

# CAN THE UNDER-EXPLOITATION OF IRANIAN OILFIELDS BE JUSTIFIED ON ECONOMIC GROUNDS ?

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The question «why is production from Iranian Oilfields not sufficiently stepped-up?» has been a live issue in Iranian political and economic circles for many years. The present article discusses only the economic aspect of the problem, and with the aid of published statistics, without any claims to special or confidential information, it is proposed to make an impartial study of what may have caused Iranian crude oil production to be kept at a low level.

Statistics and other data used have been compiled from published statistics in well-known oil publications such as «World Oil», «Oil and Gas Journal», «Petroleum Facts and Figures» as well as the World Petroleum Statistics of the U. S. Department of the Interior, Bureau of Mines. Where information from sources other than the above has been used, detailed references have been given. Quantities have been expressed in American barrels and production rates in barrels per day—units which appear to have gained general acceptance throughout the industry.

We begin by looking at crude production statistics. Table I shows the world annual production, as well as average annual increase, of crude oil production since the Second World War.

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Table I— World Oil Production (1938-1960)

Year	Million Barrels/Day	% Annual Increase
1938	5.4	
1945	7.4	4.6 (7 years average)
1950	10.4	7.0 (5 years average)
1955	15.7	8.6 (5 years average)
1956	16.7	6.4
1957	17.6	5.4
1958	18.0	2.2
1959	19.5	8.3
1960	21.0	7.6

Source : Word Oil.

It is noticed that the world production of crude oil has consistently maintained a remarkable growth rate over the past 22 years. This phenomenal rate of growth whereby production has on the average doubled itself every 10 years has been mainly due to the increasing application of the internal combustion engine, particularly in transportation, and the substitution of oil for other sources of energy. Middle East's contribution to this rapid growth of crude production, as we know, has been an ever-increasing one. Table II shows the annual production of crude oil in Middle East and for each of the four main oil producing countries of the area for the period 1950-1960.

Table II— Middle East Annual Crude Production (1950-1960)

(1000 Barrels/Day)

Year	Iran	Iraq	Kuwait	S. Arabia	Total
1950	664	136	344	547	1725
1951	338	178	561	762	1889
1952	21	386	747	825	2048
1953	26	576	862	845	2393
1954	59	626	960	961	2706
1955	330	688	1104	977	3215
1956	539	635	1109	1002	3408
1957	721	448	1172	1024	3504
1958	826	729	1437	1055	4221
1959	945	853	1441	1154	4561
1960	1068	967	1692	1315	5214

Sources: U.S. Department of the Interior, Bureau of Mines.

World Petroleum Statistics.

American Petroleum Institute, *Petroleum Facts and Figures*.

The table shows that Iranian production of crude, which held first place in the Middle East in 1950, dropped to very low levels during the period 1951 to 1954 and that only after the Suez crisis and the disruption of the IPC pipelines in 1957 did it surpass Iraqi production and became the third biggest crude producing country in the Middle East. To get a clearer idea of the share of each of the above-mentioned countries in total Middle East production let us look at table III and chart No. I which depicts in graph form the percentage share of each country in the total crude production of the area during the decade 1950-1960.

Table III— Percentage Share of Middle East Countries in Total Crude Production, 1950-1960

Year	Iran	Iraq	Kuwait	S. Arabia
1950	38.5	7.9	20.0	31.7
1951	17.9	9.4	29.7	40.3
1952	1.0	18.8	36.5	40.3
1953	1.1	24.1	36.0	35.3
1954	2.2	23.1	35.5	35.5
1955	10.3	21.4	34.3	30.4
1956	15.8	18.6	32.5	29.1
1957	20.6	12.8	33.4	29.2
1958	19.6	17.3	34.0	25.0
1959	20.7	18.7	31.6	25.3
1960	20.5	18.5	32.4	25.2

Source: Table II.

Chart No. I shows the rapid rise of Iran's share between the years 1954 and 1957 and its constancy since then. It would appear that from 1957 onward Iranian production has been maintained at around 20% of the total Middle East production. Since the 8 international oil companies that had almost complete control of oil operations throughout the Middle East during this period have been relatively free to allocate production effort amongst these countries as they see fit, and since it is assumed that these international oil companies are motivated by economic consideration of profit maximization, the problem is to find whether there is any economic justification for the maintenance of such a policy. It is proposed in this article to examine those economic factors which might affect the international oil companies' decisions in encouraging Iranian oil production to, or restraining it from, growth beyond this level. We will consider the factors which influence an entrepreneur, who has a choice of exploiting different fields, to prefer exploiting

one field to another. The following considerations might have to be taken into account in any such evaluation:

1. Considerations of reserves-to-production ratios in relation to the unexpired periods of oil agreements with different countries.
2. Problems of marketing specific crudes and the general slackening of demand for oil.
3. Present and future cost/price relationships.

Each of these factors will now be discussed below.

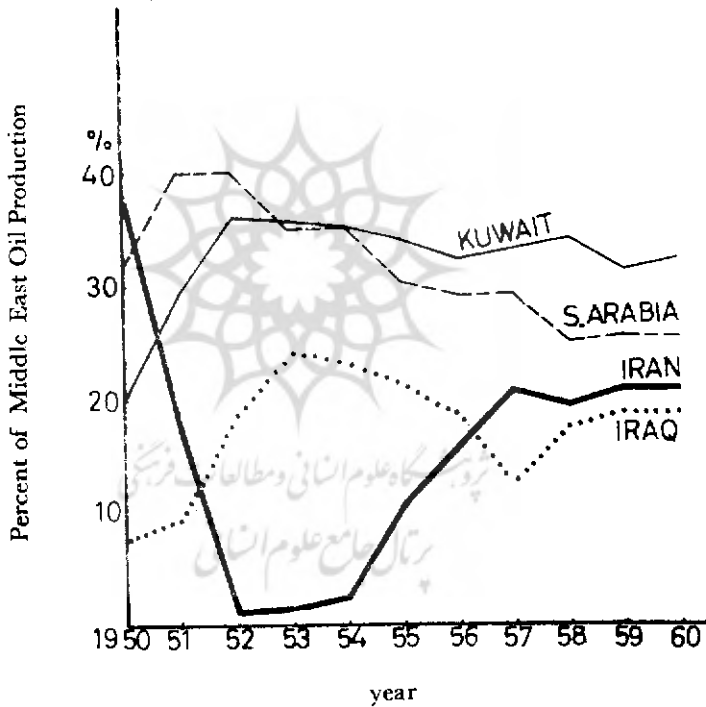


Chart No. I – Percentage share of Middle Eastern countries in total Middle East crude production (1950-1960)

### Reserves-to-Production Ratios

It is not inconceivable to suppose that an operator having a choice of exploiting different fields under different agreements should so regulate

production from each field as to ensure that the reserves in each country would carry him throughout the period of the agreement with that country. Under these circumstances, and providing no new reserves are expected to be discovered, the operator might regulate the production from each field in proportion to the reserves therein.

Table IV - Maximum Exploitation Rate of Middle East Known Reserves on Certain Assumptions.

Country	Proven Reserves at end 1960 (10 <sup>9</sup> Barrels)	Unexpired Life of Agreements at end 1960 (Years)	Maximum Exploitation Rate (10 <sup>6</sup> Barrels/Day)
Iran	35	19	5.1
Iraq	27	47	1.6
Kuwait	65	66	2.7
S. Arabia	53	39	3.7

Source: Reserves -- The Oil and Gas Journal

Table IV shows proven reserves as at the end of 1960 for each of the 4 main oil producing countries of the Middle East, together with the remaining lives of the oil agreements expressed in years. In the case of Iraq the average of the remaining years of the agreements with the Iraq Petroleum Company, the Basrah Petroleum Company and the Mosul Petroleum Company has been taken. For Saudi Arabia, Kuwait and Iran the unexpired years of the agreements with Arabian American Oil Company, Kuwait Oil Company and «The Consortium» of international oil companies have been taken. Dividing the figure representing proven reserves by the number of remaining years of agreements for each country gives a figure which may be considered as the maximum allowable annual production on the assumption that no new reserves are discovered and that the

operator wished to «spread» the draining of existing known reserves over the agreement periods. This maximum exploitation rate has been expressed in million barrels par day and is shown in the last column of table IV.

It is seen that fears that Iranian reserves might be depleted before the expiration of the agreement with the Consortium of international oil companies are unfounded and that such considerations could not possibly constitute grounds for limiting Iranian crude production at its present level. Production from Iranian oilfields could be stepped-up to 5 times its present rate without the risk of depletion of reserves during the currency of the agreement. Even if the 3 optional additional 5 years are added to the life of the agreement the production rate from Iranian oilfields could still be boosted up to nearly three times its present rate without any qualms.

### **Marketing Considerations**

That production capacity alone, and without sales outlets, even under conditions of acute supply shortages, is no guarantee of sales in worth-while quantities was amply demonstrated during the 1951-1954 period. It is therefore necessary to consider factors which might make the marketing of additional quantities of Iranian oil difficult or impossible. It is true that different crudes, having different specifications and uses, tend over a period of time to establish in the minds of refiners scales of preference. But the greater versatility and flexibility of modern refineries, and improved techniques, work in the opposite direction. Outside of the United States of America and the communist countries the greater part of the refining and sale of oil products is under the control of the international oil companies. Of the 539 million metric tons annual refining capacity existing in the free world outside of North America at the end of 1960 more than 350 million tons, or 65%, was under the control of American and British/Dutch companies.<sup>1</sup> These are in effect the same international oil companies whose widespread activities in the refining and sales end of the business enables

1. British Petroleum Equipment News, Winter, 1961/62.

them within reason to utilize almost any type of crude in accordance with varying market requirements. The question of crude specification therefore can hardly be of such importance as to limit the disposal of Iranian crude oil.

The slackening of general world demand for oil has been put up as a strong reason for the failure of Iranian production to regain its place among the oil producing countries of the Middle East. Let us look at this matter in some detail. Table I shows that the annual world production of oil, which in effect is demand at current prices, has more than doubled itself within the decade 1950 to 1960. Crude production in the Middle East, which was 1.7 million barrels per day in 1950, trebled itself and reached 5.2 million barrels per day by 1960. This shows that there was no diminution of total demand for Middle East crude during the decade, particularly in view of the frequent price reductions. In other words the market for Middle East oil was never saturated—demand was rising at a comfortable average 7% per annum throughout the decade and although the growth rate during the period 1957-1960, when Iranian production should have been stepped-up was at a slower rate, it was still a good 6% and could easily absorb a good deal of additional Iranian production.

### **Cost/Price Relationships**

But the criteria of production costs and profitability would of course be the deciding factor. The marginal productivity theory of distribution shows that an entrepreneur who has the choice of operating in various fields of activity, and who is motivated by the desire for profit maximization, will allocate productive services among the various fields in such a way as to equate marginal revenues obtainable in each field. This is an obvious truth, for if the additional revenue derived from the application of an additional unit of productive services were expected to be greater in one field than in others it would be to the advantage of the entrepreneur to continue applying productive services to that field until equality with revenue from other fields is achieved. The same considerations



apply in the case of the international oil companies that practically control oil operations in the Middle East. These companies have the choice of increasing development and exploration activities in any country that provides a higher net marginal income in order to increase production and meet increased demands — in any country, that is, where a greater differential exists between marginal revenue and marginal cost.

It goes without saying that information on marginal revenue and marginal cost for the different countries is not available. In fact information on this aspect of the industry is very scanty, so that it is difficult to verify statements made to the effect that production costs in one country are higher or lower than in another country. However, it would still be possible to obtain certain indicators from information generally supplied by the oil companies. For example, if the oil income of each country for each year is divided by the number of barrels of crude produced in that country in that year, it should be possible to calculate the various countries' net income per barrel from oil. Since the 50-50 formula generally applies throughout the Middle East (at least in so far as the main oil agreements are concerned) it is possible, with certain reservations, to consider these income-per-barrel figures so calculated as the net income to the international oil companies for each barrel of crude produced. Strictly speaking this assumption is not one hundred per cent correct for the following reasons:

1. The Governments' oil incomes are not confined to income from crude production and have refining and other income mixed in.
2. Payments in each year do not always relate exclusively to production during that year and may include adjustments in respect of other years.
3. The Governments' incomes from oil in the Middle East are generally based on posted prices and not on sales realizations; to this extent therefore the companies incomes are overstated.

However, since the above reservation apply in the case of all of the main Middle East countries studied, and since our purpose is to establish

ordinal relationships rather than cardinal values of production profitability, there appears to be no great harm in accepting these results.

Table V - Net Income per Barrel from Crude Production in Middle East Countries, (1955-1960)

	1955	1956	1957	1958	1959	1960
<b>Iran</b>						
Oil Income (\$ 10 <sup>6</sup> )	91	153	213	247	262	285
Crude Production (10 <sup>6</sup> Bbbls)	121	197	263	301	345	390
Income per Barrel (Cents)	<b>75.2</b>	<b>77.7</b>	<b>81.0</b>	<b>82.1</b>	<b>75.9</b>	<b>73.1</b>
<b>Iraq</b>						
Oil Income (\$ 10 <sup>6</sup> )	206	193	144	224	242	252
Crude Production (10 <sup>6</sup> Bbbls)	251	232	163	266	311	353
Income per Barrel (Cents)	<b>82.1</b>	<b>83.2</b>	<b>88.3</b>	<b>84.2</b>	<b>77.8</b>	<b>71.6</b>
<b>Kuwait</b>						
Oil Income (\$ 10 <sup>6</sup> )	282	293	308	354	345	385
Crude Production (10 <sup>6</sup> Bbbls)	403	405	428	524	526	618
Income per Barrel (Cents)	<b>70.0</b>	<b>72.3</b>	<b>72.0</b>	<b>67.6</b>	<b>65.6</b>	<b>62.3</b>
<b>S. Arabia</b>						
Oil Income (\$ 10 <sup>6</sup> )	275	283	303	302	315	335
Crude Production (10 <sup>6</sup> Bbbls)	357	366	374	385	421	480
Income per Barrel (Cents)	<b>77.0</b>	<b>77.3</b>	<b>81.0</b>	<b>78.4</b>	<b>74.8</b>	<b>69.8</b>

Sources: Income - Companies' Annual Reports  
Production - Table II

Table V shows these calculations in respect of the main Middle East oil producing countries for the years 1955 to 1960. This table, and chart No. 2, show that the companies' net income per barrel of crude produced in

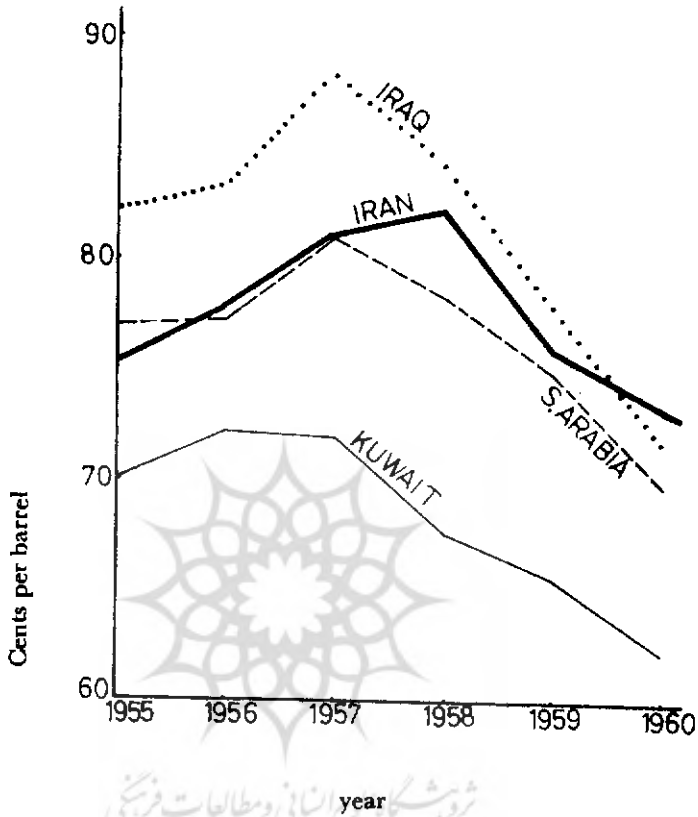


Chart No. 2 - Oil companies' net income per barrel of crude production in Middle Eastern countries (1955-1960)

Iran has been rising during the period under review and that from 1956 onward it has been one of the highest in the Middle East. It was thus more profitable for the international oil companies to meet additional demands for crude from production in Iran than from other countries.

It may be contended that although the net income per barrel on crude produced in Iran is higher now, it may not be so in the future. This could come about if the trend for income per barrel in Iran were to drop relative to that of other countries. To get an indication of the probable future

trend it might be useful to look at some well productivity figures for the 4 countries during the past decade.

Furthermore, since an entrepreneur is more interested in total profits than in profits per unit, the question of capacity must also be considered. If profitability per barrel be high in a field but productive capacity be low, then it may be preferable to develop other fields which are not so profitable in terms of unit output but which are more prolific.

Table VI - Approximate No.\* of Producing Wells in Middle East Countries (1951-1960)

Year	Iran	Iraq	Kuwait**	S. Arabia**
1951	84	53	105	114
1952	30	58	128	128
1953	30	73	149	140
1954	44	73	168	148
1955	39	74	193	163
1956	69	70	226	156
1957	85	99	272	229
1958	97	96	343	250
1959	93	110	385	270
1960	113	98	445	288

\* Average of mid-year and year-end figures.

\*\* Includes 50% of Neutral Zone.

Source : Mid-year figures - The Oil and Gas Journal

Year-end figures - World Oil

Table VI gives the number of producing wells in each of the 4 main oil producing countries of the Middle East during the period 1951-1960. If

the crude production figures for each country for each year, as given in table II, are divided by the relevant figures of table VI the resulting figures could be considered as average well productivity (in barrels per day per well) for each year in each country. The results of these calculations are shown in table VII and chart No 3.

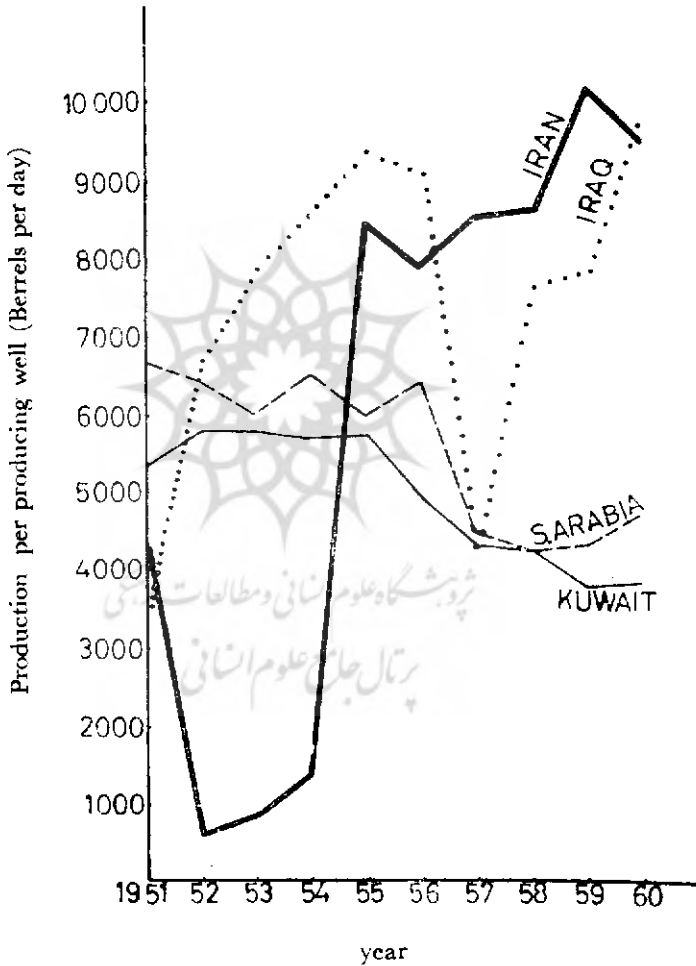


Chart No. 3 - Average crude production per producing well (1951-1960).

Table VII - Approximate Crude Production per Producing Well in Middle East Countries (1951-1960)

(Barrels per day per producing Well)

Year	Iran	Iraq	Kuwait*	S. Arabia*
1951	4029	3366	5347	6680
1952	710	6647	5837	6444
1953	860	7892	5785	6033
1954	1339	8573	5713	6495
1955	8469	9300	5720	5995
1956	7807	9067	4905	6424
1957	8481	4524	4308	4472
1958	8511	7595	4189	4222
1959	10158	7751	3744	4272
1960	9448	9865	3802	4567
Average				
1956-1960	8966	7676	4100	4652

\* Includes 50% of Neutral Zone.

Source: Tables II and VI

If the 4 years of the period 1951 to 1954 during which exceptional circumstances prevailed in Iran are excluded it will be seen that the average productivity of Iranian oilwells has, throughout, been very high, even by Middle Eastern standards. (By contrast it is worth recalling that the average production in the United States of America has been in the order of 13 barrels per day per well). It is thus seen that productive capacity required to ensure high income per barrel on a large output has been available in Iran.

An interesting sidelight indicating the probable future trend of productivities may be obtained by reference to Chart No. 4 which endeavours

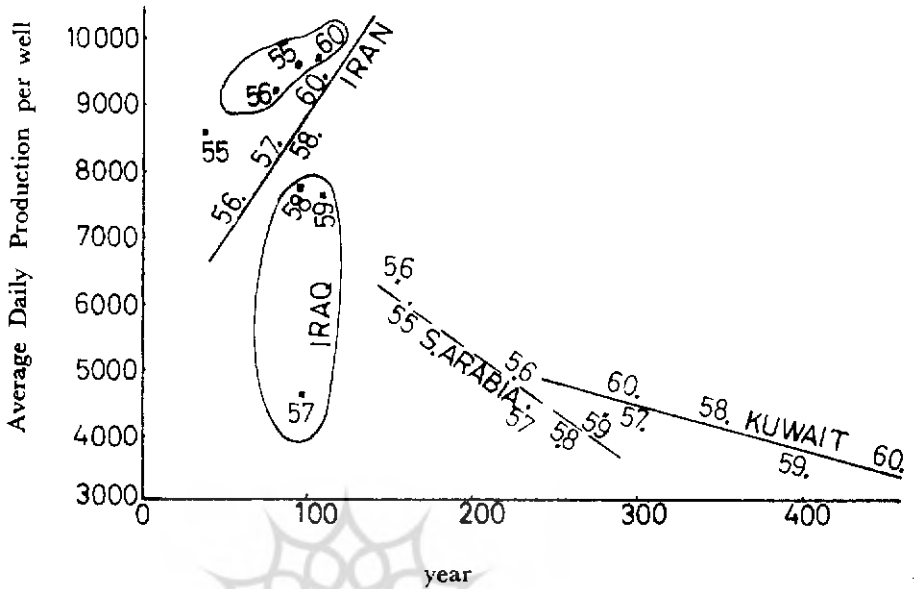


Chart No. 4 - Correlation between No. of producing wells and average productivity per well.

to discover some correlation between average well productivity and the number of producing wells in each of the 4 main Middle East countries during the past decade. The chart, which is drawn in the form of a scatter diagram, shows the number of producing wells and average well productivity for each year in each country along the horizontal and vertical axes respectively. In the case of Iraq, the disturbing effect of the cutting of the pipeline during the Suez crisis obscures any correlation indications. But a high degree of correlation is noticeable in the case of Iran, Kuwait and Saudi Arabia. In the case of Kuwait and Saudi Arabia the trend lines slope downward from left to right, indicating a negative correlation. This means that the productivity per well, as one might expect, diminishes as more wells are brought into production. What is surprising, however, is that there should be a positive correlation in the case of Iran as denoted by the upward slo-

ping of the trend time. It would indeed be unnatural to accept the possibility of a causal relationship which tended to increase well productivity as more wells are brought into production, though there may be some plausibility for the converse case. After 50 years of exploitation of Iranian oilfields it is natural to expect diminishing well productivity. That this has not been the case is probably indicative of the enormous potential productive capacity which has not been brought into play and which could, by spreading costs over a larger output, considerably reduce the effect of fixed and semi-variable overheads and large annual write-offs in respect of exploration expenditure. Production cost per barrel, that bogey which by itself outside the context of other income yardsticks, is allegedly the obstacle to a more rapid stepping-up of Iranian oil production, could be further reduced, making Iranian crude «more competitive».

#### **Summary and Conclusions**

In the above analysis the factors which might influence the international oil companies' decisions as to the relative advantages of exploiting one oilfield in preference to another were examined and it was found that neither fears of premature depletion of oil reserves, nor low productivity of the oilwells, nor relatively inadequate income per barrel of crude production could be invoked as arguments justifying the under-exploitation of Iranian oilfields. It was shown that it would have been more profitable for the international oil companies that control oil operations almost fully in the Middle East (and to a considerable extent throughout the free world outside the United States of America) to meet additional demands for oil from Iranian production. That they have not done so since 1957, that they appear to be deliberately restraining Iran from producing at a level above 20% of the Middle East production instead of allowing her to regain the position she held among the oil producing countries before she nationalized her oil industry, is the problem that we set out to find economic justifications for. The conclusions reached show that no economic justification can be found for the under-exploitation of Iranian oil resources. Perhaps considerations other than economic should be taken into account — but that would be outside the scope of this article.