

# The Petroleum Industry: Structure and Conduct

## Federal Trade Commission

This article is an excerpt from the Preliminary Federal Trade Commission Staff Report on its investigations of the petroleum industry. This report was published in 1973 by the Senate Committee on Government Operations. The report has stirred considerable controversy, many of its conclusions having been challenged by the oil industry. John M. Blair served as principal economist.

The petroleum industry is functionally divided into four basic levels: crude oil production, refining, marketing and transportation. While varying numbers of independent companies operate at each level, the industry is dominated by 18 vertically integrated companies that operate at all levels. These firms are large and generally have leading market positions at each level vis-à-vis independents. All 18, according to the *Fortune 500* sales ranking, are among the 200 largest industrial corporations. Ten are within the top 40, and seven are within the top 20. Industry concentration has resulted both from the dominant positions of these firms and from institutional constraints peculiar to this industry. In order to examine the industry, each level of activity and each relevant institutional factor on a national basis will be discussed.

### Crude Oil Production

Concentration in crude oil production by the majors has increased markedly since 1960. While it has been estimated that the number of oil producers in the United States is somewhere between 10,000 to 12,000, the Top 4, 8 and 20 oil producing companies in 1969 accounted respectively for 31, 51 and 70 percent of the average daily barrels of crude produced domestically. (See Table 1.) In 1960, the Top 4, 8 and 20 firms accounted for 26, 43 and 62 percent respectively. A clear trend toward even greater concentration is thus borne out by these comparative statistics.

**TABLE I.**  
**Company Share of Domestic Net Crude Production, 1969 and 1960**

Production Rank in 1969	Company	Company Share 1969 (percent)	Company 1960
1	Standard (N.J.)	9.76	6.53
2	Texaco	8.47	8.93
3	Gulf	6.78	5.13
4	Shell	6.08	4.78
5	Standard (California)	5.31	4.75
6	ARCO	5.11	5.92
7	Standard (Indiana)	5.09	4.30
8	Mobil	3.94	3.42
9	Getty	3.38	2.92
10	Union	2.88	2.65
11	Sun	2.47	2.54
12	Continental	2.21	1.38
13	Marathon	1.64	1.79
14	Phillips	1.55	1.29
15	Cities Service	1.28	1.22
16	Amerada Hess	1.04	NA
17	Tenneco	0.99	0.94
18	Skelly	0.88	1.39
19	Superior	0.74	0.45
20	Louisiana Lnd & Exp	0.61	26.51
	Top 4	31.09	43.76
	Top 8	50.54	63.02
	Top 20	70.21	

**NOTE:** Individual company production data obtained from the estimates of Rice, Kerr & Co., Engineers. Universe data obtained from *Report on Crude Oil and Gasoline Price Increases of November, 1970: A Background Study*, Nov. 3, 1971, p. 48.

While average daily oil production data may yield short-run insight into the structure of the crude producing industry, it is not particularly relevant for long-run considerations. As oil is pumped from a well, its technically efficient rate of production falls. Eventually it becomes a "stripper well" and is operated until the pumping costs make it uneconomic to do so. A more relevant long-run measure of concentration at the crude level is the amount of domestic proven reserves owned by firms in the industry.

While considerable difficulty has been encountered in obtaining proved reserve data, our best estimates, presented in Table 2, indicate that in 1970, the Top 4, 8 and 20 firms had approximately 37, 64 and 94 percent respectively of domestic crude proven reserves. On the basis of these data, the industry structure viewed in a long-run sense is even more concentrated than short-run statistics have indicated.

The structure of this industry, and hence its conduct and performance, is strongly influenced by certain institutional factors. Basically, these are the import quota, prorationing and special tax regulations.

The single most important federal intervention into the petroleum industry was through mandatory oil import quotas. In order to exercise monopoly power, a firm or firms must be able to control the supply of the industry's product. In the traditional tight oligopoly case, that control is exercised through a combination of few sellers acting in an interdependent fashion

**TABLE II.  
Company Shares of Proved Domestic Crude Reserves, 1970**

Rank	Company	Share of Domestic Proved Reserves (percent) 1970
1	Standard (N. J.)	9.92
2	Texaco	9.31
3	Gulf	8.97
4	Standard (Calif.)	8.97
5	Standard (Ind.)	8.46
6	ARCO	7.48
7	Shell	5.90
8	Mobil	4.87
9	Getty	3.85
10	Phillips	3.55
11	Signal	3.28
12	Union	3.18
13	Continental	2.77
14	Sun	2.67
15	Amerada Hess	2.49
16	Cities Service	2.49
17	Marathon	2.37
18	Skelly	1.09
19	Superior	1.03
20	Tenneco	0.90
	Top 4	37.17
	Top 8	63.88
	Top 20	93.55

NOTE: Individual company reserves obtained from estimates of Rice, Kerr & Co., Engineers. Universe data obtained from *Report on Crude Oil and Gasoline Price Increases*. This figure was taken as approximately 39,000,000,000 barrels, including Alaska. Concentration data would be lower the more this figure understates actual proven reserves. Concentration data should be taken to be, at best, only rough estimates. It is not known to what extent both the universe estimate and the individual company reserve data include crude production from secondary recovery techniques.

and effectively erecting barriers to entry against new suppliers. In the petroleum industry, however, that control of supply is importantly influenced by public policy. Between 1959 when the import quota system became mandatory and May 1, 1973 when the quotas were removed, the entry of foreign produced crude oil was severely limited in the United States. Thus, one of the chief sources of competitive supply was curtailed, and domestic integrated firms were operating in an environment where their domestic prices were protected against large scale alternative sources of supply, namely, imports.

It is interesting to observe that the mandatory quotas were enacted at a time when events had conspired to cause some of the previous methods of supply control to break down. Until the 1950's control of supply of crude oil was maintained largely by a system of state prorationing. Under that system the states that had enacted prorationing legislation would limit supply with the goal of maintaining crude prices. Such legislation was particularly effective when imports were unimportant and when states with prorationing (Texas, Louisiana, and Oklahoma) accounted for almost all domestic production. But, in the 1950's foreign supplies from the Middle East and domestic supplies from nonprorated states became increasingly important. In 1957 voluntary import-controls were initiated, and in 1959 the mandatory controls were imposed. Thus, at a time when supply was becoming increasingly loose, new controls to the advantage of the existing petroleum oligopoly were imposed. It is noteworthy that complaints of financial distress from independent refiners and marketers became more prevalent after the imposition of quotas and that many of those firms trace their difficulties to the international arrangement.

The major oil firms have had the advantage of other federal provisions, which have served to buttress their control over the supply of crude oil available in domestic markets. The impact of quotas on the price of domestic crude oil was substantial. The domestic price of crude has in recent years averaged \$1.25 to \$1.50 per barrel above the world price, and most of the difference is attributable to the import quota. The import quota clearly contributed to profits earned in producing crude oil by elevating prices, but the quota increased profits to the majors in another way. The right to import went only to existing refineries. Thus, the major companies through import tickets were able to purchase oil at the world price as an input for their refineries, which produced final products at elevated domestic prices.<sup>1</sup> A further benefit accruing to the majors was that they were able frequently to obtain profits by trading at favorable terms domestic crude for the independents' allotted foreign crude because some independents located inland were not in a position to economically utilize imports.

While the import quota was in effect, it was an important source of control of crude oil supply, but there are others that must be considered. The states, with an assist from the federal government, also placed limits on the production of domestic crude oil through prorationing.

Prorationing was originally instituted as a means of conserving the supply of domestic petroleum reserves and avoiding "wasteful" practices such as those that resulted from the rule of capture. However, it functions as a means of controlling supply and setting price. Essentially, the technologically maximum efficient rate of recovery (MER) is determined for each well. Then, demand forecasts for crude oil are examined, and each well is permitted to pump as much crude (subject to its MER) as will clear the market in the aggregate at the market price.

In the U.S. today, prorationing is used in the states of Texas, Louisiana, Oklahoma, New Mexico and Kansas (although these states now claim that they are permitting 100 percent well production during the present shortage). Each state has its own prorationing agency to make state supply determinations. Together, these five states accounted for approximately 74 percent of domestic crude production in 1970. Texas alone accounted for approximately 36 percent. Hence, the supply and price of the vast majority of domestic crude is determined by forces outside the marketplace.

The Federal Government gave teeth to prorationing with the passage of the Connally "Hot Oil" Act in 1935. This act prohibits interstate shipments of crude oil produced in violation of state prorationing laws. However, the Federal Government has the power to "suspend its operation - presumably both enforcement activity as well as basic consent legalizing state action-if state action should unduly burden interstate commerce." The Attorney General is responsible for an annual review, under the Interstate Oil Compact, to determine if such legislation is consistent with its intent, and if not, to suspend it. Its intent is set forth in Article V of the Interstate Oil Compact:

It is not the purpose of this compact to authorize the states joining herein to limit the production of oil and gas for the purpose of stabilizing or fixing the price thereof, or create or perpetuate monopoly, or to promote regimentation, but is limited to the purpose of conserving oil and gas and preventing the avoidable waste thereof within reasonable limitations.

Thus far, Article V has not been invoked.

The set of federal laws remaining to be discussed are those pertaining to the effect of certain tax regulations on industry incentives. Special tax provisions permit oil companies to expense many of their exploration and drilling costs rather than depreciating them over an extended period. These provisions tend to lead to an understatement of gross income and to a reduction in tax liability. In addition, the oil companies are permitted to treat royalties paid to foreign governments for drilling rights as an income tax. These "taxes" may then be used as a dollar for dollar offset against U.S. corporate income tax liability. These measures act as a subsidy to crude oil production and, therefore, stimulate increased allocation of resources to the discovery and recovery of crude oil. Hence, it is not surprising that the oil firms seek to integrate backwards to take advantage of the favorable tax provisions. It is, however, the oil depletion allowance that has had the greatest impact upon resource allocation among production stages and relative price structure in the petroleum industry in past years.

Oil depletion allowances were passed originally as a method of encouraging oil exploration. It was argued that since oil was a scarce and valuable natural resource, it would not be advisable to permit national reserves to be depleted. Therefore an incentive was granted to oil producers through a special tax deduction in the hope that more resources would be devoted to the discovery of additional crude oil sources. A crude oil producing firm is permitted to subtract from its gross income before taxes an amount equal to 22 percent of its total revenues from crude production (i.e., actual production times posted price at the wellhead) up to 50 percent of the firms net pretax income. Under this system, the major integrated firms have an incentive to seek high crude prices. The high crude prices are, however, a cost to the major firms' refineries. Thus, an increase in crude prices implies an increase in crude profits but a decrease in refinery profits. The integrated oil companies gain because the depletion allowance reduces the tax on crude profits, while refinery profits are not subject to the same advantageous depletion deduction. A simple model developed by the FTC suggests that for American integrated firms that typically produce between 40 and 80 percent of their crude needs, it pays to raise crude prices up to a point where refinery profits have been reduced to zero. Beyond that point, net income after taxes for the integrated oil firm begins to fall.

Thus, the major integrated oil companies have been able to capitalize upon the existence of import quotas, state prorationing, and oil depletion allowances to limit effectively the supply of crude oil to a point, which reduces their refinery profits to zero. Clearly, such a system creates a hazardous existence for independent refiners, who have little or no crude production. In such an environment, only those independent refiners who have: (1) lower costs through locational or other advantages; (2) some monopoly power in a local market; or (3) sufficient access to inexpensive imported oil, can survive.

It is important to note that no technological imperative renders crude production inherently profitable and refinery and marketing operations inherently unprofitable. Rather, the tax laws have made it highly remunerative for integrated firms to artificially shift profits away from downstream activities toward the crude end of integrated business. This goal is accomplished by raising crude prices through various controls on supply.

### *Refining*

The petroleum refining industry is the pivotal point in the petroleum industry. It is virtually the sole buyer of crude and it transforms crude into more efficient particular energy products. In 1969, the domestic refinery yield was as follows:

	<i>Percent</i>
Gasoline	45.5
Distillate fuel oil	21.6
Jet fuel	8.2
Residual fuel oil	6.8
Kerosene	2.6
Lubricants	1.7

**TABLE III.  
Company Share of Domestic Crude Oil and Gasoline Refining Capacity, 1970**

<i>Rank in Crude Oil Capacity</i>	<i>Company</i>	<i>Share of Crude Oil Capacity (percent)</i>	<i>Share of Gasoline Capacity (percent)</i>
1	Standard (N. J.)	8.59	9.22
2	Standard (Ind.)	8.22	7.94
3	Texaco	8.13	9.19
4	Shell	7.99	7.69
5	Standard (Calif.)	7.66	6.72
6	Mobil	6.28	6.30
7	Gulf	5.78	6.47
8	ARCO	5.42	6.25
9	Sun	3.60	4.54
10	Union	3.51	3.24
11	Standard (Ohio)	3.47	3.09
12	Phillips	3.14	4.24
13	Ashland	2.51	2.11
14	Continental	2.36	2.03
15	Cities Service	2.22	2.26
16	Getty	1.64	1.76
17	Marathon	1.12	1.92
18	Coastal States	1.06	0.73
19	Amerada Hess	0.98	0.79
20	Champlin	0.97	0.63
	Top 4	32.93	34.04
	Top 8	58.07	58.78
	Top 20	86.15	87.38

NOTE: Data obtained from Mineral Industry Surveys, Bureau of Mines, "Crude Oil Capacity," Jan. 1, 1971.

As of January 1, 1972, there were 282 domestic refineries and approximately 129 refining companies. The 1970 crude oil refining capacity as shown in Table 3, accounted for by the leading 4, 8 and 20 firms, was 33, 58 and 86 percent respectively. These same firms accounted for 34, 59 and 87 percent of gasoline refining capacity.

A comparison of firm rankings in refining and production (Table 4) yields some interesting results. While there are some minor deviations, three of the top four refiners are among the top

four crude producers and the top eight refiners are also the top eight crude producers. Further, 16 of the top 20 refiners are among the top 16 crude producers. Hence, independent monopsonistic purchasing power conducive to downward pressure on crude prices is virtually absent.

**TABLE IV.**  
**A Comparison of Company Ranking in Crude Production  
 and Crude Refining Capacity**

<i>Company</i>	<i>Rank in Crude      Production</i>	<i>Rank in Crude Oil      Refining Capacity</i>
Standard (New Jersey)	1	1
Texaco	2	3
Gulf	3	7
Shell	4	4
Standard (California)	5	5
ARCO	6	8
Standard (Indiana)	7	2
Mobil	8	6
Getty	9	16
Union	10	10
Sun	11	9
Continental	12	14
Marathon	13	17
Phillips	14	12
Cities Service	15	15
Amerada Hess	16	19
Tenneco	17	-
Skelly	18	-
Superior	19	-
Louisiana Land and Exploration	20	-
Standard (Ohio)	-	11
Ashland	-	13

There could, of course, still be some downward pressure on crude prices, despite the integration of the leading firms, if there were a mismatch between a company's crude production and its refining capacity. The extent of this would depend upon the degree of self-sufficiency and the marginal effect of higher crude prices on total revenue due to the interrelationship of self-sufficiency and the marginal effect of higher crude prices on total revenue due to the interrelationship of self-sufficiency and the oil depletion allowance. De Chazeau and Kahn developed a simple model to examine this relationship. They determined that a company with a self-sufficiency greater than 77 percent would benefit from a crude price increase even if this increase were not passed on in the price of products at all. If 50 percent of the price increase were passed on, a company with a degree of self-sufficiency in excess of 38.5 percent would benefit from a price increase. Their estimates were based on the 27½ percent depletion allowance, which was in effect at that time.

Using the identical model and substituting the present 22 percent depletion allowance only alters their conclusions slightly. If the price increase is not passed on, a company with a self-sufficiency in excess of 40.4 percent would benefit from a price increase. The greater the percentage of the price increase passed on, the lower the self-sufficiency required to benefit from a crude price increase.

As can be seen from Table 5, all of the Top 8 and 15 of the Top 17 refining companies have self-sufficiency greater than 40 percent. Three of the Top 8 and Top 5 of the Top 17 have self-

sufficiency greater than 81 percent. Thus, vertical integration combined with the depletion allowance places upward pressure on crude prices.

**TABLE V.  
Domestic Self-Sufficiency of the 17 Leading Refiners 1969**

		<i>Self-Sufficiency (percent of runs to stills)</i>
<b>Company:</b>		
	Standard (New Jersey)	87.4
	Standard (Indiana)	50.5
	Texaco	81.0
	Shell	62.1
	Standard (California)	68.8
	Mobil	42.2
	Gulf	87.6
	ARCO	64.9
	Sun	46.7
	Union	64.3
	Standard (Ohio)	6.7
	Phillips	51.8
	Ashland	12.6
	Continental	64.0
	Cities Service	49.9
	Getty	137.2
	Marathon	88.1

NOTE: Obtained from Estimates of Kerr, Rice and Co., Engineers.

**TABLE VI.  
Worldwide Self-Sufficiency of the 17 Leading U.S. Refiners 1969 and 1959**

<i>U.S. Rank in Crude Refining Capacity</i>	<i>Company</i>	<i>Self-Sufficiency 1969 (percent)</i>	<i>Self-Sufficiency 1959 (percent)</i>
1	Standard (New Jersey)	88.3	77.1
2	Standard (Indiana)	66.4	51.5
3	Texaco	106.7	92.4
4	Shell	72.5	74.2
5	Standard (California)	138.1	105.4
6	Mobil	75.5	69.5
7	Gulf	193.0	172.7
8	ARCO	96.7	64.6
9	Sun	87.4	55.7
10	Union	85.6	50.0
11	Standard (Ohio)	28.9	28.1
12	Phillips	65.4	71.3
13	Ashland	13.9	8.8
14	Continental	158.4	104.0
15	Cities Service	89.5	44.6
16	Getty	241.1	71.8
17	Marathon	163.2	109.0
	Top 4	84.8	76.5
	Top 8	96.2	84.2
	All 17	97.1	96.8
	5 largest U.S. International companies.	108.9	93.5

NOTE: Ratios obtained from the "Oil and Gas Journal," Jan. 18, 1971, pp. ZZ-Z3. Multicompany measures were computed from production and capacity data contained in the same source.

It is vitally important to keep in mind that while the recent removal of the oil import quota may to some extent exert slight downward pressure on crude prices as the U.S. price reaches an equilibrium with world prices, it will not necessarily substantially alter the structure of the refining level of the petroleum industry. This is true for two reasons. First, the major integrated companies have substantial interests in crude oil production world-wide. Second, and most important, it is questionable that new independent refiners would enter the market, even with available supplies of foreign crude. The reason is quite simple—the uncertainty of the continuing availability of foreign crude. Just as the federal government first restricted imports and then removed them, they may be restored at a moment's notice. And since refining is the pivotal point in the petroleum industry, the implications are that removal of the import quotas alone may not be sufficient to cure the present ills of the industry or alter its noncompetitive performance significantly.

### *Gasoline Marketing*

Gasoline marketing is the most competitive area of the petroleum industry and has the largest number of independent companies. Marketing consists primarily of jobbers purchasing refined gasoline and supplying retail gasoline stations. These jobbers may be completely independent, may own their own retail stations, or may be vertically tied to refinery operations. They also may carry branded or unbranded products.

The 1970 gasoline market shares of the Top 20 companies are presented in Table 7. The top 4, 8 and 20 companies accounted for approximately 31, 55 and 79 percent, respectively, of domestic gasoline sales. The Top 4 and 8 gasoline marketers correspond with the Top 4 and 8 refiners and the Top 8 crude producers are identical with the Top 8 marketers and refiners. (See Table 8.)

**TABLE VII.**  
**Company Gasoline Market Shares 1970**

Rank	Company	Market Share (percent of)
1	Texaco	8.13
2	Shell	7.87
3	Standard (New Jersey)	7.42
4	Standard (Indiana)	7.30
5	Gulf	7.12
6	Mobil	6.60
7	ARCO	5.55
8	Standard (California)	5.02
9	Sun	4.15
10	Phillips	3.97
11	Union	3.29
12	Continental	2.35
13	Cities Service	1.96
14	Marathon	1.73
15	Standard (Ohio)	1.46
16	BP	1.41
17	Ashland	1.27
18	Tenneco	0.93
19	Kerr-McGee	0.77
20	Murphy	0.75
	Top 4	30.72
	Top 8	55.01
	Top 20	79.05

NOTE: Market shares obtained from *National Petroleum News*, "Factbook Issue," mid-May 1971, p. 127.

The distinction between the major branded retail gasoline stations and the independent stations is one of the primary reasons for price competition at this level.

**TABLE VIII.**  
**A Comparison of Company Ranking in Crude Production,  
Crude Refining Capacity, and Gasoline Sales**

Company	Rank in Crude Oil Refining Production	Rank in Crude Oil Capacity	Rank in Gasoline Sales
Standard (New Jersey)	1	1	3
Texaco	2	3	1
Gulf	3	7	5
Shell	4	4	2
Standard (California)	5	5	8
ARCO	6	8	7
Standard (Indiana)	7	2	4
Mobil	8	6	6
Getty	9	16	-
Union	10	10	11
Sun	11	9	9
Continental	12	14	12
Marathon	13	17	14
Phillips	14	12	10
Cities Service	15	15	13
Amerada Hess	16	19	-
Tenneco	17	-	18
Skelly	18	-	-
Superior	19	-	-
Louisiana Land & Exploration	20	-	-
Standard (Ohio)	-	11	15
Ashland	-	13	17
BP	-	-	16
Kerr-McGee	-	-	19
Murphy	-	-	20

The major branded stations differentiate their products and convey a national image. These retail stations generally offer a full line of services, including credit cards, automobile repair, etc. The independents, on the other hand, differentiate their products primarily on a price basis and offer few services other than pumping gasoline. This, of course, gives the consumer a choice between purchasing gasoline and services at a higher price, and purchasing only gasoline at a lower price. If, in a given area, consumers show a strong preference for the latter, and/or if independents move into a market, vigorous price competition between the majors and independents may result.

Of course some price competition may result directly from the major companies themselves. This may occur when a major company decides to move into a market area dominated by other majors or possibly independents. As a new entrant, this major company may begin as a vigorous price cutter; but, as his price cuts are matched by other companies, the retail gasoline price will eventually stabilize somewhere near the old level. If he is strong enough, he may achieve his desired market share. But, in doing so, he will have obtained it at the expense of the weakest segment of the market, the independent portion. If independents are diversified geographically, however, they may withstand price competition. If not, they will be the first to be eliminated.

However, today a price war is unnecessary for the elimination of the independent marketer. Because the major oil companies control the lion's share of domestic crude oil and refinery capacity under conditions of excess demand, they have been able to direct the flow of gasoline to their own service stations first, thus denying to the independent marketer access to a substantial portion of the gasoline supply. In fact, independent gasoline marketers receive only about 2 percent of their supply of product from the eight largest oil companies.

### *Transportation*

Because crude oil is low in value relative to its weight and the refinery process requires a relatively constant flow of crude and product, pipelines are generally the most economical form of bulk land transportation in this industry. Approximately 75 percent of crude and 27 percent of refinery product are carried by pipeline.

Gathering pipelines collect crude from the wells and transport it to a main trunkline station. From the trunkline station, it flows through a larger diameter pipeline to the refinery. Product pipelines carry gasoline and other products from the refinery to local or regional storage facilities from which jobbers and ultimately retailers purchase their product.

These pipelines form a vast, complex intrastate and interstate transportation network. Because of the high construction costs, most of the pipelines are owned directly by individual major petroleum companies or by several of these companies through joint venture. However, the nature of the interstate lines causes them to come under the "common carrier" regulatory jurisdiction of the Interstate Commerce Commission.

Our investigation disclosed charges leveled against these pipeline owners by non-owners who claim that they have been excluded from using the common-carrier lines. The inherent technological nature of the pipeline system and the petroleum industry provides the basis for such exclusionary practices.

Through the pipeline system, crude oil is transported more or less on a constant flow-pressure basis. Trunkline stations can pump-in a batch of crude only when there is a slot in the flow for it and then line pressure must be increased or decreased to adjust for the desired flow speed. The scheduling of pipeline input is very complex and must be worked out in advance of the shipment. Because of this process, an independent crude producer may have great difficulty in securing a place in the flow, especially if he does not have storage tanks at the trunkline station and/or ships a relatively small amount of crude. The result of this pipeline system is to place the major firms who own the pipelines in an excellent position to discriminate against the independent producer. The opportunity to require the independent to enter into an agreement to sell his product at the wellhead in order to obtain regular sale and transportation of crude clearly exists for the majors.

### *Barriers to Entry*

In addition to being a highly integrated industry, the petroleum industry, and refining in particular, is also characterized by high barriers to entry. Without such barriers, excess profits would attract new firms into the market, increasing the supply, and eliminating the excess profits. Because of the lack of substantial entry by new independent refiners over the last 20 years, we turn our attention to factors in the petroleum industry, which tend to act as barriers to entry. In most instances, the factors leading to further concentration, e.g. import quotas, prorationing, depletion allowances, also serve to inhibit new entrants into the industry or component segments of the industry.

The most obvious barrier is the high capital cost of entering the refining industry. A refinery large enough to achieve maximum scale economies in the production of gasoline costs approximately \$250 million. The operation of the capital market is such that the number of firms, which can borrow that amount of money is relatively small. Even for those firms which have access to the required capital, the risks which they face vis-à-vis the major petroleum companies are such as to discourage entry.

Several of those risks are associated with the ability of the refiner to obtain a dependable source of supply of its major input, crude oil. In the past, refiners have had to depend on their major oil company competitors for access to this crucial input. This has occurred because the major oil companies directly own substantial amounts of the crude oil, and because they control the vast majority of the remainder of the crude (primarily through control of pipeline transportation). Thus, in any short supply situation, the independent refiner would be the first firm to lose access to crude oil and the last to regain access. Having refinery output subject to great variation because of variation in crude inputs imposes substantial costs upon nonintegrated refiners. The alternative of entering the petroleum industry as a vertically integrated firm raises capital costs to even greater proportions.

The plight of the would-be entrant at the refining stage has to some extent been alleviated through the recent Presidential removal of the oil import quotas. However, this does not eliminate the problems faced by the independent refiners in this context. All students of the petroleum industry (surely anyone planning to expend \$250 million as a capital investment would become a serious student of the industry) are well aware that the major firms have always turned to governmental entities to help them rationalize excess supply situations. They would have to assume that if the inflow of foreign crude became sufficient to cause a reduction in the current price of domestic crude, the major companies would again turn to the government to request limitations on imports. Their past success in obtaining such actions is such that one might infer a high probability of future success. Thus, a firm, which had built a \$250 million refinery, might suddenly find that its access to crude oil was greatly reduced. The nature of refinery cost functions, i.e., sharply declining average costs as a refinery nears capacity operation, would make any reduction in the availability of crude oil a traumatic and possibly bankrupting experience for the new entrant.

Since pipelines transporting crude oil across state lines are common carriers subject to Interstate Commerce Commission regulation, it might seem strange to classify pipeline control as a barrier to entry to new refinery capacity. However, there are two reasons to suppose that pipeline control does, in fact, constitute a legitimate barrier. First, the owners of pipelines seek approval from the ICC of rates that provide sufficient returns from their pipeline investment. However, the rate approved may be well above the competitive cost of transporting crude oil. For the vertically integrated owners the excessive rate is no burden. Those firms simply transfer funds from the Refinery Department to the Pipeline Department; a bookkeeping transaction of no moment is made. Nonintegrated independent refiners, though, must pay the excessive pipeline charge. For these firms a real cost is incurred. To the extent that major-firm owners of pipelines earn greater than competitive returns on investments, the independent refiners are put at a cost disadvantage relative to their major competitors, and a barrier to entry is imposed. To a lesser extent control of product pipelines can be used to erect a barrier to entry.

Second; pipelines can be employed as a barrier to entry if the owners can exclude or limit flows of crude oil to independents. In fact, this can be done by (1) requiring shipments of minimum size, (2) granting independents irregular shipping dates, (3) limiting available storage at the pipeline terminal, (4) imposing unreasonable product standards upon independent customers of pipelines, and (5) employing other harassing or delaying tactics.

A barrier of substantial importance in the past existed because of the vertical integration in the industry and the federal tax laws. The depletion allowance worked to encourage vertically integrated firms to report all profits at the crude oil stage rather than at later stages such as refining or marketing. The effect was to raise the price of crude oil for refining operations, whether vertically integrated or not. For the vertically integrated concern the price was simply a bookkeeping one and raising it resulted in decreasing refining profits, increasing profits on crude, reducing tax payments, and increasing total profit. For the independent refiner the result was to decrease refining profits, which were total profits.

The system contained all the elements essential to a squeeze on refining profits and could be overcome only if the potential refining entrant could enter on a vertically integrated basis. However, entry on this basis substantially increases the already high capital cost of entry. Even with the freeing of imports the system will still work to the disadvantage of independent refiners unless the world price of petroleum settles to a competitive level.

A final barrier to entry results from the recent emphasis on environmental impact. Even firms who can overcome the high barriers may find either that they cannot obtain government permission to build at the optimal location or that additional capital is required to eliminate possible adverse environmental impacts. In any case they may be at a disadvantage relative to existing plants, which were located without respect to such constraint.