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Abstract
Since the end of 1987, Saudi Arabia has adapted a delivery-based pricing strategy called "Formula-Pricing" (Note 1) (please see Notes page at end), of which the objective is to expand and defend its market shares. (Note 2). The authoritative International Crude Oil Market Handbook ("Handbook") pointed out the flexible and successful application of Formula Pricing as follows:

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EFFECTIVE OR INEFFECTIVE: EXAMINATION OF SAUDI PRICING STRATEGY IN THE ATLANTIC EUROPE BETWEEN 1987 AND 2000

Kazushi Uemura

INTRODUCTION

Since the end of 1987, Saudi Arabia has adapted a delivery-based pricing strategy called "Formula-Pricing" **(Note 1)** (Please see Notes page at end), of which the objective is to expand and defend its market shares. **(Note 2)**. The authoritative *International Crude Oil Market Handbook* ("*Handbook*") pointed out the flexible and successful application of Formula Pricing as follows:

It permitted sellers to target specific areas and even specific customers by modifying formulas and other aspects of the contracts to meet customer's individual needs. Formula pricing has proven to be effective as a tool for establishing and defending market share by producers in a period of surplus supplies and competition. **(Note 3)**.

When we examine Saudi pricing in Europe, we have found a variety of delivered prices of Saudi crude oil in the four large consuming countries in Atlantic Europe (Spain, France, [West] Germany, and the United Kingdom; hereafter referred to as "Atlantic Europe") as shown in Figure 1. **(Note 4 (Source for Figure 1 and Note 4))**

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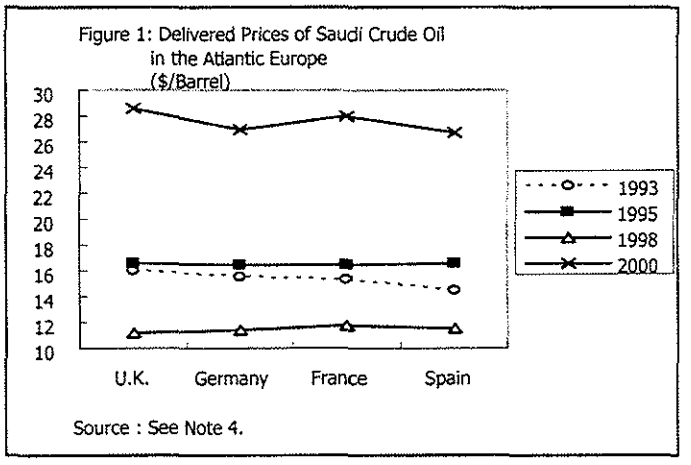
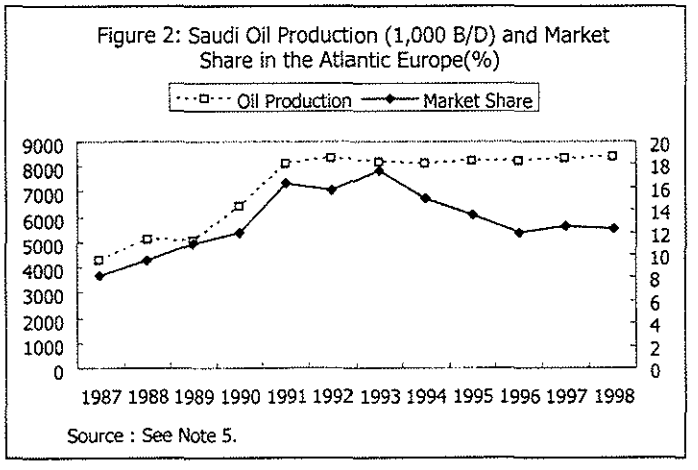


This certainly reflects the intention of Saudi Arabia to meet the needs of individual customers and shows that, as the Handbook wrote, the Saudis were flexible in marketing their crude oil in Atlantic Europe.



Yet, questions remain with regard to the effectiveness of Formula Pricing. Certainly, as shown in Figure 2, **(Note 5 (Source for Figure 2))** Saudi Arabia increased production and could increase its market share in the late 1980's and early 1990's and it looked the Saudis might reestablish their market position in Atlantic Europe like in the 1960's and 1970's. **(Note 6)**

However, the Saudi market share in Atlantic Europe peaked in 1993 with 17.4%, but did not recover that level in the period after 1993, which was certainly still "a period of surplus supplies and competition," as the Handbook assumed. One is inclined to think that the Saudis could have used the world's largest excess capacity **(Note 7)**, flooded the world oil market and defended, if not expanded, their market share in Atlantic Europe.

In this short paper, I will analyze:

(1) Why the Formula Pricing Strategy was effective until the early 1990's. Namely, why could the Saudis increase their market share in the Atlantic Europe until the early 1990's?

(2) Why the Formula Pricing Strategy not effective after the early 1990's. More specifically, why did the Saudis not use their large excess capacity, flood the world oil market, and defend their market share in Atlantic Europe after the early 1990's?

As the most promising line of discussion, we start with a brief review of Saudi oil policy.

1. Review of Saudi Oil Policy

It has been discussed that one of the major objectives of Saudi oil policy has been to achieve target (current oil) revenues. David J. Teece wrote:

> *Several important OPEC producers set oil production with reference to budgetary requirements and internal and external political constraints. If export receipts plus foreign earnings are such as to satisfy expenditure requirements, oil production policies will be determined by conservation considerations, where conservation involves shutting in production for future generations the relationship between current price and current output is best represented by a backward bending supply curve for a short run* **(Note 8)**.

Given the relatively small population but the world's largest swing production and export capacity, Saudi Arabia can reduce production, raise the world oil prices, and achieve the target revenue. In terms of the geographical marketing strategy, this could mean either marketing of oil evenly throughout the world or marketing of oil in a targeted market (most reasonably, the nearest market first). Since Saudi Arabia, like most of the oil producers, applied the posted-price system or the fixed-export-price system in most of the 1970's and in the first half of the 1980's, it apparently took the latter strategy and, first of all, targeted Asia, the nearest and large market. (**Note 9**)

Yet, it has been pointed out that, with the adoption of Formula Pricing, Saudi Arabia has tried to achieve a more aggressive objective: profit maximization. (**Note 10**)

The economics of location suggests a monopolistic producer can exercise geographical price discrimination and maximize profits. (**Note 11**) The pre-condition for this profit-maximization is that the producer needs to establish a certain market share. That is, a producer has to increase production, gain a large part of the market, and establish a market power before it can try a geographical price discrimination.

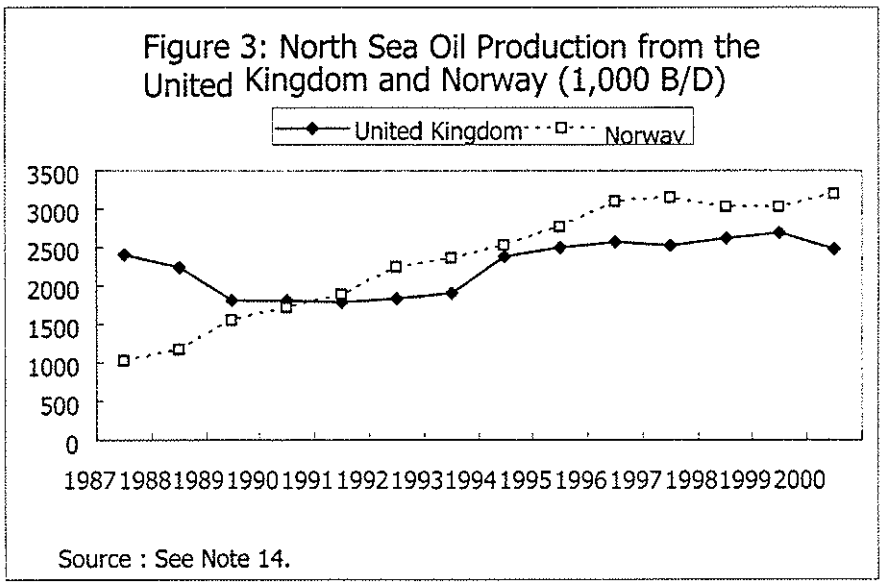
Having already established a sort of monopoly status in Asia by the middle of the 1980's, the Saudis must have targeted Atlantic Europe, the next nearest and large market for them. In fact, as previously mentioned, the Saudis successfully increased market share in the Atlantic Europe in the late 1980's and early 1990's

2. Effective Saudi Pricing Strategy

We can attribute this successful recovery of Saudi market share in Atlantic Europe to (1) the delay in the recovery of Iranian and Iraqi oil production after the 8-year Iran-Iraqi War, (2) the delay in the recovery of the UK oil production in the North Sea due to the technical problems, (3) the United Nations embargo of Iraqi (and Kuwaiti) oil export upon the Iraqi invasion of Kuwait, and (4) the reduction in oil production in the former Soviet Union.

The oil production (**Note 12**) of Iran and Iraq was about 2.3 million barrels per day ("MMBD") and 2.1 MMBD respectively in 1987. After the cease-fire of August 20, 1988, the production of the two countries rose to about 2.8 MMBD and 2.9 MMBD respectively in 1989. Yet such levels of production were still lower than the peak-time production of close to 6.0 MMBD for Iran (in 1978 before the Iranian Revolution) and that of far above 3.0 MMBD for Iraq (in 1979 before the Iran-Iraqi War).

Since the first commercial production in the early 1970's, despite the high cost of production (**Note 13**), the oil production in the UK and Norwegian sectors of the North Sea was blessed by the high world oil prices in 1979-1985 and rose to little over 2.0 MMBD in 1980 and to 3.4 MMBD in 1986. Particularly, the production in the UK sector increased rapidly to little over 1.5 MMBD in 1980 and to about 2.5 MMBD in 1986. Yet, due to a series of technical problems with platform oil production in 1987-1989, the oil production in the UK sector, as shown in Figure 3 (**Note 14 (Source for Figure 3)**), declined to 2.4 MMBD in 1987, to 2.2 MMBD in 1988 and to as low as 1.8 MMBD in 1989.



As we discussed above, the oil production of Iran and Iraq recovered to 2.8 MMBD and 2.9 MMBD respectively in 1989. Yet the Iraqi invasion of Kuwait in August 2 of 1990 immediately drew the United Nations embargo of export of Iraqi and Kuwaiti oil. Not only 2.9 MMBD of Iraqi oil, but also 1.8 MMBD of Kuwaiti oil, disappeared from the market.

Welcome news to Saudi Arabia was the decline in the oil production in the former Soviet Union (mainly Russia) in the late 1980's and early 1990's. The oil production in the former Soviet Union continued rising in the early 1980's and peaked in 1988 with 12.1 MMBD. Yet, because of several economic reasons, the production started declining in 1989.

In addition, the former Soviet Union went through the political turmoil in 1990-1991 and the oil production continued declining to 11.0 MMBD in 1990 and to 10.0 MMBD in 1991.

Taking advantage of the four factors as discussed above, Saudi Arabia increased production and could expand its market share in Atlantic Europe. The Saudis most probably dreamed of exercising geographical price discrimination in Atlantic Europe as they did in Asia and it looked as if the dream could come true.

But the turning point eventually arrived.

3. The Turning Point

The favourable conditions discussed above started to fade away in 1992-1993 because (1) the Iranian oil production quickly recovered, (2) the UK oil production in the North Sea started recovering, (3) the oil export from the former Soviet Union did not decline as much as expected, and (4) the production in Kuwait quickly recovered.

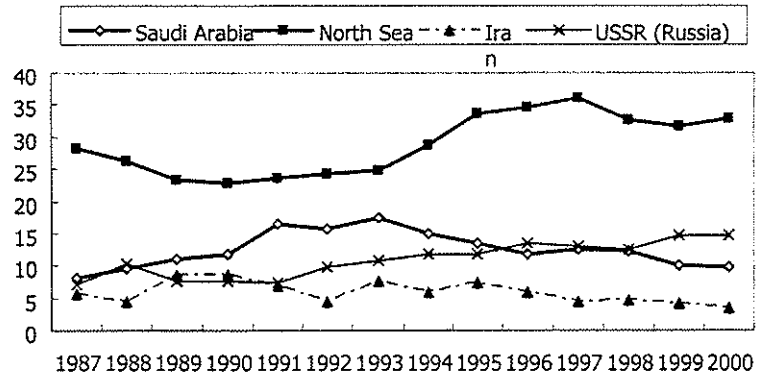
Iranian oil production rose from 3.1 MMBD in 1990 to 3.3 MMBD in 1991, to 3.4 MMBD in 1992, and to 3.5 MMBD in 1993. The oil production in the UK sector of the North Sea bottomed in 1989 with 1.8 MMBD, but showed a sign of recovery in 1990 and, after a fall in 1991, rose to over 1.9 MMBD in 1993. Also, the Norwegian production continued expanding in the early 1990's from 1.6 MMBD in 1989 to 1.9 MMBD in 1991, to 2.2 MMBD in 1992 and to 2.4 MMBD in 1993.

As discussed above, the oil production in the former Soviet Union has continued to decline since 1988. For example, the Russian oil production declined from 7.6 MMBD in 1992 to 6.7 MMBD in 1993. Due to the stagnated oil demand in the former Soviet Union and aggressive oil export policy (particularly of Russia in need of hard foreign currencies), the oil export from the former Soviet Union (about 5 MMBD in 1990) did not decline as quickly as oil production, and has stayed at around 2.0 MMBD since early 1992, and even showed a sign of slow increase. **(Note 15)**

The last unfavourable condition for Saudi Arabia was the recovery of Kuwaiti oil production, which bottomed at 0.2 MMBD in 1991. The production of Kuwait quickly recovered to 1.1 MMBD in 1992 and to 1.9 MMBD in 1993.

Faced with the tougher competition, particularly in Atlantic Europe as shown in Figure 4 **(Note 16 (Source for Figure 4))**, Saudi Arabia apparently tried to defend the market share in the Atlantic Europe in 1992.

Figure 4: Market Shares of Four Major Crude Oil in the Atlantic Europe(%)



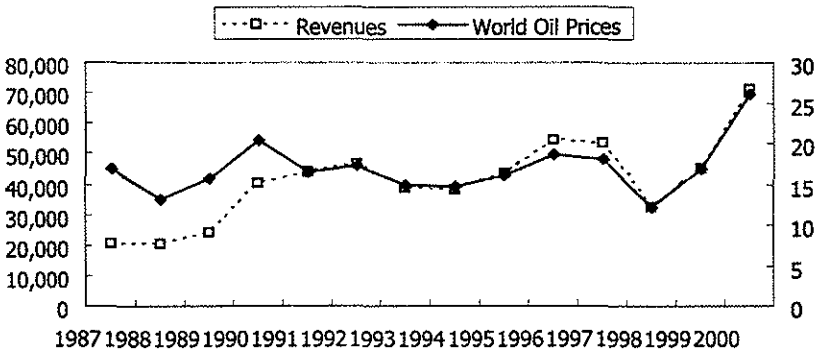
Source : See Note 16.

Saudi Arabia increased production to 8.3 MMBD in 1992 from 8.1 MMBD in 1991, but the Saudi market share in Atlantic Europe did not increase, instead declining to 15.7 % in 1992 from 16.4 % in 1991, apparently losing competition with North Sea oil of which market share went up to 24.2 % in 1992 from 23.5 % in 1991.

Still, the Saudis tried to defend their market share in early 1993 by keeping a high level of production. The Saudi production was 8.233 MMBD in the first quarter while that went down to 8.033 MMBD in the second quarter of 1993. **(Note 17)** Certainly, Saudi Arabia regained its market share from 15.7 % in 1992 to 17.4 % in 1993 while North Sea market shares stagnated to increase to 24.7 % in 1993 from 24.2 % in 1992. Reflecting this intensified competition in Atlantic Europe and still a stagnated oil demand, as shown in Figure 5 **(Note 18) (Source for Figure 5)**), the world oil prices declined from $17.19 in 1992 to $14.94 a barrel in 1993 and the oil revenues of Saudi Arabia drastically went down from $46,527 million in 1992 to $38,621 million in 1993.

Apparently the Saudis had learned by the middle of 1993 that the policy of maintaining their market share in Atlantic Europe did not bring about as much oil revenue as before and they had to choose between market share and revenues. They therefore chose oil revenues and, to prop up oil prices, reduced their oil production (less market share in the Atlantic Europe) within the framework of the Organization of Petroleum Exporting Countries ("OPEC"). **(Note 19)**

Figure 5: World Oil Prices ($/Barrel) and Revenues of Saudi Arabia's Petroleum Exports (Millions of US Dollars)



Source : See Note 18.

The Wall Street Journal reported in 1993:

> *Saudi pricing policy is guided by its revenue goals. And, until recently (February 1993), these goals were met by the kingdom's ability to produce more and more oil, and by the market's ability to absorb the rising Saudi volumes. But in recent months, the market has signaled that it sated. Prices fell, depressing Saudi revenues.* **(Note 20)**
>
> *In recent months (June, 1993), there has been increasing evidence that the Saudis, presumably pressed by economic need, wanted to see prices as much as $2 a barrel higher. Now, a leading oil minister said the Saudis appear(ed) to be moving to achieve that objective.* **(Note 21)**

Of course, the Saudis could have flooded the world oil market, terminated some of the high-cost oil (North Sea oil in particular), and defended their market share in Atlantic Europe, but apparently worried that such a policy would bring about lower oil prices and revenues, they dared not try. (This concern has proved to be right later in 1997-98 when the world oil prices collapsed upon the so-called "Asian Economic Crisis", which I shall discuss later.)

4. Ineffective Saudi Pricing Strategy

Faced with stagnated world oil demand and the continuing competition among various producers, the world oil prices did not recover and both Saudi oil revenues and its market share in Atlantic Europe declined in 1994.

Yet, the world oil prices recovered in 1995 reflecting the recovery of world oil demand and the output coordination mainly of Saudi Arabia and Iran within the framework of OPEC. The oil revenues of Saudi Arabia increased from $38,139 million in 1994 to $43,547 million in 1995 and to $54,272 million in 1996. In turn, the Saudi market share in Atlantic Europe declined from 15.0 % in 1994 to 13.5 % in 1995, and to 11.9 % in 1996 while that of North Sea oil increased from 24.7% in 1993 to 28.7% in 1994, to 33.6% in 1995, and to 34.5% in 1996. It was obvious that Saudi Arabia was no longer enthusiastic about the market share in Atlantic Europe since the middle of 1993.

The reaction of Saudi Arabia to the collapse of world oil prices in 1997-1998 will further elaborate this point. The Asian Economic Crisis which started in early 1997 caused a sudden drop in oil demand in Asia and, coupled with accelerating production of various producers (including Saudi Arabia) on the expectation of increasing world oil demand and in reflection of their rivalries, resulted in the collapse of world oil prices to as low as $10 a barrel. Saudi Arabia, with the high level of production of some 8.4 MMBD in 1997 and 1998, recovered the market share in Atlantic Europe from 11.9% in 1996 to 12.6% in 1997 and to 12.3% in 1998 but their oil revenues dropped from $53,344 million to $32,570 million. Under these circumstances, Saudi Arabia reduced its production within the framework of OPEC from 8.4 MMBD in 1998 to 7.8 MMBD in 1999. The world oil prices (and Saudi oil revenues) recovered in 1999 but in turn, Saudi market share in Atlantic Europe declined from 12.3 % in 1998 to 10.0 % in 1999. The *Handbook* wrote in 1999:

Less Saudi emphasis has been placed on Europe, in part because of tougher competition from Iranian and Russian spot sales. (**Note 22**)

CONCLUSIONS AND FUTURE IMPLICATIONS

Let us suppose that Saudi Arabia started a new campaign in Atlantic Europe at the end of 1987; they tried to establish a market power, with Formula-Pricing, as the first step to achieve a profit-maximization in Atlantic Europe but they apparently got wrecked in the middle of their campaign. The market share of Saudi Arabia in Atlantic Europe peaked in 1993 but has not recovered since.

The obvious internal constraint has been the concern of Saudi Arabia about oil revenues. The Saudis have never liked to see oil revenues go down, more so than market shares. (Perhaps Saudi Arabia's motivation for oil policy is not as sophisticated as the "Target Revenue Model" suggests but it is as simple as the one that can be discussed within the framework of the *"Ratchet Revenue Model"* (**Note 23**)). This made Saudi production policy conservative. In order to keep the current revenue from falling, they needed to reduce production and keep world oil price high. This meant they had to give up their market share in Atlantic Europe.

The most important external obstacle for Saudi Arabia's European campaign was the growing presence of North Sea crude oil. The relatively high world oil prices, which resulted from the Saudi concern about oil revenues, gave a good opportunity for the high-cost North Sea oil to grow. By the middle of 1993, the Saudis had learned a hard lesson that they had to choose either defending their market share (with a high level of production but lower world oil prices and a drastic decrease in current oil revenues) or yielding their market share in Atlantic Europe (with a conservative production policy but higher oil prices and oil revenues). In the end, they chose the latter. That is, Saudi Arabia's Formula Pricing Strategy has failed to achieve its initial objective and already lost its significance at least in Atlantic Europe.

One can conclude, without much reservation, that the Saudi Arabia's European campaign would have been easier if not for the previously mentioned Saudi concern over oil revenues and the growing presence of North Sea oil which greatly benefited from these concerns. Concerned that oil revenues might go down, the Saudis dared not flood the world oil market and defend their market share in Atlantic Europe.

One of the clear implications we can draw from our discussion is that as long as Saudi Arabia is motivated to ratchet its oil revenues, it will not flood the world oil market and therefore, without some unexpected events such as the Asian Economic Crisis coupled with the accelerating production, the world oil prices will stay at a high level. In particular, lest another campaign cause a fall in oil prices and oil revenues, the Saudis will be very cautious about marketing their oil in Atlantic Europe where North Sea oil, taking advantage of the Saudi Arabia's conservative oil policy, will most likely continue being present for the foreseeable future.

NOTES

1. Soligo and Myers Jaffe explain the Formula Pricing in detail as follows: "Virtually all Saudi ... sales to international buyers are made under long-term contract, linked to spot market prices in three broad geographic areas – North America, Western Europe and the Far East. The majority of Saudi contracts are (made on the delivery basis) for a duration of one year. Prices (delivered or cif prices) are generally determined under monthly pricing formulae that include a base price calculated by taking an average of spot market prices of a particularly widely-traded 'marker' crude oil ('Brent' crude oil for Western Europe). This base price is then modified by adding or subtracting an "adjustment factor" that takes into account differences between the refining value of the Saudi crude in each region and the relevant spot market indicator crude ('Brent' for Western Europe) as well as some of the differences in transportation costs between Saudi crude and the marker crude. Saudi (Arabia) also offers a tanker rate subsidy to large international oil companies that purchase oil on an fob basis for delivery to Europe and to the United States." (Ronald Soligo and Amy Myers Jaffe, "A Note on Saudi Price Discrimination," *The Energy Journal,* 2000, Vol. 21, #1, p.123). The writer added some comments in the parentheses.

2. The Petroleum Intelligence Weekly, *The International Crude Oil Market Handbook 1999-2000 ("Handbook"),* (Third Edition, July 1999), p.F37.

3. *Handbook,* pp. C5 and C6

4. **Source for Figure 1**: The delivered prices of Saudi crude oil are estimated by dividing the import values (in US$) by the total import (in metric tons) in each of the four countries. The metric ton is converted into barrel with 1 ton = 7.4 barrels. All of the data are from the United Nations' *World Trade Annual*, 1987-2000. The crude oil taken here is classified in U.N. SITC, Revised 3 as "Commodity 333" which includes petroleum, crude and partially refined for further refining, excluding natural gasoline. Until 1990, German figures are of West Germany while those from 1991 are of the united Germany. **Note 4:** There is not much pattern in the structure of the delivered prices of Saudi crude oil in 14 years between 1987 and 2000 in the Atlantic Europe, perhaps except the 1993 structure which appeared in five years (1987, 1988, 1993, 1994 and 1996). The others appeared

only once like the 1995 structure and the 2000 structure as shown in Figure 1 (also completely different structures in 1989, 1990, and 1999, although not shown in Figure 1) or twice like the 1998 structure as shown in Figure 1 (also the same structure in 1997, although not shown in Figure 1) and the 1991 (and 1992) structure which is not shown in Figure 1.

5. **Source for Figure 2**: The market shares of all crude oil in this paper are estimated by dividing the amount of each crude oil imported in each of the four countries by the total import of each crude oil in the four countries in each year. The United Kingdom uses its own oil from the North Sea. But that is not included in the import statistics of the United Kingdom. All of the data are from the United Nations' *World Trade Annual*, 1987-2000. The crude oil taken here is classified in U.N. SITC, Revised 3 as "Commodity 333" which includes petroleum, crude and partially refined for further refining, excluding natural gasoline. Until 1990, German figures are of West Germany while those from 1991 are of the united Germany. Until 1991, import from Russia is included in the total import from the former Soviet Union or USSR, while that is separately available from 1992. All the statistics pertaining to USSR/Russia in Figure 2 are of USSR until 1991 and of Russia from 1992.
   All of the Saudi production figures are from the US Department of Energy, Energy Information Administration, *International Petroleum Statistics Report,* 1996-2001. Crude oil includes lease condensate.

6. The market share of Saudi Arabia in the Atlantic Europe was 26.0 % in 1973. (The United Nations, *Yearbook of International Trade Statistics*, 1973, p.516)

7. It was reported that Saudi Arabia's production capacity was 7.5-8.0 MMBD in January of 1990 *(The Nihon Keizai Shimbun*, January 9, 1990, p. 9) and 9.5 MMBD in September of 1993 (*The Nihon Keizai Shimbun*, September 30, 1993,,p. 1). The Nihon Keizai Shimbun is in Japanese and is the largest economic daily newspaper in Japan.

8. David J. Teece, "OPEC Behavior: An Alternative View" in *OPEC Behavior and World Oil Prices* (edited by James M. Griffin and David J. Teece. 1982, Center for Public Policy, University of Houston, pp.64—65). Later, Carol Dahl and Mine Yucel tested various OPEC models and concluded, "Formal target-revenue models are rejected, but there is some evidence that revenue targeting may influence

production for some OPEC countries and a few non-OPEC countries." ("Testing Alternative Hypotheses of Oil Producer Behaviour", *The Energy Journal*, 1991, volume 14, #4, p. 117)

9. For example, in 1984, Saudi Arabia's market share in Japan was 32.4 %, 9.6 % in the Atlantic Europe, and 9.5 % in the United States. (The United Nations, *Yearbook of International Trade Statistics*, 1984, p.982)

10. "Over the period 1990 to 1997, Saudi fob oil prices for Asian markets have been on average 83 cents higher per barrel than for Western Europe and 93 cents higher than for the United States. An ... explanation (for this price differential) is that the Saudis are motivated by their desire to maximize profits." (Soligo and Myers Jaffe, p.122.)

11. For formal discussion, see August Losch's *Economics of Location* (Yale University Press, 1954). Particularly Chapter 13 (pp. 138-210) is useful.

12. All of the production figures in this paper (including Saudi production figures as already mentioned in Note 5 above) , unless otherwise specified, are from the US Department of Energy, Energy Information Administration, *International Petroleum Statistics Report*, 1996-2001. Crude oil includes lease condensate. To provide general pictures of production pattern, unless necessary, I have rounded the lower units of production. The Russian production figure is included in the production of the former Soviet Union or USSR until 1991 while that is separately available from 1992. The production figures pertaining to USSR/Russia in this paper are of USSR until 1991 and of Russia from 1992.

13. The "break-even" cost of production of North Sea oil was somewhere between $10 and $12 a barrel until the early 1990's. But, because of the improvement of production technologies and management techniques, "the cost of producing North Sea oil has been halved in many instances and now ranges between $5 and $6 a barrel." (*The Asian Wall Street Journal*, March 31, 1994, p. 28.)

14. **Source for Figure 3.** See Note 12 above for production statistics.

15. *The Asian Wall Street Journal*, January 19, 1992, p. 9.

15. *The Asian Wall Street Journal*, January 19, 1992, p. 9.

16. **Source for Figure 4**: See Note 5 above for market shares.

17. The quarterly production figures are from *The International Energy Analysis* (Institute of Energy Economics of Japan, January 1994, No. 192, pp. 116-117)

18. **Source for Figure 5**: The world oil prices were yearly average spot prices of Dubai crude oil until 1998 (*Handbook*, p. .K), and yearly average spot prices of Arabian Medium crude oil, which is similar to Dubai crude, for 1999-2000. (The Organization of Petroleum Exporting Countries—"OPEC", *OPEC Annual Statistical Bulletin 2002,* p. 114.) Saudi oil revenues are from OPEC's *OPEC Annual Statistical Bulletin 2001*, p.5.

19. After a series of negotiations in 1992-1993 as to how to accommodate the production of Kuwait, which was increasing production outside OPEC quotas and was the major cause of oil price fall, OPEC countries finally agreed to fix the total ceiling at 24.5 MMBD including Kuwait's 2.0 MMBD for the fourth quarter of 1993. Before the agreement was reached, "Mr. Rafsanjani had phoned the Saudi monarch and agreed to cooperate in trying to stop the fall in petroleum prices." (*The Asian Wall Street Journal*, September 28, 1993, p. 13.)

20. *The Asian Wall Street Journal*, February 18, 1993, p. 9.

21. *The Asian Wall Street Journal*, June 9, 1993, p.9.

22. *Handbook*, p. F38. Although the Figure 2 shows the Saudis increased production but their market share went down in the Atlantic Europe in 2000. The puzzle is easy to solve. They withdrew some oil from Europe and reallocated it to other markets, mostly to the United States.

23. Assume a steady and uninterrupted growth in oil revenues is achieved to R. Now suppose, for a certain reason, oil price falls and oil revenues go down. The monopolistic oil producer will make every effort to ratchet the decrease in oil revenues from R, and afterward will try to increase oil revenues beyond R.

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