

No. 7809

ON THE STABILITY OF OPEC

by

Dale K. Osborne

November 1978

Research Paper



FEDERAL RESERVE BANK OF DALLAS

No. 7809

ON THE STABILITY OF OPEC

by

Dale K. Osborne

November 1978

This is a working paper and should not be quoted or reproduced in whole or in part without the written consent of the author. The views expressed are those of the author and should not be attributed to the Federal Reserve Bank of Dallas or any other part of the Federal Reserve System.

On the Stability of OPEC

D. K. Osborne*

OPEC oil fetches some fifty times its marginal cost. In order to judge how long it is likely to do so, we must first decide whether OPEC is a classical cartel or, as many people view it, a simple price-leadership arrangement. On the latter view, Saudi Arabia sets the price, allows the other OPEC members to sell all they are able to, and supplies the remaining demand. Such an arrangement creates no cartel problems and only runs the risk of inducing sufficient new production to supplant Saudi Arabia's and so to force the price down. Price predictions turn, therefore, strictly on production and its associated activities such as exploration and development, with no need to evaluate the strengths and weaknesses of cartel arrangements.

If the price-leadership view were correct, Saudi production would be a smaller fraction of total OPEC production today than it was in 1973. The higher price would stimulate greater output from the other OPEC members, which Saudi Arabia would have to accommodate by reducing its own output. In fact, however, Saudi production has no such history. It was 25% of OPEC's in 1973, 30% in 1977, and 27% the first half of this year. This is enough to refute the price-leadership view.

It is true that some OPEC countries have substantially increased their production. Compared with an 8% fall in total OPEC production from

*Department of Research, Federal Reserve Bank of Dallas. No views here expressed have official standing in the Federal Reserve System. This paper was read at the Southern Economic Association's annual meeting, Washington, D.C., November 1978.

1973 through the first half of this year, Iraq's, for instance, rose by 21%, Dubai's by 62%, Gabon's by 48%, and Indonesia's by 26%. These countries might well be simple price followers who avoid the burdens of output restrictions. But clearly, some countries bear this burden. Over the same period, Iran's production, for instance, fell by 6%, Kuwait's by 39%, and Venezuela's by 40%.* Saudi Arabia's was substantially unchanged. OPEC thus consists of two groups, a cartel of from four to ten members and a group of four to ten apparent free riders. Of the latter, only Iraq and Indonesia (and Abu Dhabi, if it is properly included) produce very much. Saudi Arabia, Iran, Kuwait, and Libya appear to be the main cartel members, accounting for some 60% of OPEC production. These four, at least, are in a cartel.

A cartel can die of three forces: the external pressure of substitutes, the internal strain of bargaining and breaching, and the centrifugal pull of departures. The first of these--external pressure--is the only destructive force that also acts on a price-leadership arrangement. It turns out to be the only serious threat to OPEC, for our government has given this cartel the means to contain its internal strain and, in so doing, has greatly reduced the threat of departures. The United States government thus helps OPEC to avoid two of its three great cartel dangers and effectively places it in the stabler position of a price-leadership arrangement. Why this is so, I do not care to speculate; that it is so, however, is easy to see.

*Venezuela, however, might be producing all it cares to out of its declining reserves.

Internal Strain

In a joint maximizing position, each member's marginal revenue exceeds his marginal cost, so there is a gap that he could fill with profit by additional sales at or somewhat below the cartel price. Self-interest keeps this gap constantly before the mind of each member, leading him to continual assessments and reassessments of the gains and losses from trying to fill it. On the one hand lies additional profit. But on the other hand lies punishment by the other members, whether in the form of a fine imposed after formal proceedings, a punitive quota reduction, or a retaliatory increase in their own sales. As a member weighs these things, he knows that the others are doing the same and fears that some of them will decide to breach. His fear of being duped combines with his baser urges to make breaching all the more attractive. His temptation varies inversely with the chance of detection and the severity of punishment, until, with detection impossible or punishment inadequate, his breach is certain. Each breach raises the probability of another and thus adds weight to the breaching side of each member's calculation. The spiral feeds on itself and soon destroys the cartel. No cartel can survive, therefore, unless it finds or creates a detector of breaches and severely punishes those it detects.

OPEC is well placed to punish those breaches that it can detect immediately. Thanks to the high substitutability between its members' products, it simply has to meet the price and nonprice terms offered by any breacher. Though each member's ceteris paribus marginal revenue remains above his marginal cost, no member will use it in his calculations if his breach is certain to be detected. He will have to use the mutatis mutandis marginal revenue, that is, the total rather than the partial

derivative of his revenue function, taking account of the cartel's reaction. Under weak assumptions, this marginal revenue is less than marginal cost.* In this position, a member's own interest will lead him to honor his agreement. A rapid and reliable detector will relieve OPEC of the internal strain that usually issues from breaches.

OPEC of course has other sources of strain. The member governments, differing in their time preferences and estimates of demand, have different opinions about the proper price. Indeed, there is no single proper price for all OPEC oil. Variations in specific gravity, sulphur content, and distance from the market imply differences in price. These differences are never obvious and moreover change from week to week with refined-product demand and tanker rates.** It would be wrong to minify the strains they create but not, I think, seriously wrong. They are minor in comparison with the strains that breaching can create. Surely, therefore, OPEC can handle the internal strain with and only with a rapid and reliable detector.

The best cartel detector I ever heard of was enjoyed by the English Coal Cartel of ca. 1660-1840. This cartel of northeastern miners centered at Newcastle sent its coal to London by ship, mainly

*The derivatives are one-sided, taken with respect to decreases in price. The argument is analogous to the one expressed in terms of output reactions by Osborne (1976).

**See "Those Awkward Differentials in Crude Oil Prices," Petroleum Economist, February 1978, p. 53.

through two ports (Newcastle and Sunderland) and never through more than three (including Stockton after 1833). These ports were so close together that they amounted to a single funnel. The cartel had only to station inspectors there to monitor the shipments and detect breaches as they occurred.* This is undoubtedly the main reason why it survived so long, succumbing only when canals and railways brought London economically closer to the inland coal fields to which it has always been physically closer. The improvements in inland transport created many new economically viable shipping points and thus destroyed the funnel.

OPEC's geographical scatter deprives it of such a detector. The Persian Gulf ports might indeed amount to a single shipping point but together with the Mediterranean, Caribbean, and Atlantic ports they amount to a sieve rather than a funnel. Receiving points are even more scattered. OPEC has no prospects of developing the kind of physical detector enjoyed by the coal cartel.

Now a physical detector is not, of course, absolutely essential. If OPEC could see the records of all significant transactions between its members and their customers within a week or two of the conclusion of negotiations, or the records of negotiations which are likely to lead to such transactions, and if the accuracy of the records were assured by penalties for false reporting, it would have a detector. It would not need to monitor the actual shipments if it could monitor accurate records of them. Obviously, it cannot rely on its members for the required information, so its own efforts could never be sufficient.

*This cartel had an elaborate system of quotas. For an interesting detailed account of the cartel see Levy (1927, ch. 6); for a summary, see Osborne (1977).

Our government, however, has come to OPEC's aid. Since September 1977 it has recorded the details of all significant crude-oil transactions and negotiations between producing governments and any company domiciled or doing business in the United States, and it requires these companies to supply the details.* It could not keep the information from OPEC if it tried. It is OPEC's detector and thus its strain reliever.

It will be said that OPEC doesn't need this help--that extensive journalistic coverage of the oil business would lead to the eventual exposure of significant breaches and thus serve to discourage them: OPEC's detector is world journalism. But this coverage, while quite thorough and informative about production and its related activities, rarely extends to prices. Journalists learn about prices only if the contracting parties wish them to. Apparently, few now wish it; and if their wishes should change, the possibility of deception would still exert its strain. The absence of reliable price figures would be very serious for OPEC, which has no sales quotas. The uncertain future which conditions all negotiations and the irregular flow of long-term contracts mean that detection cannot focus on production or sales but only on prices. Our government's help in this respect seems crucial. Thanks to the U.S. Government, OPEC is unlikely to die of internal strain.

*See the Federal Register, Vol. 42, No. 185, pp. 48328-48331.

The notice does not specify provisions for enforcement. But perhaps the threat of prosecution for other putative violations of an incomprehensible set of energy regulations is a big enough stick to shake at the oil companies.

Centrifugal Pull

It is always better to be outside a cartel like OPEC than in it. Outside it, one can produce at the rate that equates marginal cost with the cartel price; inside it, one must bear some of the burden of restricting output in order to establish the price. The greater profit to be found outside continually pulls the members in that direction and threatens to split the cartel apart.

Apparently this force has already reduced OPEC, as the increased production of a few (maybe four) members suggests a strictly nominal membership. But the central core of four to ten members has withstood this force and will probably continue to do so in sufficiently large part to preserve the body.

While it is better to be outside a cartel it is not necessarily better to leave it, for it might then fall. The decision problem has a 2×2 payoff matrix as follows, where $G_i(\cdot)$ is member i 's profit, such that $G_i(S, L) > G_i(S, R) > G_i(F)$, and $P_i[\cdot]$ is the probability of occurrence. $P_i[S, R]$, for instance, is the probability that the cartel will stand if member i remains in it.

		Cartel	
		Stand	Fall
Member i	Remain	$G_i(S, R), P_i[S, R]$	$G_i(F), P_i[F, R]$
	Leave	$G_i(S, L), P_i[S, L]$	$G_i(F), P_i[F, L]$

The probabilities in each row sum to i . Evidently,

$$P_i[S, R] \geq P_i[S, L]$$

$$P_i[F, L] \geq P_i[F, R].$$

If member i remains in the cartel, he can expect profits of

$$E_i(R) \equiv P_i[S, R]G_i(S, R) + P_i[F, R]G_i(F);$$

if he leaves, he can expect

$$E_i(L) \equiv P_i[S, L]G_i(S, L) + P_i[F, L]G_i(F).$$

The difference C_i ,

$$C_i \equiv E_i(L) - E_i(R),$$

measures the net benefit of leaving and thus the centrifugal pull on member i . We have

$$(1) \quad C_i > 0 \text{ iff } \frac{G_i(S, L) - G_i(F)}{G_i(S, R) - G_i(F)} > \frac{P_i(S, R)}{P_i(S, L)} \equiv \frac{1 - P_i(F, R)}{1 - P_i(F, L)}$$

If the probabilities are independent of i 's action, that is, $P_i[S, R] = P_i[S, L]$, then $C_i > 0$ and pure economic calculations will lead him to depart. A member might prefer to remain in a cartel of sovereign states for reasons of prestige or fear. All such considerations as this oppose the centrifugal force and thus help to stabilize the cartel. We will mainly disregard them on grounds of imponderability.

If $P_i[F, R] < P_i[F, L] = 1$ then $C_i < 0$ and member i will remain. Hence if $P_i[F, R] < 1$ there is a $P_i[F, L]$ strictly between $P_i[F, R]$ and 1 such that $C_i = 0$ and member i is indifferent between staying and leaving. Anything that increases $P_i[F, L]$ relative to $P_i[F, R]$ reduces the centrifugal pull on the member and consequently helps the cartel.

The probabilities are not natural constants but depend on the actions and predispositions of the other members. In particular, each departure that leaves the cartel standing raises the relative importance of the remaining members and thus, on average, increases $P_i[F, L]$ relative to $P_i[F, R]$. Unlike the force of internal strain, which operates with positive feedback to create a self-feeding degeneration, the centrifugal force operates to produce its own counterforce. Departures that don't destroy the cartel actually leave it stronger.

Centrifugal pull is not independent of internal strain. Anything that relieves that strain lowers $P_i[F, R]$ without affecting $P_i[F, L]$ for a random i ; hence it reduces the total centrifugal force. Our government, in handing OPEC a strain-relieving detector, has also armed it against the other force.

Under the circumstances, who is likely to leave OPEC? Surely not Saudi Arabia or Iran. Both are essential to the cartel, i.e., $P_i[F, L] = 1$ for both, so both feel a negative centrifugal force. Kuwait and the Emirates dare not act alone for fear of military reprisals by their large neighbors. Iraq and Indonesia might already have left in all but name. Venezuela's steadily declining production seems more a result of its diminishing reserves than of cartel burdens. Libya and Nigeria are the only other majors. They are good candidates for withdrawal. Their combined proved reserves are fifteen times annual Saudi production: significant, but not enough to crush OPEC. On any reasonable assumptions about the figures

defining it, the centrifugal pull (C_i) on them is positive.* If they decide on strictly economic grounds, they will leave. The remaining members will be safe from every force except external pressure.

External Pressure

From the preceding, it appears that OPEC will last until squeezed to death by external pressure. The squeeze has already begun. Compared with the third quarter of 1973, world production of crude oil is up 2%, free-world production outside OPEC is up 9%, but OPEC's is down 13%.

*E.g., Nigeria is producing at about 80% of its pre-embargo rate and expects to continue to do so (Petroleum Economist, August 1978, p., 339). Assuming conservatively that it would reach only the pre-embargo rate upon leaving the cartel irrespective of the cartel's fate, the output x_{jk} in row j and column k of the payoff matrix is, in index form:

$$x_{11} = 80, x_{12} = x_{21} = x_{22} = 100.$$

Putting the cartel price at 1 and assuming that a 10% discount from it would recapture Nigeria's pre-embargo market if the cartel stands while price would fall by half if the cartel fell, we have

$$p_{11} = 1, p_{12} = p_{22} = .5, p_{21} = .9.$$

Under these assumptions the left-hand side of inequality (1) is $4/3$. Hence the centrifugal pull on Nigeria is positive if $P_i(S, L) > 3P_i(S, R)/4$, i.e., if the probability that the cartel would survive Nigeria's leaving is more than three-quarters the probability that it will survive with Nigeria in it.

The 2% increase in world crude production, compared with a substantial increase in economic activity generally, indicates a significant substitution of non-oil energy sources for oil, and non-energy resources for energy. Concerning the latter substitution, it is noteworthy that real GNP in the OECD rose 9% between 1973 and 1977 while energy consumption rose only 1.3%, whereas at 1960's prices these percentages were typically equal. These figures illustrate the First Law of Elasticity: Demand is more elastic than we think. The 9% increase in non-OPEC crude production illustrates the Second Law: So is supply.

These changes are, of course, only the beginning, as the adjustments in both demand and supply take some time (but--the Third Law--not as much as we think). The pressure will grow and OPEC will have to deal with it or collapse.

To deal with external pressure, it is necessary to lower the external production from which it issues. One way to do this is to reduce the cartel's underpressure by lowering the price. The other way is to surround it, at least in part, by taking in new members. This was the way of the English Coal Cartel, which, after each breakdown under the pressure of neighboring sea coal, was able to repair itself by incorporating the new mines (first along the River Tyne, then along the Wear, finally along the Tees). The same response was possible, in principle, to the Midland and western miners who gained access to the London market by the new canals and railways, but thus enlarged the cartel would have had no funnel and hence no natural detector. And while

the English government did nothing against the cartel, neither was it prepared to help; it could not be hornswoggled into the role, later so voluntarily assumed by our own government, of a breach detector. In surrounding the external pressure, therefore, the coal cartel would have created unmanageable internal strain.

OPEC of course faces no such danger, as our government's regulations apply to all foreign oil, wherever destined, lifted by all companies domiciled or doing business here including their subsidiaries. So OPEC can surround external pressure without creating much additional internal strain. If Mexico, Canada, Russia, or China export enough oil in the 1980's to crush OPEC, it will be in their interest to help reconstitute it by joining. Indeed, the immensely wasteful public investments being made everywhere under the OPEC umbrella are creating quite a few hostages to its fortunes. This is perhaps the strongest clue to its prospects.

Such considerations however are for the future. For the present and recent past, OPEC has kept the external pressure at a manageable level by reducing its price more or less in step with the growth of external capacity. Now ordinarily, price reductions pose serious problems for a cartel. When the proper price is not obvious--different, indeed, for different members according to their reserve positions and other things--the negotiations are always apt to founder on stubbornness or ignorance and thus to create additional strains. OPEC has avoided these problems by pricing in a declining currency. The \$2.35 per barrel price increase on Arabian light crude since September 1974, a 22% rise in

dollars, is a 3% fall in German marks and a 22% fall in Swiss francs. Inflation in these countries further reduces the real price. OPEC, therefore, can get its real price down simply by doing nothing. If it finds the price falling too fast or too far, it only has the much easier task of deciding how far to raise it in dollars. Here again, its customers do its work.

References

Hermann Levy, Monopolies, Cartels, and Trusts in British Industry.
London, 1927.

D. K. Osborne, "Cartel Problems," American Economic Review, 66 (December 1976) pp. 835-844.

_____, "Prospects for the OPEC Cartel," Business Review, Federal Reserve Bank of Dallas, January 1977.