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LIMITS TO THE PRICE OF OIL

by

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Abstract

Are there natural limits to the seemingly incessant rise in oil prices? The problem requires knowledge of whether the so-called energy "crisis" results from the exhaustion of oil or energy resources or from the exercise of monopoly power by the oil producers.

Investigation of price, production and discovery of new oil deposits before 1973 showed that the world is far from exhausting oil resources. On the contrary, the growth of supply had been outpacing demand. The energy crisis, therefore, is not caused by natural scarcity. It is contrived.

Contrived scarcity is subject to the laws of demand and supply. Analysis suggests as much as 40 per cent concentration in demand in five years and about 300 per cent in 20 or more years, if the 400 per cent increase in price remains. Similarly, oil supply is expected to increase four times in 20 or more years. These figures, however, cannot be realized if political and social environment will subtantially change.

Among the natural forces exerting downward pressure on price are the supply increases in the world market. This is brought about by the: (1) new oil reserves in the Organization of Petroleum Exporting Countries (OPEC) and the non-OPEC countries; (2) entry of China and Russia; (3) development of alternative sources economical at prevailing prices; and (4) development of breeder nuclear reactors, fusion reactors and solar energy.

This paper shows there are natural limits to monopoly pricing. If allowed to freely operate, the energy market will determine prices according to demand and supply. Such prices are expected to be much lower than the prevailing.

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Introduction

The 1973-1974 oil embargo and the fourfold increases in oil price, shocked the oil importing countries. For them, it meant arrested economic growths, high prices, paralyzed transportation systems, and widespread miseries.

Governments adversely affected by the so-called "oil crisis" responded by adopting energy policies to protect their societies. Two approaches clearly emerged. The West Europeans and Japanese poorly endowed with energy resources opted for energy "inter-dependence". The Americans (or certain sectors in the United States) having large deposits of energy resources preferred energy "independence". The Philippines subscribes to the idea of self-reliance.

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The policy of energy self-reliance or independence implies two important assumptions. First, it envisions continually escalating oil (energy) prices. Second, it assumes that domestically produced oil and other energy commodities can compete with those available in the world markets. If these assumptions are not correct a policy of "self-reliance" may not be in the best interest of the country concerned.

This paper aims to show that the seemingly limitless escalation of oil prices is subject to certain forces that can set a ceiling for oil prices. This is important because critical policy issues depend upon the perceived future level of oil prices.

Since the problem is economic in nature, the analysis hinges on the examination of factors affecting supply and demand. First, it is shown that increasing oil prices tends to considerably restrict consumption. Hence, proportions of consumption into say, 1985 based on the 1970s and 1960s, when real oil prices were decreasing, may be exceedingly high. Second, analysis of supply factors shows that the new level of prices increases supply. This is because (1) formerly, sub-economic resources are becoming economical on account of

high prices (movement along the supply curve), (2) new discoveries induced by high prices and other economic social and political conditions, (3) substitute energy resources such as oil shale, tar sand and uranium are becoming economical as a result of new economic and political conditions.

To put the problem in proper perspective the concepts of short-term and long-term (as applied to demand or supply) must be explained. Barnett (1963), talking about energy resources says:

> "Short-term supply is what would be forthcoming at various prices from energy facilities (mines, wells, tankers) and the present labor resources which are suitable and readily available. In the energy industries short term supply tend to be rather inelastic, except for far off peak demand in utilities, mines and wells operating below capacity . . .
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> Long-term energy supply is what would be forthcoming after completion of new facilities--construction of refineries, tankers and electric power plants; exploration and development of new mineral resources; recruiting and training of labor force; and technological advances which are visible or suspected on the horizon. The gestation of new facilities in energy is rather long. It takes about 15 years for such things as nuclear power plants, development of new oil resources and transportation in remote regions, and development of new mines. In energy we

> might roughly characterize the short-term as say five years, or less, the long-term as say 15 years or more, and view the range from five to 15 years as an intermediate gray zone (medium term). There is no sharp dividing line between short-term and long term nor even the intermediate zone in so large and complex a sector as energy . . .
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> Major studies on energy conclude that the long-term supply for energy is elastic (as in demand), . . . which implies the physical availability of energy in the long-term. Of course, most studies also identify possible social policy problems relating to foreign trade, conservation programs, monopoly forces, tax policies, national security or innovations."

The short or long-term concept is essential because long-term problems can only be solved optimally by long term solutions and short-term problems by short-term solutions. If the 1973-1974 energy "crisis" is viewed mainly as a short-term problem, as held by many energy economists (Erickson and Waverman; Mancke; Adelman; Houthakker), short-term policies are needed to solve it.

It must also be noted that the different forms of energy-oil, coal, tar sand, nuclear--are substitutable to a certain limit. All these forms are demanded because they commonly provide highly concentrated energy at reasonable costs. It is then more appropriate to speak of the demand or supply of energy rather than its specific forms.

Section 1 analyzes the current energy crisis. It points out its roots and time frame, whether the nature is short or long-term. Section 2 examines the theoretical basis of the crisis and the limits of oil price from the supply or demand side. Section 3 explores some of the available empirical evidence relating to demand and supply. The final section summarizes the main conclusions.

1. The Crisis

The oil embargo of 1973-1974 and the fourfold increase in the price of oil by the OPEC countries are easily taken as the immediate cause of the "energy crisis". No consensus has been reached however as to the ultimate cause of the energy price hike. One view presumes that the world has run out of all conventional sources of energy so the unconventional sources are resorted to (Houthakker, 1973). This implies a rapid increase of the cost of every additional unit to prohibitive levels due to depletion of energy resources.

A second view asserts that the exercise of monopoly power by the OPEC countries brought about the energy crisis. The OPEC finally succeeded in mastering the

world oil market in 1973. This assumes that energy supplies are sufficient to meet world needs even at 1971 or 1973 prices. This view also implies that the present high prices of say oil are unstable since they do not reflect actual costs (as they should were market forces allowed to operate). In fact, a number of economists seriously believe that the world price of oil can fall back to $3.00-$4.00 (Erickson and Waverman, 1974). This may sound incredible considering the prevailing high prices (about $18.00 per barrel) but it should be remembered however, that the 1973 cost of Middle East oil was less than $0.50 per barrel. (Erickson and Waverman, 1974). The upper limit of prices will therefore be set by the price of the last barrel from the highest cost source, provided the world oil market reverts to competitive pricing. Based on this, the energy crisis is then seen as short-term in nature.

But what is more essential is to know the limits to the escalation of oil prices regardless of whether it is short or long-term. The determinants of the long-term supply (and demand) determines the limits of oil prices. If it is short-term the factors influencing monopoly power, or limiting it, can set the price ceiling.

2. A Theoretical Framework: The Long Run Supply Curve and Forces Affecting Monopoly.

As is usual in Economic Analysis, it is convenient to assume the operation of a competitive market before imposing other conditions. Also, both supply and demand factors interact to determine things like prices, level of output or consumption.

The Law of Demand stipulates that per unit of time, the amount of a good consumers are willing to buy decreases as the price increases, provided all other conditions affecting demand, like level of income, tastes, etc. remain constant. This means that the increase in oil price decreases the amount demanded, assuming other conditions are not changed. Given enough time, even the slope of the demand curve can change as some consumers induced by the price changes use substitutes. In this case, the elasticity of the demand curve--defined by the percentage in the amount demanded for every per cent change in price can change. This demand elasticity measures the consumer's response to changes in price. In fact, it introduces error to all projections of demand based on historical data if it is excluded in the projection (as shown in the next section). Should any of the factors assume constant change, the demand curve may shift to the left.

This results in lesser amounts of oil demanded for the same price, compared to previous schedule, without changing its slope. The shift, however, can be to the right if altered condition favors expansion of demand.

The supply curve reflecting the amount of oil producers are willing to sell at different prices per unit time also implies the production cost at different levels of output under competition. If price rises, more oil will be generally available as subeconomic portions of a deposit become economic, assuming that the structure of costs remains the same. If any component of cost changes, like labor or capital, the supply curve slope may change. Hence, a supply elasticity can also be defined, as in demand. Again, conditions which tend to reduce costs like lower taxes and interest rates, can shift the curve to the right. Similarly, conditions increasing costs such as inflation and unfavorable political and social climate can shift the supply curve to the left.

Most discussions of supply and demand curves assume single, homogenous good. In the case of energy, the supply curve is really a bundle of different types of materials. Hence, each requires different costs to transform to some standard product, like a barrel of oil

with fixed characteristics for instance. In general, the long-term supply of energy can be divided into three segments. The first, corresponding to lowest costs, consists of oil and natural gas supplies, including those recoverable under secondary or tertiary conditions. Its slope may be steep.

The second segment has a lesser steep slope and broader component on the horizontal axis. It comprises oil or gas from oil shale, tar sand and coal and energy from fission reactors. The third is a horizontal line indefinitely extending to the right. It corresponds to energy derived from fusion and the sun. Although it maybe argued that the sequence of the segments according to costs, need not be strictly as stated, at least under ideal conditions the ordering is right. (Barnett and Morse, 1963). Such supply schedule should provide conceptual ceilings to the price of energy. It suggests that under competition, the upper limit to the price of oil or gas is set by the last unit of oil (gas) in the most expensive well. When conventional sources run out (i.e. oil, gas, coal), the more abundant shale oil, tar sand, and uranium, become economic at some higher cost range. Should the former be depleted, fusion and solar energy may become available at higher costs.

Under competition, the equilibrium price is determined by the intersection of the supply and demand curves. If for some reason, the price is set above the clearing price due to OPEC's political intervention, some producers will be selling unsold units at lower prices. This then increases their profits and market shares at the expense of other cartel members. The tendency will only stop when the clearing price is attained. At this point, the amount demanded equals the amount producers are willing to sell.

3. Empirical Evidence

The empirical evidence on factors which tend to arrest or amplify the growth of demand and supply are examined here. Their effect on potential future prices can be assessed with the use of the conceptual tools developed in the preceding section. Later, an analysis of the future of the OPEC cartel setting the limit to the oil price in the short and medium-term is included.

3.a) Limits on Demand

Without considering the effect of increased prices, demand based on the 1960 and early 1970s experience can be dangerously too high. The danger arises if such pro-

jections become the basis of policies.

In the short-term, demand elasticity for oil is fairly small, about -0.1, (Erickson and Waverman, 1974) though not negligible. The value implies that a one per cent increase in price triggers a 0.1 per cent reduction in consumption. Hence, a fourfold increase in price can result in a reduction of 40 per cent in consumption. Such a change however, may not be immediately realized since it spawns a substantial dislocation in the economy and society. But perceptible and measurable effects can be seen in a year's time. For instance, the Philippine National Oil Company (PNOC) noted that increased price cut gasoline consumption in 1976 by 3.4 per cent. Compared with 1973, the 1976 gasoline consumption decreased by 10.6 per cent (Bulletin Today, March 9, 1977, p. 1).

Sharp decreases in oil consumption can be expected in the medium and long-terms. Data Resources Inc. reported that demand for gasoline in the U.S. has a -0.75 price elasticity. A 400 per cent increase in oil price can induce up to 300 per cent decrease in gasoline consumption.

The above elasticities however should be interpreted carefully. First, price increases experienced in 1973-1974

were not included by those elasticities. Second, even if society desires very radical decrease in oil consumption certain physical, political and social factors will limit such an action. Expensive thermal plants and steel mills for example, can not be immediately scrapped just to save on energy. Obviously, many other complex factors have to be considered. Attendant dislocation of labor, communities and governments do feature prominently in such decisions. In any event, the demand elasticities point to forces capable of bringing down prices. They can countervail the exercise of monopoly power. The pressure on the long-term supply can also be alleviated by prolonging the economic life of exhaustible energy resources.

Government policies likewise affect oil consumption. Better roads, bridges and traffic cut down oil consumption. Conversion of oil-powered plants to coal, hydro-, geothermal-or nuclear-powered can substantially reduce the level of oil consumption.

Chapman (1974) in his study of the U.S. electric industry projected demand from 1968 to 1990 based on 0.0, 19.0 and 100 per cent increase in price. For the first three years, no perceptible difference in the projected demand was observed. In 1975, the 0.0 and 19.0 per cent

price increases yielded the same projected level of demand, 4.5 per cent higher than that obtained from the 100 per cent price increase. By 1985, projection based on the 19 per cent price increase was 22 per cent lower while that based on 100 per cent was 39 per cent lower than the 0.0 per cent price increase. Finally, by 1990, the 19.0 per cent assumption yielded projected demand about 30 per cent lower. The 100.0 per cent price increase yielded a value about 56 per cent lower than the projected demand based on constant price. This illustrates that in the short-term, the effect of even large price increases on demand may be negligible or too small. But, in the medium and long-term even a small price increase can lead to a considerable decline in consumption. Posner (1974) subscribing to the same idea argues that the probable energy demand for Western Europe by 1980 based on constant prices will be 15-20 per cent lower than projected.

Recent developments have tended to expand demand. Environmental regulations led to the design of automobiles consuming more gasoline and to installations of anti-pollution devices requiring additional energy.

3.b The Supply of Oil

If indeed the energy crisis was caused by the impending exhaustion of low cost oil deposits, a continuing spiral of prices is reasonably expected as growing demand eats up what little is left. Thus, only a very substantial price hike can considerably increase supply. In other words, based on the prevailing 1973 or 1976 price , no increase in supply is expected. No right-ward shift in the supply curve is therefore anticipated. This implies that even before 1973, prices must have been increasing.

However, production and reserves should decrease if prices decrease or remain the same. This implies that, if prices were decreasing and production increasing before 1973, depletion of low cost reserves did not cause the abnormally high current oil prices. Moreover, new deposits discovered shifts the supply curve to the right. If the latter is true, prices are expected to go down as supply expands faster than demand.

A number of facts support the hypothesis that energy crisis results from causes other than depletion of energy resources. Studies by Adelman on the costs of oil production (Crandall, 1974) show that in the Middle East the per barrel cost of oil was $0.07 - $0.28. In

addition, it takes $.80 - $1.00 per barrel to transport oil to the east coast of North America. This clearly shows that the $18 - $23 oil price from the Middle East does not reflect rising production costs as will be the case if the price hike is due to depletion. In fact, in 1957-1970 the trend of the real price of oil was declining (Adelman, 1972). This indicates probable declining costs or more rapid growth of supply than demand. Growth in production during 1968-1972 was even more revealing. Crandall (1974) showed that during the period, production grew by 84 per cent in the Middle East, 29.3 per cent in the U.S. and Canada and about 60 per cent in Algeria and Libya. These facts adequately establish that the energy crisis does not result from exhaustion of nature's energy resources but from the exercise of market power by the oil producers.

Now, the natural forces which tend to undermine the current high level of prices will be examined. Although the short-term elasticity of oil supply is low, as it takes five to 15 years to develop a new deposit, major studies show that long term supply is elastic. Elasticity for example, is about 1.0 or greater for oil, and a little more for natural gas in the U.S. (Barnett, 1963); Erickson and Waverman, 1974). In the long-term,