

Andrew P. Morriss

D. Paul Jones, Jr. and
Charlene A. Jones Chairholder
in Law & Professor of Business,
University of Alabama
School of Law
Box 870382
Tuscaloosa, AL 35487
amorriss@law.ua.edu

Roger E. Meiners

Goolsby-Rosenthal Chair in
Economics and Law
Department of Economics
University of Texas at Arlington
Arlington, TX 76019
meiners@uta.edu

Competition in Global Oil Markets: A Meta-Analysis and Review

Andrew P. Morriss & Roger E. Meiners

Abstract

The OPEC cartel has affected the oil market for four decades. An unstable cartel representing the interests of the major oil exporting nations, OPEC has at times been effective in forcing up the price of oil and, thereby, allowing the export nations to obtain a significant premium captured by national oil companies on behalf of their sovereigns. At times, this means a transfer of wealth from oil-consuming nations to oil-producing nations totalling hundreds of billions of dollars more than what the competitive-market price of oil would suggest. When the cartel has failed in its objective, the price of oil has collapsed, possibly lower than would have been the case were the market not subject to cartelization. The instability of the cartel means the price of oil has been highly variable over time, making it difficult to predict the future direction of oil prices. A review of the literature indicates that there is a general consensus that the oil market is greatly affected by the cartel. That is, the international market for oil is not a free market.

Introduction

In the earliest days of the international oil trade, a small number of oil companies, including Standard Oil, vigorously competed for market share. Those firms dominated both international trade in petroleum and access to reserves. Public policy debates centered on the dangers of private monopolies controlling the market. Today, traditional for-profit companies no longer control the vast majority of the world's oil reserves. Instead, an international cartel (the Organization of Petroleum Exporting Countries or OPEC) has the ability to influence the supply of oil. State-owned national oil companies (of both OPEC members and non-members) hold the vast majority of proven reserves.

The problem of monopoly remains, although the economic concerns about pricing are now mingled with concerns over the motivations of companies responsive to governments rather than investors.

This report was commissioned by Securing America's Future Energy, a non-partisan 501(c)3 non-profit organization committed to reducing America's dependence on oil and improving U.S. energy security.

Due to the importance of oil to the world economy, international oil markets have attracted considerable attention from economists and policy analysts. Numerous studies (we summarize more than 200 scholarly articles, reports, and government investigations in this document's appendix) have been devoted to attempting to describe the economic structure of the petroleum market. This report examines this literature in search of a consensus on the key features of the oil market's structure. We conclude that there is a consensus that the global oil market deviates in important ways from the competitive model and that these market anomalies have significant economic impacts and so are relevant for policy makers.

Since the early 1970s the oil market has frequently been significantly affected on the supply side by strategic market intervention by oil-producing countries. In particular, the oil market has periodically experienced the consequences of cartelization as a result of OPEC's strategy over the past 40 years. As any cartel would, OPEC members have attempted to restrict output. It is generally recognized that Saudi Arabia, the largest oil exporter, is the lynchpin of OPEC. For example, in January 2013 the Saudis announced that they had cut production five percent in December. Immediately after, "Light, sweet crude oil for February delivery on the New York Mercantile Exchange rose 72 cents, or 0.8%, its highest settlement since Sept. 18."¹ Since the details of the deliberations of the organization are known indirectly through commentary, leaks, and after-the-fact disclosures, the exact role of the Saudis is not known. What is clear is that OPEC has had periods of spectacular success in restricting supply sufficiently to force prices up significantly. Of course, it has also had periods during which it has been much less successful.

Whatever the particulars of its operations, when OPEC is successful in imposing artificial scarcity, it forces demanders to move up the demand curve and, more importantly from the suppliers' perspective increases profit margins for the oil producing countries.² Because OPEC's success at this strategy varies with political conditions within and among OPEC member states, factors such as the amount of non-OPEC supply, policies in consuming countries, and the costs of competing forms of energy, OPEC is not able to behave as a stable, textbook monopolist would. Thus an important part of understanding OPEC's influence on world oil markets is to recognize that its influence varies considerably across time in ways that are difficult to predict.

Basic economic theory has long explained that monopolists seek to reduce output below the competitive equilibrium to force the price above the competitive market price. Monopolies have other ill effects, including reduced innovation and internal inefficiencies. (In this regard, economist J.R. Hicks noted in 1935 that "the best of all monopoly profits is a quiet life."³) When a cartel is successful in acting as a monopolist, prices are less variable. Price gyrations reduce demand for the product, injuring the monopoly's long-term profits and harming

-
- 1 David Bird, "Oil Rises on Saudi Cutback," *Wall Street Journal*, January 11, 2013. Supposedly the price increase might have been larger except Nigeria, an OPEC member, had a number of "unsold cargoes." This kind of activity would be consistent with the notion that Saudi Arabia is the major force in OPEC and often reacts to the actions of other OPEC members.
 - 2 2012 was a good year for OPEC, as its members pocketed a trillion dollars in net revenues (accounting profits). Javier Blas, "OPEC Cartel to reap record \$1tr," *Financial Times*, December 30, 2012.
 - 3 John R. Hicks, "Annual Survey of Economic Theory: The Theory of Monopoly," *Econometrica*, January 1935, at 8.

customer relations. Particularly where a cartel faces competition from substitute goods, it must pay attention to the impact of price on long-term demand. Not surprisingly, such demand considerations are a constant worry for OPEC, which fears demanders will diversify out of oil products if prices rise too high or become unpredictable. OPEC's long term interest is therefore in a price that is high enough to provide its members with substantial economic rents, but not so high as to reduce the total economic rents it is able to collect over time by encouraging diversification out of oil by demanders.

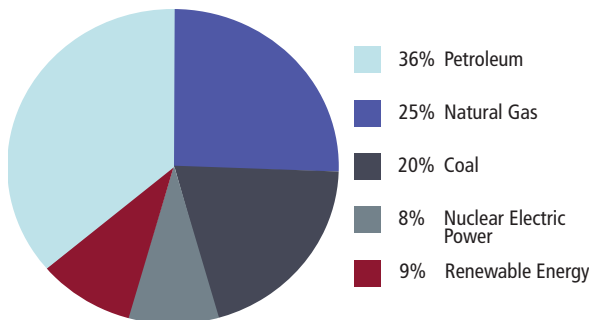
Unfortunately for OPEC, it is regarded as an unstable cartel whose members are known to "cheat" on the legally unenforceable gentlemen's agreements that have been made about production restrictions. Hence, it does not consistently restrict supply even from its member nations. Of course, non-member oil exporters have even less of an incentive to comply with cartel efforts to limit production. As the history of oil prices indicates, at times OPEC, perhaps often due to Saudi actions, is effective at keeping the price artificially high; at other times the price has dropped to levels not profitable for some producers over time. That is, oil markets frequently experience significant price swings not seen in similar markets for other commodities. For example, we can compare oil price gyrations with coal prices. Coal is a carbon-based energy source competitive with oil in several markets, but we do not see price swings in the coal market comparable to those we see in oil. An important reason is that there is no coal cartel.

As competitiveness in international oil markets varies over time, prices rise and fall in response to sellers' changing degree of market power. This source of supply intervention means oil markets are more volatile than they would be in either a competitive market, or a stable, monopolistic market. If international oil markets more closely resembled a textbook competitive market, prices would often have been lower than they were during periods of high prices in the past four decades. If international oil markets more closely resembled a stable monopoly, prices likely would have been higher than they were during periods of low prices. In short, oil markets switch back and forth from more competitive to less competitive market structures due to the politics of OPEC and other non-market factors. This adds to the overall price volatility of the market, a significant disadvantage for consumers and potential investors in both the development of new, higher cost oil supplies and substitutes for oil as it makes investment decisions less easy to predict.

In addition to OPEC, there are other major differences between international oil markets and more competitive commodity markets. Beginning in the 1950s, an increasing amount of global oil reserves have been controlled by national oil companies (NOCs). These companies differ from private companies because the NOCs must respond to non-market considerations related to domestic and international politics, not just market forces. For example, the Venezuelan national oil company, Petroleos de Venezuela (PDVSA), only hired supporters of Hugo Chavez and the company serves as the primary revenue generator for the government. A market with major suppliers that are not primarily governed by market forces differs significantly from a competitive market made up of suppliers driven by the profit motive.

FIGURE 1
Primary Energy Use by Source, 2011

Quadrillion Btu and Percent
Total U.S. = 97.5 Quadrillion Btu



Source: EIA, *Monthly Energy Review*, Table 1.3 (March 2012), preliminary 2011 data

Even before the rise of the NOCs, much of the world's oil reserves were controlled under concessions negotiated between the major oil companies (often acting as cartels) and producer state governments. In many respects, there was no real international oil market under the concessions, since the buyer-side of the market had been effectively cartelized through the oil company consortia. With the addition of a major supplier cartel and the shift of reserves to non-profit-maximizing firms, the current international oil market bears almost no relation to the classic conception of a competitive market in which supply and demand determine prices.

This report reviews the elements of the oil market, the economic consequences of these deviations from the competitive model, and examines the literature on oil markets to provide a non-statistical meta-analysis of scholarly publications. The papers, reports, and other materials collected and reviewed allow us to summarize the collective wisdom of independent researchers over many decades, rather than only report our own assessment of the competitive nature of the petroleum industry. Before getting to the review of the literature, we provide a brief overview of the economics of the oil industry.

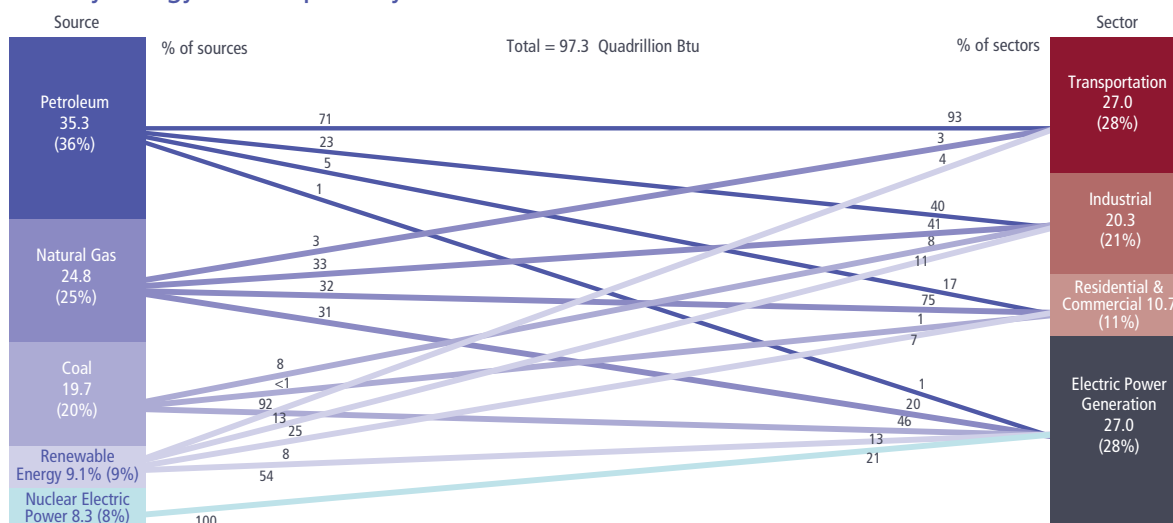
A Short Primer on Energy and Petroleum

The unparalleled wealth the developed world enjoys today, and particularly the U.S. Economy, is based on energy. That energy is overwhelmingly derived from fossil fuels: oil, natural gas, and coal. Indeed, energy economist Robert Bradley termed oil the “master resource” because of its significance in our economy.

This is a comparatively recent development. Before about 150 years ago, the only significant fossil fuel in widespread use was coal, and even that was not available in much of the world. As in poverty-stricken areas of the world today, most people relied on wood for heat for cooking, for minimal heat in the winter, and to help power the small number of engines in use. Today fossil fuels (coal (solid fossil fuel), oil (liquid fossil fuel), and natural gas (gaseous fossil fuel)) provide about 80 percent of total U.S. energy, as illustrated in Figure 1 (Primary Energy Use by Source, 2011). The remainder comes from nuclear and hydroelectric power. Solar, wind, and biofuels produce only a tiny fraction of our energy. The U.S. Department of Energy and most other experts expect fossil fuels to continue to dominate the coming decades, both in the United States and globally.

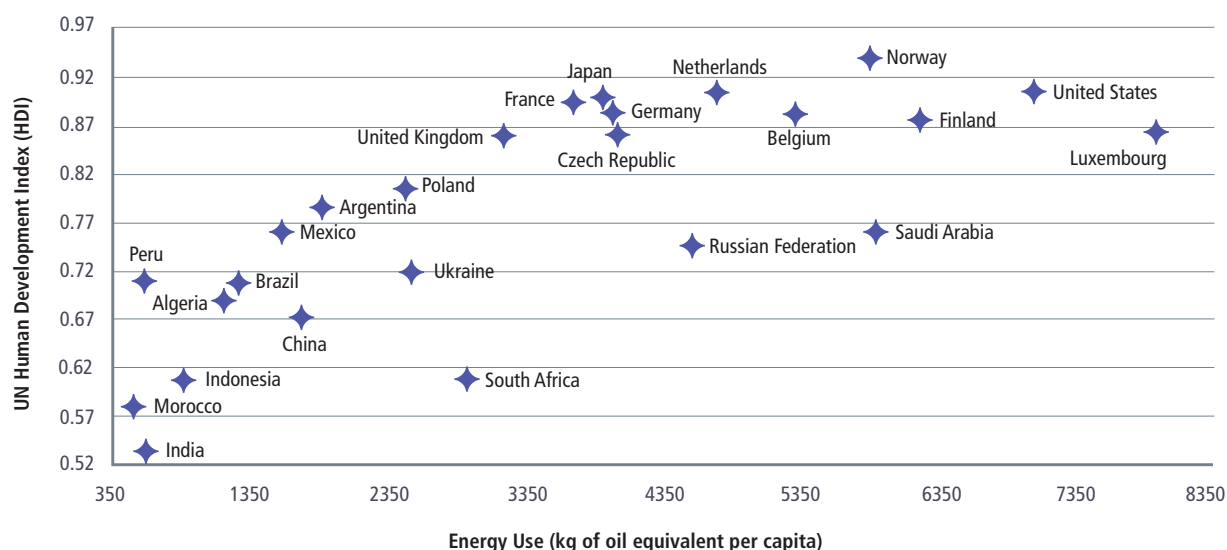
Further, as seen in Figure 2, energy use is not simply direct uses, as when we heat our homes or drive our cars, but also is used indirectly.

FIGURE 2
Primary Energy Consumption by Source and Sector, 2011



Sources: EIA, *Annual Energy Review*, Tables 1.3, 2.1b-2.1f, 10.3, and 10.4

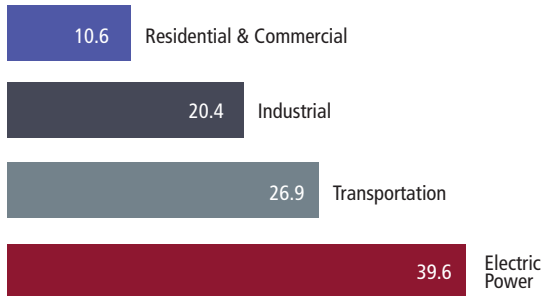
FIGURE 3
U.N. Human Development Index vs. Energy Use, 2009



Energy use is so deeply embedded in our society and economy that it is easy to forget how critical it is to human welfare. Energy is important not simply because it enables production of consumer goods, as critics of energy use sometimes over simplistically suggest. It is vital to human welfare: Figure 3 indicates how the United Nation's Human Development Index (HDI) is highly correlated to per capita energy use. In countries that rank high on the HDI, such as Finland, Norway and the United States, energy use is the equivalent of around 6,000 kg of oil per capita per year. In the poorer parts of the world that rank low on the HDI, such as India,

FIGURE 4
Primary Energy Use by Sector, 2011

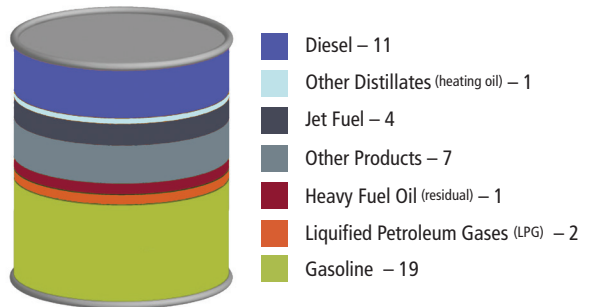
Quadrillion Btu



Source: EIA, *Monthly Energy Review*, Table 2.1 (March 2012), preliminary 2011 data

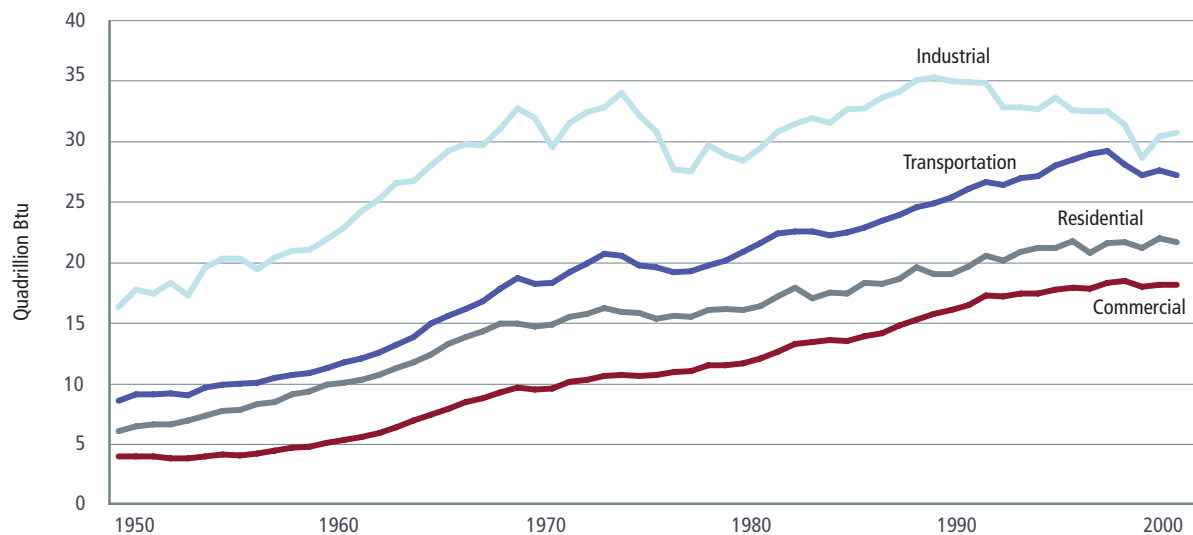
FIGURE 5
Products Made from a Barrel of Crude Oil, 2011

Gallons



Source: EIA

FIGURE 6
U.S. Energy Consumption Estimates by End-Use Sector, 1950-2011



Sources: EIA, *Annual Energy Review 2011*, Tables 2.1a and 2.1f

per capita energy use is orders of magnitude lower. Human wealth relies on oil, natural gas and coal. All developed nations rely on these energy sources, making them critical to human welfare around the globe. The structure of the markets for these fuels is thus an important issue for policy makers.

Petroleum is a critical part of our overall energy use. Not all fuels are equal when it comes to providing energy for specific uses, however. Oil's key role becomes clearer when we focus on the connections between specific fuels and specific uses. As noted in Figure 4 (Primary Energy Use by Sector, 2011), generation of electricity is the single largest use of energy. However, oil

plays little role in electricity production; coal, natural gas, nuclear, and hydroelectric provide virtually all electricity.⁴ However, the second largest use category is transportation, and it relies almost entirely on oil-based fuels, (some oil is also used in the production of consumer and industrial products). Figure 6 shows the growth of energy use in the U.S. by sector over the last 60 years.

As our focus is on oil, we now turn to how petroleum is used. While oil is moved around the world, crude oil is not a fully fungible commodity. Crudes differ in the mix of hydrocarbon molecules they contain. “Heavy” oils, such as from Venezuela, are tar-like because they have a greater proportion of long chain hydrocarbons. “Light” oils contain a lower proportion of those molecules and a higher proportion of shorter chain molecules. Different crudes also have different levels of contaminants such as sulfur (“sweet” crudes containing relatively little; “sour” crudes relatively more). Not only do refining costs differ across the various types of crude oil, but particular refineries may be optimized for a certain crude and be unable to handle a heavier, sour crude for lack of specific equipment. Prices for different types of crude diverge as a result.

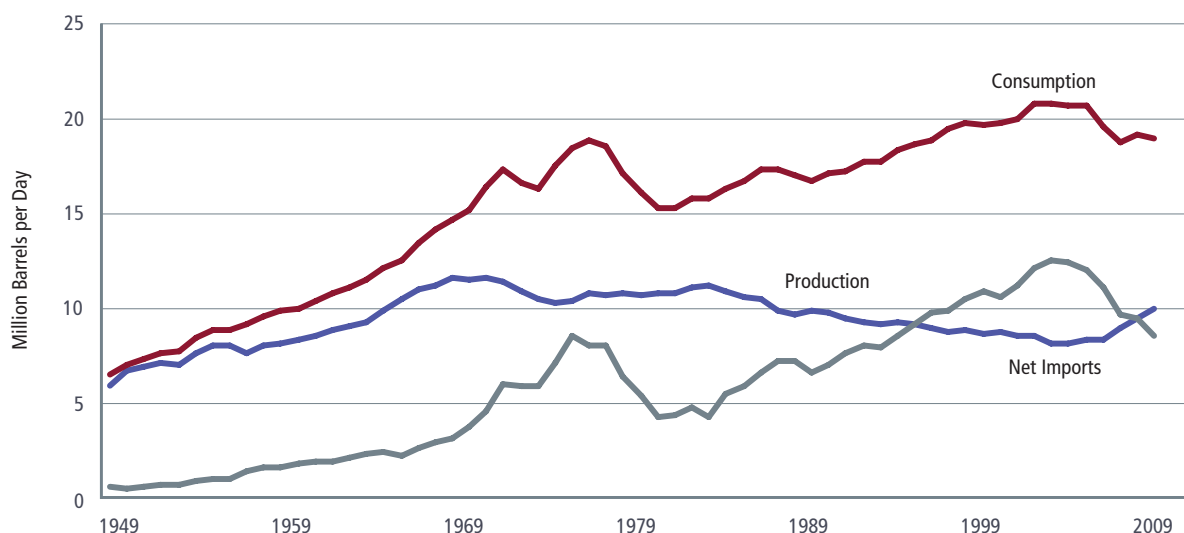
Regardless of the kind of oil, as Figure 5 (Products Made from a Barrel of Crude Oil) shows, oil’s primary energy role is as a source for the production of transportation fuels. Trains, planes and automobiles would not move without it. Oil’s central role in our economy thus rests on its usefulness for producing high-energy content, safe-to-use transportation fuels. Thus far, substitutes for oil-based fuels, such as ethanol and biodiesel, are not cost-competitive and have serious disadvantages as fuels. Biodiesel, for example, is subject to gelling at low temperatures, which make it more difficult to use during the winter in large portions of the United States. Ethanol has serious environmental problems related to corn production and ground water use in the Midwest, results in increased food prices when made from corn, is more corrosive than gasoline, and has a lower energy content than gasoline.

With coal and natural gas, U.S. consumption is almost entirely from domestic sources, because of the combination of abundant domestic supplies and relatively high transportation costs in moving coal (which is heavy) and natural gas (which requires expensive infrastructure). Of course, other nations import significant amounts of coal (China) and natural gas (most Western European countries and Japan). For the United States, however, the market for petroleum is different from our other fossil fuel-based energy sources because we import significant quantities of oil and refined products. U.S. policymakers have worried about the national security implications of dependence on foreign crude supplies since before World War I. Some have also expressed concern over dependence on oil more generally.

Although at one time the United States was the world’s largest oil producer and dominated world oil markets, since the 1970s it has imported substantial and generally increasing amounts of oil, as seen in Figure 7.

4 Today, petroleum is rarely burned to generate electricity, although from the 1950s to the 1980s, U.S. energy policy created considerable demand for oil for generation and industrial purposes. This illustrates the importance of policy decisions for how oil is used and the shape of the market.

FIGURE 7
U.S. Petroleum and Other Liquids: Consumption, Production, and Imports, 1949-2011

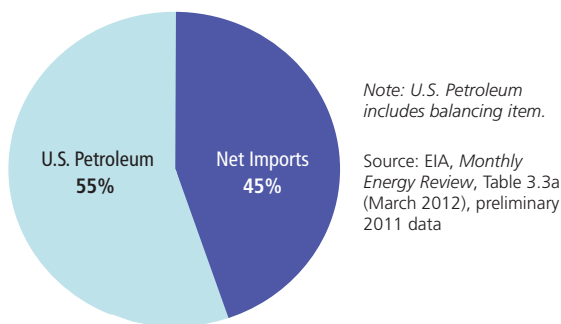


Sources: EIA, *Monthly Energy Review*, Table 3.1 (December 2012), and EIA, *Annual Energy Review*, Table 5.1a (October 2011)

We now import a little less than half of what we need to keep our transportation system functioning (see Figure 8). As domestic production has risen, largely due to surging output of new oil production in Texas and North Dakota, while domestic demand has fallen with the economic slowdown after 2007, the share of imports has fallen, and it is expected to decline further in the coming years. Yet, whether oil is produced in the U.S. or in another country, it is part of a world market. Prices adjust for transportation and refining costs, but crude oil is a global commodity. So increased production in the United States need not mean that oil will be cheaper in the United States, just that revenues will be captured domestically.

The growth of oil imports had multiple causes, but among the most important was a major shift in the relative cost of United States and foreign production. By the end of World War II, the United States had become a relatively high cost oil producer as the cheaper reserves that had been exploited first were exhausted. As a result, U.S. crude suppliers became increasingly less cost-competitive relative to foreign producers. Not only was the cost of production much lower outside the United States, but the post-World War II consortia of international oil companies exercised monopsony power with respect to many foreign suppliers but did not with respect to the more fragmented domestic crude production market. To exploit the low cost supplies in the Middle East and elsewhere, the international oil companies made major investments in tanker fleets, oil terminals, refineries, and development of supplies from low cost sources. Many U.S. domestic crude producers viewed these developments with alarm, worrying (correctly) that they would not be able to compete with a flood of cheap foreign oil. U.S. domestic producers then sought protection against cheap foreign oil. This led to a variety of protectionist measures, including the 1959-1971 Mandatory Oil Import Program (MOIP) that sought to keep U.S. producers in business, (after the MOIP was ended, the Nixon Administration shifted to using price controls on oil). One study estimated that the cost of the

FIGURE 8
Net Imports and Domestic Petroleum
as Shares of U.S. Demand, 2011



MOIP to the U.S. economy was almost \$10 million per year in 1970.⁵ Once world prices rose to a level at which U.S. producers were cost-competitive, such measures became less important.

The relative cost of production is important in evaluating oil markets. Although the United States has considerable oil reserves, a significant portion of our relatively low-cost-of-production reserves are off-limits to development as a result of political decisions. Because of these political restrictions, U.S. oil production has often

shifted to more costly, and dangerous deep water drilling. The Deepwater Horizon disaster, for example, involved more costly and complex drilling conditions than other Gulf Coast, Alaskan and West Coast areas currently off limits. Similarly, U.S. high cost domestic reserves, such as the Alaska North Slope and shale oil production in the upper Midwest, is economical only when crude prices are relatively high. Some estimates indicate that production from the Bakken field in North Dakota is economical only when crude prices are above \$55-70/barrel (the exact amount depends on the estimate). The EIA estimates that Middle Eastern oil fields have average total upstream costs (discovering to production) of under \$17/barrel.⁶ By comparison, the EIA estimates that U.S. offshore upstream costs average \$51.60/barrel and U.S. onshore upstream costs average \$31.38. The extent to which the United States meets its energy needs through domestic oil supplies is thus partially dependent on the price of oil; as the price rises, more domestic U.S. supplies become economically viable. It also depends on U.S. politics, since that determines which areas are open for exploration and production within the United States to some extent.

A further factor enters into oil production discussions. Once a well is drilled, it cannot always be turned on and off without an impact on production. For a variety of technical reasons, maintaining production from a well is sometimes important to the well's ability to produce in the future. A sudden drop in oil prices may lead to a well's closure but a subsequent rise in price may not bring the well back online.

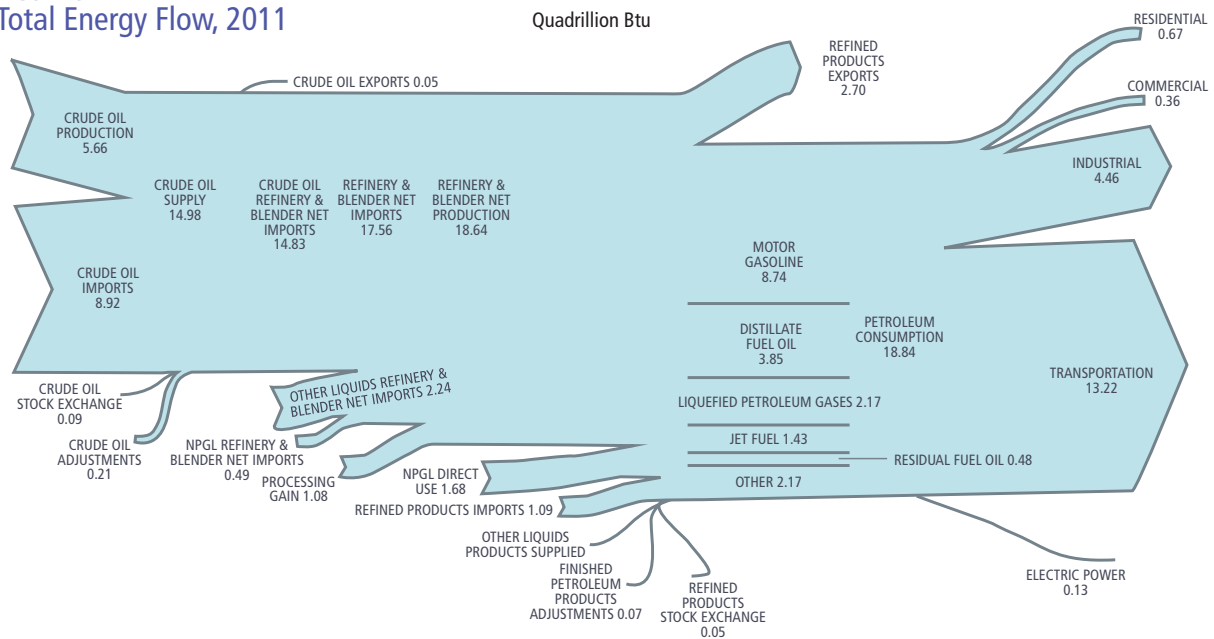
As Figure 9 from the Energy Information Administration shows, in 2011 the United States produced 11.6 percent of world crude oil and consumed 21.6 percent, so, given the size of the economy, it means the country is a major importer of crude oil.⁷ More than 70 percent of the oil ends up being used, one way or another, for transportation purposes—planes, trains, and automobiles.

5 Charles Cicchetti & William J. Gillen, *The Mandatory Oil Import Program: A Consideration of Economic Efficiency and Equity*, Nat. Res. J. 399, 420, Table 6 (1973).

6 EIA, *Performance Profiles of Major Energy Producers* (2011). Tables 10-12.

7 Unless otherwise clearly noted, graphs can be accessed at the EIA website.

FIGURE 9
Total Energy Flow, 2011



Are we running out of oil?

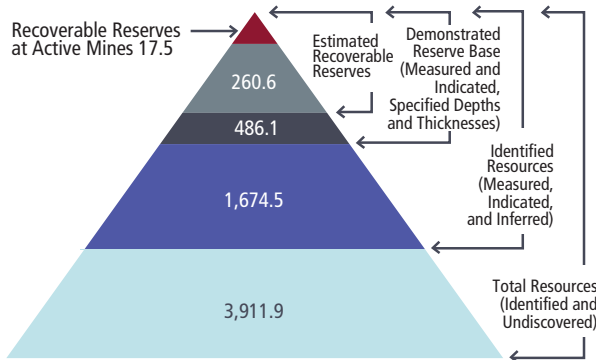
Almost since oil became an important energy source, concern over its exhaustion has been significant. A theory of “peak oil” has been popular at least since promulgated in 1956 by the geologist M. King Hubbert who, based on his extensive knowledge of petroleum reserves and of industry practices, calculated that we would be running out of oil by now.⁸ The notion that oil supplies are physically limited and in danger of exhaustion appears to be common sense: if we are using a commodity like oil and no more is being made (or it is being made more slowly than we are using it), eventually it will all be gone. However, these discussions usually neglect the role the price mechanism plays in adjusting consumption of an increasingly scarce good.

Oil is not the first energy source about which these concerns were raised. A leading English economist, Stanley Jevons, wrote *The Coal Question* in 1865. Using statistical analysis, he showed that England was running out of coal. This was a serious issue for Britain, as coal was the primary energy source for the industrial revolution that had brought unparalleled economic growth and wealth. Utilization of coal led to a sixteen-fold increase in human welfare—an unprecedented move out of a “Malthusian economy” that progressed little during the previous centuries.

Jevons feared the lack of a domestic coal source would bring about an economic collapse. That, of course, did not occur. His lack of prescience was not peculiar. Cassandras are present in every generation predicting economic tragedy based on physical resource constraints. As

8 M. King Hubbert, “Nuclear Energy and the Fossil Fuels,” March 1956. Hubbert warned that because oil reserves were going to run low, the United States and other nations should build many nuclear power plants as uranium is plentiful as a substitute for fossil fuels.

FIGURE 10
U.S. Coal Resources and Reserves
 Billion short tons as of January 1, 2010



Source: EIA, Form EIA-7A, *Coal Production Report* (February 2011)

with Mr. Jevons, who worried about running out of coal, for decades there has been talk of vanishing reserves and running out of oil. But, as with other commodities, if sales go up and profits are to be made, producers make more. As markets grow, new producers are apt to come along to take advantage of the opportunities and production capacity increases further. That is true of oil and other commodities.

Contrary to common concern that we will run short of oil in the future, in fact, "No mineral, including oil, will ever be exhausted."⁹ When the price of

something, such as oil, rises, producers get busy and find more. We are not going to "run out" of oil, which has been as important to economic growth for many decades as coal was in Jevon's time. The fact that this critical market is plagued by persistent intentional interventions that disrupt supply and cause prices to fluctuate wildly is not related to a physical scarcity of petroleum. Proven oil reserves are greater today than at any time in the past.

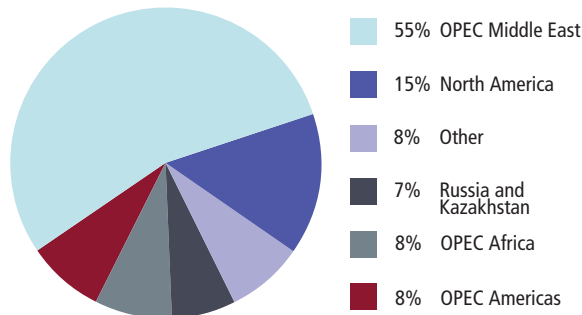
Returning to the coal example, note that for all practical purposes there is an endless supply of coal. As Figure 10 (U.S. Coal Resources and Reserves) indicates, there is a significant supply of coal in the U.S. alone. American working coal reserves are equal to a 112-year supply.¹⁰ Long before we exhaust our coal reserves, rising prices will eliminate low valued uses from the market place.

Three things account for the failure to run out of coal. First, we are much better able to estimate coal reserves today than in Jevon's day. Second, demand for coal spurred the discovery of new reserves previously unknown. Third, rising prices for coal in England led to substitution of alternative energy sources (including oil-based fuels). These same three effects play similar roles with respect to oil, although since much oil is deep in the earth, in places not searched before, or offshore, reserves are much harder to estimate than is the case with coal. In addition, many national oil companies and governments do not publish accurate data on their reserves for competitive or political reasons. For example, there is little information available on Saudi oil reserves. The overall point, however, is the same. We are not running out of oil; it is "simply" a matter of investing in further search and production to satisfy demand. Human ingenuity resolves most problems.

9 M.A. Adelman, *Genie Out of the Bottle: World Oil Since 1970*, MIT Press, (1995) at11.

10 B.P., plc. *Statistical Review of World Energy* (2012) Coal Reserves.

FIGURE 11
Shares of Proven Oil Reserves
Holders/Locations, 2010



Source: EIA, *International Energy Statistics*, 2010

World oil production and consumption, which runs about 85 million barrels a day, draws down on inventories of proven reserves. When demand is high, there is more exploration and development. As BP explains in its *Statistical Review of World Energy 2012* “proven reserves” of oil are now at 54 years of expected consumption (1,653 billion barrels).¹¹ Reserves increased in 2011 by 31 billion barrels over the previous year—that is, inventory increased by about the same as was used. Firms continue to explore for more oil, so the reserves continue to grow and are now at historic highs. The worries that we are running out of oil are

less relevant now than they were when Hubbert was writing 57 years ago.

Where are the reserves? As Figure 11 (Shares of Proven Oil Reserve Holders/Locations, 2010) indicates, a majority of proven reserves are in the Middle East. OPEC-member nations control approximately 70 percent of global oil reserves. Because their known reserves are huge, the OPEC nations are not particularly aggressive in searching for more oil, so there is no doubt the world reserves are much larger than what is known to date.

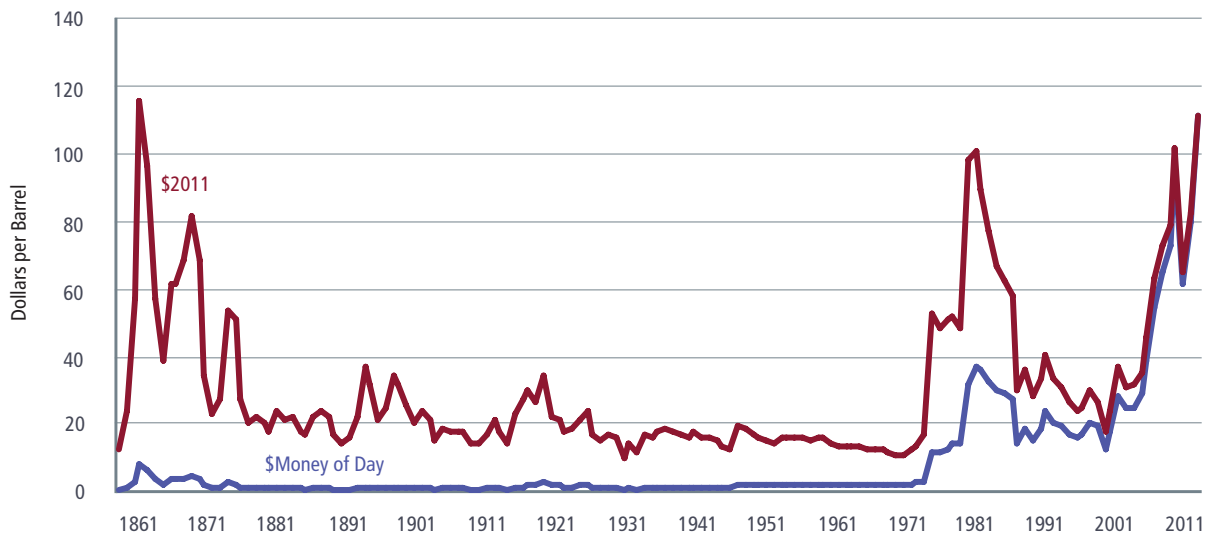
Coal also serves as a useful basis for comparison with oil because the U.S. coal industry more closely resembles a textbook competitive market. Many producers must compete with each other; there is no OPEC attempting to control the output and price of coal. Of course, coal prices fluctuate with changes in the demand for coal,¹² when new regulations increase production costs, or with other market forces. But we do not see global price changes triggered by supply disruptions by a coal producers’ cartel. There is no coal cartel. Because the U.S. has more than a quarter of the known coal reserves, the U.S. is the equivalent of the Saudi Arabia of coal, but we do not have a national coal company that monopolizes and controls its production and sale in an effort to affect the world price.

All commodity prices fluctuate—the prices of corn and cotton rise and fall from year to year largely due to crop conditions. A bad crop means short supply and higher prices; that may be followed by a year of abundance. A revolution or other event in a country that is a major producer of a commodity can cause price to spike, but no other major non-crop commodity exhibits the kind of price instability and price swings over time seen with petroleum. It is not due to sudden large spikes in demand or an inability to supply enough due to bad weather; it

11 The BP estimate is in stark contrast to the view of Hubbert in 1956, and many others since Hubbert’s day, that we are running out of oil. Hubbert estimated world reserves to be about 75 percent of what BP estimates oil reserves to be today. That does not take into account the fact that we consume almost 20 times more oil today as was consumed when Hubbert was writing.

12 This especially so when oil price increases and cheaper substitutes are sought; see EIA.gov.

FIGURE 12.
Crude Oil Prices, 1861-2011



Source: BP, plc., *Statistical Review of World Energy 2012*

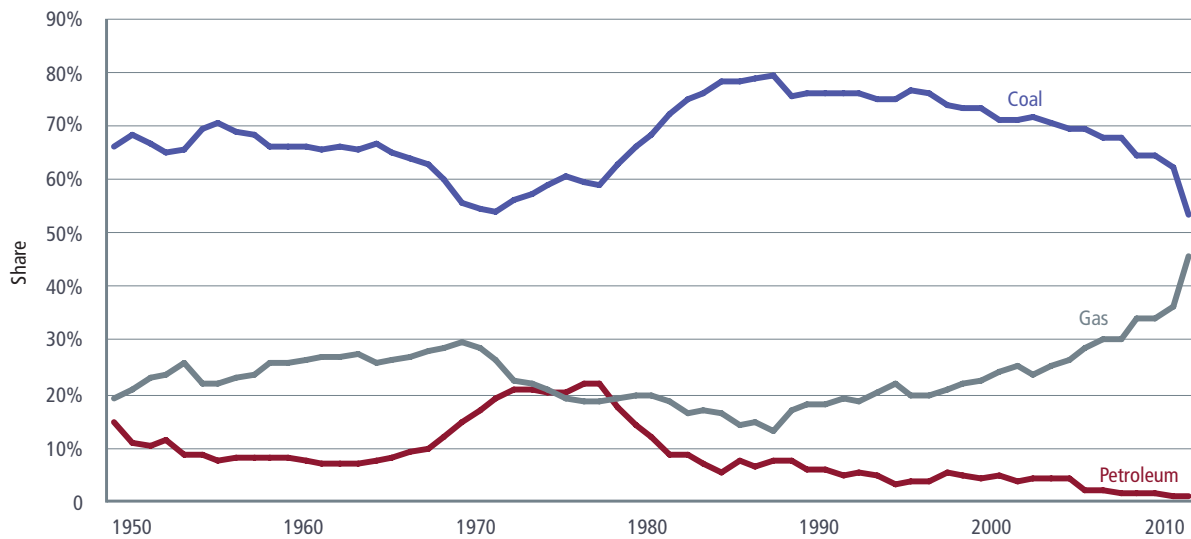
is because of intentional steps to control quantities of oil sold so that price can be impacted in ways favorable to suppliers that other commodity producers could only hope to imitate. As seen in Figure 12, for most of the 20th century, the real price of oil was relatively stable (the red-colored upper line is in 2011 prices). Then in the early 1970s, real prices rose sharply. This was not due to a sharp jump in demand but due to the execution of effective policies by OPEC and the Arab oil embargo. Although OPEC was formed in 1960, it was not until the early 1970s that it was able to effectively act as a cartel to manipulate the supply of oil and, therefore, the price. OPEC member nations command about 70 percent of oil reserves and are the world's greatest exporters, so the cartel has the potential to dominate the industry and earn extraordinarily high profits, as happened in the 1970s into the 1980s, and then again in recent years. OPEC's success varies from time to time, however, depending on its internal dynamics, political issues in member states, oil discoveries elsewhere, and world events.

As the Energy Information Administration shows in Figure 13 (Annual share of fossil-fired electric power generation, 1950-2012), in the U.S. oil became an even less popular source for power generation as the cost rose and producers moved more toward coal. Now that natural gas production has jumped, its price has fallen, and it is in more favor with the Environmental Protection Agency than is coal, we see a shift toward increased natural gas usage that is expected to continue.

Simple Model of the Cost of Oil Production

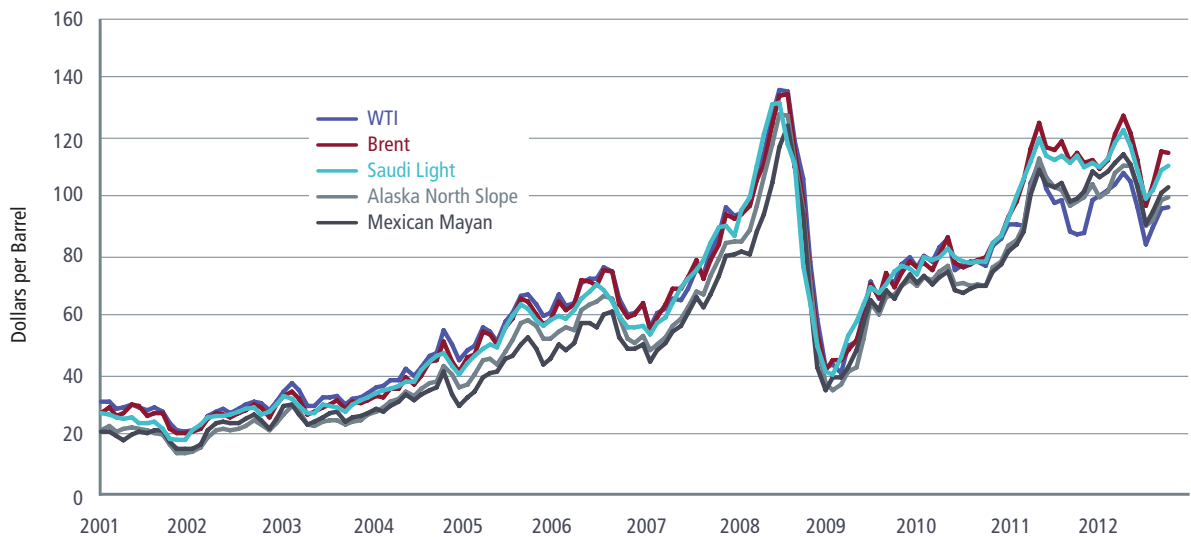
The price of oil, regardless of point of origin, can move rapidly and swing widely as Figure 14 shows. Why would something selling for about \$20 in 2002 go as high as \$140 by 2007? A shortage? A change in cost conditions in that short period? That is unlikely in a large industry

FIGURE 13
Annual Share of Fossil-Fired Electric Power Generation, 1950-2012



Source: EIA, *Monthly Energy Review*, Table 7.2a (December 2012) and EIA, *Annual Energy Review*, Table 8.2a (October 2011)

FIGURE 14
World Oil Prices Move Together Due to Arbitrage



Many types of crude oil are produced around the world. Variations in quality and location result in price differentials, but because oil markets are integrated globally, prices tend to move together.

Source: EIA

with relatively stable production and 50 years worth of known reserve supply. Let's walk through the most basic economic cost conditions of a highly complex industry. To simplify matters, let us just assume the development of a single oil well.

To produce oil, one must explore for it. Exploration may be done by vertically-integrated companies, such as Shell or Chevron, that are in every part of the industry from exploration to refining to sale, or by firms that specialize only in identifying oil deposits. This can be thought of as basic research, much like a drug company pouring money into the study of many chemicals in the hope that one will end up being marketable. Often, such exploration or research is all expense, no revenue. Assuming an oil deposit is found that can be successfully exploited by the installation of a well, a new asset has been identified. The exploration firm may develop the well or it may be sold to another company to do the development work. In either case, an expenditure we classify as a fixed cost has been incurred.

Next comes the development of the well. Once government permission and mineral rights have been obtained, the well must be drilled, pipe installed, and set up for pumping into an existing oil-field delivery system or, if isolated, a new distribution system must be put in place to get the oil pumped from the well to a location where it can be moved for processing. Again, up-front fixed costs are incurred to get to the point of developing a product that can generate revenue.

Because oil wells are expected to have long lives, investors hope to cover the up-front cash expenditure over time by allocating, say, five percent of the cost of the well per year so that a constant amount (the fixed cost) is assigned to a well or any production unit as it brings in revenue over time. It may be a good investment or a bad one; that remains to be seen. But it is sensible accounting to plan to recover the cost of the investment over time (we know that different depreciation methods are used, largely for tax purposes, but for our discussion those do not matter).

If we plan to cover the exploration and development cost over 20 years, then we assign, for accounting purposes, five percent of the up-front fixed cost against the revenues earned annually. So we could have an accounting estimate of the cost to produce each barrel and contrast that to the revenue that we book from the sale of oil from the well each year. If our fixed costs were \$1 million, then we hope to recover \$50,000 a year for each of twenty years.

We must consider the time value of money and the risk involved, so a discount rate must be applied. If we have \$1 million to invest, and we pick between a "riskless" investment and a risky one, we must expect higher compensation to take on the riskier investment. The closest thing we have to a riskless investment is a Treasury bill. The United States government has a huge debt, but few believe it will default. At the time of this writing, the ten-year Treasury rate is 1.75 percent (five years ago the rate was about five percent). The 20-year rate is 2.5 percent. So we could invest our \$1 million and be "guaranteed" one of those returns; pick your poison. At the end of the period we get our money back and have earned annual interest in the meantime. If we put our \$1 million into drilling a well, we get the money back in the form of oil sales

over time at a price we cannot predict today. While the recovery this year may seem a near certainty, the recovery of our \$50,000 each year many years out becomes more dubious, so we must add a premium to the cost of making the investment. There are various risks—the well could nearly run dry sooner than expected; the price of oil may fall, so even if the well is productive we do not earn the revenues hoped for; there could be political trouble such as expropriation of our investment by a government that will not allow as much income as we had hoped to earn; a government may insist on new taxes or on renegotiating contractual terms (as happened regularly from the 1950s until full nationalization of oil resources in many countries) or, worse, the expropriating government simply refuses to pay what it may have promised or a value assigned in litigation against the government that seized the asset. A risk premium exists that is built into discount rates to consider in our fixed cost of finding and developing the well.

The discount rate in the oil industry is high. M.A. Adelman, the leading academic analyst of oil industry economics, reported that prior to OPEC becoming effective in the early 1970s, the rule of thumb in the industry was a discount rate of 20 percent.¹³ Once expropriation of oil company assets became more common, contracts were ignored, and prices became highly volatile, the discount rate jumped to 40 percent. That is, companies must expect a chance of rapid, rich rewards because the risk of losing everything greatly increased. Wildcatting is tough.

While high discount rates are relevant for risky exploration, that is often not the case for oil companies that do not own wells. Many firms now are on contract to do exploration, development or production work for oil deposits owned by governments. Equity interests by oil companies in Middle East oil operations dominated before 1970. However, by 1974 the international oil companies' share had dropped to about a third of Middle East oil interests. It fell further to less than ten percent by 1980.¹⁴ Oil companies, experienced in industry risk, just became the hired help. Of course, there is still significant risk. Governments can (and do) change the terms of contracts or even expropriate the assets a firm has on the ground. In some cases, companies still bid for risky rights to search for oil and drill wells. The uncertainty of well productivity is compounded by price uncertainty and by uncertainty about whether the contracting government will abide by the deal.

Once a firm begins to operate a successful well, it incurs "variable costs" that include the day-to-day costs of pumping the oil, moving it to the point of sale, and company overhead expenses. These costs involve employees in place, energy bills to pay, and other costs that can be assigned against the revenues we earn from sale. So costs consist of fixed costs (acquiring the right to drill test wells and, after finding good ones, then putting successful wells into operation) and variable costs of operation. The fixed costs are in the past—the upfront money has been spent.

13 M.A. Adelman, "OPEC as a Cartel," in James M. Griffin and David J. Teece, *OPEC Behavior and World Oil Prices* (1982) at 42.

14 James M. Griffin and David J. Teece, *OPEC Behavior and World Oil Prices* (1982) at 10.

There is no guarantee in any business that fixed costs will ever be recovered. The investment went into a hole in the ground; it is a “sunk cost.” No one cares about the investment except those who put cash at risk. However, variable costs are in the present. Costs can be reduced by shutting down operational wells and by eliminating or reducing our work force. The “marginal cost” of producing a barrel of oil can also be calculated. That is, given that the well is in place and operational, how much does it cost us to pump one more barrel of oil and move it to market? Each of these costs matter as they come into play depending on the price of oil over time.

Of course the producer/seller wants to capture as much revenue as possible, and works diligently to control costs, so as to maximize net revenues after tax or accounting profits. If lucky, we more than cover our fixed cost and variable cost each year. While we know costs quite well, we know less about future revenue because the flow of oil may not be what was anticipated and, even more, we cannot predict the future price of oil. Maybe revenues will be more than sufficient as we move through time to cover all costs, or not.

Suppose, given our production cost and revenue estimates, we believe that if oil is at least \$40 a barrel we cover all costs; anything above that would be profit. But what if the price of oil falls to \$20? Are we out of business? At the low price, we can cover our variable (operating) costs but do not recoup our fixed costs as hoped. We can shut down the well, but then revenue falls to zero. At \$20 we cover all variable costs and cover some of our fixed costs. Something is better than nothing. We can save the oil in the ground hoping the price goes up in the future, but an operator has no knowledge of when or if that will happen, in which case revenue above variable cost has been sacrificed. This is not peculiar to oil. It is common for many businesses to operate so long as they earn revenue sufficient to cover variable or operating costs—the initial investment or fixed cost may or may not ever be recovered. Indeed, at the extreme, a firm may continue to produce so long as revenue is greater than the marginal cost of producing extra barrels of oil (which is usually a very low number).

The notion of fixed cost recovery is a hope expressed in accounting books that may have little to do with market reality about the price that can be had for the product to be sold. In a business as risky as oil, that is why discount rates are high. Most firms have a portfolio of investments—some will provide a bonanza, others will suffer large losses due to market conditions in the future or due to bad behavior by contracting governments.

In the oil industry there are thousands of wells. Some are gushers that produce high net revenue for their owners while others are not worth running unless the price of oil is so high that the cost of extracting a few barrels can be recovered. As oil fields exist around the world, there are many competitors. Further, unlike a product that may suffer swings in demand due to fickle consumers, demand for petroleum tends to grow at a steady and increasing pace. In 1980, world consumption was 60 million barrels per day; 30 years later it was 87 million barrels per day or 45 percent higher. Over that time period annual consumption never varied more than five percent from one year to the next. In this respect, it is a relatively stable industry compared to others. The fact of continual slowly rising demand is old news, so suppliers know the expected long-run level of demand quite well. Hence, compared to other industries, where

demand can vary significantly from year to year, the oil industry can enjoy a relatively high degree of stability, so prices should be relatively stable over time, as is true of most industrial base products, such as coal.

Having thought about the basic model, consider what the International Energy Agency (IEA) estimates to be current costs relevant to producers. While the average oil well in the U.S. pumps 20 barrels per day (b/d), in Saudi Arabia the average is 3,400 b/d. The U.S. has 370,000 wells (and half the drilling rigs in the world); Saudi Arabia has only 2,900 wells. The U.S. employs 2.2 million in the oil and gas industry, Saudi Arabia only 90,000. One new area of development in Saudi Arabia has an upfront cost of about \$15,000 per barrel per day, whereas the capital cost for deep water wells, such as in the Gulf of Mexico, run \$40,000 to \$80,000 per barrel per day. For all that effort, the U.S. currently produces about 20 percent less oil than Saudi Arabia (a country with less than ten percent of the population of the U.S.).

The highly productive nature of wells in Saudi Arabia puts the estimated breakeven cost for oil production there at about \$10 per barrel.¹⁵ Many other OPEC nations enjoy similar low costs, so the profit margins are huge, allowing many countries to essentially be run using oil revenues to fund their governments, including expensive development products and extensive welfare states. For example, Saudi Arabia provides so many benefits for its citizens that the IEA estimates oil must stay above \$80 a barrel for the government to be able to balance its budget.¹⁶ Venezuela needs an even higher price. This dependence on high prices provides an incentive for members to make OPEC work. If the price of oil fell significantly, while the low price would more than cover production cost, it could leave the governments in a tenuous situation with respect to covering the cost of entitlements their citizens now receive.

This does not mean that the market price of oil should be \$10 or so; the Saudis and Iranians and others are simply fortunate to have plentiful cheap oil. In contrast, the IEA estimates that oil produced by the “super major” oil companies outside OPEC today requires \$75 to \$80 a barrel to break even. The costs of production in the U.S. and other places the majors often go to drill new wells are much higher than in many OPEC nations. In general, the market price will tend toward the long run average cost of the marginal (higher cost) producer, not the breakeven cost of the low cost producers. Saudi Arabia and other OPEC nations may or may not be able to fulfill all oil needs at current prices. They just happen to be the lowest cost producers and so will earn significant economic rents.

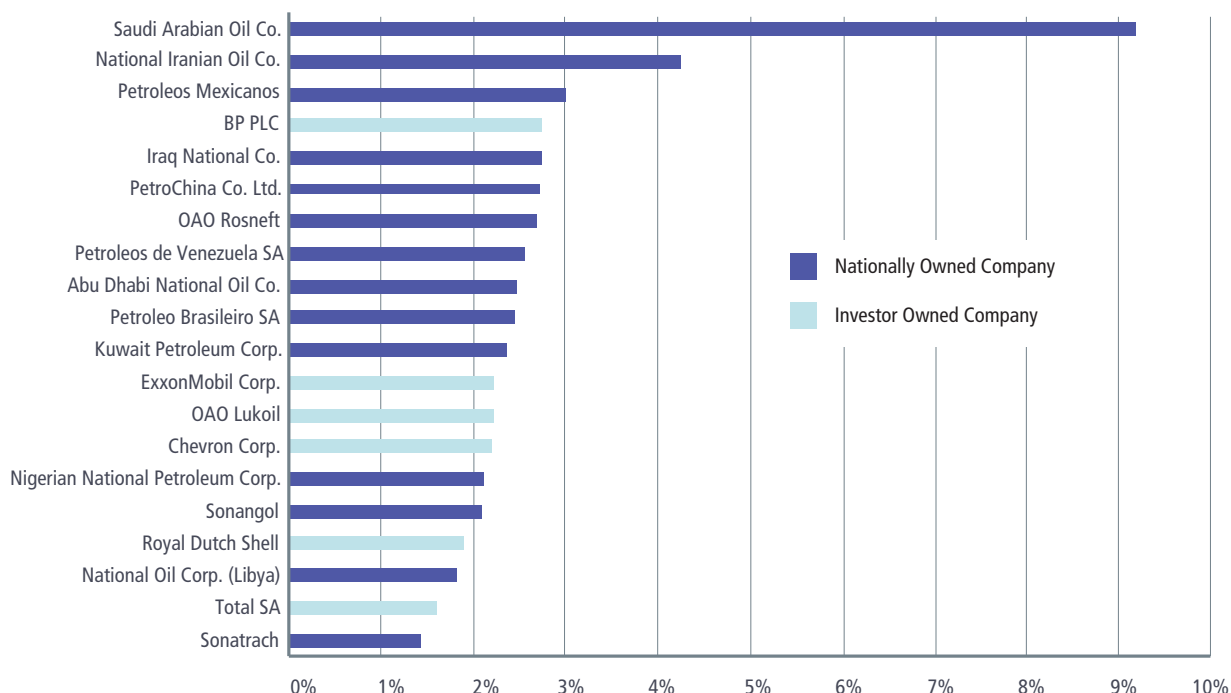
Who Owns and Makes What?

The United States is unique in that private property owners commonly own subsurface mineral rights; in other nations, subsurface mineral rights are held by the state. This means some oil and other minerals in the U.S. are privately owned, such as in North Dakota and Texas. However, significant mineral resources are located on federal lands in the West or offshore,

¹⁵ International Energy Agency, *World Energy Outlook* (2011) at 139-40.

¹⁶ *Id.* at 140.

FIGURE 15
Percent of Worldwide Crude Oil and Liquids Production by Company, 2010



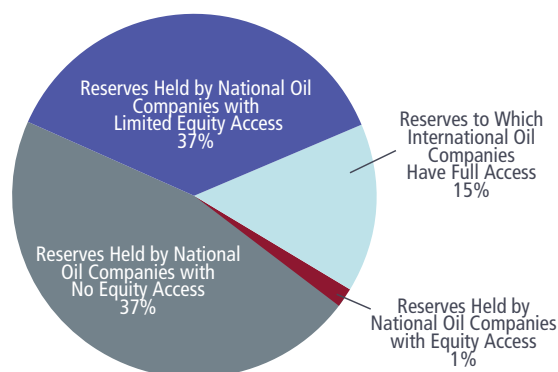
Source: API, calculated from EIA estimated world total of 87.06 million barrels per day in 2010 and leading oil companies according to Oil & Gas Journal, October 3, 2011

which is under government control. All told, governments own the overwhelming majority of the world's crude oil. In many countries, private firms are hired to develop the oil; in some countries, such as Mexico and Venezuela, much of the production is done by government-run firms, such as PEMEX, the Mexican national oil company, or PDVSA, the Venezuelan state-controlled operation. These state-owned entities operate quite differently than do firms focused solely on making a profit.

Oil companies have long been blamed for "high" gasoline prices, but today they are largely at the mercy of suppliers. Most oil companies, such as Shell and ExxonMobil, own few oil wells; they are developers of government-owned wells by contract. They are also in the refinery business, which is highly competitive. ExxonMobil is a huge company because the world oil market is huge, but its net income is often below 10 percent,¹⁷ which is normal in the oil development and refining business. That is, after taking industry risk into consideration, ExxonMobil does not earn abnormally high rates of return. Compare oil companies to other firms that do research and development, such as Apple and Microsoft. Those firms generally have much higher profit margins. As the following graph indicates, ExxonMobil is just one small player in the world market, as seen in Figure 15, producing a

17 ExxonMobil, *Financial and Operating Review* (2009).

FIGURE 16
Shares of World Oil Reserves Access, 2010



Source: EIA, *International Energy Statistics, 2010*, and EIA, *Country Analysis Briefs*, and IHS, *Global Insight Energy Country Profiles*

little more than two percent of world oil production. State-owned enterprises in Saudi Arabia and Iran dwarf Exxon and other American firms.¹⁸ Even tiny Kuwait has a state oil company larger than ExxonMobil. Oil production is dominated by state-owned agencies. (Note that Lukoil is listed as a private company. That designation is questionable. Like other large Russian companies, it is subject to much more government control than are private firms such as BP and Chevron.)

Oil reserves are dominated by OPEC member nations. Those countries manage their reserves using state-owned monopoly

“companies” that are arms of the central government. As Figure 16 (Shares of World Oil Reserves Access, 2010) indicates, governments own most reserves. Private companies own little in the way of reserves; they tend to be the expert hired help paid to extract and sell oil for a host nation. In some oil-producing areas, private companies have “access to reserves” by contract, but since most such contracts are with governments, even those can be eliminated at the stroke of a pen. ExxonMobil and ConocoPhillips had multi-billion dollar investments in Venezuela that were abandoned without compensation in 2007 when the government demanded that the “share” of the project held by PDVSA be doubled. Four other private oil companies “accepted” the deal that gave PDVSA about 78 percent of their projects rather than the 40 percent stipulated by contract.¹⁹ Hence, only a small share, perhaps 20 percent, of the world’s oil supply is secure private property as we generally think of company assets. Hence, the majority of the world’s oil reserves are under the direct control of governments such as Saudi Arabia, Iran, Iraq, and Venezuela.

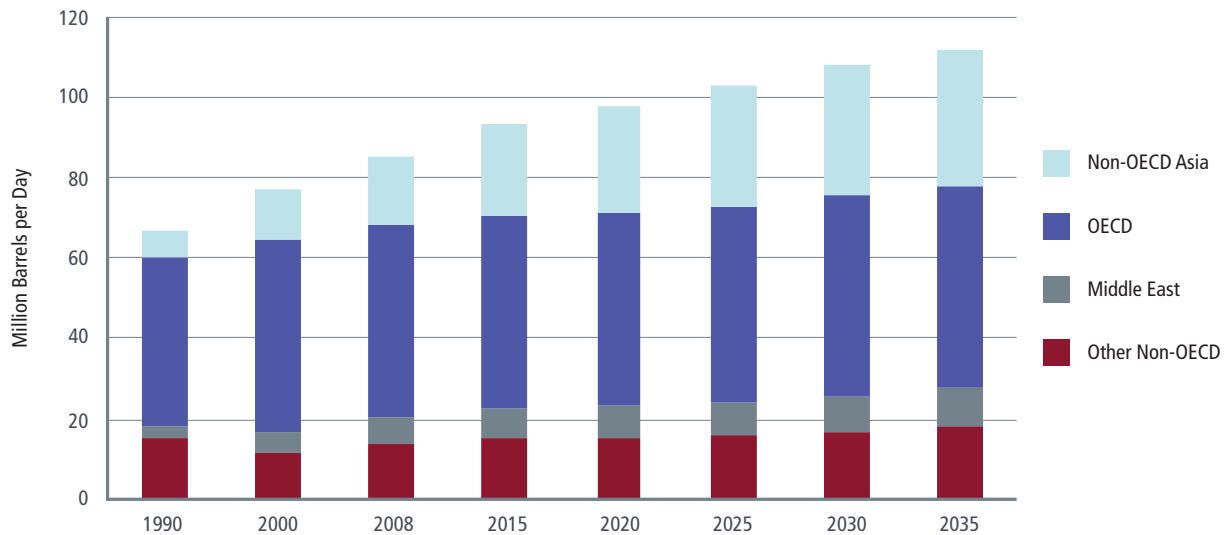
As the Congressional Research Service has noted, the largest national oil companies (NOCs) that hold the vast majority of the world’s reserves of oil do not act like competitive private firms. This is illustrated by the fact that the reserves-to-production ratio is low. The average reserve to production ratio is 78 years for the largest NOCs. That is, at existing rates of production it would take 78 years to exhaust *known* reserves. Private firms such as Shell have reserve-to-production ratios averaging 11 years.²⁰ The behavior of the firms is quite different when they are for-profit, investor-owned entities rather than state agencies doing the bidding of their national governments that belong to OPEC.

18 ExxonMobil, 2010 Largest Oil Companies (percent of worldwide crude and liquids production), *ExxonMobil Perspectives* (2011).

19 Robert Pirog, *The Role of National Oil Companies in the International Oil Market*, Congressional Research Service Report for Congress, Aug. 21 (2007) at 1.

20 *Id.* at 3.

FIGURE 17
World Liquid Fuels Consumption by Region, 1990-2035



Source: EIA, *International Energy Outlook 2011*, Figure 27 (September 2011)

This means oil demanders who rely on international purchases often must buy from corrupt governments. Transparency International, in its 2012 rankings, ranks Iraq and Venezuela as two of the most corrupt regimes in the world at 169 and 165 respectively.²¹ (For comparison, Afghanistan and Somalia at 174 are tied as most corrupt in the world.) Iran is marginally better at 133. Saudi Arabia, ranked 66th in the world, is tied with Italy. The point is, many OPEC nations that determine if oil will flow are deeply corrupt regimes. Since their decisions are political, and not strictly based on business considerations, corruption affects their impact on the market. This has an important impact on global oil markets. First, the existence of corruption in major oil producers further removes decision making from market forces. For example, corruption undermines market mechanisms that discipline firms.

As the EIA looks into its crystal ball about the future of oil use, it sees continued global growth as Figure 17 (World liquid fuels consumption by region, 1990-2035) indicates.²² While the developed (OECD) economies are expected to be quite flat in energy use due to low rates of economic growth and enhanced efficiency in energy use, the demand for energy in the rest of the world, especially in Asia, is likely to continue to grow. The EIA estimate is consistent with ExxonMobil's estimate, which sees global oil consumption rising steadily from about 85 million barrels per day in 2010 to about 110 million barrels per day in 2040.²³

What will the price of oil be as we move forward? Although EIA is sensibly cautious in its predictions given the different scenarios that could occur, it estimates that oil might be

21 Transparency International, *Corruption Perceptions Index* (2012).

22 For details about future supply and demand, see EIA, *International Energy Outlook* (2011) at Liquid Fuels.

23 ExxonMobil, *The Outlook for Energy: A View to 2040* (2013).

anywhere from about \$75 to more than \$200 a barrel, in constant dollar terms. Lower prices will result in greater focus on traditional oil sources; higher prices mean there will be greater incentives to develop non-traditional alternatives such as Canadian tar sands. In sum, there is plenty of oil; where it will come from will depend largely on the price, which depends largely on the behavior of suppliers, many of which are corrupt governments.

Monopoly Elements in a Market

The price of any commodity depends on the balance of supply and demand. If a good becomes more scarce, demanders must pay more. The higher payment is an incentive for suppliers to increase supply. In the case of oil, it means added investment so as to extract more oil. As noted earlier, there is, for practical purposes, a nearly endless supply of oil; the question is if demanders will pay enough to induce suppliers to add to reserves that may be drawn upon. Payment received, or expected to be received, must be sufficient for a supplier to believe that costs will be recovered so as to justify further exploration and development.

As noted before, depending on market conditions, revenue to the seller may not be sufficient to recover all fixed cost in exploration and well development, but the seller still has an incentive to produce so long as revenue per barrel of production is at least equal to the operating (variable) cost of producing another barrel. As is the case in other industries, there are high fixed costs in oil operations that may or may not be recovered over time; the fixed cost investment is usually a sunk cost—money sunk into a well in this case. Buyers do not care if the supplier recovers such costs as buyers wish to pay as little as possible. The seller has an incentive to continue to produce and sell so long as price is above the operating cost of running the well. If revenue drops below operating (variable) cost, then the wells could be shut down to wait for a price sufficient to justify keeping the operation going. Different producers have different operating costs. Some low volume wells are relatively costly to run compared to wells flowing more easily. It is not uncommon in many industries for at least some sellers not to recover all costs. Past costs are history—operations today are based on current and expected costs and revenues.

Until the early 1970s the low-cost producing nations (members of OPEC such as Saudi Arabia, Iran and Venezuela) attracted substantial investment compared to older producers, such as the United States, which had already plucked much of the low-hanging fruit. The price of oil should have stayed low or even gone lower, as production expanded in the low-cost areas. Instead, “[b]y the rules of competitive economics, water began to run uphill about twenty-five years ago.”²⁴ That is, despite low costs, prices jumped up in the early 1970s. “The only story that makes sense is that the sellers achieved some degree of market control monopoly.”²⁵ Once it became effective, “OPEC members now sold to refiners, which had thin profit margins”²⁶ OPEC’s long-run aim was to raise the price to the cost of synthetic liquid hydrocarbons from coal, oil share, or tar sands [substitutes]. This is a monopoly goal. It can be reached only when oil-on-oil competition is suppressed.”²⁷

24 M.A. Adelman, *Genie Out of the Bottle* (1995) at 3.

25 *Id.* at 3.

26 *Id.* at 5.

27 *Id.* at 7.

Adelman's key analysis of some years ago still holds. "A competitive price for oil would not only be lower than current; it would also be more stable. The oil price explosions were unrelated to scarcity and entirely due to the cartel."²⁸ Indeed, Adelman was writing before the price explosion of recent years, where suppliers again greatly profited from the kind of record high prices they enjoyed in the 1970s. These events confirmed his earlier analysis. There is no reason to believe the high prices of recent years are due to a natural short supply or a sudden spike in demand. Demand for oil fluctuates, but the trend over time has been steady. As Figure 17 indicates, world oil usage has grown quite consistently over the years and is expected to continue to rise, which makes it quite easy for producers to know what demand will be. To some extent, the price explosion in the past few years is evidence that the cartel is back in business. Taking advantage of demand spikes as China's energy appetites increased, and supply issues as producers including Venezuela, Iraq, and Nigeria had to cut back at various time, OPEC was able to exert price pressure. Moreover, a number of major producers have underinvested in expanding reserves and improving production infrastructure, reducing supply below what a competitive market would produce. For example, political and legal considerations have limited Mexico's ability to accept foreign investment in its oil industry.

The literature on the history of OPEC is consistent with this view. Although OPEC had been around for many decades, it did not become economically effective until the early 1970s. As a former Finance Minister of Iran Jahangir Amuzwgar explains "OPEC members were at no time a homogeneous group except for two principal features: reliance on petroleum export revenues as a mainstay of their economies; and primacy of the state in the ownership, acquisition and disposition of oil revenues."²⁹ Amuzwgar details the machinations of OPEC over the years. Members would agree to limit production, but some would cheat and sell more than their share, thereby driving down price. Saudi Arabia was always seen as the lynchpin as it had the largest share of OPEC output. But its actions were not just OPEC-directed since "we see that the role played by Saudi Arabia in pursuit of its national interest was paramount."³⁰ No surprise, Saudi Arabia cares more about Saudi Arabia than about OPEC itself. "OPEC never acquired the exclusive power to set oil prices or restrict a country's access to oil supplies, it could not even effectively cope with its own cycles of boom and bust."³¹

Americans naturally tend to view OPEC through the lens of American issues. The oil "embargo" of 1973-74 is often portrayed as Arab punishment of Western nations for supporting Israel. However, regardless of Arab antipathy toward Israel, the price hike was in the economic interest of OPEC members. "When the Arab countries cut production during the so-called 'embargo' of 1973-74, this was a deliberate collusive act..."³² It was not disparate oil producers each deciding to punish other nations for supporting Israel. Competitors in a market would not decide, independently, to all reduce production by set amounts at the same time. Rather, OPEC successfully coordinated, and continues to try to coordinate, such actions.

28 *Id.* at 329.

29 Jahangir Amuzwgar, *Managing the Oil Wealth*, I.B. Tauris Publishers (2001).

30 *Id.* at 44.

31 *Id.* at 204.

32 Adelman, in Griffin and Teece (1992) at 39.

There are times when, despite no change in anti-Israeli feelings among some OPEC members, the cartel cannot hang together and prices fall. That is, the politics of U.S. support for Israel are likely irrelevant to OPEC policy. The member nations would prefer more income to less regardless of their view of U.S. foreign policy. OPEC does not always succeed in its efforts to control supply and price, as production goes up and prices fall as the cartel sometimes cannot overcome the inherent tendency of cartel members to attempt to cheat on quotas.

A classic monopolist, or fully effective cartel, would want price to be relatively high and stable. In the decades before OPEC rose to prominence, the Texas Railroad Commission worked as a cartel manager to keep oil prices relatively high for the benefit of Texas and Texas oil producers—in doing so it helped keep price relatively stable.³³ OPEC is a cartel, but not as effective as it could be, as its members well know. Nonetheless, suppression of competition in the oil market has resulted in decades of price gyrations, mostly on the high side, that cannot be explained in the absence of cartel restrictions that allow oil-producing countries to earn monopoly profits.

The Costs of Monopoly

Private cartels have existed on and off, but are illegal, so we do not know about them unless they are uncovered.³⁴ Members of an industry, knowing there can be harsh punishment for illegal cartel activity, may seek legislative protection rather than risk criminal violations of antitrust laws. Most common within a nation is for producers to obtain tariffs or quotas that restrict competition, the textbook example being the quota on imported sugar. U.S. sugar growers are too high cost to be competitive with low cost producers in the Caribbean and elsewhere, so they sought and received protection in the form of quotas. This forces up sugar prices in the U.S. In 2012, refined sugar was running about double the price paid by European sugar users, creating higher consumer prices and making it difficult for U.S. sugar users, such as candy companies, to be price competitive.³⁵ The loss to consumers is estimated to be approximately two billion dollars a year due to higher prices. That is, the government restrictions on trade effectively created a legal cartel for U.S. sugar growers. The growers capture the benefits; consumers bear the loss.

OPEC is legal because it is a collection of governments seeking to restrain competition (antitrust law is discussed below in this regard). Sovereign entities can engage in anticompetitive activities without fear of antitrust consequences. Governments are exempt from other governments' efforts to legislate their behavior; only when they agree to restrict their behavior through treaties or other agreements are governments bound. This immunity extends to organizations of governments. As the U.S. Court of Appeals for the Ninth Circuit noted in rejecting an antitrust suit brought against OPEC in 1979 in *International Association of Machinists and Aerospace Workers v. OPEC*, 649 F.2d 1354 (9th Cir. 1981) cert. den. 454 U.S. 1163 (1983), OPEC is immune because the governments from which it is constituted are

33 *Id.* at 49.

34 Five elevator companies were fined more than \$1 billion in the European Union for a cartel that rigged that market. The case further litigation from elevator buyers who paid artificially high prices over the years. Europa, Antitrust: Commission welcomes Court judgement in the Elevators and Escalators cases (Press Release), July 13 (2011).

35 Alexandra Wexler, "Sugar Users Want U.S. to Ease Import Curbs," *Wall Street Journal*, April 1, 2012.

immune. Not fearing effective anti-trust litigation, OPEC need not sneak around to manipulate supply or prices; it has headquarters in Vienna and openly discusses some aspect of its activities.

Why do we care if OPEC exercises monopoly power? Economics (and common sense) tells us that monopolies are costly. Robert Pindyck of MIT and Daniel Rubinfeld of University of California, Berkeley, explain, "Because monopoly power results in higher prices and lower quantities produced, we would expect it to make consumers worse off and the firm better off."³⁶ Economically, the concern is not just that extra money is transferred to sellers with monopoly power, but also because of 1) "low productivity"—we get less economic bang for the buck because output per dollar is too low and 2) "misallocation of resources"—the monopoly sellers grab more resources, such as capital, that would otherwise be available to other, more productive parts of the economy.³⁷ This causes what is referred to as a "deadweight loss" to the economy; real economic value has been destroyed and we are a bit poorer.

Let us work through the economic details using a different commodity as an example. The market for corn is competitive—there are lots of buyers and sellers. Assume that all corn is fungible and that the market price one year happens to be \$2.50 a bushel and that 10 billion bushels are sold. Multiply the market price by the quantity sold and you have total expenditures on corn, which is equal to total revenue to the producers.

Even if many corn consumers would have paid more than \$2.50 a bushel, competition among sellers meant that they did not have to pay that much. The difference in how much a demander would pay and how much they do pay is called "consumer surplus." It is one of the gains from a market transaction. Suppose a given corn buyer would have been willing to pay as much as \$4 a bushel. When the price happens to be \$2.50, the demander gets to keep the extra value (the surplus) of \$1.50. That surplus can be used to buy other things.

On the supplier side, in a competitive market, different producers have different costs of production. One low cost producer may only incur a cost of \$0.50 a bushel but gets to sell for \$2.50 along with all other sellers. That seller gets a large "producer surplus"—the difference between the lowest price the producer would take and the market price received. The low-cost producer pockets \$2.00 extra per bushel sold (note that this is not accounting profit, it is the difference between what the producer would be willing to take if no other good alternatives and what the market price happens to be). Other producers have higher costs and get a smaller surplus. At the margin, some producer may have a cost of \$2.50 and receive \$2.50, so that producer captures no surplus. The existence of surpluses on both sides keeps parties participating in the market.

36 B. Douglas Bernheim and Michael D. Whinston, *Microeconomics*, 8th ed., (2013) at 377.

37 James A. Schmitz, Jr., "New and Larger Costs of Monopoly and Tariffs," *The Region*, Federal Reserve Bank of Minneapolis, (2012) at 20.

Now assume the corn market is somehow monopolized and rather than 10 billion bushels, only 7 billion are put on the market. That forces demanders to compete for the smaller supply and forces market price up to, say, \$4.00 a bushel. Now the sellers who are in the market get an extra gain of \$1.50 a bushel sold compared to the gain they happened to receive when the competitive price was \$2.50. They are, of course, happy. Buyers lose much of their surplus—many will still buy some corn, but most buy less because of the higher price. They search for alternatives. They lose some of their consumer surplus—it is a transfer of wealth from buyers to sellers.

Note that this wealth transfer, which most people regard as unfair due to the monopoly enjoyed by the sellers, is considered by economists to be economically neutral. Buyers paid more than they would have in a competitive market, so the sellers get more. It is “just” a wealth transfer, but the money still exists in the economy. We return to this point later.

However, besides the wealth transfer, there is, economically, something more. The failure to produce the competitive level of output of 10 billion bushels of corn, and to restrict the supply to 7 billion bushels, means less was produced, which is economically efficient given the values revealed in a competitive market by the voluntary actions of suppliers and demanders when in competition. The under production causes what is called a “deadweight loss.” The economy has suffered a pure economic loss as resources have been devoted to other products and activities that are, by definition, less desired because demanders were forced in the monopolized market to buy less (due to the higher price) despite the fact that suppliers would have willingly produced more in the absence of monopolization. The value of production lost is greater than the cost of the level of production that would occur in a competitive market, so it is a pure loss to the economy—and one that cannot be recovered, although it could be eliminated in the future if such losses no longer occurred.³⁸

When a monopoly exists, extra profits called “rents” are created. In the case of OPEC, the fact that so much money is up for grabs causes conflict. “[T]he distribution of these rents—splitting the spoils—causes conflict.”³⁹ That is, in the race to grab the gold, members of a cartel can get greedy and cheat on the cartel by selling more than their quota, thereby causing price to fall. OPEC has a long history of such. Sometimes the cartel works well, other times the incentives to get revenues today overcome pure economic sense: “OPEC members were ... unable in 1982 to agree on either a production or price strategy that would best serve their interest”.⁴⁰ OPEC has never completely solved the problem, but in most years it has been successful enough to keep price artificially high (above the competitive level) and, thereby, transfer resources (economic rents) to OPEC nations, allowing them to earn hundreds of billions in extra income. How much extra income comes from the United States is discussed below.

38 This discussion is drawn from B. Douglas Bernheim of Stanford University and Michael D. Whinston of Northwestern University, from their book *Microeconomics*, McGraw-Hill (2008) at 526-27: 636.

39 Schmitz (2012) at 22.

40 Amuzwegar (2001) at 35.

Elasticity of Demand

A cartel is not likely to be successful if the product does not have market power. Corner the market on paper clips and it may not do much good—we can use staples instead. Because of oil's key role in the economy and its characteristics that make it particularly well suited to the production of transportation fuels, oil has few ready substitutes. When the price of gasoline goes up, we still have to get to work and need food at the store, so we need gasoline and diesel in the absence of good, available substitutes. We do not abandon cars and trucks in favor of bicycles and hand-pulled carts. We can conserve some, but large-scale change is difficult. That means the price elasticity of demand for oil is relatively low (inelastic), especially in the “short run.”

Elasticity refers to the relationship between two variables. How much does one variable respond to a change in another variable? The term elasticity has a particular meaning in economics. The focus is on the impact of a change in a price. If the price of a good rises ten percent, holding other relevant factors in a market constant, how much does the quantity demanded go down? We know quantity demanded will go down (the law of demand), but it may not go down very much if it is relatively inelastic.

Most goods are price inelastic in the short run. That is, if the price of beef goes up ten percent, consumption in the market may decline by, say, five percent—if the percent decline in sales is less than the percent increase in price, then we say it is price inelastic. Over time, elasticity tends to rise as buyers search out more cost-effective alternatives and move to other goods. In the case of beef, when price goes up, people eat less beef and switch consumption to ready substitutes such as pork and chicken.

Another measure of elasticity is income elasticity. That is, if average income rises by, say, five percent, how much does demand for a good change? For most goods, demand rises—people have more money, they spend more money.

Oil is known to be price inelastic. If the price of oil goes up, so does the price of fuel, the main use of oil. We may cut back driving a bit, but few people stop driving in favor of walking, riding bikes, or carpooling. Demand for oil is more inelastic in the short run because of the scale of the investments necessary to adjust to a desire to consume less. Higher oil prices may mean you buy a higher mileage car for your next purchase, but if you just bought a new SUV it may be several years before you are able to do so. Similarly, trucking companies do not abandon their fleets in favor of trucks that get a bit better mileage due to higher diesel costs. Capital costs are high and, as we have experienced before, oil prices fluctuate so investment in costly equipment that is more fuel efficient may not turn out to be a wise decision after the fact.

This inelasticity lessens over time as buyers adjust to higher prices when they think the higher prices are here to stay. Some buy more fuel-efficient vehicles. Some move closer to where they work. But demand is still relatively inelastic even after several years as there are no good substitutes for much of our transportation system. Trains are not going to go back to burning

coal (natural gas does not work well in such engines) and airplanes need jet fuel. In addition, much of our built infrastructure is slow to change—cities are rebuilt slowly over many decades. As a result, major changes in lifestyle—such as shifting population from suburban single family homes to urban high density apartments—is something likely to happen over quite long periods, if at all.

Yale economist Paul MacAvoy, a former member of President Ford's Council of Economic Advisers, estimated that short run price elasticity of oil was about -0.1, meaning that a ten percent price increase results in only a one percent decline in quantity demanded. In the longer term, meaning two or three years later, elasticity would rise to around -0.15 to -0.5, which is still low.⁴¹ Such low elasticity in the long run is unusual. Most goods have much larger increases in price elasticity over time, but substitutes for oil are not as easy to produce as with many other goods. MacAvoy's estimates are consistent with many other studies. They are briefly summarized in the literature review that follows, at the end of the economics section, under the title "Elasticity."

The demand for oil rises as income rises (called income elasticity of demand). Wealthier people use more transportation services—hence the explosion in the demand for cars in China as hundreds of millions have moved into the middle class and want to enjoy the fun of their own car—which means more gasoline. When China was poor, it exported some of the tiny amount of oil it produced. Now it must import oil as rising wealth means more energy consumption, including of oil. Over the years, as nations have become more wealthy, the demand for petroleum has risen, especially in the fast-growing nations in Asia.

That matters because it means oil suppliers are in an enviable position. If price goes up, the quantity demanded does not fall much, and revenues to sellers rise. That is not the case for goods that have relatively elastic demand. If Hewlett Packard tries to hike the price of its laptops or printers to earn higher profits, customers flee to Dell, Apple, Epson, and other suppliers. The demand for Hewlett Packard products is price elastic. If Shell tries to raise the price of retail gasoline, customers can easily go down the street to Fina or Valero. The demand for Shell-brand gasoline is highly price elastic because of the many substitute brands. But if crude oil goes up in price, much of the increase (which goes to the owners of oil, not the processors such as Shell), buyers see higher prices at all gas stations, and people do not see cost-effective alternatives.

In sum, what happens when the price of oil jumps? Since it is mostly used for transportation, the price of transporting people and goods rise. Airplane tickets go up in price, so fewer people fly. Gasoline goes up in price, so people cut back on driving a bit. But the total reduction is small relative to the increase in price. The average household devotes a larger share of spending on gasoline, which means other things have to go. For some people, this means cutting back on "frills" such as restaurant meals and other of life's niceties; for others it can mean serious lifestyle changes. When the price of oil goes up, besides a marginal

41 Paul W. MacAvoy, *Crude Oil Prices: As Determined by OPEC and Market Fundamentals*, Ballinger (1982) at 28.

reduction in use, there is more effort put into energy efficiency, such as designing engines to get more miles per gallon and such, so we get the benefits of oil without using as much. Over time, such actions matter more than they do in the short run, but still demand is relatively inelastic as the cost of change is high.

Cost of OPEC Action

As discussed, cartelization of a market, and thereby the introduction of monopoly, inflicts costs on consumers and the economy in general due to a loss of economic efficiency. The consensus of the scholarly literature is that OPEC has been a clumsy cartel—effective sometimes, not effective other times—in terms of its ability to produce above-competitive prices. How big has that cost been in the oil market? It is difficult to pinpoint exactly, but is clearly large, as consumers know when they see the price of gasoline jump.

One way to see the impact of cartelization on individual Americans is to consider gasoline prices in the context of family budgets. When gasoline was about \$1.40 a gallon in 2002, the average family spent \$1,235 on gas and oil, which was 3.036% of total family expenditures.⁴² By 2007, when gasoline averaged about \$2.80 a gallon, the average family spent \$2,384 on gasoline, which was 4.803% of total household expenditures. The Consumer Price Index rose 15.25% from 2002 to 2007. If we increase gas and oil prices at the same rate as the overall CPI, then annual expenditures on gasoline in 2007 would have been \$1,423, which is \$960 per year less per household than was actually spent. In 2007 there were 120 million households, so a reasonable estimate of the cost of OPEC is that the cartel's efforts cost American consumers \$115 billion in that one year alone. Assuming the price of oil was close to the competitive level in 2002, the \$115 billion represents a transfer from consumers to oil and gasoline sellers that can be attributed to the cartelization of petroleum. This is a floor to the true cost, as that sum does not include extra expenditures by airlines, the military, trucking fleets, and other large petroleum users.

The total cost to the U.S. economy of monopolistically-priced oil has been estimated to be more than \$500 billion for the year 2008.⁴³ In the years when the price of oil is “low”—that is when OPEC is less effective and competition had broken out—the cost is smaller, but when OPEC is successful in restricting output and pushing the price of oil up, the cost is considerable. Moreover, most of the extra half-trillion dollar in cost to American oil users was a transfer of consumer surplus to producers—money going from consumers to producers that would not be paid if not for pricing above the competitive level. Thus the transfer is from American consumers to the recipients of oil producer nations' revenue. In many cases this means Americans were paying for OPEC welfare state benefits. The half-trillion dollar estimate appears to be on the high side, but it is in the ballpark for a year when the price of oil is exceptionally high.

42 In 2002, oil was in the \$25-30 a barrel range; in 2007 it began at about \$60 and went up to about \$90 a barrel. Price data from Bureau of Labor Statistics.

43 David L. Green, “Measuring Energy Security,” *Energy Policy* (2010) at 1617.

The calculation is complicated by our inability to confidently estimate the price of oil in the absence of OPEC. However, we can make a conservative estimate that at least provides a ballpark figure.⁴⁴ The International Energy Agency (IEA) estimates that the breakeven cost of oil production (as of 2011) was at most \$40 a barrel.⁴⁵ For low cost producers in the Middle East the breakeven cost (which includes the total cost of developing and producing oil, but not taxes and profits) is \$10 or less. For the high-cost “super majors” such as Shell Oil, which is taking on difficult projects in the Arctic, the breakeven cost is about \$40. The “commercially attractive” price for the super majors operating in the highest cost places to develop new oil, such as the United States, is estimated to be around \$75 a barrel. High-cost locations such as the Canadian tar sands and the Arctic might not be developed if the biggest low-cost oil producers, such as Saudi Arabia and Russia, were to consistently sell at competitive prices. The low-cost countries could still earn high profits, but such prices would not be enough to induce huge investments by private companies in high-cost developments.

The average price of a barrel of oil in 2011 was a bit over \$90.⁴⁶ Taking the IEA’s breakeven cost of \$40 a barrel as likely profitable for all producers, then one can impute a \$50 a barrel transfer payment, which is about a third of a trillion dollars since the U.S. consumed a little less than seven billion barrels.⁴⁷ The GDP of the United States was a bit under \$15 trillion in 2011, so the oil premium equals about 2.3 percent of GDP. This cost has been higher some years and lower in years when oil price is more competitive.

Note that the oil companies usually do not pay the low price—they either pay spot market prices or, if producing for a government, they must pay royalties and other fees to supplier nations that consume the money above production cost (which is as low as \$10 a barrel in countries such as Saudi Arabia). Low cost producers such as Saudi Arabia would capture a huge premium even in a competitive market. Such countries simply capture a larger premium when the world price is artificially high. If we presume oil could have been \$40 a barrel, rather than \$90, then the \$50 premium was paid. Consumption in the U.S. averaged 18.4 million barrels a day or 6.7 billion barrels in 2011, then the premium paid was \$335 billion. Indeed, going back to the earlier chart that showed nominal and current dollar crude oil prices throughout history, we see the price consistently (in current dollar terms) below \$40 until OPEC first became effective in the early 1970s. Since then there have been spikes up to \$100 and lows under \$20. From 1984 to 2004, the price of crude oil was generally under \$40. There is no reason to believe that the spike in oil since that time is significantly different than the spike from 1973 to 1984, when the price was above \$40. It is not due to a physical limit on the amount of oil or the increased demand in China; oil use has grown at a relatively constant rate over the decades. There is no restriction on supply to meet the growing demand of a growing world.

44 We would like to be more precise, but there are serious data limitations and strong assumptions that must be made to justify any calculation. We accept price estimates from reliable experts such as the International Energy Agency but use the high end of their estimates in order to be conservative.

45 IEA, *World Energy Outlook* (2011) at 140. Other data are consistent with this estimate.

46 EIA, *Petroleum and Other Liquids, This Week in Petroleum*, Crude Oil Production.

47 EIA, *Countries, Overview*, Oil Consumption.

Globally, the oil price premium is not as economically destructive as it is in the U.S. and other oil consuming nations—it is a wealth loss to U.S. consumers in favor of OPEC nations in particular that enjoy the extra cash. That is, U.S. oil buyers lose much of their consumer surplus and the producer surplus captured by the oil producers is higher. Ordinarily, while economists do not “like” monopolies, the transfer of the surplus is considered to be economically neutral. The money is still there; it is just in different hands than would be the case in a competitive market. In the case of oil, however, much of the surplus leaves the consuming country. It goes to producers in Venezuela, Saudi Arabia, and other countries. This makes the transfer more costly to the domestic economy, as those funds cannot be devoted to other purchases that holders of those funds inside the United States might have enjoyed. That is, if the surplus transfer from demanders to suppliers were entirely domestic, then the net economic cost to the U.S. economy of high-priced oil would be less than when that transfer is to foreign nations. Some of the funds return to the United States via purchases of goods and services, but likely only a fraction of the total.

As a thought experiment, suppose the price of oil was high because big American oil companies got together in a cartel and rigged the market in the United States. Then Exxon Mobil, Chevron, and others would rake in the profits from high prices. Wealth would be transferred from oil buyers to oil sellers. Oil buyers would not like it, but American firms would capture much of the wealth (the surplus), so stock prices would rise and benefit many people in the United States who owned oil stocks (and the government from higher tax revenue on profits, dividends earned by stockholders, and capital gains realized by those who sold their stocks). There is redistribution of wealth, but not loss of wealth. However, when the extra revenue from abnormally high prices flows to foreign nations, there is little or no domestic benefit captured by domestic firms and their owners. The additional revenues flow to foreign governments via their national oil companies. It is a genuine wealth transfer. The world economy is roughly the same size, but the American economy is smaller.

As noted previously, when monopoly pricing exists and demanders pay above-competitive prices, besides the wealth transfer there are also pure economic losses called, appropriately, deadweight losses. Monopoly prices cause disruptions as people and companies scramble to adjust to the jump in oil prices. Firms rearrange production and consumers adjust consumption in response to price shocks. Products that would have been purchased at competitive prices are not and resources move. Some production that would have occurred when lower cost inputs existed (oil in this case) does not. These changes are costly, especially when there is uncertainty. Will prices stay high forever or temporarily? What kinds of capital changes should be made based on current price changes?

Consider the airline and trucking industries that buy petroleum products to move their fleets. If the price of diesel and aviation fuel doubles, the firms are often caught by surprise and suffer losses. While it is true that the higher fuel costs get “passed on” to customers, that does not happen immediately and losses may be suffered. When airline ticket prices go up and trucking delivery costs rise, fewer airline tickets are sold as some people forego travel or decide to go by car and the cost of delivering goods rise, so customers devise ways to use less delivery

services.⁴⁸ Airlines cannot simply pass on all cost increases, as the demand for flights is not completely inelastic. They eat some of the higher cost but, having to raise prices, sell fewer tickets than they would have with lower operating costs. The result is that routes may become unprofitable and service be reduced. gyrations in the price of aviation fuel are one factor contributing to the constant financial problems faced by firms in the industry.

The process of change is costly, especially since firms have no idea if fuel costs will continue to rise, may fall next year, or what will happen. Should permanent changes in the scale of organizations be made, such as cutting back the size of the airline due to fewer customers at higher prices? Should costly new equipment be purchased that will help shave fuel costs?

Such economic costs are inefficient as they are expenditures and decisions that would not otherwise have been made. This is an economic loss that cannot be recovered; the economy is poorer. Greene and others estimate the annual cost of this due to OPEC impact on oil may run as much as a half-trillion dollars a year.⁴⁹ We cannot disagree. The number may be larger or smaller, but it is huge and has reoccurred on and off for 40 years as OPEC has progressed by fits and starts attempting to cartelize oil.

Does Antitrust Law Matter?

Wealth transfers due to the monopoly, as well as the costs of economic dislocation due to monopoly pricing, are kept under control by competition. Putting on our lawyer hats, we consider the notion of a legal solution to the problem of monopoly. The purpose of antitrust law is to provide a remedy for those who suffer economic losses as well as punish illegal monopolists (those protected by law are a different matter). Cartels created by competitors who seek to rig a market are illegal.

While some members of Congress have blustered about applying antitrust law to OPEC nations, that is unrealistic. Sovereign entities can ignore statutes and court rulings of other nations, especially those directed at nations themselves. That is, even if federal courts in the U.S. were to declare, say, Saudi Arabia to be in violation of the Sherman Antitrust Act, it would, obviously, ignore the ruling. The Sherman Antitrust Act does not apply to sovereigns. Even if the United States attempted to apply its domestic antitrust law to a foreign government, such efforts would be unenforceable in the absence of a treaty or other agreement allowing it to do so. Such talk is hollow. While there is no doubt that if private oil companies engaged in this behavior that they would be hauled into the halls of justice, that will not happen in the case of a cartel composed of sovereign nations. Nations may conspire to reduce supply and run up prices in an effort to earn high profits.

48 The rising price of oil from 2002 to 2007 meant that airline spending on fuel rose from a bit under \$12 billion to \$38.6 billion, almost a tripling of cost (discounting for inflation); see Bureau of Transportation Statistics, Research and Innovative Technology Administration, *Airline Fuel Costs and Consumption*, January 2000-January 2013.

49 David L. Greene, "Measuring Energy Security," *Energy Policy* (2010) at 1617

Conclusion

This paper reviewed decades of research exploring the question: how competitive are global oil markets? Much of that work is summarized in the following appendix. We found that the issue has witnessed significant discussion over the past four decades, starting with the oil price hikes of the early 1970s. The collective conclusion of hundreds of studies is that the OPEC cartel has utilized its ability to force oil prices substantially above competitive levels. Conversely, oil companies operate under competitive conditions, as no one private firm has more than a trivial share of the oil market. Most oil is under the control of governments (particularly the governments of OPEC member nations) through national oil companies. Such governments have strong incentives to attempt to restrict oil supply to force up prices and to maximize their revenues. Their ability to accomplish this varies over time with changes in political and economic factors. As a result, over the years we have seen oil prices rise and fall dramatically.

Oil suppliers do not like “low” oil prices set through a competitive market; despite this, competition breaks out at various times that are not easy to predict, just as the success of efforts to enforce price hikes are not always predictable. When they are high for sustained periods, it is evidence of the ability of OPEC to restrain supply sufficiently to force price up. These price gyrations impose transition costs on firms and consumers forced to respond to price changes. The costs of adjustment do not appear to have been quantified by researchers, but are undoubtedly significant. The cost of price spikes is primarily borne by oil buyers who pay high prices for fuel, thereby transferring substantial wealth to foreign sovereigns.

Appendix

THE SCHOLARLY LITERATURE ON THE OIL MARKET

Over the years, a good bit has been written about the oil market. Many analysts, from economics and other disciplines, have considered the matter, and it is now to that literature that we turn. Review of these papers has provided a sense of the results of many independent researchers. The review is chronological by category, as papers tend to build upon, or are written with knowledge of, existing works.

To review decades of work we were assisted by a team of a half-dozen graduate students and a professional librarian who collected the hundreds of documents and articles about the oil industry (a statement of the search methods he used is provided below before the summaries). The instruction we provided to each team member was to find scholarly articles and documents that concerned all aspects of the competitive nature of the oil market. More articles were collected and reviewed than are reported here, as we reviewed all work provided by our research assistants and only included reviews of papers pertinent to the issues addressed in this report. We revised each review that is included in this report to ensure consistency in focus and style.

We have not discriminated against publications or authors based on academic reputation; we report all relevant articles that are on point and were uncovered by our research team. For those not familiar with economics journals, note that some journals are much more respected than others. The *American Economic Review* and the *Review of Economics and Statistics*, for example, are highly regarded. Some other journals that appear here are not so esteemed, but the articles still represent the scholarly work of the investigators, and served as part of our review in an effort to present an inclusive conversation.

The following pages below give short summaries of relevant points about restrictions against competition in the oil market that are made in the articles cited. The overwhelming consensus of the literature is that for 40 years OPEC has been the dominant force limiting competition in the petroleum market. Its effectiveness waxes and wanes, but there is little question but that it is effective in forcing up oil prices in periodic episodes. A few writers, mostly publishing in less-quality journals, or who are employed by OPEC, assert that OPEC does not act as a monopolist. They place the blame on oil companies, oil speculators, or no one at all if they think the market fully competitive, but such views are in the clear minority. Economic logic, direct evidence of OPEC agreements, and empirical evidence of the results of OPEC actions lead to the clear conclusion that the oil market has been constrained from acting in a competitive manner.

SUMMARY OF MATERIALS ON COMPETITION IN OIL MARKETS

Research Methodology Used to Identify Materials

The process by which articles were identified was as follows. A professional research librarian began with a search of a university article database. Common searches would include articles that contain words like oil in the title, oil and consumption in the title, oil and prices in the title, oil and production in the title, petroleum and prices in the title, petroleum and consumption in the title, oil petroleum and consumption in the title, OPEC and prices in the title, OPEC and consumption in the title, OPEC and production in the title, etc. Other searches focused on subject headings (Oil prices, oil consumption, petroleum production, etc.). These searches were limited to scholarly journals/articles written post-1945. Variations of these searches were used throughout the project.

In addition, the searches were also run in several other databases, with a focus on business, economics, and science: ABI-Inform, Business Source Premier, JSTOR, and Science Direct. The searches themselves focused on terms similar to those used on SCOUT. JSTOR and Science Direct were the most fruitful in terms of providing articles and also in providing direction for other searches. (Science Direct prompts the researcher with lots of related materials. An article that appears on JSTOR will also have some information about citing materials, which occasionally leads to other relevant materials).

Once the journals that tended to provide many relevant articles were identified (e.g., *Energy*, *Energy Economics*, *Energy Policy*, *Foreign Affairs*, etc.), multiple searches that were limited to the journal were added. These searches were significantly broader (e.g., all articles with OPEC or oil in the title) than the ones ran across the large databases.

For articles that seemed particularly pertinent or that were authored by name writers (a sense of the latter developed over the course of the research), the article's bibliography was reviewed. This technique was particularly useful later in the research, as it allowed development of new leads and a check of the thoroughness of the work.

To find working papers or position papers, several different sorts of searches were run on the internet. One Google search was limited to .pdf documents that might contain words like oil or petroleum in the title. If a search of this ilk was fruitful, the website where the fruitful document appeared was searched for additional material. E.g., if the original broad Google search retrieved a working paper from the Oxford Institute of Energy Studies, then the website of the Oxford Institute of Energy Studies was searched for additional materials. (This technique proved useful). Many of the working papers have extensive bibliographies, which—as noted earlier—proved a good source of information.

For congressional materials, an initial search across the ProQuest database, which indexes congressional documents, including hearings, reports, and CRS reports, was supplemented by running a search within the government printing office's database. A further step involved running multiple Google searches for Congressional Research Service reports. Westlaw's JLR databases were searched for relevant law review articles.

Near the end of the research, a search for online CVs or bibliographies for prolific authors (e.g., Derek Gately, Morris Adelman, J.D. Hamilton) ensured that no key works were missed. A new search was also done on JSTOR on the names of the most prominent authors.

The hundreds of articles provided by this search were placed into a cloud-based file server and then reviewed by six graduate research assistants who were told to focus on issues relating to competitiveness in the oil industry. Many articles mentioning the search terms provided no analysis of that issue. Articles that provided an analysis or opinion about competitiveness were summarized, and the summaries put in the server file. Those summaries were reviewed by us and then condensed into the article summaries provided here that focus on competitiveness issues. Every relevant article is included here, although some were little more than off-the-cuff opinions by the author about competitiveness in the oil industry. Most articles are from economics journals; others were scattered in journals on other subjects. Some Congressional hearings are also included below. Nothing was excluded if it addressed competitiveness. Our conclusion about the state of the literature was provided previously in the narrative above. This allows us to provide a non-statistical meta-analysis that draws on years of independent scholarship and reporting.

ECONOMIC ARTICLES ABOUT THE GLOBAL OIL MARKET

Levy, W.J. "The Past, Present, and Likely Future Price Structure for the International Oil Trade." Paper presented at the Third World Petroleum Congress, The Hague, the Netherlands, May 28–June 6, 1951.

The author discusses several major potential changes to the price structure for crude oil. First, that in the future, U.S. oil prices will still influence the international market, but less so than currently; second, Middle Eastern pipelines will shift pricing from a Persian to a Mediterranean basis; third, Middle Eastern and European product prices will become independent of U.S. Gulf quotes; and finally, that Caribbean prices will be determined by competition with other Caribbean and Middle Eastern crude oil. "During the period of transition from the old to the new supply pattern there will be confusion and conflict, but competitive forces are likely to result ultimately in a price structure that will resemble closely the one described here. Such a price structure would assure the world abundant supplies of oil at a reasonable price" (126).

Leeman, W.A. "Crude Oil Prices in the United States at the Gulf Coast." *The Journal of Industrial Economics* 5 (1957): 180–191.

This paper shows that until 1957, the supply side of the crude oil market in the U.S. had some characteristics of oligopoly because of the intervention of states in regulating oil production. Despite these state controls, there was no formal collusion among the producers. In addition, there were no formal barriers to entry for new crude oil suppliers, nor were there any restrictions of production in the Middle East. Therefore, the paper concludes that the degree of power of the main producers' states was limited to the short-term. Moreover, the companies that buy and process the crude oil had no degree of price control on the demand side of the crude oil market.

Manes, R.P. "Import Quotas, Prices, and Profits in the Oil Industry." *Southern Economic Journal* 30 (1963): 13–24.

In the 1930s, the U.S. oil industry was very competitive. However, since the late 1950s, the U.S. industry has been surrounded by regulations, mainly on the supply side, with restrictions on foreign oil imports. In the 1950s, all foreign oil available for import to the United States was produced by seven major oil firms, five of which were American.

Adelman, M.A. "Oil Price in the Long Run (1963–75)." *The Journal of Business* 37 (1964): 143–161.

This paper analyzes the fundamentals that drive oil prices and utilizes these to forecast the path of oil prices from 1963 to 1975. The author quotes a Shell report in saying that "competition in [world oil] is massive rather than hysterical." This competition had, since 1957, been responsible for the fall in crude oil and refined product prices. Lower oil prices existed when this paper was written because one could easily have drilled wells to install larger producing capacity at a cost not much higher, if at all, than the contemporary one. The situation would not change through 1975, despite the great increase foreseen in consumption. Hence, if refineries' capacity to process oil continued to increase and if crude oil prices did not change, the price of refined oil products would decrease sharply until 1975.

Dixon, D.F. "The Growth of Competition among the Standard Oil Companies in the United States, 1911–1961." *Business History* 9 (1967): 1–29.

After the 1911 dissolution of the Standard Oil Company, each of its successor companies had to focus on its regional operations, but each acted in a way that indicated that they faced little fear of competitive response from nearby sibling companies. Following World War I, expansion took place as companies sought to become more integrated. In the 1920s, surplus crude required new markets for sales, which led to mergers, acquisitions, and company expansions. Following World War II, some of the Standard Oil successor companies made pushes toward involvement in the U.S. national market. Income shares from their original areas dropped for almost all of these companies (although they largely maintained their ranks as the top regional producer) and their share of the market, as a whole and individually, fell as well. This pattern indicated increased levels of competition between Standard companies and non-Standard companies, as well as among Standard companies.

Jensen, J.E. "Crude Oil: Capacity, Supply Schedule, and Imports Policy." *Land Economics* 43 (1967): 384–392.

The paper surveys U.S. policy for crude oil. Since 1959, the U.S. government severely restricted imports of foreign crude oil by imposing mandatory import quotas. These restrictions were imposed for national security purposes and to encourage development of new domestic reserves. In practice, wildcat well completions declined by one-third of their previous amount, and development drilling diminished by one-quarter its previous rate once the restrictions were in place. Specialists believed that U.S. crude oil capacity would reach its peak around 1975–1980. This author points out that if the U.S. had a free market for crude oil during this time, more oil would have been produced at \$2.00 per barrel than the amount that was produced at \$2.90 per barrel.

Further, in a situation free of market pro-rationing, the lower price would have frozen out the more inefficient oil producers while the best producers would have increased their flow.

It is therefore ironic that the domestic oil industry appears to be entering a decline in terms of exploration and reserves, despite the incentive of crude import restrictions. The crude oil import restrictions were planned to subsidize development of a synthetic oil industry. A free market for crude oil in the U.S. would have conserved existing domestic reserves, lowered the cost of energy, allowed for better international relations with Caribbean and Middle Eastern countries, and preserved U.S. crude reserves longer, since the U.S. would be using more foreign crude oil.

Heitmann, G. "United States Oil Import Quotas and the Price of Foreign Oil." *The Journal of Industrial Economics* 21 (1973): 266–271.

This paper offers an analysis of a report by Charles River Associates (CRA) that investigated whether U.S. tariffs on foreign oil are good for the U.S. economy. The author examines a scenario where the U.S. decreases the barrier for the entry of foreign oil into the domestic market. What would the Organization of the Petroleum Exporting Countries do in this situation: increase or decrease oil prices?

The CRA report claims that the demand for OPEC oil slopes downward; at lower prices, OPEC will sell more oil. If there is an increase in the demand (i.e. a shift to the right in the demand curve), and if the cost to produce one additional unit of oil (i.e. the marginal cost) is constant, then a rise in OPEC oil prices will be profitable only if the new demand curve is less elastic than the previous one. The author also points out that the elasticity of the new demand curve for OPEC oil is the weighted average of both the U.S.'s demand elasticity for imports and the rest of the world's demand elasticity for oil.

Since the U.S.'s elasticity of demand for imports is greater than that of European countries, the new demand curve for oil will be more elastic. Therefore, if the U.S. decreases tariffs on OPEC oil, then OPEC would not find it more profitable to raise its oil prices.

The author concludes that if the U.S. decreases tariff barriers to foreign oil, then OPEC would benefit from increasing its oil prices. This conclusion is contrary to the CRA report's findings. Heitmann considers OPEC to be a monopolistic organization and argues here that the new demand curve would be more inelastic than the previous one.

Norr, D. "Some Elements of Oil Profitability." *Financial Analysts Journal* 29 (1973): 58–66

This paper traces the generation of profits from the production of a typical barrel of oil, Arabian light crude, including its transportation to northern Europe, its refining, and then its sale in wholesale markets. The estimated average cost per barrel is \$1.70 (production costs = \$0.10, royalties = \$0.343, and tax = \$1.26 per barrel). On average, a typical company has a profit of \$0.75 per barrel when the sale price is equal to \$2.472 per barrel. The refining cost estimated here ranges from \$0.10 to \$0.15 per barrel.

Amuzegar, J. "The Oil Story: Facts, Fiction and Fair Play." *Foreign Affairs* 51 (1973): 676–689.

The paper is written by a Finance Minister in the Iranian government under the Shah. He examines the contemporary oil crisis through analysis of four major issues: 1) oil shortage in the U.S. and in other industrialized countries; 2) the alliance of major oil companies with OPEC member countries; 3) an increase in the amount of redistribution of the oil revenues for the producing countries, which may concentrate power over the oil supply in the future; and 4) the reaction of the oil-shortage countries to the OPEC countries.

Amuzegar argues that oil suppliers are not a cause of the oil shortage problem. The cause is instead that the demand for energy is increasing much faster than the supply. The supply of natural gas and crude oil failed to increase at the same rate of energy demand because the incentives for production have been weak. This lack of incentive is due, in part, to policies of the industrial world that keep premium energy prices below their true costs. On the supply side, 63 percent of the world's petroleum reserves are located in OPEC member countries, especially those in the Persian Gulf, 6 percent are located in the U.S., and 15 percent are in socialist nations. On the demand side, the U.S. consumes 33 percent of all oil produced, and it imports approximately 30 percent of its needs; European countries import approximately 90 percent of their needs; Japan imports virtually all of the oil that it consumes; and Russia and China are currently self-sufficient in energy requirements but may become oil importers in the future.

Average production costs of a crude oil barrel between 1946 and 1972 were as follows: \$0.10 in Middle Eastern countries, \$0.51 in Venezuela, \$0.82 in Indonesia, \$1.31 in the U.S., and \$0.80 in the U.S.S.R.

Another aspect of the present energy "shortage" is due to the inefficient use of oil. The relatively cheap price of oil creates an idea that there is an infinite supply of oil. Consequently, industrial countries used this energy inefficiently. The author argues that cheap oil is the main reason for the shortage of oil. The artificially low price discouraged oil producers from searching effectively for new sources of supply, which helped keep the prices of substitutes low and likewise dampened development prospects despite their huge reserves; helped to postpone research in more efficient technology in the use of nonconventional sources of energy; and helped increase the wasteful and inefficient usage of world premium fuels.

OPEC was originally organized by Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela in 1960 in response to the action of the major oil companies to reduce the posted price of oil. Later, Algeria, Indonesia, Libya, Nigeria, Qatar, and the United Arab Emirates joined OPEC. Since its beginning, OPEC tried to fight for higher oil prices, but it took a decade for OPEC to really get some successful changes in oil prices. The author argues that despite the fact that

OPEC is a “sheep in a wolf’s clothes,” OPEC’s fight for an increase in oil prices was a “blessing for the long-term interest of all mankind.”

The rise in oil prices does not reflect an oligopoly market. Even in a competitive framework prices could go up, for “every smart seller, mindful of the reactions of his rivals, will find it ultimately suicidal to undercut prices. Not to grant OPEC leaders this much instinctive sagacity would be the height of incredulity, if not the down the prejudice.” The best alternative would be international cooperation among the supplier and consumer countries.

OPEC members fall into three categories: (1) Those who are net debtors and expect to remain in this situation because their rising oil revenues will still fall short of their capital needs for domestic economic development—Iran, Nigeria, Venezuela, Iraq, Indonesia, and Algeria. (2) Those who maybe net creditors now, but whose annual oil production is expected to remain at about the present level, and whose future annual receipts will not increase except for possibly higher oil prices and inflation—Kuwait and Libya. (3) Those whose production and incomes are destined to rise, but whose domestic investment opportunities are not likely to absorb their total foreign exchange rate—Saudi Arabia, United Arab Emirates, and Qatar.

Consumers have not been victims of a cartel of oil producers. Rather, they have been victims of their own governments and the false belief that there is no end for the supply of cheap oil.

Adelman, M.A. “Politics, Economics, and World Oil.” *The American Economic Review* 64 (1974): 58–67.

Oil scarcity is a pressure of oil demand on the oil supply. The true measure of oil scarcity is the long-run marginal cost of oil production, which is represented by the return required to compensate investors for the cost of developing additional capacity to produce oil. An increase in anticipated costs leads to a delay of capacity developments; the result is more intensive work on existing deposits. This more intensive work leads to higher costs, and consequently higher prices. Stable marginal costs indicate a no scarcity situation—the case actually argued by Adelman.

During 1972–73, the relationship between supply and demand fluctuated with occasional excess supply. Buyers experienced little downside risk because when oil-producing countries delivered oil at a contract prices, buyers were guaranteed speculative gains, and when oil was delivered at the expected higher prices very little was lost. OPEC countries pointed to rising oil delivery contract prices to justify a rise in tax rates. In doing so, OPEC created a “tax floor” that validated rising oil price expectations.

In this article, Adelman argues that what matters is the power to raise the price of oil close to the cost of expensive substitutes. “Monopoly means control of supply, hence the power to place a stop on supply.” The keys to control were threats by the oil producers and collaboration by the oil-consuming nations. Saudi Arabia and other producers limited their oil revenues to what they ‘needed.’ They held back oil output to maintain a monopoly optimum—the point that maximizes the present worth of their assets.

The cutback at its maximum amounted to 4.7 millions of barrels per day, or about 14 percent of oil moving in international trade. The U.S. lost about 450 thousands of barrels daily, or approximately 7 percent of imports (2.44 percent of its total domestic oil supply). The place most vulnerable to the oil supply cutback was the U.S. east coast. As a result of U.S. dependence on oil, in 1974, cartel customers paid out well over \$100 billion to the OPEC countries; as those nations become richer, the oil supply becomes less reliable.

Kennedy, M. “An Economic Model of the World Oil Market.” *The Bell Journal of Economics and Management Science* 5 (1974): 540–577.

This paper takes a quantitative rather than qualitative approach to forecasting world oil prices. By using a six-region, five-product model, the author predicts that the price hikes of 1973 will not persist into the future, and that the export duty imposed by Persian Gulf producers will fall to half of its 1973 level by 1980 as other OPEC and non-OPEC producers and consumers react to prices.

Levy, W.J. “World Oil Cooperation or International Chaos.” *Foreign Affairs* 52 (1974): 690–713.

The control of oil resources has shifted such that importers act in complaisance with regard to the actions of producers. The author discusses the possibility of oil-consuming nations cooperating to counter the cooperation of producers (OPEC) as a way to confront the problems of oil supply and finance, but he is not optimistic. Oil prices

are set in an economic framework, but political and other factors play a large role. Prices are set by the cartel because competitive prices would be far too low (bounded by costs of production) to provide any incentive for investment in alternative energy.

Adelman, M.A. "Population Growth and Oil Resources." *The Quarterly Journal of Economics* 89 (1975): 271–275.

The events of 1970 and 1971 opened up a new chapter in economic history—"a cartel or shared monopoly of a group of sovereign states. Such a monopoly is not subject to any kind of national or international control." OPEC is the vehicle used by individual nations to pursue their own advantages in the oil market. Current high prices will not last as competition among members will break out. "Economic growth will not be constrained by lack of oil" since it is not in short supply.

Farmanfarmaian, K. et al. "How Can the World Afford OPEC Oil?" *Foreign Affairs* 53 (1975): 201–222

OPEC countries meet with each other to regulate production. In this paper the author predicts that OPEC will break down due to competition of its members over a shrinking market and declining oil prices. OPEC must significantly lower the price of oil in order to reduce the unsustainable trade deficit incurred by oil-importing countries and to keep their economic growth healthy. Therefore, OPEC countries must also reinvest the proceeds from the sale of their oil in productive investments in the oil-importing countries, or the latter will suffer a slowdown in economic growth due to lack of capital goods.

Jamieson, J.K. "The Oil Industry: Prices, Profits, and Taxes." Paper presented at the American Bankers Association 56th National Trust Conference, Miami Beach, Florida. January 28, 1975.

This presentation addressed the energy problems and myths of late 1973. For many years, before and after the inception of OPEC, the international oil industry made oil available to consumers at modest and stable prices. The recent problem is not collusion between oil companies and the governments of OPEC, but rather the assertion of control over production and prices by the member countries of OPEC. There is little evidence that a complete removal of oil companies from the scene would cause OPEC administered prices to fall because the OPEC countries have an overwhelming incentive to hold together. The speaker argued that only way to lower oil prices is to diminish dependence on oil from OPEC countries and accelerate efforts to develop alternative energy sources.

Kalymon, B.A. "Economic Incentives in OPEC Oil Pricing Policy" *Journal of Development Economics* 2 (1975): 337–362.

This article constructs and evaluates economic models of price-setting in the world oil market. The first model addresses the sensitivity of equilibrium prices to the size of oil reserves, demand elasticity, and time preferences. The second model evaluates the implications for individual coalition members of alternative pricing policies in conjunction with specific market-sharing agreements.

The supply cost coefficients reflect the current marginal cost per barrel on the order of \$0.12 as reported by World Oil in 1974 with the assumption that the 800 billionth barrel will have a cost of around \$4.00 due to both more expensive recovery procedures and higher finding costs. The world export demand curve faced by OPEC was estimated chiefly on the basis of the assessments provided by the Federal Energy Office's study of Project Independence. This study assumed that oil consumption in each consuming area of U.S., Canada, Europe, Japan, and non-OPEC developing countries adjusts to prices with an elasticity on the range of -0.2 to -0.6 in the long run. Various elasticity values are estimated. At an oil price of approximately \$15 a barrel, non-petroleum substitutes would be feasible.

Fischer, D., D. Gately, and J.F. Kyle. "The Prospects for OPEC: A Critical Survey of Models of the World Oil Market." *Journal of Development Economics* 2 (1975): 363–386.

Various theoretical approaches are used to analyze OPEC behavior. In Comparative Static Simulation Models, the basic question asked is: if OPEC sets its price at a certain level, and then maintains that price through a given year, what are the implications for its output level and profits in that year? Alternatively, Dynamic Simulation Models trace the year-to-year movements towards equilibrium rather than just the final equilibrium position. Optimization Techniques are unlike the Simulation Models, in which a finite number of pre-specified price paths are investigated, in that Optimization Models evaluate the infinite variety of possible price paths.

The contemporary (1975) price of oil is higher than consideration of OPEC's long-run interests would indicate, so

the price should have fallen in the not-too-distant future. All models point to the same general level of prices that would be most likely. The most likely price range is: \$7–\$10, with general agreement on an expected value of about \$8.

Cremer, J. and M.L. Weitzman. "OPEC and the Monopoly Price of World Oil." *European Economic Review* 8 (1976): 155–164.

This paper acknowledges that modeling OPEC as a single monopolist that acts only as a profit maximize is an unrealistic assumption. Based on the authors' model, oil prices should be stable in real terms from 1975 to 1995 with a sharp increase afterward regardless of changes in the discount rate, rate of demand growth, or rate of growth of non-OPEC production. However, in the short-run an increase in the discount rate will have a large effect on OPEC's production: they will greatly reduce production in order to have higher profits in the future when prices will be higher.

Over time OPEC will eventually become the only producer of oil, because non-OPEC producers' reserves will run out first, due to their smaller size and the tendency of their owners to produce at levels close to capacity. This paper concludes that the spike in oil prices in 1973 was a onetime event caused by the formation of the OPEC cartel.

Danielsen, A.L. "Cartel Rivalry and the World Price of Oil." *Southern Economic Journal* 42 (1976): 407–415.

This article emphasizes the collusion rather than the competition that affects crude oil pricing. Whereas Adelman's analyses are based upon widely known and generally accepted theory of oligopoly and cartel behavior, here Danielsen argues that the dominant theory is inadequate because it neither considers a possibility that one cartel may supplant another, nor does it consider the fact that cartel formation takes place in a historical context. The "oil industry is not a natural monopoly and therefore competition rather than monopoly would tend to predominate." Prices would decline due to the marginal costs of exploration, development and extraction, which were \$0.1–\$0.2 per barrel. The price of oil had long been substantially higher than those costs. The oil price decline during 1957–1971 was "a very slow working of the competitive process." Increased oil prices in 1953 and 1957 were due to the American and European protection of domestic oil and coal. The price increase since 1971 received active support from oil-consuming nations, especially the U.S. OPEC emerged as the dominant cartel. The author supports this conclusion by articulating a mathematical and theoretical model of cartels.

Ezzati, A. "Future OPEC Price and Production Strategies as Affected by its Capacity to Absorb Oil Revenues." *European Economic Review* 8 (1976): 107–138.

This paper analyzes OPEC's price and production strategies within a dynamic special cartel theory based on the ability of individual member countries to absorb oil revenues for the purpose of importing, consuming, and investing, and also based on their economic infrastructures, volumes of oil reserves, and potential levels of production. The author reaches the conclusion that the OPEC cartel will be stable until 1980 given the condition that OPEC's oil price would be maintained at \$11 (in constant 1973 U.S. dollars) until that time. The paper also notes that OPEC should be able exert pressure for prices higher than \$11 with assumption that OPEC members will attempt to maximize the present value of future consumption and would avoid excessive military expenditures.

Salant, S.W. "Exhaustible Resources and Industrial Structure: A Nash–Cournot Approach to the World Oil Market." *Journal of Political Economy* 84 (1976): 1079–1094.

This is a theoretical paper that models the world oil industry as a collection of independent firms. Each firm is a participant in a Cournot non-cooperative game maximizing its own discounted profits while taking as given the sales paths of remaining firms. The author derives the equilibrium price and oil sales paths based on a modified theory of exhaustible resources for the world oil market, in which he stresses the role of a unified cartel enterprise that dominates over competitive fringe oil producers. Under certain simplified cost assumptions, a disproportionate share of the increased profits resulting from formation of a cartel would end up with non-members of the cartel. The cartel's sales restrictions effectively result in the cartel being a sole oil supplier.

Oppenheim, V.H. "The Past: We Pushed Them." *Foreign Policy*, Winter 1976.

"Since 1971, the U.S. has encouraged Middle East oil-producing states to raise the price of oil and to keep that price elevated." This article contains a detailed analysis of the historical events related to oil price increases in 1971–1976, including an examination of State Department documents, Congressional testimony, and interviews of

policymakers who are no longer employed by the government. The author concludes that oil price increases were a result of policies pursued by the U.S. State Department.

Why were these policies adopted? In the period of intense economic mistrust prior to the devaluation of the dollar in early 1973, the effects of an oil price increase would have been a competitive advantage for the U.S. relative to economic damage caused by oil price hikes in Europe and Japan. Although the U.S. was having difficulties in its own economic relations with its allies, it was still “truth believed in” that the continuity of the traditional supplier relations with Saudi Arabia and Iran would persist. The economic benefits to the U.S. resulting from higher oil prices and oil revenues to those countries would have boosted U.S. production, jobs, exports, and balance-of-payments altogether. In addition, the U.S. developed a program for “soaking-up petro-dollars” reinvested in the U.S.

Gately, D., J.F. Kyle, and D. Fischer. “Strategies For OPEC’s Pricing Decisions.” *European Economic Review* 10 (1977): 209–230.

This paper examines the implications of various price paths that could be selected by OPEC based on a model of the world energy market that incorporates price expectations and lagged adjustments of demand and supply. The paper presents a variety of rule-of-thumb pricing strategies under which OPEC would set its oil price in response to various market signals.

The model used in this paper assumes that OPEC acts monolithically as a price-setting residual supplier in the world energy market, that non-OPEC energy suppliers react along short-run and long-run supply curves, and that demanders of energy react along short-run and long-run demand curves.

Mauil, H. “The Price of Crude Oil in the International Energy Market: A Political Analysis.” *Energy Policy* 5 (1977): 142–157.

This paper claims that political processes operating within an economic framework are better at explaining world oil markets. The paper notes that the price band between costs of production and costs of alternatives is so wide that the band itself possesses little practical importance. Actors in this market face differences in levels of control over resources, interactions, and external influences. The world oil market has shifted over time from one dominated by major oil companies, to one of increased competition due to the rise of independent and national oil companies, to finally a system dominated by a group of exporting nations.

Phelps, C.E. and R.T. Smith. *Petroleum Regulation: The False Dilemma of Decontrol*. R-1951-RC. Santa Monica, California: RAND Corporation, 1977.

This report attempts to offer a comprehensive analysis of interrelations between forces in the petroleum industry, effects of regulations administered by the Federal Energy Administration, pricing policies, and interactions of the domestic and world market. The conclusion is that national oil policy as of 1977 was bounded by domestic price controls that were believed to combat higher prices for refined oil products. This price ceiling reduced U.S. oil production and increased dependence on imports. Price controls were therefore not effective; they served primarily to redistribute income among firms in the petroleum industry.

Adelman, M.A. “Constraints on the World Oil Monopoly Price.” *Resources and Energy* 1 (1978): 3–19.

This paper predicts future behavior of oil prices based on the oil market structure. In previous work, Adelman showed that the oil price was set by the monopoly of oil-producing countries, not by scarcity of oil supply. Adelman argues that oil-consuming countries have the power to preempt the profit of the producing countries if these countries impose taxes in response to the increase in price of the producer countries.

Smith, R.T. and C.E. Phelps. “The Subtle Impact of Price Controls on Domestic Oil Production.” *The American Economic Review* 68 (1978): 428–433.

Using both a theoretical, qualitative analysis of the microeconomics of the oil industry, as well as empirical evidence, this paper concludes that price controls distorted levels of U.S. oil production in the 1970s. Price controls created conflicting incentives, which at first boosted production, but later accelerated the decay rate of domestic production. After the 1975 Energy Policy and Conservation Act, domestic oil production became inversely related to world oil prices, and the supply curve shifted in a way that led to a larger transfer of U.S. income to OPEC than had previously been seen as the result of future increases in the world price of oil.

Hammoudeh, S. "The Future of Oil Price Behavior of OPEC and Saudi Arabia: A survey of optimization methods." *Energy Economics* 1 (1979): 156–166.

"There is no agreement among the models on a specific trajectory for future optimal prices. Nevertheless there is a consensus that current prices are higher than OPEC's long-run interest would dictate and in the long run, most models predict that a steady and gradual increase in prices is optimal." (11)

Hammoudeh, S. and V. Madan. "The Dynamic Stability of OPEC's Oil Price Mechanism." *Energy Economics* 14 (1992): 65–71.

This paper analyzes three different mechanisms available to OPEC in its role as the residual supplier. These mechanisms are: trying to fix price and quantity; focusing only on quantity; or a synthesis in which both price and quantity are targeted/set, but the quantity adjustments incorporate price movements. The first and third mechanisms are shown to be stable, whereas the second mechanism representing OPEC's long-lived mechanism. One of the key variables in the equations presented in this paper is the market's speed of price adjustment. Although this variable has important implications concerning the sluggishness or volatility of the oil market, the paper offers no empirical evidence on the observed speed of adjustment.

"From the description of the [first] market mechanism and the response of OPEC to the discrepancies in the quantities it should be clear that the Organization is basically not attempting to fight the underlying market conditions. Their underlying objective is to play out the role of the residual supplier to its fullest while maintaining a steady stream of revenues for the member countries." (67)

al Khail, M.A. "The Oil Price in Perspective." *International Affairs* 55 (1979): 517–530.

In this opinion piece, the Saudi Finance Minister discusses the dominance of international oil companies prior to 1973; how the events of 1973–1974 served to remove some of the distortions in the world oil market; and the fact that the price of oil should be at its upper limit (at the cost of substitutes). He states that the transition to alternative energy sources needs to be stretched out over time.

Willett, T.D. "Conflict and Cooperation in OPEC: Some Additional Economic Considerations." *International Organization* 33 (1979): 581–587.

This article is a response to a paper written by Paul Jabber in 1978, in which Jabber argued that it was only political incentives that encouraged oil producers to maintain low prices. Here, Willett describes how economic incentives confronting individual states, operating within the OPEC framework, may also serve to keep oil prices lower. This situation is partly due to the fact that OPEC is not a full-fledged cartel.

Wilson, T. "The Price of Oil: A Case of Negative Marginal Revenue." *The Journal of Industrial Economics* 27 (1979): 301–315.

This paper offers two possible explanations for why the oil industries in OPEC countries were operating at negative net marginal revenues in the 1970s. Temporal considerations with respect to costs, revenues, and competition from alternative energy sources may have led a company to operate at negative marginal revenue in the current period. Additionally, the price of oil can have significant macroeconomic effects, one of which could be that production of non-oil assets held by oil-producing countries could suffer, which would harm the real income of those countries. Thus, the author concludes that it was not necessarily political considerations, but both political and economic considerations that lead to oil production at negative marginal revenues.

Bruce, A. "Oil Supply Projection Techniques: Past Developments and Future Requirements." *Managerial and Decision Economics* 1 (1980): 61–66.

This paper discusses the consideration of technological choice in regard to the study of oil supply projection. The author does not directly address competition or price volatility.

Dohner, R.S. "Macroeconomics Aspects of Oil Price increases." *The Fletcher Forum* (1980): 180–202.

The paper posits that oil embargoes and supply disruptions have only a limited negative effect on economies, because spot prices quickly recede and supply disruptions subside. However, in industrialized countries, increases in the price of oil relative to its output prices have a profound impact on national economies and can therefore cause a substantial transfer of wealth from non-oil producers to oil-producing countries.

Newbery, D.M.G. "Oil Prices, Cartels, and the Problem of Dynamic Inconsistency." *The Economic Journal* 91 (1981): 617–646.

In this paper, the author analyzes the world oil market and concludes that "the Nash–Cournot equilibrium, which is dynamically consistent, is the best simple approximation to the rational expectations Stackelberg equilibrium" (643). This conclusion is based on the fact that OPEC operates in the absence of binding contracts. Newbery explains that, "However, for plausible parameter values the cartel still enjoys substantial monopoly rents, and the absence of credible contracts benefits the fringe producers whilst harming consumers. The political economic implications of dynamic inconsistency are profound, for producers within importing countries have an incentive to undermine inter-national negotiations. Whilst there is an incentive for both consumers and the cartel to negotiate international supply agreements, there remains the incentive for producers to break their agreements subsequently, causing mistrust and potential conflict" (643–644).

Roberts, S. "Who Makes the Oil Price? An Analysis of Oil Price Movements 1978–1982." Working paper. Oxford, England: Oxford Institute for Energy Studies (1984).

Through examining the movement of oil prices from 1978 to 1982, this author concludes that at times of very tight or very slack markets, a dominant producer may set and hold firm to a market price. In traditional economic models, a competitive fringe would be forced to act as price takers. However, in tight markets, small producers can simply follow the market, and those producers in between the small and dominant poles will exhibit behavior characteristic of Arrow's model. In slack markets, the competitive fringe can still set its own prices, and the dominant producer's price will act as a reference point and constraint. When markets are only somewhat slack, the traditional model of price leadership prevails: a dominant producer sets a price and all others follow the leader.

Verleger, P.K. "The Determinants of Official OPEC Crude Prices." *The Review of Economics and Statistics* 64 (1982): 177–183.

The objective of this paper is to empirically identify which factors determine the crude oil prices charged by the members of OPEC. The market clearing prices that are reported to prevail for petroleum products on the principal petroleum spot market, Rotterdam, are the primary determinants of changes in official crude prices. There is a systematic relationship between official and spot prices that has been prevailing since 1974. Crude oil, like any other unfinished commodity, is valued for the products derived from it. The value of a barrel of a type crude oil at a certain time is expressed as a weighted average of the market prices of the principal products (gasoline, naphtha, fuel oil, residual fuel oil) that can be produced from it.

The author concludes that the official price for crude oil set by OPEC countries is determined by the prevailing prices of the products derived from crude oil on the major world petroleum product markets. The author also concludes that price-setting behavior differs substantially among the various members of OPEC.

Hamilton, J.D. "Oil and the Macroeconomy since World War II." *Journal of Political Economy* 91 (1983): 228–248.

This paper presents evidence of a statistically significant relationship between occurrence of oil supply shocks and subsequent U.S. economic recessions over the period 1948–1972. The author concludes that the timing, magnitude, and duration of some recessions prior to 1973 would have been different had oil price increases or energy shortages not occurred.

Roncaglia, A. "The Price of Oil: Main Interpretations and Their Theoretical Background." *Journal of Post Keynesian Economics* 5 (1983): 557– 578.

This paper surveys some of the main theories that attempt to explain long-run movements in the prices of crude oil, with a focus on the multifold increase that took place between the years 1973 and 1974. The author concludes that neither scarcity nor marginal costs provide the desired explanation. Oligopoly appears to fit better than competition as a model of the international market for crude oil.

Roumasset, J., D. Isaak and F. Fesharaki. "Oil Prices without OPEC: A Walk on the Supply-Side." *Energy Economics* 5 (1983): 164–170.

This paper employs a theory of exhaustible resources to estimate an efficiency price path for oil to compare with actual prices. The paper argues that much of the increase in oil prices can be attributed to supply side factors such as expected increases in the costs of backstop (i.e. alternative) technologies and a fall in real interest in the late 1970s. The authors explain, "In our view, oil was slightly underpriced in the late 1960s and early 1970s due to the

fact that OPEC did not have complete control of production, and slightly overpriced in 1974 due to some degree of monopoly power. But most of the price increase can be interpreted as a response to fundamental economic changes on the supply side" (169). The paper concludes that in the early 1980s, that actual prices were beginning to rise above the efficiency price.

Sheehan, R.G. "Oil Prices and World Inflation." *Journal of Economics and Business* 35 (1983): 235–238.

The paper applies Granger–Causality procedure to study the nature of the causal relationship between oil prices and U.S. inflation. The paper addresses the question: have higher rates of U.S. inflation 'caused' higher oil prices, or has inflation been a result of, or exacerbated by, higher oil prices?

There appears to be a significant causal relationship between the Wholesale Price Index and both imported and domestic oil prices that may be consistent with OPEC's claims that their recent oil price increases had been in response to worldwide inflation. The author's results also suggest a causal relationship between imported and domestic oil prices to wholesale prices: higher oil prices lead to higher wholesale prices, which in turn prompt even higher oil prices.

Gately, D. "A Ten-Year Retrospective: OPEC and the World Oil Market." *Journal of Economic Literature* 22 (1984): 1100–1114.

Some argue that the quadrupling of oil prices between 1973 and 1974 was "artificial scarcity orchestrated by a cartel." Most economists agree that "OPEC effectively cartelized the world oil market in 1973–1974," exploiting its power to raise prices above competitive level by restricting production.

"Others say that the price increases reflected an emerging scarcity of an exhaustible resource, in a basically competitive market." The world's oil demand had been increasing rapidly, and the oil market was already very tight in the months before the Arab–Israeli war erupted. OPEC member countries acted competitively, but "the shifting in property rights from international oil companies to the producing countries," which lower discount rates; or OPEC supply curve being backward bending had caused a huge increase in price. An embargo caused a shift from the low-priced equilibrium to the high-priced equilibrium. OPEC did not collapse because, according to Adelman, "the higher the price, the better the financial condition of the sellers, and the less pressure on them to cheat [...] to pay their bills."

The 1979–1980 doubling of the oil price was a surprise. "Some argue that OPEC consciously exploited the Iranian disruptions to extract still greater profits. But others argue that OPEC was irrelevant [...] and price rose due to underlying demand and supply condition." Perhaps the most interesting decision during this period was that of Saudi Arabia, in early 1979 at the height of the Iranian disruption, to cut its own level of production. In 1982, Adelman cited this cut as the cause of price doubling, placing the blame on a duplicitous, not "moderate," Saudi Arabia: "the Iranian revolution is generally considered as the cause for the price jump of 1979–80, from about \$12 to about \$32 per barrel. But this cannot possibly be true [...] [spot] prices again rose in January [1979], to not quite \$20. Then on January 20, 1979—a day to remember—Saudi Arabia cut production from 10.4 to 8 million barrels per day [...] by mid-February the [spot] price had jumped to over \$31 [...] Saudi Arabia 'led the regiment from behind,' keeping its own official price usually \$2 or so below the price for equivalent crudes sold by others [...] Saudi actions speak louder than words. Their 1979 output cutbacks drove the price up to \$32 from \$12."

Such a view is consistent with a dominant-producer theory of OPEC: Saudi Arabia sets the price and allows other members to produce what they wish, then acts as the "swing producer" to defend the price. Saudi Arabia didn't want to offend the new regime in Iran or the newly preeminent Iraq with an increase in production that would have hurt its neighbors. Thus, political factors were as important as capacity utilization in determining oil prices. The paper concludes that "OPEC [...] controlled the timing and magnitude of the price increases. [...] But it seems equally clear, in the light of plausible estimates for the demand elasticities and the costs of oil and of alternative energy sources, that pre-1973 [...] and pre-1979 oil prices were too low to be sustained. [...] OPEC will continue to have power over price, especially in the short term, and its power will increase when its capacity utilization increases. But, over the longer term, taking ten-year or twenty-year averages, OPEC's market power will be constrained by the underlying price-responsiveness of demand and of non-OPEC supply, for oil and alternative energy sources."

Lowinger, T.C. and R. Ram. "Product Value as a Determinant of OPEC's Official Crude Oil Prices: Additional Evidence." *The Review of Economics and Statistics* 66 (1984): 691–695.

Verleger's 1982 article in *The Review of Economics and Statistics* posited that OPEC sets official crude oil prices on the basis of product values as determined by refiners in terms of the value of petroleum products. That theory is tested here in the framework of Bivariate Granger Causal Ordering. Verleger's framework is akin to a situation in which a monopolist sets a price with reference to demand, subject to the proviso that demand for crude oil is 'derived demand.'

Verleger's model is simple and intuitively appealing, but his empirical estimates depend critically on the causal flow of product values to OPEC's official prices. Therefore, it is appropriate to test the hypothesis that the direction of causality is predominantly from realization values (i.e. product values) to OPEC's official crude oil prices. Causality tests do provide support for the hypothesis of unidirectional causal flow from product values to OPEC's official crude prices. The resulting regression estimates are broadly similar to those reported by Verleger; however, estimates for the period of rising prices differ somewhat from those for the more recent period of falling prices. Given that the product value variable is computed on the basis of spot prices of petroleum products, extraction rates, and refining and transportation costs, and these calculations are independent of OPEC's official crude oil prices, it is a significant finding that there is a consistent pattern of unidirectional causal flow from the product value variables to the official crude oil prices.

Mabro, R. "On Oil Price Concepts." WPM 3. Oxford, England: Oxford Institute for Energy Studies, 1984.

This paper reviews various price concepts as they relate to crude oil in international trade. At any given time, crude oil is acquired internationally by different buyers at different prices, and sometimes at different prices by the same buyer. A large number of market-influenced price elements produce actual contract prices that are different from each other. The spot price for a particular crude variety will almost certainly be different from actual contract prices. The author poses a series of relevant questions: Why do not all buyers move to the spot market when spot prices are below official prices? Why do not all sellers set their premiums to the level of the highest spot price when the market is tight, or set their discount to the levels of the lowest spot price when the market is slack? The author concludes that the answers to these questions are related to the imperfection of knowledge and information, uncertainty, institutional constraints (including contracts), time lags, and restrictions on the mobility of agents and on their free access to all possible sources of supply.

Marquez, J. and P. Pauly. "OPEC's Pricing Policy and the International Transmission of Oil Price Effects." *Energy Economics* 6 (1984): 267–275.

This paper offers a study on OPEC's pricing strategies. The paper's key idea is to study the international transmission of oil price effects and the determination of optimal oil price paths not as separate problems, but as one problem by recognizing that economic activity and oil prices are jointly determined. The paper developed OPEC pricing policy while recognizing that oil price changes affect the real income of oil importers and that changes in the real income of oil importers affect oil prices.

The paper's most important finding is that taking account income feedback effects into the study of oil prices leads to a path for oil price growth below the oil price path when income effects are not taken into account. Real oil revenues of OPEC grow at a faster rate when income effects are allowed in the determination of oil prices. Not accounting for feedback effects of oil price changes results in a significant upward bias of the total price elasticity of oil demand and in the oil price path, neither of which is in OPEC's best interests.

Odell, P.R. "Outlook for the International Oil Market and Options for OPEC." *Energy Policy* 12 (1984): 5–12.

Much of the world's lower-cost reserves of energy are in danger of remaining unexploited. Use of inherently higher costs sources of energy is increasing, which will undermine the world's economic growth prospects. There is an unsubstantiated, but widely accepted, belief that oil is an inherently scarce energy source that the world has been depleting too rapidly. The overpricing of this commodity by OPEC has occurred in its period of politically and institutionally based control of the market.

Saunders, H.D. "On the Inevitable Return of Higher Oil Prices." *Energy Policy* 12 (1984): 310–320.

The paper offers a 'thought experiment' to make a case for the inevitable return of higher real oil prices irrespective of the existence or non-existence of OPEC. There is an exponentially increasing population in a global economy fueled by an exhaustible energy source: oil. Even assuming a 'backup' technology that could supply the world's oil

needs indefinitely, but only at prices no higher than current levels, the mathematics lead to only long-run upward oil prices. When all costs are considered, the inexorable nature of energy demand growth and the absence of a substitute for oil at 1980s prices, combined with the exhaustibility of oil lead to a conclusion that return of higher oil prices is inevitable. The author concludes that the inevitable return of higher oil prices is not a question of if but when.

Dixit, A.K. and D. Newbery. "Setting the Price of Oil in a Distorted Economy." *The Economic Journal* 95 (1985): 71–82.

During the oil shocks of 1974 and 1979, many developing countries kept their domestic prices of oil products below import parity levels, and borrowed abroad to finance increased oil import costs. Some international agencies, such as the International Monetary Fund and the World Bank, advised countries that adopted this policy to increase their domestic prices of oil. As a result, many economists tried to calculate an optimal price of oil (i.e. a tax of imported oil) in a distorted economy.

This paper tried to calculate the range of an optimal tariff for imported oil for Turkey with data from 1978. To calculate the optimal tariff, the author uses the computable general equilibrium model and the Ricardo–Viner model to estimate the weights of the *ad valorem* rate. The paper argues that if in some economy oil were subsidized relative to all other goods, then, with positive weights, the price of oil should have been raised. With possibly negative weights it would no longer be possible to argue that the price of oil should be raised without careful calculations.

Goldstein, W. "Price and Prospects for Oil: Carrying the Burden of Excess Capacity in the 1980s and Beyond." *Energy Policy* 13 (1985): 524–534.

In the early 1980s the supply of oil increased while the demand for it became weaker, and as a result, the price of oil decreased. There was also increasing substitution of fuels by coal, natural gas, and hydroelectric power, as well as energy conservation and increased competition among oil producers. Increases in oil price volatility weakened OPEC's power over setting oil prices. This paper predicted that an oil glut would continue for 10 to 15 years.

OPEC's cartel could dispose of less than one-half of its export potential; one-third of global refinery capacity had to be shut down; and approximately one-quarter of all tanker fleets have been scrapped or mothballed. As a result of the excess capacity and the decrease in oil prices, companies halted their oil drilling, refinery building, and stock filling schedules. Companies refused to invest in long-term placements or to invest in new drillings areas.

Griffin, J.M. "OPEC Behavior: A Test of Alternative Hypotheses." *The American Economic Review* 75 (1985): 954–963.

This author used data from 1971–1983 to test four different theories about OPEC behavior: a cartel model, a competitive model, a target revenue model, and a property rights model. Empirical tests strongly suggested that the cartel model with partial (i.e. changing) market shares, with no dominant Saudi Arabia most of the time, was the most plausible model and the one that best explained production levels. The other models were rejected. Non-OPEC producers' behavior is well-explained by the competitive model. The author concludes that OPEC is a cartel with at least some effective coordination. Thus, the relative stability of the cartel is puzzling given that its members have large incentives to cheat.

Hope, C. and P. Gaskell. "The Competitive Price of Oil: Some Results Under Uncertainty." *Energy Economics* 7 (1985): 289–296.

Since 1973, world oil prices have considerably exceeded the marginal cost of production. There are two main hypotheses to explain this. The first one is "the cartel explanation:" OPEC had exploited a significant degree of market power to obtain monopoly profits from the sale of its oil. Several authors estimated that oil prices should be around \$8 per barrel in 1983 dollars terms. The second hypothesis is the "depletion explanation," which claims that producers, aware that oil was a depleting resource, would not be willing to supply oil unless the oil price greatly exceeded marginal production cost.

To calculate the price of the crude oil in a competitive market, the authors used a model based on the assumption that in a competitive market the difference between the price of any finite resource and its marginal production cost must grow with time at a rate equal to the discount rate employed by the producers of the resource. These authors assumed that the cost to produce one extra unit of the oil increases exponentially through time until

depletion occurs, at which time an expensive backstop technology would be introduced to replace crude oil in all its uses.

This paper estimated that the cost of oil production of the Middle East is approximately \$0.07 per barrel in 1975 prices, and \$0.50 per barrel in 1983 prices (these values includes the delivered price in U.S. or Europe). The production costs in the Alaskan North Slope was between \$7 and \$12 per barrel. The paper estimated the production cost in the North Sea as \$8 per barrel.

In a competitive non-cartelized market, there is a 10 percent chance that the price of oil in 1983 would be below \$3 per barrel, a 50 percent chance of the price being less than \$6 per barrel, and a 90 percent chance of it not exceeding approximately \$11 per barrel. These values are all considerably below the price of over \$25 per barrel that was observed since 1979. The authors concludes that the present oil price is high not because of fears of depletion, but because the market is cartelized.

Loderer, C. "A Test of the OPEC Cartel Hypothesis: 1974–1983." *The Journal of Finance* 40 (1985): 991–1006.

This author analyzed whether high oil prices during the 1970s and beginning of 1980s could have been the result of producer collusion. There are few, if any, systematic attempts at finding out whether the oil market is in fact cartelized. This paper tried to address whether a necessary condition for the presence of an effective cartel is met. If OPEC is an effective cartel, its policy decisions must affect market prices. This condition is analyzed by examining whether spot and futures prices for oil products and stock market portfolio returns change at the time of OPEC producer meetings.

The empirical results indicate that there is no convincing statistical evidence that high oil prices during the period of 1974–1980 were due OPEC influence. However, the paper does find statistical evidence that OPEC influenced the declining prices experienced during 1981–1984. Although the output time-series of OPEC producers (exclusive of Iran and Iraq) and the output time-series of major non-OPEC producers (excluding new producers Egypt, Norway, and the United Kingdom) were positively correlated during the years 1977–1980, they were negatively correlated during 1981–1983: an observation consistent with the findings of this paper.

Lowinger, T.C., C. Wihlborg, and E.S. Willman. "OPEC in World Financial Markets: Oil Prices and Interest Rates." *Journal of International Money and Finance* 4 (1985): 253–266.

Oil producers can use their revenues to import consumption or investment goods, to invest in financial markets, or to borrow against future oil revenues. These decisions are influenced by interest rates. OPEC is a cartel, so its savings and portfolio behavior are different than those of the rest of world. A transfer of income from OECD to OPEC occurs when the value of OPEC's oil exports exceeds the cost of their production and extraction. If OPEC's marginal propensity to save is greater than that of OECD's member countries, the result is an excess of world savings over investment. The real rate of return on investment must then fall to equalize world savings and investments. The portfolio effect refers to changes in the demand for interest-bearing financial assets due to OPEC's current account surpluses. A surplus implies that OPEC's claims on the rest of the world are increasing, and if OPEC's preferences for interest-bearing financial assets issued within OECD are greater than OECD residents' preferences, then the real rate of return on financial assets would fall with OPEC's accumulation of claims on the rest of the world.

Stournaras, Y. "Are Oil Price Movements Perverse? A Critical Explanation of Oil Price Levels 1950–1985." WPM6. Oxford, England: Oxford Institute of Energy Studies, 1985.

From 1950 to 1970 the real price of crude oil was generally falling due to continual expansion of output. Some attribute this falling price to the buying power of oil companies. Oil prices went up and down significantly during the period 1970–1985. This author saw the price increases as political acts by Middle Eastern countries, not economic acts. He concludes that OPEC may have become an economic cartel after 1981.

Adelman, M.A. "The Competitive Floor to World Oil Prices." *The Energy Journal* 7 (1986): 9–31.

This paper argues that without OPEC, its members would be price takers and that they would greatly increase production, because oil production costs in the Persian Gulf area are extremely low. Furthermore, in a competitive market the producer countries with low production costs should produce at maximum capacity and ramp up investment on expanding existing oil fields and exploration. As a consequence, more than half of the oil production

in the U.S. and the North Sea would have been shut down, because it would have become unprofitable.

Gately, D., M.A. Aldeman, and J.M. Griffin. "Lessons from the 1986 Oil Price Collapse." *Brookings Papers on Economic Activity* 1986 (1986): 237–284.

This provides a simulation of the impact of different oil prices. The results show that if the price stays at \$26 per barrel, OPEC would not reach 25 million barrels per day (bpd) until 1997. But if the price drops to \$18 per barrel, OPEC would reach 25 million bpd in 1994. With price at \$10, OPEC would reach 25 million bpd in 1990 and 35 million bpd in 1995. The \$26 constant-price scenario requires OPEC's core countries (Saudi Arabia, Kuwait, the United Arab Emirates, and Qatar) to continue to restrict their output well into the mid-1990s.

At oil prices of \$26 and \$18 per barrel, the revenue of the OPEC's core countries are not greatly affected. But if the price falls to \$10 per barrel, the core countries' revenue falls significantly by almost 20 percent. In other price ranges, the revenue of OPEC's core countries is almost constant, because price declines are almost exactly offset by output increases. But if the price declines to \$10 per barrel, the core countries face an inelastic demand and competition would drive prices lower.

The collapse of the oil prices in 1986 was due the decision of the Saudis and some of its neighbors to increase their shares of the oil market. Unlike the effect on other producers, the drop in the oil prices did not result in great revenue losses to these economies because the price declines were offset by their increments in oil output. However, these authors estimate that an oil price lower than \$12 per barrel would hurt their revenues (and their economies), therefore they expected that these countries would restrict output until oil reached this price. This paper forecasts that oil prices will increase substantially over the following two decades, and that there would be no alternative for oil as a source of energy during this period.

Marquez, J. "Policy Coordination among the North, the South, and OPEC." *Journal of Economic Dynamics and Control* 10 (1986): 59–62.

This paper simulates a model of cooperative policies among the North, South, and OPEC countries and its consequences on economic growth. The model contains 37 equations estimated using ordinary least squares regression with sample data from 1960–1979. The targets of the coordination policy are the growth rate for real oil revenues of OPEC, the growth rates for both the North and the South, and the North's inflation rate. The policy instruments are the growth rate for the oil prices, the long-term nominal interest rate, fiscal expenditures in the North, and nominal net lending to the South.

The results of the model indicate that cooperative policies can generate worldwide recovery if oil prices' annual growth is less than one percent in real terms, real fiscal spending annual growth is 0.9 percent, and annual growth of nominal net lending to the South is 10 percent. The author notes that there is a conflict of interests between oil importers and oil exporters with regard to the optimal oil price path.

Tomitate, T. "Simulation Study on Falling Oil Prices: Supply–Demand and Prices Scenarios to 2000." *Energy Policy* 14 (1986): 571–574.

This paper describes a series of simulations of oil supply and demand using four different oil price scenarios in which oil prices decline from its average in January 1986. This study had the objective of evaluating how falling oil prices impact oil supply and demand from a global viewpoint. The analysis started with the average oil price of \$26.5 per barrel, then simulated supply and demand with drops in oil prices to \$25, \$20, \$15, and \$10 per barrel.

Moran, T.H. "Managing an Oligopoly of Would-Be Sovereigns: The Dynamics of Joint Control and Self-Control in the International Oil Industry Past, Present, and Future." *International Organization* 41 (1987): 575–607.

The challenge for a natural resource oligopoly or cartel is to generate revenues for the participants by setting and maintaining a price well above the participants' costs of production. The oil industry has a history of generating oligopoly rents for more than a century with varying degrees of achievement and an impressive record of maintaining price levels at more than ten times the marginal cost of production for most of its proven reserves. Evidence from the international oil industry suggests that basic structural changes have occurred in the behavioral patterns of the oligopoly; OPEC has maintained oligopoly control since 1971 by establishing formal production ceilings for OPEC members.

The history of the international oil industry shows a devotion, care, and ingenuity to build mechanisms of supra-sovereign restraint on the ability for self-interested action to occur. OPEC tried to reach explicit agreements about maintaining price, production and market shares, but these seldom held for long. Understand the oil oligopoly requires assessing the participants' ability to limit their scopes for independent action (both their own and others') when collusive agreements are under stress, to make credible commitments in the face of future uncertainties, and to bind themselves to a joint objective. Consumer governments, as history suggests, will allow (and perhaps provide direct support) in helping the oil oligopoly to reconstruct the cartel again and again.

Morrison, M.B. "The Price of Oil: Lower and Upper Bounds." *Energy Policy* 15 (1987): 399–407.

This paper argues that the oil market oscillates between a perfectly competitive market (at the lower bound of the market) and a monopoly (at the upper bound). OPEC tries to find the optimal path between these extreme states, but it can only see either boundary only when they get very close.

The author argues that the oil price increases in 1973–74 were rational, as OPEC was taking advantage of its cartel power. On the other hand, the second oil shock was not economically justifiable and any short-term profit gain would be erased by demand and supply adjustments.

The author concludes that it is unlikely that the price of oil will stay in the competitive range for long periods of time, because "throughout the history of the oil industry, market power has tended to rest in the hands of a few powerful actors, giving credence to the view that the industry has a tendency to be naturally imperfect, in an economic sense."

Samii, M.V. "OPEC's Return to Fixed Oil Pricing." *Energy Policy* 15 (1987): 421–431.

This author argues that OPEC should enforce a somewhat flexible fixed-pricing system in order to maximize its revenue. Plummeting oil prices in 1986 convinced OPEC and non-OPEC producers to be more cooperative by competing less on production and pricing. Furthermore, OPEC's members understood that 'cheating' their quotas and restrictions for short-term gains would have just damaged them in the medium to long run. For the fixed-pricing system to work, the swing producer (Saudi Arabia) had to be guaranteed that it would be allowed to produce its annual quota and not be the only one to suffer production cuts during depressed market periods.

Syme, J. *Forecast Models and Policy Analysis: The Case of Oil Prices*. N-2524-RC. Santa Monica, California: RAND Corporation, 1987.

This paper makes a comparison of the assumptions underlying ten different economic models that failed to accurately forecast future oil prices subsequent to 1973 oil shock incident. The main results suggest that the probable source of error was the price elasticity of oil demand variable input employed in the models. The actual elasticity values, evidence indicates, were considerably higher relative to the assumed ones. "In sum, the predictions made by the models used in EMF [Energy Modeling Forum] were wrong—not just slightly, but remarkably so. Compared with the actual price path, the forecasts did not even predict the correct direction."

Baldwin, N. and R. Prosser. "World Oil Market Simulation." *Energy Economics* 10 (1988): 185–198.

Most of the models used to analyze the world oil market can be categorized into two groups: (1) recursive simulation models, in which market actors make decisions based on information about past and present, but not future, events. Typically, these models assume that OPEC uses some form of empirically derived "reaction function" based on target-level capacity utilization as a price-setting decision rule. (2) Intertemporal optimization models, which allow the cartel to take account of information about future events. These models are based on Hotelling's Theory of Wealth Maximization, which suggests choosing the price that maximizes the net present value of oil revenues. However, the way in which OPEC behavior is modeled varies among these models, and both types of models assume that OPEC operates as a cartel.

This paper develops a framework by presuming that OPEC sought to maintain a share of the global oil market consistent with its desire to increase revenues. Within this framework the paper employs a recursive simulation model of the world oil market in which it varies the ranges of prices and oil output.

The paper concludes that the price reaction function successfully explains the 1973–1974 and 1979–1980 price rises, but not the 1986 price fall that occurred when OPEC increased production. These authors find that during 1979–1981, spot market prices led official prices by one or two quarters, which is consistent with Verleger's findings of a statistical relationship between spot and official prices between 1975–1980. These authors found

evidence that OPEC “is groping toward an unknowable optimal price path,” or that an adjustment process was occurring as OPEC learned from its efforts to manipulate the oil market.

Crémer, J., and D. Salehi-Isfahani. “The Rise and Fall of Oil Prices: A Competitive View.” *Annales d’Économie et de Statistique* 15/16 (1989): 427–454.

The paper develops a theory to explain the most recent history in the oil market. The proper way to study the oil market is via the competitive model corrected for deviations because only certain oligopolistic properties would apply. The supply curve for oil is backward bending and primarily determined by the development strategies of oil-producing countries.

Data on economic and political systems of oil-producing countries are of prime importance; however, it is not necessary to distinguish between OPEC and non-OPEC countries: “no need to worry about the size of the competitive fringe.” The shape of the supply curve is based on the constraints of disposal of oil revenues via consumption or investment. The existence of multiple equilibria is more comprehensive than cartel theories in explaining the behavior of principal participants in the oil market. This paper uses a dynamic model of economic growth to demonstrate how a “perverse” supply response can arise from a high enough price level. The authors conclude that the recent collapse of the price of oil is not the result of dislocation of the cartel, but is rather an outcome of shifts in the supply and demand curves of oil due to excess supply.

Libecap, G.D. “The Political Economy of Crude Oil Cartelization in the United States, 1933–1972.” *The Journal of Economic History* 49 (1989): 833–855.

This article examines the behavior of the U.S. domestic interstate oil cartel (i.e. state regulatory agencies) in controlling crude oil production during the period 1933–1972. The presence of the cartel resulted in economic rents; the distribution and size of the rents depended on political factors.

The author concludes that U.S. crude oil output was controlled during this time period in order to raise and stabilize nominal, but not real, oil prices. Stabilization of real oil prices would have required more output intervention. The political influence of high-cost producers in all states led to quota allocations that effectively promoted high-cost production by imposing restrictions on low-cost production in Texas. The internal political environment prevented the Texas Railroad Commission from adjusting Texas oil output in response to fluctuations in U.S. oil demand in order to maintain nominal prices; however, the regulatory agencies in the pro-rationing states coordinated their monthly production authorizations to adjust domestic oil output to fix nominal prices.

The behavior of the interstate oil cartel reveals that government-sponsored cartels can better police output limits relative to private cartels, however, they involve political trade-offs that lower monopoly rents through higher production costs and non-optimal production patterns.

Amano, A. “Energy Prices and CO2 Emissions in the 1990s.” *Journal of Policy Modeling* 12 (1990): 495–510.

This paper provides an econometric analysis of the 1990s world oil market that controls for OPEC’s strategic behavior. It also uses an energy consumption and carbon dioxide emissions model to examine the possibilities of stabilizing or reducing emissions below the contemporary level. The paper concludes that the growth in world oil consumption in conjunction with an increase in OPEC’s global oil market share will result in OPEC’s ability to substantially raise oil prices by the middle of the decade. Only slow growth in world output and/or intensive energy conservation efforts will make it possible to postpone the tightening of world oil market condition.

Fesharaki, F. “Oil Prices in the Short, Medium and Long-term.” *Energy Policy* 18 (1990): 66–71.

This paper argues that in the short-term oil prices are determined mainly by OPEC’s adherence to their quotas and, to a lesser degree, by economic growth and demand, because it is impossible to switch from oil to alternative energy sources. This argument assumes that discipline among OPEC’s members will remain high. When there is softness in the oil market, the richer and larger producers in OPEC will cut production the most in order to raise oil prices. When the market is tight, only the Gulf States and Venezuela have large enough reserves that could be tapped.

According to the paper, a shock similar to the one in 1979 would create a large spike in oil prices starting in 2000, because demand would surpass OPEC’s preferred capacity. Furthermore, OPEC has not learned from its past mistakes and it will allow huge oil prices spikes in the future.

Gault, J. et al. "OPEC Production Quotas and their Application to non-OPEC Countries." *Energy Policy* 18 (1990): 73–79.

OPEC's pricing power is hindered by a lack of cooperation by non-OPEC producers in limiting production. This paper concludes that it is unlikely that non-OPEC producers will cooperate, because if they were to adopt production quotas calculated using the OPEC "formula," which is based on production capacity, total imports per capita and political and other considerations, some countries would have to drastically reduce their production to unacceptable levels. For example, Norway would have to reduce its production from 1.5 to 0.5 million barrels per day.

Powell, S.G. "The Target Capacity-Utilization Model of OPEC and the Dynamics of the World Oil Market." *The Energy Journal* 11 (1990): 27–63.

The objective of this paper was to evaluate the dominant behavioral simulation model of OPEC, the so-called Target Capacity Utilization (TCU), and to study its performance in a simple model of the world oil market. The TCU model is a simple behavioral rule that links OPEC's price with two other variables: OPEC production and OPEC capacity. The TCU model is based on the idea that at high rates of capacity utilization OPEC will raise its price dramatically, whereas at low rates of utilization it will lower its price slowly.

The results of the simulations presented in this paper indicate that both the empirical and theoretical support for the TCU model are weak. The empirical evidence for this price rule is ambiguous, and the model shows that in a simple world oil model when OPEC follows the TCU strategy, the outputs do not replicate the expected relationship between price changes and capacity utilization. Furthermore, it can be shown that the TCU model does not achieve a particularly desirable outcome for OPEC. The TCU rule has the ability to return the market to equilibrium when disturbed, but this equilibrium may not be especially attractive for OPEC. The approach to that equilibrium will generally be cyclical. Finally, the model generally exhibits a tendency to cycle around the target capacity level, a behavioral mode that is not readily apparent in the historical record. In reality, the approach to equilibrium is characterized by hysteresis: shocks have led to large increases in prices that are followed by long periods of gradually declining prices.

Suárez, C.E. "Long-term Evolution of Oil Prices 1860–1987." *Energy Policy* 18 (1990): 170–174.

In oil price determination, political and economic considerations outweigh other factors such as the size of oil reserves and microeconomic aspects such as extraction and transportation costs. "[I]f the market were acting freely, the prices would be very much lower than the real ones" but the U.S. and United Kingdom governments, as well as multinational oil companies, were interested in having prices above equilibrium. "In 1970 the average well-head price in the USA was 163 percent higher than the Middle East spot price. This differential was possible partly because of transport costs but basically due to the explicit intervention of the state against the market trends in order to protect the country's marginal producers."

According to this article, oil-producing countries were weak and caved to pressure to lower their prices. This author argues that developed countries and multinational oil companies in effect cartelized to counterbalance OPEC's power.

Wirl, F. "The Future of World Oil Prices: Smooth Growth or Volatility?" *Energy Policy* 18 (1990): 756–763.

This article discusses different approaches for projecting world oil prices and for rationalizing past oil price movements. It addresses price volatility within a rational economic and political framework. Typical economic forecasts of oil prices, including the one discussed in this paper, apply Hotelling's theory of exhaustible resources. The optimal (i.e. collusive) OPEC strategy exhibits the typical characteristic of most oil price projections, but also indicates that oil prices during the 1st half of 1980s might have exceeded the ideal level for a strongly cartelized OPEC. This paper proposes considering non-cooperative oligopolistic behavior individually by all OPEC members (i.e. rational strategies by each member to maximize individual profits) rather than considering OPEC operations in terms of a single profit-maximizing organization.

The author concludes that the current market tends to reflect an oligopolistic market. Prices prevailing during the first half of 1980s were roughly in line with an optimal cartel strategy. The sluggish nature of contemporary energy demand relations offered large profits, suggesting that volatile oil price strategies, such as dynamic relations, may lead to an optimal cartel policy which alternates between 'high' and 'low' oil prices. Since only high prices require formal cooperation, OPEC's behavior as an economic cartel maybe a re-occurring but short-lived phenomenon.

This paper concludes that a scheme of low production quotas but high prices is not sustainable because producers operate in their own interests and the potential gains from opportunistic behavior are large.

Dahl, C. and M. Yücel. "Testing Alternative Hypothesis of Oil Producer Behavior." *The Energy Journal* 12 (1991): 117–138.

This paper tests competing hypothesis for the production decisions of OPEC and non-OPEC oil producers: dynamic optimization, target revenue, competition, cartel price control and swing production. The authors conclude that their results yield no evidence to support dynamic optimization. Formal target-revenue models are also rejected; however they found some evidence that revenue targeting may influence production for some OPEC countries and for a few non-OPEC countries. They found no evidence in support of the hypothesis that OPEC countries behave in a competitive manner, but more importantly, they also did not find evidence that oil fringe producers behave in a competitive manner. Finally, based on co-integration tests, the authors were unable to find formal evidence of coordination across OPEC producers to support either strict market-sharing cartel behavior or swing production behavior. However, greater-than-average relative swings might imply loose roles as swing producers for Iraq, Saudi Arabia, Kuwait, Libya, and Venezuela, whereas cost evidence suggested some loose cooperation between producers. The authors found some tendency for low-cost production countries to produce more than high-cost countries, as would be true in a cartel, but they found no evidence that similar-cost countries behave in a similar way. The paper's final conclusion is that OPEC behavior is most consistent with a loose coordination or duopoly.

Goldstein, W. "What is the Right Price for Oil? Will the OPEC Ransom Price Survive the Gulf War?" *Energy Policy* 19 (1991): 514–516.

This paper argues that after the end of the Gulf War, a glut of oil in the market greatly reduced OPEC's pricing power and pushed Saudi Arabia to abandon its role as a swing producer. Saudi Arabia was pushed by its huge war cost, claimed to be \$50 billion, and by years of low production; its revenue decreased from \$119 billion to \$26 billion in the period from 1981–1985. On the other hand, Algeria, Nigeria, and Libya were in favor of \$20 per barrel oil price, due to their limited productive capacity.

The author asserts that President George H.W. Bush did not want oil prices to go too high or too low; otherwise most of the marginal Texas oil companies would have gone out of business. The New World Order would have probably gone against a pure market model in order to avoid an increase in foreign oil dependency by the U.S.

Green, S.L. and K.A. Mork. "Toward Efficiency in the Crude-Oil Market." *Journal of Applied Econometrics* 6 (1991): 45–66.

This paper applies the theory of futures (i.e. forward) markets in its analysis and utilizes the Generalized Method of Moments estimation technique to test for efficiency in the relationship between the official OPEC oil prices and the ex-post spot market prices.

The authors conclude that the market for crude oil has, at times, produced large and persistent differences between official contract prices and spot prices. Such differences are not necessarily evidence of an inefficient market; they may reflect a risk or monopoly premium or the institutional fact that the contract prices are adjusted only at discrete and infrequent intervals. The authors do reject the notion of petroleum market efficiency for the sample period 1978–1985. They show that prices can be predicted by a linear combination of current and lagged changes in the official prices. Their results reveal a time-varying and predictable premium due to either risk or monopoly.

Greene, D.L. "A Note on OPEC Market Power and Oil Prices." *Energy Economics* 13 (1991): 123–129.

This paper employs the von Stackelberg static model of OPEC operating as a monopolist with a peripheral group of competitive producers to define short and long-run monopoly prices as a function of OPEC's share of the global market. Here, the author defines OPEC's market power as its ability to charge a price higher than the competitive market price. The cartel's optimal von Stackelberg monopoly price is a direct function of its market share. Given the world price elasticity of demand for oil and the supply response slope for the peripheral world oil producers, the monopoly price markup is an upward-sloping curve that is a function of market share.

The von Stackelberg model implies that a rational profit-maximizing cartel, with adequate knowledge of the demand for oil and of the fringe competitive supply response, would choose a price on this curve depending on its current share of the market, assuming that the price elasticity of demand and the peripheral production response were constant over time. However, a basic characteristic of the energy market is that it takes time for demand to

adjust to price changes and short-run elasticity values are almost always far smaller than they are in the long run. Therefore, the cartel's optimal short-run price mark-up is always much larger than its long-run mark-up.

Economic theory implies that a rational, knowledgeable cartel will operate somewhere between its short-run and long-run monopoly price curves. Curves drawn using price elasticity values for crude oil demand and fringe competitive production responses reported widely in the literature suggest that OPEC's cartel has behaved rationally. Prices during the periods 1974–1978 and 1986–1990 lie just above the total OPEC long-run price mark-up curve. Prices during the period 1981–1985 lie near the Arab-countries OPEC short-run price mark-up curve.

Darrat, A.F., O.W. Gilley, and D.J. Meyer. "Petroleum Demand, Income Feedback Effects, and OPEC's Pricing Behavior: Some Theoretical and Empirical Results." *International Review of Economics and Finance* 1 (1992): 247–259.

This paper forms a theoretical model for oil demand facing OPEC, and tests that model using data from the late 1970s and 1980s, which was a period of relatively stable or falling oil prices. One key assumption the authors make is that OPEC functions as a cartel. This paper demonstrates how the markup OPEC earns on oil depends on the price elasticity of demand, which in turn depends on the income elasticity of oil demand and the domestic price elasticity of real income in oil-consuming and oil-importing countries.

Using weighted measures of individual OECD countries' income and demand elasticity values, the paper concludes that "the more sensitive the real income of major importing countries is to oil price increases, the less potential market power OPEC retains if it chooses to set higher oil prices in the world market" (256). In particular, the U.S. and Japan are found to exhibit significant impacts on this demand elasticity, given the position of the U.S. as a major consumer and importer of OPEC oil and the heightened sensitivity of Japanese income and oil demand to changes in world oil prices.

Gochenour, D.T. "The Coming Capacity Shortfall: The Constraints on OPEC's Investment in Spare Capacity Expansion." *Energy Policy* 20 (1992): 973–982.

This article examines the ability of oil-producing nations to invest in capacity expansion. A country's ability to expand capacity is constrained by financial, political, structural, and technical factors. In discussing these constraints, this paper paints a picture of how oil-producing nations, and their national oil companies (NOCs), function in ways that prevent them from acting as a typical Western, privately-run corporation might act in a competitive market.

Political constraints include the dependence of producer governments on their NOCs as revenue sources, which results in the NOCs having little to nothing left with which to reinvest in production or expansion. The reliance on NOCs by governments to meet certain social welfare goals, such as income and employment, leaves little hope for change in this constraint. In addition, after the nationalization of oil in the 1970s, producer nations were left with serious technical, managerial, and organizational deficiencies. Further exacerbating this lack of expertise was the inability of these countries to attract foreign investment because of challenges associated with national laws and popular sentiment.

Although this paper focuses on capacity expansion, it also makes clear that oil-producing nations and their NOCs do not operate in ways that would allow them to act as truly competitive players. Without the power of the state behind them, and continued strong demand by oil-consuming nations, the NOCs would fail despite the fact that they operate as state monopolies and collude through OPEC.

Goldstein, W. "How Many Years will 'Cheap Oil' Last?" *Energy Policy* 20 (1992): 763–765.

This viewpoint paper asserts that the price hawks in OPEC have failed to convince the other members to cut down production and raise prices due to past volatility in spot prices. This volatility made cheating on quotas tempting; and Saudi Arabia was too powerful to be opposed in its effort to raise the \$65 billion it owed to the U.S. for Operation Desert Storm. The Kingdom would not accept sacrifices in its revenue stream. Venezuela and United Arab Emirates were unsympathetic towards OPEC members with little spare capacity. Regardless of what happened on the demand side, the weaker OPEC members would have to follow the Saudi, Emirati, and Venezuelan price leads.

The Secretary General of OPEC, Mr. Subroto, and Sheikh Yamani declared that to avoid a future oil supply crisis, the oil industry needed to be bailed out. That would mean that OPEC would be helped financially and also would

keep oil prices high, because increasing oil production requires time and capital. At the time, capital was scarce and difficult to accumulate in a depressed oil market.

Linderoth, H. "Target Revenue Theory and Saudi Arabian Oil Policy." *Energy Policy* 20 (1992): 1078–1088.

This paper evaluates whether Saudi Arabian oil policy can be explained by target revenue theory, which argues that domestic budgetary needs would play a significant role in determining the level of production in the face of existing prices. The paper concludes that this theory does not always best explain Saudi policy and its actions during and after the 1970s oil shocks, but that the theory may hold in the future to describe actions in the short term. The author predicts that Saudi Arabia will move away from being a swing producer toward increasing its share in OPEC production, which may result in future price declines.

Mabro, R. "OPEC and the Price of Oil." *The Energy Journal* 13 (1992): 1–17.

OPEC can manipulate oil prices only during periods of slack market, which are usually long (1974–1978 and 1981–1985). During tight market periods OPEC is weak even though consumer countries are in awe of its power. Since 1987 OPEC has tried to influence prices through production plans that aim to hit a target zone. Actual oil prices are determined by the interaction between production plans and oil supply from the fringe producers, which are price-takers. OPEC wants to avoid shocks and thus wants to stay within its upper limit, because after the residual demand is passed, OPEC ceases to be a price-maker. This author concludes that therefore, OPEC should invest in expanding capacity to maintain substantial unused capacity.

OPEC wields substantial market power on the supply side; oil prices will stay within its target zone in the long-run due to this power. However, supply and demand respond not only to prices indirectly set by core producers, but also to other powerful economic, political, geophysical, and fiscal factors over which OPEC has no power.

Seymour, I. "OPEC in the 1990s." *Energy Policy* 20 (1992): 909–912.

This paper argues that after the Gulf War, a strengthened Saudi Arabia would no longer sacrifice its oil production for OPEC. The major Gulf producers' financial situation had greatly deteriorated by low oil prices, which made them less willing or able to bear the short-term cost of production cutbacks. Kuwait quickly restored its oil production after the Gulf War, and the return of Iraq production will cause downward pressure on oil prices. Saudi assertiveness came from U.S. backing, but Iran could challenge its dominance in the region. The author concludes that there will be a surplus of oil for most of the following decade and that only OPEC can manage this surplus.

Wirl, F. "Impact on World Oil Prices When Larger and Fewer Producers Emerge from a Political Restructuring of the Middle East." *Energy* 17 (1992): 367–375.

This paper analyzes the direct effects of the redistribution of oil reserves by OPEC's producers on OPEC's oil extraction policies and the indirect effects of that redistribution on crude oil prices. This paper accepts the fundamental role of OPEC in the global oil market, but it assumes that OPEC members behave non-cooperatively. The author's analysis suggests that new coalitions within OPEC, either due to brute force or as the result of bargaining, would encourage cooperation among all OPEC members (similar to 1973–1974) or would lead to substantial increases in oil prices.

Huntington, H.G. "OECD Oil Demand: Estimated Response Surfaces for Nine World Oil Models." *Energy Economics* 15 (1993): 49–56.

This paper estimates econometric responses (e.g. aggregated oil demand) for nine different models of world oil within OECD. A comparison of the models revealed a wide dispersion in oil consumption projections that had been standardized for oil price and economic growth paths. Much of discrepancy was attributed to large differences in the response of oil demand to both past and current prices, economic growth, and autonomous technological advances. This study provides a brief summary of each model's response to key factors; responses are based on the simultaneous consideration of all scenarios.

The estimated responses found here are consistent with previously inferred elasticity values. One key advantage of response surface approach used here is its ability to estimate long-run price elasticity values directly instead of inferring 20-year cross-scenario results. Slow turnover rates in capital stock prevented an accurate measurement of the long-run response. Given the dynamic nature of oil demand, past oil prices can affect future oil demand as the capital stock is gradually replaced. Models projecting low future oil demands had strongly negative momentum

effects and those projecting high future oil demands had strongly positive momentum effects. On the basis of that finding, this paper urges oil demand modelers to be more explicit about what modeled systems reveal with regard to the context of extent of disequilibrium embedded in oil demand conditions of those models.

Moosa, I.A. "Can OPEC Cause Inflation and Recession?" *Energy Policy* 21 (1993): 1145–1154.

This article investigates whether higher oil prices initiated by OPEC have effects on economic activities in OECD countries (i.e. OPEC's ability to cause inflation and recession in OECD by raising price of oil). This effect is similar to imposing a tax on factor inputs.

By using empirical results based on OECD data, the author concludes that no long-run relationship exists between oil prices and macroeconomic variables in OECD countries. Causality testing points to the existence of a unidirectional causal relationship from oil prices, both higher and lower, to domestic prices and output in OECD countries. However, not all of the OECD countries display the same behavior in response to an oil price shock.

Hammoudeh, S. and V. Madan. "Escaping the Tolerance Trap: Implications of Rigidity in OPEC's Output Adjustment Mechanism." *Energy Economics* 16 (1994): 3–8.

This paper introduces rigidity to the quantity adjustment model as determined by OPEC, and the author argues that such 'torpidity' creates a 'tolerance trap.' Once price and quantity cross into this tolerance zone, the wrong action may cause a collapse in price, as was witnessed in 1985 when Saudi Arabia flooded the market rather than adjusting quantity gradually. The paper concludes "OPEC's tolerance of rigidity in quantity adjustments on the part of its members proves to be an impediment to the convergence of the market to the target price. [...] It also increases uncertainty."

Young, D.P.T. "The Nature of OPEC and Oil Price Changes." *Energy Economics* 16 (1994): 107–114.

This paper provides a framework for considering the monopoly aspects of OPEC and the non-optimal, flexible behavior of individual member countries through the internal workings of the organization. The author argues that prices are the key to OPEC's behavior. Quotas have gained importance, but the group's mechanism is mainly concerned with price stability. The key element in each cartel member's objective function is a particular 'target' level of revenue required to finance the expenditure commitments contained in its national budget. The standard objective of maximizing the discounted sum of profits is replaced by a 'revenue target' specified in accordance with the requirements of individual members. Therefore, each member acts as if it were a monopolist facing a demand curve that embodies its expectations of the demand for its own oil regardless of the ramifications of the group accepting its preferred price and output.

There are stages to the bargaining process. First, each member acts as a monopolist in isolation during initial price bids. In the second round of bargaining, alternative bids are reconciled. The next stage involves comparing revenues that would accrue to each member if it accepts the given price (P^*). Once the group agrees on P^* , OPEC estimates the likely output that the market would sustain at this price. Each member also has its own view of output it might expect to sell at price P^* . The overriding consideration is the system of output quotas, which indicates the output of each member on the basis of an agreed formula. Changes in P^* will change overall demand for the group to the extent that future revenue requirements of many members may not be met. In such circumstances, some major adjustment of the member's output quotas would be considered.

The author concludes that such a comprehensive framework is necessary because OPEC does not conform to any standard monopoly theory, yet there is a degree of monopoly discernible in OPEC's price behavior. This model provides grounds for reinstating of the importance of the internal structure of the organization (in particular for reinstating the individual revenue requirements of the member states), but it does so within a framework that is compatible with basic monopoly assumptions.

Gately, D. "Strategies for OPEC's Pricing and Output Decisions." *The Energy Journal* 16 (1995): 1–38.

OPEC misjudged the oil market in 1979; it could not dramatically increase oil price without negative consequences. The subsequent loss in market share to fringe competitors and the collapse of oil prices in the mid-1980s have been costly for OPEC. Its mistake was a short-run myopia that prevailed among its members. Its optimal strategy would have been to increase production at about the same rate of world income growth; this strategy would have maximized net present value in both "optimistic" and "pessimistic" scenarios for OPEC.

Hammoudeh, S. and V. Madan. "Expectations, Target Zones, and Oil Price Dynamics." *Journal of Policy Modeling* 17 (1995): 597–613.

This paper considers inventory shocks and market expectations in its analysis of OPEC's pricing mechanism. The authors also address oil price dynamics in a two-sided target zone model and an asymmetric tolerance zone model. Their analysis is centered on the smooth-pasting and speculative attack solutions associated with credible and non-credible intervention policies.

The authors conclude that the credibility of OPEC's intervention declines with the output ceiling due to price becoming more vulnerable to speculative attacks. The opposite also holds true: there is a positive relationship between the credibility of OPEC's interventions and the sensitivity of the market price to changes in output. There also exists a negative relationship between OPEC's intervention credibility and a positive inter-temporal bias in the number of random shocks.

Hammoudeh, S. "Oil Price, Mean Reversion and Zone Readjustments." *Southern Economic Journal* 62 (1996): 916–929.

This paper examines OPEC's oil market price behavior under three scenarios. (1) Credible OPEC policy and oil market price within a given target zone. Under this option, the zoned market price is more stable than both the free market price and the managed price with mean reversion. (2) Imperfect credibility of OPEC's policy and oil price reversion to the free market price triggered by speculative attacks from an output ceiling that is too large. The credibility of OPEC's policy depends on the level of trend drift, the sensitivity of the market price to changes, the market participants' expectations, and the magnitude of the risk. (3) In the most realistic scenario, OPEC either defends its current price or shifts the current target zone and declares new price. The relationship between the price and the fundamental for all the zones depends on the levels of the jump probabilities of defending the current zone or re-adjusting the fundamental at both ends of the fundamental band.

Stevens, P. "Oil Prices: The Start of an Era?" *Energy Policy* 24 (1996): 391–402.

This paper develops a framework to explain how oil prices are determined. The author argues that the international oil market has experienced a fundamental change that may lead to much lower prices and subsequently to market instability. The three dimensions to the new environment are: poor information on physical availability of supply and of requirements for demand; larger number of buyers and sellers in the markets; and greater transparency of transactions. Greater price volatility and squeezing out of economic rents will result from this new environment for the equilibrium price.

Greene, D.L., D.W. Jones, and P.N. Leiby, "The Outlook for U.S. Oil Dependence." *Energy Policy* 26.1 (1998): 55–69.

This article provides an analysis and coherent explanation of various elements critical to determine the nature and level of U.S. dependence on foreign oil. The authors conclude that U.S. oil dependence is a combined result of the short-run inelasticity of oil supply and demand, and the monopoly power, especially by OPEC, in the world oil markets that is exercised by the few nations that hold a majority of the world's oil resources. U.S. reliance on imports, the importance of oil to the U.S. economy, and oil's cost share of GDP are discussed. Members of the OPEC cartel have created or capitalized on disruptions in the world oil market by collecting hundreds of billions of dollars in monopoly rents from oil-consuming countries such as the U.S.

Mabro, R. "The Oil Price Crisis of 1998." SP10. Oxford, England: Oxford Institute for Energy Studies, 1998.

Oil-exporting countries and private oil companies have been on a production binge in recent years. The exceptions, until late 1997, were Saudi Arabia, Kuwait, and the United Arab Emirates, the three OPEC countries that voluntarily restricted their production to the levels of quotas agreed within OPEC in 1993. However, the quotas for the United Arab Emirates and Kuwait happened to be set fairly close to the productive capacity of these countries, which meant that Saudi Arabia was carrying a significant volume of idle capacity. Another exception was Iraq, which was involuntarily restricted by United Nations sanctions.

As in any competitive market, small producers in the oil market may have no choice but to act individually as price-takers. This paper points out that in the oil industry, an institutional mechanism for coordinating decisions exists through OPEC. However, OPEC does not seem capable of preventing price crises, but is instead only able to respond to them with varying degrees of success when they occur.

Alhajji, A.F. and D. Huettner. "The Target Revenue Model and the World Oil Market: Empirical Evidence from 1971 to 1994." *The Energy Journal* 21 (2000): 121–144.

Building off of their previous research that asserts that OPEC is not a cartel, and that Saudi Arabia is a dominant producer, these authors show here that target revenue theory holds for countries that are centrally planned (i.e. have a low degree of economic freedom) and are relatively isolated states that act as fringe competitors. These are states that depend heavily on oil revenues and where oil is owned and controlled by the state. A special case of target revenue theory holds for a few countries that are shown to have backward bending supply curves. The authors state "the main thesis of this model is that OPEC looks like a cartel because OPEC members cut or increase their production at the same time. This does not occur because of a unified policy, but because OPEC members have limited absorptive capacity and cannot absorb the extra revenues from oil sales" (127).

Alhajji, A.F. and D. Huettner. "OPEC and World Crude Oil Markets from 1973 to 1994: Cartel, Oligopoly, or Competitive?" *The Energy Journal* 21 (2000): 31–60.

These authors summarize their result as: "this study is the first to use a multi-equation model to test dominant firm, Cournot and competitive models for the world crude oil market. Neither OPEC, nor the core fit the dominant firm model. Only Saudi Arabia is found to act as a dominant producer. This study suggests that the world oil market is not competitive since the competitive model is rejected and it is dominated by Saudi Arabia, not OPEC or the core. There is not statistical support for Cournot or competitive models" (52).

Alhajji, A.F. and D. Huettner. "OPEC and Other Commodity Cartels: A Comparison." *Energy Policy* 28 (2000): 1151–1164.

This article concludes that cartel characteristics do not describe OPEC well. The authors argue that statistical analyses supporting the notion of OPEC as a cartel only prove parallel action. They note that there are limitations to the study of OPEC due to economic sanctions, currency fluctuations, and the general overdependence on a single commodity, oil. Because Saudi Arabia is more influential than other OPEC members, they analyze it separately and the other countries as sub-groups. The authors argue that recent developments in the oil market are best explained by the dominant role of Saudi Arabia and capacity limitations, not by OPEC becoming a full cartel.

Reynolds, D. B. "The Case for Conserving Oil Resources: the Fundamentals of Supply and Demand." *OPEC Review* 24 (2000): 71–86.

This paper predicts an oil price shock in 5–10 years based on slowing discovery rates and increasing oil demand. The author recommends lowering oil production and easing the transition to higher oil prices by steadily increasing prices to spur energy conservation. He argues that the two oil shocks in the 1970s had no political cause, but rather that they were a natural reaction of producers wanting to conserve a valuable resource. OPEC should not be afraid of pushing prices higher, because even very high oil prices wouldn't be able to increase adequately proven reserves through more intensive exploration and better technology. Oil markets are not efficient because they are based on present prices that are fallible forecasts of the future.

Adelman, M.A. "The Clumsy Cartel." *Harvard International Review* 23 (2001): 20–23.

Since 1970 the price of crude oil has been high and unstable due to the restriction of oil output by OPEC and the lack of reliable data about worldwide oil inventory and supply. The lack of reliable data and uncertainty about what OPEC members will supply brings volatility to oil prices and makes the market speculative. OPEC has been declining in importance in setting oil prices but it still has power over oil prices. Without the agreement by OPEC members to restrict output and to maintain or raise prices, crude oil prices would decline toward the competitive price level. OPEC members try to forecast the demand for oil by trial and error by estimating non-OPEC oil output and subtracting it from consumption. OPEC then supplies the remaining amount. However, the problem for OPEC is determining how to allocate this share among its members as they try to maximize their own profits. Limits on this caused OPEC to lose much of its control.

OPEC will lose power to set oil prices if (1) OPEC members cheat on agreements as has happened in the past when Saudi Arabia would bear the entire loss; or (2) the non-OPEC countries invest more in the production of oil. Many countries restrict foreign companies in order to exploit domestic oil levels, which actually strengthens OPEC. If countries instead facilitated investments by foreign companies, the result would be cheap oil and the loss of OPEC dominance. Restrictions by non-OPEC countries are more important than oil scarcity in driving oil prices.

Alhajji, A.F. "What have we Learned from the Experience of Low Oil Prices?" *OPEC Review* 25 (2001): 193–220.

This paper describes the positive and negative consequences of low oil prices for producers (nations and companies) and consumers, and concludes that the costs of low oil prices outweigh the benefits. The paper asserts that recent price increases were the result of market failures, caused by imperfections such as "production cuts by some oil-producing countries, political turmoil, labor strikes, pipeline explosions and technical problems" (214). However, low prices had consequences that spurred higher prices, so the market was able to correct itself. The author also notes that interventions such as taxes, subsidies, and embargoes are impediments to a competitive market.

Kumins, L. "Oil Prices: Overview of Current World Market Dynamics." *Congressional Research Service*. October 26, 2001.

One of the key points in this report is that OPEC reacts to world demand and prices for oil much as any supplier would. It also highlights the challenges OPEC confronts including managing excess production capacity, ensuring discipline among its members, and potential new increases in world supply from producers such as Iraq. The author notes that OPEC has no control over demand, which would imply some level of price-taking on the part of OPEC. However, it also appears that OPEC has become "more confident in its ability to control prices" (7) and that it can better manage member discipline and excess capacity than it could in the past.

Ghouri, S.S. "Oil demand in North America: 1980–2020." *OPEC Review* 25 (2001) 339–355.

This article examines price and income elasticity of demand for oil in the U.S., Canada, and Mexico. Oil demand proves to be inelastic in both the short run, when consumers are constrained by technology and other barriers, and in the long run. However, demand is somewhat more responsive in the long run. Oil demand exhibits a positive relationship with economic growth. The author also notes that there is a negative relationship over time, which indicates that energy efficiency has been increasing over time.

Horn, M. "Price of Crude Oil to Remain High." *Economic Bulletin* 38 (2001): 111–118.

The market's role in determining oil prices has been increasing in importance over the past few decades as the oil industry has become less vertically integrated. Spot prices are now the reference prices for supply contracts and price controls have mostly disappeared. Futures markets have decreased price volatility but OPEC still has control over the oil market. OPEC's pricing power is strengthened by the world's increasing dependence on oil as an energy source because technological advances in exploration and extraction in non-OPEC countries are not enough to cover the growth rate of energy demand and also by persistently low stocks, especially in the US.

After OPEC decided to increase its production quotas, prices plunged from about \$20 per barrel in fall of 1997 to less than \$10 per barrel at the beginning of 1999. OPEC members then understood that they needed to cooperate on cutbacks. In March 2000, the price of oil was over \$30 per barrel, which motivated OPEC to decide to increase production in order to avoid excessive dampening of oil consumption and world GDP growth.

Jabir, I. "The Shift in U.S. Oil Demand and its Impact on OPEC's Market Share." *Energy Economics* 23 (2001): 659–666.

By investigating U.S. demand for crude oil imports, this paper shows that OPEC's ability to maintain prices depends on the cohesion of its members to their assigned quotas and their cooperation with non-OPEC producers in order to alleviate any competitive behavior. This behavior is much more important than changes to the level of the strategic petroleum reserve possessed by the U.S.

Ramcharan, H. "OPEC's Production under Fluctuating Oil Prices: Further Test of the Target Revenue Theory." *Energy Economics* 23 (2001): 667–681.

In an overview of the challenges facing the organization, the authors find that "OPEC faces a challenging future because of: (a) increasing supply from non-OPEC sources; (b) new exploration and discoveries by small producers; (c) expansion of production capacity in some member countries; (d) better drilling and exploration technology that could cut operating cost and lower price; and (e) volatile demand patterns in importing countries because of economic cycles or recession. OPEC may have to adjust to a market in which price and quantity are determined to some extent by demand and supply" (677).

Adelman, M.A. "World Oil Production and Prices 1947–2000." *The Quarterly Review of Economics and Finance* 42 (2002): 169–191.

This article explains why lower-cost oil output from OPEC has decreased while the production of higher-cost output, from non-OPEC countries, has increased. The author explains why the price of oil has increased since 1970 and why it became so volatile. In a competitive market, oil prices would be relatively stable. Oil production would be flexible if it were not controlled by governments or by monopoly. In a competitive market, fixed costs are unimportant and the industry marginal cost is close to price.

Before 1971, oil prices were stable because oil output was flexible. Since then, however, prices have fluctuated widely. Every price increase between 1973 and 2001 followed a deliberate cut in or refusal to increase output by OPEC while there was excess OPEC oil capacity. The contemporary oil price is high and unstable because the competitive thermostat was disconnected; producers no longer set output independently of each other. Instead, a cartel of low-cost producer nations restrains output to support the price. Cooperation is usually difficult, reluctant, and slow, so output often overshoots or undershoots demand. Prices are volatile not because of the methods of production or consumption, but because of the clumsy OPEC cartel.

Adelman also makes several other points. (1) In the 1980s, oil production in the Middle East and Venezuela had been almost completely nationalized. (2) In most of the world, governments own the subsoil resources. (3) The worst economic climate is in the former Soviet Union, where the state industry was privatized to persons skilled in maneuvering to seize wealth, not investing to create it. Foreign companies saw great promise for new investment in discovery and development in this region. However, local barriers, excessive and capricious taxes, and the lack of a law enforcement system for contracts and property rights aborted investment. Several successor republics may be better than one government.

Alvarez-Ramirez, J. et al. "Multifractal Hurst Analysis of Crude Oil Prices." *Physica A: Statistical Mechanics and its Applications* 313 (2002): 651–670.

Based on works by Mandelbrot, Mantegna, and Stanley, this article exploits a new approach to the investigation of regularities in economic and financial systems of data: analysis divorced from assumptions of random dynamics. The authors apply multi-fractal analysis methods to analyze daily time-series data of international crude oil prices. Based on rescaled range analysis, the authors conclude that crude oil price formation is a persistent stochastic process with long-run memory effects at work: it is a complex process with highly interacting dynamics acting at different time scales.

Kohl, W.L. "OPEC behavior, 1998–2001." *The Quarterly Review of Economics and Finance* 42 (2002): 209–233.

OPEC wielded significant market power during this time period, as evidenced by its large effects on oil prices in 1999 from its production cut and in 2000 from its production increase. However, OPEC often makes mistakes in determining the optimal level of production due to its misreading of the world economy and its limited forecasting ability. It recognizes that high oil prices in the long run will hurt it because they would lower world economic growth and therefore lower world oil consumption. High oil prices also push countries toward oil substitution. OPEC's discipline since 1999 has been strengthened by Chavez, by the rapprochement of Saudi Arabia and Iran, and by its more frequent meetings. OPEC's control of the oil market is challenged by the fact that it only has one tool with which to exercise its market power: the management of its supply.

Because OPEC does not have an enforcement mechanism, its situation is akin to a repeated n-prisoners dilemma. Quota compliance has been weak when there have been cuts in production because many OPEC members, notably Saudi Arabia, rely too much on oil revenue to cover their debt servicing. Even though OPEC usually decides the general direction of oil prices, the futures market can influence the pace and final values of a price move.

Tang, L. and S. Hammoudeh. "An Empirical Exploration of the World Oil Price under the Target Zone Model." *Energy Economics* 24 (2002): 577–596.

This article investigates the behavior of the world oil price based on the first generation target zone model. Based on analysis of monthly data from 1988–1999, the authors conclude that OPEC attempted to maintain a weak target zone regime for the world oil price. Empirical evidence suggests that movement in oil price was manipulated by OPEC interventions that changed the production ceiling only when the price was approaching the limits of the

band at \$15–\$25 per barrel. In addition to that manipulation, market price outcomes were tempered by market participants' expectations of these OPEC's interventions.

Ramcharan, H. "Oil Production Responses to Price Changes: An Empirical Application of the Competitive Model to OPEC and non-OPEC Countries." *Energy Economics* 24 (2002): 97–106.

This article analyzes oil production behavior within the competitive framework. The author used data from 1973–1997 to estimate a supply function based on Griffin's model. The results do not support the competitive hypothesis for any OPEC countries, but they do support the competitive hypothesis for non-OPEC oil producers. This analysis implies a negative and significant price elasticity of supply. The author concludes that this work provides support for the target revenue theory. Due to increasing supply from non-OPEC sources, new oil exploration, discoveries by smaller producers, and expansion of productive capacity by Venezuela and Nigeria, OPEC will face a challenge to survive.

Bamberger, R. "Energy Policy: Historical Overview, Conceptual Framework, and Continuing Issues." *Congressional Research Service*. January 30, 2003.

After 1999 OPEC showed a level of discipline that it had not shown since the 1970s. The U.S. oil market deregulation that started in 1975 became more market oriented. By the late 1980s OPEC members realized that in the long run, persistent high oil prices would hurt demand for their oil. Consequently, they increased production. OPEC can adjust the price of oil enough to make substitutes economically unfeasible, but the political balance among OPEC nations can prevent that from happening. OPEC exerts influence on oil prices because it holds a majority of the world's oil.

Kanovsky, E. "Oil: Who's Really Over a Barrel?" *The Middle East Quarterly* 10 (2003): 51–63.

Oil-producing countries are not rich monopolists that can manipulate oil prices. In Saudi Arabia a lavish welfare state and corruption precipitated a revenue crisis in the Kingdom. Consequently, Saudi Arabia could not afford to assume the role of swing producer to prop up oil prices. Improvements in oil exploration and extraction have diminished concerns about oil depletion. Alternative energy sources such as natural gas, and improvement in energy efficiency, have been and will further decrease oil dependency. Oil producers, led by Saudi Arabia, now depend on the U.S., rather than the opposite.

Al-Nuwaizer, W. "The Oil Market Postwar Iraq." *Studies in International, Financial, Economic and Technology Law* 6 (2003): 343–350.

This article addresses different scenarios that could take place if an occupied Iraq were to increase its oil production despite its OPEC quota. The author also discusses a possible reorganization of the oil industry in which the new political power in Iraq would decide to leave OPEC.

Saudi Arabia is the only country that has the ability to vary rates of oil production from a low of 5 million barrels per day to over 10 million barrels per day; therefore international oil market conditions are primarily a determinant of Saudi oil output. The author concludes that Saudi Arabia remains the most important player in the global oil market and that without a deal with the Saudis, the market would not be in a good shape. The author also concludes that Iraq should not withdraw from OPEC because it is not in a position to compete against OPEC members.

Barsky, R. and L. Kilian. "Oil and the Macroeconomy since the 1970s." NBER Working Paper Series No. 10855. Cambridge, Massachusetts: National Bureau of Economic Research. October 2004.

Oil producers regularly trade off immediate gains from abandoning the OPEC cartel against the present value of the future cartel rents foregone. This tradeoff suggests that unusually low real interest rates as occurred in the 1970s should be conducive to the formation of cartels. High interest rates, on the other hand, should be detrimental to cartel formation. The ability of cartels to keep prices high will be pro-cyclical if producers are unable to tell whether other cartel members are cheating by exceeding their production quotas. The assumption of imperfectly observable output is appealing for crude oil because the actual production level of crude oil in many cases can be only estimated, and reliable output statistics become available at best only with a long lag time. Therefore, when all other factors are held constant, strong economic expansions should strengthen oil cartels and major recessions should weaken them. This model helps to explain the surplus production of oil following the Asian crisis of 1997–1998 as well as the success of OPEC during 1999–2000. Turning points for oil prices occurred as the first signs of U.S. recession began in late 2000. Within weeks the oil price began to slip, and its fall accelerated throughout 2001.

Bernabe, A. et al. "A Multi-Model Approach for Describing Crude Oil Price Dynamics." *Physica A: Statistical Mechanics and its Applications* 338 (2004): 567–584.

This article constructs a two-fold model of oil price dynamics. Prices are shown to fluctuate around two equilibrium prices, each of which can be modeled with a mean-reversion stochastic process. On rare occasions, "large social, political and economic events involving oil-exporting countries" (580) can cause prices to move between the lower price equilibrium and the higher price equilibrium, and this movement can be modeled as a jump diffusion process. Using daily averages of the high and low prices of oil, the authors found equilibrium values of about \$19 and \$28 per barrel, and showed that prices tend to follow the mean-reversion process centered on the lower of the two prices.

Blaydes, L. "Rewarding Impatience: A Bargaining and Enforcement Model of OPEC." *International Organization* 58 (2004): 213–237.

OPEC is a cartel; as such it is inherently unstable. Only through periodic meetings where its members achieve consensus it can persist. A cartel has two tasks: maximize profits for the cartel and divide these profits among its members. The latter task is the one that can cause a cartel collapse when its members cannot agree.

By using a bargaining and enforcement model, the author found that cartel members with low reserves per capita (i.e. a low "patience" discount factor) are allowed to overproduce by the richer ones in a situation akin to a repeated prisoners' dilemma. The reason is that present-oriented members' threat of leaving the cartel is credible, therefore richer member have to subsidize them to maintain the cartel.

Brook, A. et al. "Oil Price Developments: Drivers, Economic Consequences and Policy Responses." *OECD Economics Working Paper No. 412. December 8, 2004.*

This paper offers an analysis of factors influencing the price of oil and their likely evolution over the next 25 years. The authors discuss fundamental forces that shape long-term oil price developments with a focus on growth-led demand for oil (i.e. a focus on developing countries). The current oil price is significantly greater than the six-month futures oil price, what implies that the convenience yield (i.e. the premium attached to ownership of physical asset) has risen. The authors assume two possibilities for OPEC oil supply behavior: (1) OPEC targets a constant market share; and (2) OPEC attempts to stabilize oil price. Based on this analysis, the paper concludes that stabilizing the price of oil by increasing market share may be the optimal long-run behavior for OPEC. The optimal strategy of oil-producing countries is to prevent the oil price from rising too far. Reserves should be adequate to ensure adequate supply over the next 25 years; they will be subject to increasing longer-term dependence on OPEC oil. Investment in the energy sector may not receive the required share of global capital because the global oil supply is concentrated in a limited number of OPEC countries where investment is not allocated according to market forces. Global investment, supply, and price extrapolations are contingent upon the extent to which OPEC (or a subset of OPEC) will exercise its market power. Other suppliers face much higher and more steeply increasing marginal costs than does OPEC. The reserve-rich producers in the Middle East have incentives to exploit this cost advantage by trading off market share for a higher price. The less elastic global oil demand and non-OPEC oil supply are in the long run, the greater are OPEC's incentives to restrict output and thus raise prices along with rising world oil demand.

Gately, D. "OPEC's Incentives for Faster Output Growth." *The Energy Journal* 25 (2004): 75–96.

This article assumes that "OPEC does not act collectively and has difficulty reaching and enforcing agreement among its members." In some views, two groups within OPEC are engaged in a constant sum game: one side makes a move and the other group responds, but neither side is better off. This represents a serious problems of coordination within the cartel.

Jalali-Naini, A.R. and M. Asali. "Cyclical Behavior and Shock-Persistence: Crude Oil Prices." *OPEC Review* 28 (2004): 107–131.

This article concludes that over time, higher prices stimulate non-OPEC production at the cost of OPEC market share, and that lower prices have the opposite effect. At lower prices OPEC also acts to prevent a drastic price drop. "OPEC's members are 'rational' and risk-averse" and are influenced by the need for smooth, inter-temporal revenue streams.

Kaufmann, R.K., et al. "Does OPEC Matter? An Econometric Analysis of Oil Prices." *The Energy Journal* 25 (2004): 67–90.

This article investigates the relationship between real oil prices and OPEC's capacity utilization, OPEC production quotas, the degree to which members cheat on quotas, and crude oil stocks in OECD nations. The authors find a cointegrated relationship between price, on the one hand, and the other factors on the other, with evidence of Granger causality in the direction of OPEC's decisions to price. The authors note that they did not address whether OPEC is a cartel, and they explain that as production increases in non-OPEC countries in the future, the ability of OPEC to influence prices may be challenged. However, "OPEC has considerable power over price via decisions about quotas, production, and operable capacity," variables that are "relatively independent of real oil prices" (88).

Mazraati, M. and S.M. Tayyebi Jazayeri. "Oil Price Movements and Production Agreements." *OPEC Review* 28 (2004): 207–226.

This article notes that "OPEC's market stabilization measures...are self-imposed" (210). The authors use intervention analysis and a measure of OPEC compliance (the ratio of actual production to the price ceiling) to demonstrate that compliance on the part of individual OPEC members can have an impact on oil prices. Higher compliance rates following production quota cuts can boost prices, whereas lower compliance rates can have a negative impact on prices.

Wirl, F. and A. Kujundzic. "The Impact of OPEC Conference Outcomes on World Oil Prices 1984–2001." *The Energy Journal* 25 (2004): 45–62.

This article addresses the question: does OPEC achieve its goals post-meeting, and do meetings reveal any information to market participants that influences price? The authors conclude that the market does not reveal much about meetings; a weak significance in regressions indicates that there is no impact of conferences. However, OPEC does influence the market: sufficient information may leak prior to conference communiqués. News may show up in hourly or other higher frequency data. The authors also note that the conference lacks credibility and follow-through at member level.

This article also addressed the question: is OPEC a market follower? The authors conclude that OPEC is not a market follower; the conference tries to counteract large changes in the price of oil. The authors found weak empirical analysis for the hypotheses that OPEC leads or follows the market, although there may be some evidence that OPEC reacts to large, pre-conference price changes rather than more frequent moderate changes.

Yousefi, A. and T.S. Wirjanto. "The Empirical Role of the Exchange Rate on the Crude-Oil Price Formation." *Energy Economics* 26 (2004): 783–799.

These authors conclude from their empirical analysis "in other words, our results do not seem to be in accord with both the hypothesis of a cartel model of OPEC and the perfectly competitive market structure" (793). The authors found that Saudi Arabia behaves like a price leader during their period of study; it had lower rival-price elasticity. "Our interpretation of the result of this exercise is that the role played by Saudi Arabia as a price leader is indeed a reflection of the fact other members are too small to share away some of Saudi Arabia's market power" (797). There is segmentation within OPEC: the members try to exert market power by price rivalry. Instead of unified price determination by OPEC, there is partial market sharing.

Mabro, R. "The International Oil Price Regime: Origins, Rationale, and Assessment." *The Journal of Energy Literature* 11 (2005): 3–20.

This author argues that OPEC influences oil prices only indirectly through setting quotas and a price band. Buyers and sellers of futures contracts will respond to OPEC's signals only if they believe in OPEC consensus on policy-making and regard this policy as realistic. This article argues that opposing market forces can neutralize OPEC's influence. Moreover, there has been a transfer of pricing power from OPEC to non-commercial traders such as hedge funds and other financial institutions in the current market-related pricing system. The most important factor in determining the trend of oil prices is the lack of spare capacity due to underinvestment by OPEC, growing demand from emerging countries, and insufficient refining capacity in the U.S. In a tight market OPEC has little power to bring down prices within its preferred band.

Pirog, R. "World Oil Demand and Its Effect on Oil Prices." *Congressional Research Service*. June 9, 2005.

Even though some question OPEC's discipline because of member countries' violations of production quotas, this author thinks that OPEC influences the market by just existing because buyers and sellers check the institution's

behavior. According to the General Accounting Office, mergers between 1991 and 2000 had increased the wholesale oil price by \$0.02 per gallon due to higher industry concentration ratios. Speculation on future contracts and options might have also been a factor affecting oil prices. The adoption of a just-in-time strategy by the oil companies and strained refining capacity have both contributed to low inventory and to oil price increases. Furthermore, a “fear factor” premium based on the War on Terror and general instability in the Middle East and Venezuela was factored into the price of oil. High prices led to bouts of increases in proven reserves, which in turn depressed oil prices. However, some experts believe that world oil production will peak. This report concludes that high oil prices will probably be a constant from now on, due to high growth rates in China and other Asian countries that will cause substantial increases in oil demand. These factors will keep oil prices higher than OPEC’s price target.

Smith, J.L. “Inscrutable OPEC? Behavioral Tests of the Cartel Hypothesis,” *Energy Journal* 26.1 (2005): 51-82.

There is a mix of views on the success of OPEC in efforts to restrict production to raise prices. The general view is that OPEC operates as a cartel, but statistical evidence to support the cartel hypothesis is weak. It is not clear if price fluctuations are due to collusive or competitive behavior—a story can be made in either direction. A new “production-based approach for examining alternative hypotheses” is used and finds “OPEC is much more than a non-cooperative oligopoly, but less than a frictionless cartel.” A move to quotas in 1982, away from posted prices, increased the difficulty of operating OPEC. It is like a bureaucratic syndicate. It is not clear if Saudi Arabia and other major producers play a special role in OPEC.

Stevens, P. “Oil Markets,” *Oxford Review of Economic Policy* 21 (2005): 19–42.

This article examines the current and future state of oil markets with a focus on some elements in oil market that may attract concern and call for policy intervention. The key to operation of the global oil market lies in the role of market power in a strongly oligopolistic market structure that creates considerable rents in the international price, pushing crude prices far above marginal costs. Although supply and demand influence price determination, they do so in a highly distorted market.

The price of oil has always exceeded the cost of replacing the produced barrel. This rent, which arises either from low production costs as a result of favorable geology or from resulting from market manipulation, created an incentive for oil producers to develop capacity to produce. Existing production facilities had been subjected to sudden outages from accidents and/or political events that required rapid development of replacement capacity. However, once losses were restored, the new capacity became surplus capacity to the requirement.

Given this excess capacity, the function of OPEC was to prevent the excess production from creating downward pressure on oil prices. Therefore, OPEC needed to estimate the call for its crude and then allocate that call among the members to ensure that the market would be managed. OPEC faced two challenges: the poor quality of market information and the classic cartel problem of cheating. In the 1950s and 1960s when international oil companies were in control, their operational vertical integration gave them excellent information on supply and demand, which allowed them to orchestrate supply and protect prices from downward pressure. The breakdown of this horizontal and vertical integration by processes such as nationalization in the 1970s led to lost market information. As a consequence, when OPEC assesses oil demand and non-OPEC supply the data are poor and unreliable. The best OPEC can do is to guess and hope. Thus, the price collapse of 1998 was triggered by OPEC’s decision made at the November 1997 meeting in Jakarta, in which the cartel grossly overestimated demand and under-estimated supply outside OPEC.

Bina, C. “The Globalization of Oil: A Prelude to a Critical Political Economy.” *International Journal of Political Economy* 35 (2006): 4–34.

This author uses a Marxist framework to argue that after the first oil shock in 1973 the oil market became dominated by market forces. Consequently, OPEC does not hold market power. Oil prices are instead determined by market forces and spot prices. Before 1973–1974, the oil market was dominated by a cartel formed by the major multinational oil companies.

Ghouri, S.S. “Assessment of the Relationship between Oil Prices and U.S. Oil Stocks.” *Energy Policy* 34 (2006): 3327–3333.

This article contains an empirical analysis of the relationship between the U.S. monthly oil stock and West Texas

Intermediate (WTI) oil prices based on data collected between February 1995 and July 2004. The author concludes that oil prices were mainly influenced by levels of inventories of crude and petroleum products. He found a negative relationship between WTI prices and U.S. monthly stock positions. The article concludes that the U.S. government aggressively builds its strategic petroleum reserves and ignores the deteriorating short-term stock positions of crude and petroleum products, thereby driving oil prices up.

Watkins, G.C. "Oil Scarcity: What Have the Past Three Decades Revealed?" *Energy Policy* 34 (2006): 508–514.

This author argues that oil will be abandoned as an energy source long before reserves are exhausted through substitution by alternative energy sources. The concept of "ultimate reserves" is not useful because it is based on future technology and knowledge that cannot be predicted; proven reserves change due to the tug-of-war between declining yields and better knowledge and technology in the oil industry. There has been less reliance on OPEC because its share of world oil production has decreased. If OPEC went to a lower reserves to production ratio comparable to the non-OPEC ratios, the world would be flooded with cheap oil and non-OPEC production would stop. Therefore, countries with high costs of production, such as the U.S., are not displeased with relatively high oil prices.

Bentzen, J. "Does OPEC Influence Crude Oil Prices? Testing for Co-Movements and Causality between Regional Crude Oil Prices." *Applied Economics* 39 (2007): 1375–1385.

This article uses cointegration and error-correction modeling of high-frequency (daily) data from 1988–2004 to analyze co-movements among crude oil prices. High frequency oil price data allows for a deeper analysis of very short-run co-movements, but still adopts cointegration and error-correction modeling of oil prices in a vector-autoregression system. The main focus of the paper is to test if "the law of one price" holds for crude oils: weak and strong exogeneity among three major oil prices of Brent, OPEC and Texas (WTI). Empirical results suggest a bi-directional causal relationship among these three crude oil prices. The author suggests a rejection of the hypothesis of regionalization of the global oil market, which may be indicative that OPEC works as a benchmark for Brent and WTI.

The author invokes a study by Kaufmann et al. from 2004 that found that OPEC production capacity and quotas were affecting real oil prices (in the sense of Granger causality) and thus supported the hypothesis of OPEC influence on oil prices. The article also invokes other work on oil futures contracts that found an influence of the volatility of oil futures options from the Ministerial Monitoring Committee of OPEC, which indirectly supported the hypothesis of OPEC influencing crude oil prices. Based on the previous studies' results and the current analysis, the author concludes that OPEC has gained increasing influence on the development in crude oil prices. The shift in OPEC's strategy during 1999–2000 from a focus on quotas and market shares towards a more direct price-targeting policy had probably influenced the world market for oil, and might reduce the benchmark role of crude oils like Brent and WTI.

Dées, S., et al. "Modeling the World Oil Market: Assessment of a quarterly econometric model." *Energy Policy* 35 (2007): 178–191.

This article constructs a quarterly model for the world oil market that includes a pricing rule and demand and supply schedules for different regions of the world. For the supply model, the authors separate non-OPEC and OPEC production. For non-OPEC countries, the authors assume a competitive market subject to geological and institutional constraints. For OPEC the authors assume two frameworks: a cartel behavior in which OPEC is the price maker, and a competitive behavior in which OPEC is a price taker. The authors point out that OPEC behaves somewhere in-between the cartel and competitive market according to definitions from the literature.

Under this model an increase in oil stocks lowers real oil prices. Similarly, an increment in the OPEC quota tends to alleviate upward pressure on prices. If some OPEC member "cheats" its quota by producing more than it should, oil prices decrease. An increase in capacity utilization is associated with a rise in oil prices. From the forecasting and simulation equations, a 50 percent increase in oil prices reduces demand by 3 percent in the long run. The authors argue that oil demand and supply are quite inelastic in the medium term (3–5 years). "OPEC has considerable power over price via decisions about quotas, production, and operable capacity," variables that are "relatively independent of real oil prices."

Fattouh, B. "OPEC Pricing Power: The Need for a New Perspective." WPM 31. Oxford, England: Oxford Institute of Energy Studies. March 2007.

This article states that OPEC's pricing power is not constant, but varies over time. This change in pricing power is induced by market conditions and can occur both in weak and tight market conditions. This condition does not imply that market participants can afford to ignore OPEC because it has succeeded in many instances to implement production cuts that have prevented declines in oil prices. OPEC (more specifically, Saudi Arabia) has succeeded in offsetting the impact of sudden disruptions of supply and in moderating the rise in oil prices. However, pursuing output policies has become more complicated with the growing importance of the futures market in the process of oil price discovery. The effectiveness of any policy depends to a large extent on the ability of OPEC to influence participants' expectations in the futures market. By changing production quotas, OPEC and its dominant player Saudi Arabia are bound to have an influence on oil prices. The author concludes saying that oil is a political commodity, but like any other commodity in the long run its price responds largely to economic forces.

Fattouh, B. "The Drivers of Oil Prices." WPM 32. Oxford, England: Oxford Institute of Energy Studies. March 2007.

In this paper's analysis, the supply side equation is separated into one equation for the non-OPEC countries and another for OPEC members. Whereas non-OPEC members behave competitively, OPEC behavior is much more complex and there are many diverse theories in the literature that try to explain it. According to this paper, the pricing power of OPEC varies over time and the change in pricing power is induced by market conditions that can occur both in weak and tight market conditions. Pursuing output policies has become more complicated with the growing importance of the futures market in the process of oil price discovery.

Gately, D. "What Oil Export Levels Should We Expect From OPEC?" *The Energy Journal* 28 (2007): 151-173.

OPEC is a loose association with a limited ability to impose its will upon uncooperative members, but it is nonetheless important for its collective decisions. OPEC's exports are constrained by its rapid internal oil consumption. The most realistic strategy that explains OPEC's behavior is a market-adaptive one in which it tries to maintain a constant market share of non-OPEC demand. Maintaining such a share would require substantial and difficult-to-achieve increases in capacity for some of its members. The members that expand production will have extremely high returns on investment. If OPEC keeps prices too high for too long, it won't be able to quickly lower them to regain market share from the stimulated non-OPEC producers. Therefore, the paper concludes that \$70 per barrel is not a sustainable price for oil.

Gholtz, E. and D.G. Press. "Energy Alarmism: The Myths that Make Americans Worry about Oil." *Policy Analysis* No. 589. Washington, DC: Cato Institute. April 5, 2007.

These authors argue that "market forces, modified by the cartel behavior of OPEC, determine most of the key factors that affect oil supply and prices," and that the oil market is imperfect and has some idiosyncrasies, but overall it functions just like any other market. OPEC members often disagree on how much they should restrict supply and on their respective quotas. Even when they reach an agreement they have a short-term incentive to produce beyond their quota. The existence of political risk and of OPEC does not change the underlying importance of market forces; they just modify the response of the oil industry to political shocks and price changes.

Jaffee, A.M. and R. Soligo. "The International Oil Companies." Houston, Texas: The James A. Baker III Institute for Public Policy of Rice University. November 2007.

The international oil market is somewhat competitive because there are a large number of buyers and sellers of a mostly homogenous good. The market is less competitive when demand outstrips or approaches production capacity, because at that point OPEC wields market power due to inelasticity of demand. However, high prices also incentivize non-OPEC companies to increase production and investment that ultimately increase oil supply and depress prices, as happened in the 1970s and early 1980s. At that time, OPEC production cuts were unable to reverse the negative trend in prices. The response from non-OPEC producers to the contemporary high prices had not been the same, because the Big Five had invested very little in exploration due to: (1) increased industry concentration which caused easier tacit coordination on exploration; (2) a shortage in skilled labor and equipment due to boom-bust cycles; (3) high volatility that could be counteracted by hedging and long lead-in times (i.e. OPEC could increase price volatility in order to discourage non-OPEC investments); (4) investors in international oil companies preferring short-term to long-term gains, along with hopes of the companies' management to acquire smaller rivals when oil prices would go down; and (5) the scarcity of good large prospects available to international

oil companies. The authors conclude that there will be a competitive fringe that will undermine OPEC's monopoly power and therefore the oil market is mostly competitive and resilient to OPEC's power.

Pirog, R. "The Role of National Oil Companies in the International Oil Market." *Congressional Research Service*. August 21, 2007.

National oil companies, especially the ones in OPEC, are not necessarily as interested in maximizing profits as are the international oil companies. The national companies are not as efficient as international companies because they pursue other objectives as well such as subsidizing domestic oil consumption, increasing employment, helping other domestic industries, achieving foreign policy goals, and pursuing energy security on both the demand and supply side. Decreases of reserves held by international oil companies will give more market power to national oil companies, which already have the majority of proven reserves. The poor efficiency of national oil companies means that they will not be able to keep up with the increases in world demand.

Verleger, P.K. "The Coming Triple-Digit Oil Prices: Most Think Tanks and Government Experts Predict a Price Decline in the Coming Decades. They're Dead Wrong." *The International Economy*, Fall 2007.

This article predicts that triple-digit oil prices will be a constant in the future due to a high rate of demand growth, especially in China and India, that will not be greatly affected by high oil prices. Lagging production and refining capacity will also constrain the supply of oil. Approximately 70–85 percent of world's resources are exclusive to the inefficient national oil companies. Importantly, disruptions are also likely because most oil is in politically unstable countries.

Elekdag, S. et al. "Oil Price Movements and the Global Economy: A Model-Based Assessment." *IMF Staff Papers* 55 (2008): 297–311.

This paper examines how real adjustment costs, for both supply and demand, impact the price of oil. Shocks such as changes in productivity and energy use intensity can each have impacts on the price, and amplify each other, so that the total impact of any one shock is greater than the shock itself. In addition to slow adjustment costs, when a shock occurs, prices may be forced to increase or decrease dramatically in order to clear the market in the short-run, while demand and supply go through adjustments in the medium- to long-run.

Kaufmann, R.K. et al. "Determinants of OPEC Production: Implications for OPEC Behavior." *Energy Economics* 30 (2008): 333–351.

This article develops a model to analyze the relationship between a nation's level of oil production and variables including the price of oil, production by other OPEC members, quotas, and a vector of other country-specific factors such as capacity and reserves. The authors conclude that: (1) the elasticity of production response by any given nation depends in part on the level of that nation's quota cheating; (2) price exhibits a co-integrating relationship with the other variables; (3) OPEC nations do appear to practice market sharing (i.e. there is little evidence of tit-for-tat production response, especially by Saudi Arabia); and (4) that there is no evidence of asymmetric responses for almost all individual nations through responses to production cuts or increases at different rates.

The article concludes that "OPEC is able to influence (but not control) production through its quotas system without a monitoring system, punishment for cheaters, or central authority" (348). Although some may consider their mixed findings to be weak, the authors view this dichotomy as a strength of their work, acknowledging "that OPEC does not fit neatly into a single behavioral model is not an intellectual retreat. Rather, it is an admission of real world complexities" (349).

Sodhi, G. "The Myth of OPEC." *Policy* 24 (2008) 5–6.

This opinion piece, written by a junior analyst, claims that OPEC was producing at full capacity in 2008 and thus could not lower oil prices through higher production. The author argues that OPEC is just a loose alliance among 12 diverse producers; its members do not have reserves large enough to significantly affect prices, and thus they can produce more than their quota without anybody noticing. Therefore OPEC is like a peacock in that it looks impressive but cannot 'fly.'

Dvir, E. and K.S. Rogoff. "Three Epochs of Oil." NBER Working Paper Series No. 14927. Cambridge, Massachusetts: National Bureau of Economic Research. April 2009.

These authors document and test for changes in oil price behavior based on data from the period 1861–2008.

They argue that historically, the real oil price has had a tendency to be highly persistent and volatile whenever rapid industrialization in a major world economy coincided with uncertainty regarding access to the oil supply. By testing for persistence and for changes in volatility, the authors found empirical similarities between the periods 1861–1878 and 1972–2008 in which oil prices were significantly more persistent and more volatile relative to the long period that separates them (1878–1972). This paper describes striking historical similarities between these two end-periods in terms of supply and demand factors that affected the market for oil. On the demand side, both periods were years of intense industrialization in regions that were becoming major engines of the global economy: the U.S. in 1861–1878, and East Asia in 1972–2008. On the supply side, both periods featured uncertainty regarding the continued access of consumer markets to oil. This was due to the monopoly by railroads on transportation in the period 1861–1878 and to the monopoly by OPEC on easily exploitable reserves in the 1972–2008. Despite a remarkable difference in the scale of the oil industry between the two periods, both monopolies had a similar effect: in periods of rising demand, oil companies were able to restrict access to additional oil supplies, thereby causing oil prices to rise.

Graefe, L. “The Peak Oil Debate.” *Federal Reserve Bank of Atlanta Economic Review* 94 (2009).

This author thinks that OPEC might have lost some of its pricing power because most market participants were skeptical about OPEC’s future ability to meet increasing demand. Consequently, “global prices have been exceptionally inelastic to supply announcements [by OPEC].” However, the author argues that OPEC is a cartel that distorts market pricing when it colludes to withhold supply.

Hamilton, J.D. “Causes and Consequences of the Oil Shock of 2007–08.” NBER Working Paper Series No. 15002. Cambridge, Massachusetts: National Bureau of Economic Research. May 2009.

This paper analyzes similarities and differences between the run-up of oil prices during 2007–2008 and a previous oil price shocks. The world’s most important oil exporter has been Saudi Arabia. Saudi output has historically been volatile, not because of depletion but because the Saudis followed a deliberate strategy of adjusting production in an effort to stabilize prices. The Kingdom’s decision to increase production sharply in late 1990 was a reason why the oil price shock of that year was so short-lived; increased Saudi output accounts for much of the early rebound. The author’s major conclusion is that, in contrast to oil price shocks prior to 2007 that were caused by physical disruptions of supply, the price run-up of 2007–2008 was caused by strong demand that was confronting stagnating world oil production. Despite different causes of the shocks, the consequences for the economy appear to have been similar in both time periods. Based on the time-series plots of the relevant price and quantity parameters and conventional estimates of the price elasticity of oil demand, the author concludes that constraints on the production of crude oil after 2005 and growing demand for crude oil driven by the boom in the world economy are the primary explanation for the 2007–2008 oil price shock.

Hamilton, J.D. “Understanding Crude Oil Prices.” *The Energy Journal* 30:2 (2009): 179–206.

Price is equal to marginal costs for standard competitive goods, but because oil is exhaustible, its price is greater than its marginal cost. The difference between price and marginal cost should rise over time at the rate of interest. “Since Saudi Arabia alone accounts for a third of the production from the OPEC-10, one might alternatively consider the hypothesis that the Kingdom makes a calculation based on its unilateral monopoly power, with the rest of the world producing on a more competitive basis.” Oil demand has become less price elastic over time, which implies that its price should increase dramatically. Strong demand may have moved us into a regime in which scarcity rents are now an important permanent factor in the price of petroleum.

Khan, M.S. “The 2008 Oil Price ‘Bubble’.” Policy Brief BB09-19. Washington, DC: Peterson Institute for International Economics. August 2009.

This policy brief explains a possible cause for the historically high price of oil at \$147 per barrel that was reached in 2008 and the sharp decline afterward. The author states that OPEC had lost substantial market power compared to the 1970s and 1980s. Absent speculation, oil prices in 2008 would have stayed within the \$80–\$90 range, instead of reaching \$147 per barrel. This paper concludes that in 2008 there was a “bubble” because oil prices increased more than its valuation by oil companies, which is an indicator of the long-run equilibrium price of oil. A “bubble” could happen again in the absence of an increase in capacity and energy conservation.

Kilian, L. “Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market.” *American Economic Review* 99 (2009): 1053–1069.

This article proposes a structural vector autoregressive model of the global crude oil market to identify the

underlying demand and supply shocks in the global crude oil market. The author sought to explain not only to the fluctuation in the real price of oil, but also to understand the response of the U.S. economy associated with those fluctuations. This article applies newly developed measure of global real economic activity to structurally decompose the real price of crude oil into three component parts: (1) crude oil supply shocks; (2) shocks to the aggregate global demand for industrial commodities; and (3) demand shocks that are specific to the crude oil market. The article also estimates the dynamic effects of these shocks on the real price of oil.

The author's central message in this article is that oil price increases may have very different effects. This article's identification scheme allows for the possibility that OPEC may have acted as cartel during part of the estimation sample since OPEC has historically tended to restrict supply in order to prop up the price of oil. Such reductions would be captured by the oil supply shock in the proposed model.

Sankey, P., S. Micheloto and D.T. Clark. "Peak Oil Market: Price Dynamics of the Oil Age." *Global Market Research GRMC2009PROD016575*. Frankfurt, Germany: Deutsche Bank Securities, Inc. October 4, 2009.

These authors describe the dynamics of oil prices as follows: short run supply elasticity is almost entirely set by Saudi Arabia and selected core OPEC members that retain genuine discretionary spare oil supply capacity. There is a very limited reaction in non-OPEC countries beyond U.S. onshore stripper wells, the marginal North Sea, Canada and other mature oil-producing regions that occurs only at prices over \$80 per barrel and which is a limited short run response on marginal, mature production.

Smith, J.L. "World Oil: Market or Mayhem?" *Journal of Economic Perspectives* 23.3 (2009): 145-64.

OPEC has not been successful at restricting existing production capacity. Limitations on growth of new capacity by restricting growth of new capacity and developing new resources have been more successful. Cartel members seem to understand that if capacity exists it is likely to be used, so the best strategy is to restrict new capacity. Poor management of existing supplies means increased price volatility (exacerbated by inelasticity on the supply and demand sides). Failure to develop new capacity to grow supplies means the average price level has been driven up. It can be difficult to distinguish among the various actions taken by OPEC members. Enforcement of quotas imposed on OPEC members has a spotty track record. Different members have different incentives, so cohesive action is unlikely. Hedging and speculative trading in oil do not have significant impacts on oil prices.

Sornette D., R. Woodard, and W. Zhou. "The 2006–2008 Oil Bubble: Evidence of Speculation, and Prediction." *Physica A: Statistical Mechanics and its Applications* 388 (2009): 1571–1576.

This article presents an analysis of oil prices denominated in U.S. dollars and other major currencies. The authors support the hypothesis that the oil price peak of 2008 was amplified by speculative behavior. This article discusses information in the oil supply–demand data reported by the U.S. Energy Information Administration (EIA) and the International Energy Agency (IEA). The authors claim that the identification of increasing discrepancies in figures provided by EIA and IEA can provide a measure of error estimation. The methodology applied in this analysis aims to detect the transient phases where positive feedbacks operating on some markets or asset classes create local unsustainable price run-ups. Until the end of 2005, both agencies were in sync and supply was systematically exceeding demand. However, since 2006 that deterministic fact has broken down as the oil market has entered an opaque regime. Because uncertainty fuels speculation, speculative behavior of the type found during a bubble-like expansion was the cause of 2008 oil price run-up.

Wurzel, E., L. Willard, and P. Ollivaud. "Recent Oil Price Movements: Forces and Policy Issues." *OECD Economics Department Working Papers* (2009).

This paper considers the major forces behind the evolution of oil prices using a simple model of supply and demand elasticity values as a benchmark. The authors conclude that the run-up in crude oil prices since 2003 was due to both vigorous growth in oil demand by emerging markets and a weaker-than-expected oil supply response to rising prices. This paper also concludes that prices are unlikely to fall back to the levels observed in the beginning of the 2000s in the short or medium run.

The effective depreciation of the U.S. dollar since the beginning of the decade and the long period of relatively low real interest rates are also factors likely to have contributed to the upward pressure on oil prices. Because crude oil is priced in the U.S. dollar, depreciation of the dollar reduces the price of oil in the other currencies, thereby increasing oil demand. As the purchasing power of oil producers' revenues in terms of a 'currency basket' declines with the dollar's depreciation, OPEC can exercise a certain degree of market power, and has an incentive to

compensate for this decline by letting oil prices rise. Lower interest rates tend to stimulate demand, including that of oil, although they make it less profitable for producers to extract oil and invest proceeds on the bond market.

Aune, F.R. et al. "Financial Market Pressure, Tacit Collusion and Oil Price Formation." *Energy Economics* 32 (2010): 389–398.

This article analyzes whether a change in investment behavior among international oil companies (IOCs) towards the end of the 1990s had long-lived effects on OPEC strategies and oil price formation. On the oil supply side, the degree of concentration among the most important oil producers is significant, which leaves a potential scope for pricing power. The total oil supply is comprised of production from two groups of players: OPEC countries and non-OPEC countries, and is also strongly influenced by the IOCs.

The authors found that the strategic redirection of the international oil industry towards the end of the 1990s had long-lasting effects on OPEC's behavior and on oil price formation. The paper simulates a detailed model called FRISBEE, a dynamic partial equilibrium model, for the global oil market to analyze effects of the change in investment pattern on oil supply and oil prices, and compares these results to a situation characterized by industrial stability and unchanged price ambitions within OPEC. Particular attention is paid to the oil industry's supply of oil, which the model accounts for explicitly through parameters for discoveries, reserves, field development, and production in four field categories across 13 global regions including two OPEC regions. The model is calibrated with market data for the base year 2000, as well as with other relevant data and estimated parameters from the literature such as demand elasticity values, production costs, and oil resources. The oil market is assumed to clear in each yearlong period, and investment and exploration decisions are assumed to take place at the end of each year. Regional supply, demand, and trade flows are included as outputs of the model. The results of simulated scenarios suggest that the change in investment strategies of the late 1990s caused a lift of approximately 10 percent in the long-term price of oil. Both OPEC and non-OPEC producers gained from this development, whereas the cost is carried by oil importers and consumers.

Fattouh, B. "Oil Market Dynamics through the Lens of the 2002–2009 Price Cycle." WPM 39. Oxford, England: Oxford Institute of Energy, January 2010.

This paper emphasizes the interactions among oil price determinants and the players in the oil market. The author focuses on the dual nature of crude oil as a physical commodity and as a financial asset, and on the role of expectations in the formation of the oil price. As a physical commodity, oil's price is influenced by current market fundamentals such as the supply–demand balance, the level of inventories and the availability of spare capacity. As a financial asset, oil's price is influenced by expectations of market fundamentals, as well as other macroeconomic news that influences those expectations.

In the past decade, OPEC's behavior can be understood as cyclical. In a rising market, OPEC tends to satisfy demand at the available market-determined prices by using its spare capacity. In a falling market, OPEC sends a signal to the market about its preferred oil price. If the signal is successful in stabilizing expectations about its preferred price, OPEC will not have to resort to output cuts. Instead, it continues to meet demand at a price with which it is comfortable given prevailing market conditions.

Gallo, A. et al. "What Is Behind the Increase in Oil Prices? Analyzing Oil Consumption and Supply Relationship with Oil Price." *Energy* 35 (2010): 4126–4141.

This article investigates the reasons for increments in oil prices, specifically whether recent price increments came from the supply side or from an increase in consumption. The authors analyze the characteristics of oil prices, production, and consumption for many countries using time series models and Granger causality tests. To establish the relationship among these variables the paper estimates unrestricted vector autoregressive models to perform causality tests between oil prices and consumption. The authors conclude that they cannot establish a strong relationship between oil prices and consumption, but that supply variables have a much stronger influence in determining oil prices. As a result, they claim that the causes of recent rising and falling oil prices appear to come from the supply side of the market and not from consumption influences.

Greene, D.L. "Measuring Energy Security: Can the United States achieve oil independence?" *Energy Policy* 38 (2010): 1614–1621.

This article shows how market failure arises from imperfect competition in the world oil market. This is largely due to the use of market power by OPEC. The costs of this market failure have amounted to multiple trillions of dollars

over time, including more than \$500 billion to the U.S. economy alone in 2008.

Hedenus, F., C. Azar, and D.J.A. Johansson. "Energy Security Policies in EU-25: The Expected Cost of Oil Supply Disruptions." *Energy Policy* 38 (2010): 1241–1250.

This article develops an analytical framework to study one important aspect of energy security: the expected cost of an oil disruption. The authors built a model based on previous work by adding two new aspects: (1) they modeled OPEC as a rent-maximizing strategic actor, and (2) they modeled price interdependence between oil and other energy commodities, such as ethanol and natural gas.

The authors argue that the oil market is not competitive. OPEC, which supplies 41 percent of the global oil and holds more than 75 percent of the proven reserves, exercises market power. They claim that it is clear that OPEC does not act as an optimally coordinated cartel; OPEC is often referred to as a clumsy cartel in previous research. Nevertheless, the price of oil would likely have been significantly lower if the oil market were competitive. The oil price in a competitive market is estimated at \$7–15 per barrel. Other studies estimate that there are reserves of 10 trillion barrels of conventional and non-conventional oil at a cost below \$15 per barrel. An oil price that is higher than the competitive level (as in 2006–2007) would imply that there is a dead weight loss for the global economy and that wealth is transferred from oil importers to oil exporters.

Kesicki, F. "The Third Oil Price Surge: What's Different This Time?" *Energy Policy* 38 (2010): 1596–1606.

This article identifies similarities and differences between the oil price shocks of 1973 and 1979–1980 and compares the various aspects on the demand and supply sides to the oil price increase in the period 2003–2008. OPEC's power came mainly from its control over marginal supply through its huge proven oil reserves and its export volume. In previous decades, OPEC had been very important in influencing oil prices. For example, during the oil embargo of 1973, when OPEC's members accounted for 53 percent of global production, OPEC members were able to exercise their market power by withdrawing oil production from the market. Since 1992, OPEC's market share is again above 40 percent, which may be a sign of higher influence by the oil market cartel. All three oil price crises were marked by low OPEC surplus capacity, which indicates the importance of OPEC's oil supply.

Killian, L. "Oil Price Volatility: Origins and Effects." Staff working paper ERSD 2010-02. Geneva, Switzerland: World Trade Organization, January 2010.

Supply shocks have had little effect on real oil prices since 1973. Demand shocks associated with fluctuations in the global business cycle have been responsible for long swings in the real price of oil, especially in the periods 1973–1974, 1979–1980, and 2003–2008. Demand speculation that reflected forward-looking behavior by traders played an important role in 1979, 1986, 1990/1991, 1997–2000, and late 2008. "Speculative demand shocks can cause large immediate effects on the real price of oil, for example in response to geopolitical events."

Reynolds, D.B. and M.K. Pippenger. "OPEC and Venezuelan Oil Production: Evidence Against a Cartel Hypothesis." *Energy Policy* 38 (2010): 6045–6055.

This article revisits the OPEC cartel hypothesis based on a case study. A test was designed and implemented to identify whether Venezuela was a subject to its OPEC quota or whether Venezuelan production causes its OPEC quota. Shortly after production cuts, Venezuela tends to cheat on agreements, which suggests a tit-for-tat oligopoly game. Long-run results suggest that Venezuelan oil production causes OPEC's quota for Venezuela, but not vice versa. This result suggests that OPEC does not coordinate outputs as much as it reacts to them and that Venezuela is not a part of an OPEC anti-competitive syndicate.

The authors conclude that OPEC cannot be a cartel or a bureaucratic production syndicate because it had no quotas in 1970s, precisely when oil prices were high. OPEC only engaged in oil quotas when oil prices were low. OPEC does not look to be a market manipulator; rather it looks to be part of a set of players where each member restricts its own production due to its own internal risk-averse institutions.

Sankey, P., D.T. Clark and S. Micheloto. "The End of Oil Age, 2011 and Beyond: A Reality Check." *Global Market Research*. Frankfurt, Germany: Deutsche Bank Securities, Inc. December 22, 2010.

This report argues that as reserves become concentrated into the hands of nationalist governments under-investment will likely become chronic. Beyond OPEC, the major reserve holders with no or very limited access are Mexico, Russia, and arguably Brazil. Also, OPEC reserve holders restrict access, activity, and ultimately, production. This is evidenced by the relationship between their share of global reserves and their share of the global production

of oil. In contrast, the U.S. and Russia produce more oil than their share of reserves would imply, which shows how much more production aggressive private activity can generate in excess of implied market share.

Allsopp, C. and B. Fattouh. "Oil and International Energy." *Oxford Review of Economic Policy* 27 (2011): 1–32.

This article focuses on issues surrounding the oil market in the context of international energy, the global economy, and conflicting agendas such as energy security and climate change. The dynamics of oil prices during the 2002–2009 cycle reflected great uncertainty about future fundamentals. When analyzing supply, it is common to distinguish between OPEC and non-OPEC supplies. It is widely assumed that non-OPEC oil producers behave competitively, or at least commercially.

The article explains that the debate over OPEC behavior is not about whether OPEC restricts output, but rather about the reasons behind restrictions. Some studies suggest that production decisions are made with reference to budgetary needs that depend on absorptive capacity of domestic economies. OPEC behavior has been modeled in many ways, ranging from classic cartel, to a 'clumsy' cartel, to a dominant firm, to a loosely cooperating oligopoly, to a residual firm monopolist, and as a 'bureaucratic' cartel. Other studies suggested that OPEC oscillates between various positions but always acts as a vacillating federation of producers.

Fan, Y. and J. Xu. "What Has Driven Oil Prices Since 2000? A Structural Change Perspective." *Energy Economics* 33 (2011): 1082–1094.

This article examines market mechanisms and their impacts on oil prices between 2000 and 2008. The authors find two main periods: one of relative calm from 2000 to 2004, and bubble accumulation from 2004 to 2008 leading up to and during the financial crisis.

"During the 'Relatively Calm Market' period from January 7, 2000, to March 12, 2004, speculation and episodic events were the main drivers affecting oil price changes, whereas during the 'Bubble Accumulation' period from March 12, 2004, to June 6, 2008, as large amounts of funds flooded energy markets, other financial market variables, especially speculation, became important drivers affecting oil price changes..." (1093). Regular supply–demand fundamentals did not play much of a role pre-2008, but after the financial collapse, these fundamentals and the level of economic recovery played a much bigger role than financial factors after speculative funds retreated.

Fattouh, B. and P. Scaramozzino. "Uncertainty, Expectations, and Fundamentals: Whatever Happened to Long-Term Oil Prices?" *Oxford Review of Economic Policy* 27 (2011): 186–206.

These authors explain that a lesson to be drawn from recent experience in the asymmetry of OPEC's responses to oil prices movements is that a key objective of OPEC is to avoid oil prices from falling below some level deemed unacceptable by its members. Its role is not to prevent oil prices from rising above certain levels or to set a price ceiling. Given the asymmetry in OPEC's responses, and the diversity of market players, OPEC's influence in the market is not straightforward.

In a rising market, OPEC tends to satisfy demand at the available market-determined prices by using its spare capacity. In a falling market, OPEC sends a signal to the market about its preferred oil price. If the signal is successful in stabilizing expectations about its preferred price, then OPEC will not have to resort to output cuts. However, OPEC's signals are rarely successful. The market may not see them as credible because it is costless for OPEC to make them. In a falling market, financial players expect OPEC to implement output cuts to balance the market. If the expected cuts are too large, these players start to question whether OPEC will be able to implement them given its internal divisions, the different needs of OPEC members, and OPEC's difficulty in sustaining a unanimous production level decision in the face of falling demand. Interactions with market players complicate the channels through which OPEC influences the market and create a time lag between OPEC's announcement of a cut and when market players respond to OPEC's signal.

Gately, D. "OPEC at 50: Looking Back and Looking Ahead." Paper presented at the conference on OPEC at 50 at the National Energy Policy Institute, Tulsa, Oklahoma, April 18, 2011.

This presentation offered a retrospective of the world oil market over the past 50 years. The speaker summarized and compared long-term projections until year 2030, examined projections, and analyzed expectations about OPEC's behavior with respect to oil export levels and market share.

Since the 1970s, OPEC has not exploited its market power to raise price abruptly, although its capacity expansion decisions have had long-term effects on world oil supply. Given the very low short-run responsiveness of demand for oil and the non-OPEC supply, the OPEC countries still have the ability to raise prices abruptly by cutting their oil export levels. Although that action would increase their revenues in short run, it would make OPEC worse off relative to its position without abrupt price increases due to long-run price responsiveness and the negative impact of high oil prices on world income growth. Therefore, OPEC's optimal strategy is to maintain its export share of non-OPEC demand and increase exports as necessary.

Lin, C.Y.C. "Estimating Supply and Demand in the World Oil Market." *The Journal of Energy and Development* 34 (2011): 1–32.

This article applies a variety of econometric methods to estimate supply and demand curves for oil under simplified assumptions of a static and perfectly competitive world oil market. Monthly world oil demand, monthly oil demand in non-OPEC countries, and two specifications for monthly oil supply appear consistent with static perfect competition. Monthly OPEC oil demand and most specifications for monthly oil supply do not appear consistent with static perfect competition. Simplifying theoretical assumptions of a static and perfectly competitive oil market are unrealistic, especially in modeling the supply of oil. The author contends that these peculiar results may be due to the static nature of the model employed. A model that "incorporates either the dynamic or oligopolistic aspects of the oil market, or both, appears to be a more promising prospect [...] and one from which richer and more realistic results are likely to be extracted" (29).

Brémond, V., E. Hache, and V. Mignon. "Does OPEC Still Exist as a Cartel? An Empirical Investigation." *Energy Economics* 34 (2012): 125–131.

These authors examined the possibility of a co-integrated link between production of one OPEC member and global production of other members. They found an absence of co-integration in periods in which OPEC's market share was volatile, but more market share stability after 1993. They conclude: "in particular, investigating the OPEC behavior on various sub-periods, we find that, while OPEC's influence was strong in the period that just follows the oil counter-shock, it acts as a price taker for the majority of the considered sub-periods since 1973. Finally, by splitting OPEC into two groups, the savers and spenders, we show that OPEC may be viewed as a divided organization in the sense that it acts as a cartel mainly with a subgroup of its members" (131).

Coleman, L. "Explaining Crude Oil Prices Using Fundamental Measures." *Energy Policy* 40 (2012): 318–324.

This article offers an analysis of the influence of futures market speculation on global oil prices, threats to security in the Middle East, and shocks from unexpected short-lived events using monthly data from 1984–2007 of fundamental and market parameters that cover financial markets, global economic growth, demand and supply of oil, and geopolitical measures.

The dominant feature of the supply side of the oil market was its concentration within the producer cartel OPEC, in which members dominate global oil production with almost half the total production. This makes OPEC an obvious object for study of monopoly pricing power.

The most significant impact on long-term oil price is OPEC's market share, followed by the corporate bond yield, size of the oil futures market relative to physical oil demand, global GDP, the number of U.S. troops deployed to the Middle East, and the frequency of fatal terrorist attacks in the Middle East. A pronounced cyclical influence on oil prices is due to OPEC's ability to leverage its market dominance. This influence varies with dependence on imports by OECD, thus oil prices move inversely with OPEC's share of the global oil market. This behavior indicates that OPEC tends to move volume in line with oil price to keep revenues roughly constant. OPEC will opportunistically exert its monopoly power to lift prices when OECD import dependence is high.

Hamilton, J.D. "Oil Prices, Exhaustible Resources, and Economic Growth." NBER Working Paper Series No. 17759. Cambridge, Massachusetts: National Bureau of Economic Research. January 2012.

With respect to the world oil supply during the period 1973–2010, oil production from members of OPEC must be viewed differently than non-OPEC oil producers. Episodes of declining production have little to do with geological depletion but instead reflect dramatic geopolitical events. Saudi Arabia in particular has made deliberate decisions to increase or decrease production in an effort to mitigate price increases or decreases. For example, it cut production to try to hold up prices during the weak oil market in the period 1981–1985 and during the recession of

2001, and boosted production to make up for output lost from other producing countries during the two Persian Gulf wars. However, the decline in Saudi Arabian production since 2005 would have to be attributed to different considerations from those that explain earlier historical data. Saudi Arabia produced 600,000 fewer barrels each day in 2010 than it did in 2005; with growing Saudi consumption of its own oil, the drop in exports from Saudi Arabia may have much more dramatic consequences in the near future.

ARTICLES PROVIDING ESTIMATES OF OIL MARKET ELASTICITY

Huntington, H.G. "OECD Oil Demand. Estimated Response Surfaces for Nine World Oil Models." *Energy Economics* 15 (1993): 49–56.

Ten different short run price elasticity values for demand were estimated; they ranged from -0.03 to -0.11 . Long run price elasticity values for nine studies fell between -0.16 and -0.77 ; one outlier was -2.5 . Income elasticity values were estimated to be between 0.5 and 1.1 , with average of approximately 0.8 .

Brook, A. et al. "Oil Price Developments: Drivers, Economics Consequences and Policy Responses." OECD Economics Department Working Papers, No. 412. Paris, France: OECD Publishing, 2004.

This report offers a review of the literature on estimates of elasticity values. Long run price elasticity values ranged from -0.1 to -0.6 and income elasticity values ranged from 0.4 to 1.2 .

Krichene, N. "An Oil and Gas Model." IMF Working Paper WP/07/135. Washington, DC: International Monetary Fund, June 2007.

This paper explains how expansionary, then accommodative, monetary policy seemed to cause strong world economic growth, and in turn, high pressure on oil and gas markets during the period 2002–2006. Little work has been done to evaluate the role of monetary policy on oil and gas markets; estimates show that short-run demand for oil and gas was price-inelastic, relatively income-elastic, and was influenced by exchange and interest rates; short-run supply was price-inelastic. This price-inelasticity of demand is a source of high volatility and could have major implications by driving prices to record peaks or troughs.

Hamilton J.D. "Causes and Consequences of the Oil Shock of 2007–08." *Brookings Papers on Economic Activity* 40 (2009): 215–283.

This author found four earlier articles that surveyed the literature regarding elasticity values. Short-run price elasticity of demand for crude oil was estimated to be between -0.05 and -0.07 . Those values are consistent with Hamilton's own estimates, based on changes when price shocks occurred, of between -0.03 and -0.10 . Other articles found the price elasticity of demand for gasoline to be -0.25 , -0.26 , -0.26 , and -0.34 . These findings imply that numerous studies find oil and its products to be highly inelastic in demand with respect to price changes, especially in the short run, but also relatively inelastic in the long run. This is unusual because most product elasticity values are greater than one in the long run.

CONGRESSIONAL HEARINGS AND STUDIES

U.S. Congress. Senate. Committee on Interior and Insular Affairs. *Oil Price Decontrol*. 94th Cong., 1st sess., September 4 and 5, 1975.

This committee examined the competitive and economic impacts of permitting the decontrol of petroleum prices and of terminating allocation authority. Some members feared that decontrol would only raise profits of the major oil companies, and would kill the independent sector. The argument for continuing price control was that resuming the Arab oil import embargo or the OPEC embargo, which that the nation witnessed in the 1970s, would cause serious problems in the U.S. oil market due to the higher oil prices.

Most of OPEC's power lies in the short run, due to the unrealistically high oil prices that it can get from the rest of the world. Over the long run, however, consumers can change habits in a way that would backfire against OPEC by reducing global demand for oil. The U.S. initially stepped in with controls on oil price and supply in order to help during the OPEC-induced shortage. At the time of this hearing, the regulations to deal with that shortage were producing some undesired side effects. Small, independent retailers felt that decontrol on price would cause prices to rise and cut into the already small margins that retailers faced.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Testimony by CIA National Intelligence Council Chairman Henry Rowen*. February 18, 1983.

The CIA believed that the price of oil was going to decline due to instability in oil-producing countries, inventory

outpacing supplies, and people conserving more energy. This price decrease would have been gradual because it was in OPEC's interest to keep prices stable, and any dramatic decreases in price could lead to retaliation by Iran.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *World Oil Outlook*. 100th Cong., 1st sess., 1987.

An import fee that would have raised the price of oil to a certain level would have given American producers the knowledge that if they explored, invested, and found oil, they could sell it for \$25 per barrel. This higher oil price would offer the incentive for a renewed search and development effort for oil in the U.S. However, U.S. consumers would resent this due to the increased cost of gasoline and other oil products.

This report argued that the U.S. must stop talking about allowing the free market to set the price of oil: there is no free market for oil, and there has never been one in the U.S. OPEC had gone through a price war, so it knew exactly what the consequences would be of noncooperation, and they were quite determined to make a good agreement. There also knew that there was no guarantee that countries would not cheat. This report also addressed that question: if a floor price were implemented in an effort to keep domestic production profitable, how would OPEC react? It was possible that OPEC would use this price as a target and would try to meet that number because the U.S. is the world's largest importer of oil. An import fee would have probably resulted in the world oil price going down. This would put more barrels on the market because U.S. demand would go down, and production would go up. If the objective was to achieve a price above a certain level so that domestic drilling is profitable and maintained, this floor price may have been a good idea.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Hearing on Domestic Petroleum Production and International Supply*. 104th Cong., 1st sess., 1995.

A report by Department of Commerce stated that increasing oil imports from OPEC countries increases U.S. vulnerability to a supply disruption, and is thus a national security issue. Senators were worried about the lack of a plan for energy independence from the President and his administration.

William White, Deputy Secretary of the Department of Energy, stated that oil accounts for 97% of the transportation sector's total energy use. He argued that the U.S. needed to achieve better fuel economy, and to develop cost-competitive, domestic, and clean transportation fuels. Between 1988 and 1990, Saudi Arabia opened up its oil production; this change in Saudi policy affected both the price and availability of oil. Increased demand in Asia meant the world's demand for oil was increasing. Over the subsequent 15 years, this increase would lead to increased global dependence on oil from the Persian Gulf.

Dave Work, the Vice President of Amoco Corporation, noted that Amoco had shifted its exploration focus away from the U.S. primarily because of the lack of incentives to explore domestically. He cited public lands closures that restricted hunting for large target areas as another reason to shift focus internationally. He said that increasing basin maturity, high regulatory costs, and the lack of access to the most prospective opportunities, have all negatively impacted U.S. exploration and development activity. He explained that ultra-deepwater discovery plays were promising, but also very capital-intensive and risky. Government cooperation was needed to make these plays a commercial reality.

U.S. Congress. House. Committee on Commerce, Subcommittee on Energy and Power. *National Energy Power: Ensuring Adequate Supply of Natural Gas and Crude Oil*. 106th Cong., 2d sess., 2000.

Low oil prices occurred after the Asian financial crisis, and were followed by a sharp rise in prices in 2000, and a recent production increase by OPEC. Analysts and policymakers discussed the nation's increasing dependency on foreign oil, controversy over drilling in the Arctic National Wildlife Refuge, and restrictions on federal land and off-shore development. They also addressed the merits of government support, such as extending the Section 29 tax credits established in 1980, for developing oil and gas from unconventional sources, and strategies for moderating demand and reducing greenhouse gases emissions.

There was also discussion about the costs of reformulated gasoline, the purpose of the Strategic Petroleum Reserve as security during wartime, the Saudi policy of excess capacity as a type of reserve, ethanol, the exploitation of marginal wells, the oil industry's budget for research and development, and merits of the Department of Energy's Organization Act. Additional discussion centered on environmental protection with regard to oil production, how regulation affects refinery capacity, the advantages of a free market ("20 years of more and more overlapping

regulations that have left our nations' petroleum distribution system with minimal flexibility"), the inevitability of a global oil market, and the importance of independent oil producers.

U.S. Congress. House. Committee on Commerce, Subcommittee on Energy and Power. *Price Fluctuations in Oil Markets*. 106th Cong., 2000.

This report argued that oil did not have an open marketplace because OPEC set oil prices. The focus was on harnessing American energy as an alternative, and the report argued that President Clinton should use foreign policy and negotiations to force OPEC to open markets. There would not be a free market for oil as long as the U.S. relied on regions like Saudi Arabia, Kuwait, Mexico, and Venezuela for oil. Because OPEC is an unreliable cartel, increasing domestic supply would be necessary.

U.S. Congress. House. Committee on International Relations. *OPEC and the Northeast Energy Crisis*. 106th Cong., 2d sess., February 10, 2000.

Oil prices had more than doubled in one year. This committee heard complaints that the Strategic Petroleum Reserve was untouched, although OPEC had dropped production and the U.S. faced an oil shortage due to a cold winter in the Northeast.

The oppressive regime in Afghanistan had prevented pipeline construction, which isolated Central Asia from oil markets. There were complaints during the hearing that many OPEC nations took military aid from U.S. Dana Rohrabacher of California said, "I believe in market. I am a free-market guy. This is not a product of a free market. This is a product of a controlled market that is manipulated by a price-fixing conspiracy."

U.S. Congress. House. Committee on International Relations. *U.S. Policy Toward OPEC*. 106th Cong., 2d sess., 2000.

During a severe winter in the U.S., OPEC dropped production so that fuel prices were very high. Crude oil was priced at \$11 per barrel in December 1998, and in March 2000 it was priced at \$30 per barrel. This hearing closely followed the themes of a hearing before the same committee on February 10, 2000. Energy Secretary Bill Richardson took heated questioning. There were multiple comments suggesting that the Strategic Petroleum Reserve should be drawn down, and that the U.S. should pressure other nations to increase production. Legislation was introduced that suggested the establishment of a northeast regional reserve, and to suspend the federal tax on diesel fuel. There were also allusions to a bill to impose sanctions on under-producing countries.

Donald Manzullo of Illinois argued that the rules of supply and demand do not 'kick in' when a cartel determines production. He claimed that it was 'time to get tough,' especially with countries "where we landed troops to protect them during the Gulf War." He proposed resisting entry of uncooperative OPEC nations into the World Trade Organization by withdrawing military sales, or by holding back International Monetary Fund money.

Secretary Richardson mentioned the overproduction by OPEC in the period 1996–1997 coincided with a drop in demand due to an Asian slump. He argued that the government's goal should be stability in oil markets, and that market forces should dictate prices. He had been lobbying other countries to recognize the negative impact of price spikes on the world economy. He saw promising signs. For example, President Clinton had authorized the release of emergency Low Income Home Energy Assistance Program funds and had urged wider eligibility for that program and more money for weatherization. New Small Business Administration loans were also available for businesses impacted by high fuel prices, and an Office of Energy Emergencies was being reestablished. Increasing use of natural gas use in the Northeast was also being studied. The administration was trying to spur domestic production, and draw down of the Strategic Petroleum Reserve was "not off the table." High gas and heat prices were due to transportation problems and cold weather, as well as from OPEC.

U.S. Congress. House. Committee on International Relations. *H.R. 3822. The Oil Price Reduction Act of 2000*. 106th Cong., 2d sess., 2000.

H.R. 3822 was "a bill to reduce, suspend, or terminate any assistance under the Foreign Assistance Act of 1961 and the Arms Export Control Act to each country determined by the President to be engaged in oil price-fixing to the detriment of the United States economy, and for other purposes." The bill was described as "a diplomatic blueprint [...] leading to the eventual dismantling of the OPEC cartel." The bill applied to OPEC as well as to Mexico, Norway, Oman, Russia, and Angola, and would require the president to report the overall relationship of the U.S. with each major oil exporter, and report whether each was price-fixing. The bill also required the president to undertake a

diplomatic campaign to eliminate price-fixing within 30 days of enactment, and to report on progress at no later than 120 days. The counterargument against this bill was that it could have reduced sales of American technology but not affect oil prices because trade would occur elsewhere. An amendment was submitted that would require agreement with European nations before proceeding.

U.S. Congress. House. Committee on International Relations. *OPEC's Polices: A Threat to the U.S. Economy*. 106th Cong., 2d sess., 2000.

These hearings were about OPEC price-fixing. The pieces of legislation that were introduced were the Foreign Trust Busting Act and the International Energy and Fair Pricing Act of 2000. These bills would have: allowed lawsuits against foreign energy cartels, required policy review, and opposed lending by the International Monetary Fund and others to OPEC nations and supporters. Energy Secretary Bill Richardson noted that OPEC had increased production, but increased demand had mitigated the hoped-for price drops. The committee discussed Partnership for a New Generation of Vehicles, a program to develop a car that would achieve a fuel standard of 80 miles per gallon. The President's energy initiative included \$4 billion in incentives for domestic oil and gas production and the purchase of efficient products. There was also a call for a regional home-heating oil reserve in the Northeast. There were also some negative comments regarding high profits by domestic oil companies.

U.S. Congress. Senate. The Committee on Governmental Affairs. *Oversight of Rising Oil Prices and the Efficiency and Effectiveness of Executive Branch Response—Part II*. 106th Cong., 2d sess., 2000.

This committee's chairman stated that the practices of OPEC should be illegal under the Sherman Antitrust Act, and that the domestic industry may be price gouging. He also claimed that "domestic consumption has been reduced in the past—we can do it." A senator from Oklahoma responded that we should release oil from the Strategic Petroleum Reserve. The announcement of an investigation by the Federal Trade Commission (FTC) had coincided with wholesale price drop. Governor Taft of Ohio responded that a national energy policy should protect the U.S. from price spikes, and expressed concern that Ohio is losing revenue because of tax breaks on ethanol.

Denise Bode, from the Oklahoma Corporation Commission, commented that since Standard Oil, there had not been a free market for oil—it was always manipulated. OPEC-induced price swings reduced domestic exploration. She reviewed the actions of the Executive Branch since 1992 as well as OPEC's responses. Policies to encourage low oil prices caused job loss and drops in refinery capacity. States were instituting their own incentives for domestic production. She pleaded, "don't whipsaw us," and that the U.S. needed a comprehensive look at refinery capacity policy. Richard Blumenthal, the Attorney General of Connecticut, claimed that OPEC was mainly to blame for high prices. He argued that the FTC investigation on domestic factors was good and pointed out that state attorneys general had launched their own investigations.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Oil Supply and Prices*. 108th Cong., 2003.

This hearing regarding oil supply and demand started with a discussion of the Venezuelan shutdown, and jitters regarding a possible war with Iraq. Senators expressed concern about the lack of world infrastructure to exploit new resources in places such as Russia and Africa, the lack of access to U.S. federal lands and offshore reserves, and blocked exploration. Robert Ebel, of the Center for Strategic and International Studies, presented four post-Iraq-war scenarios. The worst-case scenario would have been an \$80 per barrel price spike. An airline spokesman showed charts that linked oil shocks to recessions and linked recessions to airline losses. He argued for releases from the Strategic Petroleum Reserve and a repeal of the tax on jet fuel. There was also discussion about hydrogen fuel cells, superconductivity, and other energy research initiatives supported by government.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Crude Oil Supply. Gasoline Demand And The Effects on Prices*. 108th Cong., 2d sess., 2004.

In this hearing, a representative from the Department of Energy made statements about which factors contribute to high gas prices, specifically high crude oil prices. Industry spokesmen pointed to record demand and claimed that mergers were not responsible for high oil prices. OPEC had debated whether there was an actual shortage, but agreed to increase production when prices reached \$40 per barrel (a price that was a "line in the sand").

U.S. Congress. House. Committee on Government Reform. *Minority Staff: U.S. Dependence on Foreign Oil Worsens under Administration's Energy Policies*. 108th Cong., 2004.

This report was based on an analysis published by the Energy Information Administration (EIA). The U.S. consumed

over 19 million barrels of petroleum per day, but it depended on other nations for over half of its supply. The EIA projected U.S. demand to grow to 28.3 million barrels per day by 2025, which would be a 44% increase from demand levels in 2002. The President's policies would have only minimally reduced the amount of foreign imports required to power the U.S. economy.

U.S. Congress. House. Committee on Resources, Subcommittee on Energy and Mineral Resources. *The Vast North American Resource Potential of Oil Shale, Oil Sands, and Heavy Oils, Parts 1 and 2.* 109th Cong., 2005.

These two hearings were held to "set the record straight" on issues such as oil sands. An effort in the 1970s to exploit shale oil was a bust. However, the price of oil had reached \$60 per barrel. Members stated that there were vast resources in oil shale, but no federal leasing program to exploit them. Environmental impacts must also be considered. Industry representatives explained that heavy oil is "tar sands," and that most of what the U.S. could recover, it had already, as was the case for other unconventional sources. Much oil was beyond recovery with current technology, but the situation was improving. They recommended: (1) government-sponsored field tests; (2) a public-private partnerships to develop new technology; (3) risk mitigation incentives; (4) the development of a shale leasing program; (5) lifting leasing acreage restrictions; (5) adjusting royalty rates and tax incentives to encourage investment; and (6) streamlining permitting through the National Environmental Protection Act.

U.S. Congress. House. Committee on Energy and Commerce, Subcommittee on Energy and Air Quality. *Understanding the Peak Oil Theory.* 109th Cong., 2005.

One view offered in this hearing was that oil discoveries had been dropping for 20 years, and consumption was catching up with known reserves. Oil as a fuel is very hard to replace, so the best thing to do is conserve. China was just getting started, and it consumed much less than its per capita share. Unconventional oil sources were hard to exploit, and estimates varied on how well technology could address increasing demand. Estimates for the timing of peak oil production range from 2010 to 2050.

The opposing view presented was that the earth was not running out of oil imminently or in the medium term, and that the term "peak oil" was not a helpful concept. In this view there was an expectation of an undulating plateau of production, not a drop. Instead, capacity to produce would increase in the near term and peak oil capacity will not occur before 2020 or 2030.

U.S. Congress. Senate. Committee on Foreign Relations, Subcommittee on Near Eastern and South Asian Affairs. *U.S. Foreign Policy, Petroleum, and the Middle East.* 109th Cong., 2005.

An arrangement with Saudi Arabia dates back to the Roosevelt era: while the U.S. provides security, the Saudis provide a supply of oil. Therefore, Congress should set a national goal for reducing oil consumption through unequal taxing of fuel imports, switchgrass, biomass, hybrid electric and flexible fuel vehicles, waste fuel, efficiency legislation, the Freedom Car, and geothermal energy. A spokesman from Set America Free said that the government should eliminate tariffs on biofuel imports, and should instead invest in 'smart growth' urban development and promote diversification of the energy supply.

U.S. Congress. Joint Economic Committee. *Explaining the High Price of Oil.* 109th Cong., 2005.

OPEC did not properly anticipate the growth in world demand for oil. Due to this error, they would need to drill more wells before they could substantially increase their output. Smaller, non-OPEC producers were operating near full capacity because they were price takers; any output they did not exploit was money that was wasted.

U.S. Congress. Joint Economic Committee. *Ten Myths About the Price of Oil.* 109th Cong., 2005.

"The world crude oil market is not competitive and the prices it generates cannot be properly interpreted as though it were."

The ten myths of the world oil supply presented to the committee were that:

1. The world is running out of oil.
2. The price of crude is high because it is expensive to find and produce.
3. Increases in demand are the only reason for the increase in oil price.
4. It would be difficult for OPEC to increase its production capacity.
5. Non-OPEC producers are to blame for underinvestment in exploration/development.
6. Political instability leads to high costs of oil.
7. OPEC stabilizes prices and offsets volatility.

8. OPEC maintains excess production for the benefit of buyers.
9. Refinery “bottlenecks” should bear the blame for high costs.
10. Competition between wealthy nations has led to the increase in costs and demand.

U.S. Congress. Senate. Committee on Foreign Relations. *The Hidden Cost of Oil*. 109th Cong., 2d sess., 2006.

National oil companies control more than three quarters of the world’s oil reserves. In 2006, the U.S. was importing more than twice as much oil in absolute terms than it was in 1973. Out of its six top suppliers of oil, four—Saudi Arabia, Venezuela, Nigeria, and Iraq—were of questionable reliability. Part of the hidden cost of oil was the tax that the U.S. paid to OPEC countries, which used their pricing power to charge a higher price than they could otherwise get in an open international market for oil. Prices also concealed the costs of the security commitments that the U.S. faced to protect the supply of oil from OPEC and other foreign sources.

U.S. Congress. Senate. Committee on Foreign Relations. *Oil Dependence and Economic Risk*. 109th Cong., 2d sess., 2006.

A few large Middle East producers gained market power in 1971, and to capitalize on their newly acquired pricing power in the early 1970s, many producing nations in the Middle East nationalized their oil companies. The U.S. lost any pricing power it had over oil and was unlikely to get it back. Thus, a portion of the world’s oil reserves, held by nationalized oil companies, became subject to political, and not market, forces. Even non-OPEC countries, such as Mexico, prevented foreigners from having any ownership in their crude oil businesses.

U.S. Congress. House. Committee on Energy and Commerce. *World Crude-Oil Pricing*. 109th Cong., 2006.

The topics discussed in this hearing were the Energy Policy Act, refinery reform legislation, promotion of shale production, the Fuel Choices for American Security Act, H.R. 4409, clean coal, coal to liquid technology, building nuclear reactors, and a \$50M subsidy to support ultra-deep offshore drilling. A rapid switchover from methyl tert-butyl ether to ethanol had added market pressure. A ranking Democratic member mentioned speculative trading, another member mentioned the Prevent Unfair Manipulation of Prices Act, HR 5248. Due to neglect of Nigeria, destabilization of Venezuela, fumbled Iraq reconstruction there was a need to engage major consumer nations in an “energy security system.”

China’s Growing Demand for Oil and Its Impact on U.S. Petroleum Markets. *Congressional Budget Office* (2006).

This report reviewed major developments in China’s demand for crude oil and refined petroleum products over the previous decade, and considered the implications of those changes for motor fuel prices in the U.S. through 2010. Demand growth in China was likely to affect U.S. oil markets by causing higher crude oil prices, higher costs to refine oil, and greater price volatility. There was uncertainty about future oil supplies because OPEC had shown an indication of struggling to keeping pace with worldwide demand. China’s demand increases could further exacerbate this situation.

U.S. Congress. Joint Economic Committee. *OPEC’s 902 Billion Barrel Oil Reserve*. 109th Cong., 2006.

OPEC held 902 billion barrels of oil reserves, which cost roughly \$5–\$9 per barrel to produce. Even though OPEC countries had the most reserves, two of the top five oil exporters (Norway and Russia) were not OPEC members. Even though OPEC countries contain more oil than the rest of the world, and their reserves have been growing since the 1970s, they were producing about the same amount of oil that they produced in that decade, and were even threatening production cuts.

U.S. Congress. Senate. Committee on Homeland Security and Governmental Affairs, Subcommittee on Investigations. *The Role of Market Speculation in Rising Oil and Gas Prices: A Need to Put the Cop Back on the Beat*. 2006.

This report highlighted speculation as the cause of recent oil price increases. Speculators held futures to effectively create additional demand for oil. Inventories of U.S. crude were at very high levels, but speculative trading had caused them to be overly expensive. The report recommended that Congress eliminate the Enron Loophole, which limited oversight of energy commodity markets by the Commodity Futures Trading Commission. This report also recommended increasing trader reports.

U.S. Congress. House. Joint Economic Committee. *OPEC's Opportunism. Research Report #109-46. 2006.*

This report described how OPEC was using the rise in Asian oil demand to exploit oil prices. OPEC was holding back 2 million barrels per day of production capacity in order to support a higher price band. OPEC also kept oil reserves undeveloped to maintain high demand for oil.

Sullivan, Mark P. and Clare M. Ribando. "Latin America: Energy Supply, Political Developments, and U.S. Policy Approaches." *Congressional Research Service (2006).*

Canada, Mexico, and Venezuela accounted for almost half of the oil and petroleum products supplied by the Western Hemisphere to the U.S. High oil prices had spurred the rise of resource nationalism in several Latin American energy-producing countries, which had raised concerns about access to energy resources and political interference with the level of energy production and investment in that region.

Due to resource nationalism, foreign oil companies in a number of Latin American countries needed to pay more to do business, and many feared that this behavior could slow foreign investment in the region's energy sectors. Venezuela had made some threatening comments in the past about cutting off oil to the U.S. However, energy analysts maintained that Venezuela was dependent on the U.S. oil market and would plunge into chaos if it stopped oil shipments to the U.S.

U.S. Congress. House. Committee on the Judiciary, Antitrust Task Force. *Prices At The Pump: Market Failure and the Oil Industry. 110th Cong., 2007.*

This task force argued that antitrust enforcement against OPEC should be enabled through legislation. There was evidence of reduced capacity to drive up prices and abuse of market power. The PUMP Act, H.R. 594, and the Federal Price Gouging Prevention Act, H.R. 1252, were mentioned, and banning of zone pricing and a moratorium on oil company mergers was proposed. A spokesperson from the CFA Institute suggested consideration of a federal investigation, breaking up monopolistic oil companies, and mandating minimum inventory levels. Thirty states had price-gouging laws. For the previous seven years, the U.S. had a different excuse each year. "Once is an accident, twice is a surprise, six times means there is a fundamental flaw in the structure that has failed to build an industry that can actually deliver a stream of product at reasonable prices." A 2006 pamphlet on price factors, by economist Carol Dahl, was incorporated into the Congressional record. The paper concluded that fuel price patterns mirrored those of other commodities, and domestic oil companies could not and did not control the market.

U.S. Congress. House. Select Committee on Energy Independence and Global Warming. *Economics of Dependence on Foreign Oil – Rising Gasoline Prices. 110th Cong, 1st sess., 2007.*

Since 1986, U.S. dependence on foreign oil increased from 27% to 60% in terms of how much foreign oil it imported as a nation. If fuel economy averages were improved from 25 miles per gallon to 35 miles per gallon, the U.S. could stop importing oil from Persian Gulf states. OPEC was able to "tip consumers upside down and shake money out of their pockets" because the U.S. did not have a national policy that is effective to protect consumers.

Republican leadership said that the U.S. needed to allow drilling on the Outer Continental Shelf or in the Arctic National Wildlife Refuge, but roughly 80% of the oil and gas resources in the Outer Continental Shelf are located in areas where drilling was already allowed. The U.S. had the ability to refine about 17 million barrels of oil per day into gasoline, but the average U.S. demand for gas was 21 million barrels per day. That gap was often met by importing gasoline that had been refined in other countries, which expanded reliance on foreign sources of energy. It had been 30 years since a new gasoline refinery had been built in the US.

Crude oil prices had fluctuated significantly due to lingering geo-political tensions, OPEC's continuing production controls, and worldwide demand growth. Oil companies did not set the price of crude oil; it was bought and sold in international markets, and the price paid for a barrel of crude oil reflected the market conditions of that day. Legislation about price gouging was discussed at this hearing, but the economist on the panel warned that it may have been too much like the price ceilings that devastated the oil industry in the 1970s.

U.S. Congress. Senate. Committee on Appropriations. *Energy Security and Oil Dependence – Recommendations on Policies and Funding to Reduce U.S. Oil Dependence. 110th Cong., 1st sess., 2007.*

The majority of the oil that is sold and traded around the world is done so through corporations that are owned by nation-states. Senator Dorgan pointed out that due to this condition, there was no free market for oil. Instead, he made an argument to support policies that advanced conservation and efficiency at home, advanced additional

domestic production in an environmentally safe manner, and advanced diversification of the kind of fuels that power our lives.

The SAFE Act of 2007 was also discussed. One goal of the bill was to reduce gasoline consumption through alternative fuel standards, and fuel economy standards for cars and trucks. The Act called for a significant change in the U.S. energy portfolio.

U.S. Congress. House. Committee on Energy and Commerce, Subcommittee on Oversight and Investigations. *Gasoline Prices, Oil Company Profits, and The American Consumer*. 110th Cong., 2007.

A committee member mentioned the importance of fuel choices at the pump. A new Apollo Energy Act was proposed that would spur industry retooling and promote the development of alternative fuels. There were also bills proposed to promote hybrid electric cars and improve battery technology. HR 1252 was about to reach a vote, and a 2006 Federal Trade Commission (FTC) investigation into price gouging was completed with a finding of no price manipulation. FTC investigations had cooled off some oil company attempts to merge.

U.S. Congress. House. Select Committee on Energy Independence and Global Warming. *Oil Shock: Potential for Crisis*. 110th Cong., 1st sess., 2007.

Forty-five percent of the world's oil is located in Iraq, Iran, and Saudi Arabia; and almost two-thirds of known oil reserves are in the Middle East. The single biggest step that the U.S. could take to curb our oil dependence and remove OPEC's leverage would be to raise the fuel economy standards of our automotive fleet. When Corporate Average Fuel Economy regulations were passed in the mid-1970s in response to the first oil crisis, imported oil fell as a percentage of total consumption in the U.S. from 47% in 1977 to 27% in 1985. Fuel efficiency in the transportation sector was discussed at length. U.S. dependence on oil gives Saudi Arabia much greater leverage in its dealings with the U.S.

U.S. Congress. Joint Economic Committee. *OPEC Strategy and Oil Price Volatility*. Research Report #110-2. 2007.

OPEC had reduced output by 1.7 million barrels per day to keep the price of oil from falling below \$50 per barrel, which was far above its alleged target of \$22–\$28 per barrel. Oil revenue tripled between 2002 and 2008. \$50 to \$60 per barrel was relatively a very high price. OPEC could not control demand for energy, but could restrict output in order to control supply. OPEC holds 70–80% of world oil reserves, but it kept market share at about 40% as part of this supply restriction. The cartel was hard to control; there was disunity and cheating, but all members enjoyed the high profits because most OPEC firms spend little on infrastructure improvements.

U.S. Congress. Joint Economic Committee. *OPEC's Pursuit of \$70 to \$80 Oil*. Research Report #110-10. 2007.

World oil demand continued to grow, but the non-OPEC supply could not keep pace. OPEC had cut output in 2007 by one million barrels per day, compared to its production levels in 2005 and 2006. OPEC had said that it wanted a higher price and had been able to force prices up. Statements by OPEC about its intended action should not be taken at face value, but they did provide clues about its direction. Although the production cost of oil is less than \$10 per barrel for most OPEC members, and less than \$5 per barrel for Persian Gulf nations, they would prefer higher margins and seem to be pushing price towards \$80 per barrel.

U.S. Congress. Joint Economic Committee. *Explaining the High Price of Oil: An Update*. Research Report #110-17. 2007.

In 2005, the price of oil was in the mid-\$50s per barrel range, and OPEC suspended its supposed goal of \$22–\$28 per barrel. At the time of this report, oil had been as high as \$90 per barrel, and it was clear that OPEC was likely to retain that price. The non-OPEC oil supply had increased, but OPEC supply had been reduced to keep price pressure upward. Countries such as China and India had tried to keep domestic oil prices low and needed to pay large subsidies to do so; whereas China had announced price increases. Per capita oil consumption in the U.S. had been flat since at least 2000, but total consumption had been rising as the population increased because demand is inelastic. OPEC's oil export revenue was greater than \$600 billion per year, which is triple the level that it was at five years previously. Consumption in China had risen in particular, but OPEC restricted supply so as to push prices upward, and at this time it saw \$90 per barrel.

U.S. Congress. Joint Economic Committee. *Expect No Relief from OPEC*. Research Report #110-19. 2008.

This report describes that OPEC's intent is to "maximize the wealth transfer from oil-consuming nations by manipulating the international oil market." Therefore, it had no incentive to increase supply or lower price unless there might have been a global recession that could be worsened by high oil prices. There was abundant oil and low-priced fuel in OPEC nations, and it was unclear how Angola and Iraq would integrate with OPEC. OPEC has idle capacity; although oil flows freely at low prices in OPEC nations, in the export market there is "coordinated action to drive the price level to unprecedented heights."

U.S. Congress. Joint Economic Committee. *The Dollar and Oil*. 2008.

This report described how high oil prices put pressure on the economy, and indirectly on the value of the dollar, by prolonging the need for low-interest U.S. monetary policy. OPEC would continue to price oil in U.S. dollars and prefer to receive payment in dollars. Persian Gulf countries also peg their currencies to the dollar. However, the impact of other nations piling up large sums of cash can be destabilizing in investment markets.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Workshop on Oil Prices*. 110th Cong., 2d sess., 2008.

This hearing focused on why oil and transportation fuel prices were so high and what could be done to address that situation. Between 1984 and 2005, OPEC had lots of unused capacity. Prices did not go up because when they did, OPEC added these unused barrels to the market to increase supply to control price. By 2005, the spare capacity had diminished almost completely due to increased demand and use by both mature market countries and emerging countries due to economic expansion in the early 2000s. Without spare capacity, there was lots of upside risk in price rather than chances to drive price down by adding barrels to the market.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Oil Demand*. 110th Cong., 2d sess., 2008.

This panel gathered to discuss a variety of near-term proposals for reducing dependence on petroleum, and to hopefully lessen the pain at the pump that U.S. consumers were experiencing. Increased fuel efficiency cars, as well as hybrids and plug-in electric cars, were being developed in order to help ease demand, however, it would take time for these models to fully penetrate the market. Performance and cost both delayed the introduction of these technologies. Fiscal incentives for more energy efficient vehicles may therefore be the most efficient policy. However, light duty vehicles accounted for less than one half of total U.S. petroleum use, and therefore the U.S. needed to address all arenas where petroleum products were used. Industry in the U.S. consumed almost one fourth of petroleum use. This hearing featured other discussions about how to reduce fuel consumption in the transportation sector and thus overall oil dependency.

U.S. Congress. Senate. Subcommittee of the Committee on Appropriations. *Energy Information Administration's Forecasts for Oil and Gasoline Prices*. 110th Cong., 2d sess., 2008.

The price of oil had nearly doubled in one year. Some senators believed that speculation had played a huge role in this price increase. Others believed that it had not, but rather the increase in demand, geo-political instability, and limited production capacity were the causes. The Saudis had put extra oil in the market in an effort to reduce prices, but production cuts in Nigeria had offset the extra production to the point that there had been no price decrease.

Diplomatic efforts throughout the world could have been a useful strategy to get more oil online and thus increase the supply. However, American leverage on the overall market was potentially shrinking relative to China, where per capita use of petroleum products was increasing at a much faster pace than in the U.S.

OPEC shifted towards a tight inventory policy. Global oil demand had increased, which caused the global market balance to tighten and inventories to decline sharply. Then, a large jump in world oil demand, fostered by growth in economic activity in the U.S., further reduced excess capacity, which pushed prices to their contemporary high levels. World oil consumption growth had outpaced non-OPEC supply growth every year since 2003, and this imbalance increased reliance upon OPEC production and inventories to fill the gap. Surplus capacity was highly concentrated in a few countries, and Saudi Arabia had the most. Due to the Saudis power over OPEC, the market could not rely on increased production from OPEC as a whole in order to restore balance to avoid dramatic price fluctuations.

U.S. Congress. Senate. Committee on the Judiciary. *Exploring the Skyrocketing Price of Oil*. 110th Cong., 2d sess., 2008.

A bill called NOPEC was discussed at this hearing. This bill would have required that nations that participate in the OPEC oil cartel be held accountable under U.S. antitrust law when the cartel limited supply in order to fix the price of oil. Some Congressional members offered support for the bill and said that the legislation would give the U.S. government a real tool to combat OPEC.

A Shell executive pointed out that gas prices were determined by supply and demand, and were influenced by such factors as OPEC supply restrictions, free market competition, the fluctuating price of crude, supply availability, growing global demand, seasonal blend requirements, boutique fuels, the current transition to ethanol-based gasoline, and the changing regulatory framework.

OPEC influenced the market in two ways: members collectively seek to manage production levels, and members individually manage production capacity within their own countries. In the previous year, OPEC members who participated in production cuts reduced crude oil output by 700,000 barrels per day. This was a substantial contributing factor behind the increase in oil prices over the previous year and half, however the exact dollar impact was impossible to calculate.

U.S. Congress. Senate. Committee on Energy and Natural Resources. *Non-Commercial Institutional Investors on the Price of Oil*. 110th Cong., 2d sess., 2008.

This panel discussed the role that commercial and non-commercial investors, such as hedge funds and money managers, had played in the recent run-up in the price of oil.

A panel member noted that OPEC controls 80% of the world's oil reserves. OPEC nations might not have been enthusiastic about inviting western companies into their production bases, but they were enthusiastic about potentially investing their money downstream in the U.S., because they had very cheap oil and could make more money by turning that oil into gasoline and selling it into the high demand U.S. market.

U.S. Congress. House. Committee on the Judiciary. *Retail Gas Prices (Part II): Competition in the Oil Industry*. 110th Cong., 2d sess., 2008.

From a global perspective, sovereign states and their national oil companies own the majority of the resources consumers need. Chevron ranked 18th in terms of its access to oil reserves. U.S. energy companies needed the scale that was necessary to partner and compete with large national oil companies in order to gain access to critically needed energy resources that fuel America. Exxon Mobil was the largest U.S. oil and gas company, but it accounted for only 2% of global energy production, only 3% of global oil production, only 6% of global refining capacity, and only 1% of global petroleum reserves. For an American company to succeed in this competitive landscape and go head-to-head with large government-backed national oil companies, it needed the financial strength and scale to execute massive, complex energy projects, which require enormous long-term investments. Margins were tight in the gasoline business because the industry was very competitive. The Federal Trade Commission (FTC) and other government agencies had repeatedly confirmed this fact. Any evaluation of the concentration of the oil industry in the U.S. shows that oil is one of the least concentrated industries. The industry had been repeatedly investigated by the FTC; and not any investigations, out of 100 over the past 35 years, had found any evidence of price collusion or anticompetitive behavior.

U.S. Congress. Senate. Committee on Foreign Relations. *\$150 Oil: Instability, Terrorism and Economic Disruption*. 111th Cong., 1st sess., 2009.

In this hearing, Senators Lugar and Kerry noted the importance of energy with respect to foreign policy. Senator Lugar pointed out that, although long-term issues can be dealt with domestically, short- and medium-term energy security issues are dependent on the decisions and activities of other countries. Senator Kerry noted the overlap in sources of energy and sources of instability, as well as the connectedness of energy, foreign policy, and other issues. Witnesses in the hearing stressed issues regarding political stability and the quality of governance in Africa, the Middle East, and other oil-producing regions.

U.S. Congress. House. Committee on Foreign Affairs. *Rising Oil Prices and Dependence on Hostile Regimes: The Urgent Case for Canadian Oil*. 112th Cong., 1st sess., 2011.

Some Congressional representatives and three witnesses in this hearing were supporters of the use of Canadian oil. They stressed the need for energy and economic security, and argued that the U.S.'s goal should be less reliance on "thugocrats" and "menaces to the region." Canadian tar sand oil would therefore be a good replacement for Venezuelan crude oil. Hugo Chavez appeared to be the predominant target of Representatives' concerns in this hearing. Whether the Keystone pipeline was built, Canada would produce their tar sand oil and that oil would be transported elsewhere. If the U.S. could choose where it pays economic rents for oil, Canada would be a much better choice than Venezuela.

Opponents of Canadian oil use, a few Representatives and one witness, stressed the environmental impact of expanded tar sand production and the construction of the Keystone pipeline. Tar sand oil is expensive to produce because it requires a higher price in order to be profitable, and it results in higher levels of greenhouse gas emissions during extraction. Overall, use of Canadian tar sands oil could mean higher costs for consumers. Spare pipeline capacity already exists, so the Keystone project would deliver crude oil to deep water ports in Texas, from which point it could be exported around the world to the benefit of oil companies. Refining capacity was being expanded around the world; countries like China and Saudi Arabia were developing the ability to refine Venezuelan oil. Canadian oil would go somewhere, perhaps China, through pipelines to the Canadian west coast.

James, K.J. "The U.S. Trade Deficit, the Dollar, and the Price of Oil." *Congressional Research Service* (2011).

Data in this report showed that the main factors behind the sharp run-up in the price of oil during 2008 were an increase in demand for crude oil that exceeded the supply of oil, and the pace of production capacity. Oil was priced in dollars, so as the exchange value of the dollar declined, the purchasing power of oil producers also fell, which in turn prodded oil producers to reduce their supplies to the market in order to push up the market price of oil and restore their own purchasing powers. This is one rationale for the interconnectedness of oil price and purchasing power.

OPEC's stated objective was to coordinate and unify petroleum policies among OPEC countries in order to secure "fair and stable prices for petroleum producers; and efficient, economic and regular supply of petroleum to consuming nations; and a fair return on capital to those investing in the industry." Data, however, indicate that big fluctuations in the price of oil since 2006 reflected slow growth in oil production, an increase in demand, and concerns related to political turmoil.

It was not unreasonable to assume that OPEC members would respond to a decline in the purchasing power of the dollar by reducing their production, or holding down the rate of increase in production, in order to raise the market price of oil and regain some portion of that purchasing power. In practice however, OPEC and other oil producers, did not attempt to set the price of oil directly. Instead, they attempted to alter the supply of oil in the market relative to a given level of expected demand, and then relied on the market to search out the corresponding price. The price of oil therefore reflected the actual level of demand and supply in the market, and was affected by expectations about both demand and supply conditions and production capacity.

LAW AND POLICY ARTICLES

Hoskings, H.L. "Needed: A Strategy for Oil." *Foreign Affairs* 29 (1951): 229–237.

This paper details how oil is the central commodity critical to the success of the U.S. In times of peace, oil needs can easily be estimated, but in times of potential conflict this determination is extremely difficult. In the short run (20 years), domestic and North American oil may be enough to fuel the U.S. The author concludes that the best way to develop a strategic reserve for American oil is to stop drilling and cap American reserves, except for times of emergency in which the wells could be reopened. In the meantime the U.S. needs to develop Middle Eastern drilling to supplement the lost oil production from the capped reserves.

Feis, H. "Oil for Peace or War." *Foreign Affairs* 32 (1954): 416–429.

This paper describes the need for oil as a basis for military security. New reserves are available in the form of shale oil from Canada, and from offshore oil. There are massive reserves in Saudi Arabia that are enough to fuel the world, but they have considerable startup costs and the political climate is not the best for their production. The author points out that governments take half of the net income of oil companies.

Levy, W.J. "Oil Power." *Foreign Affairs* 49 (1971): 652–668.

OPEC creates an effective oil monopoly. Agreements by OPEC with oil-consuming nations have caused oil production to greatly increase revenues.

Adelman, M.A. "Is the Oil Shortage Real? Oil Companies as OPEC Tax-Collectors." *Foreign Policy*, Winter 1972.

The author argues that there is no issue of actually running out of oil, but rather that there has been inept foreign policy with regard to oil. The multinational oil companies have "become [...] the 'tax collecting agency' of producing nations" (70). After the success of its embargo, OPEC will continue to use that threat to drive prices up.

"1. The price of crude oil, set by a world monopoly, is many times what is enough to make it worthwhile to expand output. Therefore, even if price declines and especially if it rises, there will always be more crude oil available than can be sold, as there is now and has always been.

2. Assume the contrary: that oil is becoming increasingly scarce, and that the price will reach \$5 or whatever. At this price, the market is cleared, and just as with a monopolized market, anyone who can pay the price gets all he wants.

3. There is real fear, exploited but not created by the U.S. government, that massive American oil and gas imports will somehow preclude buyers from other countries, especially if the producing nations take the advice to limit output. Assume they do so. Then lower-cost and more profitable companies will outbid their rivals for the limited supply. Japanese iron and steel companies, for example, are obviously much lower-cost than their American rivals. The dwindling of the American export surplus seems to show a higher cost level; if so, high oil prices will harm this country more than others.

4. One often-expressed fear is that the American multinational companies will divert supplies to American customers in preference to non-American. But if there is some constraint such that both groups cannot be fully supplied, then the price must rise. To imagine American companies deliberately holding down the price, in order to precipitate a shortage, in order to be able to discriminate, is fantasy. They would not wish to do it, and their masters the producing nations would not allow it.

5. The OPEC nations may wish to deny oil to some particular country. But if some or even most of them do so, the capacity of others will be available, and at most there will be a reshuffling of customers. Yet let us now assume that all OPEC nations unite to boycott one country. They must also prevent diversion of supplies of crude oil and products from other consuming countries to the victim. Yet nobody has suggested why the OPEC nations should join in this profitless persecution. Moreover, non-OPEC oil is large relative to a single consuming country's needs.

6. Even if all the foregoing is incorrect, and "access" is a real problem, it is useless to try to obtain access through a company owned by the consuming nation, since real power is in the producing nation" (99–100).

Moran, T.H. "Coups and Costs." *Foreign Policy*, Autumn 1972.

As oil-exporting countries become independent producers, political instability will increase. Pressures for national development by oil-producing countries has led to nationalization of oil infrastructure. These pressures have also led to demands for larger returns on their petroleum production. During the 1960s most of the domestic influx of revenue for the oil-producing countries came at the expense of the international oil companies. Average net worth of the seven largest oil companies declined from 1959–1969. This paper develops a theory that military leaders seeking to increase their power can sell out to foreign oil powers by offering both lower priced crude and expanded crude production.

Krasner, S.D. "The Great Oil Sheikdown." *Foreign Policy*, Winter 1973.

The American position can be summarized as protecting corporate interests and minimizing the political instability of the Middle East. Even if oil-producing states broke out of OPEC, the private oil companies could arguably collude to make prices go even higher than they would within OPEC.

Levy, W.J. "World Oil Cooperation of International Chaos." *Foreign Affairs* 52 (1974): 690–713.

This paper describes how international oil companies are no longer able to assure the continuity or price of regular supplies to oil-importing countries because oil-exporting countries have taken over production and pricing

decisions. Countries began nationalizing the oil industry in the early 1970s. Oil-importing countries thus cannot rely on international oil companies to be effective intermediaries between themselves and the oil-exporting countries. Cooperation among the oil-importing countries is necessary since the oil-producing countries are also cooperating. One-sided decisions by OPEC have led to high prices and oil-importing countries must work together to combat price increases.

King, G.M. "Cartel Pricing in the International Energy Market: OPEC in Perspective." *Oregon Law Review* 54 (1975): 643–668.

OPEC's ability to sustain oligopolistic control depends in large measure on the continued cooperation among its members and on favorable market factors. One OPEC goal was to become more involved in the downstream operations of the oil industry to render more effective the right of permanent sovereignty over its resources. This happened in the early 1970s. By 1975, six countries were operating wholly or partially nationalized industries. OPEC's future in large part depends on the extent to which its members abide by OPEC policies.

Moran, T.H. "The Future: OPEC Wants Them." *Foreign Policy*, Winter 1976.

Saudi Arabia is the "residual supplier" of OPEC that can set production at its whim. The author argues that even though Saudi Arabia could drop production to keep prices high, the social costs that it would suffer, including cuts to its defense and domestic policy budgets, would outweigh the advantages of keeping the price of oil high. The U.S. has three options: hardline negotiations with OPEC, soft line negotiations with OPEC's moderates in the hopes of securing better financing for oil, and just taking a "wait and see" approach and hope that OPEC falls apart.

Levy, W.J. "Oil: An Agenda for the 1980.", *Foreign Affairs* 59 (1981): 1079–1101.

This article reviews problems for the world oil economy with an eye towards the issues posed in achieving a balance between the vital interests of oil importers and exporters. The author points out that Saudi Arabia, by 1981, had created a glut by maintaining its oil production well in excess of market requirements and at prices well below the general OPEC level in order to stabilize the price of oil.

Bénard, A. "World Oil and Cold Reality." *Harvard Business Review* 58 (1980): 91–108.

OPEC's supply now conforms to 'producer logic' and the oil-consuming nations must take positive steps to adjust to that situation. Under producer logic, the availability and prices of oil are suited to the interests of producers and to their perception of the future. Therefore, OPEC now determines supply based on its own economic and political interests, and the needs of the oil-consuming countries no longer determine the price and availability of OPEC oil.

Doran, C.F. "OPEC Structure and Cohesion: Exploring the Determinants of Cartel Policy." *The Journal of Politics* 42 (1980): 82–101.

OPEC's decision-making process is normally thought of as highly complex and largely motivated by economics. This author argues that in actual practice it is neither. OPEC's decision-making involves the comparatively simple task of periodically setting a single price for a single grade of petroleum, light Arabian crude, which is the marker crude. The initial price decision itself however is highly politicized and falls more appropriately into the political arena of legitimized action and issue priorities than in the economic realm of equilibrium theory. Whereas long-term shifts do occur in the world supply of petroleum, intra-OPEC politics is more often the arbiter of OPEC policy in the short term.

Within OPEC, each of the exporters is allowed to produce at its chosen level. Saudi Arabia, with its enormous petroleum reserves, has great production flexibility and thus makes up any difference between the quantity of petroleum demanded at the agreed upon price and the quantity supplied by the other members of OPEC at that price. However, Saudi Arabia is subject to outside and inside pressures with respect to its output and thus its government is not able to unilaterally set the world price for petroleum in defiance of the preferences of the other members. The world price is therefore negotiated among changing coalitions of member states with the Saudis.

If the price of oil increases too rapidly, security relations with specific consumer nations may be threatened. If price increases do not take place rapidly enough, consensus may break down and OPEC risks predatory price-cutting by dissatisfied governments; or, the cartel leadership may face unacceptable levels of regional hostility and turbulence. Moreover, excessive price increases in the medium term are likely to induce massive energy substitution, thus eventually undermining OPEC's share of the world's energy supply.

Moran, T.H. "Modeling OPEC Behavior: Economic and Political Alternatives." *International Organization* 35 (1981): 241–272.

This paper attempts to model and predict OPEC behavior based on economics. The author uses game theory to predict what OPEC will do with regard to pricing and to predict how individual nations will try to act in order to preserve their own self interests. Countries with plentiful resources will try to set a lower price point in order to maximize their immediate profits. The article addresses the price fluctuations of the 1970s and analyzes the U.S.'s attempts to negotiate with the Saudis at each juncture.

Scott, B.R. "OPEC: The American Scapegoat." *Harvard Business Review* 59 (1981): 6–8.

To blame OPEC for oil price increases overlooks the basic economics of the oil industry and of each member country: the large spread between production cost and value to the user; the shift from a buyer's market to a sellers' market; the sellers' difficulties in absorbing rising oil income; and the sellers' subsequent desire to limit production rather than generate excess government revenues and domestic demand, rapid inflation, and political instability in their own countries. The author concludes that the U.S., with energy-inefficient automobiles, houses, and factories is the number one culprit of price increases, not OPEC.

Levy, B. "World Oil Marketing in Transition." *International Organization* 36 (1982): 113–133.

State-owned oil enterprises are challenging the dominance of the major oil companies. Even though oil-producing countries increased their ownership of the oil companies, they left most marketing to foreign corporations. National oil companies shifted to direct marketing to help decrease their costs, which helped independent oil companies have access to these countries. The author proposes a multinational structure to set the price of crude oil on the market for maximum fairness to all refiners.

Verlanger, P.K. "When the Oil Spigot is Suddenly Turned Off." *Journal of Policy Analysis and Management* 1 (1982): 541–545.

Oil prices can be expected to increase by a very large magnitude during future supply interruptions despite the contingency plans of oil-consuming countries. When a supply disruption occurs, there becomes a gap between supply and demand, which quickly causes both suppliers and consumers to hoard. This hoarding process pushes prices upwards and further increases the demand for stocks.

When changing prices, OPEC countries are guided by changes in the spot market. During a supply disruption, the spot market prices will increase at a level consistent with the magnitude of the shortage. However, OPEC countries tend to make their price adjustments slowly, which creates an incentive for those with access to low-priced OPEC crude oil to profit from the temporary difference between the prices set by exporting countries and the spot market prices. This prolongs the disruption and increases the magnitude of increases in spot prices. Thus, one way to deal with a disruption quickly is by raising prices faster, which can be accomplished by importers imposing a tariff. Also, the same outcome could be reached by OPEC raising prices more quickly.

The paper recommends that after a disruption: (1) Prices be raised quickly because higher prices start the conservation process that is required to return supply and demand to equilibrium; (2) Apply a tariff on imported oil because it will force up consumer prices and induce quick conservation; (3) Use a graduated tariff to defend any price and thus encouraging consumers to postpone consumption by holding out the promise of declining prices; (4) Set up mechanisms for recycling the receipts of the tariff that would reduce the transfer of wealth from the U.S. to oil-producing countries; (5) Do not substitute refiner and consumer taxes for a tariff; (6) Encourage the development of greater private stockpiles; (7) Provide quick and easy access to government owned stockpiles; (8) Do not spend too much time debating future emergency conservation measures; (9) Price controls and allocations of supply are a terrible mistake because they delay adjustment and drive up prices even higher; and (10) International cooperation is helpful but not essential to meet a disruption, the response should just be quick.

Odell, P.R. "OPEC, Oil Prices and the West." *The World Today* 41 (1985): 82–83.

In a situation of little or no growth in energy usage, where oil prices make alternatives economically attractive, the world's dependence on OPEC oil will be reduced. The relatively higher price of oil will cause consumers to use less, reducing demand for oil and the higher price will make alternatives more economically viable. Alternatives include exploration and production of non-OPEC oil as well as traditional alternative energy projects. These two results in tandem will lower demand for OPEC oil and increase the supply of non-OPEC oil and alternative energies.

OPEC is now realizing that it is no longer in a position to control the oil market alone. By keeping oil prices artificially high, OPEC creates incentives for alternative fuels, thereby reducing global demand for oil, and promoting growth in production of non-OPEC oil. If these trends persist, there will continue to be steady attrition of the export demand for oil from the OPEC countries.

However, the western economic system as a whole could be damaged if OPEC oil becomes less relevant in the West because of the costs incurred in the production and use of energy supplies that are available only at resource costs well above those of OPEC oil.

Gately, D., M.A. Adelman, and J.M. Griffin. "Lessons from the 1986 Oil Price Collapse." *Brookings Papers on Economic Activity* 1986 (1986): 237–284.

This paper reviews the 1986 oil price collapse, discusses why it came as a surprise, and assesses what it meant for subsequent oil prices. The author concludes that the price collapse was a result of a decision by Saudi Arabia to increase its share of the oil market. Saudi Arabia did not suffer great revenue losses because the price declines were offset by output increases. In the future, OPEC will restrict production in an effort to increase price as the price becomes so low that even the Saudis lose revenue.

The Saudis do not want their long-term profitable future jeopardized by fuel-switching or development of alternative energy sources, so they have some incentive to keep prices down. Prices will, however, increase quickly. With the 1986 collapse fresh in OPEC's mind, it will be much easier to get OPEC members to stick to production quotas and to not overproduce, because that would drive up prices. Saudi Arabia has shown that it will flood the market if members are cheating and overproducing to increase their revenues. One pricing strategy that is likely to serve OPEC well is being cautious about major, abrupt price increases. Such a strategy would increase price only gradually when market conditions warrant and would cut price aggressively if necessary to defend OPEC's market position.

The International Association of Machinists and Aerospace Workers (IAM) sued OPEC on the basis of Sherman Antitrust laws, but no court found jurisdiction, and in 1982 the Supreme Court refused to review the case. Judge Hauk dismissed the case because IAM was not a direct purchaser from OPEC, the activities of producing and selling oil were not "commercial acts" under the meaning of the Foreign Sovereign Immunities Act, and foreign governments are not "persons" under the meaning of the Act.

Morse, E.L. "After the Fall: The Politics of Oil." *Foreign Affairs* 64 (1986): 792–811.

Given oil's pervasive influence on industrial growth, and the record of government and industry interventions over the decades, the oil sector has not generally functioned as a free transparent market in which price is determined by the interaction of many buyers and sellers.

Nationalization of oil companies changed the structure of oil market. It broke linkages between the developing world's oil production and that of industrialized countries. Nationalizations motivated international oil companies to aggressively search for oil in new frontier areas and in countries where they were permitted to search. Further, nationalization broke the tight coordination of production and refining, which had been considered a prerequisite to managing the petroleum economy by reducing price volatility. Low-cost producers had shut production while high-cost producers had pumped oil at near maximum capacity. This condition is exactly the opposite of what one would anticipate in a free market.

Efficient marketplace prices should decline toward the level of production expenses in the least-cost-producing countries, and production capacity of higher cost producers would be shut until such time as demand warranted the production of higher-cost oil. Saudi Arabia is a much more significant producer than the others due to its high reserves and thus has different purposes than other countries.

Owen, R. "The Arab States under Stress: The Impact of Falling Oil Prices." *World Policy Journal* 3 (1986): 643–665.

Between 1981 and 1985, the price of oil dropped and consequently less value was brought in to the Arab oil-exporting region. In November 1985, the price for OPEC oil was \$29, however, it then began a fall and took the price down to lows between \$8 and \$9 per barrel in July of the following year. The trigger was Saudi Arabia's announcement in September 1985 that it would sell its oil at the market rate rather than at OPEC's price. Further,

Saudi oil production increased. This increase destroyed the quota system OPEC relied on to prop up and control the price of oil. This Saudi defiance may have been the result of cheating by other OPEC members, or it could have been a way to reestablish OPEC discipline in the long run, restore Saudi leadership, and allow OPEC to return to its central place in the world energy equation.

Johnson, R.H. "The Persian Gulf in U.S. Strategy: A Skeptical View." *International Security* 14 (1989): 122–160.

Central to the operation of OPEC is a well-known division of interest within it. A Saudi-led group of Persian Gulf states with small populations has relatively more limited revenue needs and possesses large oil reserves. This group tends to be concerned with the longer-term market for oil and therefore favors more moderate prices. The behavior of other OPEC members, which generally have larger populations, greater needs and smaller reserves, tends to be dominated by more immediate revenue requirements.

OPEC is more likely to operate like a cartel in situations where prices are beginning to fall from a peak than in circumstances where prices are rising or falling rapidly. When prices rise rapidly, Saudi Arabia is likely to increase production in an effort to moderate the oil price increase since it is looking out for its long-term interests, rather than for a short-term windfall. When prices are falling rapidly, the Saudis are likely to reduce output in order to raise the price to level more in-line with the overall market.

Morse, E. "The Coming Oil Revolution." *Foreign Affairs* 69 (1990): 36–56.

OPEC now appears to be in institutional decay and its role is increasingly outmoded by the economic and political logic of the petroleum sector's evolution. This is due to the emergence of a new international petroleum sector. This is binding producing and refining centers together more than at any time since the early 1970s and gives more bargaining leverage to the oil-exporting countries. By the end of the 1980s, the market seemed to set the price of oil, not the governments of the oil-producing countries. Governments' only role is to change adjustment factors in pricing formulas.

Adelman, M.A. "Oil Fallacies." *Foreign Policy*, Spring 1991.

OPEC should, in setting oil prices, calculate the most profitable price–output combination. Yet in practice, OPEC lacks the basic knowledge to do so. It is even harder for OPEC to allocate the burdensome task of restricting output. When OPEC governments displaced the multinational oil companies in the early 1970s, they lost agents who were skilled in mediating among the various oil-exporting nations as well as in slowing down competitive forces. Without precise and timely data on consumption, inventories, even production of oil, the OPEC cartel is flying blind.

OPEC countries tend to overreact because their governments overspend and are chronically short of cash. OPEC nations often artificially inflate oil prices and then sustain them at high levels. First, an actual or likely production cut drives up the spot price, which generates panic buying. As panic subsides, governments raise the official contract or target prices. These new higher prices must then meet the test of the market, which leads to a third stage in which demand falls off and cartel members cut back output to hold up the price and act as if the market forces caused this price increase.

Increased non-OPEC oil production has disturbed the cartel's domination over oil prices. Further, increased natural gas usage in the future could further disturb OPEC's power. However, OPEC countries will continue to produce more oil than they have need for. Without excess capacity, a cartel member lacks bargaining power over production quotas because there is less of a threat of 'cheating.' A member that threatens continued overproduction to undermine prices has leverage in OPEC negotiations. Therefore, OPEC capacity will always exceed the demand for oil.

Issues involving research and the Strategic Petroleum Reserve cannot be left in private hands. Price explosions are rooted in individuals' fears of shortage. The Strategic Petroleum Reserve can be a seller of last resort and prevent this fear by assuring buyers a constant supply. History has shown that cooperation and dialogue with OPEC nations will not keep prices down, or even affect their actions. The author concludes that the U.S. should follow one strategy: do nothing to help the cartel.

Stanislaw, J. and D. Yergin. "Oil: Reopening the Door." *Foreign Affairs* 72 (1993): 81–93.

OPEC's share of the world oil market fell from 63 percent in 1972 to 38 percent by the end of 1985. In response to this drop, many countries are now 'reopening the doors' to private investment after the nationalization trend that swept through in the 1970s. The movement now is towards deregulation and fragmentation of the oil industry. The authors argue that best bet for price and supply stability is a pattern of investment and trade in which security is enhanced by the diversity and density of economic and political links and by the commonality of interests in an environmental age.

Zanoyan, V. "After the Oil Boom: The Holiday Ends in the Gulf." *Foreign Affairs* 74 (1995): 2–7.

Despite investments over the past two decades, almost every economy in the Persian Gulf faces serious structural and financial problems. The oil boom of the 1970s led to high revenues for these states and consequently prosperous times and a sort of economic 'holiday.' Lower oil prices recently have led to economic problems within these countries. The U.S. must act in order to help facilitate the fundamental changes that are required to keep these economies and countries stable so as to keep oil supply relatively secure.

Chalabi, F.J. "OPEC: An Obituary." *Foreign Policy*, Winter 1997.

OPEC's decisions are no longer taken seriously because the agreed-upon level of oil production is completely out of line with the organization's actual output. Revolutionary changes in technology, the emergence of other regional suppliers of oil, lower barriers to entry for new companies, the diverging economic interests of oil-producing nations, international environmental accords, the rise of the futures markets, and expanding oil resources have all taken their toll on OPEC's power.

OPEC is a therefore relic of a different era. The Seven Sisters used to be a small clique of oil companies that dominated the industry in the 1950s. OPEC was later formed as a kind of defensive instrument used by oil-producing countries to stabilize the oil market. In 1973, OPEC decided to set the price of oil unilaterally and not in consultation with the oil companies. The success of this action gave OPEC a sense of power and paved the way for more aggressive behavior from the cartel.

The oil shocks caused by OPEC eventually led to market backlash that caught up with the organization. The price shocks led to decreases in the growth of the demand for oil. Further, consumers began to rely more heavily on their own private inventories as a hedge against future supply disruptions. Consumers also began to conserve. This market backlash has undermined OPEC's influence in the global oil market.

This paper concludes that the once exclusive club of oil-producing nations is gone and instead there is a hypercompetitive market for oil with many participants.

Gause, F.G. "Saudi Arabia Over a Barrel." *Foreign Affairs* 79 (2000): 80–94.

During 1999, when oil prices were rising, Saudi Arabia, along with OPEC, agreed to reduce oil production. Saudi oil policy is now driven by the immediate revenue needs of their government which is struggling to maintain a welfare state. This policy was designed in the 1970s when money was limitless for the Saudis, for a society with a fast-growing population. The Saudi fiscal situation has led to an output reduction in an effort to raise revenue by raising prices.

The conundrum that Saudi Arabia and OPEC face, is that if prices stay up, new oil will find its way onto the market, and demand might not grow at forecasted rates. Further price increases could therefore mean a drop in demand. If prices soften however, OPEC and non-OPEC members alike will be tempted to cheat on their quota agreements. But in the short term, price considerations will loom large in Saudi policy because the government needs the money.

Victor, D.G. and N.M. Victor. "Axis of Oil?" *Foreign Affairs* 82 (2003): 47–61.

American and Russian governments cannot exert much leverage over the price of oil in the world market. More than half of the world's total oil production is traded openly on a single, integrated world market and most of the oil that does not move across an international border is still priced in national markets that move world prices. Since there is one international market, the origin of a particular barrel is largely irrelevant.

Therefore, prices on the world oil market are mainly a function of swing suppliers, which was the role dominated by OPEC for three decades. What holds OPEC together is an ideology of market manipulation as well as the facts that production in OPEC fields is inexpensive and that OPEC member governments are generally able to exert

strong control over production decisions. Privatization and competition in Russia make it increasingly difficult for Russia's oil industry to behave as a coherent unit, whereas it is much easier to control production in OPEC states, where the state and producer act as one cohesive unit.

Adelman, M.A. "The Real Oil Problem." *Regulation* 27 (2004): 16–21.

This paper argues that real problem that we face over oil dates from after 1970: a strong but clumsy monopoly of mostly Middle Eastern exporters cooperating as OPEC. These exporters constrain supply and thus raise the price of some of the world's cheapest oil. One big problem OPEC has is finding and maintaining the right price. When the price is set too high, it costs them money because purchasers cut consumption by buying less. OPEC's second big problem is how to allocate sales among cartelists. Rogue members seeking windfall profits can disrupt the cartel's overall supply and pricing plan. This happened with the Saudis in the 1980s. Deciding on group action is not easy and usually like a game of chicken until some agreement is achieved because OPEC is committed to nothing; it will raise or lower output to increase profits.

Claes, D.H. "The United States and Iraq: Making Sense of the Oil Factor." *Middle East Policy* 12 (2005): 48–57.

OPEC will gain more in the long run from a slow increase in Iraqi oil output than from a sudden increase. The oil market has transitioned into a short-term market with lots of volatility. The war in Iraq did not lower the costs of oil; and the cost to develop Iraqi oil fields made development counterproductive.

Kohl, W.L. "The Perfect Storm: OPEC and the World Oil Market." *Harvard International Review* 26 (2005): 68–72.

OPEC does a poor job of attempting to stabilize world oil prices. OPEC countries contain about 75 percent of the world's oil reserves, but currently produce only about 35 percent of the world's oil. OPEC is hampered by the fact that as a group of sovereign countries, it has no enforcement mechanism. Therefore, exceeding quotas is a constant problem that undermines its efforts to manage the market. OPEC also cannot control sudden shifts in demand or geopolitical risks. The oil market is difficult to manage, and OPEC continues, as MIT Professor M.A. Adelman once explained, to act like a "clumsy cartel."

Maugeri, L. "Two Cheers for Expensive Oil." *Foreign Affairs* 85 (2006): 149–163.

The high price of oil is brought about because of economic conditions, not because of geological concerns. Oil costs are high not because we are running out of oil, but rather due to underdevelopment of oil infrastructure. The Seven Sister oil companies intentionally underdeveloped oil in the Persian Gulf in order to keep demand high. But when oil facilities became nationalized, they stopped being developed. There are potential oil reserves in the Caspian region, Russia, and Africa that have not been developed. The major chokepoint is in refining capacity; there has not been a new refinery built in the United States in 30 years.

Morse, E.L. "Low and Behold: Making the Most of Cheap Oil." *Foreign Affairs* 88 (2009): 36–52.

This paper outlines the opportunities created by recent low prices for oil, and the policy responses that would best serve the interests of the OECD countries. Much of the discussion revolves around spare capacity, which has fluctuated over time. Despite fears that low prices would stifle exploration and increase investment production, new capacity has come online. New oil and gas resources have also been developed following technological advances that were spurred on by high energy prices. In the wake of these high prices, projections for growth in oil demand typically flatten out, so markets will not be as tight going forward.

With its spare capacity, Saudi Arabia is in a position to work with the U.S. to achieve shared goals: moderate prices, reduced oil revenues to Iran, stopping the flow of petrodollars to terrorists, and limited volatility in oil prices. President Obama needs to "recognize that bringing energy independence to the United States is an impossible task and that pursuing more modest goals is a better way to ensure the country's energy security."

Elass, J. and A.M. Jaffee. "The History of U.S. Relations with OPEC: Lessons to Policymakers." Houston, Texas: James A. Baker III Institute for Public Policy, September 2010.

OPEC's best defense against the expansion of alternative energy would be to drop the price of oil to levels that would render alternative energy as commercially unprofitable. However, OPEC is not currently worried about this threat since it does not believe that such technologies can be scaled up to commercially significant levels within the next twenty to thirty years. OPEC is more worried about a U.S. or global climate regime that would tax or penalize petroleum in a substantial fashion that significantly disadvantages oil-based fuel.

Elass, J. and A.M. Jaffe. "Iraqi Oil Potential and Implications for Global Markets and OPEC Politics." Houston, Texas: James A. Baker III Institute for Public Policy, July 2011.

The lesson OPEC may have learned from its price war was that the Saudis will act to make sure that no fellow OPEC countries will gain the financial or oil capacity wherewithal to threaten its kingdom. It is in Saudi Arabia's best interests to maintain its leadership role. The ability to threaten other oil producers that it could flood the oil market is a critical reason why it holds the leadership role it does inside OPEC and gives the country regional clout as well. Further, Saudi Arabia's ability to singlehandedly alter the price of oil gives it significant geopolitical power as well. However, many do not believe that the Saudis have invested enough in production to maintain the enormous amounts of spare capacity needed to flood the market.

Fang, S., A. Jaffe, and T. Temzelides. "New Alignments? The Geopolitics of Gas and Oil Cartels and the Changing Middle East." Houston, Texas: James A. Baker Institute for Public Policy, January 2012.

Russia is trying to establish a natural gas cartel similar to OPEC. However, the U.S. strategic agreements with Saudi Arabia and Qatar have effectively locked Russia out of the Middle East oil rush.

Fattouh, B. "The Dubai Benchmark and Its Role in the International Oil Pricing System." Oxford, England: Oxford Institute for Energy Studies, March 6, 2012.

The paper explains the role of Dubai as a benchmark for pricing oil cargos destined for Asia. The author points out a series of innovations by Dubai into what he calls a brand name. Shifts to partials trading in 2004 initially produced encouraging results by increasing the volume of trading and improving efficiency of price discovery. However, in recent years liquidity in Dubai has declined to a point where only a few deals are concluded each month. For Oman partials between September 1, 2010 and December 31, 2010 there was no trading on 93 percent of the days. Trading activity in the Platts partials is highly concentrated in the hands of a few players. Some traders, investing in as little as a 25,000 barrel partial contract, can influence the pricing of millions of barrels traded daily. Some argue that market players monitor trading in the Dubai window closely, and if prices are being manipulated, other players have incentive to enter Dubai and exert influence on prices and push it where it should be. This paper points out existing barriers to entry that could prevent such an adjustment mechanism from taking place.

Fattouh, B., L. Kilian, and L. Mahadeva. "The Role of Speculation in Oil Markets: What Have We Learned So Far?" WPM 45. Oxford, England: Oxford Institute for Energy Studies, March 2012.

This paper is a survey reviewing evidence of the popular claim that the surge in the price of oil during 2003–2008 cannot be explained by economic fundamentals; and that it was instead caused by increased financialization of oil futures markets, which in turn allowed speculation to become the major determinant of the spot prices of oil. The paper concludes that existing evidence does not support the claims of the role of speculation as a driving force in oil price determination in the period. The paper asserts that evidence exists to support the claim that both the spot and futures oil prices were driven by economic fundamentals.

Maugeri, L. "Oil: the Next Revolution." Discussion paper 2012-10. Cambridge, Massachusetts: Belfer Center for Science and International Affairs, Harvard Kennedy School, June 2012.

Oil supply capacity is growing worldwide and might outpace consumption. With new technology, the four nations with the most future oil production potential are the U.S., Canada, Mexico, and Iraq. Most of the U.S. shale and tight oil reserves are profitable if the market cost of oil ranges between \$50 and \$65 per barrel. The U.S. could potentially produce 11.6 million barrels of oil per day. The author argues that oil in shale and tight oil fields is not a bubble; they represent the future of America's energy independence.

Pierce, J. "Oil and the House of Saud: Analysis of Saudi Arabian Oil Policy." *Digest of Middle East Studies* 21 (2012): 89–107.

Saudi interest is to maintain high levels of oil exports at comparatively moderate prices. The politics of Saudi Arabia are a function of the price of oil, and the price of oil is a function of Saudi politics. Saudi Arabia has the greatest administrative capability to influence the price of oil since it has the largest excess capacity of oil in the world, but it cannot control the price. Saudis tend to utilize OPEC when it meets their needs, but also tend to act unilaterally or in concert with non-OPEC countries. Saudi Arabia is able to use its huge amount of excess capacity to wield some power over OPEC.

Yergin, D. "How is Energy Remaking the World?" *Foreign Policy*, July 2012.

In this article, the author argues that every U.S. President since 1973 has heralded energy independence, and it is finally becoming a possibility due to better technology. The discussion ultimately concludes that peak oil is a myth.

