federal Trade Commission (FTC) began an investigation of the Colonial Pipeline Company. The Company, a joint venture, was in the process of constructing the largest product pipeline in the United States which would, via connections, link the major refining centers of PAD III with the eastern part of the United States. The investigation was instigated in response to complaints by competing transportation modes.[1]

The FTC in 1963 transferred the investigation to the Department of Justice's Anti-trust Division. Justice had earlier begun to focus on joint ventures and as an outgrowth of the initial investigation of the Colonial Pipeline Company, determined that there was a need to investigate a number of other joint-venture pipelines. In 1966 the antitrust division began an investigation of the proposed Gateway and the Glacier Pipelines and towards the end of the 1960's also began an investigation of the Explorer Pipeline Company, the Olympic Pipeline

Company, and the proposed Trans Alaska Pipeline.[2]

In testimony before Congress in 1972 the Deputy Assistant Attorney General outlined the reasons for Justice's investigations of joint-venture pipelines. These revolved around the following considerations: (1) the close cooperation needed to plan, construct, and operate jointly owned lines and their effect of eliminating competition between owner companies as well as non-owner competitors; (2) the possible replacement of alternative transportation modes already in existence; (3) the efficiency of the line and other facilities were such that it gave an inherent competitive edge to the shipper/owner since it was exclusively designed for them and because invariably jointly owned pipeline companies did not operate either input or output terminals but simply provided connections to the shipper/owner terminals or their customers; (4) the non-owner shipper would have to pay the tariff rate while the shipper/owners would in effect have to pay cost; (5) the effect on refinery operations and the location of these refineries, by influencing input/output points, there was the possibility that the shipper/owners could share in the disposition of excess product and thus eliminate the need to dispose of products on regional spot markets at lower prices; and (6) the impact on marketing, the planning of these pipelines necessarily involved an extensive study into the supply and demand balance of markets which were to be served by the pipeline. The planning of the line provided owners the opportunity to establish new joint-venture terminal facilities which provided a common cost facility. This provided an incentive for the owners to pool their interests and specifications to supply common points for several individual companies.[3]

The issues raised by the Justice investigations were substantial since they affected not only transportation but refining and marketing as well. They were eventually to include nearly all major joint ventures that were constructed after 1963.[4] Little is known about the Justice activities other than what has been disclosed in testimony before Congress. This information is not substantial since the Department's response to questions were invariably that they were matters still under investigation and legal inhibitions preclude them from discussing many of the facts involved in these ongoing investigations.[5]

Of the investigations, the Colonial Pipeline Company was by far the most important because of its location and since the participants in the venture included 7 of the 10 largest major petroleum companies. Its status remained confidential until 1976 when Business Week reported that "the Justice Department has quietly shut down its 13-year-old antitrust investigation of Colonial Pipeline . . . . Top officials decided they have no case."[6]

The investigation of the proposed Glacier and Gateway pipelines did lead the Department to conclude that they had sufficient information to proceed with an antitrust suit. Upon announcing their intentions to the parties involved both the Gateway and the Glacier System were abandoned by the prospective owners of these lines.[7] The proposed Gateway system is of historical interest because it initially involved 11 owners who proposed to acquire the Little Big Inch refined products pipeline. This line, owned by Texas Eastern Transmission Corporation, was originally built by the U.S. government during World War II. Its disposal at the end of the War was of considerable concern to the industry.[8]

The Gateway System was plagued from the start with disagreement among the prospective owners as to a suitable route. One opposing group (the Match Group) called for part of the route to extend to Chicago. Although Justice had proposed to bring suit, a more plausible reason for the abandonment was that the disagreement over a suitable route was never resolved. The Match Group was eventually reformed to build the Explorer Pipeline Company.[9]

While the 1976 announcement ended speculation concerning Colonial, the status of the other investigations are unknown. By surrounding its investigation in secrecy the Justice Department continued to fuel a controversy that has its origins in the Elkins and Mother Hubbard cases. For whatever reason, the Justice Department never succeeded in bringing the substantial pipeline issues to court for litigation. This has denied all parties a public forum in which the allegations could be resolved.[10]

The Federal Trade Commission: 1959-1977

The FTC began the initial investigation of the Colonial Pipeline Company but later transferred the case to the Department of Justice. Beyond the Colonial Pipeline case the FTC was publicly silent in the area of pipelines until 1973.

In October of 1970, the Chairman of House Small Business Committee sent a letter to the FTC urging an investigation and action in the energy field. In 1971 an investigation into the petroleum industry was authorized by the Commission.[11] An outcome of this investigation was a staff report on the petroleum industry. This initial and internal report was apparently finished in the first six months of 1973.

It was at about this time that the energy shortages had become most obvious and numerous committees and subcommittees of both the House and Senate were conducting hearings into the shortages. It was in this environment that the internal report became the subject of numerous leaks and newspaper releases and was soon given wide publicity as it was published by two Congressional committees.[12]

The New York Times reported that the Federal Trade Commission was publicly prodded into saying when it would report the results of its investigation of the structure of the oil industry.[13] In supplying the preliminary staff report to the Permanent Select Committee on Small Business, the Chairman of the FTC indicated that the report had neither been evaluated nor approved by the Commission and the findings and conclusions in the report did not necessarily reflect the views of the Commission. He went on to say that the Commission itself would not make the report public and asked that care be taken in avoiding unnecessary publicity which would weaken any future law enforcement action by the Commission in this area.[14]

The staff report set out to investigate the structure, conduct, and performance of the petroleum industry.[15] That the report took a structure/performance approach was a major departure from the antitrust approach that had long marked the history of both the FTC and the Department of Justice's antitrust division. The FTC had sought to determine anti-competitive structure as opposed to anti-competitive practices.[16]

The five major conclusions of the staff report were:

(1) The eight largest majors have effectively controlled the output of many of the independent crude producers' (2) A high degree of

> control over crude is matched by few crude exchanges with independents, an exclusionary practice which denies a degree of flexibility to the independent sector while reserving it for the majors; (3) Independent refiners are largely dependent on the majors for their crude supply, but independents sell very little of their gasoline output back to the major oil companies, . . . the welfare of the independent marketing sector is largely dependent on the well-being of independent refiners; (4) The continued existence and viability of the independent refiners is necessary for the survival of the independent marketer. This is especially true since the eight largest majors rarely sell gasoline to the independent marketers; (5) The major oil companies in general and the eight largest majors in particular have engaged in conduct which exemplifies their market power and has served to squeeze independents at both the refinery and market level . . . [this was particularly true] in Districts 1 and 3, results in a threat to the continued viability of the independent sector in this market.[17]

The report became not only public but the basis for a July, 1973 FTC complaint alleging that eight corporations--Exxon, Atlantic Richfield, Gulf Oil, Mobil Oil, Shell Oil, Standard Oil Company of California, Standard Oil Company of Indiana, and Texaco--were in violation of Section 5 of the FTC Act.[18]

The complaint filed by the FTC was reminiscent of the Mother Hubbard Case in its complexity and comprehensiveness. The complaint alleged three separate violations of Section 5 of the Federal Trade Commission Act. The first charged that the respondents were, through combination or agreement, monopolizing the relevant market (defined as PAD I and III); the second charged the respondents with maintaining monopoly power in the relevant market; and third, the respondents were charged both individually and with others with restraining trade and maintaining a non-competitive market structure in the relevant market.[19]

All three charges allegedly arose out of the same acts and practices. The contemplated relief sought by the FTC staff was not precisely defined but would have the following goals: (1) reduce refinery

concentration; (2) reduce barriers to entry into refining; (3) make the industry more responsive to consumer demand with respect to the product mix; and (4) create conditions and incentives which would promote open market transactions.[20] The chief form of "structural" relief would be the divestiture of refinery capacity from each of the respondents in the relevant market. This refinery capacity should be divested into some ten to thirteen firms.[21]

In the matter of pipelines, the divestiture relief would include some pipeline assets. The Commission staff proposed that all crude and product lines which connected directly to the spin-off refineries be divested totally to the new firms. They also suggested that the ownership shares in the connecting joint ventures would also be transferred to the new refining company. Although they suggested other relief, the remedies were essentially the same type as were being sought in vertical divestiture bills before Congress. They were, however, not as comprehensive as were the bills before the Senate.[22]

The FTC complaint was the most important petroleum antitrust case since the Mother Hubbard Case. It was also important because it marks a departure from the traditional approach to antitrust since the FTC was seeking relief directly related to an anti-competitive structure rather than directed to anti-competitive practices.[23]

Since 1973 the FTC and the industry have been sparring over procedures, chiefly discovery procedures and not the merits of the complaint. More than 36 months after the complaint was filed both the companies and the FTC staff continued the struggle over the subpoena of material and the discovery process.[24] In newspaper accounts of the

process it was indicated that the FTC staff estimated it would need at least three years to prepare for the trial before an administrative law judge and would take another 8-10 years to complete. The long struggle over the discovery procedures would indicate that the staff estimates were optimistic in terms of reaching the stage of a hearing before an administrative law judge.[25]

The FTC complaint was opposed by the Nixon Administration and then by the Ford Administration. In addition, the Department of Treasury and its Secretary, William Simon, mounted a major effort to oppose the preliminary staff report as well as the entire complaint.[26]

The Federal Trade Commission continued in early 1978 to pursue the Exxon, et al. Case. On at least two occasions between 1973 and 1978 there have been internal FTC recommendations that the case should be withdrawn.[27] The history of petroleum antitrust since 1911 and the complexity of this case suggest that it will eventually go the way of the Mother Hubbard Case and the Department of Justice's Colonial Pipeline Company investigation.

Interstate Commerce Commission, 1959-77

On August 4, 1977 President Carter signed legislation creating the Department of Energy. The new department consolidated three energy-related agencies and parts of several others. The Department began official operations in October. The law also transferred all ICC oil pipeline functions to the new Department.[28] What changes in pipeline regulations the transfer will produce remains to be seen. The law did not provide new powers for pipeline regulation and one must assume that in the short-run the recent behavior of the ICC and its rulings remains

not only relevant but also merely transferred.

Recent Congressional hearings provide an insight into the ICC modern role as regulators of interstate pipelines and also the prevailing philosophy with regard to this regulation. The chairman of ICC offered the following opinions concerning pipeline regulations:

1. Considering the size and economic significance of pipelines, the expenditure on regulatory efforts had not been large compared to that devoted to other types of regulated carriers. This was a reflection of a congressional determination that the protection of the public interest required a less comprehensive range of regulatory devices;

2. There were real limitations to the regulatory power of the Commission over pipelines. These revolved around the issuance of certificates of public convenience and necessity, issuance of securities, the construction and abandonment of lines, and the formation of interlocking directorates;

3. Pipeline transportation is one of the most highly concentrated segments of transportation. The concentration was justified on the basis of cost. A more competitive market structure could entail losses in efficiency;

4. The economies of large diameter pipelines explained why pipelines were jointly owned;

5. The ICC has adequate regulatory power over pipelines and required no changes in the present form of regulation. It had the power to investigate and correct abuses as they occurred.

6. Pipelines were one of the best run transportation systems, rates were just and reasonable, and the system was largely free of

of complaints of abuse.[29]

The Chairman's views were not shared by Congressional committees nor has it been shared by other groups. It may have also increased the support for transferring the regulatory function to the Energy Department. One committee concluded that while there are limitations to the ICC power, pipelines are subjected to a number of significant regulatory provisions but the ICC, however, had never exercised its power with respect to oil pipelines.[30] They also criticized the complacent attitude of the Commission as expressed by its chairman and expressed a concern that pipeline transportation, which accounted (at that time) for more than 20 percent of all inter-city freight movement, could be so casually regulated. They criticized the Commission's position that their action was the result of the lack of complaints from injured parties or more urgent prodding by the Congress.[31]

Historically, the resources and time of the ICC has been dominated by railroad and motor carrier issues and the record supports the statement that there have been relatively few pipeline complaints. There have been probably more complaints lodged with the Congress and the Department of Justice than with the Interstate Commerce Commission. The lack of complaints can be interpreted two ways. The first, accepted by industry proponents and by the ICC,is that interstate pipeline operations are largely free from abuses. The second interpretation is that pipeline operations are not free of abuses but complaints have not been filed with the ICC for three reasons: time delays, costs of filing complaints, and the fear on the part of a non-owner/shipper of retaliation.

That the ICC moves slowly in regard to developing regulatory

procedures is an established historical fact. It is also well established that once procedures and rules were established, the length of time required after a complaint was filed was so long as to render the process almost useless.[32] In terms of costs, this problem is well illustrated by the fact that the ICC is not a forum for the poor man. It is extraordinarily expensive to make and present a case before the ICC. Cost to litigate include attorney fees, witnesses' expenses, consulting fees, and printing. A relatively simple case which is opposed will certainly run to several thousands of dollars. Most complicated cases will run hundreds of thousands of dollars.[33]

The issue of the fears of retaliation is an important and normative question. In testimony before Congress, two members of the Department of Justice staff illustrate the influence of the fears of retaliation. The testimony of William John Lamont, a senior attorney in the antitrust division, indicated that ". . . independent refiners and marketers of substantial size would admit privately that the pipeline situation was strangling them, but would hasten to add, 'don't say we said so, because if we do, we will die very quickly and, no, we will not testify.'"[34] Mr. Clearwater, then Deputy Assistant Attorney General, stated

> Many of those who would seem to have some basis for complaint about the operation of oil company-owned pipelines have been reluctant to come forward, perhaps because of the feeling of dependence upon the goodwill of the major oil companies in other phases of their operation. In short, they may fear retaliation.[35]

The most lucid statement on pipeline regulation by the Interstate Commerce Commission and the control of common carriers by the major oil companies was offered in the testimony of Charles B. Siess,

Jr., then President of Apco Oil Corporation. In responding to the question raised concerning the control of common carrier transportation facilities by the major oil companies and whether this condition had contributed to the decline of the independent segment of the industry, Mr. Siess stated:

> Apco--and other independents--do have difficulty obtaining access to the common carrier transportation system to move crude to our refineries when it is needed there.
>
> There are a number of reasons given why the so-called "common carriers" crude pipelines cannot ship your crude, if it does not suit the interest or convenience of that pipeline's major company owners to do so. This is the day to day, practical, operating truth of the matter. The fact that the independent shipper theoretically has available administrative remedies at the Interstate Commerce Commission to test the validity of those "reasons why"--is practically speaking, no help at all.
>
> It is difficult to operate your refineries on a supply of documents filed in the ICC. Inevitably regulatory delays render these remedies useless. Resort to those useless remedies serve only to make it more difficult later to obtain access to those pipelines essential to keeping your refinery running.[36]

Statistical data prepared by the ICC for the years 1969-1975 give some insight into the pipeline cases that the Commission has addressed over this period. During this time 23 pipeline cases came before the Commission. Of the 23, eight cases involved the Williams Pipeline Company, a wholly-owned subsidiary of the Tulsa-based Williams Companies. Twenty cases involved product lines and only three involved crude lines. Only five involved companies controlled by major companies.[37]

The majority of the cases involved refined products, LPG, or ammonia lines and operations in PAD District II. PAD District II is the least concentrated pipeline and petroleum market in the United States. The PAD II cases involve mostly independent pipeline companies and other small independents.[38] Thus, between 1969 and 1975, the ICC

regulatory process seems to function in a market (PAD II) that has the greatest number of independent oil companies and independent pipeline companies.

The cases involving Williams Pipeline Company, since consolidated into one, was the first major case involving important pipeline issues to come before the ICC since the Reduced Rates and Gathering Charges Case. The Williams' case has its origins in the pipeline consent decree of 1941 for Williams purchased the Great Lakes Pipeline (a party to the decree) in 1964. Although there were several reasons the owners gave for selling Great Lakes, one of the most conspicuous was that the sale would free assets which were in effect frozen by the decree.[39]

With the purchase of the pipeline, Williams began to file tariffs based upon the new valuation of the assets (i.e., related to the purchase price of the pipeline network). This was in its simplest form, the primary issue involved in the case. The shippers' complaint argued that the valuation (upon which the 10 percent return was to be calculated) should reflect the valuation used by Great Lakes. The Commission ruled in favor of the new valuation.[40]

The Williams Pipeline case had a second effect for it served as a stimulus for the Commission to address pipeline issues that Congressional hearings continued to request. The Commission's study of the piepline valuation process led the ICC to initiate a proceeding, ex parte number 308, which was an investigation of the valuation of common carrier pipelines. In issuing their decision in the Williams Brothers Pipeline Case on October 10, 1975, the majority suggested that the ex parte number 308 should be extended to an investigation of the

determination of a proper rate of return for regulatory purposes. They also suggested that pipeline structures and practices deserve closer scrutiny.[41]

In a dissenting opinion, one commissioner indicated that the investigation was not sufficiently broad and recommended that it be extended to include an investigation of possible violations of Section 8 of the Clayton Act. The pertinent part of the Clayton Act follows: ". . . that no corporation engaged in commerce shall acquire . . . the whole or any part of the assets of another corporation engaged also in commerce, where . . . the effect of such acquisition may be substantially to lessen competition, or tend to create a monopoly."[42] The commissioner also felt that there should be an extension of the investigation into Elkins Act violations.[43]

Congressional investigations certainly played a role in this dissent. In the dissenting narrative a portion of the recommendations made by the House Select Committee on Small Business in 1972 were cited. These included five major recommendations:

> (1) Initiate a comprehensive investigation of the structure and operation of joint venture pipelines in order to determine which such pipelines operate as true common carriers;
>
> (2) Investigate the possibility of discrimination in pipeline rates by segments with respect to the entire pipeline industry;
>
> (3) Investigate practices regarding the setting of joint through pipeline rates . . .;
>
> (4) Investigate the failure of joint-venture pipelines to provide common terminal facilities for use of a shipper . . .;
>
> (5) Investigate the possibilities of violations of . . . Section 7 of the Clayton Act by joint-venture pipelines . . .[44]

In 1976, the Commission was to undertake an investigation of the broader

pipeline issues, an investigation now being carried out by the Department of Energy.[45]

The Trans Alaska Pipeline System: A Challenge To The Government's Rate Making Authority

In preparation for the 1977 startup of the Trans Alaska Pipeline System, the eight participants in the system filed with the ICC proposed tariffs ranging from $6.04 to $6.44 per barrel. The tariffs were immediately challenged by the Justice Department, the state of Alaska, the Arctic Slope Regional Corporation, and the ICC's Bureau of Investigations and Enforcement. On June 28, 1977 the ICC unanimously rejected the proposed tariffs as excessive and ordered them cut 20 percent. The ICC order was upheld by a lower court but was appealed to the U.S. Supreme Court. On November 15, 1977 the U.S. Supreme Court ruled (4-3) that seven of the eight companies could continue to charge the tariffs pending a full hearing.[46]

This case raises substantial questions concerning the ICC's method of rate regulation. It is complicated by the state of Alaska's involvement. The state's interest in the case is directly related to the determination of royalties to be paid to Alaska. Royalties are based upon the wellhead price of oil (pegged at the world price of oil, around $13.50 in June of 1977) less transportation costs.[47] As has been emphasized in this paper, the tariffs paid are largely paper transfers between subsidiaries (certainly the case in the initial start-up of the Trans Alaska System) and thus the higher the rates the more directly the offset to the royalties cost of the companies.

The royalty issue has no direct bearing on the ICC ruling. The

determination of the valuation base and the definition of expenses and therefore net income is apparently at the center of the case. Is interest paid on debt an expense? Is the rate of return allowable calculated on equity or total valuation (equity plus debt)? Are federal taxes paid a hypothetical payment (at the 48 percent rate) or will they be based on actual payments? It is the companies' contention that the ICC has reversed its historical method of addressing these questions. These are the issues awaiting the Supreme Court ruling.

Public Policy Developments 1959-1977: A Summary

In many respects, the pipeline issues of 1959-1977 were a repeat of 1906-1958. After a large expenditure of public/private monies and manhours, the pipeline controversy continues. The Department of Justice, the FTC, the Department of Energy, Congress, and now the Supreme Court are debating issues that are only a variant of issues debated in 1906. A resolution in the near future appears unlikely.

[1]U.S., Congress, Senate, Market Performance and Competition in The Petroleum Industry, Hearings Before The Committee on Interior and Insular Affairs, U.S. Senate, 93rd Congress, 157 Session (Washington: Government Printing Office, 1974), Part 1, p. 409.

[2]Ibid.; the case was transferred because the FTC has limited discovery powers with respect to common carriers (see U.S., Congress, House, Anti-Competitive Impact . . ., p. 204); also see Market Performance and Competition in The Petroleum Industry, Part 1, p. 410.

[3]Anti-Competitive Impact . . ., pp. 205-206 [4]Ibid.

[5]Ibid., p. 203; Between June, 1963 and June, 1973, the antitrust division undertook 224 investigations involving the petroleum industry, fifteen involved pipelines. Of the 15 cases 7 involved restraint of trade and 6 involved mergers. The 224 investigations produced 40 cases, none included pipelines (see Market Performance . . . Part 1, p. 417).

[6]Business Week, July 5, 1976, p. 71.

[7]Market Performance . . ., Part 1, p. 410; also see Anti-Competitive Impact . . ., n. 6, p. 136.

[8]Industry spokesmen went so far at one point to urge that the facility be filled with oil and sealed for use in the next emergency (see Johnson, Petroleum Pipelines and Public Policy, p. 342.).

[9]Anticompetitive Impact . . ., pp. 136-137.

[10]The Justice Department continues to talk of bringing a test case concering petroleum companies' ownership of pipelines (see the Wall Street Journal, May 6, 1977, p. 3); John Shenefield, Assistant Attorney General, Antitrust Division in March of 1978 commented ". . . But I am concerned about oil companies owning fuel pipelines. They should be operated by firms that don't own the products that are passing through them" (U.S. News & World Report, March 20, 1978, p. 67); for a critical appraisal of the Department of Justice and its effectiveness in dealing with the petroleum industry see Mark J. Green, Beverly C. Moore, Jr., and Bruce Wasserstein, The Closed Enterprise System (New York: Grossman Publishers, 1972), pp. 273-292.

[11]U.S., Congress, House, Energy Crisis and Small Business, Permanent Select Committee on Small Business, U.S. House, 93rd Congress, 1st Session (Washington, D.C.: Government Printing Office, 1973), Committee Print, pp. 1-3.

[12]Ibid., pp. 3-4; the FTC report, "Preliminary Federal Trade Commission Staff Report on Its Investigation of The Petroleum Industry," (hereafter called the FTC Staff Report) was also published by the U.S. Senate, Permanent Subcommittee on Investigations.

[13]New York Times, March 16, 1975, p. F15.

[14]U.S., Congress, House, Energy Crisis and Small Business, p. 3.

[15]Ibid., p. 7. [16]Ibid., pp. 7-9. [17]Ibid., p. 46.

[18]New York Times, March 16, 1975, p. F15.

[19]United States of America Before the Federal Trade Commission, In The Matter of EXXON Corporation, et al., Docket No. 8934, Complaint Counsel's Prediscovery Statement, pp. 96-98.

[20]Ibid., p. 137. [21]Ibid., p. 138.

[22]Ibid.; for example in June of 1976, the Senate Judiciary Committee sent a divestiture bill to the floor of Congress, the bill would require 18 of the largest U.S. oil companies to operate in only one phase of the industry (i.e., crude production, pipelines, or refining and marketing), see Business Week, August 16, 1976, pp. 93-98.

[23]In congressional testimony, Professor Breyer of the Harvard Law School indicated that the structural approach had less chance of success than the more traditional attack on anti-competitive practices (see Market Performance . . ., Part 1, pp. 442-445.).

[24]New York Times, March 16, 1975, p. F15; interview with FTC staff.

[25]New York Times, March 16, 1975, p. F15.

[26]Tulsa World, June 2, 1974, p. G7.

[27]Richard B. Manche, "Competition In The Oil Industry," in Vertical Integration In The Oil Industry, ed. by Edward J. Mitchell (Washington, D.C.: American Enterprise Institute, 1976), n. 38, p. 64.

[28]U.S., Federal Energy Administration, Energy Reporter, August/September, 1977, p. 1.

[29]U.S., Congress, Senate, Market Performance and Competition in The Petroleum Industry, Hearings before the Special Subcommittee on

Integrated Oil Operation, U.S. Senate, 93rd Congress, 2nd Session (Washington, D.C.: Government Printing Office, 1974), Part 3, pp. 895-901.

[30]U.S., Congress, House, Anticompetitive Impact of Oil Company Ownership of Petroleum Products Pipelines, A Report of The Subcommittee on Special Small Business Problems, U.S. House, 92nd Congress, 2nd Session (Washington, D.C.: Government Printing Office, 1972), pp. 6-7 and 29.

[31]Ibid.

[32]Supra, pp. 22-33; Robert C. Fellmeth, The Interstate Commerce Omission (New York: Grossman Publishers, 1970), pp. 261-263 and 353.

[33]The Interstate Commerce Omission, p. 10; Interstate Commerce Commission, "Petroleum Products, Williams Brothers Pipe Line Company," No. 35533, Interstate Commerce Commission Reports, p. 123.

[34]Market Performance . . ., Part 1, p. 494.

[35]Ibid.; also see Johnson, Petroleum Pipelines and Public Policy, pp. 233-234.

[36]Testimony of Charles P. Siess, Jr., President of APCO Oil Corporation, Before The Subcommittee on Antitrust and Monopoly of The Committee on The Judiciary, U.S. Senate, 93rd Congress, 2nd Session, August 7, 1974, p. 11 (mimeograph).

[37]From enclosures of a letter from George N. Stafford, Chairman, Interstate Commerce Commission to the Honorable William L. Hungate, Chairman, Subcommittee on Activities of Regulatory Agencies, Committee on Small Business, House of Representatives, November 10, 1975, pp. 1-4.

[38]Ibid.

[39]See Brief of Complainants, MidContinent Petroleum Shippers, before the Interstate Commerce Commission in the matter of American Petrofina Company of Texas, et al, v. Williams Brothers Pipe Line Company, et al. (I.C.C. Docket No. 35720), July 27, 1973, pp. 14-30.

[40]"Petroleum Products, Williams Brothers Pipe Line Company," No. 35533, p. 103-137.

[41]Ibid. [42]Ibid., p. 131, also see pp. 127-133.

[43]Ibid. [44]Ibid., p. 132.

[45]Business Week, March 22, 1976, p. 48.

[46]Tulsa Tribune, June 3, 1977, p. B3; Tulsa World, June 16, 1977, p. C16; Tulsa World, June 18, 1977, p. C20; Tulsa Tribune, June 28, 1977, p. B14 and June 29, 1977, p. C18; Tulsa World, November 15, 1977; and the Wall Street Journal, September 26, 1977.

[47]Tulsa Tribune, June 28, 1977, p. B14.

CHAPTER XI

SUMMARY AND CONCLUSIONS

Ownership and control of pipelines by the largest integrated petroleum companies has had a long and controversial history. The controversy has its origins in nineteenth-century development of the industry and the rise of the Standard Oil Company of New Jersey. The control of pipelines and other modes of transportation by the Standard Oil group was a key element in the monopolization of the industry by the turn of the century. It was this abuse of the ownership of pipelines that led to the passage of the Hepburn Act of 1906 which extended partially the jurisdiction of the ICC to cover pipelines. The failure at that time to apply the commodity clause to pipelines as it was in the case of railroads was the genesis of the controversy over shipper/owner pipelines that would continue for at least the next 70 years.

Pipelines have largely been built and controlled for the convenience of the major oil companies, companies which survived the 1911 stock redistribution of the Standard Oil Company of New Jersey as well as those companies which emerged in the first 30 years of this century when major discoveries and over-production was the norm.

During this time the alleged abuses of the shipper/owner

relationship shifted from a focus on a single holding company to a group of companies. The complaints have largely remained the same. Pipelines have allegedly been used as an instrument by these companies to prevent entry and effective competition at all stages of the industry.

These complaints and the alleged abuses have persisted for over 70 years in the face of numerous Congressional hearings, other governmental investigations, court decisions, and ICC regulation. Since the end of World War II the emphasis of these activities shifted along with the development within the industry toward joint-ventures and product pipelines.

The purpose of this paper has been to review the origins of the controversy through 1959 and to examine the structure and conduct of the pipeline segment of the domestic petroleum industry since that time. This study initially focused on the changing character and geography of domestic production, refining, and imports and the transportation responses to these changes.

It was concluded that pipelines continue as the dominant mode for moving crude to refineries and moving refined products to major consumer markets. The economies of scale associated with pipeline operations were found to be so pervasive that the alternative modes were complementary and not competing modes.

The domestic transportation system in 1975 was moving an average of 29 million barrels of crude and refined products each day. Pipelines were moving these commodities at a unit cost only slightly higher than in 1957. In constant dollars, the unit costs had actually declined. Total mileage in place in the United States in 1974 was 222,355 miles

nearly double the 1931 mileage. The interstate system, which was the primary empirical focus of this paper, constituted nearly 77 percent of the total. Outside of gathering activities and mileage in PAD V, intrastate pipelines were found to be relatively insignificant. The principal post World War II pipeline developments were the dramatic growth in refined product pipelines and the shift to larger diameter lines.

Having established the characteristics of the domestic industry and the growth in pipelines, overall and geographically, the focus moved to a theoretical examination of the pipeline firm and the role of vertical integration. Pipelines were shown to be a classic example of natural monopoly and in addition possess power on the demand side of the equation. The economic rationalization for public regulation was clearly established. The decreasing long-run average cost curves demonstrated that society is best served when oil and refined products are conglomerated in large quantities. They also demonstrated how important access to pipelines is for integrated companies.

Pipelines were found to epitomize the historical trend towards vertical integration within the petroleum industry. The role pipelines played as an integrated unit extended beyond their transport function. They have historically served as a means for balancing market forces, as an agency for excluding possible entry, and as an instrument of cooperation. Pipeline affiliates of integrated companies have little incentive to operate as common carriers or as profit maximizers, and the competitive model was found to be inappropriate for this segment of the industry.

In the second half of this paper, the structure and conduct of

the pipeline segment was explicitly analyzed by examining the number of sellers and their owners, the extensive pattern of cooperation among owners through joint venture, primarily, as well as through other organized forms of cooperation. The number of firms operating interstate pipelines were found to be relatively small with no more than 104 operating in any given year. More than half of the increase in companies over 1957-75 were product companies.

Five ownership patterns were found to exist and were dominated throughout the period by affiliations with petroleum parents. The focal point of the major petroleum companies' investment in pipelines resided in the "all phase" company. Pipeline operations of the majors were found nearly always to reside in legally separate entities. This was the result of ICC regulatory jurisdiction, Texas statutes, and the threat of divestiture. The major ownership form, the joint venture, was well established in 1957 but over the 19 years emerged as the dominant method of investing in pipelines.

The number of independents (i.e., unaffiliated with petroleum companies) doubled during 1957-75 but still totaled only 16 companies. Their entry was significant in that they concentrated in specialized services, geographic markets, and made significant innovations. With a few exceptions their entry was confined to refined products and not crude oil.

Because joint venture pipelines have emerged as the dominant form of organization and because they raise significant anti-competitive implications they were examined in some detail. Two forms were found to exist in domestic pipeline activities--the corporate and the system.

While the corporate joint venture is a common feature of other industries the joint venture pipeline system is a unique form. The system form has minimized the impact of regulation and has other significant advantages especially for the minority owners. Although joint venture systems experienced the most rapid growth the corporate joint venture pipeline continues to be the most numerous.

Joint ventures were found to represent from one third to one half of the interstate market and participation patterns were found to have created a maze of interlocks which greatly reduce the independency in this segment of the industry. Although participation by smaller companies had increased significantly, the participation continues to be relatively limited with the major companies being the predominant force in joint activities.

Joint ventures, while the principal form of cooperation, were not the only form of cooperation found to exist in pipelines. Three other forms were examined, these were "phantom pipeline companies," "phantom pipelines" (i.e., exchange agreements), and the physical interconnecting of pipelines.

The extent of the cooperation has increased the efficiency of pipeline transportation and transformed the pipeline networks into a semi-national one. The cooperation among the major companies raises substantial questions concerning the likelihood that the benefits of cooperation flow indiscriminantly to all firms. The empirical analysis does not suggest that this is likely. The pervasiveness of the demonstrated cooperation within a pivotal segment of the entire petroleum industry does little to support the competitiveness of the industry.

While the foundations of oligopoly are based upon interdependency which is a function of responses to independent actions--interdependency in domestic pipelines and the international industry extends considerably beyond this.

A study of concentration trends in Chapter IX, demonstrated the substantial control held by the major's interstate pipelines. Concentration ratios have, with the exception of product lines, been declining over 1957-1975. The erosion occurred largely between 1957-1964. Joint ventures were shown to have a substantial impact on concentration measures, an impact that should not be ignored.

Regional concentration ratios emphasized the need to improve the data since the majors are more dominant in the significant crude, refining, and consumer PAD's. PAD's I, III, and V are highly concentrated markets, factors not apparent using only national measures.

The structure and conduct of the pipeline segment of the industry has been under investigation by Congress, the Justice Department, and the Federal Trade Commission since the latter part of the 1900's. It also has been "regulated" by the ICC since 1906. In reviewing the period 1906-1959 Arthur Johnson concluded that impact of this extensive governmental activity through 1959 was miniminal at least in its effects on the structure and conduct of pipelines. This conclusion has also been supported by the public policy review of Chapter II.

In Chapter X the focus was on public policy developed since 1959. Public policy changes through 1977 do not alter the conclusion that government activity, both judicial and regulatory, has not altered the structure of the pipeline segment of the petroleum industry.

The Trans-Alaska Pipeline is an exception resulting primarily from environmental issues. The changes that have occurred have largely been of a legal and accounting nature with the economic functions and relationships remaining unaltered.

It is the conclusion of this paper that public policy has been ineffective and pipelines have for all practical purposes been unregulated. There are several reasons for reaching this conclusion, among these are:

1. The slow process of the governmental activity as opposed to the rapid growth and development within the industry. The structure of the industry was determined and cemented prior to any real action on the part of the government;

2. A misplaced emphasis on the rate of return analysis that was developed;

3. The role of taxation and the economics of large diameter pipelines has been more important than either the consent decree or the Interstate Commerce Commission regulation;

4. The impact of the consent decree was avoided largely because of a restructuring of the equity/debt ratio.

The slow process of governmental action and activity is illustrated by the fact that in 1880, at the time the Standard Oil group was emerging, there was a total of 1,216 miles of crude gathering and trunk lines in the United States. In 1905, one year before the passage of the Hepburn Act there was a total of 24,666 miles of interstate pipeline. By the time the 1934 valuation process was completed and the Reduced Pipeline Rate and Gathering Charge Case was tentatively concluded there

125,950 miles of pipeline. By the time the consent decree was ruled upon by the Supreme Court there were almost 190,000 miles of pipeline. This data illustrates that by the time the Interstate Commerce Commission and the Department of Justice made its major rulings concerning pipelines the structure of the pipeline segment of the industry had for all practical purposes been determined.

In terms of the rate of return analysis neither the ICC nor the consent decree has dealt effectively with the issues of:

1. The rate of return on segments of the system rather than on the entire system;

2. Rates of return are calculated based upon a theoretical net income; and

3. For the major shipper/owner lines much of the "profit" is an accounting transfer among subsidiaries which may or may not have any economic meaning.

The Congress, the Interstate Commerce Commission, and the Department of Justice and now the Department of Energy have all had the opportunity to resolve the controversial issues surrounding pipelines. Each of these agencies (except Energy) have in varying degrees failed in this obligation. Never have the central issues concerning the shipper/owner relationship reached the ultimate forum, a court of law. Whether any of the current actions will resolve these issues remains to be seen.

While it is the opinion that the 1957-1975 structure of pipelines has been unaltered by governmental intervention, pipeline companies' conduct/behavior has been altered as they sought to cope with the time

and cost of governmental intervention.

Finally, this study has laid the groundwork for future research on the functioning of the domestic petroleum industry. Of the issues remaining unresolved concerning pipelines, those involving concentration by region, and the where, when and for whom outside shipments are carried, as well as where exchanges take place needs research as does the performance side of pipeline activities.

APPENDIXES

APPENDIX A: ASSETS OF MAJOR PETROLEUM COMPANIES

TABLE A1

ASSETS OF MAJOR UNITED STATES PETROLEUM COMPANIES, 1957 AND 1976 (BILLIONS OF DOLLARS)

Company	Assets (1957)	Company	Assets (1976)
Standard Oil (NJ)	8.71	Exxon	36.3
Gulf Oil	3.24	Mobil	18.8
Socony Mobil	3.10	Texaco	18.2
Texas Co.	2.73	Standard Oil (CA)	13.8
Standard Oil (IN)	2.54	Gulf	13.4
Shell	1.76	Standard Oil (IN)	11.2
Standard Oil (CA)	1.65	Atlantic Richfield	8.9
Sinclair	1.25	Shell	7.8
Phillips	1.13	Standard Oil (OH)	6.3
Cities Service	1.05	Continental	6.0
Tidewater Oil	0.80	Phillips	5.1
Sun Oil	0.77	Sun	4.8
Atlantic Refining	0.75	Union Oil of CA	4.2
Union Oil of CA	0.67	Cities Service	3.6
Continental Oil	0.60	Getty	3.6
Sunray Mid-Continent	0.54	Marathon Oil	3.0
Pure Oil	0.53	Amerada Hess	2.8
Ohio Oil	0.39	Ashland Oil	2.1
Standard Oil (OH)	0.39	Kerr McGee	1.6
Skelly Oil	0.38	Diamond Shamrock	1.5

SOURCE: Fortune, July, 1958 and May, 1977.

TABLE A2

INTERNATIONAL MAJOR/MINOR PETROLEUM COMPANIES AND SELECTED STATE OWNED COMPANIES, SALES AND ASSETS, 1976

Company	Country	Sales (Billions of Dollars)	Assets (Billions of Dollars)
Majors[1]			
Exxon	U.S.	48.6	36.3
Royal Dutch/Shell[2]	Britain/Netherlands	36.1	29.6
Texaco	U.S.	26.5	18.2
Mobil	U.S.	26.1	18.8
Standard Oil (CA)	U.S.	19.4	13.8
British Petroleum, Ltd.[2]	Britain	19.1	14.9
Gulf Oil	U.S.	16.5	13.4
Minors[1]			
Standard Oil (IN)	U.S.	11.5	11.2
Ente Nazionale Idrocarburi[3]	Italy	10.0	12.8
Francaise des Petroles[2]	France	9.9	8.9
Badische Anilin-und Soda Fabrik[4]	Germany	9.2	6.6
Atlantic Richfield	U.S.	8.5	8.9
Continental	U.S.	8.0	6.0
Tenneco	U.S.	6.4	7.2
Phillips	U.S.	5.7	5.1
Occidental	U.S.	5.5	3.9
Sun	U.S.	5.4	4.8
Union Oil of CA	U.S.	5.4	4.2
Ashland	U.S.	4.1	2.1
Petrofina S.A.	Belgium	4.1	4.7
Cities Service	U.S.	4.0	3.6
Amerada-Hess	U.S.	3.9	2.8
Marathon	U.S.	3.5	3.0
Getty	U.S.	3.1	3.6
Standard Oil (OH)	U.S.	2.9	6.3
State Owned			
National Iranian Oil	Iran	19.7	6.5
Petroleos de Venezuela	Venezuela	9.1	5.0
ELF-Aquitaine	France	7.5	9.8
Petrobras (Petroles Brasileiro)	Brazil	7.3	8.3

(Continued)

TABLE A2 (CONTINUED)

SOURCE: Fortune, May, 1977 and August, 1977.

[1]The Major/Minor Companies are those shown in Jim I. Sturgeon, "Joint Ventures in the International Petroleum Industry: Exploration and Drilling" (Ph.D. dissertation, University of Oklahoma, 1974), pp. 197-198.

[2]Company is partially government owned.

[3]Company is government owned.

[4]Fortune identified company's primary business as being chemicals (Fortune, August, 1977, p. 226).

APPENDIX B

TABLE B1

INTERSTATE PIPELINE COMPANIES THAT TRANSPORTED BOTH CRUDE PETROLEUM AND REFINED PRODUCTS IN THE UNITED STATES, DECEMBER 31, 1975

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
AMDEL PIPELINE INC.[2] AMDEL INC. (American Petrofina, Inc., a subsidiary of Petrofina, S.A. (72%))	None
AMERICAN PETROFINA PIPELINE CO.[2] American Petrofina, Inc. (Petrofina, S.A. (72%))	None
AMOCO PIPELINE COMPANY Standard Oil of Indiana	Formerly the Service Pipeline Co.
ARCO PIPELINE COMPANY Atlantic Richfield Co.	Formerly the Sinclair Pipeline Co. until merger of Sinclair and Atlantic Richfield in 1969. Atlantic Pipeline Co. merged into ARCO Pipeline Co. in 1971.
ASHLAND PIPELINE COMPANY Ashland Oil Co.	None
BUCKEYE PIPELINE COMPANY Pennsylvania Co.	Purchased Tucarora Pipeline Co., Ltd. in 1960. New York Transit and Northern Pipeline Co. merged into Company in 1965. Pennsylvania Co. purchased company in 1964. Buckeye was a publicly traded company from 1957-64.
CHEVRON PIPELINE COMPANY Standard Oil of California	Formerly the Salt Lake Pipeline Co. In 1970 new company formed by same name in Delaware combining the Chevron Pipeline Co. (Nevada) and Cal-Ky Pipeline Co.

(Continued)

TABLE B1 (CONTINUED)

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
CITIES SERVICE PIPELINE CO. Cities Service Co.	Formerly the Empire Pipeline Co. Arkansas Pipeline Co. merged into company in 1963.
CONTINENTAL PIPELINE COMPANY Continental Oil Co.	None
DOME PIPELINE COMPANY Dome Petroleum Corp. (Dome Petroleum Ltd.)	None
EXXON PIPELINE COMPANY EXXON Co., U.S.A. Division	Formerly the Humble Pipeline Co. Wholly owned subsidiary, Interstate Pipeline Co., merged into company in 1960.
GULF REFINING COMPANY Gulf Oil Co.	Purchased the Toronto Pipeline Co. from British-American Oil in 1967. (Gulf held a majority interest in BA Oil).
MARATHON PIPELINE COMPANY Marathon Oil Co. (Formerly Ohio Oil Co.)	Illinois Pipeline Co. of Texas, Muskegon Pipeline Co., and pipeline department of Ohio Oil Co. merged in 1960. Plymouth Pipeline Co. merged in 1962.
MOBIL PIPELINE COMPANY Mobil Oil Co.	Formerly the Magnolia Pipeline Co.
PASCO PIPELINE CO. PASCO, Inc.	PASCO, Inc. was in 1975 a subsidiary of Studebaker-Worthington.
PHILLIPS PIPELINE COMPANY Phillips Petroleum Co.	None
PURE TRANSPORTATION COMPANY Union Oil of California	Ute Pipeline Co. merged into Co. in 1964. Pure Oil merged into Union Oil in 1965.
SHAMROCK PIPELINE CORPORATION Diamond Shamrock Oil & Gas Co.	Shamrock merged with Diamond Alkali in 1967.

TABLE B1 (CONTINUED)

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
SHELL PIPELINE CORPORATION Shell Oil Co., U.S.A.	Shell Oil is 69.57% owned by Shell Petroleum N.V. which is in turn owned by the Royal Dutch Group (60%) and the Shell Transport & Trading Co. of England (40%).
SKELLY PIPELINE COMPANY Skelly Oil Co.	Skelly Co. is controlled by Getty Oil Co.[3]
SOHIO PIPELINE COMPANY Standard Oil of Ohio	Purchased Sun Pipeline Co. of Illinois in 1964.
SUN PIPELINE COMPANY Sun Oil Co.	None
TEXAS PIPELINE COMPANY Texaco, Inc.	None

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; The International Petroleum Register, 1966-67; and Moody's Industrial Manual, selected annual issues.

[1]Unless noted, ownership is 100 percent.

[2]In 1971, American Petrofina, Inc. purchased terminal facilities and a trunk line system from ARCO Pipeline Co.; in 1973, American Petrofina, Inc. purchased interest in crude pipelines from BP OIL CO., a subsidiary of Standard Oil Co. (Ohio).

[3]In February of 1977, Skelly Oil was, along with Mission Corporation, merged into Getty Oil Co.

TABLE B2

INTERSTATE PIPELINE COMPANIES THAT TRANSPORTED CRUDE PETROLEUM IN THE UNITED STATES, DECEMBER 31, 1975

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
ACORN PIPELINE COMPANY Charter Oil Co.	Nantucket Pipeline Co. transferred to Acorn in 1971.
BELL FOURCHE PIPELINE COMPANY (Individuals)	None
COOPERATIVE REFINERY ASSOCIATION (Since 1964, CRA, Inc.) Farmland Industries	CRA, Inc. operates a pipeline dept.
CROWN-RANCHO PIPELINE CORP. Crown Central Petroleum Co.	None
HESS PIPELINE COMPANY Amerada Hess Petroleum Co.	Prior to 1969, was owned by Hess Oil and Chemical Company
KERR-MCGEE PIPELINE COMPANY Kerr-McGee	None
KIANTONE PIPELINE CORPORATION United Refining Co.	None
MICHIGAN-OHIO PIPELINE CORP. Leonard Refineries	Leonard Refineries merged into Total Petroleum Ltd. in 1970 and now operates as Total Leonard, Inc. Total Petroleum Ltd. is partially owned (44%) by Compagnie Francaise des Petroles S.A.
OWENSBORO-ASHLAND CO. Ashland Oil Co.	Formerly an intrastate gathering line company.
WESTERN OIL TRANSPORTATION CO. Permian Corp. (Occidental)	None

(Continued)

TABLE B2 (CONTINUED)

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
WESCO PIPELINE COMPANY Western Crude Oil Co. (Reserve Oil & Gas)	PANOTEX Pipeline Co. was merged into WESCO in 1974. Did not represent ownership change.

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; The International Petroleum Register, 1966-67; and Moody's Industrial Manual, selected annual issues.

[1]Unless noted, ownership is 100 percent.

TABLE B3

INTERSTATE CORPORATE JOINT VENTURE PIPELINE COMPANIES THAT TRANSPORTED CRUDE PETROLEUM IN THE UNITED STATES, DECEMBER 31, 1975

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes, 1957-75
ARAPAHOE PIPELINE COMPANY		
Union Oil of California . . . 50.0	Pure Oil Co. 50.0	Change in ownership is the result of the merger of parent companies. The company is operated by the Pure Transportation Co. (a wholly owned subsidiary of Union Oil).
Atlantic Richfield 50.0	Sinclair Oil Co. 50.0	
BLACKLAKES PIPELINE COMPANY		
Atlantic Richfield 50.0	Sinclair Oil Co. 50.0	Change in ownership is the results of the merger of Sinclair and Atlantic Richfield in 1969. Placid Oil Co. is part of the Hunt interests. Company is operated by ARCO Pipeline Co.
Placid Oil Co. 50.0	Placid Oil Co. 50.0	
BUTTE PIPELINE COMPANY		
Shell 51.0	Shell 60.0	Shell sold 9% to Western Crude Oil Co. Company is operated by the Shell Pipeline Co.
Murphy Oil Co. 17.5	Murphy Oil Co. 17.5	
Continental Oil Co. 12.5	Continental Oil Co. . . 12.5	
Burlington Northern, Inc. . . 10.0	Northern Pacific RR . . 10.0	
Western Crude Oil Co. 9.0		

(Continued)

TABLE B3 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes, 1957-75
CHICAP PIPELINE COMPANY		
Union Oil of California . . . 48.1	Union Oil of California . 43.4	Company is operated by the Pure Transportation Company. Change in ownership reflects use of pipeline.
Clark Oil and Refining . . . 22.7	Clark Oil and Refining . 33.2	
Standard of Indiana 29.2	Standard of Indiana . . . 23.4	
COOK INLET PIPELINE COMPANY		
Marathon Oil Co. 30.0	Marathon Oil Co. . . . . (a)	(b)
Union Oil of California . . . 30.0	Union Oil of California . (a)	
Atlantic Richfield 20.0	Atlantic Richfield. . . . (a)	
Mobil Oil Co. 20.0	Mobil Oil Co. . . . . (a)	
	Cities Service . . . . . (a)	
EUREKA PIPELINE COMPANY		
Pennzoil 52.0	Elks Refining Co. 22.2	(b)
Quaker State. 17.4	Quaker State 16.4	
Universe Ltd. 5.7	South Penn Oil. 9.1	
Others 24.9	Others 52.3	
FOUR CORNERS PIPELINE COMPANY		
Shell Oil Co. 25.0	Shell Oil Co. 25.0	Change in ownership the results of the merger of Atlantic Refining and Richfield Oil Co. Shell Pipeline Co. operates company.
Standard of California . . . 25.0	Standard of California . 25.0	
Gulf Oil Co. 20.0	Gulf Oil Co. 20.0	
Atlantic Richfield 10.0	Richfield 10.0	
Continental Oil 10.0	Continental Oil 10.0	
Superior Oil 10.0	Superior Oil 10.0	

(Continued)

TABLE B3 (Continued)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes, 1957-75
JAYHAWK PIPELINE COMPANY				
Colorado Interstate Corp.	50.0	Colorado Interstate Corp.	50.0	None
Farmland Industries	50.0	Farmland Industries	50.0	
KAW PIPELINE COMPANY				
Cities Service	33.3	Cities Service	33.3	Operated by the Texas Pipeline Co.
Phillips	33.3	Phillips	33.3	
Texaco	33.3	Texaco	33.3	
KENAI PIPELINE COMPANY				
Standard of California	50.0	Standard of California	50.0	Change is the results of the merger of Atlantic Refining and Richfield.
Atlantic Richfield	50.0	Richfield Oil and Gas	50.0	
LAKEHEAD PIPELINE COMPANY				
Interprovincial Pipeline Co.	100.0	Same		None
Imperial Oil, Ltd.	32.8			
Gulf Oil Canada, Ltd. (Gulf Oil)	7.0			
Shell Canada, Ltd.	2.0			
Amoco Canada (Standard of Indiana)	(a)			
Others	(a)			

(Continued)

TABLE B3 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes, 1957-75
MID VALLEY PIPELINE COMPANY		
Sun Oil Co. 50.0	Same	Sun is the operating agent.
Standard of Ohio 50.0		
(Gulf Oil owns 9% of Class B Stock)		
MINNESOTA PIPELINE COMPANY		
Kock Industries 59.6	Woodley Petroleum 40.0	Pure Oil acquired Woodley in 1960. When Sinclair sold its interest is unknown. Union Oil sold its (Pure) interest to MPL Financial Corp., which in 1973 sold its interest to Kock Industries. Ashland acquired its interest in 1970.
Ashland Oil Co. 33.3	Sinclair 40.0	
J. Howard Marshall 7.1	J. Howard Marshall . . . 20.0	
NATIONAL TRANSIT		
Pennzoil 91.0	Quaker State. . . . . (a)	Bradford Transit purchased company in 1965 and now both operate as the National Transit Co.
Whitco Chemical 9.0	Kendall Refining. . . . . (a)	
	Waverly Oil Works . . . . (a)	
	South Penn Oil Co. . . . (a)	
	Cities Service . . . . . (a)	

(Continued)

TABLE B3 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes, 1957-75
OSAGE PIPELINE CO.		
Skelly Oil (Getty) 50.0	Same	None
Mobil Oil 20.0		
Farmland Industries 20.0		
American Petrofina, Inc. . . 10.0		
PALOMA PIPELINE COMPANY		
Hunt Interests 30.7	Same	Owns an interest in the Ship Shoals and White Cap Pipeline Systems
Ashland Oil 25.6		
Transocean Oil Co. 15.7		
Kewanee Oil Co. 11.2		
Hamilton Bros. Oil 6.8		
General Crude Co. 6.1		
Highland Resources 3.9		
PLATTE PIPELINE COMPANY		
Marathon Oil Co. 25.0	Ohio Oil Co. 25.0	Change in ownership is the result of the merger of parents.
Atlantic Richfield 25.0	Sinclair 25.0	
Continental Oil Co. 20.0	Continental Oil Co. . . . 20.0	
Union Oil of CA 15.0	Pure Oil Co. 15.0	
Gulf Oil 15.0	Toronto Pipeline Co. . . . 15.0	
PORTAL PIPELINE COMPANY		
Burlington-Northern 50.0	Great Northern RR . . . . (a)	(b)
Hunt Oil Co. 50.0	Hunt Oil Co. . . . . (a)	
	Northwestern Refining . . (a)	

(Continued)

TABLE B3 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes, 1957-75
PORTLAND PIPELINE CORPORATION				
Montreal Pipeline Co.	100.0	Montreal Pipeline Co.	100.0	British Petroleum, Ltd. purchased a 10% interest in 1960. McColl-Frontenac Oil was controlled by Texaco and British American Oil by Gulf.
Imperial Oil, Ltd.	32.0	Imperial Oil, Ltd.	36.0	
Shell, Canada	16.0	Shell, Canada	18.0	
Texaco Canada	16.0	McColl-Frontenac Oil, Ltd.	18.0	
Gulf Oil, Canada	16.0	British American Oil, Ltd.	18.0	
Canadian Petrofina	10.0	Canadian Petrofina	10.0	
British Petroleum, Ltd.	10.0			
SOUTHCAP PIPELINE COMPANY				
Union Oil of CA	64.0	Same		Southcap owns and uses an undivided interest in the Capline Pipeline System.
Clark Oil and Refining Co.	36.0			
TECUMSEH PIPELINE COMPANY				
Union Oil of CA	40.0	Pure Oil Co.	40.0	Change in ownership is result of the merger of parent companies. Company was operated by Sinclair and now operated by ARCO Pipeline Co.
Atlantic Richfield	40.0	Sinclair Oil Co.	40.0	
Ashland Oil Co.	20.0	Ashland Oil Co.	20.0	

(Continued)

TABLE B3 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes 1957-75
TEXAS-NEW MEXICO PIPELINE COMPANY		
Texaco 45.0	Texaco 45.0	Change in ownership is result
Atlantic Richfield 35.0	Sinclair 35.0	of merger of parent companies.
Getty Oil. 10.0	Tidewater Oil. 10.0	Texas Pipeline Co. is operat-
Cities Service 10.0	Cities Service 10.0	ing agent.
TEXOMA PIPELINE COMPANY		
Sun Oil Co. 25.0	Same	None
Reserve Oil and Gas. 20.0		
Mobil Oil 10.1		
Kerr-McGee 10.1		
Skelly (Getty) 10.1		
United Refining Co. 7.0		
Texas Eastern Trans 5.0		
Rock Island Refinery 5.0		
Lion Oil 5.0		
Bicker Petroleum Corp. . . . 2.7		
TRANS MOUNTAIN OIL PIPELINE COMPANY		
Trans Mountain Oil Pipeline Co., Ltd. 100.0	Trans Mountain Oil Pipeline Co., Ltd. . . . . 100.0[c]	(b)
Imperial Oil, Ltd. 8.6	Standard Oil (NJ). . . 8.7	
Standard Oil of British Columbia, Ltd. 8.6	Standard Oil (CA). . . 8.7	
Shell, Canada 8.6	Shell. 8.7	
Gulf Oil, Canada 8.6	Gulf 8.7	
	Union. 6.7	

(Continued)

TABLE B3 (CONTINUED)

Joint Venture Company Participants, and Percent Ownership, 1975		Participants and Percent Ownership 1957 or entry date		Significant Changes, 1957-75
Trans Mountain Oil Pipeline Company (Continued)				
Amoco, Canada	(a)	Richfield	3.3	
Others	(a)	Independents	16.6	
		Others	38.6	
WEST TEXAS GULF PIPELINE COMPANY				
Gulf Oil	57.7	Gulf Oil	57.7	Change in ownership is the result of the merger of parent companies. Company is operated by Gulf.
Sun Oil	12.6	Sun Oil	12.6	
Cities Service	11.4	Cities Service	11.4	
Standard of Ohio	9.2	Standard of Ohio	9.2	
Union Oil of CA	9.1	Pure Oil	9.1	
WHITE SHOAL PIPELINE COMPANY				
Kerr McGee	64.5	Same		None
Cabot Corp.	16.1			
Case-Pomeroy Oil Corp.	9.7			
Felmont Oil Corp.	9.7			

SOURCE: data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; USA Oil Directory, 1973-1976; Directory of Pipe Line Companies and Pipeline Contractors, 1953-1976; The Oil and Gas Journal, 1957-1975. Data was cross checked against Ownership data published in congressional hearings and prepared by the Interstate Commerce Commission; data prepared by the Association of Oil Pipe Lines; the International Petroleum Register, 1966-67; Moody's Industrial Manual, selected

(Continued)

TABLE B3 (CONTINUED)

annual issues. Additional data came from a variety of sources, such as the Tulsa Daily World, Tulsa Tribune, and Prospectus and Annual Reports of Petroleum and Pipeline Companies.

[a]Percent ownership not available.

[b]Date and sequence of changes is unknown.

[c]Ownership data shown by Cookenboo in Crude Oil Pipe Lines and Competition in the Oil Industry, p. 42.

TABLE B4

INTERSTATE PIPELINE COMPANIES THAT TRANSPORTED REFINED PRODUCTS IN THE UNITED STATES, DECEMBER 31, 1975

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
AIRFORCE PIPELINE, INC. Southern Railway	None
ALLEGHENY PIPELINE COMPANY Texas Eastern Transmission Co.	None
AMERICAN PETROFINA COMPANY OF TEXAS American Petrofina, Inc.	Petrofina, S.A., Brussels, Belgium owns 72% of American Petrofina, Inc.
CALNEV PIPELINE COMPANY Union Pacific Railroad	Since 1970 operated by Champlin Petroleum Co. (Since 1970, Champlin has been a wholly owned subsidiary of Union Pacific. Prior to 1970 and from 1964, Champlin was a part of the Celanese Corp. of America.)
CROWN CENTRAL PIPELINE AND TRANSPORTATION COMPANY Crown Central Petroleum	None
DIAMOND SHAMROCK OIL AND GAS COMPANY (Pipeline Dept.)	Formerly the Shamrock Oil & Gas Co. until merger in 1967 with Diamond Alkali.
EMERALD PIPELINE CORPORATION Emerald Corp. (Diamond Shamrock)	Emerald Corp. was a subsidiary of Shamrock Oil and Gas Co. until 1967 when Shamrock merged with Diamond Alkali.
GETTY PIPELINE COMPANY Getty Oil	Formerly Tide-water Pipeline Co., Ltd.
HYDROCARBON TRANSPORTATION, INC. Northern Gas Products Co.	None
JET LINES, INC. (Individuals)	None

(Continued)

TABLE B4 (CONTINUED)

Pipeline Company[1] & Parent Company	Corporate/Ownership Changes, 1957-75
KANEB PIPELINE COMPANY Kaneb Services, Inc.	Augusta Pipeline Co. merged into Kaneb in 1960.
MID-AMERICA PIPELINE COMPANY Independent	Name changed to MAPCO in 1968.
OHIO RIVER PIPELINE COMPANY Ashland Oil Co.	Formerly a joint venture between Ashland Oil Co. (50.0) and Standard Oil (Ohio) (50.0). Ashland purchased Ohio interest in 1972.
OKAN PIPELINE COMPANY Gulf Oil	Control in 1957 by Gulf was via Warren Petroleum Co. (The Warren Co. and the Warren Employee Pension Trust were the sole owners of Okan.)
OKIE PIPELINE COMPANY Kock Industries	None
PHILLIPS PETROLEUM COMPANY (Pipeline Department)	
POWDER RIVER CORPORATION Phillips Petroleum Co.	51.0% of Co. is held by First National Bank of N.Y., trustee for Phillips retirement income plan.
SANTA FE PIPELINE COMPANY Chanslor-Western Oil and Development Co. (AT & SF Railway System)	None
SOUTHERN PACIFIC PIPELINE CO. Southern Pacific Co.	None
SUN PIPELINE COMPANY OF MICHIGAN Sun Oil Company	None
TEXAS EASTERN TRANSMISSION CORP. (Products Division)	Project Five Pipeline Corp. merged into Corp. in 1959.

(Continued)

TABLE B4 (CONTINUED)

Pipeline Company & Parent Company[1]	Corporate/Ownership Changes, 1957-75
TRANS-OHIO PIPELINE COMPANY Texas Eastern Transmission Corp.	None
UCAR PIPELINE, INC. Union Carbide Corp.	None
WEST EMERALD PIPELINE CORP. Emerald Corp. (Diamond Shamrock)	Change in ownership results of merger of Shamrock and Diamond Alkali.
WILLIAMS PIPELINE COMPANY Williams Companies	Purchased Great Lakes Pipeline Co. in 1966. Operated as Williams Brothers Pipeline Co. until 1974.

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; The International Petroleum Register, 1966-67; and Moody's Industrial Manual, selected annual issues.

[1]Unless noted, ownership is 100 percent.

TABLE B5

INTERSTATE CORPORATE JOINT VENTURE PIPELINE COMPANIES
THAT TRANSPORTED REFINED PRODUCTS IN THE
UNITED STATES, DECEMBER 31, 1975

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes, 1957-75
BADGER PIPELINE COMPANY				
Atlantic Richfield	34.0	Sinclair	34.0	Change in ownership is the result of merger of parent companies. Operated by Cities Service Pipeline Company.
Cities Service	32.0	Cities Service	32.0	
Texaco	22.0	Texaco	22.0	
Union Oil of California	12.0	Pure Oil Co.	12.0	
CHASE TRANSPORTATION CO.		Same		Chase Pipeline Company is an intrastate joint venture corporation owned by Kock Oil Co. (50%) and Skelly (Getty) operated by Kock Oil.
Chase Pipeline Co.	50.0			
Skelly (Getty)	50.0			
CHEYENNE PIPELINE COMPANY (Both crude and product)		Same		Formerly the Wyoming-Nebraska Pipeline Co. until 1966 when it was purchased by Nielson Enterprise, Inc. (now a partnership).
Nielson Enterprise, Inc. (Managing Partner)	33.3			
Geoli Investment Co.	33.3			
Ecodor Investment Co.	33.3			

(Continued)

TABLE B5 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes, 1957-75
COLLINS PIPELINE COMPANY		
Tenneco, Inc. 80.0	Same	None
Murphy Oil Corp. 20.0		
COLONIAL PIPELINE		
Gulf 16.8	Gulf 14.9	Change in ownership is the result of: Merger of parent companies; purchase of an interest by B. P. Oil Co. (now a subsidiary of Standard of Ohio under the merger agreement with British Petroleum Company, Ltd.); change in percent ownership of the original participants in 1970 which reflects the use of the pipeline from 1962-70.
Standard of Indiana. 14.3	Standard of Indiana. . . 13.6	
Texaco 14.3	Texaco 15.9	
Cities Service 14.0	Cities Service 15.3	
Mobil 11.5	Mobil. 10.5	
Standard of Ohio 9.0	Continental. 3.7	
Continental. 7.5	Phillips 11.0	
Phillips 7.1	Pure Oil 4.4	
Union Oil of CA 4.0	Sinclair 10.7	
Atlantic Richfield 1.6		
DIXIE PIPELINE COMPANY		
Gulf Oil 18.2	Same	Union Texas Petroleum is a division of Allied Chemical Corporation. Operated by Exxon Pipeline Company.
Phillips 14.5		
Standard of Indiana 12.1		
Exxon 11.1		
Union Texas Petroleum. 8.6		
Atlantic Richfield 7.4		

(Continued)

TABLE B5 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes 1957-75
Dixie Pipeline Company (Continued)				
Shell	5.5			
Cities Service	5.0			
Texaco	5.0			
Mobil	5.0			
Continental	4.0			
Transcontinental Gas Pipe Line Corporation	3.6			
EXPLORER PIPELINE COMPANY				
Shell	26.0	Shell	26.0	Gulf sold a 10% interest to Marathon in 1974.
Gulf	16.7	Gulf	26.7	
Texaco	16.0	Texaco	16.0	
Marathon	10.0	Sun Oil	9.4	
Sun Oil	9.4	Continental	7.7	
Continental	7.7	Cities Service	6.8	
Cities Service	6.8	Phillips	4.5	
Phillips	4.5	APCO Oil Corp	2.9	
APCO Oil Corp	2.9			
LAKE CHARLES PIPELINE COMPANY				
Continental	50.0	Same		Operated by Continental Pipeline Company
Cities Service	50.0			
LAUREL PIPELINE COMPANY				
Gulf	49.1	Gulf	40.0	Operated by Gulf. Change in ownership result of merger of

(Continued)

TABLE B5 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes, 1957-75
Laurel Pipeline Company (Continued)				
Texaco	33.9	Sinclair	35.0	Sinclair and Atlantic Richfield and required sale of part of Sinclair assets.
Standard of Ohio	17.0	Texaco	25.0	
OLYMPIC PIPELINE COMPANY				
Shell	43.5	Same		Operated by Mobil Pipeline Co.
Mobil	29.5			
Texaco	27.0			
PIONEER PIPELINE COMPANY				
Continental	80.0	Continental	65.0	Atlantic Richfield sold its interest to Pasco in 1972. Pasco, in 1973, sold 15% interest to Conoco. Operated by Continental Pipeline Co.
Pasco, Inc. (Studebaker-Worthington)	20.0	Sinclair	35.0	
PLANTATION PIPELINE COMPANY				
Exxon	48.8	Standard of New Jersey	48.8	Standard of California became a participant in 1961 when it acquired Standard of Kentucky.
Standard of California	27.1	Standard of Kentucky	27.1	
Shell	24.0	Shell	24.0	
TEXACO-CITIES SERVICE (Both crude and product)				

(Continued)

TABLE B5 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes, 1957-75
Texaco-Cities Service (Continued)				
Texaco	50.0	Same		Operated by Texas Pipeline Co.
Cities Service	50.0			
WEST SHORES PIPELINE COMPANY				
Shell	20.0	Same		Standard of Indiana (via American Oil) is operator. Union holds interest previously held by Pure Oil.
Standard of Indiana	16.5			
Mobil	14.0			
Texaco	9.0			
Marathon	9.0			
Cities Service	8.0			
Clark Oil & Refining	8.0			
Continental	6.5			
Union	5.5			
Exxon	3.5			
WOLVERINE PIPELINE COMPANY				
Union Oil of CA	26.0	Shell	40.0	Operated by Shell Pipeline Co. In 1968 Union purchased 26% of Co.
Mobil	21.0	Cities Service	35.0	
Texaco	17.0	Texaco	25.0	
Clark Oil & Refining	11.0			
Marathon	10.0			
Cities Service	8.0			
Shell	7.0			

(Continued)

TABLE B5 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes 1957-75
WYCO PIPELINE COMPANY				
Texaco	40.0	Same		Operated by Amoco Pipeline Co.
Standard of Indiana	40.0			
Mobil	20.0			
YELLOWSTONE PIPELINE COMPANY				
Exxon	40.0	Standard of New Jersey	40.0	Operated by Continental Pipeline Co.
Continental	40.0	Continental	40.0	
Union Oil of California	20.0	Husky Oil	6.0	
		Union Oil of CA	14.0	

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; USA Oil Directory, 1973-1976; Directory of Pipe Line Companies and Pipeline Contractors, 1953-1976; The Oil and Gas Journal, 1957-1976. Data was cross checked against Ownership data published in congressional hearings and prepared by the Interstate Commerce Commission; data prepared by the Association of Oil Pipe Lines; the International Petroleum Register, 1966-67, Moody's Industrial Manual, selected annual issues, Moody's Transportation Manual, selected annual issues. Additional data came from a variety of sources, such as the Tulsa Daily World, Tulsa Tribune, and Prospectus and Annual Reports of Petroleum and Pipeline Companies.

TABLE B6

JOINT VENTURE SYSTEMS THAT TRANSPORTED CRUDE OIL IN THE UNITED STATES, 1975

Joint Venture System, Participants, and Percent Ownership		Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
BASIN PIPELINE SYSTEM		Operated by Texas Pipeline Co. Atlantic Richfield now owns Sinclair's former interest.	517
Texaco	46.0		
Shell	30.9		
Atlantic Richfield	14.3		
Cities Service	8.8		
CAPLINE PIPELINE SYSTEM		Southcap is owned jointly by Union Oil of California (64.0) and Clark Oil and Refining (36.0). Mid Valley Pipeline Co. is owned jointly by Sun Oil (50.0) and Standard of Ohio (50.0). System is operated by Shell Pipeline Co.	650
Southcap Pipeline Co	20.6		
Ashland	18.7		
Texaco	18.0		
Shell	14.4		
Marathon	9.6		
Standard of IN	9.6		
Mid Valley Pipeline	9.1		
CAPWOOD PIPELINE SYSTEM		In 1969, Shell purchased Capwood from Marathon and sold 20% to Clark. Operated by Shell Pipeline Company.	57
Shell	80.0		
Clark Oil and Ref.	20.0		
CHEROKEE PIPELINE SYSTEM			
Continental	(a)	Formerly a corporate joint venture. System is operated by Continental Pipeline Co. and owns majority interest in system.	p 1445 c 417 g 436
APCO	(a)		
CUSHING-CHICAGO PIPELINE SYSTEM		Operated by Arco Pipeline Company Shares were previously held by Sinclair and Pure.	711
Atlantic Richfield	71.4		
Union Oil of CA.	28.6		
EAST CAMERON BLOCK 321 PIPELINE SYSTEM			
Marathon Oil	(a)	Operated by Marathon Pipeline Co.	32
Amerada Hess	(a)		

(Continued)

TABLE B6 (CONTINUED)

Joint Venture System, Participants, and Percent Ownership	Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
EAST TEXAS MAIN LINE SYS.		
Texaco 63.5	Operated by Texas Pipeline Company.	177
Cities Service . . 36.5	Tidal Pipeline originally had an interest which was sold to Crown Central (20.0). Crown Central sold its interest to other two participants between 1973 and April, 1975.	
EL PASO-WARFIELD PRODUCTS SYS.		
Standard Oil Co. (CA) (a)	Operated by Chevron Pipeline Co.	255
Texaco, Inc. . . . . (a)		
MESA PIPELINE SYSTEM		
Gulf 61.0	Operated by Gulf. Pure Oil held	80
Cities Service . . . 14.5	interest prior to merger with	
Standard of Ohio . . 9.5	Union Oil of California.	
Union Oil of CA . . 8.8		
Sun. 6.2		
NEALE PIPELINE SYSTEM	Sohio Pipeline Company is operator.	c-71
Standard of Ohio . . 70.0	Amdel is owned by American Petro-	g-49
Amdel Pipeline Co. . 30.0	fina, Inc.	
OZARK PIPELINE SYSTEM		
Shell 55.0	Operated by Shell Pipeline Co.	441
Texaco 45.0		
PALINE SYSTEM		
Standard of Ohio . . 70.0	(See Neale System)	190
Amdel Pipeline Co. . 30.0		
RANCHO PIPELINE SYSTEM[b]	Operated by Shell Pipeline Co.	460
Shell 40.0	Acorn Pipeline Company is owned by	
Atlantic Richfield . 23.7	Charter Oil Company. Crown Rancho	
Standard of IN . . . 7.3	is owned by Crown Central Petroleum.	
Phillips 8.0	Atlantic Richfield's interest was	
Acorn Pipeline Co. . 9.3	previously owned by Sinclair.	
Ashland 6.0		
Crown Rancho 5.7		

(Continued)

TABLE B6 (CONTINUED)

Joint Venture System, Participants, and Percent Ownership		Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
SARNIA PIPELINE SYSTEM			
Dome Petroleum Corp. (a)		Operated by Dome Pipeline Corp.	c 4
Standard Oil Co. (IN) (a)			p 9
SHIP SHOAL PIPELINE CO.		Operated by Shell Oil Company.	107
Shell	42.5	Paloma Pipeline Co. is a corporate joint venture.	
Union Oil of CA	40.0		
Paloma Pipeline Co.	17.5		
STERLING PIPELINE SYSTEM		Arapahoe is a corporate joint venture. Data is for 1957, no record of system after 1967.	-
Toronto (Gulf)	50.0		
Shell	33.3		
Arapahoe	16.7		
TEXAS-EMPIRE-TIDAL		Operated by Texas Pipeline Co. (May no longer be operating.)	64
Texaco	80.0		
Crown Central	20.0		
TRANS ALASKA PIPELINE SYSTEM			
Standard (OH) and British Petroleum.	49.18	Alyeska Pipeline Service Company is building and will operate system for owners.	800
Atlantic Richfield	21.00		
Exxon	20.00		
Mobil	5.00		
Union Oil of CA.	1.66		
Phillips	1.66		
Amerada Hess	1.50		
VENTURE PIPELINE SYSTEM			
Gulf	17.0	Operated by Union Oil of California. (Intrastate System)	17
Texaco.	17.0		
Union Oil of CA	17.0		
Mobil	17.0		
Continental	8.0		
Cities Service.	8.0		
Sun Oil	7.0		
Superior.	5.0		
Marathon.	4.0		

(Continued)

TABLE B6 (CONTINUED)

Joint Venture Systems Participants, and Percent Ownership		Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
WHITE CAP PIPELINE SYSTEM			
Union Oil of CA . .	53.3	Operated by Pure Transportation Company. Both Paloma and White Shoals are corporate joint ventures.	44
Paloma	33.3		
White Shoal Pipeline	13.3		
WOODPOT PIPELINE SYSTEM		Operated by Marathon Pipeline Co.	55
Texaco	60.0		
Marathon	40.0		

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; USA Oil Directory, 1973-1976; Directory of Pipe Line Companies and Pipeline Contractors, 1953-1976; The Oil and Gas Journal, 1957-1976. Data was cross checked against Ownership data published in congressional hearings and prepared by the Association of Oil Pipe Lines and the Interstate Commerce Commission; the International Petroleum Register, 1966-67, Moody's Industrial Manual, selected annual issues, Moody's Transportation Manual, selected annual issues. Additional data came from a variety of sources, such as the Tulsa Daily World, Tulsa Tribune, and Prospectus and Annual Reports of Petroleum and Pipeline Companies.

[a]Percent ownership not available.

[b]System has three segments with varying percent ownership in each segment. Percents shown are average for the three segments.

TABLE B7

INTERSTATE JOINT VENTURE SYSTEMS THAT TRANSPORTED REFINED PRODUCTS IN THE UNITED STATES, DECEMBER 31, 1975

Joint Venture System, Participants, and Percent Ownership		Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
ATA PRODUCT SYSTEM			
Phillips Petroleum	33.3	Operated by Diamond Shamrock's subsidiary, West Emerald Pipeline Company.	296
Texaco	33.3		
Diamond Shamrock	33.3		
BAYOU PIPELINE SYSTEM			
Marathon Oil	33.8	In 1963, Standard of Indiana and Pure Oil sold their interest to the remaining four. System is leased and operated by Plantation Pipeline Company.	256
Crown Central	29.2		
Atlantic Richfield	21.5		
Shell Oil	15.5		
BORGER-DENVER PRODUCTS PIPELINE SYSTEM			
Phillips	81.1	Operated by Phillips Pipeline Co.	319
Diamond Shamrock	18.9		
CASA PRODUCTS PIPELINE SYSTEM		Atlantic Richfield's interest was held previously by Sinclair. Operated by ARCO Pipeline Co.	249
Gulf Oil	50.3		
Atlantic Richfield	49.7		
CROWN-SHELL-BAYTOWN FEEDER LINE			
Crown Central	65.7	Operated by Shell Pipeline Co.	14
Shell Oil	34.3		
EVANGELINE PIPELINE SYSTEM (as of 1957)			
Gulf	40.5	In 1957, this system tendered products to the Plantation Pipeline Co. The Texas Pipeline Co. was operator. No record after 1963.	196
Texas Company	23.7		
Sinclair	20.4		
Teche Pipeline Co.	15.3		
(Pure 68.0)			
(Cities Service 32.0)			

(Continued)

TABLE B7 (CONTINUED)

Joint Venture System, Participants, and Percent Ownership		Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
GROVES TO NEDERLAND, TEXAS PIPELINE SYSTEM		Operated by Atlantic Pipeline Co. (may no longer be in operation).	23
Atlantic Richfield	50.0		
Union Oil of CA	50.0		
HARBOR PRODUCTS		Standard of Ohio acquired part of interest previously held by Sinclair. Remaining interest was redistributed so that all participants held one-third interest. Operated by Sohio Pipeline Company.	81
Standard of Ohio	33.3		
Texaco	33.3		
Gulf Oil	33.3		
JAY PIPELINE SYSTEM		Operated by Exxon	9
Exxon	(a)		
Standard Oil of CA	(a)		
Sun Oil	(a)		
Louisiana Land & Expl. Company	(a)		
L & L PIPELINE SYSTEM		Operated by Buckeye	96
Buckeye Pipeline Co.	50.0		
Texas Eastern Transmission Corp	50.0		
MEDICINE BOW PRODUCTS		Prior to 1972, system was owned equally by Atlantic Richfield & Skelly Oil. Pasco acquired Atlantic Richfield's interest in 1972 & Skelly's in 1973 (may no longer be operating as a system).	205
Pasco Pipeline Co. (controlled by Studebaker-Worthington, Inc. in 1975)	100.0		
NEW HOPE SYSTEM		Operated by Texas Pipeline Co. (May no longer be in operation.)	42
Crown Central	50.0		
Texaco	50.0		
PORT ARTHUR PRODUCTS		Union of California holds interest previously held by Pure Oil. Operated by Texas Pipeline Company	Terminal Facilities
Texaco	43.4		
Gulf Oil	31.4		
Union of CA	25.2		

(Continued)

TABLE B7 (CONTINUED)

Joint Venture System, Participants, and Percent Ownership		Operating Agent and Significant Changes, 1957-75	Pipeline Mileage
PRODUCTS PIPELINE SYSTEM			
Texas Eastern Transmission Corp.	50.0	(May no longer be in operation.)	180
Mobil Oil	50.0		
SAAL PRODUCTS PIPELINE SYSTEM			
Phillips	33.3	Operated by Shamrock Pipeline Company (a subsidiary of Diamond Shamrock).	181
Diamond Shamrock	33.3		
Texaco	33.3		

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; USA Oil Directory, 1973-1976; Directory of Pipe Line Companies and Pipeline Contractors, 1953-1976; The Oil and Gas Journal, 1957-1976. Data was cross checked against ownership data published in congressional hearings and prepared by the Interstate Commerce Commission; data prepared by the Association of Oil Pipe Lines; the International Petroleum Register, 1966-67, Moody's Industrial Manual, selected annual issues, Moody's Transportation Manual, selected annual issues. Additional data came from a variety of sources, such as the Tulsa Daily World, Tulsa Tribune, and Prospectus and Annual Reports of Petroleum and Pipeline Companies.

[a]Percent ownership not available.

TABLE B8

INTRASTATE CORPORATE JOINT VENTURE PIPELINE COMPANIES IN THE UNITED STATES
DECEMBER 31, 1975 (includes both crude and product pipelines)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes 1957-75
ARBUCKLE PIPELINE COMPANY (Product only)				
Skelly (Getty)	66.7	Skelly	33.3	In 1973 Skelly increased its interest by purchase of Continental's 33.3%. Operated by Skelly Pipeline Co.
Sun	33.3	Sun	33.3	
		Continental	33.3	
CHANSLOR-WESTERN OIL AND DEVELOPMENT COMPANY (Product only)				
Atchison, Topeka & Santa Fe Railroad	50.0	Same		None
South Pacific	50.0			
CHASE PIPELINE COMPANY				
Kock Oil Co.	50.0	Same		None
Skelly (Getty)	50.0			
EVERGLADES PIPELINE COMPANY				
Buckeye	41.0	Buckeye	41.0	Change in ownership is the result of merger of parent companies only. Buckeye is operator.
Cities Service	39.0	Cities Service	39.0	
Union of California	10.0	Pure	10.0	
Phillips	10.0	Phillips	10.0	

(Continued)

TABLE B8 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975		Participants and Percent Ownership, 1957 or entry date		Significant Changes, 1957-75
INLAND CORPORATION (Product only)				
Standard of Ohio	46.8	Standard of Ohio	50.0	Sun Oil purchased a 10.0% interest in Corp. in 1967.
Shell	27.0	Shell	30.0	
Union Oil of California	16.2	Pure	20.0	
Sun Oil	10.0			
MASSACHUSETTS PIPELINE COMPANY (Product only)				
Exxon	66.7	Same		None
Shell	33.3			
MIAMI VALLEY				
Standard of Ohio	50.0	Standard of Ohio	80.0	Change in ownership is the result of the merger of Union and Pure and also the purchase of 30% from Standard of Ohio.
Union Oil of California	50.0	Pure	20.0	
OWENSBORO-ASHLAND CORPORATION (Crude gathering only)				
Ashland Oil	100.0	Ashland Oil	50.0	
		Standard Oil (Ohio)	50.0	In 1965 Ashland purchased Standard of Ohio's interest. In 1974 company began interstate operation.
PIPELINES OF PUERTO RICO (Product only)				
Shell Co. (P.R.), Ltd.	40.0	Same		None

(Continued)

TABLE B8 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes 1957-75
Pipelines of Puerto Rico Continued		
Texaco 40.0		
Commonwealth Oil and Refining. 20.0		
PROMIX (product only)		
Getty Oil 33.3	Same	None
Placid Oil 33.3		
Wanda Petroleum. 33.3		
SAN DIEGO PIPELINE COMPANY (Product only)	Same	None
Pacific Petroleum Pipeline Co. (Subsidiary of Southern Pacific) 50.0		
Chanslor-Western Oil and Development Co. (Subsidiary of Santa Fe). 50.0		
SLEEPING TURTLE (Crude only)		
Tenneco. 50.0	Same	None
CATC Group 50.0		
RIVER PIPELINE COMPANY		
American Petrofina 50.0	Same	None
Cosden Pension Plan. 50.0		

(Continued)

TABLE B8 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership, 1975	Participants and Percent Ownership, 1957 or entry date	Significant Changes, 1957-75
WASCANA PIPELINE COMPANY Reserve Oil & Gas . . . . . 33.3 Gibson Petroleum . . . . . 33.3 Murphy 33.3	Same	None

SOURCE: Data compiled from The Oil Record, 1956-1959; the Association of Oil Pipe Lines; Moody's Industrial Manual, selected annual issues; USA Oil Directory, 1973-1976; and The Oil and Gas Journal, 1957-1976.

TABLE B9

INTERSTATE PIPELINE COMPANIES THAT TRANSPORTED BOTH CRUDE PETROLEUM AND REFINED PRODUCTS IN THE UNITED STATES, 1957-1974

Pipeline Company & Parent Company[1]	Reason Pipeline Company No Longer Reports to The Interstate Commerce Commission
ATLANTIC PIPELINE COMPANY Atlantic Refining Co.	In 1966, Atlantic Refining and Richfield merged. Pipelines merged into ARCO Pipeline Co. in 1970.
INTERSTATE PIPELINE COMPANY Standard Oil of New Jersey	Merged into Humble Pipeline Co. in 1960.
MAGNOLIA PIPELINE COMPANY Socony Mobil Co.	Socony Mobil's central pipeline division merged into Pipeline Co. in 1959. Name changed to Mobil Pipeline Co.
NAVAJO REFINING COMPANY	Acquired facilities from Continental Pipeline Co. which was under court order to sell facilities. Has not filed ICC report since 1971.
OHIO OIL COMPANY (Pipeline Division) (Now Marathon Oil Co.)	Division was merged into Marathon Pipeline Co. in 1961.
SALT LAKE PIPELINE COMPANY Standard Oil of California	Merged into Chevron Pipeline Co. in 1966.
SERVICE PIPELINE COMPANY Standard Oil of Indiana	Named changed to Amoco Pipeline Co.
SHOSHONE PIPELINE COMPANY LTD	Tariffs adopted and cancelled by Husky Oil Co. in 1967.
SINCLAIR PIPELINE COMPANY Sinclair Oil Co.	Purchased Wheat Belt Pipeline Co. in 1961. Merged into ARCO Pipeline Co. in 1969.
SUN PIPELINE COMPANY OF ILLINOIS Sun Oil Co.	Sold to Sohio Pipeline Co. in 1964.

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; The International Petroleum Register, 1966-67; and Moody's Industrial Manual, selected annual issues.

[1]Unless noted, ownership is 100 percent.

TABLE B10

INTERSTATE PIPELINE COMPANIES THAT TRANSPORTED CRUDE OIL IN THE UNITED STATES, 1957-74

Pipeline Company & Parent Company[1]	Reason Pipeline Company No Longer Reports to The Interstate Commerce Commission
ARKANSAS PIPELINE CORPORATION Arkansas Fuel Oil Corp. (Cities Service)	Company merged into Cities Service in 1963.
BELL CREEK PIPELINE COMPANY (a)	Merged with Fairview Pipeline Co. and name changed to Wesco Pipeline Co. in 1972.
BIGHEART TRANSPORTATION COMPANY (a)	Relieved of filing in 1972 by ICC.
B.P. EASTERN PIPELINE COMPANY British Petroleum Co.	Tariffs of B.P. were adopted by Sohio Pipeline Co., 1-1-71.
CAL-KY PIPELINE COMPANY Standard Oil of California	Merged into Chevron Pipeline Co. in 1969.
FAIRVIEW PIPELINE COMPANY (a)	Merged with Bell Creek in 1969.
GENERAL AMERICAN PIPELINE CO. General American Oil Co.	No longer engaged in interstate commerce.
GREAT NORTHERN PIPELINE CO. (a)	Acquired by Portal Pipeline Co. in 1972.
ILLINOIS PIPELINE COMPANY OF TEXAS Ohio Oil Co. (Now Marathon Oil Co.)	Merged into Marathon Pipeline Co. in 1960.
NANTUCKET PIPELINE COMPANY Eastern States Petroleum Corp.	Nantucket Pipeline Co. facilities transferred to Acorn in 1971. Owned an undivided interest in the Rancho Pipeline System.
NEW YORK TRANSIT, INC. Buckeye Pipeline Co.	Merged into Buckeye in 1965.

(Continued)

TABLE B10 (CONTINUED)

Pipeline Company & Parent Company[1]	Reason Pipeline Company No Longer Reports to The Interstate Commerce Commission
NORTHERN PIPELINE CO. Buckeye Pipeline Co.	Merged into Buckeye in 1965.
PANOTEX PIPELINE COMPANY Western Crude Oil (Reserve Oil & Gas)	Merged into WESCO Pipeline Co. in 1974.
PLYMOUTH PIPELINE COMPANY Plymouth Oil Co.	Acquired by Ohio Oil Co. and name changed to Marathon Pipeline Co.
SOCONY MOBIL (CENTRAL PIPELINE DIVISION)	Merged into Magnolia Pipeline Co. (Now Mobil Pipeline Co.)
TIDAL PIPELINE COMPANY Tide water Oil Co. (Controlled by Getty Oil Co.)	(b)
TORONTO PIPELINE COMPANY British-American Oil Co.	Purchased by Gulf in 1967
UTE PIPELINE COMPANY Pure Oil Co.	Taken over by Pure Transportation Co. (Now part of Union Oil of California.)

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission. Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; The International Petroleum Register, 1966-67; and Moody's Industrial Manual, selected annual issues.

[a]Ownership is unknown.

[b]Reason is unknown.

TABLE B11

INTERSTATE CORPORATE JOINT VENTURE PIPELINE COMPANIES THAT TRANSPORTED CRUDE OIL IN THE UNITED STATES, 1957-74

Joint Venture Company, Participants, and Percent Ownership		Reason Pipeline Company No Longer Reports to Interstate Commerce Commission
BRADFORD TRANSIT COMPANY		
South Penn Oil Co.	50.0	Merged into National Transit in
Tidewater Oil Co.	50.0	1961.
GLACIER PIPELINE COMPANY		
Texaco	50.0	Continental purchased Texaco's
Continental	50.0	interest in 1964.
MUSKEGON PIPELINE COMPANY		
Standard of Indiana	50.0	Ohio Oil (now Marathon) purchased
Ohio Oil Co.	50.0	Standard's interest in 1960.

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; USA Oil Directory, 1973-1976; Directory of Pipe Line Companies and Pipeline Contractors, 1953-1976; The Oil and Gas Journal, 1957-1976. Data was cross checked against ownership data published in congressional hearings and prepared by the Interstate Commerce Commission; data prepared by the Association of Oil Pipe Lines; the International Petroleum Register, 1966-67, Moody's Industrial Manual selected annual issues, Moody's Transportation Manual, selected annual issues. Additional data came from a variety of sources, such as the Tulsa Daily World, Tulsa Tribune, and Prospectus and Annual Reports of Petroleum and Pipeline Companies.

TABLE B12

INTERSTATE PIPELINE COMPANIES THAT TRANSPORTED REFINED PRODUCTS IN THE UNITED STATES, 1957-74

Pipeline Company & Parent Company	Reason Pipeline Company No Longer Reports to The Interstate Commerce Commission
AMERICAN OIL PIPELINE COMPANY Standard Oil of Indiana	Formerly Fairfax Pipeline Co. Merged into Service Pipeline Co. (now Amoco Pipeline Co.) in 1959. Owned an undivided interest in Bayou operated by Shell Pipeline Co.
APCO PIPELINE COMPANY Anderson-Prichard Oil	Tariffs cancelled in April, 1958.
AUGUSTA PIPELINE COMPANY Publicly held	Acquired by Kaneb Pipeline Co. in 1960.
CENEX PIPELINE COMPANY Farmers Union Central Exchange, Inc.	Relieved of filing in 1971 by ICC.
CENTRAL FLORIDA PIPELINE CO. Independent	No longer reporting to ICC.
MID-CONTINENT PIPELINE CO. Sunray-Midcontinent	Unknown
TIDE-WATER PIPELINE CO. LTD. Tidewater Oil Co.	Tidewater was controlled by Getty. Activities transferred to Getty in 1969.
TUSCARORA PIPELINE COMPANY (In 1957 outstanding shares were in names of individuals who held stock in the interest of Esso Standard Oil Co.)	Purchased by Buckeye Pipeline Company in 1960.

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; The International Petroleum Register, 1966-67; and Moody's Industrial Manual, selected annual issues.

TABLE B13

INTERSTATE CORPORATE JOINT VENTURE PIPELINE COMPANIES THAT TRANSPORTED REFINED PRODUCTS IN THE UNITED STATES, 1957-74

Joint Venture Company, Participants, and Percent Ownership	Reason Pipeline Company No Longer Reports to Interstate Commerce Commission
CHEROKEE PIPELINE COMPANY (Both crude and product) Continental . . . . . 50.0 Cities Service. 50.0	Gulf purchased Cities Service's interest in 1966. In 1974 Continental purchased Gulf's interest in company. (Now operating as a system.)
DETROIT SOUTHERN PIPELINE CO. Pure. . . . . 51.0 Sun . . . . . 29.0 Gulf. 20.0	Pure purchased remaining 49% in 1965 and merged company. Now a part of the Union Oil of California's pipeline operations.
GREAT LAKES PIPELINE COMPANY Continental . . . . . 29.2 Sunray DX . . . . . 19.0 Skelly . . . . . 14.2 Texaco . . . . . 12.1 Union of California . . . 9.5 Sinclair. . . . . 5.9 Cities Service. . . . . 5.1 Phillips 5.0	Company was purchased by Williams Brothers Pipeline Co. in 1966. Debentures of Williams were initially held in same percent as was ownership in the Great Lakes Pipeline.
OKLAHOMA-MISSISSIPPI PRODUCT PIPELINE COMPANY, INC. Sunray Mid-Continent. . . 49.6 All Others 50.4	Merged into Sun Oil in 1972.
PROJECT FIVE PIPELINE COMPANY Gulf. . . . . 69.0 Socony Mobil . . . . . 24.0 Lion Oil Co. . . . . 5.0 Premier Oil Refining. . . 2.0	Merged into Texas Eastern Transmission Co. in 1959.
SOUTHEASTERN PIPELINE COMPANY Gulf. . . . . 52.5 Pure. 47.5	Common carrier status ended in 1963.

(Continued)

TABLE B13 (CONTINUED)

Joint Venture Company, Participants, and Percent Ownership	Reason Pipeline Company No Longer Reports to Interstate Commerce Commission
SOUTHERN PIPELINE COMPANY	No records after 1963.
Ashland 42.0	
Unknown 58.0	
TECHE PIPELINE COMPANY	
Pure 68.0	Unknown
Cities Service. 32.0	
WABASH PIPELINE COMPANY	Merged into Marathon Oil (formerly
Ohio Oil Co. 75.0	the Ohio Oil Co.) in 1972.
Continental 25.0	
WYOMING-NEBRASKA PIPELINE CO.	Company purchased by Nielson
Frontier Refining 51.0	Enterprise and name changed to the
Others 49.0	Cheyenne Pipeline Co. in 1965.

SOURCE: Data compiled from The Oil Record, 1956-1959; the Interstate Commerce Commission, Valuation Dockets, 1973 and Transport Statistics in the United States, Part 6: Pipelines, 1957-1975; USA Oil Directory, 1953-1976; The Oil and Gas Journal, 1957-1976. Data was cross checked by the Association of Oil Pipe Lines; the International Petroleum Register, 1966-67, Moody's Industrial Manual, selected annual issues, Moody's Transportation Manual, selected annual issues. Additional data came from a variety of sources, such as the Tulsa Daily World, Tulsa Tribune, and Prospectus and Annual Reports of Petroleum and Pipeline Companies.

APPENDIX C

TABLE C1

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF CRUDE OIL BY JOINT VENTURE CORPORATIONS, 1957

	1. STANDARD OIL (NJ)	2. SOCONY MOBIL	3. GULF	4. TEXAS CO.	5. STANDARD OIL (IN)	6. SHELL	7. STANDARD OIL (CA)	8. SINCLAIR	9. PHILLIPS	10. CITIES SERVICE	11. SUN	12. CONTINENTAL	13. TIDEWATER	14. ATLANTIC REFINING	15. PURE OIL	16. UNION OIL OF CALIFORNIA	17. STANDARD OIL (OHIO)	18. SUNRAY MID-CONTINENT	19. ASHLAND OIL	20. OHIO OIL	21. SKELLY OIL	22. RICHFIELD OIL	23. PLYMOUTH OIL	24. AMERADA PETROLEUM	25. KERR MC GEE	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. STANDARD OIL (NJ)																												
2. SOCONY MOBIL																												
3. GULF	3																											3
4. TEXAS CO.	1		1																									2
5. STANDARD OIL (IN)	1		1																									2
6. SHELL	3		3	1	1																							8
7. STANDARD OIL (CA)	1		1																									2
8. SINCLAIR			1	1																								2
9. PHILLIPS				1																								1
10. CITIES SERVICE			1	2				1	1																			5
11. SUN			2																									2
12. CONTINENTAL			1			1		1																				3
13. TIDEWATER				1				1		1																		3
14. ATLANTIC REFINING																												
15. PURE OIL			2					3		1	1	1																8
16. UNION OIL OF CALIFORNIA	1		1			1																						4
17. STANDARD OIL (OHIO)			2							1	2				1													6
18. SUNRAY MID-CONTINENT																												
19. ASHLAND OIL								1							1		1											3
20. OHIO OIL			1		1			1				1			1													5
21. SKELLY OIL																												
22. RICHFIELD OIL	1		1			1	1																					4
23. PLYMOUTH OIL																												
24. AMERADA PETROLEUM																												
25. KERR MC GEE																												
ALL OTHER PETROLEUM CO	2		2	1		3	1			4		1	1									1						16
NON PETROLEUM						1						1																2
GRAND TOTAL	13		20	7	2	7	3	8	1	7	3	4	1		3		1					1						81

SOURCE: Compiled from data in Appendix B.

TABLE C2

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF CRUDE OIL BY JOINT VENTURE CORPORATIONS, 1975

	1. EXXON	2. TEXACO	3. MOBIL	4. STANDARD OIL (CA)	5. GULF	6. STANDARD OIL (IN)	7. SHELL	8. ATLANTIC RICHFIELD	9. CONTINENTAL	10. PHILLIPS	11. UNION OIL OF CALIFORNIA	12. SUN	13. ASHLAND	14. CITIES SERVICE	15. AMERADA HESS	16. GETTY OIL[1]	17. MARATHON OIL	18. STANDARD OIL (OHIO)[2]	19. KERR MC GEE	20. DIAMOND SHAMROCK	21. PENNZOIL	22. CHARTER	23. AMERICAN PETROFINA[3]	24. MURPHY OIL	25. TESORO PETROLEUM	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. EXXON																												
2. TEXACO	1																											1
3. MOBIL																												
4. STANDARD OIL (CA)	1																											1
5. GULF	3			2																								6
6. STANDARD OIL (IN)	2			1	2																							5
7. SHELL	3	1		2	4	2																						12
8. ATLANTIC RICHFIELD		1	1	2	2		1																					7
9. CONTINENTAL				1	2		2	2																				7
10. PHILLIPS		1																										1
11. UNION OIL OF CALIFORNIA			1		2	1		4	1																			9
12. SUN			1		1						1																	3
13. ASHLAND								1			1																	2
14. CITIES SERVICE		2			1			1		1	1	1																7
15. AMERADA HESS																												
16. GETTY OIL[1]		1	2					1				1		1														6
17. MARATHON OIL			1		1			2	1		2																	7
18. STANDARD OIL (OHIO)[2]	1	1			2						1	2		1														8
19. KERR MC GEE			1									1				1												3
20. DIAMOND SHAMROCK																												
21. PENNZOIL																												
22. CHARTER																												
23. AMERICAN PETROFINA[3]	1	1	1		1											1		1										6
24. MURPHYOIL							1		1																			2
25. TESORO PETROLEUM																												
ALL OTHER PETROLEUM CO.	2		5	2	3	3	3	2	2		1	5	7			5			7		1							48
NON PETROLEUM			2				1		1		1	1	1			2			2		3		1			2		17
GRAND TOTAL	14	9	15	10	21	6	8	13	6	1	8	11	8	2		9		1	9		4		1			2		158

SOURCE: Compiled from data in Appendix B.

TABLE C3

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF CRUDE OIL BY JOINT VENTURE SYSTEMS, 1957

	1. STANDARD OIL (NJ)	2. SOCONY MOBIL	3. GULF	4. TEXAS CO.	5. STANDARD OIL (IN)	6. SHELL	7. STANDARD OIL (CA)	8. SINCLAIR	9. PHILLIPS	10. CITIES SERVICE	11. SUN	12.CONTINENTAL	13. TIDEWATER	14. ATLANTIC REFINING	15. PURE OIL	16. UNION OIL OF CALIFORNIA	17. STANDARD OIL (OHIO)	18. SUNRAY MID-CONTINENT	19. ASHLAND OIL	20. OHIO OIL	21. SKELLY OIL	22. RICHFIELD OIL	23. PLYMOUTH OIL	24. AMERADA PETROLEUM	25. KERR MC GEE	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. STANDARD OIL (NJ)																												
2. SOCONY MOBIL																												
3. GULF																												
4. TEXAS CO.																												
5. STANDARD OIL (IN)																												
6. SHELL			1	2	1																							4
7. STANDARD OIL (CA)																												
8. SINCLAIR			1	1	1	3																						6
9. PHILLIPS					1	1		1																				3
10. CITIES SERVICE			1	2		1		1																				5
11. SUN			1							1																		2
12.CONTINENTAL																												
13. TIDEWATER																												
14. ATLANTIC REFINING																												
15. PURE OIL			2			1		2		1	1																	7
16. UNION OIL OF CALIFORNIA																												
17. STANDARD OIL (OHIO)			1							1	1					1												4
18. SUNRAY MID-CONTINENT																												
19. ASHLAND OIL					1	1		1																				3
20. OHIO OIL																												
21. SKELLY OIL																												
22. RICHFIELD OIL																												
23. PLYMOUTH OIL																												
24. AMERADA PETROLEUM																												
25. KERR MC GEE																												
ALL OTHER PETROLEUM CO				2	2	2		2	2	1									2									13
NON PETROLEUM																												
GRAND TOTAL			7	7	6	9		7	2	4	2					1			2									47

SOURCE: Compiled from data in Appendix B.

TABLE C4

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF CRUDE OIL BY JOINT VENTURE SYSTEMS, 1975

	1. EXXON	2. TEXACO	3. MOBIL	4. STANDARD OIL (CA)	5. GULF	6. STANDARD OIL (IN)	7. SHELL	8. ATLANTIC RICHFIELD	9. CONTINENTAL	10. PHILLIPS	11. UNION OIL OF CALIFORNIA	12. SUN	13. ASHLAND	14. CITIES SERVICE	15. AMERADA HESS	16. GETTY OIL[1]	17. MARATHON OIL	18. STANDARD OIL (OHIO)[2]	19. KERR MC GEE	20. DIAMOND SHAMROCK	21. PENNZOIL	22. CHARTER	23. AMERICAN[3] PETROFINA	24. MURPHY OIL	25. TESORO PETROLEUM	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. EXXON																												
2. TEXACO																												
3. MOBIL	1	1																										2
4. STANDARD OIL (CA)		1																										1
5. GULF		1	1																									2
6. STANDARD OIL (IN)		1																										1
7. SHELL		3			1	2																						6
8. ATLANTIC RICHFIELD	1	1	1		1	1	3																					8
9. CONTINENTAL		1	1		1																							3
10. PHILLIPS	1		1			1	1	2																				6
11. UNION OIL OF CALIFORNIA	1	2	2		3	1	3	1	1	1																		15
12. SUN		2	1		2	1	1		1		2																	10
13. ASHLAND		1				2	2	1		1	1	1																9
14. CITIES SERVICE		3	1		2		1	1	1		2	2																13
15. AMERADA HESS	1		1					1		1	1																	5
16. GETTY OIL[1]																												
17. MARATHON OIL		3	1		1	1	1		1		2	2	1	1	1													15
18. STANDARD OIL (OHIO)[2]	1	1	1		1	1	1	1		1	3	2	1	1	1		1											17
19. KERR MC GEE																												
20. DIAMOND SHAMROCK																												
21. PENNZOIL																												
22. CHARTER						1	1	1		1			1															5
23. AMERICAN[3] PETROFINA																		2										2
24. MURPHYOIL																												
25. TESORO PETROLEUM																												
ALL OTHER PETROLEUM CO.		4	1		1	3	4	1	2	1	5	2	2	2			2	1										32
NON PETROLEUM																												
GRAND TOTAL	6	25	12		13	14	18	9	6	6	16	9	5	4	2		3	3			1							152

SOURCE: Compiled from data in Appendix B.

TABLE C5

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF REFINED PRODUCTS BY JOINT VENTURE CORPORATIONS, 1957

	1. STANDARD OIL (NJ)	2. SOCONY MOBIL	3. GULF	4. TEXAS CO.	5. STANDARD OIL (IN)	6. SHELL	7. STANDARD OIL (CA)	8. SINCLAIR	9. PHILLIPS	10. CITIES SERVICE	11. SUN	12.CONTINENTAL	13. TIDEWATER	14. ATLANTIC REFINING	15. PURE OIL	16. UNION OIL OF CALIFORNIA	17. STANDARD OIL (OHIO)	18. SUNRAY MID-CONTINENT	19. ASHLAND OIL	20. OHIO OIL	21. SKELLY OIL	22. RICHFIELD OIL	23. PLYMOUTH OIL	24. AMERADA PETROLEUM	25. KERR MC GEE	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. STANDARD OIL (NJ)																												
2. SOCONY MOBIL																												
3. GULF		1																										1
4. TEXAS CO.		1																										1
5. STANDARD OIL (IN)		1		1																								2
6. SHELL	1			1																								2
7. STANDARD OIL (CA)																												
8. SINCLAIR				2																								2
9. PHILLIPS				1				1																				2
10. CITIES SERVICE				4		1		2	1																			8
11. SUN			1																									1
12.CONTINENTAL	1			1				2	1	2																		7
13. TIDEWATER																												
14. ATLANTIC REFINING																												
15. PURE OIL			2	1				1		2	1																	7
16. UNION OIL OF CALIFORNIA	1			1				1	1	1		2																7
17. STANDARD OIL (OHIO)																												
18. SUNRAY MID-CONTINENT				1				1	1	1		1				1												6
19. ASHLAND OIL																												
20. OHIO OIL																												
21. SKELLY OIL				1				1	1	1		1				1		1										7
22. RICHFIELD OIL																												
23. PLYMOUTH OIL																												
24. AMERADA PETROLEUM																												
25. KERR MC GEE																												
ALL OTHER PETROLEUM CO	2	2	2			1						1				1		1	1									11
NON PETROLEUM																												
GRAND TOTAL	5	5	5	14		2		9	5	7	1	5				3		2	1									64

SOURCE: Compiled from data in Appendix B.

TABLE C6

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF REFINED PRODUCTS BY JOINT VENTURE CORPORATIONS, 1975

	1. EXXON	2. TEXACO	3. MOBIL	4. STANDARD OIL (CAL)	5. GULF	6. STANDARD OIL (IN)	7. SHELL	8. ATLANTIC RICHFIELD	9. CONTINENTAL	10. PHILLIPS	11. UNION OIL OF CALIFORNIA	12. SUN	13. ASHLAND	14. CITIES SERVICE	15. AMERADA HESS	16. GETTY OIL[1]	17. MARATHON OIL	18. STANDARD[2] OIL (OHIO)	19. KERR MC GEE	20. DIAMOND SHAMROCK	21. PENNZOIL	22. CHARTER	23. AMERICAN[3] PETROFINA	24. MURPHY OIL	25. TESORO PETROLEUM	ALL OTHER PETROLEUM CO.	NON PETROLEUM	GRAND TOTAL
1. EXXON																												
2. TEXACO	2																											2
3. MOBIL	2	6																										8
4. STANDARD OIL (CA)	1																											1
5. GULF	1	4	2																									7
6. STANDARD OIL (IN)	2	4	4		2																							12
7. SHELL	3	5	4	1	2	2																						17
8. ATLANTIC RICHFIELD	1	3	2		2	2	1																					11
9. CONTINENTAL	3	4	3		3	3	3	2																				21
10. PHILLIPS	1	3	2		3	2	2	2	3																			18
11. UNION OIL OF CALIFORNIA	2	4	3		1	2	2	2	3	1																		20
12. SUN		1			1		1		1	1																		5
13. ASHLAND																												
14. CITIES SERVICE	2	7	4		3	3	4	3	5	3	4	1																39
15. AMERADA HESS																												
16. GETTY OIL[1]																												
17. MARATHON OIL	1	3	2		1	1	3		2	1	2	1		3														20
18. STANDARD[2] OIL (OHIO)		2	1		2	1		1	1	1	1			1														11
19. KERR MC GEE																												
20. DIAMOND SHAMROCK																												
21. PENNZOIL																												
22. CHARTER																												
23. AMERICAN[3] PETROFINA																												
24. MURPHYOIL																												
25. TESORO PETROLEUM																												
ALL OTHER PETROLEUM CO.	2	4	3		2	2	4	1	4	2	2	1		4			3								1			35
NON PETROLEUM	1	1	1		1	1	1	1	1	1				1		1										1		12
GRAND TOTAL	24	51	31	1	23	19	21	12	20	10	9	3		9		1	3								1		1	239

SOURCE: Compiled from data in Appendix B.

TABLE C7

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF REFINED PRODUCTS BY JOINT VENTURE SYSTEMS, 1957

	1. STANDARD OIL (NJ)	2. SOCONY MOBIL	3. GULF	4. TEXAS CO.	5. STANDARD OIL (IN)	6. SHELL	7. STANDARD OIL (CA)	8. SINCLAIR	9. PHILLIPS	10. CITIES SERVICE	11. SUN	12.CONTINENTAL	13. TIDEWATER	14. ATLANTIC REFINING	15. PURE OIL	16. UNION OIL OF CALIFORNIA	17. STANDARD OIL (OHIO)	18. SUNRAY MID-CONTINENT	19. ASHLAND OIL	20. OHIO OIL	21. SKELLY OIL	22. RICHFIELD OIL	23. PLYMOUTH OIL	24. AMERADA PETROLEUM	25. KERR MC GEE	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. STANDARD OIL (NJ)																												
2. SOCONY MOBIL																												
3. GULF																												
4. TEXAS CO.			2																									2
5. STANDARD OIL (IN)																												
6. SHELL					1																							1
7. STANDARD OIL (CA)																												
8. SINCLAIR			3	2																								5
9. PHILLIPS				1																								1
10. CITIES SERVICE			1	1				1																				3
11. SUN																												
12.CONTINENTAL																												
13. TIDEWATER																												
14. ATLANTIC REFINING					1	1																						2
15. PURE OIL			1	1	1	1		1		1				1														7
16. UNION OIL OF CALIFORNIA																												
17. STANDARD OIL (OHIO)																												
18. SUNRAY MID-CONTINENT																												
19. ASHLAND OIL																												
20. OHIO OIL																												
21. SKELLY OIL																												
22. RICHFIELD OIL																												
23. PLYMOUTH OIL					1	1								1	1													4
24. AMERADA PETROLEUM																												
25. KERR MC GEE																												
ALL OTHER PETROLEUM CO		1		1	1	1			1					1	1							1						8
NON PETROLEUM																												
GRAND TOTAL		1	7	6	5	4		2	1	1				3	2							1						33

SOURCE: Compiled from data in Appendix B.

TABLE C8

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTERSTATE TRANSPORTATION OF REFINED PRODUCTS BY JOINT VENTURE SYSTEMS, 1975

	1. EXXON	2. TEXACO	3. MOBIL	4. STANDARD OIL (CA)	5. GULF	6. STANDARD OIL (IN)	7. SHELL	8. ATLANTIC RICHFIELD	9. CONTINENTAL	10. PHILLIPS	11. UNION OIL OF CALIFORNIA	12. SUN	13. ASHLAND	14. CITIES SERVICE	15. AMERADA HESS	16. GETTY OIL[1]	17. MARATHON OIL	18. STANDARD OIL (OHIO)[2]	19. KERR MC GEE	20. DIAMOND SHAMROCK	21. PENNZOIL	22. CHARTER	23. AMERICAN[3] PETROFINA	24. MURPHY OIL	25. TESORO PETROLEUM	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. EXXON																												
2. TEXACO																												
3. MOBIL																												
4. STANDARD OIL (CA)	1																											1
5. GULF		3																										3
6. STANDARD OIL (IN)																												
7. SHELL																												
8. ATLANTIC RICHFIELD		1			2		1																					4
9. CONTINENTAL																												
10. PHILLIPS		2																										2
11. UNION OIL OF CALIFORNIA		2			2			2																				6
12. SUN	1			1																								2
13. ASHLAND																												
14. CITIES SERVICE		1			1			1			1																	4
15. AMERADA HESS																												
16. GETTY OIL[1]																												
17. MARATHON OIL							1	1																				2
18. STANDARD OIL (OHIO)[2]		1			1																							2
19. KERR MC GEE																												
20. DIAMOND SHAMROCK		2								3																		5
21. PENNZOIL																												
22. CHARTER																												
23. AMERICAN[3] PETROFINA																												
24. MURPHYOIL																												
25. TESORO PETROLEUM																												
ALL OTHER PETROLEUM CO.	1	1		1			2	1				1					1											8
NON PETROLEUM			1																									1
GRAND TOTAL	3	13	1	2	6		4	5		3	1	1					1											40

SOURCE: Compiled from data in Appendix B.

TABLE C9

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTRASTATE TRANSPORTATION OF CRUDE AND REFINED PRODUCTS BY JOINT VENTURE CORPORATIONS, 1957

	1. STANDARD OIL (NJ)	2. SOCONY MOBIL	3. GULF	4. TEXAS CO.	5. STANDARD OIL (IN)	6. SHELL	7. STANDARD OIL (CA)	8. SINCLAIR	9. PHILLIPS	10. CITIES SERVICE	11. SUN	12. CONTINENTAL	13. TIDEWATER	14. ATLANTIC REFINING	15. PURE OIL	16. UNION OIL OF CALIFORNIA	17. STANDARD OIL (OHIO)	18. SUNRAY MID-CONTINENT	19. ASHLAND OIL	20. OHIO OIL	21. SKELLY OIL	22. RICHFIELD OIL	23. PLYMOUTH OIL	24. AMERADA PETROLEUM	25. KERR MC GEE	ALL OTHER PETROLEUM CO	NON PETROLEUM	GRAND TOTAL
1. STANDARD OIL (NJ)																												
2. SOCONY MOBIL																												
3. GULF																												
4. TEXAS CO.																												
5. STANDARD OIL (IN)																												
6. SHELL																												
7. STANDARD OIL (CA)																												
8. SINCLAIR																												
9. PHILLIPS																												
10. CITIES SERVICE									1																			1
11. SUN																												
12. CONTINENTAL											1																	1
13. TIDEWATER																												
14. ATLANTIC REFINING																												
15. PURE OIL						1			1	1																		3
16. UNION OIL OF CALIFORNIA																												
17. STANDARD OIL (OHIO)						1									2													3
18. SUNRAY MID-CONTINENT																												
19. ASHLAND OIL																	1											1
20. OHIO OIL																												
21. SKELLY OIL											1	1																2
22. RICHFIELD OIL																												
23. PLYMOUTH OIL																												
24. AMERADA PETROLEUM																												
25. KERR MC GEE																												
ALL OTHER PETROLEUM CO									1	1																		2
NON PETROLEUM																												
GRAND TOTAL						2			3	2	2	1			2		1											13

SOURCE: Compiled from data in Appendix B.

TABLE C10

NUMBER OF JOINT INTERLOCKING OWNERSHIP ARRANGEMENTS IN THE INTRASTATE TRANSPORTATION OF CRUDE AND REFINED PRODUCTS BY JOINT VENTURE CORPORATIONS, 1975

	1. EXXON	2. TEXACO	3. MOBIL	4. STANDARD OIL (CA)	5. GULF	6. STANDARD OIL (IN)	7. SHELL	8. ATLANTIC RICHFIELD	9. CONTINENTAL	10. PHILLIPS	11. UNION OIL OF CALIFORNIA	12. SUN	13. ASHLAND	14. CITIES SERVICE	15. AMERADA HESS	16. GETTY OIL[1]	17. MARATHON OIL	18. STANDARD OIL (OHIO)[2]	19. KERR MC GEE	20. DIAMOND SHAMROCK	21. PENNZOIL	22. CHARTER	23. AMERICAN PETROFINA[3]	24. MURPHY OIL	25. TESORO PETROLEUM	ALL OTHER PETROLEUM CO.	NON PETROLEUM	GRAND TOTAL
1. EXXON																												
2. TEXACO																												
3. MOBIL																												
4. STANDARD OIL (CA)																												
5. GULF																												
6. STANDARD OIL (IN)				1																								1
7. SHELL	1	1		1		1																						4
8. ATLANTIC RICHFIELD				1		2	1																					4
9. CONTINENTAL																												
10. PHILLIPS				1		2	1	2																				6
11. UNION OIL OF CALIFORNIA		1					1			1																		3
12. SUN							1				1																	2
13. ASHLAND																												
14. CITIES SERVICE										1	1																	2
15. AMERADA HESS																												
16. GETTY OIL[1]						1		1		1		1																4
17. MARATHON OIL			1								1																	2
18. STANDARD OIL (OHIO)[2]							1				2	1	1															5
19. KERR MC GEE																												
20. DIAMOND SHAMROCK																												
21. PENNZOIL																												
22. CHARTER																												
23. AMERICAN PETROFINA[3]																												
24. MURPHYOIL																												
25. TESORO PETROLEUM																												
ALL OTHER PETROLEUM CO.		2					1			1	2			1		2	1								1	2		13
NON PETROLEUM																												
GRAND TOTAL	1	5		4		6	6	3		4	7	2	1	1		2	1							1	2			46

SOURCE: Compiled from data in Appendix B.

APPENDIX D

TABLE D1

JOINT VENTURE COMPANIES
OPERATING PIPELINE MILEAGE

YEAR	GRAND TOTAL	TRUNK LINES		GATHERING LINES	OTHER THAN OWNED
		CRUDE	PRODUCT		
57	35293.	12196.	12757.	10259.	81.
58	36882.	12943.	13371.	10467.	81.
59	37663.	12924.	14219.	10440.	80.
60	37843.	13059.	14160.	10541.	83.
61	39348.	13271.	14622.	11372.	83.
62	40749.	13720.	15976.	10971.	83.
63	42980.	14064.	17593.	11240.	83.
64	44399.	14020.	19046.	11250.	83.
65	44976.	14268.	19410.	11296.	2.
66	45749.	14284.	19622.	11841.	2.
67	40001.	14747.	13422.	11830.	2.
68	41235.	15613.	13960.	11660.	2.
69	41494.	15915.	14210.	11369.	0.
70	41659.	15940.	14458.	11258.	3.
71	41838.	15783.	15331.	10724.	0.
72	41287.	15244.	16976.	9067.	0.
73	39303.	15306.	15827.	8170.	0.
74	40394.	14942.	17044.	8408.	0.
75	38462.	14913.	15538.	8011.	0.

SOURCE: INTERSTATE COMMERCE COMMISSION. "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES." WASHINGTON: U.S. GOVERMENT PRINTING OFFICE, ANNUALLY.

TABLE D2

JOINT VENTURE COMPANIES
(SHARE OF TOTAL MARKET (TOTAL=1.0))
OPERATING PIPELINE MILEAGE

YEAR	GRAND TOTAL	TRUNK LINES		GATHERING LINES	OTHER THAN OWNED
		CRUDE	PRODUCT		
57	0.246	0.210	0.422	0.200	0.020
58	0.258	0.222	0.429	0.213	0.019
59	0.254	0.219	0.397	0.212	0.019
60	0.251	0.221	0.370	0.215	0.019
61	0.258	0.224	0.368	0.232	0.019
62	0.266	0.233	0.376	0.231	0.019
63	0.277	0.240	0.389	0.241	0.017
64	0.281	0.233	0.403	0.243	0.018
65	0.281	0.235	0.399	0.246	0.000
66	0.272	0.240	0.349	0.254	0.000
67	0.244	0.242	0.261	0.252	0.000
68	0.246	0.253	0.262	0.249	0.000
69	0.246	0.257	0.255	0.247	0.0
70	0.242	0.253	0.255	0.241	0.001
71	0.246	0.259	0.266	0.233	0.0
72	0.244	0.255	0.276	0.211	0.0
73	0.237	0.267	0.256	0.196	0.0
74	0.239	0.263	0.260	0.202	0.0
75	0.229	0.261	0.244	0.200	0.0

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES." ANNUALLY.

TABLE D3

JOINT VENTURE COMPANIES

SELECTED PHYSICAL OPERATING DATA (IN 1000S OF BARRELS)

	TOTAL INPUT		ORIGINATED		PERCENT ORIGINATED		TOTAL OUTPUT		TERMINATED		PERCENT TERMINATED	
YEAR	CRUDE	PRODUCT	CRUDE	PRODUCT	CRUDE	PRODUCT	CRUDE	PRODUCT	CRUDE	PRODUCT	CRUDE	PRODUCT
57	813438.	331680.	404891.	221133.	0.50	0.67	808988.	327053.	321733.	303474.	0.40	0.93
58	786086.	340297.	410053.	231787.	0.52	0.68	785244.	340455.	339505.	314255.	0.43	0.92
59	846492.	391533.	460129.	277912.	0.54	0.71	859336.	389197.	379443.	349513.	0.44	0.90
60	849612.	390629.	461696.	265893.	0.54	0.68	858065.	390432.	380096.	347523.	0.44	0.89
61	912585.	407081.	525998.	278585.	0.58	0.68	909809.	406033.	422587.	358422.	0.46	0.88
62	949276.	458994.	556144.	325473.	0.59	0.71	939038.	456236.	436898.	404701.	0.47	0.89
63	1003814.	488694.	602486.	357104.	0.60	0.73	1004021.	477860.	477747.	427877.	0.48	0.90
64	1110282.	596367.	638810.	501360.	0.63	0.84	1009163.	588383.	495226.	532959.	0.49	0.91
65	1332819.	757307.	656788.	648161.	0.64	0.86	1033024.	756636.	517816.	635037.	0.50	0.84
66	1094503.	739844.	711417.	647226.	0.65	0.87	1091596.	741859.	566429.	645436.	0.52	0.87
67	1134457.	830818.	742734.	720852.	0.65	0.87	1131037.	829364.	613935.	713542.	0.54	0.86
68	1251347.	952005.	832229.	813256.	0.67	0.85	1245798.	950213.	679697.	810379.	0.55	0.85
69	1369660.	993271.	878206.	853435.	0.64	0.86	1365078.	991179.	733616.	848149.	0.54	0.86
70	1513192.	1037519.	970948.	892928.	0.64	0.86	1509809.	1036629.	818368.	886012.	0.54	0.85
71	1565230.	1095586.	1008106.	940479.	0.64	0.86	1565365.	1093769.	849613.	955119.	0.54	0.87
72	1658060.	1223007.	1076806.	1030718.	0.65	0.84	1669335.	1219739.	931938.	1054704.	0.56	0.86
73	1837301.	1336332.	1141754.	1125577.	0.62	0.84	1834411.	1335194.	902450.	1136887.	0.49	0.85
74	1752871.	1289803.	1058729.	1076192.	0.60	0.83	1749021.	1289761.	879642.	1077124.	0.50	0.84
75	1682731.	1264485.	1031995.	1079385.	0.61	0.85	1676749.	1265297.	859450.	1057787.	0.51	0.84

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6. PIPELINES," ANNUALLY.

TABLE D4

JOINT VENTURE COMPANIES
(SHARE OF TOTAL MARKET (TOTAL=1.0))
SELECTED PHYSICAL OPERATING DATA

	TOTAL INPUT		ORIGINATED		TOTAL OUTPUT		TERMINATED	
YEAR	CRUDE	PRODUCT	CRUDE	PRODUCT	CRUDE	PRODUCT	CRUDE	PRODUCT
57	0.223	0.402	0.186	0.337	0.223	0.399	0.147	0.442
58	0.233	0.366	0.204	0.309	0.233	0.365	0.167	0.408
59	0.236	0.373	0.213	0.331	0.239	0.372	0.173	0.420
60	0.234	0.351	0.207	0.298	0.235	0.351	0.169	0.396
61	0.245	0.340	0.226	0.290	0.245	0.324	0.182	0.380
62	0.251	0.346	0.234	0.303	0.249	0.345	0.181	0.393
63	0.258	0.341	0.244	0.303	0.257	0.337	0.189	0.376
64	0.254	0.374	0.249	0.364	0.254	0.370	0.191	0.412
65	0.258	0.407	0.251	0.399	0.258	0.407	0.196	0.433
66	0.260	0.364	0.252	0.365	0.260	0.365	0.200	0.395
67	0.254	0.359	0.246	0.358	0.252	0.356	0.200	0.382
68	0.265	0.373	0.260	0.370	0.264	0.373	0.213	0.400
69	0.272	0.367	0.258	0.369	0.271	0.366	0.220	0.392
70	0.286	0.363	0.272	0.365	0.296	0.363	0.233	0.385
71	0.296	0.364	0.287	0.363	0.295	0.362	0.241	0.387
72	0.303	0.365	0.298	0.359	0.303	0.365	0.251	0.390
73	0.321	0.367	0.313	0.362	0.319	0.369	0.244	0.393
74	0.305	0.363	0.297	0.354	0.305	0.362	0.239	0.379
75	0.297	0.348	0.296	0.345	0.297	0.349	0.243	0.364

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES," ANNUALLY.

TABLE D5

JOINT VENTURE COMPANIES

SELECTED PHYSICAL AND FINANCIAL OPERATING RATIOS

YEAR	AVERAGE MILES BARREL SHIPPED		AVERAGE REVENUE PER BARREL MILE			AVERAGE EXPENSE PER BARREL MILE			GROSS-INCOME PER BARREL MILE		
	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT
57	368.9	412.7	0.00049	0.0	0.0	0.00022	0.0	0.0	0.00028	0.0	0.0
58	384.6	409.7	0.00052	0.0	0.0	0.00023	0.0	0.0	0.00029	0.0	0.0
59	389.8	387.3	0.00051	0.0	0.0	0.00022	0.0	0.0	0.00029	0.0	0.0
60	383.0	392.9	0.00051	0.0	0.0	0.00022	0.0	0.0	0.00029	0.0	0.0
61	387.8	386.0	0.00049	0.0	0.0	0.00022	0.0	0.0	0.00027	0.0	0.0
62	381.1	372.8	0.00050	0.0	0.0	0.00023	0.0	0.0	0.00027	0.0	0.0
63	383.7	377.9	0.00049	0.0	0.0	0.00022	0.0	0.0	0.00027	0.0	0.0
64	386.1	447.5	0.00045	0.00038	0.00057	0.00025	0.00019	0.00033	0.00021	0.00019	0.00024
65	394.1	554.3	0.00041	0.00038	0.00044	0.00021	0.00019	0.00022	0.00021	0.00019	0.00022
66	389.9	621.3	0.00037	0.00035	0.00038	0.00018	0.00018	0.00018	0.00019	0.00017	0.00020
67	396.9	666.0	0.00034	0.00034	0.00034	0.00017	0.00018	0.00016	0.00017	0.00016	0.00018
68	381.7	662.7	0.00032	0.00034	0.00031	0.00017	0.00018	0.00016	0.00015	0.00015	0.00014
69	363.2	660.9	0.00032	0.00035	0.00030	0.00017	0.00019	0.00016	0.00015	0.00016	0.00014
70	374.2	639.6	0.00033	0.00034	0.00032	0.00017	0.00018	0.00016	0.00016	0.00016	0.00015
71	391.8	614.4	0.00034	0.00034	0.00035	0.00018	0.00018	0.00018	0.00016	0.00016	0.00017
72	385.2	611.6	0.00034	0.00033	0.00034	0.00019	0.00018	0.00019	0.00015	0.00015	0.00015
73	397.5	602.9	0.00034	0.00033	0.00035	0.00019	0.00018	0.00020	0.00015	0.00015	0.00015
74	405.1	620.2	0.00037	0.00034	0.00040	0.00021	0.00020	0.00021	0.00016	0.00014	0.00018
75	393.5	636.0	0.00044	0.00040	0.00048	0.00023	0.00022	0.00024	0.00021	0.00018	0.00025

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES." (ANNUAL).

TABLE D6

JOINT VENTURE COMPANIES

SELECTED FINANCIAL DATA (IN 1000$)

	OPERATING REVENUE			OPERATING EXPENSE			GROSS INCOME		
YEAR	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT
57	213400.	0.	0.	94176.	0.	0.	119224.	0.	0.
58	228647.	0.	0.	101727.	0.	0.	126920.	0.	0.
59	249114.	0.	0.	108821.	0.	0.	140293.	0.	0.
60	245263.	0.	0.	107744.	0.	0.	137519.	0.	0.
61	250285.	0.	0.	114312.	0.	0.	135973.	0.	0.
62	261516.	0.	0.	120081.	0.	0.	141436.	0.	0.
63	275711.	0.	0.	124934.	0.	0.	150777.	0.	0.
64	295638.	146378.	149260.	161318.	74262.	87056.	134320.	72116.	62204.
65	339720.	154140.	185580.	170292.	76773.	93519.	169428.	77367.	92061.
66	323724.	149465.	174259.	159099.	76606.	82493.	164625.	72859.	91766.
67	337644.	148973.	188671.	170373.	80548.	89825.	167271.	68425.	98846.
68	351831.	162092.	189739.	188965.	89358.	99607.	162866.	72734.	90132.
69	372173.	173529.	198644.	200073.	95730.	104343.	172100.	77799.	94301.
70	410233.	192105.	211128.	210145.	101361.	108784.	198088.	90754.	107334.
71	433654.	201627.	232027.	226674.	108250.	118424.	206980.	93377.	113603.
72	466660.	213917.	252743.	259144.	117562.	141582.	207516.	96355.	111161.
73	522801.	239568.	283233.	291730.	130015.	161715.	231071.	109553.	121518.
74	556888.	239528.	317360.	312863.	142184.	170679.	244025.	97344.	146681.
75	650588.	262643.	387945.	335758.	146590.	189168.	314830.	116053.	198777.

SOURCE: INTERSTATE COMMERCE COMMISSION. "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6. PIPELINES." WASHINGTON: U.S. GOVERNMENT PRINTING OFFICE. ANNUALLY.

TABLE D7

JOINT VENTURE COMPANIES
(SHARE OF TOTAL MARKET (TOTAL=1.0))
SELECTED FINANCIAL DATA

	OPERATING REVENUE			OPERATING EXPENSE			GROSS INCOME		
YEAR	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT
57	0.293	0.0	0.0	0.245	0.0	0.0	0.348	0.0	0.0
58	0.319	0.0	0.0	0.261	0.0	0.0	0.388	0.0	0.0
59	0.326	0.0	0.0	0.269	0.0	0.0	0.391	0.0	0.0
60	0.320	0.0	0.0	0.262	0.0	0.0	0.387	0.0	0.0
61	0.319	0.0	0.0	0.273	0.0	0.0	0.371	0.0	0.0
62	0.323	0.0	0.0	0.290	0.0	0.0	0.358	0.0	0.0
63	0.329	0.0	0.0	0.286	0.0	0.0	0.375	0.0	0.0
64	0.342	0.271	0.459	0.321	0.238	0.459	0.370	0.316	0.462
65	0.374	0.284	0.505	0.331	0.243	0.470	0.429	0.342	0.547
66	0.344	0.275	0.439	0.299	0.239	0.390	0.403	0.328	0.494
67	0.340	0.270	0.428	0.302	0.243	0.385	0.390	0.309	0.476
68	0.344	0.287	0.415	0.316	0.260	0.393	0.383	0.328	0.442
69	0.339	0.283	0.405	0.312	0.258	0.384	0.374	0.321	0.432
70	0.340	0.291	0.401	0.314	0.263	0.384	0.372	0.330	0.421
71	0.350	0.301	0.408	0.324	0.276	0.396	0.384	0.336	0.425
72	0.354	0.309	0.405	0.340	0.285	0.404	0.374	0.343	0.406
73	0.367	0.326	0.410	0.353	0.295	0.419	0.386	0.372	0.400
74	0.356	0.301	0.414	0.358	0.284	0.401	0.383	0.329	0.432
75	0.354	0.255	0.423	0.331	0.275	0.393	0.382	0.299	0.457

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES," ANNUALLY.

TABLE D8

JOINT VENTURE COMPANIES

SELECTED FINANCIAL OPERATING RATIOS

	AVERAGE REVENUE PER BARREL			AVERAGE EXPENSE PER BARREL			GROSS INCOME PER BARREL		
YEAR	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT	TOTAL	CRUDE	PRODUCT
57	0.198	0.0	0.0	0.083	0.0	0.0	0.105	0.0	0.0
58	0.203	0.0	0.0	0.090	0.0	0.0	0.113	0.0	0.0
59	0.200	0.0	0.0	0.087	0.0	0.0	0.112	0.0	0.0
60	0.196	0.0	0.0	0.086	0.0	0.0	0.110	0.0	0.0
61	0.190	0.0	0.0	0.087	0.0	0.0	0.103	0.0	0.0
62	0.187	0.0	0.0	0.086	0.0	0.0	0.101	0.0	0.0
63	0.186	0.0	0.0	0.084	0.0	0.0	0.102	0.0	0.0
64	0.185	0.145	0.254	0.101	0.074	0.148	0.084	0.071	0.106
65	0.190	0.149	0.245	0.095	0.074	0.124	0.095	0.075	0.122
66	0.177	0.137	0.235	0.087	0.070	0.111	0.090	0.067	0.124
67	0.172	0.132	0.227	0.087	0.071	0.108	0.085	0.060	0.119
68	0.160	0.130	0.200	0.086	0.072	0.105	0.074	0.058	0.095
69	0.159	0.127	0.200	0.086	0.070	0.105	0.073	0.057	0.095
70	0.159	0.127	0.204	0.083	0.067	0.105	0.076	0.060	0.099
71	0.163	0.129	0.212	0.085	0.069	0.108	0.078	0.060	0.104
72	0.163	0.128	0.207	0.090	0.070	0.116	0.072	0.058	0.091
73	0.165	0.131	0.212	0.092	0.071	0.121	0.073	0.060	0.091
74	0.183	0.137	0.246	0.103	0.081	0.132	0.080	0.056	0.114
75	0.221	0.157	0.307	0.114	0.087	0.150	0.107	0.069	0.157

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES." (ANNUAL).

TABLE D9

JOINT VENTURE COMPANIES
(SHARE OF TOTAL MARKET (TOTAL=1.0))
SELECTED BALANCE SHEET DATA

YEAR	TOTAL ASSETS	NET ASSETS	STOCKHOLDERS EQUITY1	STOCKHOLDERS EQUITY2	LONG-TERM DEBT	NET INCOME
57	0.3681	0.3909	0.2627	0.2627	0.4936	0.2926
58	0.3843	0.4106	0.2635	0.2635	0.5221	0.3115
59	0.3772	0.4007	0.2633	0.2633	0.5261	0.2869
60	0.3597	0.3917	0.2614	0.2614	0.4909	0.2801
61	0.3649	0.3940	0.2677	0.2677	0.5056	0.2654
62	0.3734	0.4041	0.2702	0.2702	0.5261	0.2720
63	0.4428	0.4831	0.2790	0.2790	0.6369	0.2958
64	0.4376	0.4852	0.2844	0.2515	0.6396	0.2832
65	0.4331	0.4849	0.2824	0.2493	0.6364	0.3879
66	0.3819	0.4239	0.2701	0.2321	0.5286	0.4051
67	0.3612	0.3997	0.2538	0.2241	0.4953	0.3731
68	0.3822	0.4195	0.2539	0.2248	0.5161	0.3578
69	0.3692	0.4111	0.2490	0.2213	0.5037	0.3361
70	0.3481	0.3930	0.2420	0.2219	0.4622	0.3202
71	0.3386	0.3868	0.2281	0.2281	0.4262	0.3447
72	0.3527	0.4069	0.2250	0.2250	0.4639	0.2960
73	0.3392	0.3946	0.2237	0.2233	0.4523	0.3009
74	0.2774	0.3291	0.1947	0.1947	0.3563	0.2475
75	0.2731	0.2743	0.2061	0.2061	0.2172	0.2662

SOURCE: CALCULATED FROM DATA PUBLISHED BY THE INTERSTATE COMMERCE COMMISSION IN "TRANSPORTATION STATISTICS IN THE UNITED STATES: PART 6, PIPELINES." ANNUALLY.

TABLE D10

JOINT VENTURE COMPANIES

YEAR	RATE OF RETURN ON: TOTAL ASSETS	NET ASSETS	STOCKHOLDERS EQUITY1	STOCKHOLDERS EQUITY2	DEBT/ EQUITY1 RATIO	DEBT/ EQUITY2 RATIO	DEBT/ ASSETS RATIO
57.	0.0571	0.0666	0.1880	0.1880	2.018	2.018	0.6130
58.	0.0579	0.0665	0.1930	0.1930	2.077	2.077	0.6233
59.	0.0579	0.0671	0.1945	0.1945	1.898	1.898	0.5649
60.	0.0533	0.0611	0.1665	0.1665	1.838	1.838	0.5881
61.	0.0528	0.0616	0.1623	0.1623	1.808	1.808	0.5984
62.	0.0593	0.0687	0.1797	0.1797	1.787	1.787	0.5901
63.	0.0445	0.0517	0.1693	0.1693	2.459	2.459	0.6462
64.	0.0469	0.0526	0.1750	0.1730	2.338	2.311	0.6262
65.	0.0660	0.0742	0.2457	0.2411	2.319	2.275	0.6230
66.	0.0756	0.0847	0.2788	0.2733	2.249	2.205	0.6097
67.	0.0794	0.0879	0.3002	0.2886	2.351	2.260	0.6218
68.	0.0662	0.0736	0.2688	0.2605	2.488	2.411	0.6128
69.	0.0609	0.0681	0.2418	0.2349	2.487	2.415	0.6263
70.	0.0690	0.0765	0.2647	0.2559	2.368	2.290	0.6169
71.	0.0706	0.0792	0.2604	0.2604	2.294	2.294	0.6218
72.	0.0537	0.0594	0.2142	0.2142	2.647	2.647	0.6632
73.	0.0609	0.0675	0.2359	0.2359	2.499	2.499	0.6445
74.	0.0467	0.0526	0.2056	0.2056	2.687	2.687	0.6100
75.	0.0599	0.0690	0.2816	0.2816	2.767	2.767	0.5884
MEAN	0.0599	0.0678	0.2224	0.2199	2.283	2.260	0.6147
STANDARD DEVIATION	0.009521	0.010134	0.044737	0.042205	0.3019	0.2954	0.023547
STANDARD ERROR	0.002184	0.002325	0.010263	0.009683	0.0693	0.0678	0.005402
VARIANCE	0.000091	0.000103	0.002001	0.001781	0.0911	0.0873	0.000554
SUM OF SQUARED DEVIATIONS	0.001632	0.001849	0.036025	0.032063	1.6405	1.5712	0.009980
DEGREES OF FREEDOM	18	18	18	19	18	18	18

APPENDIX E

TABLE E1

DISTRIBUTION OF INTERSTATE PIPELINE NET INVESTMENTS
IN PAD I, BY MAJOR COMPANIES, 1972
(MILLIONS OF DOLLARS)

Company	Market Value of Investments[1]			Percent of Grand Total
	Total	Subsidiaries	Corporate Joint Ventures	
Pennsylvania Co.	78.4	78.4	--	11.7
Gulf Oil	73.9	2.1	71.8	11.0
Exxon Corp.	64.0	4.3	59.7	9.5
Texaco, Inc.	60.6	3.3	57.3	9.0
Mobil Oil	52.9	21.1	31.8	7.9
Standard Oil Co. Ind.	40.8	--	40.8	6.1
Cities Service Co.	38.5	--	38.5	5.7
Atlantic Richfield Co.	35.6	29.8	5.8	5.3
Standard Oil Co. Ohio	35.0	6.3	28.7	5.2
Shell Oil Co.	33.9	--	33.9	5.0
Standard Oil Co. CA	27.8	--	27.8	4.1
Phillips Petroleum	22.0	--	22.0	3.3
Continental Oil Co.	20.9	--	20.9	3.1
Sun Oil Co.	19.1	19.1	--	2.8
Texas Eastern Trans. Co.	18.6	18.6	--	2.8
Union Oil Co. of CA	10.7	--	10.7	1.6
Pennzoil	7.4	--	7.4	1.1
All Others	30.8			4.6[2]
Total Investments, All Companies	670.9			
CONCENTRATION RATIO (PERCENT)				
Top 4	41.2			
Top 8	66.2			

SOURCE: Calculated from data published by the Interstate Commerce Commission in Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1972. Pipeline investments were assigned to the above companies based on the ownership data in Appendix B. Joint venture investments were prorated to these companies based on the percent owned by the participants.

[1]Market value of investments (net investment) is defined by the Interstate Commerce Commission for valuation purposes as the cost of reproduction less depreciation (and excluding land).

[2]Details may not equal 100 due to rounding.

TABLE E2

DISTRIBUTION OF INTERSTATE PIPELINE NET INVESTMENTS
IN PAD II, BY MAJOR COMPANIES, 1972
(MILLIONS OF DOLLARS)

Company	Market Value of Investments[1]			Percent of Grand Total
	Total	Subsidiaries	Corporate Joint Ventures	
Williams Companies	237.3	237.3	--	12.2
Standard Oil Co. Ind.	131.7	121.4	10.3	6.8
Atlantic Richfield Co.	110.0	83.2	26.8	5.7
Texaco, Inc.	96.0	36.1	59.9	4.9
Shell Oil Co.	93.2	45.0	48.2	4.8
Pennsylvania Co.	91.8	91.8	--	4.7
Gulf Oil	90.2	6.8	83.4	4.6
Mapco, Inc.	90.0	90.0	--	4.6
Marathon Oil	80.2	66.0	14.2	4.1
Phillips Petroleum Co.	79.8	70.5	9.3	4.1
Exxon Corp.	69.1	0.5	68.6	3.6
Union Oil Co. of CA	65.7	18.2	47.5	3.4
Continental Oil	55.6	20.1	35.5	2.9
Sun Oil	53.5	23.6	29.9	2.8
Mobil Oil	52.5	41.0	11.5	2.7
Standard Oil Co. Ohio	48.5	30.3	18.2	2.5
Cities Service	48.3	4.9	43.4	2.5
Hydrocarbon	47.2	47.2	--	2.4
Texas East. Trans. Crp.	45.7	45.7	--	2.4
Ashland Oil Co.	38.6	31.8	6.8	2.0
Kaneb, Inc.	31.4	31.4	--	1.6
Clark Oil & Refining	16.7	--	16.7	0.9
Getty Oil[3]	5.7	--	5.7	0.3
Diamond Shamrock	3.8	--	3.8	0.2
All Others	256.8			13.3
Total Investment, All Companies	1939.5			100.0[2]
CONCENTRATION RATIO (PERCENT)				
Top 4	29.6			
Top 8	48.3			
Top 20	83.7			

SOURCE: Calculated from data published by the Interstate Commerce Commission in Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1972. Pipeline investments were assigned to the above companies based on the ownership data in Appendix B. Joint venture investments were prorated to these companies based on the percent owned by the participants.

[1]Market value of investments (net investment) is defined by the Interstate Commerce Commission for valuation purposes as the cost of reproduction less depreciation (and excluding land).

[2]Details may not equal 100 due to rounding.

[3]Includes Skelly Oil Company.

TABLE E3

DISTRIBUTION OF INTERSTATE PIPELINE NET INVESTMENTS
IN PAD III, BY MAJOR COMPANIES, 1972
(MILLIONS OF DOLLARS)

Company	Market Value of Investments[1]			Percent of Grand Total
	Total	Subsidiaries	Corporate Joint Venture	
Exxon Corp.	310.8	245.8	65.0	16.2
Gulf Oil	220.1	143.3	76.8	11.5
Texaco, Inc.	195.1	129.9	65.2	10.2
Mobil Oil	181.7	158.7	23.0	9.5
Shell Oil	168.6	118.0	50.6	8.8
Standard Oil Co. Ind.	102.3	71.8	30.5	5.3
Atlantic Richfield	96.8	67.3	29.5	5.0
Standard Oil Co. CA	91.4	56.4	35.0	4.8
Cities Service Co.	66.5	22.5	44.0	3.5
Phillips Petroleum	66.1	46.1	20.0	3.4
Sun Oil Co.	61.3	32.7	28.6	3.2
Standard Oil Co. Ohio	56.1	18.7	37.4	2.9
Texas East. Trans. Corp.	48.1	48.1	--	2.5
Union Oil Co. of CA	44.4	23.8	20.6	2.3
Continental Oil Co.	31.1	8.4	22.7	1.6
Ashland Oil Co.	29.8	28.4	1.4	1.5
Mapco, Inc.	29.6	29.6	--	1.5
Diamond Shamrock	23.6	23.6	--	1.2
Amerada-Hess	19.8	19.8	--	1.0
Marathon Oil	14.7	--	14.7	0.8
Southern Pacific Co.	8.6	8.6	--	0.4
All Others	50.4			2.7
Total Investment, All Companies	1916.9			100.0[2]
CONCENTRATION RATIO (PERCENT)				
Top 4	47.4			
Top 8	71.3			
Top 20	96.7			

SOURCE: Calculated from data published by the Interstate Commerce Commission in Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1972. Pipeline investments were assigned to the above companies based on the ownership data in Appendix B. Joint venture investments were prorated to these companies based on the percent owned by the participants.

[1]Market value of investments (net investment) is defined by the Interstate Commerce Commission for valuation purposes as the cost of reproduction less depreciation (and excluding land).

[2]Details may not equal 100 due to rounding.

TABLE E4

DISTRIBUTION OF INTERSTATE PIPELINE NET INVESTMENTS
IN PAD IV, BY MAJOR COMPANIES, 1972
(MILLIONS OF DOLLARS)

Company	Market Value of Investments[1]			Percent of Grand Total
	Total	Subsidiaries	Corporate Joint Ventures	
Continental Oil	60.4	41.9	18.5	24.3
Standard Oil Co. Ind.	48.1	41.3	6.8	19.3
Standard Oil Co. CA	30.8	29.9	0.9	12.4
Phillips Petroleum Co.	13.3	13.3	--	5.3
Marathon Oil	12.3	7.4	4.9	4.9
Union Oil Co. of Ca.	11.7	1.6	10.1	4.7
Bell Fourche	10.7	10.7	--	4.3
Atlantic Richfield	9.8	--	9.8	3.9
Shell Oil Co.	9.6	0.3	9.3	3.9
Exxon Corp.	9.4	7.0	2.4	3.8
Texaco, Inc.	8.3	0.5	7.8	3.3
Diamond Shamrock	4.1	4.1	--	1.6
Mobil Oil	3.8	0.4	3.4	1.5
Gulf Oil	3.7	--	3.7	1.5
Getty Oil Co.[3]	1.7	1.5	0.2	0.7
All Others	11.0			4.4
Total Investment, All Companies	248.7			100.0[2]
CONCENTRATION RATIO (PERCENT)				
Top 4	61.3			
Top 8	79.1			

SOURCE: Calculated from data published by the Interstate Commerce Commission in Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1972. Pipeline investments were assigned to the above companies based on the ownership data in Appendix B. Joint venture investments were prorated to these companies based on the percent owned by the participants.

[1]Market value of investments (net investment) is defined by the Interstate Commerce Commission for valuation purposes as the cost of reproduction less depreciation (and excluding land).

[2]Details may not equal 100 due to rounding.

[3]Includes Skelly Oil Co.

TABLE E5

DISTRIBUTION OF INTERSTATE PIPELINE NET INVESTMENTS
IN PAD V, BY MAJOR COMPANIES, 1972
(MILLIONS OF DOLLARS)

Company	Market Value of Investments[1]			Percent of Grand Total
	Total	Subsidiaries	Corporate Joint Ventures	
Southern Pacific Co.	107.2	107.2	--	47.0
Shell Oil Co.	21.2	--	21.2	9.3
Standard Oil Co. CA	20.4	9.1	11.3	8.9
Mobil Oil	16.9	--	16.9	7.4
Atlantic Richfield	14.3	--	14.3	6.3
Union Oil Co. of CA	11.4	--	11.4	5.0
Marathon Oil	10.8	--	10.8	4.7
Texaco, Inc.	8.9	--	8.9	3.9
Gulf Oil	5.3	--	5.3	2.3
Continental Oil	3.9	--	3.9	1.7
Exxon Corp.	2.4	0.9	1.5	1.0
Standard Oil Co. Ind.	0.3	--	0.3	0.1
All Others	4.9			2.1
Total Investments, All Companies	227.9			100.0[2]
CONCENTRATION RATIO (PERCENT)				
Top 4	72.6			
Top 8	92.5			

SOURCE: Calculated from data published by the Interstate Commerce Commission in Valuation Dockets, 1973, and Transport Statistics in the United States, Part 6: Pipelines, 1972. Pipeline investments were assigned to the above companies based on the ownership data in Appendix B. Joint venture investments were prorated to these companies based on the percent owned by the participants.

[1]Market value of investments (net investment) is defined by the Interstate Commerce Commission for valuation purposes as the cost of reproduction less depreciation (and excluding land).

[2]Details may not equal 100 due to rounding.

TABLE E6

DISTRIBUTION OF OPERATING REFINERY CAPACITY IN THE UNITED STATES, CENTRAL AND SOUTH AMERICA, BY COMPANY, 1973
(CAPACITY IN THOUSANDS BARRELS PER DAY)

	Grand Total		United States		Central & So. America	
	Capacity	Percent Of Total	Capacity	Percent Of Total	Capacity	Percent Of Total
Exxon	2,555.0	13.7	1,242.0	8.7	1,313.0	29.4
Shell[2]	2,044.6	10.9	1,127.0	7.9	917.6	20.6
Texaco	1,510.1	8.1	1,058.0	7.4	452.1	10.1
Standard Oil (CA)	1,220.7	6.5	952.0	6.7	268.7	6.0
Standard Oil (IN)	1,072.3	5.7	1,065.0	7.5	7.3	0.2
Mobil	1,055.3	5.7	950.3	6.7	105.0	2.4
Gulf	998.3	5.3	860.6	6.0	137.7	3.1
Atlantic Richfield	830.4	4.4	785.0	5.5	45.4	1.0
Amerada Hess	688.5	3.7	98.5	0.7	590.0	13.2
Sun	569.0	3.0	484.0	3.4	85.0	1.9
Union Oil of CA	487.0	2.6	487.0	3.4	--	--
Phillips	408.7	2.2	403.7	2.8	5.0	0.1
Standard Oil (Ohio)	388.0	2.1	388.0	2.7	--	--
Continental	364.0	1.9	364.0	2.6	--	--
Ashland	361.8	1.9	361.8	2.5	--	--
Marathon	318.0	1.7	318.0	2.2	--	--
New England Petrol	300.0	1.6	--	-	300.0	6.7
Cities Service	268.0	1.4	268.0	1.9	--	--
Getty	213.7	1.1	213.7	1.5	--	--
American Petrofina	200.0	1.1	200.0	1.4	--	--

CONTINUED

TABLE E6 CONTINUED

	Grand Total		United States		Central & So. America	
	Capacity	Percent Of Total	Capacity	Percent Of Total	Capacity	Percent Of Total
All Others	2,830.0	15.1	2,593.6	18.2	236.4	5.3
Total	18,683.4	100.0[3]	14,220.2	100.0[3]	4,463.2	100.0[3]
Concentration Ratio						
TOP 4		39.2		30.4		66.1
TOP 8		60.3		56.4		72.8
TOP 20		84.6		81.5		--

SOURCE: Data for the United States and Puerto Rico from Bureau of Mines, Mineral Industry Survey, "Petroleum Refineries in the United States and Puerto Rico, January 1, 1974"; capacity data for other areas from the Petroleum Publishing Company, International Petroleum Encyclopedia, 1974; and ownership data for refineries outside the United States from James Sturgeon, "Joint Ventures in the International Petroleum Industry: Exploration and Drilling" (unpublished Ph.D. dissertation, University of Oklahoma, 1973).

[1]Includes only Central America, Caribbean, Venezuela and Puerto Rico; joint venture refineries are prorated to parent company based on percent participation; all known subsidiaries are included in parent totals; and excludes a 250,000 B/D refinery in El Salvador jointly owned by J. A. Clements and Associates/Toyo Menka Kaisha Ltd. which just came on stream and was not exporting products in 1973.

[2]Royal Dutch/Shell Group.

[3]Detail may not equal 100 due to rounding.

TABLE E7

DISTRIBUTION OF OPERATING REFINERY CAPACITY
IN PAD I, BY MAJOR COMPANIES, 1973

Company	Operating Capacity (Thousand Barrels Per Day)	Percent of Grand Total
Exxon Corp.	265.0	15.8
Atlantic Richfield Co.	185.0	11.0
Gulf Oil	168.5	10.1
Sun Oil Co.	165.0	9.9
Mobil Oil	148.3	8.9
Getty Oil Co.	140.0	8.4
Standard Oil Co. Ohio	100.0	6.0
Texaco, Inc.	88.0	5.3
Standard Oil Co. CA	88.0	5.3
Standard Oil Co. Ind.	75.0	4.5
Ashland Oil Co.	70.8	4.2
Amerada Hess Corp.	70.0	4.2
Pennzoil Co.	16.3	1.0
All Others	93.6	5.6
Total Operating Capacity	1,673.5	100.0[1]
CONCENTRATION RATIO (PERCENT)		
Top 4	46.9	
Top 8	75.5	

SOURCE: Calculated from data published by the U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico, Jan. 1, 1974."

[1]Details may not equal 100 due to rounding.

TABLE E8

DISTRIBUTION OF OPERATING REFINERY CAPACITY
IN PAD II, BY MAJOR COMPANIES, 1973

Company	Operating Capacity (Thousand Barrels Per Day)	Percent of Grand Total
Standard Oil Co. Ind	575.0	14.8
Ashland Oil Co.	291.0	7.5
Standard Oil Co. Ohio	288.0	7.4
Mobil Oil	272.0	7.0
Sun Oil Co.	262.0	6.7
Shell Oil Co.	260.0	6.7
Marathon Oil	257.0	6.6
Texaco, Inc.	206.0	5.3
Union Oil Co. of CA	152.0	3.9
Continental Oil	140.5	3.6
Atlantic Richfield Co.	126.0	3.2
Farmland Industries[1]	121.1	3.1
Clark Oil and Refining Co.	108.0	2.8
Kock Industries	107.0	2.7
Gulf Oil	92.4	2.4
Phillips Petroleum	85.0	2.2
Getty Oil Co.[2]	73.7	1.9
Champlin Oil Co.[4]	49.5	1.3
Murphy Oil Corp.	37.0	1.0
American Petrofina Co.[3]	25.0	0.6
All Others	327.7	8.4
Total Operating Capacity	3889.4	100.0[5]
CONCENTRATION RATIO (PERCENT)		
Top 4	36.7	
Top 8	62.0	
Top 20	90.7	

SOURCE: Calculated from data published by the U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico, Jan. 1, 1974."

[1]Includes CRA, Inc. and National Cooperative Refining Association.

[2]Includes Skelly Oil Co.

[3]Includes American Petrofina of Texas.

[4]A wholly-owned subsidiary of Union Pacific Railroad

[5]Details may not equal 100 due to rounding.

TABLE E9

DISTRIBUTION OF OPERATING REFINERY CAPACITY IN PAD III, BY MAJOR COMPANY, 1973

Company	Operating Capacity (Thousand Barrels Per Day)	Percent of Grand Total
Exxon Corp.	845.0	14.2
Texaco, Inc.	630.0	10.6
Shell Oil Co.	586.0	9.9
Gulf Oil	521.2	8.8
Mobil Oil	335.0	5.6
Standard Oil Co. Ind.	333.0	5.6
Standard Oil Co. CA	311.0	5.2
Cities Service Co.	268.0	4.5
Atlantic Richfield Co.	213.0	3.6
Phillips Petroleum	180.0	3.0
American Petrofina Co.[1]	175.0	2.9
Coastal States Petrochemical Co.	135.0	2.3
Union Oil Co. of CA	116.0	2.0
Southwestern Oil & Refining Co.	105.0	1.8
Crown Central Petroleum Corp.	100.0	1.7
Continental Oil	98.0	1.7
Tenneco Oil Co.	97.5	1.6
Murphy Oil Corp.	92.5	1.6
Charter Companies[2]	70.0	1.2
Champlin Oil Co.[3]	62.2	1.0
All Others	659.5	11.1
Total Operating Capacity	5932.9	100.0[4]
CONCENTRATION RATIO (PERCENT)		
Top 4	43.5	
Top 8	64.4	
Top 20	88.8	

SOURCE: Calculated from data published by the U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico, Jan. 1, 1974."

[1]Includes American Petrofina of Texas and Cosden Oil and Chemical Co.

[2]Charter Oil Co.

[3]A wholly-owned subsidiary of Union Pacific Railroad

[4]Details may not equal 100 due to rounding.

TABLE E10

DISTRIBUTION OF OPERATING REFINERY CAPACITY IN PAD IV, BY MAJOR COMPANIES, 1973

Company	Operating Capacity (Thousand Barrels Per Day)	Percent of Grand Total
Continental Oil	82.5	16.3
Standard Oil Co. Ind.	82.0	16.2
Husky Oil Co.	46.5	9.2
Exxon Corp.	45.0	8.9
Standard Oil Co. CA	45.0	8.9
Farmers Union Central Exchange, Inc.	41.6	8.2
Pasco, Inc.	40.0	7.9
Phillips Petroleum	28.7	5.7
Texaco, Inc.	21.0	4.1
The Refinery Corp.	17.5	3.5
Little America Refining Co.	16.8	3.3
Tesoro Petroleum Corp.	10.5	2.1
All Others	28.6	5.6
Total Operating Capacity	505.7	100.0[1]
CONCENTRATION RATIO (PERCENT)		
Top 4	50.6	
Top 8	81.3	

SOURCE: Calculated from data published by the U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico, Jan. 1, 1974."

[1]Details may not equal 100 due to rounding.

TABLE E11

DISTRIBUTION OF OPERATING REFINERY CAPACITY IN PAD V, BY MAJOR COMPANIES, 1973

Company	Operating Capacity (Thousand Barrels Per Day)	Percent of Grand Total
Standard Oil Co. CA	508.0	22.9
Shell Oil Co.	281.0	12.7
Atlantic Richfield Co.	261.0	11.8
Union Oil Co. CA	219.0	9.9
Mobil Oil	195.0	8.8
Texaco, Inc.	113.0	5.1
Phillips Petroleum	110.0	5.0
Exxon Corp.	87.0	3.9
Gulf Oil	78.5	3.5
Continental Oil	43.0	1.9
Edgington Oil Refineries, Inc.	33.0	1.5
Champlin Oil Co.[1]	28.8	1.3
Powerine Oil Co.	28.5	1.3
San Joaquin Oil Co.	27.0	1.2
Toscopetro Corp.	26.6	1.2
All Others	179.3	8.1
Total Operating Capacity	2218.7	100.0[2]
CONCENTRATION RATIO (PERCENT)		
Top 4	57.3	
Top 8	80.1	

SOURCE: Calculated from data published by the U.S. Department of the Interior, Bureau of Mines, Mineral Industry Surveys, "Petroleum Refineries in the United States and Puerto Rico, January 1, 1974."

[1]A wholly-owned subsidiary of Union Pacific Railroad.

[2]Details may not equal 100 due to rounding.

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2. Kaneb, John A., President of Northeast Petroleum Industries Inc.
3. Myers, Stewart C., Associate Professor of Finance, Sloan School of Management, Massachusetts Institute of Technology
4. Siess, Charles P., Jr., President of Apco Oil Corporation.