Oil: Economics and Politics

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This article deals with the evolution of the international petroleum sector since 1973 with a special view to interdependence between the economic and political factors that influence it. Two issues are focused upon: (1) the effects of the nationalization of oil companies on the sharing of oil rents and on changes in the structure of the oil market; and (2) the determination of oil prices. The latter involves a discussion of, on the one hand, the political and economic behaviour of the United States and Saudi Arabia and, on the other, the combination of cooperation and conflict that has tended to characterize relations among OPEC countries.

L'article présente une synthèse et une tentative d'explication de l'évolution du secteur pétrolier international depuis 1973 en tenant compte du phénomène de l'interdépendance entre les facteurs économiques et les facteurs politiques. Deux points sont privilégiés. Le premier est l'examen des effets des nationalisations (facteur institutionnel) sur la partage de la rente pétrolière et les modifications des structures du marché. Le deuxième point met l'accent, d'une part, sur les comportements économiques et politiques des Etats-Unis et de l'Arabie-Saoudite, et d'autre part, sur le "conflit-coopération" entre les pays et l'OPEP, pour expliquer la détermination et l'évolution des prix.

I. Introduction

Until the Gulf crisis of 1990-91, many were arguing that oil had lost its strategic role, that it had become an ordinary commodity governed by the standard laws of the market, and that the market would peacefully solve any conflict within OPEC or between OPEC and the oil-buying countries. "Desert Storm" blew down those convictions by demonstrating, if it was still necessary, the strategic and vital role of oil. Furthermore, it indicated again the interdependence between economics and politics in everything concerning oil.

Such interdependence may appear as evident to anyone involved in oil management in either the public or private sectors. It is not the case, however, for economists at universities who have studied the market structures and price mechanisms involved. For them, the oil market has been another area in which to apply standard formal economic analysis, without taking into account the role of politics. The results of these exercises have often appeared to be in a vacuum, far from the real world.

Indeed, 20 years after the oil shock of 1973, the academic literature is abundant but inconclusive.[1] Despite the great sophistication of the models describing the behaviour of OPEC and

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1/ See, among others, the surveys by Griffin and Teece (1982), Gately (1984 and 1986), Barbet (1983), and Ayoub and Percebois (1987).

oil prices, the question remains an "open" one (Gately, 1984, p.1113) and econometric testing of all the models does not seem conclusive (Griffin, 1985; and Fischer, 1987). In short, an assessment of those many years of work is apparently disappointing. The past does not seem to be explained in a way that would satisfy a majority of economists, and the predictions regarding future prices do not tend to be confirmed by what is subsequently observed on the market.

This lack of consensus is, sadly, neither new nor unique in economics. In the context of this discussion, however, it offers an advantage: a margin of freedom in our search for new approaches to the problem. The approach I have chosen is deliberately institutional, in the sense that it tries to tackle and understand economic phenomena (and change in them) by accounting, as much as possible, for institutional changes and geopolitical factors. It is true that such an approach is difficult to formalize, but that may be the price to pay to be closer to the complex reality of the oil sector.

In my view, neither the thesis of oil as an "ordinary commodity" (allowing explanation by economics alone), nor the thesis of a "plot" (allowing explanation by politics alone and attributing any changes to the occult actions of some country), appear satisfactory as ways of understanding the problems and the evolution of the oil sector. Consequently, I have tried since the beginning of the 1970s to analyze this evolution by taking into account, as much as possible, the convergence and the divergence of both economic and political interests, which has sometimes led the actors to a compromise and sometimes to a rupture. This article gives me an occasion to bring earlier papers up to date and to clarify, develop, and correct some propositions already formulated (Ayoub, 1975, 1976a, 1976b, 1986, 1988, 1990, 1991). Without fully sharing all their conclusions, I note that many authors have adopted the same institutional approach used here. It is possible to mention, among others, Moran (1982), Mohnfeld (1984), and Verleger (1988).

By adopting such an approach, I admittedly bear the risk of setting out on a difficult path without a safety belt. For, despite the important and recognized role of political factors in economic activity, there is not to my knowledge a theory that has succeeded in integrating, within a consistent and formal framework, the effects of political power within an economic analysis. It is precisely for this reason that what follows does not claim to defend a thesis but rather proposes for discussion a framework which will perhaps allow one to understand better the complex reality of the oil sector.

My arguments are organized around two points that I consider fundamental. The first is an attempt to trace back the effects of the nationalization of oil companies (i.e., an institutional change) on the sharing of oil rents and on market structure (a phenomenon of disintegration and of vertical reintegration). The second point will deal more particularly with oil price determination and the influence of political factors on that determination. In this regard, the emphasis will be put on the linkage of Saudi Arabia and the United States and on the "conflict-cooperation game" within OPEC.

II. Nationalization and Oil Rent Sharing

During the 1960s and 1970s, national sovereignty over natural resources was one of the main demands of a majority of newly independent Third World countries. The dominant idea at the time was that political independence would be an empty concept if it was not accompanied by a transfer of the ownership and control of the resources of foreign firms, mostly multinational, to the national public sector.

The oil sector did not escape the consequences of such an idea; indeed, it was a favoured ground for its application. Thus we can consider the abolition of the concession system and the nationalization of the oil companies in the OPEC countries as perhaps the most important turning point in oil history (Penrose, 1988). It is this major institutional change — much more important than the 1973 fourfold price increase, which was its consequence — that is the starting point for an analysis of the evolution of the overall economic structure of the oil sector. The first issue to deal with is the sharing

of oil rents.

Oil Rent: Definitions

Recall that oil production generates various sorts of rents and quasi-rents: scarcity rent (λ), monopoly (or, more generally, imperfect market) rent (r_m), and Ricardian differential rents (r_d). Because the exploitation of a reserve of a non-renewable resource takes place through time, the determination of the path of its price is really a dynamic question. However, we can represent the price at a given moment in time as

$$P^* = C + \lambda, \quad (1)$$

where P^* is the equilibrium price in a competitive market, C is the marginal cost of the resource (in this case crude oil), and λ is the scarcity rent.

The above assumes that all firms (with each firm defined by a single homogeneous deposit) are identical. Now relax this assumption, as well as the competitive market assumption, allowing firms to have some monopoly power. Considering the case in which monopoly power is identical for all firms, (1) is replaced by

$$P = C_i + \lambda + r_m + r_{di}, \quad (2)$$

where P would be the price in an imperfect market and C and r_d can vary across firms.

It is useful to recall the definitions and the conditions that result in the above mentioned natural resource rents:

- *Scarcity rent* (user cost), λ, is, despite the terminology, a cost and not a rent. It pays for the **exhaustion** (or the **non-renewability**) of the resource, assuming that the supply is fixed. Once the assumption of a fixed stock is accepted, λ is greater than zero. A competitive market does not eliminate λ; only the relaxation of the fixed stock assumption could do that. On the other hand, λ can rise or fall and is affected by changes in the marginal cost of a barrel of oil.
- *Imperfect market rent*, r_m is a function of market structure. This form of rent vanishes completely in a perfectly competitive market and is at its maximum in the presence of a pure monopoly.
- *Differential rent (Ricardian)*, r_d, can be defined as the return received by certain units of a resource due to some advantage they have in production relative to other units which are nevertheless essential for the achievement of market equilibrium (Percebois, 1989). Thus, at a given time, even in a competitive market, some production units (or resource deposits) involve different (average and marginal) costs. Consequently, a deposit that can be exploited at lower cost than the marginal deposit extracts a rent from buyers.

Why Nationalize?

In light of the above definitions, we can now ask: was it necessary for OPEC members to nationalize the oil companies? Were the takeovers only the result of an exacerbated nationalism and the political independence recently acquired — factors that certainly had their influence — or were they also a response to a much more precise economic constraint? In other words, were these nationalizations not the perfect example of the interweaving of economics and politics?

If we admit that the "oil game" is in the end a matter of rent sharing, the nationalizations (or other similar legal arrangements, such as association, participation, etc.) which the majority of the OPEC countries declared at the beginning of the 1970s, and sometimes long before, have a *raison d'être* and a justification.

From equations (1) and (2), and for the case where the two partners (the owner and the franchise holder) are involved in the production process, it is obvious that the sharing between them of all the rents (λ, r_m and r_d) is influenced by the knowledge that each has of the real values of P^*, P and C. If this condition is not satisfied, the bargaining power of the uninformed partner is very weak and the informed partner is likely to impose the sharing rules (Ayoub, 1975).

Before 1973, the "informed" partners surely were the foreign independent companies, particularly the *Majors*. The producing countries were considered as "sleeping partners," content with taxing the companies according to more or less complicated formulae, such as the "tax paid cost," or apparently more radical formulae such as "fifty-fifty." Reality was a lot simpler: the

rigorous enforcement of those formulae, or even negotiations about their concrete use, were directly and exclusively dependent on the information provided by the oil companies to the producing countries about P^*, P and C.

Regarding the production cost C, the oil companies were the only ones to explore for and produce crude oil in the host countries. Consequently, they were the only ones to know about the reserves and the production costs involved. Concerning P^* and P, the situation was even more complicated because the system of vertical integration and internal transfer prices that had been adopted by the Majors at the beginning of the 1920s so dominated the market that it was practically impossible to find your way from the prices of oil products to the price of crude oil.

In such a situation, one way for the producing countries to find out the true values of P^*, P and C was to nationalize the companies and thereby gain direct control over their national reserves and production. In almost no time, the OPEC countries found themselves the owners of large and growing quantities of crude oil that they had to market directly. After having been collectors of taxes and fees from the oil companies operating on their territory, those countries became in a short time the holders of the world's most important oil reserves and the world's principal producers and sellers of crude oil. The OPEC market was born.

The changes brought about by the nationalizations during the 1970s can be considered, justly, as the really historic breaking point in the process of oil policy-making in these countries. In them we find a perfect example of an institutional change that induces a whole set of economic phenomena, either directly or indirectly.

Regarding the particular question of rent sharing, the only possible conclusion — and in fact, the one we observed in reality — is that with the elimination of the concession system and the recovery of direct control over their resources, the OPEC countries obtained the means not only to change rent sharing to their advantage, but also to extract the full rent at the production level.

But the nationalizations also had another effect, maybe more important than rent sharing: the determination of the amount of rent available to extract. Indeed, once the producing countries became the sole owners of their resources, they had to face a serious question: how can this rent be made as great as possible through time or, to be more precise, how can the net present value of their known stock of oil in the ground be maximized? Such a question immediately leads one to the quantity-price equation which ultimately determines the size of the rent at a point in time and its trend through time. This question will be discussed again in section IV.

III. Nationalization and Market Structures

Breaking Vertical Integration

As a second effect, the nationalizations led to the breaking up of the market system built and managed by the Majors since the 1920s. This system was based on: (a) vertical integration from the "well to the pump;" (b) horizontal (geographic) concentration allowing the management, under a common authority, of deposits dispersed in different countries; and (c) an agreement, implicit or explicit, between the companies regarding market sharing (Ayoub, 1986 and 1988).

Until the beginning of the 1970s and with the help of this system, the Majors had under their control the exploration, production, transportation, refining, and distribution of between 70 to 80% of all crude oil and oil products consumed in the "free world" outside the United States.

The direct consequence of this system of control was undoubtedly stability in oil markets, in contrast with the chaos and wastage of resources that had prevailed before. Although from time to time there were tensions and associated incidents — foreseeable consequences of competition from independent firms outside the agreement — these had marginal impacts on price levels, which were in a downward trend until the 1970s (see Figure 1).

The nationalizations imposed a clear break with this system: an important link in the oil chain, the production and marketing of crude oil,

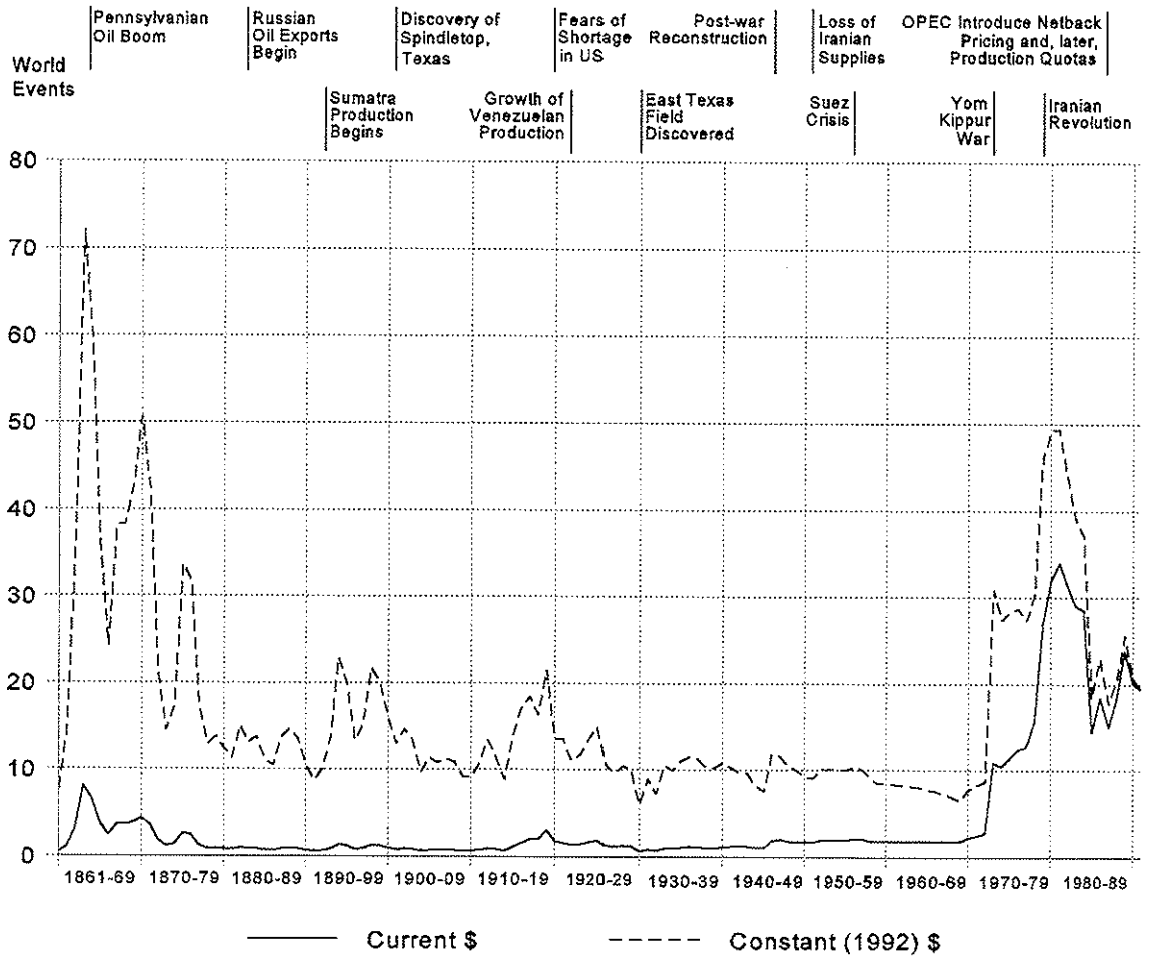

Figure 1: Price of Crude Oil since 1861

Source: BP Statistical Review of World Energy, 1993.

was put under the direct control of the OPEC countries. This induced the disintegration of the system run by the Majors and the implementation of a dual system, with the OPEC countries controlling the upstream activities (production and marketing of crude oil), and the oil companies controlling the downstream activities (transportation, refining, distribution, and sale of oil products).

As a result of this dual structure, the integrated system of the Majors could no longer work as before, while the OPEC system, neither vertically nor horizontally integrated, revealed itself, after some years of trying, to be unable to take over control of the whole sector from the oil companies.

This consequence of the new structure, although written in the facts as early as 1973, was temporarily hidden by the fear of an oil shortage, justified or not, that was prevalent throughout the 70s, and by the particular relations between the largest producing countries of the Gulf and the previous concessionary companies. The nature of these relations (long-term contracts, discount of official prices, phase-out clauses, etc.) induced a sort of artificial vertical integration (Verleger, 1988). When, from 1981 onwards, trade in oil switched from being a sellers' to a buyers'

market, this transitory system did not hold up and the path was cleared for the expansion of free markets.

Many consequences have been observed following the nationalizations and the changes in market organization that they induced.

Access of the Majors to oil: A direct observable effect of the nationalizations was a radical change in the competitive position of the Majors in the market for crude oil (Mohnfeld, 1984). Between 1973 and 1982, these companies lost around 50% of their share of the crude oil market, from 30 million barrels per day (MMbbl/d) to around 15.2 MMbbl/d, while "free world" demand decreased by only 15% over the same time period. Even more significant, in 1982 the Majors could only rely on 6.7 MMbbl/d of production from the reserves under their control, while the corresponding number in 1973 was 25.5 MMbbl/d — a decrease of 74% in less than 10 years. In other words, the Majors were becoming important net buyers of crude oil after having for a long time been vertically integrated sellers to their own refineries.

Breakdown of horizontal concentration: The decrease in the share of the Majors in the crude oil market was accompanied by the entry of newcomers — the non-OPEC producers — attracted by the increase in oil prices of the 70s. This increase stimulated them to explore and produce at home. (Examples are Norway, Mexico, Great Britain, Egypt, and some African and Asian countries.) The Herfindal index of horizontal concentration in an industry went from 1600 in 1965 to around 930 in 1986 for the crude oil production industry, and from 1250 to around 600 for the exploration industry (Verleger, 1988). This indicates that the nationalizations not only indirectly favoured free entry into the market, but also, and by this very fact, created a further destabilizing factor for OPEC, as we will see below. Even more to the point, the large majority of the new producing countries (especially those from the Third World) followed the OPEC example by nationalizing oil at home and creating public oil companies.

Restructuring of the refining sector: The decrease in the direct access of the Majors and of other companies to the oil reserves of the OPEC countries pushed them to rationalize their world refining and distribution network in order to decrease their dependence on OPEC crude oil and preserve, as much as possible, their integrated structure as companies. Thus the world refining capacity of the Majors decreased from 23.3 to 14 MMbbl/d between 1973 and 1982. This trend toward rationalization was to be reinforced by the increase in the refining capacity of some of the OPEC countries, that wanted to sell not only crude oil, but also refined products.

Expansion of Free Markets

In the wake of a declining OPEC the most important market was without question the spot market (i.e., the Rotterdam free market). This market had, of course, been operating since the 1930s, but was fulfilling only a complementary role in the Majors' delivery system for refined products (Abu Khadra, 1980). With the nationalizations and the emergence of the OPEC market, the spot market changed in orientation and in size. In orientation because it started dealing in crude oil as well as refined products; in size because as the OPEC market was declining, the number of transactions on the spot market was increasing. From the beginning of the 80s, "the spot" became the reference market in world crude oil trade.

The consequences of the expansion of the spot market and the important role that it ended up taking on, to the disadvantage of the OPEC market, can be summarized in the following points.

Increase in the number of participants: The number of active participants in the crude oil market increased substantially. While it was previously reserved for a few large companies, today's oil market is invaded by an increasingly large number of actors: the national oil companies of the OPEC and the non-OPEC countries; the private and public companies of the consuming nations (from multinationals to medium-size companies); and finally, the traders and brokers.

Multiplication of complementary markets: As the spot market functions a lot like the stock exchange, its development made oil prices volatile and the risks to be borne fairly high. To

decrease these risks or to provide protection against them, parallel markets developed, such as the forward market, which in turn led to the option market. Many saw in this evolution a "standardization" of oil and its transformation from a strategic product to an ordinary commodity. Without going that far (the events of 1990-91 in the Gulf reducing this conclusion to nothing), and without taking a position as to whether the free markets were stabilizing or destabilizing (see Artus, 1989, on this point), we can nevertheless assert that the development of these markets made price control more difficult for OPEC than was foreseen.

Market structure and prices: The combination of the two above mentioned consequences did indeed result in an industrial structure favouring competition or, at the very least, made it more difficult to reach oligopolistic agreements. This development of free markets, with its consequence of making it less easy to control prices, gave rise to two opposing impacts on OPEC. On the one hand, it had a destabilizing effect, in the sense that the existence of a flourishing and accessible free market was an easy "way out" for an OPEC member who did not wish to respect its own quota. As one would expect, the pattern was widely imitated. On the other hand, it had a stabilizing effect, or rather provided an incentive for cooperation, in the sense that the free market, by bringing prices down, made it more profitable for OPEC countries to reestablish agreement rather than seeking individually to profit from their own actions. Many examples can be found in the recent history of OPEC and the oil industry of these two effects, although they also show that the second effect is more important in a buyers market.

Return to Vertical Integration?

Many years ago, Frankel (1948) reached two important conclusions in his masterly study of the international oil sector. The first is that "non-stop" competition, when it reigns over the oil industry, either leads to a general failure, or to the survival of a monopoly. The second is that "there is no doubt that always and everywhere, there has been an irreversible tendency toward concentration, integration, and collusion."

About 40 years later, he again confirmed these conclusions in a recently published paper (Frankel, 1989). The arguments used to make his point are simple but penetrating (or rather penetrating because they are simple). For him, oil is a high-risk industry, not only because of the random aspects of exploration, but also because of the large investments required in the other phases of production (transportation, refining, and distribution). To decrease this risk, or as protection against it, the producers have the incentive to diversify their exploration in space to be able to compensate for disappointments (dry wells) with other successes (marketable discoveries): this is the *raison d'être* of horizontal concentration. What is true for exploration is also true, according to him, in the other phases of the industry. Hence, the goal of vertically integrating two or more phases is to decrease risk and insure an acceptable average rate of return on a consolidated investment. We can add two other incentives: the availability and control of the supply of crude oil and the potential for capturing the refined products market. For Frankel the conclusion is that "integration is the natural habitat of the oil industry;" it leads, further-more, to a certain price stability through time.

Although this view is not fully shared by Adelman (1972), who does not see "natural" reasons for integration and concentration in the oil industry, Frankel's thesis and his conclusions are nearly a credo for the professionals, and the behaviour of decision makers in the oil industry confirms the tendencies expressed therein. Regarding the relation between integration and price "stability," Hubbard (quoted by Verleger, 1988) thinks that vertical integration favours short-term price stability, while horizontal concentration favours long-term stability.

Whatever is the outcome of this debate, it remains that in the last 10 years a clear willingness has been observed on the part of a few OPEC countries to invest in the refining and distribution sectors in the United States and Europe. This trend took two forms (Ayoub, 1988): direct control (the Kuwaitian case), or shared control in joint ventures with the Majors (Saudi

Arabia with Texaco in the US) or with private oil companies of lesser importance (the cases of Venezuela, Libya, Mexico, etc). Currently, OPEC members' acquisitions in downstream activities outside their borders represent 7.4% of total refining capacity in Europe and the US (about 1.77 MMbbl/d). (See Petroleum Intelligence Weekly, 1990.) If we add to these acquisitions the contribution to exports of refineries built in most of the OPEC countries, we can reasonably talk of a new restructuring of the oil industry as a real, although hesitant, possibility (Bourgeois et Perrin, 1989).

Our conclusion at this stage is that a return to a form of vertical integration at the world level will never be achieved without taking into account the radical institutional change involved in the nationalizations. The forms that such an integration will take will be closer to a partnership between each OPEC country and the oil companies than to exclusive control on the part of the oil companies, as was the case before 1973.

On the other hand, paradoxical though it may seem, it is precisely the nationalizations that have led, by their effects on market structure and prices, to a more pointed awareness of the interdependence between producing countries, consuming countries, and the oil companies.

IV. Oil Prices: An Economic Observation and Two Political Constraints

If we had to summarize the overall oil pricing problem, we could say that it is characterized by the existence of a floor price that has not been pierced since 1973, and by the absence of an agreed upon and stable ceiling price. The existence of the floor price is the consequence of the adoption by the United States of a preference for security rather than for narrowly defined pure economics. The absence of a ceiling price is a demonstration of the contradictions within OPEC which divide members between those who advocate a "short plan" and those who prefer a "long plan."

A Floor Price Never Breached

Figure 1 shows the evolution of the average price of crude oil from 1900 to the present. One notes the sharp contrast between the period 1900-1970 and the one that begins in 1973. While the first long period seems characterized by relative stability, the second is clearly dominated by abrupt and large fluctuations.

Indeed, the average price (in current dollars) changed from US$1.90/bbl in 1972, to $11/bbl in 1974, to $36/bbl in 1981, back to $14/bbl in 1986, to $17/bbl in 1989, and to $18-19/bbl currently. Over a 20-year interval prices have exploded twice (in 1973/74 and 79/80), collapsed (in 1986), been almost stagnant (1975-1978), gone down steadily (1981- 1985), and been highly volatile and uncertain (from 1987 to now).

Despite this stormy history — which took mischievous delight in frustrating any attempt at rationalization, explanation, or prediction — it is nevertheless possible to find a constant requiring an explanation. From 1973 to now, annual average oil prices never went below the threshold of $14-15/bbl in nominal terms and $18-20/bbl in real terms (1991 US$). Even during the price war of 1986, prices went down to $7/bbl for only a few days, while for the whole of 1986 the average price was about $14/bbl. Looking closely, there seems to be some sort of floor price that has not been pierced during the period under consideration.

This constant in oil price determination is even more worrisome because over the period nearly all of the likely configurations of market and pricing structures were experienced. First, in regard to controlling prices, we saw in succession the official OPEC price system (1973-80), the mixed system of official and spot prices (1981-85), domination by the spot price (since 1986), and its regionalization (Dubai, Brent, West Texas Intermediate). Second, in regard to market structure, we observed the passage from a vertically and horizontally integrated structure by the oil companies to a dual structure (the producing countries controlling the upstream activities, the oil companies the downstream ones), the emergence and development of free markets at the expense of the OPEC-market, and the beginning of new shapes of vertical integration linking some producing countries and some companies. Finally, in regard to the

composition of aggregate supply, since the beginning of the 1980s we have recorded a continuous decrease in the market shares of the OPEC countries to the advantage of the non-OPEC countries (from 60-65% in the 70s to 30-35% in the 80s), along with many attempts by OPEC countries to regain their shares, even by waging price wars, like the devastating one of 1986 (Ayoub, 1988).

If we were to adopt a "happiness" criterion of the sort suggested in economics textbooks to characterize a market dominated by a monopoly, such a rocky and unrelenting story might lead us to claim that it was OPEC that introduced disruptions and competition in a sector of the economy which until 1973 was obviously living in a dreary tranquillity! But reality is even more complex. How can one explain the existence of a floor price, and especially its persistence under diverse market structures?

The Logic of Cost

The first explanation of this phenomenon, the easiest and certainly the most widespread, especially among English-speaking economists, can be briefly summarized by referring to the work of Adelman (1986), a representative of this school of thought.

Adelman starts from the observation that the replacement cost of a barrel of oil[2] extracted in 1978 in the US was nearly 69 times higher than the corresponding cost in Saudi Arabia.[3] In this light, he argues that economic logic necessarily leads to three conclusions.

1) Scarcity does not explain the price level (neither the current price, nor the floor price).
2) In a competitive market with such a cost spread between Saudi Arabia and the US, demand would first be satisfied by the producers with abundant reserves and low costs (Saudi Arabia and the Gulf countries), and only then by contributions from producers with low reserves and high costs (the US and the rest of the world). The differential rent that the first group of countries now collects would then tend to decrease, and could in the long run even vanish completely.
3) Closing the argument, if prices did not fall to a level near the lowest costs, it was, according to Adelman, because OPEC is a cartel, the function of which was to establish a dam against a fall in prices. "If the dam breaks, so will the price" (Adelman, 1986, p.394).

The Logic of Security

Initially very attractive, the cost argument fails to take into account the equally meaningful geopolitical factors or, more precisely, the question of the security of oil supplies. The first consequence of strict economic logic is that, in a free market, low-cost petroleum would quickly drive out high-cost petroleum. In the case of the US, this would mean a radical decrease, and eventually a complete cessation, of oil production, with a parallel increase of dependence on foreign suppliers. This would have been conceivable in principle if the world consisted of a single political entity, rather than a group of sovereign entities, different from one another by their interests and objectives. And it is true that the US wants to avoid complete dependence on a country or a group of countries in a politically explosive region.

All the more so because the nationalizing of the oil multinationals by the producing countries through the 1970s had launched a kind of dialectic relation between resource control and the security of supply. The more the producing countries increased their control, the more the importing industrialized countries tried to decrease their dependence on oil as an energy source and on OPEC as a supplier (Ayoub, 1976a).

In fact, US policy tried to substitute national oil, to the extent it existed (in Alaska, for instance), and more generally non-OPEC oil (from the North Sea), for OPEC oil. Thus, the difference in the production cost between these

2/ Its marginal cost, which is, according to Adelman, the sum of the marginal extraction cost and the marginal cost of the invested capital required to maintain or increase production.

3/ $0.13/bbl in Saudi Arabia and $8.06/bbl in the US.

two types of oil can be considered as the cost of security. This cost can even be measured and quantified. Indeed, if the cost of OPEC-oil is C_o and the cost of non-OPEC oil is C_n, we can write the cost for security C_s as

$$C_s = C_n - C_o \quad (3)$$

C_n can even be considered as the "floor price" of crude oil that the US tries to maintain on the market. This cost is, furthermore, the major portion of the differential rent of the OPEC countries.

Even if we hear from time to time that the US lacks an energy policy, it is nevertheless clear that it has for a long time had a precise strategy involving two objectives. The first has been to avoid a significant increase in its oil dependence. This implied the acceptance of some increase in price in support of that objective, though at the same time it did not want to jeopardize the rate of economic growth. The second strategic objective has been to assure the security of its necessary oil imports, especially in regard to those imports originating in the nervous Gulf region.

Consequently, if the current oil price was around the average cost of using the American deposits, the first objective was to an extent realized. The spread in production costs between the US and Saudi Arabia would be the price to be paid by the US to preserve its national oil industry from closure and to provide some margin of protection from foreign imports. The second objective, to ensure the security of imports, of course required other actions than maintaining a certain price level. These were: a policy on strategic stocks; better cooperation, within the framework of the International Energy Agency, for the allocation of stocks in case of emergency; the reinforcement of bilateral relations with the Gulf countries (especially with Saudi Arabia), etc. The US pursued these actions during the last 20 years, while making it clear from time to time, that they were not excluding the use of military power in the last resort to protect the security of their oil supplies at a "reasonable price" (Hogan in Griffin and Teece, 1982).

As early as 1974, Henry Kissinger even specified the level of this price by saying that, for the US, a price above a ceiling of $7/bbl (1974 US$) would, according to him, strangle the economy. However, the ceiling he suggested was a price which, while not discouraging the exploration and production of substitutes for oil, did not endanger economic growth. Throughout the 1974-1981 period, Saudi Arabia tried, without great success, to lead OPEC to adopt this price. Hence, the price suggested by Mr. Kissinger was in fact becoming the "floor price," while the official OPEC price could be seen as the "ceiling price" which evolved in response to the organization's concerns that high oil prices would encourage substitution.

During the presidencies of Nixon, Ford and Carter, American policy consisted mostly of putting pressure on the OPEC countries to let go of their policy of increasing prices and move as closely as possible toward the floor price, as conceived of here. The switch of the market in 1981, which was mostly a consequence of this short-sighted policy of price increases, was to reduce the market shares of the OPEC countries more and more, and to trigger off many conflicts among its members, conflicts which have now become permanent.

The culmination of this situation was without doubt the price war of 1986, in which at one point the famous floor price was almost pierced. The reaction of the US was fast, since George Bush, then Vice-President, was sent to Saudi Arabia to ask it to stop the price war and to bring the prices back to the floor price level of the time, $15-16/bbl. In a few days, the prices indeed rose from $7-8/bbl, their lowest level, to $16-17/bbl. This clear and direct intervention, in the middle of the period of Reaganite conservatism on economic matters, shows sufficiently the vital interest of the US in the maintenance of a floor price which would satisfy to the greatest extent possible its objective of relative oil autonomy. This episode also shows the convergence of the interests of Saudi Arabia (along with those of other smaller countries in the Gulf, such as Kuwait and UAE) with the interests of the US in maintaining a current price level not too far from this floor price, neither too high nor too low.

But why do the countries of the Gulf want to defend this price? The answer to this question

sends us directly to the second contradiction of the oil system: the opposition between the "long-term plan" and the "short-term plan" within OPEC. The considerable difficulties which prevent the Organization from finding and maintaining a ceiling price agreeable to everyone are the direct consequences of this opposition.

Long Plan and Short Plan

As early as 1975, I had the occasion, with other observers, to focus on a deep contradiction within OPEC which evidently constitutes one of the major causes of its instability (Ayoub, 1975): the problem of the determination of the optimal price level ("ceiling price") for the member countries as a group (Al-Chalabi, 1986).

Two conceptions were in opposition to each other and have remained so since the first oil shock. Each possesses its own logic which in the end follows directly from a physical reality, not easily subject to modification, and from an economic reasoning that implies constraints.

For the low-population Gulf countries, with limited financial needs, large stocks, and extremely low extraction and development costs (no more than $0.50/bbl on average), the oil price should be maintained at a competitive level with respect to the costs of substitutable forms of energy. Price increases, according to this logic, should be spread over a long time period to protect the in-ground value of the stocks of these countries from the premature competition of other energies. This position, the "long plan," is the basis of the behaviour of countries like Kuwait, United Arab Emirates, and the most important among them, Saudi Arabia.

On the other hand, for other OPEC countries, with relatively more modest stocks and larger populations and financial requirements, the optimal valuation of their in-ground stocks leads them, with a logic just as meaningful as that of the first group of countries, to be inclined to an increase in oil prices in a relatively short period. Their goal is to ensure that oil prices get as close as possible, and faster would be better, to the costs of substitutes. This is because when the latter become available on the market, the oil stocks of those countries will be either exhausted or in decline. This is the "short plan" of countries like Algeria, Indonesia, Nigeria and Venezuela. Iran and Iraq are in this respect in a particular position given the sizes of their reserves, their populations, and their financial requirements. The deadly and devastating war in the 1980s between these two countries considerably increased their financial requirements and led them to adopt the "short plan" despite their large hydrocarbon reserves.

To summarize the positions of these two groups, we can say that the first tries to optimize its revenues at the margin by adjusting quantities, while the second tries to do the same by adjusting prices. There is not, to my knowledge, a solution, either theoretical or practical, that could completely and simultaneously satisfy these two groups of countries. In other words, there is no single optimal price that would protect the interests of the OPEC countries taken as a whole and, at the same time, the interest of each country taken individually. The only peaceful solution to this problem is compromise, and all the more so since the 13 members of OPEC are sovereign states, each with its own (international, regional and national) political vision and its own alliances. By definition, such compromise is a function of bargaining powers at the time considered.

Indeed, assume that each country determines its price according to an objective function f_i dependent on many variables (X_i, ..., X_g, ..., X_n). According to what we have written above, these variables are not only economic, but also political, strategic, social, etc. For the OPEC countries taken as a whole, we then have a series of objective functions corresponding to the number of members. This series can be written:

$$f_1(X_1^1,...,X_g^1,...,X_n^1), ..., f_i(X_1^i,...,X_g^i,...,X_n^i), ..., f_N(X_1^N,...,X_g^N,...,X_n^N) \quad (4)$$

with (i=1,...,N) and (g=1,..., n).

Because of the interdependence among them, it would be impossible to maximize all of these functions simultaneously. It is thus necessary to introduce a composite function of the type:

$$\Omega(f_1, f_2, \ldots, f_i, \ldots, f_N) \quad (5)$$

in which the variables are the own functions of each country. The maximization of Ω can be considered if: (a) for each function, the variables are introduced (X_1, X_2, ..., X_g, ..., X_n) in a way such that Ω becomes a function of these variables; and (b) if we can put weights on the relative importance of the different functions f_1, f_2, ..., f_i, ..., f_N by a system of given prices. Given the nature of these variables (economic, but also strategic, political, social, etc.), it is clear that only a political trade-off can determine, at a given moment in time, the relative weights of these variables for each country, and the relative weights assigned to each country in the composite function (see Ayoub, 1975).

The lack of a collective optimal solution does not, however, exclude the possibility of two strategies, both sub-optimal in other respects. The first is the competitive market, with the risk of a price war, especially when the market is overcrowded, as in the 1980s. The second possible strategy is a compromise within OPEC between the optimal positions of each different country or group of countries. The latter strategy is relatively easier to put in place and more likely to succeed when each member produces at a level close to its production capacity, as was the case in the 1970s. When each country produces well below its capacity, as has been the case since 1981, the same strategy is less likely to succeed and the associated compromise is fragile. Recent history gives us many examples of these strategies and of their limitations (Ayoub, 1988).

To illustrate the importance of the effect of political factors on both the stability of OPEC and its survival, we can again take the example of Saudi Arabia. On purely economic grounds, this country holds in its hands the key to the whole situation because it controls around 40% of the total reserves of all the OPEC countries. In principle, then, the economic and social damage that this country can cause the others to suffer if it decides to go its own way are without comparison to the damage it might itself suffer if all the other countries were to collude against it. The 1986 price war demonstrated this. But this same example also demonstrates that Saudi Arabia had to stop this price war and to lower its production when the political reactions of the suffering countries began to be felt. The latter included not only the other OPEC countries, but also the US.

Given these conditions, it is not really necessary to resort to a conspiracy theory to explain the behaviour of the Gulf countries in regard to pricing policy, especially in the cases of Saudi Arabia and Kuwait. On the one hand, we have seen that this policy has coincided with that of the US, which favours a current price that is not too high, nor too far from the floor price. On the other hand, this convergence in economic interests is strengthened by the needs of these vulnerable countries for military protection, which they try to obtain from the US.

The following conclusions can be underlined:

- There is a floor on the average price that has never been pierced since 1973, despite numerous changes in market structures.
- This floor price, currently in the range of $18-20/bbl in nominal dollars, approximately corresponds to the average production costs of American (and Canadian) deposits.
- The maintenance of this price since 1973 has not allowed the US to realize energy independence (a costly project and, in any case, a chimera), but it has preserved a certain energy autonomy. In the case of a completely free and competitive market, this floor price would not have resisted, and the US would have been totally dependent on foreign oil (mostly that of the Gulf). That is not the case today.
- The fact that this floor price did hold throughout this period is not because OPEC is a cartel, but rather because Saudi Arabia has agreed to defend it by adjusting its production according to the state of supply and demand (except for the short gap of the price war).
- If Saudi Arabia, Kuwait, and the UAE adopted the policy of moderated increases in prices by increasing production, it is on the one hand because this policy corresponds to their own economic interests and on the other because it ensures them of political and military protection by the US.

V. Conclusions

The nationalizations of oil resources in the OPEC countries and the transfer of their management from the foreign oil companies to the governments of these countries set in motion a series of events.

Regarding oil rents, this institutional change first induced an internalization of rents by the producing countries and then led to the emergence of a differential (Ricardian) rent, which was in effect supported by the policies of the industrialized countries (especially the US) designed to develop national substitutes for imported oil in order to increase their independence from the OPEC countries.

Regarding the structure of oil markets, the nationalizations led to the breakup of the systems of vertical and horizontal integration of the Majors and to its replacement by a new dual structure with OPEC controlling the upstream activities of the oil sector and the oil companies controlling the downstream ones. This transformation also facilitated the growth of free markets for crude oil.

Regarding price determination and OPEC behaviour, prices move between a floor price determined by the costs of substitute deposits in the US, while the determination of ceiling levels by OPEC appears to rest on successive compromises which are necessarily fragile.

Overall it appears obvious that oil is a strategic product, despite the appearances created by the existence of spot markets, forward trading, options, etc. The determination of prices and quantities depend not only on economic considerations, but also on political imperatives in international, regional, or national spheres.

If we have to characterize the oil market using available models from economic theory, researchers should consider an adjustment to the bilateral oligopoly model, with the US and Saudi Arabia as the principal actors. Detailed analysis of the economic and geopolitical factors that determine the behaviour of these two countries is then a necessity.

References

Abu Khadra, R. (1980) 'The Spot Oil Market: Genesis, Qualitative Configuration and Perspectives,' *OPEC Review*, vol. III/4 & IV/1.

Adelman, M.A. (1972) *The World Petroleum Market*, (Baltimore: John Hopkins University Press).

—(1986) 'Scarcity and World Oil Prices,' *The Review of Economics and Statistics*, 387-97.

Al-Chalabi, Fadhil (1987) 'What is the Optimal Price of Oil from the Producer's Point of View,' *Middle East Economic Survey (MEES)* 28 sept, 1-8.

Artus, P. (1989) 'Quand la création d'un marché à terme peut-elle déstabiliser le cours au comptant?,' *Revue Économique*, 71-93.

Ayoub, A. & Percebois, J. (éds.) (1987) Pétrole: marché et stratégies, *Economica*, Paris.

Ayoub, Antoine (1975) 'Le marché-OPEP du pétrole brut et ses conséquences sur les relations entre pays producteurs,' *Revue d'Économie Politique*, 85:2:257-74.

—(1976a) 'Les prix pétroliers: essai d'explication,' *Études Internationales*, VII:1:3-24.

—(1976b) 'Prix du pétrole et degré de stabilité de l'OPEP,' *L'Actualité Économique*, juillet/septembre, 311-23.

—(1986) 'Évolution du marché pétrolier: de l'intégration verticale à la décentralisation,' *Revue de l'Énergie*, no. 381, mars, 1-8.

—(1988) 'Le marché pétrolier international: instabilité et restructuration,' *Revue de l'Énergie*, no. 407, décembre, 754-63.

—(1990) 'Oil to 2000,' *Natural Resources Forum*, May, 163-67.

—(1991) 'Le pétrole économie et politique, réflexion préliminaires sur la crise du Golfe,' *Revue de l'Énergie*, no. 432, juillet-août, 473-82.

Barbet, Philippe (1983) 'La théorie des prix de l'énergie dans la pensée économique: une recension,' *Économies & Sociétés*, XVII:12:1809-34.

Bourgeois, B. & Perrin, F. (1989) 'Les compagnies pétrolières des pays producteurs en développement s'internationalisent,' *Énergie Internationale*, 1989-90, Economica, 81-93.

British Petroleum Company (1992) *BP Statistical Review of World Energy*, London, June.

Fisher, Anthony, C. (1987) 'Whither Oil Prices: the Evidence from Theory,' *Natural Resource Modeling*, 2:1:5-22.

Frankel, Paul (1948) *L'Économie pétrolière*, (trad.), éd. Lib. Médicis.

—(1989) 'Principles of Petroleum - Then and Now,' *The Energy Journal*, 10:2:1-5.

Gately, Dermot (1984) 'A Ten Year Perspective: OPEC and the World Oil Market,' *Journal of Economic Literature*, 22:3:1100-14, September.

—(1986) 'Lessons from the 1986 Oil Price Collapse,' *Brookings Papers on Economic Activity*, no. 2, 237-84.

Griffin, J. & Teece, D. (éds.) (1982) *OPEC Behavior and World Oil Prices* (London: George Allen & Unwin).

Griffin, James M. (1985) 'OPEC Behavior: A Test of Alternative Hypothesis,' *American Economic Review*, 75:5:954-63.

Mohnfeld, J.H. (1984) 'The Trend of Structural Change in the International Oil Industry in the 1980s' *Annual Review of Energy*, vol. 9, 155-78.

Moran, T. (1982) 'Modeling OPEC Behavior: Economic and Political Alternatives' dans Griffin & Teece, *OPEC Behavior and World Oil Prices* (London: George Allen & Unwin) 94-130.

Penrose, Edith (1988) 'Defending the Price of Oil,' *The Energy Journal*, 9:1:19-25.

Percebois, Jacques (1989) Économie de l'Énergie, *Economica*, Paris.

Petroleum Intelligence Weekly (PIW) (1990) 'What's Next for OPEC Downstream Club,' Special Supplement Issue, January 15, 1-4.

Verleger, Ph. K. Jr. (1988) 'The Role and Impact of Commocity Market Institutions in the Determination of Oil Prices,' *Annual Review of Energy*, 13, 359-82.