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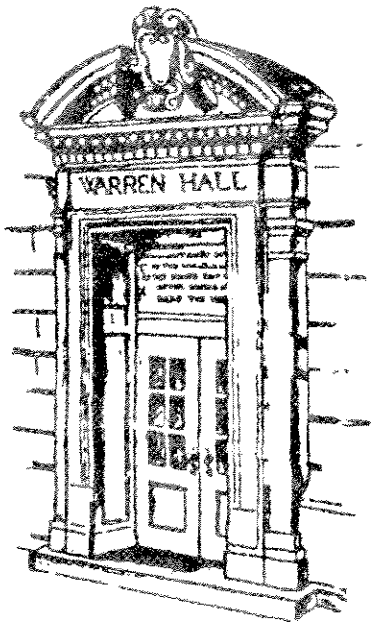

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AN ECONOMIC ANALYSIS OF ASPECTS OF PETROLEUM AND MILITARY SECURITY IN THE PERSIAN GULF

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An Economic Analysis of Aspects of Petroleum and Military Security in the Persian Gulf

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ABSTRACT

Geologic estimates of remaining global petroleum resources place about 50% in the Persian Gulf. Production costs are estimated at $5 per barrel there, and $15 per barrel in the North Sea and Alaska. Using mathematical methods derived from depletion theory, the present value of economic rent from oil is on the order of $20 trillion. Game theory is utilized to explain the $15-$20 per barrel price band that existed from 1986 to 1999. New economic forces have displaced this previously stable pattern; a new price range of $22 to $28 may be emerging. International trade in petroleum and conventional weapons are analyzed with econometric methods; the occurrence of nuclear weapons capability in the Persian Gulf region is explored.

I. Introduction

In 1980, shortly after Saddam Hussein assumed the Presidency of Iraq, that country attacked Iran in the southwest Khuzistan region. Iraq sought control over two major geographic goals: the Shatt-al-Arab channel, a shipping route for export of Iraqi oil; and the petroleum production facilities in Khuzistan, where more than 75% of Iran's oil resources were located.[1]

In 1990, Iraq occupied Kuwait and threatened Saudi Arabia. If Iraq had been successful in these military actions, it would have controlled 40% of identified global reserves and 75% of Persian Gulf reserves (see Table 1).

In 1991, U.S. President George Bush supported a U.S.-led U.N. military coalition which defeated Iraq, emphasizing that, "Our jobs, our way of life, our own freedom and the freedom of friendly countries around the world would all suffer if control of the world's great oil reserves fell into the hands of Saddam Hussein" (Yergin, 1991, p. 773). This military action eliminated Iraq's potential to raise crude oil prices and attain quasi-monopoly profits. Yet five years earlier, then Vice-President Bush had flown to the Persian Gulf, meeting with Saudi government ministers and the King. The purpose of this 1986 trip had been to raise crude oil prices, which at the time were below $10 per barrel.

The purpose of our analysis is to illuminate part of the economic rationale for these superficially contradictory U.S. policies. We shall show the magnitude of the economic incentives for control of Persian Gulf oil, and also the logic which led the U.S. and some other OECD nations to work against crude oil prices below $15 per barrel, and above $20 per barrel for a 13-

[1] See Yergin (1991) and the *International Petroleum Encyclopedia* (1983).

Table 1: Estimates of World Conventional Crude Oil Resources (billion barrels, 1993)

Region/Country	Identified Reserves	Undiscovered Resources[a]	Remaining Resources
Persian Gulf[b]	**592.4**	**113.7**	**702.1**
Saudi Arabia	258.6	50	308.6
Iraq	90.8	35	125.8
Kuwait + Neutral Zone	99.4	4	103.4
Iran	69.2	19	88.2
UAE	61.1	4.2	65.3
Former Soviet Union	**125.1**	**100**	**225.1**
United States	**51.1**	**40.6**	**91.7**
N. Sea - W. Europe	**37.3**	**12.3**	**48.9**
United Kingdom	19.5	5.6	25.1
Norway	17.1	6.7	23.8
Netherlands	0.7	na	49
World[c]	**1094.5**	**427.7**	**1513.3**

[a]: modal value.

[b]: includes Oman, Brunei, Qatar, and Bahrain, in addition to the 5 countries mentioned.

[c]: includes other regions and countries.

na: not available

Source: Masters et al. (1994). Table 1.

year period from 1986 through 1999. The same incentives operate now to create a new, higher price range of potentially comparable stability.

The first section identifies the magnitude of economic rent (defined below) which partially motivates foreign policies of the Gulf countries and the U.S. It uses game theory logic to explain the $15-$20 per barrel range in which crude oil prices usually moved. The next section analyzes the framework now evolving toward a price range. The third part analyzes global military trade in the context of petroleum imports and exports. This is followed by a brief summary of the growth in nuclear weapons capability in the region. Then we summarize the pre-1980 history of Gulf production and international relations. We conclude with a discussion of future implications for the early part of this Century, and the likelihood of a near-term price range of $22 to $28 per barrel.

II. Petroleum Price, Rent, and Game Theory, 1986-1999

In the petroleum economics trade literature, $5 per barrel is widely used as the likely equilibrium price in a theoretically competitive world oil market working without production quota agreements (Adelman, 1986 and 1993; The Economist, 1999; Yergin, 1991).

Table 2 illustrates the production cost in a low-cost area in the Persian Gulf, and also for the North Sea. "Production cost" here means exploration, development, lifting, and shipping costs to an OECD consumer. It includes a normal return on investment ("profit"), and allowances for depletion and risk factors. However, for purposes of discussion, assume average Persian Gulf cost is $5 per barrel, and North Sea (and Alaskan) cost is $15 per barrel.

In other words, if the market price is $15 per barrel, a Persian Gulf producer earns "rent"

Table 2: Illustrative Production Cost

	Possible Low Persian Gulf Cost	**Possible North Sea Cost**
Investment in Development, amortized (including profit)	55¢	$10
Operations, lifting	25¢	$5
Shipping	$1.50	included in operations
Total (rounded)	$2.50	$15

Source: Chapman and Khanna (2000) and Chapman (1993).

of $10 per barrel above the $5 per barrel production cost. At $25 per barrel, the rent is $20. With Gulf production typically 6 or 7 billion barrels per year, total economic rent above production cost was on the order of $120 billion annually in early 2000.

Mathematical techniques can be used in economic modeling to analyze the potential surplus or rent associated with use of the world's remaining oil resources. (Remaining resources are the sum of (a) identified reserves, and (b) geological estimates of undeveloped or unexplored petroleum resources). Equation (1) shows the basic objective of a hypothetical monopolistic world oil industry:

$$\text{Maximize, with respect to } q_t \text{ and } T \quad NPV = \sum_{t=1}^{T}\left[\frac{P_t(N_t, Y_t, q_t)q_t - C_t(q_t, t)}{(1+r)^t}\right] \tag{1}$$

$$\text{subject to} \qquad \sum_{t=1}^{T} q_t \le S.$$

The logic is straightforward. NPV is the net present value of rent, the excess of revenue above cost. The demand functions P(N,Y,q) shift upwards over time in response to rising global population (N) and per capita income (Y). Revenue is P*q, and cost is C. In the denominator, r represents the interest rate in calculating net present value. Remaining resources are S. The second line in the equation notes that future cumulative oil use cannot exceed remaining resources.

The goal, then, is to maximize NPV for producers by finding T, the optimal length of time

for remaining production, and the best annual production levels q_t. (For a full explanation of this mathematical technique applied to world oil, see Chapman and Khanna, 2000, and Chapman, 1993[2].) Of course the same method can be applied to an assumption of a competitive market. The results are summarized in Table 3. In Table 3, the magnitude of the present value of producers' rent is generally $15 to $20 trillion. (The exception, Case 4, has a lower NPV of $5.5 trillion).

Gross World Economic Product now exceeds $30 trillion. The magnitude of economic rent above cost for world oil producers is comparable but smaller. The incentive for Iraqi-type military actions is clear, as is the incentive for OECD and other nations to oppose monopolistic or single-nation influence in the Persian Gulf.

Notwithstanding the magnitude of economic surplus potentially available to a monopoly, crude oil prices were usually in the $15 to $20 per barrel range from 1986 through 1999. A competitive market would have had lower prices (e.g. $5), and a monopolistic market would have higher prices (e.g. $30) during the last decade. Yet, since the Bush trip to Saudi Arabia in 1986, world oil prices were in the $15 to $20 range for 10 of the 13 years (MER, various issues).

We believe that economic, political, and military factors led both OECD consumers and OPEC producers to prefer the $15-20 per barrel range, as summarized in Table 4. Consider U.S. net imports of petroleum, which have risen slowly and have passed the 50% level for total

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[2] In these optimal control analyses, the problem is addressed with continuous rather than discrete functions. With the utilization of the shift in demand functions that is induced by growth in population and per capita income, the solutions show (a) in all cases, a long period of accelerating use followed by decline, (b) prices in the near term are stable, declining slightly, or increasing, depending upon near term assumptions about production cost trend and the exercise of market power as analyzed in the game theory discussion following, and (c) near term price trajectories are all followed by continuing price rise.

Table 3: Economic Rent and Oil Use

Case	T: optimal production period until depletion (years)	NPV: net present value of economic rent above cost (trillions)
1. Competitive market	69	$ 16.7
2. Monopolistic market	92	$ 21.5
3. Competitive market until 2030, then monopolistic	81	$ 16.2
4. Competitive, but substitute biomass or coal liquid fuels available at $50 per barrel	48	$ 5.5
5. Monopoly with substitute fuels available at $50 per barrel	55	$ 14.9

Source: Chapman and Khanna (2000)

Table 4: General Economic Impact of Crude Oil Price Decision in a Game Theory Framework: 1986-1999

Price per barrel	OECD Countries	Persian Gulf Oil Producers
$10 or less	• Higher GNP growth • Shut some domestic production • Greatly increased oil consumption • Much more imports • More pollution, climate change • End Persian Gulf political support by OECD oil industry	• loss of political support from OECD oil industry • lower revenue, greater volume • faster depletion • higher market share
$15 - $ 20	• stable GNP growth • stable OECD oil production • slow growth in oil consumption • slow growth in import share • stable prices • continued Persian Gulf support	• continued OECD political, military support • stable revenue, profit, rent
$30	• decline in GNP growth • rapid near-term growth in domestic production • stable or declining consumption • OECD Persian Gulf support opposed by oil consumers	• loss of OECD political, military support • increased incentives for Central Asia, other non-OPEC production • less market share • less production, more profit, rent • greater payoff to successful Iraq-type action

consumption. The U.S. production is costly; production cost in the Persian Gulf is not. Consequently, low crude oil prices increase U.S. dependence on imports in two ways. High cost U.S. production has to be shut down when crude prices are near $10 per barrel on a long-term basis. Second, U.S. consumption of oil increases with lower prices. The end result is that crude prices in the $15 to $20 per barrel range avoided financial loss for American oil producers, slowed the decline in U.S. production levels, and encouraged U.S. political support for Persian Gulf governments threatened by Iraq or other forces seeking monopoly power over Persian Gulf oil.[3]

Consider Japan's position in supporting the military defense of Kuwait by the U.S.-led operation. Japan imports essentially all of its petroleum. Three-fourths of its crude oil has originated in the Persian Gulf region (USEIA, 1994, p. 52). In the short run, it would benefit from a $5 to $10 per barrel world price. But, if Persian Gulf oil drives out U.S. and North Sea producers, the resulting monopoly-influenced price would increase significantly. With a long run perspective, Japan can depend upon stable prices and political stability for its supply, both supported by the U.S. (Yergin, 1991, pp. 759-760).

Table 4 lays out these and related points in a game theory framework. Both Persian Gulf and OECD governments were accustomed to the $15 to $20 per barrel price range. Either group acting alone could, for a short period, force prices in either direction. However, both groups had incentives to keep prices in this range. This is similar to the game theory concept of *Nash Equilibrium*: a status quo where neither side can improve its overall situation by changing its strategy. An initiative by either group acting alone, if opposed by the other side, leads to consequences which leave the initiator worse off than previously. A game theory approach is

[3] This discussion of Table 4 is based upon the game theory analysis in Chapman and Khanna (2000).

intended to represent the previously noted interaction of politics, military defense, and economics in world oil markets. This $15 to $20 per barrel level was far below a true monopoly price. It was also far above a truly competitive world price. The outcome in one narrow facet resembled a competitive market: world price was about at the level where it equaled the marginal cost of high cost producers.

In 1998, cash prices for Persian Gulf oil declined to $10 to $15 per barrel. The primary cause may have been a cessation of accelerated growth in petroleum consumption in Asia. Throughout most of that year, futures prices remained within the $15-$20 per barrel range. With the downward pressure on 1998 cash prices, the 1999 response could be anticipated which would raise crude oil prices.

III. 2000: Evolution to a Higher Price Band

As the year 2000 began, Jaffee and Manning reported in the policy journal *Foreign Affairs* their prediction of "The high probability of oil prices in the $12 to $20 range over most of the next two decades...." Their analysis was in sharp contrast to ours, published in this journal at the same time (Chapman and Khanna, 2000).

In early 2000, crude oil prices had risen from a low of $10 in late 1998 to a high of $34 in early 2000, and temporarily stabilized near $25. The U.S. Energy Secretary had negotiated with Saudi Arabia, Mexico, and some OPEC members, seeking a new political agreement on a higher price band to replace the old $15 to $20.

The President of OPEC recently articulated the political economy of the game-theory framework analyzed by us above and in earlier publications. An extensive excerpt follows (NYT,

April 2000): "If prices fall below $22, we will cut production to push prices back up. When prices are above $28, we will increase production."

Several trends converged to move the game theory equilibrium to a higher price range. Inflation since 1986 would restate the $15 to $20 target range as $22 to $29 in year 2000 dollars.[4] This matches nearly perfectly with the current target price range. On the OPEC/PG side, a feeling of entitlement to inflation-adjusted prices seems to be matched by an OECD acceptance of the validity of this point.

Notwithstanding the new and higher price range, the ability of Europe and North America to respond to high prices by increased production in Alaska and the North Sea is increasingly weakened. Alaskan production is reduced by 50% from its 1988 peak (MER, 2000). In the North Sea, increased production may be financially and physically feasible, but Norway's coordination with OPEC reduces the competitive power of this option.

Within the international oil industry, the acquisition of Mobil, Amoco, ARCO, and Standard of Ohio by Exxon and British Petroleum has eliminated the potential competitive influence of four previously independent major global oil companies. Exxon, BP, and Royal Dutch Shell are no longer in an adversarial position with Persian Gulf countries with respect to price.

BP, because of its dominant position in Alaska and its major positions in the North Sea and the Persian Gulf, is particularly well placed to benefit from and implement new pricing arrangements.

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[4] Assuming the GDP deflator increases about 44% from 1986 to mid-2000. The increase to 1999 was 42% (ECRP, SCB 2000).

As noted, Norway does not see itself as a price competitor. Mexico as well as Norway is now coordinating production planning with Persian Gulf and OPEC countries.

On the demand side, continued growth in U.S. petroleum consumption and the resumption of growth in Asian consumption has resumed the pattern of continuously rising demand curves. Each year, at any given price, more petroleum will be consumed than previously.

Taken together, these six factors (inflation, the decline in Alaskan and U.S. output, the stabilization of North Sea production, Norway and Mexico coordination with OPEC, consolidation among major oil companies, and the resumption of upwardly shifting demand curves) combine to create a new calculus.[5] The game theory framework is still intact, but the new price range has been articulated as $22 to $28 (in current dollars), rather than the prior $15 to $20 range.

It is too early in the evolution of this new stage to be confident. Nevertheless, we speculate that target prices will continue to define OPEC/PG-OECD policy in the near future. The price-per-barrel values in Table 4 should be redefined accordingly.

The same logic on each side continues. For example, the U.S. Congress threatened to terminate U.S. military support to Kuwait and Saudi Arabia. The U.S. Secretary of Energy negotiated with Persian Gulf, OPEC, and Mexican governments. Saudi Arabia, Kuwait, and other Persian Gulf countries led OPEC, Norway, and Mexico to increase production and lower prices in March 2000 (NYT, March 2000).

The duration of the new $22 to $28 target price range is uncertain. However, the game

[5] In addition, the U.N. control of Iraqi production and the decline of Russian production have reduced output from these traditional major producers (MER, 2000).

theory logic continues intact beyond the demise of the old 1986-1999 price range.

IV. Arms Trade and the Oil Economy

The economic incentive underlying military activity in the Persian Gulf has been established in the previous sections. Here we examine the global arms trade in the context of the oil economy and determine the empirical significance of a few key nations in this context.

Based on a comprehensive global data set, Table 5 determines a fairly close empirical relationship between world trade in conventional weapons and the trade in crude oil and refined petroleum products: arms exports (imports) are highly correlated with oil imports (exports).

Exploring this relationship are a pair of regression models based on a cross section of 121 countries for 1995. The regression coefficients have the expected sign given the results in Table 5. Arms variables are measured in million dollars whereas the oil variables are in billion dollars. Thus, according to these regression results, a $1 billion increase in total oil imports yields a $0.16 billion increase in the exports of conventional weapons, on average. Similarly, a $1 billion increase in the total volume of oil exports results, on average, in a $0.11 billion increase in the value of arms imports. It is interesting that in both models variables measuring the size and overall economic health of the economy, namely GNP and GNP per capita, were found to be insignificant explanatory variables.[6]

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[6] In the regression Equations (2) and (3), ARMEXP and ARMIMP are arms exports and imports. TOILIMP and TOILEXP are total imports and exports, and ε represents error terms. The sources for these data are the same as those in Table 5. The figures in parenthesis are the heteroscedasticity consistent t-ratios based on White's heteroscedasticity consistent standard error estimates. See Greene (1997) for details. As expected, no evidence of autocorrelation was found. The regression slope coefficients are significant at the 5% level in both models.

Table 5: Correlation Coefficients

Correlation of			Pearson's Correlation Coefficient
Arms exports	with	Oil imports	0.74
Arms imports	with	Oil exports	0.70
Total arms trade	with	Total trade	0.69
Total arms trade	with	Total oil trade	0.80
Total trade	with	Total oil trade	0.81

Variable definitions: All data are for 1995

Arms exports (imports): value of conventional weapons exports (imports)

Arms trade: sum of arms exports and arms imports

Oil imports (exports): total volume of crude oil and refined petroleum products imports (exports)

Total trade: total value of merchandise imports and exports

Data sources: ACDA 1997 and 1998, WTO 1999, USEIA 1996.

$$ARMEXP = \underset{(-1.11)}{-294.56} + \underset{(2.16)}{159.95}\ TOILIMP + \varepsilon \qquad R^2 = 0.52 \quad (2)$$

$$ARMIMP = \underset{(-0.03)}{-2.65} + \underset{(2.32)}{108.24}\ TOILEXP + \varepsilon \qquad R^2 = 0.51 \quad (3)$$

To identify the key countries in this context, consider Table 6, which provides details on the value of arms transfers between the major supplier and recipient countries. It is clear from this table that more than 50% of the global exports of conventional arms between 1994 and 1996 originated in the United States, followed by the United Kingdom at a distant second. Saudi Arabia was the single largest recipient of these weapons, receiving almost three as times as high a value of arms imports as the next highest recipient, Egypt. Other countries in the Persian Gulf region, particularly Kuwait and the United Arab Emirates, are also significant importers of conventional weapons, each receiving approximately $800-$1000 million per year.[7]

Drawing together the statistics on arms trade presented above, the crude oil reserves data in Table 1, and country specific details on the imports and exports of crude oil and refined petroleum products (USEIA 1998), we can identify the key countries in the international oil-conventional weapons economy. It is clear that, in general, the worlds largest arms exporters are

[7] For detailed country specific arms imports and exports data see various issues of the World Military Expenditure and Arms Trade reports published annually by the United States Arms Control and Disarmament Agency.

Table 6: Value of Arms Transfer Deliveries by Major Supplier and Recipient Country
(Cumulative 1994-1996, millions of current dollars)

Supplier / Recipient	Total	US	UK	Russia	France	Germ-any	China	Other NATO	Middle East	Other East Europe	Other West Europe	Other East Asia	All Others
World	**119,565**	**67,210**	**16,405**	**8,490**	**6,675**	**4,045**	**1,970**	**4,610**	**3,070**	**2,130**	**2,485**	**595**	**1,880**
Developed	**52,070**	**38,760**	**1,355**	**845**	**2,160**	**3,025**	**40**	**1,990**	**1,310**	**180**	**1,370**	**200**	**835**
US	3,330	-	950	40	160	320	40	950	330	30	140	200	170
Israel	2,865	2,600	0	0	0	150	0	5	0	10	0	0	80
Russia	50	30	0	-	0	0	0	0	0	20	0	0	0
France	695	550	0	0	-	0	0	40	5	0	0	0	80
Germany	2,710	2,600	0	0	0	-	0	60	10	0	0	0	0
Japan	6,020	6,000	0	0	0	0	0	0	0	0	0	0	0
Developing	**67,495**	**28,450**	**15,050**	**7,645**	**4,515**	**1,020**	**1,930**	**2,620**	**1,760**	**1,950**	**1,115**	**395**	**1,045**
China	2,565	120	0	2,000	0	0	-	0	320	30	0	0	80
Taiwan	4,090	3,300	0	0	775	0	0	0	0	0	0	0	0
OPEC	**36,080**	**15,150**	**12,915**	**1,625**	**3,040**	**190**	**525**	**940**	**85**	**310**	**860**	**150**	**290**
Iran	1,025	0	0	320	0	0	500	10	10	80	10	50	5
Kuwait	3,405	1,900	675	750	60	0	0	0	0	20	0	0	0
Saudi Arabia	26,585	11,700	11,200	0	2,000	60	0	775	0	0	850	0	0
UAE	2,270	800	260	200	750	0	0	0	0	20	0	40	200
NATO	**25,525**	**18,150**	**1,195**	**230**	**1,300**	**1,470**	**40**	**1,785**	**580**	**45**	**275**	**200**	**255**

Source: ACDA, 1998. Table III.

also the largest oil importers, whereas the countries with the largest remaining and identified crude oil resources are the largest recipients of these arms.

V. Instability, Local Conflict, and Nuclear Weapons

The Middle East, the Persian Gulf, and South Asia are usually considered distinct regions. However, a broader network of national tensions overlays the Persian Gulf region. Five of the world's nuclear-capable countries have borders within 1600 miles of the Straits of Hormuz.[8] In all cases, existing missile range capability makes nuclear aggression in the Persian Gulf region a technically feasible option (see Table 7). The other two nuclear capable regions, the United States and the European Community, are both major importers of Persian Gulf oil.

Figure 2 shows countries with nuclear warheads and their oil production. The apparent association is spurious, in the sense that crude oil production does not cause nuclear capability. There are at least seven sets of national rivalries that have involved nuclear-capable countries.[9] The simplest interpretation of the Figure is that most of the conflicts associated with nuclear-capable countries have the potential of affecting the Persian Gulf.

Pakistan, though not a major oil producer, borders the Gulf of Oman and the Indian Ocean. A nuclear conflict involving India and Pakistan would probably impact Persian Gulf shipping and perhaps production. A Pakistan strategy might potentially involve the threat of

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[8] From West to East: Israel, Russia, Pakistan, India, China. See map (Figure 1).

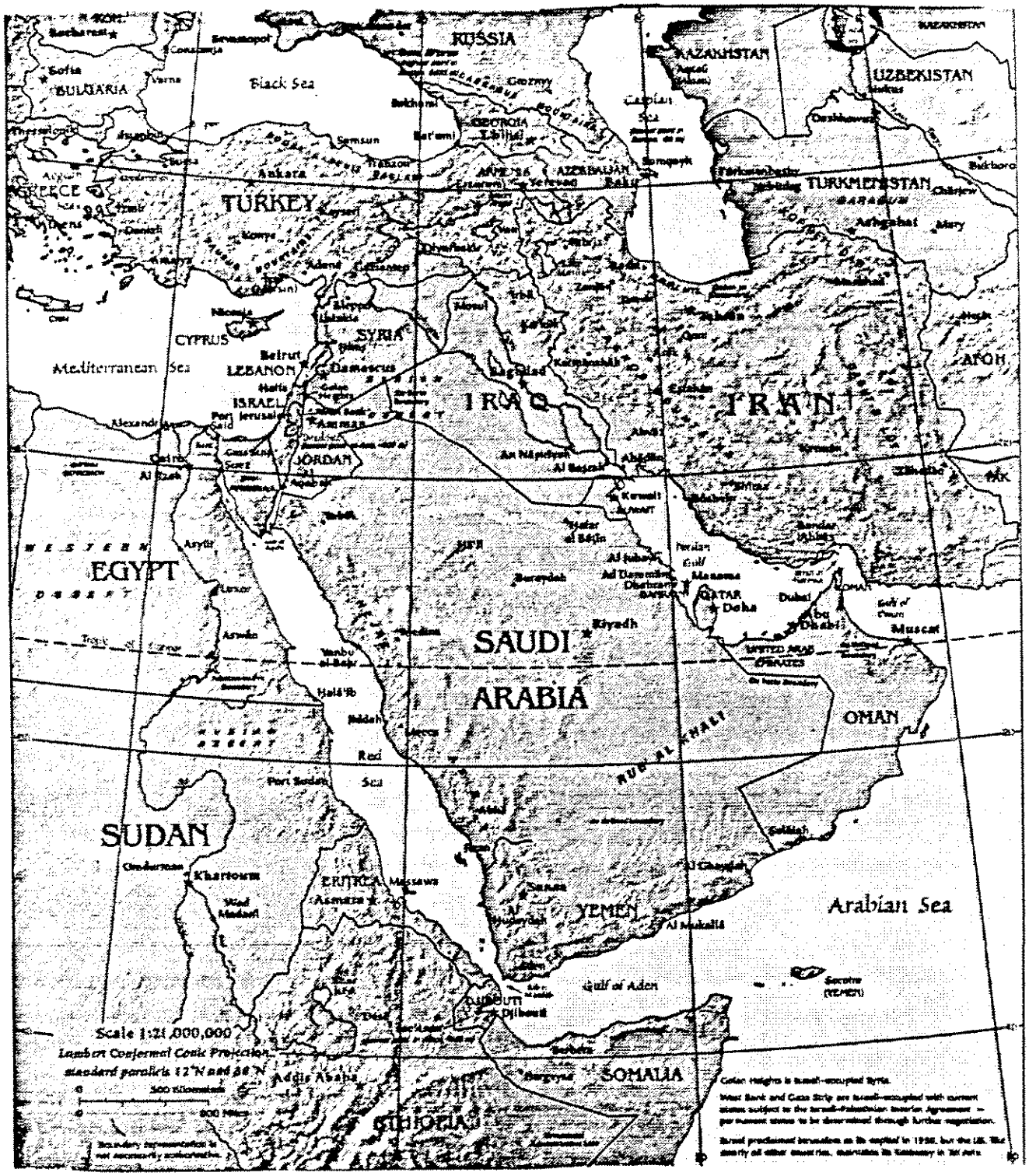
[9] Since World War II: Israel-Arab countries; Pakistan-India; India-China; Russia-U.S.; France and U.K.-Russia; Russia-China; China-U.S.

Table 7: Nuclear Weapons

Name and history	Arsenal (number of warheads)	Representative Missile Range (miles)
1. Countries with declared nuclear weapons capabilities		
United States First test: 1945 Total number of tests: 1,030	12,070	8,100
United Kingdom First test: 1952 Total number of tests: 45	380	7,500
France First test: 1961 Total number of tests: 210	500	3,300
Russia First test: between 1945-1952 Total number of tests: 715	22,500	6,800
China First test: 1964 Total number of tests: 45	450	6,800
India First test: 1974 Total number of tests: 6	65	1,500
2. Countries with undeclared nuclear weapons capabilities		
Israel Known to have bomb	64-112	930
Pakistan Began secret program in 1972	15-25	930
3. Countries that terminated nuclear weapons programs		
Algeria, Argentina, Brazil, Belarus, Kazakhstan, Ukraine, South Africa.		

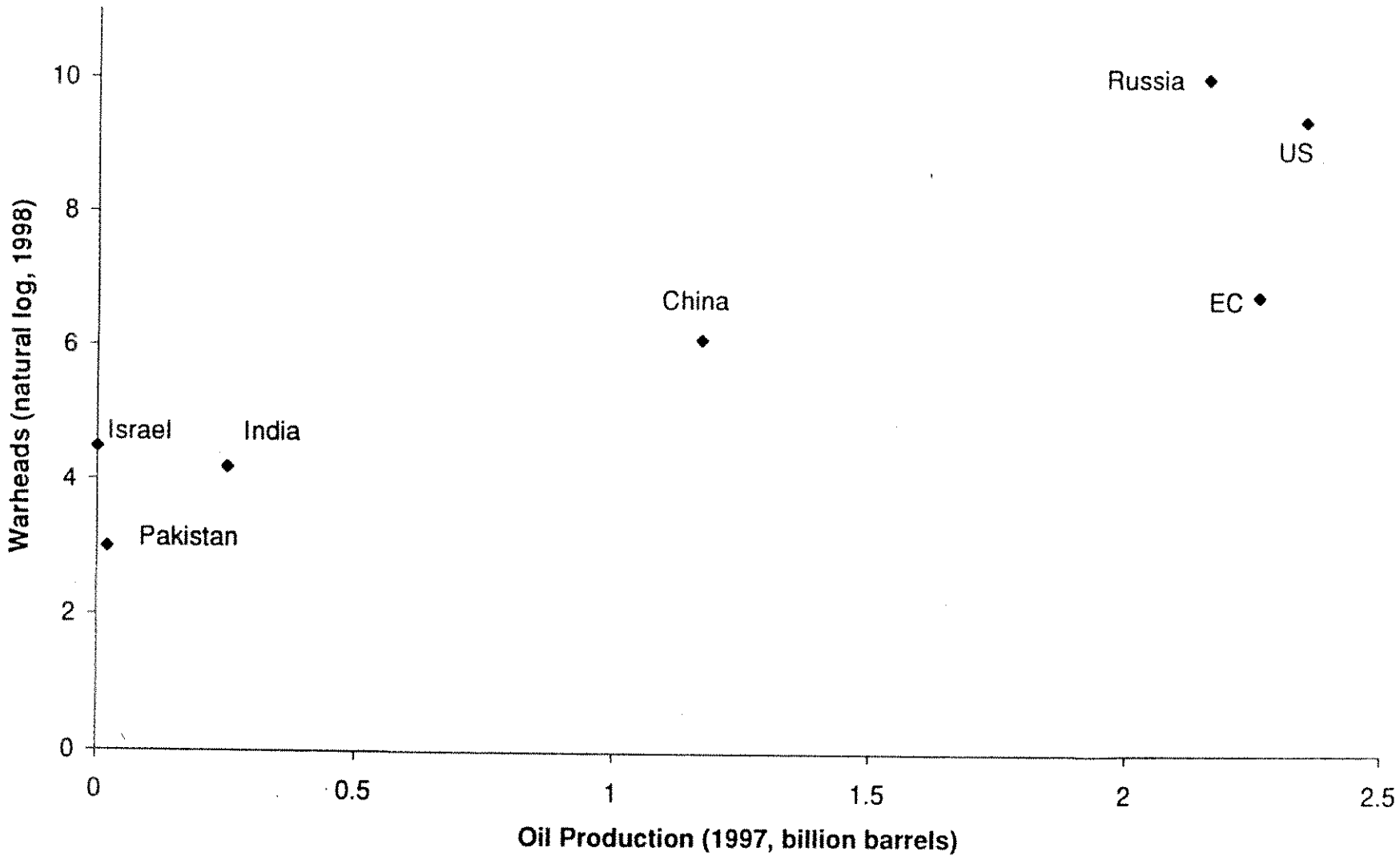
Source: *Time Magazine*, 1998.

Figure 1: The Persian Gulf and Surrounding Regions



Source: http://www.lib.utexas.edu/Libs/PCL/Map_collection/middle_east.html

Figure 2: Countries with Nuclear Warheads and Oil Production



Data for this figure were obtained from USEIA (1999) and *Time Magazine* (1998).

nuclear detonations in the Gulf to encourage OECD support for the Pakistani position on Kashmir.

Petroleum revenues received from the OECD by Gulf producers probably do not directly finance conflict in what, for lack of an established term, we might call the "Straits of Hormuz global sector". But individuals and organizations in the Gulf countries finance military operations in other countries in this sector.[10]

VI. A Historical Perspective on Persian Gulf Policy

Throughout the 20th century, the Gulf was of considerable interest to the U.S., European, and Russian governments. The Anglo-Persian Oil Company preceded the British Petroleum Company. Both companies worked to provide a secure supply of petroleum for the United Kingdom during the earlier decades of the century. As was typical, British companies simply assumed the responsibilities of government in their concessions in Iran's oil regions: customs, police, taxation, telegraph, education, and banking (Upton, 1961; Chapman, 1983). Russia, on the other hand, sought, rather unsuccessfully, to promote Soviet republics in Northern Iran. From 1953 to 1978, Iran's policies were coordinated with U.S. interests, as is well known (e.g., Yergin, 1991; Roosevelt, 1979).

In Saudi Arabia, four U.S. oil companies established economic relations with the Saudi government. Originally formed in 1933 as the California Arabian Standard Oil Company, ARAMCO (Arabian American Oil Company) managed Saudi oil after WWII (ARAMCO, 1960;

[10] It has been asserted that sources in Saudi Arabia and Iran support Muslim military operations in Kashmir (*National Geographic*, 1999).

Yergin, 1991). While the companies no longer exert such control, the relations between the Saudi and the U.S. government remain strong, as discussed above.

Each Persian Gulf country has an analogous individual history that fits into the larger mosaic of oil production and historical relations with European and U.S. companies and governments.

VII. Summary: Implications for International Policy

Historically, Europe, the United States, and Russia have sought to secure access to Persian Gulf oil. Its low cost and high volume of remaining resources continue to place the Gulf at the center of petroleum geopolitics. The magnitude of economic rent above cost is on the order of $15-20 trillion.

Military power has played a significant role in policy. Iraq, in its invasions of Iran and Kuwait and its threat to Saudi Arabia, has sought control over one-half of the world's remaining oil resources. The U.N. alliance, led by the United States, eliminated Iraq's military power, and continues to control Iraq's military capabilities as well as its oil sales.

Thus far, international policy in the Gulf is the result of diplomacy, military action, and economic relations, setting the $15-20 per barrel price range outlined above during the last 13 years of the last Century and creating a higher target price range in 2000.

Production from Alaska and the North Sea continues to decline while world consumption grows. Mexico and Norway have initiated effective coordination with Saudi Arabia and OPEC (NYT, 1999). The ability of OECD producers to increase production to force lower prices is lessened. In addition, consolidation among major petroleum companies has reduced the

competitive potential of the industry.

In combination with the resumption of upwardly shifting global demand functions and inflation, these six factors (see Sections II and III) keep the political economy/game theory structure intact, but raise the target price range to $22-$28 per barrel.

In the late 1990s, weapons trade became closely associated with petroleum trade, as analyzed above. As nuclear weapons capabilities slowly spread, an unexpected byproduct of national rivalries has been the creation of a geographic pattern in which five of the nuclear powers are within 1600 miles of the Straits of Hormuz. The other nuclear powers are major consumers of Persian Gulf oil. Iraq would probably have nuclear warheads today if not for the U.N./U.S. control over its military resources.

We do not suppose that we can suggest or advocate practical new policies to stabilize politics, prices, and production. We hope this analysis delineates some of the economic and security motivation for more explicit international policies in this context.

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