

"PRODUCTION PROGRAM AND THE DEGREE OF  
STABILITY OF THE OPEC" (\*) (\*\*)

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I- INTRODUCTION

It is evident that the stability of the OPEC\* is an important problem for its members as well as for the industrialized and developing oil consuming countries. This stability can be defined as being the maintenance of a high degree of cohesion among the members in order to make it possible for them to have a certain bargaining power which is acceptable to all at any given moment and within a given context.

By definition, the field of application and the consequences of this power can not be confined to the limits of the oil sector. In fact, last two years have shown us that this power is exercised equally on the level of relations between the industrialized countries and the Third-World nations.

In the last analysis, the principle measure of the degree of cohesion among the members is their unanimous will to apply a common strategy concerning the matters related to the quantity/price of the crude oil. Such a strategy could not work without a common production program which would determine not only the annual total production, but also the relative share of each country, the level of prices and the rate of expansion of the individual and global capacity of production.

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\* Organization of Oil Exporting Countries.

Even if the absence of such a common program did not constitute an obstacle to the success of the periodical actions of the OPEC, it is clear that this situation can not last much longer without creating serious problems that might threaten the very fundamentals of this organization. It is especially true when one considers the fact that the consumer countries, taken individually or grouped within International Energy Agency, are actively elaborating and applying consumption and production plans which must be envisaged as being serious constraints to the future stability of the OPEC. In fact, these plans are prepared to achieve the very objective of weakening this stability. On the contrary, the position of the OPEC countries in the face of the urgent necessity of preparing a production plan does not seem to be very clear especially because of the opposition of the Saudi Arabia.

The objective of this paper is certainly not to formulate such a production program but to provide a general approach to the subject. In fact, generally, the basic flaw of the simulation and optimization models, concerning the supply and the price of oil, is the lack of such a general approach. Consequently, the criteria that they use to determine the actual and predicted behavior of the OPEC concerning the price level, for example, are often intuitive and ambiguous. (1)

So, starting with the example of the OPEC, we shall analyse some theoretical problems related to this question.

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Our analysis will concentrate on the following three themes: 1) the necessity of the OPEC; 2) the problem of price determination, and; 3) the problem of the instability of a coalition. These three themes will be treated by taking into consideration the specific characteristics of the oil sector as an industry producing a non-renewable resource as well as the international environment in which the development process of the OPEC countries and that of the Third-World countries takes place.

2- COALITION AND THE COST CURVE.

We must start by clarifying the relations between the cost curves and the incentives to form coalitions because it is a subject that might be a source of confusion and misunderstanding. At this point, it seems to us that admitting that the oil industry, at the exploration and production levels, passed from a phase of decreasing marginal costs to a phase of increasing marginal costs in 1970-1971 does not necessarily imply that the oil producing countries "do not even need to make an agreement to attain this objective because their situation improves by itself".<sup>(2)</sup>

It is true that, in a situation of pure and perfect competition, surplus (profit) exists only when the average and marginal cost curves

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are rising because when they are falling, the application of the principle of equalizing marginal cost to price would maximize the losses and not the profits. Consequently, all the points on the increasing segment are preferable to those on the falling segment. But in our case, the problem is not to compare the different positions in a situation of perfect competition. The question is, to compare, on an increasing cost curve, the dimension of the surplus (profit) of the industry in two different forms of market organization: namely, in perfect and imperfect (coalitions and agreements between the producers) markets.

In this case, it seems evident to us that the agreements between producers in a given industry are preferable, *for the group as a whole*, to a situation of competition. In fact, such agreements, if they are respected by every one and if they last for a long period of time, lead to an increase of the *joint profits* given that the producers can control a considerable part of the total production of the industry.

Though the underlying motives are a little different, this incentive to resort to coalitions exists both in a situation of decreasing costs and that of an increasing ones. In fact, when the costs are increasing this incentive is there simply because there are substantial profits to protect from the entrance of new firms attracted by the level of benefits. When the costs are decreasing, the competition is altogether out of question since in that case only a monopoly can prevent the

maximization of losses.<sup>(3)</sup>

Whether the costs are increasing or decreasing, the incentive to coalitions or to monopoly exists and the joint profits will always be higher with agreement than those made without agreement. Evidently we can always question the possibilities, durability and the fragility of these agreements but such arguments fall into the scope of the theorem of the "congenital" instability of all market imperfections that we will discuss later on and they do not cast doubts on the principle that we have just stated.

This theoretical principle has a great importance since its rejection might lead to doubts concerning the very necessity of the OPEC.

3- THE COMPONENTS OF THE UNIT COST.

To say that the agreements are beneficial to all producers collectively does not mean that without these agreements oil prices would tend towards \$1 per barrel as M. Adelman<sup>(4)</sup> thinks or towards \$3.20 for the rest of the century as calculated by W. Nordhaus.<sup>(5)</sup> At this point, too, there is a misunderstanding that must be clarified but this time it is related to the economic theory of non-renewable resources.

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To go directly to the essential problem, let's suppose that the OPEC does not exist and we are in a situation of perfect competition. If then, the prices fall relative to their present level, we may conclude that the gap between these two levels is a measure of the power derived from the collective action or from the agreements within OPEC.

Nevertheless, in order to determine the magnitude of this price fall we must analyse, without leaving aside the assumption related to the equality of marginal costs and prices, the components of the cost of a non-renewable resource such as the oil.

If we consider the oil in the ground as a fixed stock, it becomes clear that more it is consumed today, the less we shall have in the future everything else being equal. So the rational entrepreneur would compare the present value of profits that he hopes to make from the future sales (for each period in the future) with the profits to be made from the similar sales in the present. Thus, the current marginal revenue must cover not only the marginal costs of the factors used for the production of a barrel of oil (technical cost) but also a user cost inherent to all exhaustible resources.<sup>(7)</sup>

In the case of oil, the supply is not only fixed in the long run such as the land but it is also exhaustible and non-renewable. So it is

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necessary to remunerate not only this exhaustible character but also the cost of the uncertainty which all the investments that seek to extend the limits of supply in the short and middle run bear.

Generally, we consider the royalty as an approximation of this user cost. This royalty represents, in a way, a social property right on the future utility lost by the present extraction of the resource.<sup>(8)</sup>

Although the principle of user cost is accepted, its quantification creates a most difficult problem. In fact, if this cost is determined by the future prices, it is impossible to know these latter in the absence of the future markets which would sanction the anticipations (or the speculations) of the producer.

It has been a long time since H. Hotelling tried to prove that in a competitive market, and given the condition of a known volume of fixed stock, a path of optimum output at each period would be reached if the marginal royalty increases at a rate equal to the increase of the market interest rate.<sup>(9)</sup> Today R. Solow takes the arguments of Hotelling without adding something new to it.<sup>(10)</sup> But this rule is contested given that its application does not lead to the maximum production each year, the principle that should be satisfied in competitive market.<sup>(11)</sup>

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In any case, the use of the interest rate prevailing in the private sector to solve this problem (the method used in most of the models) is not altogether justified to the extent that this rate is not necessarily equal to the social discount rate in spite of the proposition of the standard theory which states that these two rates are identical in a competitive market. In fact, in order to be able to accept such a proposition, we must admit a number of rather unrealistic assumptions. In this situation, government intervention becomes necessary to define a royalty on each barrel produced.

Definitively, if the perfect markets are not able to determine the exact dimension of this royalty, there is no reason to believe that an imperfect market (government intervention) would necessarily be harmful. In this sense, the burden of the proof of the "exactitude" of their solutions falls upon Adelman and Nordhaus and not upon the government authorities. It is especially true when we consider that there are other models that estimate a price of \$5-6. in 1985 in competitive markets.<sup>(12)(13)</sup> Another model shows that in the same period, with a price of \$8.50 there would be very little restriction of the production.<sup>(14)</sup>

In short, there are three points to be kept in mind: a) the existence of a user cost aside from the differential rents and technical costs; b) the fact that in a competitive market, this cost and this rent

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do not disappear in the middle run even if we suppose that they disappear in the very long run (in the House of Eternity in terms of J. Robinson!), and; c) the determination of the user cost cannot be left to the so called free play of market forces whose protagonistes have no reason to consider in their present transactions the interests of the future generations.

4- THE DETERMINATION OF THE SALE PRICE.

But, aside from the costs that we have mentioned, the sale price include other costs that we must try to define precisely. Thus, in order to explain the level of prices and to see to which extent this level is determined by the coalition of the OPEC, we must consider two fundamental realities of the present international setting. The first is the determination of the industrialized countries, especially of the United States, to attain, at a minimum cost and in a very short laps of time, what they call their "energy independance". The second reality is the will of the producer countries to recuperate the total control and administration of their natural resources to accelerate their economic development: this is the objective of economic sovereignty.

The point to be underlined is that a hypothetical competitive market would not take into consederation these two objectives because, by definition, it considers them as being contrary to the principle of

optimum resource allocation. In fact, we can not suppose the absence of nation states and their objectives, the division of labor according to the theory of comparative advantages, in short, all the assumptions and principles of the stand theory and consider, at the same time, the objectives that are incompatible with them.

For different reasons, it is these objectives that dominate the international setting and not the "heroic" assumptions of the standard theory. Thus, it is necessary to approach to the question of determination of prices by considering all their implications. If we choose this approach, we see that these objectives provide important incentives to the OPEC to maintain and even to reinforce its internal cohesion. Otherwise, the oil would be exhausted before a self-sustained and cumulative development is realized and at a moment when the energy independance of the industrialized countries will be attained.

In this sense, concerted action of producer countries in the face of these two objectives seems to us an absolute necessity for the following two series of reasons:

A) The cost of independance: Let us consider that the cost of supply security or that of the energy independance is measured by the gap between the cheap but unsafe oil (Middle East)

and the expensive but safe oil (domestic oil or substitutes). Under normal conditions, this cost must be assumed by the oil consuming countries all through the period necessary to realize the energy independence. However, in order for this payment to accrue to the oil producing countries and not to the consuming nations and multinational companies, the coalition of the producers is necessary.

If we analyse the American strategy, this necessity becomes more evident. In a few words this strategy can be summarized by the desire of the United States to achieve an economic and political objective (energy independence) without paying its price by using their international power.

The measures like import taxes and the permanent struggle to reduce the prices set by OPEC to the desired levels are two means of the American strategy. If the prices fall to \$7, for example, the United States will be able to tax the imported oil up to the point where its sale price equals to the cost of production of the domestic substitute products. In this fashion, this tax, instead of being transferred abroad, would be used to finance the investments necessary for the realization of the Project Independence. On the contrary, if the OPEC fixes its export prices equal to the cost of production of substitute products, it would be very difficult and economically disastrous for the United States to impose a supplementary import tax to finance the investments in alternative energy resources.

Of course, the strategy of the United States can be realized in a somewhat more complicated and risky manner. That is, by the famous "recycling", or draining, of the petro-dollars into the American frontiers or towards the so-called multinational companies. These companies would then use these dollars for the financment of the investments in substitute products. Moreover, unbalanced distribution of the petro-dollars among the industrialized countries and the privileged position of the United States in this matter serves to show that our assumption is far from being merely theoretical. (15)

In this situation, destabilization of the OPEC or, what becomes the same thing, its domination by a leader that would be an advocate of not only the principle of the floor price but also of its suggested level would serve perfectly to the fulfillment of the American objectives. In the same manner, establishment of a competitive market would make this "quasi-rent" disappear without making disappear the objective of energy independence. Evidently, the situation would be different if the United States accept not to impose import taxes on the foreign oil. But this would imply the renunciation of their project independence.

This last assumption is so unrealistic that one asks himself if it is worth examining. On the contrary, any business man knows perfectly well that the important and often very risky investments in the substitutes to OPEC oil will not be made unless there is a sufficient guarantee

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for the maintenance of high and stable sale prices for the imported oil. To argue that this investments could be realized gradually, following the increase of oil prices<sup>(16)</sup> becomes rather absurd when one considers the fact that the principal characteristics of these investments are their enormity and indivisibility which are not easily compatible with the requirements of marginal calculation.

B) The cost of development: Since we accept to take into consideration the objectives of the oil consuming countries, we must also accept the objective of the producers which consists of developing and diversifying their economies. Now, this development process takes place in an international environment which, at least, does not facilitate the task for these countries.

In fact, if the majority of the markets of technology, machinery, alimentation and industrial raw materials are cartellized and it is evident that the oil producing countries will never realize their economic development by facing these markets separately.

To propose to these countries, in the name of the international economic optimality, the establishment of a competitive oil market and the dislocation of their "common front", when the oligopolistic competition and sometimes the monopoly are the rules of the markets of the products manu-

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factured and sold by the industrialized countries, is really at the limit of hypocrisy.

In this sense, the supplementary cost that these countries should pay for because of the imperfection in other markets justify by large the increase in oil prices.

Thus, to the technical costs, the royalty and the cost of independence, we must also add a margin which constitutes a compensation for the general phenomenon of cartellization in the world markets. We do not need to say that the break-up of the OPEC would eliminate these last two costs. In this situation, the purchasing power of the oil revenues accruing to the producer countries would be eroded because of the dominant position of the firms which fix the oligopolistic export prices. The lancinating problem of the deterioration of terms of trade would reappear accompanied with all the theories trying to justify the situation.

Definitively, it would be absurd to respond to the oligopolies by the competitive markets because this would tend to block the development of the Third-World in the manner that we know only too well: monopoly profits and the draining of the capital from the periphery towards the center followed by a ridiculous "compensation" in favor of the periphery in form of aid. To be able to change this paternalistic model in which the relations between the industrialized countries and the under-developed

countries take place and to enter into real discussions concerning a new model, the example of the OPEC must be generalized to other cases whenever it is possible. But, before anything else, the stability of the pilot experience must be maintained. This brings us to the necessity of a production program.

5- STABILITY OF THE OPEC.

An approach to the problem of the OPEC's stability which does not take into consideration the "extra-economic" factors is bound to be limited to only one aspect of the problem: the so-called measurable economic aspect.

In the case in which we are interested, such an approach would be insufficient because of a series of reasons the most important of which are the following:

a) In all the situations that are different from pure and perfect competition, that is, in all real world situations, the effects of the power structure are present and they must be taken into consideration. This power structure is related by a functional relationship to the concentration or coalition of the economic agents. The more this coalition is solid, the more important will be the power it generates especially if the



coalition in question is formed in a vital sector of the economic activity such as the oil industry. In economic terms, the vitality of a given sector is inferred by the fact that the elasticity of demand for the goods produced within this sector is low and constant: this, too, is the case for the petroleum products. In these conditions, it is evident that the trade act can not be limited to a purely economic act which, in principle, excludes the effects of the power structure.

b) The economic theory while making a note of this power as well as the functional relationship between this power and the coalition, refuses to analyse the role of "extra-economic" factors in the emergence or disappearance of a coalition. Consequently, it excludes the study of the effects of power from its field of observation and analysis. This leads to the weakness of this theory in explaining and predicting when it deals with the problem of the stability of coalitions. The only proposition that this theory advances in this field can in fact be summarized in a few words. Starting with the assumption that each member of a coalition is always motivated by the desire of maximizing his individual profit, *expressed in monetary and measurable terms*, it is deduced that every situation of market imperfection and of non competitive equilibrium is bound to instability and, finally, to disappearance. This is the well known thesis of congenital instability of every coalition and of the unavoidable return, in a more or less short laps of time, to perfect competition.

There are certain economists who, on the basis of such generalities, announce periodically the disintegration of the OPEC for the coming months. We see here a confusion of intuition or personal desire and scientifically controlled predictions.

c) The weak point of this thesis is certainly not the unquestionable and everlasting tensions that exist among the members of a coalition. It is rather, the reduction of the behavior of each member to a role of maximizing its *monetary profits* whereas in reality he seeks to maximize his *total profits*: that is, the monetary profits plus the non-monetary ones. The fact that this latter is very difficult to measure does not at all mean that it is inexistant.

In the case of a coalition, or even in the relations between states, this type of behavior is easy to verify. Even beyond the sphere of oil problems, the examples of political behavior motivated by non-monetary gains are quite numerous: sale of low priced cereales to U.S.S.R. by the U.S. to "buy" the *détente*; assistance given to Third-World countries by the industrialized nations "to buy", among other things, a certain alignment of these countries on the national and international political fronts ...etc.

It seems to us that it is necessary to include in our analysis the political factors without under-estimating the role of economic forces

which fix a floor and a ceiling to all decisions that a coalition can take (concerning the price fixing, for example). It is necessary, at least to be able to assign probabilities to the points of equilibrium among the members within this zone of indetermination between the floor and the ceiling that we have just mentioned.

Proceeding in this manner, we shall sketch briefly the central question to which a production program must answer.

It is already established that a nation, which refuses to admit a given distribution of world income and which desires to maximize its own well-being rather than that of the world, can choose to "tax the foreign" by taxing exports or imports or, in certain situations, both of them.<sup>(17)</sup>

If the elasticity of the foreign demand for the product in question is low and constant, and if the country exporting it can control a large portion of its production, the export tax brings about an amelioration of the terms of trade.

For a foreseeable future, these two conditions are satisfied in the case of OPEC except for the fact that this organization contains several nations whose preferences concerning the dimension of an "optimum tax" are neither essentially nor automatically the same.<sup>(18)</sup>

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Let us suppose that each country determines this tax according to an objective function  $f_i$  depending on various variables  $(X_1 \dots X_g \dots X_n)$ . Following our preceding discussion, these variables can be not only economic but also political, strategical, ...etc. We shall thus have, for all the OPEC countries, a series of objective functions corresponding to the number of members. This series can be formulated as:

$$f_1(X_1^1, X_2^1, \dots, X_g^1, \dots, X_n^1) \dots f_i(X_1^i, X_2^i, \dots, X_g^i, \dots, X_n^i) \dots f_N(X_1^N, X_2^N, \dots, X_g^N, \dots, X_n^N)$$

with:  $(i = 1, \dots, N)$

$(g = 1, \dots, n)$

It is impossible to maximize simultaneously all these functions given the interference that exists among them. So, it is necessary to introduce a composed function of this type:

$$\Omega (f_1, f_2, \dots, f_i, \dots, f_N)$$

in which the variables are functions of each country. Maximization of  $\Omega$  is possible if:

- we introduce, for each function, its variables  $X_1, X_2, \dots, X_g, \dots, X_n$  in a way as to render  $\Omega$  a function of these variables.
- we can arrive to a *ponderation* of the relative importance of the different functions  $f_1, f_2, \dots, f_i, \dots, f_N$  by a *given price system*.

The solution of this problem is not impossible if the prices, that is, the relative weights of the functions and the variables in each function, are known. Now, it is clear that only a political arbitration can determine these prices.

This arbitration can be accomplished on two levels. Firstly, on the national level to determine the relative importance that each country assigns to the variables that enter into its objective function. Secondly, on the level of the whole group, the arbitration can be carried on by the *tâtonnement* method well known in the field of economic planification.

Nevertheless, it is evident that this method cannot give the maximum satisfaction to each member and a mechanism of compensation must be established to protect the stability of the OPEC.

In the sections 3 and 4, we have tried to explain why it is preferable, in the present situation, for all the OPEC countries to maintain the actual level of prices and to start from this level to elaborate a production program.

6- CONCLUSION.

As the effects of the OPEC on the structure of international

economic relations become more precise, its attraction on other Third-World countries will continue to increase. In fact, these countries see, more and more clearly, the beneficial consequences that they can get from their eventual coalition to solve the terms of trade problem.

When it is considered from this point of view, the experience of the OPEC goes much beyond the interests of oil producing countries and puts in question the whole structure of the relations between the industrialized countries and the Third-World nations. If, for some reason, this experience fails, it would constitute a backward step delaying the development process of the countries striving to achieve this goal. In order to avoid such an eventuality, not only the political will of the producing countries must overcome their divergences, but also an objective theoretical analysis of the mechanisms and constraints of all the agreements between economic agents must be brought forward. Our study is meant to be a modest contribution in this field.

REFERENCES

- (1) FISHER and al. (1975): "A critical survey of models of the world oil market", Journal of Development Economics, Dec., Vol. 2, No. 4, pp. 363-386.
- (2) J.M. CHEVALIER (1975): "Eléments théoriques d'introduction à l'économie pétrolière: l'analyse du rapport de force", Revue d'Economie Politique, March/April, No. 2, pp. 230-256.
- (3) For all this discussion see: J. ULLMO (1970): "Le Profit", ed. Dunod, pp. 77-80.
- (4) M. A. ADELMAN (1972): "The World Petroleum Market", John Hopkins Univ. Press, Baltimore.
- (5) W.D. NORDHAUS (1973): "The Allocation of Energy Ressources", Brookings Papers on Economic Activity, No. 3, pp. 529-576.
- (6) For more details on this point, see: A. AYOUB (1975): "Oil prices: An Attempt of Explanation", text presented to 2nd International Symposium of Petroleum Economics, GREEN, Univ. Laval (mimeo).
- (7) P. DAVIDSON and al. (1974): "Oil; its time allocation and Project Independance", Brookings Papers on Economic Activity, No. 2.
- (8) W.D. SCHULZE (1974): "The Optimal Use of non-renewable ressources: the theory of extraction" Jou. Env. and Management, No. 1.
- (9) H. HOTELLING (1931): "The Economics of exhaustible resources", Journal of Political Economy, 39, pp. 137-175.
- (10) R. SOLOW (1974): "The Economics of Ressources and Ressources of Economics", American Economic Review, May.
- (11) R.L. GORDON (1974): "Mytheology and Reality in Energy Policy", Energy Policy, September.
- (12) M. KENNEDY (1974): "An Economic model of the World Oil Market", Bell Journal of Economics and Management Science, 5, No. 2, pp. 540-577.
- (13) Federal Energy Administration (1974): "Project Independance Report", U.S. Gov. Printing Office, Washington.
- (14) B.A. KALYMON (1975): "Economic incentives in OPEC oil pricing", Journal of Development Economics, 2, No. 4, pp. 337-362.
- (15) A. AYOUB (1975): "Demand for Capital of the non-oil producing Arab countries and the constraints of supply", Text presented at the Symposium of ICEED, University of Colorado (mimeo).

- (16) C. STOFFAËS (1975): "Pétrole, cynisme et théorie des jeux", Contrepoint, No. 16, pp. 9-25.
- (17) J. de V. CRAAFF (1970): "Fondements théoriques de l'économie du bien-être", (trad.) Dunod.
- (18) A. AYOUB (1975): "Le marché-OPEP du pétrole brut et ses conséquences sur les relations entre pays producteurs", Revue d'Economie Politique, No. 2, pp. 257-274.