

●

It seems discount rates and oil price expectations are two fundamental factors which have caused supply behaviour changes and subsequent demand behaviour changes.

could affect the overall market supply significantly, and this could in turn imply that even in a competitive market there could be more than one equilibrium price. Thus a downward-sloping demand curve could intersect the backward-bending supply curve at both a low and high price.

The jumps in price are thus movements between these different equilibrium prices.

With this argument, one should expect, in the case of ordinary oil demand curve, sudden movements in oil prices from one equilibrium to another can be realized. And this applies equally to price falls as it does to price rises.

-Political reasons:

It is also argued the political events were responsible for oil price crises in the 1970s. Some of them are mentioned as follows:

- The revolution in Libya in 1969
- In May 1970 Syria blocked the Trans-Arabian-Pipeline
- Oil embargo of October 1973, regarding Arab-Israeli war
- Action of U.S. against Japan and some western countries
- Islamic Revolution of Iran in 1979
- Invasion of Iraq to Iran

-Demand factors and structural changes:

It is argued that, the elasticity of

OPEC demand curve that would determine the extent of OPEC monopoly power has declined overtime, due to the changes of the elasticity of world oil demand, the elasticity of NON-OPEC supply and the share of OPEC production in total production.

Oil consumption is more elastic with respect to price than it was in the 1970s. And the demand curve has shifted leftwards and also flattened. With considerable changes of these factors it can be realized considerable changes of oil prices.

Demand for oil is clearly falling, due to the decrease of oil intensity.

These demand factors and structural changes are associated with the changes in the structure of the market away from a system where almost all the decisions in the oil market, from exploration through to petrol distribution, were taken by oil companies, to a situation where production decisions by oil producing countries are taken independently from decisions by oil companies to buy crude oil for their refineries.

Dominance of spot markets and the rule of future markets in the oil markets suggests that oil prices may well be more volatile in the future.

- CONCLUSION:

The Expectations have played an important role in oil price movements so far.

It seems discount rates and oil price expectations are two fundamental factors which have caused supply behaviour changes and subsequent demand behaviour changes.

This Hotelling-type model is a more satisfactory explanation than other views. This has considerable explanatory power of the drastic changes in oil price movements since 1950 up to now.

It can be concluded that the direction of oil price movements, depend on discount rate and oil price expectation in the future.

- REFERENCES:

1. A. Mokadem and et al, " OPEC and the world oil market 1973-1978 ", Surrey Energy Economics Centre
2. C. Robinson and J Morgan, " North Sea oil in the future "
3. D. W. Pearce & R K Turner, " Economics of Natural Resources and Environment ", Harvester Wheatsheaf
4. D. W. Pearce (ed), " The Economics of Natural Resource Depletion ", Macmillan, 1975
5. C. Robinson, " Depletion Control in Theory and Practice ", Zeitschrift fur energie wirtschaft, March 1986
6. H. Hotelling, " The Economics of Exhaustible Resources " Journal of Political Economy, April 1931
7. A. Ulph, " The price of Oil ", Economic Review, May 1984
8. C. Robinson, " Energy Depletion and the Economics of OPEC "
9. " British Petroleum (BP) ", Statistical Review of World Energy, June 1994
10. D. Aperjis, " the Oil Market in the 1980s "
11. D. Hawdon and et al, " Oil Prices in 1990 and Beyond " SEEDS 52, July 1990
12. I. Himona and et al, " Prospects for Oil Prices ", SEEDS 44, 1989
13. C. Robinson, " The Future of Crude Oil Prices ", SEEDs 12 Nov. 1982
14. I. Himona, " Crude Oil and Product Prices ", SEEDS 36, July 1987
15. C. Robinson, " The World Energy Situation and Prospects for the 1980s ", SEEDS 4
16. C. Robinson's Lecture, " Natural Resource Economics ", 1994
17. C. Bina, " The Economics of the Oil Crisis ", 1985

●

**Following 1973
most economists
in western countries
would have sought to
explain the quadrupling
of oil prices as an attempt
by OPEC
to exert monopoly power
in the oil market**

of changes of two variables in the price expectation-discount rate model.

In this period discount rates of oil producers came down as countries took over production from the oil companies. And high oil prices were expected as explained, so that : ($p^* > i$)

The 1986 oil price collapse:

During 1981-1985, inflation in most developed countries was high and controlling inflation had a top priority. This policy achieved by control of money supply, this in turn, led to increasing the rate of interest, so that, during 1981-1985, real long term interest averaged 5.5 percent compared to an average of only 1.3 percent during 1978-1980⁷.

High oil prices in the previous decade stimulated the following actions:

- Intensify the investment in substitutes for oil
- Development of applied technology needed to develop oil fields
- NON-OPEC production clearly speeded up
- The expected life of world oil reserves now looked very much longer than a few years ago. (from scarcity to surplus)
- Dominance of spot markets and existence of future markets in oil markets

-Dominance of buyer's market, rather than seller's market in oil markets

-Demand for oil was clearly falling, that is, decreasing in oil intensity

-Oil consumption was more elastic with respect to price than it was in the 1970s. The demand curve shifted leftwards and flattened.

In these circumstances, it is obvious that the expected oil price was low. In this period, with a high discount rate and low price expectation, so that ($p^* < i$) it resulted in a strong tendency to increase oil production.

In this situation, and with increased fiscal needs of most oil producing countries for hard currencies, therefore, oil production competitively increased, and consequently, **1986 oil price collapse.**

Some alternative views of oil price movements:

-Monopoly position and collective decision of OPEC

It is argued, the oil crises were the result of the monopoly condition of the oil market and OPEC was the culprit. (cartel arguments)

Following 1973 most economists in western countries would have sought to explain the quadrupling of oil prices as an attempt by OPEC to exert monopoly power in the oil market.

The monopolist will slow down the rate of extraction of oil and thereby cause the price to rise above the competitive level. How far it will pay a monopolist to raise the price will depend on the elasticity of demand for oil. It is the elasticity of the OPEC demand curve that would determine the extent of OPEC monopoly power, and this would depend on the elasticity of NON-OPEC supply and the share of OPEC production in total

production.

According to this view, then, the price increase of 1973 was caused by a change in market structure from competitive to a cartel.

However, this view was not universally accepted. A problem with the cartel view is that while it explains the behaviour of prices from 1973-1978 quite well, it cannot account for the rise in price in 1979.

On the other hand, it has been mentioned even with no OPEC, individual oil producing countries would have tendency to cut output in the 1970s, thus raising the price sharply¹³. And it is also argued, if it was the action of the cartel, why not in the 1960s?

-The target revenue view:

This view starts from the fact that after 1973 it was the countries, not oil companies, who controlled oil production.

It is argued that, some OPEC countries have definite target revenue. If the oil price rises, because these countries have limited scope for investment in their economics and are not interested in acquiring a lot of foreign assets, then they will decrease their oil production. If oil prices decrease, they will increase oil production to maintain their revenues at their target level.

This implies that, for such countries the supply curve for oil will be **backward-bending**. At low prices the target level of revenue will not be reached, so the supply curve will slope up in the normal way. However once the price reaches a desirable level and the target revenue is satisfied, any further price increase will cause this country to decrease its production.

Since the countries for whom this argument might be applicable are large oil producers (eg. Saudi Arabia), this kind of behaviour

-U.S. oil imports increased in the 1970s, because of economic recovery resulting in rising oil consumption, while domestic oil production was not enough.

- Anticipation of scarcity

a) - by early 1973 articles were being written, forecasting that crude oil prices would be high, for instance, James Akins' article (.At the U.S. State Department) which appeared in April 1973.

b) -the growth of neo-malthusianideology and publications such as Meadow's (1972) "The Limits to Growth " and expectations of future oil shortage.

c) -By the early 1970s some resource economists had begun to point out that rapid depletion of oil resources would produce rising oil prices.

- Expectation of higher cost for producing oil in the future

- In the early 1970s expectation of oil price increases was a common view, and the idea was that oil prices would rise.

- It was in the oil companies' interests (in the conditions of changing property rights) to generate expectation of shortage and higher oil prices to attract concerned governmental protection for their oil activities in high cost areas.

In the late 1960s and early 1970s also due to the following political events the expectation of high oil prices were enhanced:

-The Suez Canal was closed in 1967 due to Arab-Israeli war.

-Oil supply from Nigeria had stopped due to the Biafra civil war.

-The revolution in Libya in 1969

-In May 1970 Syria blocked the Trans-Arabian-Pipeline

-The oil embargo of October 1973, regarding the Arab-Israeli war

-Changing property rights.

At this time ownership of the most oil resources in the Middle

East passed from the international oil companies to the governmental oil companies. This phenomenon caused a sharp fall in the rate of discount, because of ownership of oil governmental producers with longer horizons.

In short, significant changes both in p^* and i occurred, namely, discount rate (i) came down relative to expected oil prices, so that, ($p^* > i$)

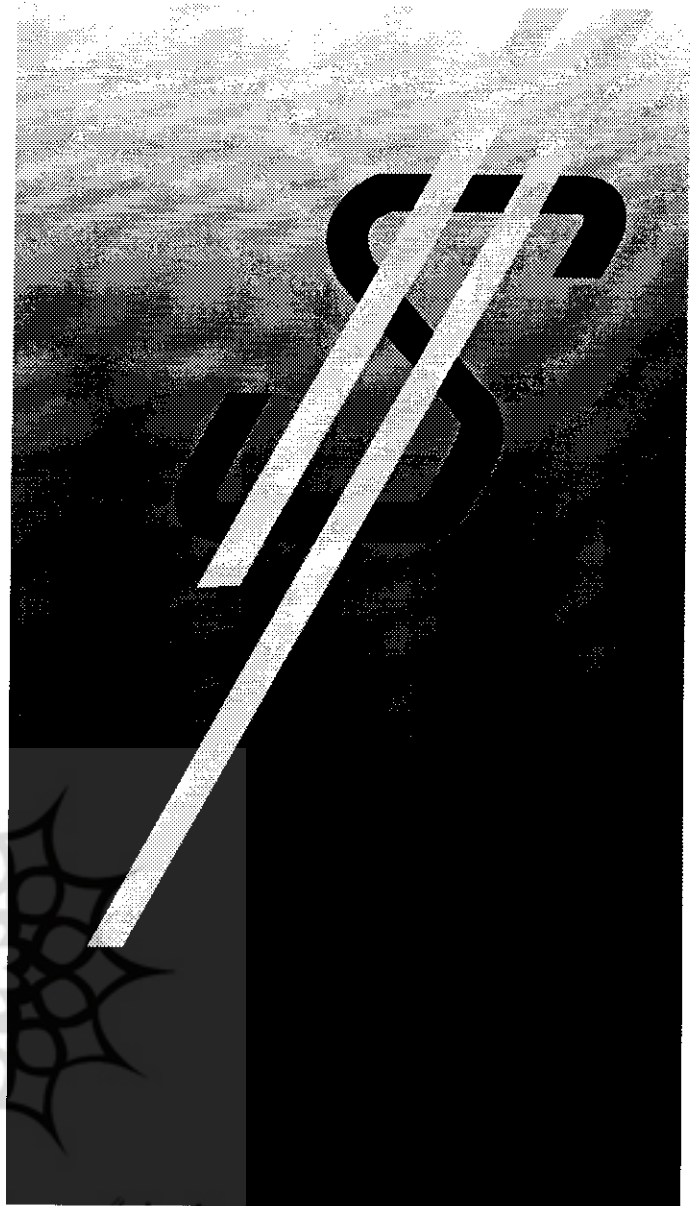
Such circumstances, in the early 1970, gave a strong incentive to hold marginal barrels of oil in the ground, that is, Supply behaviour changed, and therefore supply curves shifted to the left. By considering oil demand curve which

was inelastic with respect to price, oil prices increased sharply.

1979 oil shock:

During 1977-78 the oil price expectation was beginning to change. However, the political events pushed the expectation of high oil prices up again. And in reality, the price of oil between October 1978 and October 1981 increased by 168%. Oil prices increased mainly because of anticipated shortage and uncertainty due to the Islamic Revolution in Iran and invasion of Iraq to Iran.

In short, in this period (1973-1979) oil price movements are explained most conveniently in terms



●

**In a competitive
or monopoly market,
one would expect
real prices
to rise steadily
as the marginal cost rises,
not to jump sharply.**

$p = p - (C_{ost} + T_{ax})$ net expected price

pq = net revenue

NPV = net present value

i = producer's rate of discount

It is assumed that the producer's objective is to maximise the expected net present value of all his future investment programme, then the producer will compare the net present value of the alternative investment open to him.

In this formula three important variables are: i , p and q .

It can be argued that only q is the variable under the control of the producer. The producer's decision (with given resource (Q) and production technology) then, becomes a function of his expectation about discount rate (i) and price, (or price trend discount rate (i) and price, (or price trend $p^* = dp/dt$) that is:

Production of a resource in any period depends on the expected discount rate (i) and the expected rate of net price appreciation (p^*)

if $p^* > i$

that is, expected appreciation in the net price ($p^* = dp/dt$) is larger than expected discount rate (i), then the producer who wants to maximize the net present value of his reserves will keep his marginal barrel of oil in the ground to take advantage of high expected price appreciation in the future.

if $p^* < i$

that is a tendency to produce now, rather than later. therefore, production will be increased.

if $p^* = i$

The producer is in equilibrium, that is, the expected NPV of a marginal barrel of oil will be the same, whether it is produced or held in the ground.

In short, the oil production in each particular period depends on producer's expectations about i and p^* .

It is argued that, in the real world, oil producers are unlikely to be mere NPV maximisers, they will have more complex objectives, so the model does not hold exactly.

It can be argued that, it is not exactly necessary to assume that oil producers are net present value maximisers for this model to work. It is simply needed to assume that there is some preference for a greater (not necessarily a maximum) net present value rather than a smaller.

In the following section this theoretical analysis, with reference to the case of oil price movements since 1950 up to now, will be applied and examined.

Period of 1950 - 1973: low oil prices

The characteristic of this period is rapidly rising oil output, with oil prices steady or tending to fall.

To consider real oil prices, it is necessary to take account of both inflation and valuation of dollar (in which oil is priced).

It has been shown that real crude oil prices were falling at about 2.5 percent per year in the 1950s, and, then in the 1960s, it became steeper at about 4.5 percent per year¹³.

What is the explanation of the price-interest model?

The oil market in this period is characterized as a buyer's market and the dominant position of the major oil companies in both upstream and downstream activities.

The companies had been worried about the possibility of nationalization and there was basic uncertainty over property rights, and transfer of ownership was in perspective, therefore, the discount rate for these oil companies was high and the expected oil price was low. the reasons why declining oil prices were expected can be listed as follows:

- In the late 1950s some substantial oil discoveries had been made by independent companies and this oil came into the market and to the glut of the 1960s.

- In this period the U.S. was self-sufficient in oil

- Oil companies were working in a market which had become competitive.

- Public opinion, based on the past experience, was considering oil prices on a downward trend, and oil companies also believed this general expectation.

In short, in this period especially, during the 1960s, a high discount rate and low price expectation seem to have resulted in a strong tendency to produce oil sooner rather than later.

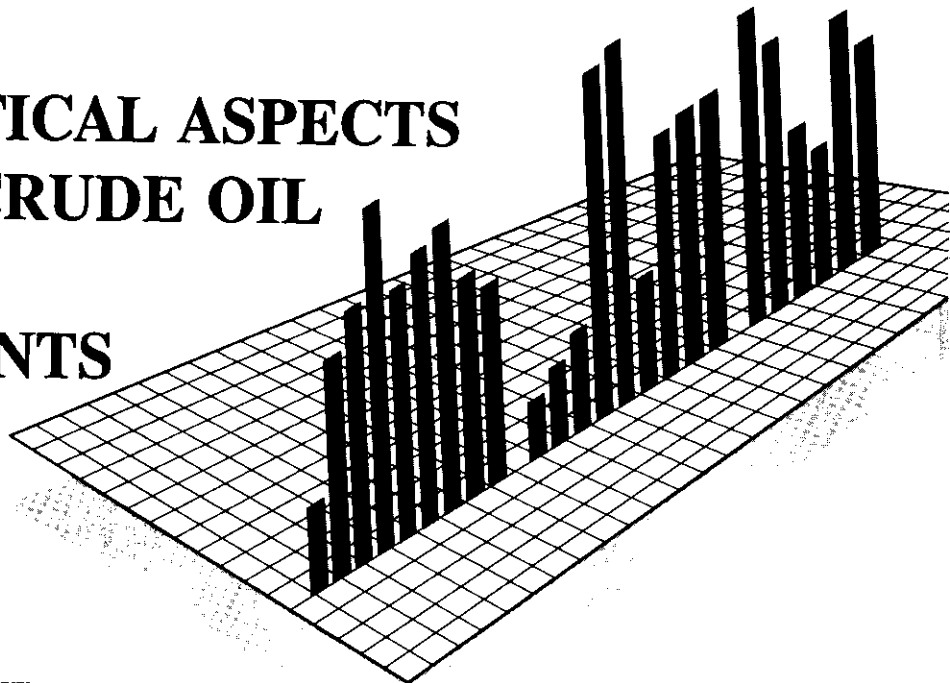
In this circumstance, ($p^* < i$) oil companies therefore had an incentive to raise production and they did so, therefore, oil price was down.

PERIOD OF THE 1970S:
high oil prices

1973 oil shock:

During the early 1970s, the following factors began to change the expectations of oil prices and discount rates.

THEORETICAL ASPECTS OF THE CRUDE OIL PRICE MOVEMENTS



ALI ISMAELI MEIBODI, PH.D.
PROFESSOR OF ECONOMICS AT THE UNIVERSITY OF ALLAMEN-TABATABA'EE

Introduction

The trend of crude oil price movements since 1950 indicates that there were four drastic oil price changes in 1973, 1979, 1986, and 1998. This critical movement of crude oil prices has been an important economic as well as political event that has produced controversy after controversy.

In a competitive or monopoly market, one would expect real prices to rise steadily as the marginal cost rises, not to jump sharply.

Is it possible to explain these variations in terms of economic theory? If we can explain the oil price

movements of the past, we can hope to be able to foresee what may happen in the future.

In this paper, the Hotelling-type model is applied and examined to see how can be explained the movement of oil prices during the 1950s and the 1960s (the periods of stability or falling oil prices) and the sharp crude oil price increases of the 1970s and also subsequent oil price decreases of 1980s.

It is argued that the explanation of oil price movements can be found within the economic theory of resource depletion.

THE ECONOMIC THEORY OF RESOURCE DEPLETION

The argument of resource depletion goes back to the "Jevons formula" for the optimal ageing of wine which was applied to resource depletion by Harrold Hotelling over 60 years ago and the development which followed.⁶

Assuming constant marginal extraction costs, Hotelling argued:

-In the case of perfect competition, the price of

non-renewable resource minus its marginal cost of extraction should rise with respect to the rate of discount, that is:

$$P(t) - MC = \lambda e^{it}$$

- In the case of monopoly, the marginal revenue minus marginal cost should rise with respect to the discount rate, that is:

$$MR(t) - MC = \lambda e^{it}$$

It is also assumed that the owner of non-renewable resources wishes to make the present value of his

future profits maximum.¹⁶

PRICE-INTEREST MODEL

How does allocation of the non-renewable resource occur?

Resource allocation by the market, operates based on the following formula:

$$\text{Max: } NP = \sum (pq)_t / (1+i)^t$$

$$\text{s.t: } \sum q \leq Q$$

where:

Q = Reserves

q = Annual production