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If all deposits of oil in the earth's crust were known, the cheaper ones would be exploited first, and within each deposit cost would be higher the more intensively the oil was exploited. Thus at the intensive and the extensive margin the cost would rise over time. When marginal cost (which exceeded average cost, thus affording a royalty) equaled the cost of the cheapest available alternative, there would be no new investment in oil, and mankind would gradually switch over to the alternative energy source as existing deposits were run down.

Since prices in this ideal scenario are expected to rise over time, the royalty on a given deposit would also rise. Hence, the owner of a low cost deposit, whether a public or private holder, would have a problem of timing: should he hold off for the higher price later, or take the lower price sooner? Depending on what he thought was the appropriate interest rate, which may include a large element of risk, he would try to arrange depletion so that the present value of exploiting the oil deposit at any given moment was equal to the present value of doing so at any other moment. Thus a market process levies a tax on premature use of low cost minerals, including oil.

The ideal process just described is logically sound, but does not quite match what happens in the real world: mineral prices have not generally risen (in relation to the general price level). However, few today will heed the warning of Richard L. Gordon that firms in the mineral industries have acted as though their reserves were inexhaustible and even renewable, and they have usually been proven right. For purposes of this paper, we too will disregard this possibility in the particular case of oil. Some time ago I did a small experiment by assuming that the nearest alternative energy source to conventional oil would cost $16 per barrel in 1975 prices, about $18 in 1977 prices, and could be installed to produce very large amounts after the year 2000 A.D. Mr. Ait Laoussine of Algeria recently estimated the cost of alternative energy sources in the range of $15.30 to $18.80 per barrel in 1977 dollars.[1] I assumed that costs increased relatively

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1. N. Ait Laoussine, Marketing of Oil and Gas: Sonatrach Case 9 (at OPEC seminar on The Present and Future Role of the National Oil Companies, Vienna, October 10-12, 1977).

little as one went from better to poorer deposits so that the royalty increased almost as much as the price. In addition, some rather conservative assumptions about demand, risky interest rates, and above all, assuming that ultimate oil reserves were indeed as estimated in 1975 and that gas reserves were to be ignored, the competitive price of oil in 1977, making full allowance for its nonrenewable character, was about $2.25 per barrel in 1977 prices. Since the price was around $12.70 per barrel it is clear that we cannot possibly explain the current and prospective international oil price levels by scarcity, present or foreseen.[2]

A different industry supplies a cautionary tale. Airline capital and operating costs have increased in recent years, yet domestic and international fares were substantially reduced because of the loss of official support for fixing rates far above competitive levels. Cost changes were less important than the strength of the monopoly. Since the oil price is also far above cost (including the present value of assumed future scarcity) only a continuing monopoly can sustain it.

Assuming that the optimal monopoly price is higher than the current price (a consensus view, which I personally share but some respected observers do not) we will try to indicate why the monopoly will move slowly and gradually. To a first approximation, we can think of the oil nations as a single seller. If they were selling tin or coffee for example, and knew the optimal price, they would charge it forthwith. But oil is so large a part of the world flow of payments that it would be reckless to disregard the effects of large sudden changes in that flow. The actions of the Organization of Petroleum Exporting Countries (OPEC), as distinguished from their rhetoric, have always been sober and cautious. The big price increases of 1973 and of 1974 (over 50 percent from January 1 to mid-October) have played a significant part in the world recession and stagnation of later years. The direct results of the price increases were not nearly as important as the secondary effects arising from the consuming nations' attempts to restrain inflation and prevent excessive balance of payments deficits. The oil sellers are much better off with higher prices and world stagnation. However, yet higher prices and worse recession would not be good for them. One should not expect higher prices until world monetary and trading systems are in better shape than they are at the time of this writing, January 1978.

2. ADELMAN, The World Oil Cartel: Scarcity, Politics, and Economics, 16 Quarterly Review of Economics & Business (Summer 1976).

There is a more particular reason for caution in price raising. The consuming nations, far from offering any resistance to the higher oil prices, have talked only of "cooperation, not confrontation," and have suited the action to the word. The official truth in the United States is that OPEC actions are good for us. One alleged benefit, incidentally, is a stronger dollar.[3] The consuming nations ought not to be goaded into seeing things as they are, and seeing OPEC as a burden to be lessened. The consuming nations could, if they wished, tax away the great bulk of OPEC revenues into their own pockets if price were in the neighborhood of the "natural limit," the same prices as an alternative energy source. The nations could also keep the price from increasing, as has been demonstrated elsewhere, by levying a progressive tariff or excise tax whose rate increases with the price.[4] A sensible monopoly ought to sacrifice considerable revenues, and stay well below the "natural limit" to lessen the risk of such a catastrophe for them. Consuming governments might never deliberately choose this policy, but if they struggled year after year with balance of payments difficulties and revenue needs, they might slowly increase taxes on oil products. Since they are closest to the final consumer, they have the power to preempt much or most of the stream of payments from ever getting to the producing governments.

There is a particular version of this weapon which an individual government could use. I have suggested an auction of American import entitlements, which would not lower consumer prices but would divert much or most monopoly revenues to the U.S. Treasury.[5] This would enable any OPEC nation to cheat, and make additional sales, or prevent loss of sales, thereby increasing its revenue, by rebating to our government for the right to export to this country. A number of OPEC governments now sell from one third to over half of their oil to the United States, and such a system would require an immediate decision between sticking with OPEC principles, boycotting the auction, and dumping oil on the world market; *or* bidding competitively and secretly for sales enough to keep the industry going at capacity.

The proposal for auctioning oil import rights was approved by the Economic Task Force of the then President-elect Carter.[6] Sub-

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3. *Huge OPEC Oil Price Rise Benefited U.S.*, Washington Post, July 10, 1977 (an excellent paraphrase of the official view, which has ruled since at least mid-1970, when the State Department supported Libyan demands).

4. For a formal proof, see my *Constraints on the World Monopoly Price* (forthcoming in vol. 1 *Resources and Energy*, (1978).

5. *See* Adelman, *Oil Import Quota Auctions*, 17-22 January/February, 1976.

6. Oil & Gas J., January 10, 1977.

sequently his energy chief agreed that the plan would work if the United States dared to let it work.[7] But the Carter Administration is, in its own language, "grovelling for Arab oil,"[8] for reasons not explained. One cannot see much with his forehead to the ground.

At any rate, the oil selling nations ought not to change the fixed belief by the consuming nations that producing nations will, for some never stated and hence irrefutable reason, hold the world oil price below the market-clearing level. (If they did so, the shortage of oil products would make product prices soar, with huge windfall gains to refiners and marketers. These gains would be appropriated by higher crude prices.) Therefore, there will always be a "gap," with more oil demanded than is offered. Oil will then be distributed by favor and influence. Hence arises the irresistible ego trip for the statesmen in declaring that they have succeeded in getting the producers, particularly Saudi Arabia, to produce "enough to meet our needs." Of course, no matter what price is set, the amount demanded at that price will equal the amount supplied. Conversely, no matter what the Saudis produce, the price will rise high enough to where anybody paying it can have all he wants. So the Saudis will produce "enough to meet our needs" no matter how much they produce and sell, at whatever price. The longer we believe in the nonsensical gap, the better for the cartel. Anything but a slow upward price adjustment might shock us into clarity.

We now relax the assumption that there is a single monopolist, and recognize that the oil exporting nations are really a group of sellers of unequal size, of whom Saudi Arabia is by far the biggest in terms of current and potential oil capacity. It is often asserted that the Saudis are in effect monopolists of any residual supply, letting everyone else currently produce at full tilt. So far, this theory does violence to the facts. The Saudis increased output by 23 percent between 1973 and 1977, while OPEC output was static. One could argue persuasively that their ability to be the residual supplier or restrictor of last resort strengthens the cartel. But if they did become the residual suppliers, their interests would diverge radically from those of the rest of the cartel. Others would benefit from a present price increase, and they would bear the cost. Higher prices would, in the long run, lessen the market and penalize those with the largest reserves and longest perspective. Assume that long run elasticity of demand for OPEC oil is around an improbably low -0.3. Allow Saudi Arabia to initially produce nearly a third of OPEC output and absorb

7. Washington Post, July 10, 1977.
8. Wall Street Journal, October 20, 1977.

the total impact of the increased price and lower consumption. Then a price increase would pay the cartel handsomely but Saudi Arabia miserably and perhaps not at all. If prices doubled, revenues for OPEC as a whole would be 62 percent higher, but for Saudi Arabia they would be only 8 percent higher.

Stagnant revenues are unacceptable to a residual supplier in a market as uncertain as the world oil market. Net demand is not predictable with any accuracy. Even mild percentage changes in the world demand for oil become magnified into large changes in the demand for OPEC oil, and still larger changes in the demand for the residual suppliers' oil. Assume that consumption expected in the non-Communist world in the early 1980's was about 60 million barrels daily, but turned out really lower by 5 percent, or 3 million barrels less daily. Nobody would be surprised. But if all the reduction were borne by Saudi Arabia, then the unexpected cut coming atop an expected cut would be intolerable.

Thus the overall notion of the producing nations as *either* a conventional cartel with a market sharing mechanism, *or* as a dominant firm monopoly or a residual-supplier monopoly, are both too simple. In truth both concepts are included. We can now understand why price fixing without allocation of markets has made for haphazard fluctuations in market shares of the OPEC governments. The over-publicized squabble in early 1977 over the "two tier" system only hides the real problem. The relative value of various crude oils keeps changing incessently because markets change. Hence, without a system of prompt corresponding adjustments in oil prices, buyers move from one supplier government to another in search of a better deal. There was a time when the margins of the operating companies were so wide that they could accept reductions in net realizations from one or another country, without switching from one supplier to another. But their margins are now so low that while it would be an exaggeration to call them mere buyers, like independent refiners, their incentives to change from one supplier to the other are many times as great as they used to be. In the current over-supply of light crudes, North Sea production is maximized at the expense of everyone else.

Thus we have three problems which must be solved simultaneously or not at all: crude oil price differentials, company producing margins, and governments' market shares. There is no solution in sight, and the cartel has gone from one ad hoc arrangement to another. The OPEC members must from time to time somehow reach an accommodation to allow all of them to share to some extent in the benefit of a higher price. The Saudis will veto the higher price unless there is something in it for them.

With all of these complex problems we really have no need for the phantoms of "gaps" and "crunches." Nor shall we be distracted by the alleged political objectives of the oil producing nations, which are served perfectly by economic gain. There is no sacrifice or trade off of one or the other. The more money one has, the better position one is in to make friends and put down enemies.

The last useless distraction involved is the notion that the Saudis keep oil in the ground for conservation or for its future value. Given their reserve position, if they produced 10 million barrels daily, a barrel produced today would sacrifice a barrel in fifty or more years. The future value of that barrel must be liberally discounted because of risks: technical, economic, political, and military. At a discount rate as recklessly low as 5 percent real, $12 from a barrel of oil sold today is better than $120 from a sale in 2025 A.D. The Saudis restrain output today to maintain the price today—a good reason, and the only one which makes sense.

CONCLUSION

We can probably look forward to a decade of rising real oil prices, slowed economic growth, chronic surpluses and increasingly strident eventual-shortage rhetoric. By 1985, the OPEC cartel may be in no worse shape than it is now, but this writer is not inclined to make any bets on any particular scenario, even his own. The world oil project at M.I.T. is working out a simulation model where many variant assumptions can be tried, but that is another story, which will not be dealt with here.