

## Environmental Policy Update #1:

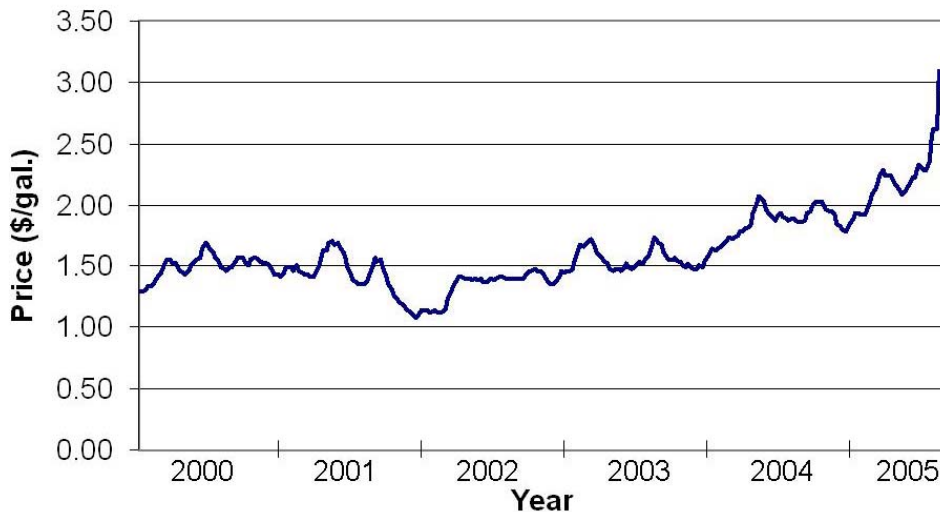
# Gasoline Prices and Energy Supplies

*Environmental and Natural Resource Economics: A Contemporary Approach, Second Edition, Jonathan M. Harris*

## Introduction

In the past few years gasoline prices in the United States have increased substantially from around \$1.10 per gallon in late 2001 (see Figure 1). Average gas prices first climbed above \$2 per gallon in mid-2004, and then rose further past \$3 per gallon in the wake of Hurricane Katrina in Sept. 2005.

**Figure 1: U.S. Average Retail Gas Prices, Jan. 2000 – Sept. 2005.**



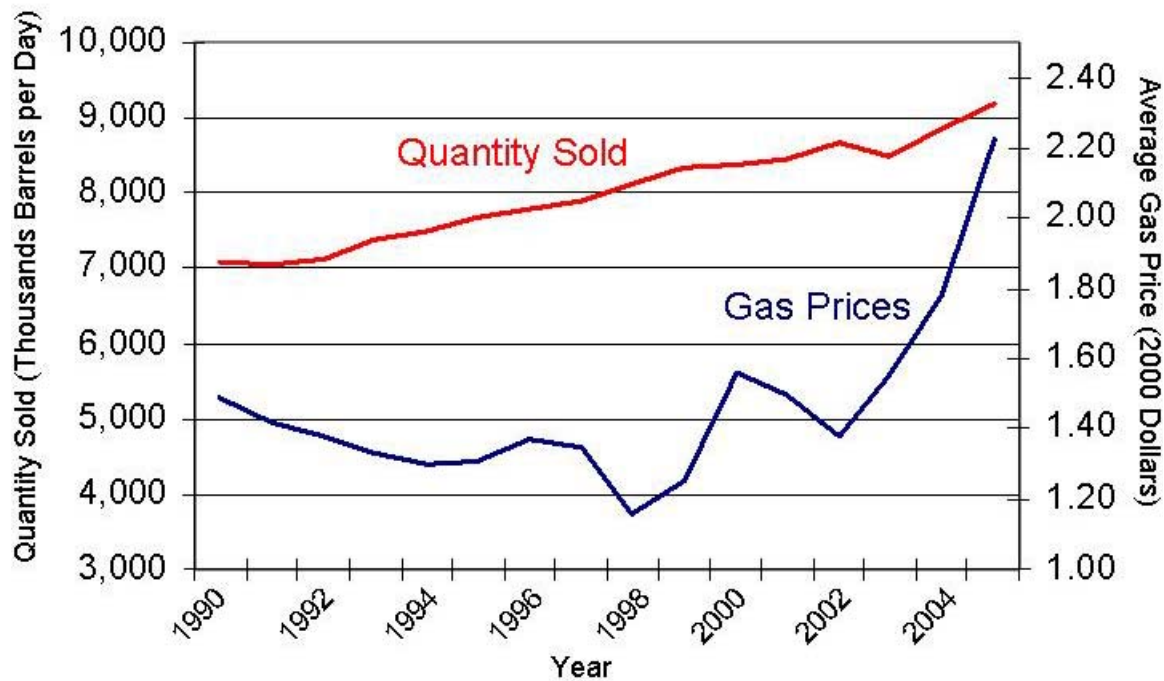
Source: U.S. Energy Information Administration,  
[http://www.eia.doe.gov/oil\\_gas/petroleum/data\\_publications/wrgp/mogas\\_history.html](http://www.eia.doe.gov/oil_gas/petroleum/data_publications/wrgp/mogas_history.html)

Why have gas prices risen, and is the change temporary or permanent? This question raises issues both about the workings of markets and, more broadly, about environmental and resource economics issues. (See text Chapters 3, 12, and 13). Viewing the issue from a perspective of economic analysis, we can broadly classify these explanations into demand-side and supply-side factors. Let's first consider a couple of demand-side explanations, then some supply-side issues.

## Explanation #1: Domestic Demand Increase

Supply-and-demand theory implies that if the demand for a good increases, we would expect its market price to rise and the quantity sold to increase (see Chapter 3). Is this at least part of the explanation for the recent increase in gas prices? While the data are not available to plot a complete demand curve for gasoline, we do have significant data on the market price and quantity sold. Figure 2 presents both the annual average market price and quantity sold for 1990-2004. Note that the price of gas has been adjusted to account for inflation.

**Figure 2: Average U.S. Gas Prices and Quantity Sold, 1990-2005**



Source: U.S. Energy Information Administration,  
[http://www.eia.doe.gov/oil\\_gas/petroleum/info\\_glance/gasoline.html](http://www.eia.doe.gov/oil_gas/petroleum/info_glance/gasoline.html)

Figure 2 shows that the quantity of gasoline sold in the U.S. has generally been steadily increasing for the last fifteen years. During this same period gas prices have fluctuated – declining in real terms during most of the 1990s and then increasing in the last few years.<sup>1</sup>

- *Based on the data in Figure 2, do you believe that an increase in domestic demand has been a primary factor leading to the increase in the price of gasoline in the last few years? Can this factor alone explain the data in Figure 2?*

<sup>1</sup> Figure 2 only shows the annual averages. Thus variations in prices and quantities within a year are not represented. In general, the quantity sold consistently rises during the summer months regardless of price.

## Explanation #2: International Demand Increase

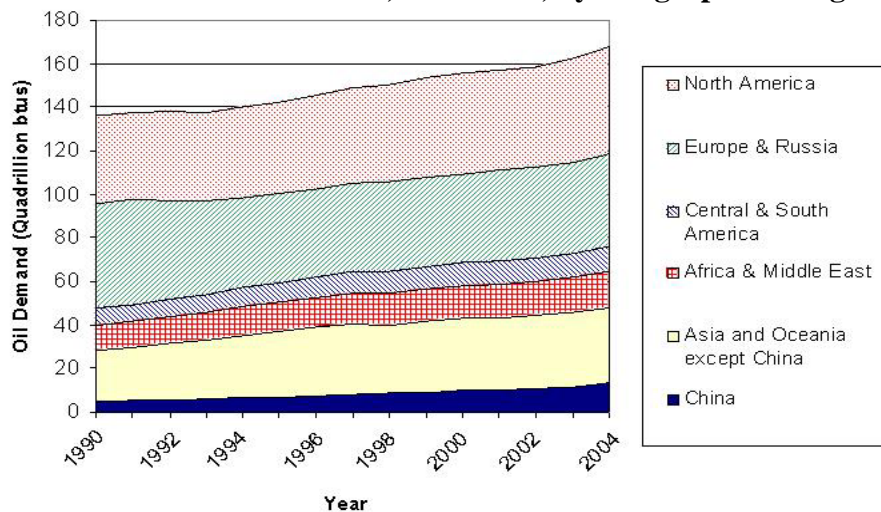
A second possible explanation is that the price of gasoline in the United States has increased because international demand has increased. The United States imports a significant portion of its oil – currently about 58% of total petroleum consumption (see text Figure 13-5). Thus for over half of its oil, the U.S. must compete with other countries on the world market and pay the going world market price. Even if U.S. demand were constant, an increase in demand in other countries would increase the world price and, consequently, prices in the U.S. The recent surge in gasoline prices is not isolated to the U.S. For the period between early 2002 and September 2005 gas prices rose about \$1.70/gal. in the U.S. but by nearly \$3/gal. in European countries such as France, Germany, and England

Demand for oil is rapidly increasing in developing countries, especially China (See Figure 13-4 and Box 20-1 in text). According to the Worldwatch Institute (<http://www.worldwatch.org>) China's oil consumption has more than doubled since 1993, with most of the increase coming from imports. Is a sudden increase in oil demand in China or other countries an explanation for the rise in gas prices in the U.S.?

Figure 3 shows international oil demand from 1990 through 2004 divided into different regions of the world. We see that global oil demand has risen consistently in the last fifteen years but the growth has not been steady. Most of the increase in world demand has occurred in China and other Asian countries, but we see that these countries still only comprise about 29% of global demand (up from 21% in 1990).

- *Based on the data in Figure 3, do you believe that an increase in global demand has been a primary factor leading to the increase in the price of U.S. gasoline in the last few years? Consider whether there has been a sudden increase in the global demand recently. Even if there hasn't been a sudden increase, is it possible that a relatively small increase in global demand could have a dramatic effect on prices? Explain.*

**Figure 3: International Oil Demand, 1990-2004, by Geographical Region**



Source: U.S. Energy Information Administration, International Energy Annual 2003 [www.eia.doe.gov](http://www.eia.doe.gov)

### Explanation #3: Price Gouging and OPEC

An explanation that focuses instead on the supply side of the petroleum market is the possibility of price gouging by oil companies. In late Sept. 2005 the governors of eight states asked Congress to investigate whether the oil companies were guilty of price gouging in response to Hurricane Katrina. A study by University of Wisconsin economist Don Nichols notes that the price mark-up between crude price and the retail price of gasoline has historically been about 85 to 90 cents per gallon and that for gas to reach \$3 per gallon the price of crude would need to be \$95/barrel. However, crude prices around the time of Hurricane Katrina were only around \$65-\$70/barrel.

Table 1 shows the difference between the price of crude oil and the average U.S. retail price of gasoline. We see that the price differential stood around \$0.80 to \$0.90 per gallon throughout 2000-2003 and jumped up slightly to around \$1 per gallon through the middle of 2005. Only in September 2005 do we see a dramatic increase in the differential between retail prices and the price of crude oil. While it appears difficult to claim that significant price gouging was occurring prior to September 2005, the data for September might be taken to suggest that some gouging may have been taking place.

- *Does Table 1 provide definitive proof that price gouging was taking place in September 2005? Can you propose any other explanations why the price differential rose in September 2005?*
- *Using the U.S. Energy Information Administration website ([www.eia.doe.gov](http://www.eia.doe.gov)), look up the current price differential between crude oil and U.S. retail gas prices. What is the current price differential? Based on these data, do you think price gouging is currently occurring?*

A related possibility is that the oil cartel OPEC (Organization of Petroleum Exporting Countries<sup>2</sup>) is artificially restricting crude oil supplies and using their market power to drive up prices. In 2004 OPEC countries produced about 40% of the world's petroleum, and this percentage has been relatively stable for the past fifteen years. Perhaps more importantly, OPEC countries provide about half of the world's oil exports. As shown in Figure 4, the price of OPEC oil has increased from below \$20/barrel at the start of 2002 up to around \$60/barrel in September of 2005.

- *Compare Figure 4 with Figure 1. How similar to do you think the OPEC crude oil price is related to U.S. retail gas prices? Can you locate any information on the Internet that supports the claim that OPEC is artificially restricting supply? Do you think restricting supply makes sense if the price of oil is high?*

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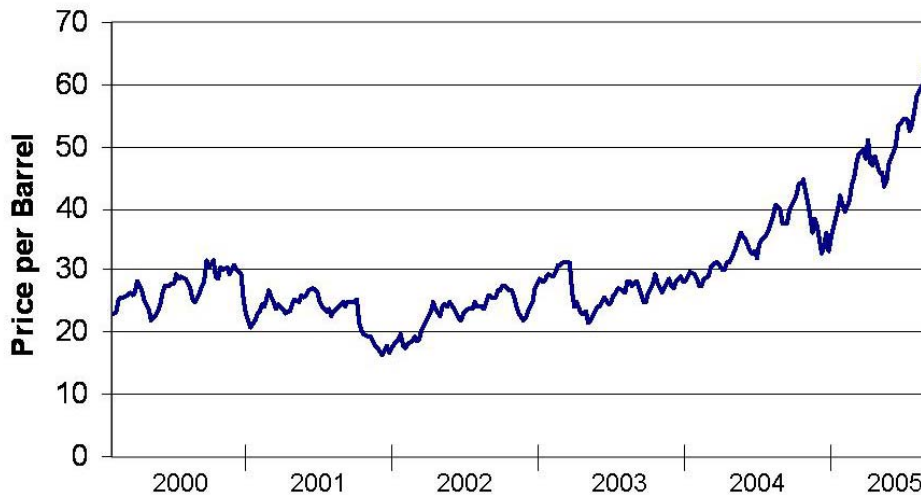
<sup>2</sup> Despite its name, OPEC includes some but not all major oil exporters.

**Table 1: Price Differential between Crude Oil and U.S. Retail Gas Prices, 2000-2005**

Time Period	Average Price of Crude Oil per Gallon <sup>3</sup>	Average U.S. Retail Price of Gasoline per Gallon <sup>4</sup>	Price Differential
2000	\$0.64	\$1.50	\$0.86
2001	\$0.54	\$1.42	\$0.88
2002	\$0.56	\$1.35	\$0.79
2003	\$0.64	\$1.55	\$0.91
2004	\$0.83	\$1.85	\$1.02
January - July 2005	\$1.10	\$2.10	\$1.00
August 2005	\$1.39	\$2.49	\$1.10
September 1-16, 2005	\$1.38	\$3.02	\$1.64

Source: U.S. Energy Information Administration,  
[http://www.eia.doe.gov/oil\\_gas/petroleum/info\\_glance/prices.html](http://www.eia.doe.gov/oil_gas/petroleum/info_glance/prices.html).

**Figure 4: OPEC Crude Oil Prices, 2000 – Sept. 2005**



Source: U.S. Energy Information Administration,  
[http://www.eia.doe.gov/oil\\_gas/petroleum/info\\_glance/prices.html](http://www.eia.doe.gov/oil_gas/petroleum/info_glance/prices.html).

<sup>3</sup> Average is “All Countries Spot Price FOB Weighted by Estimated Export Volume” variable from the U.S. Energy Information Administration. The price of crude oil is generally given by the barrel. The price per barrel is converted to a per-gallon basis by dividing by 42.

<sup>4</sup> Average is “U.S. All Grades Conventional Retail” variable from the U.S. Energy Information Administration.

## Explanation #4: Increasing Oil Extraction and Production Costs

Another explanation that considers the supply side of oil is that increasing oil extraction and production costs are responsible for the rise in gas prices. The “easy” deposits of petroleum have already been extracted and, other factors held constant, the remaining deposits are more difficult and expensive to extract. Counteracting this trend, however, is improvements in technology that lower extraction and production costs (See Chapters 12 and 13 in the text).

While variation in refinery costs may be responsible for a share of the increase in gas prices, Figure 4 strongly suggests that it is the increase in the price of crude oil which is the more significant factor driving up gas prices. So is the increase in the price of crude oil recently a result of increasing extraction and production costs? An August 31, 2005 article notes:

“The issue of costs might not get much attention as hurricanes, terrorist threats to oil production, the dwindling spare capacity of oil in Saudi Arabia and the insatiable thirst for energy in China and the U.S. But cost inflation is being viewed as a significant reason why oil prices are so high and a sign that they will remain so for some years to come. [One oil expert] expects the cost of producing a single barrel of oil to increase by 9 percent a year, from about \$22 a barrel this year to \$36 in 2010, and the cost of finding and producing the so-called marginal barrel - beyond which the activity becomes unprofitable - will double to \$60 over the same period.”<sup>5</sup>

As oil reserves eventually start to decline, costs would be expected to increase as production shifts to marginal and unconventional crude oil deposits.<sup>6</sup> There is considerable debate about whether global oil production is nearing its peak (see the discussion of the Hubbert curve in Chapter 13). With global demand increasing, if oil production fails to keep pace economic theory suggests that we would see prices rising steadily and permanently. Globally, humans have already extracted about 800 billion barrels of oil from the earth. Different estimates of remaining oil reserves range from around 1,000 to 1,800 billion barrels (see text Figure 13-7). Further reserves will likely be discovered in the future although discoveries of new reserves have slowed recently

The year when global oil production will peak is difficult to estimate because it depends on many factors, including how many additional reserves are discovered, whether technology improvements will allow economic extraction of non-conventional crude oil sources, and how quickly oil demand grows. The U.S. Energy Information Administration estimates that global oil production will peak as early as 2021 or as late as 2112.<sup>7</sup> But the more relevant question may be: When will non-OPEC oil production peak? Oil production among the non-OPEC nations may peak around 2015<sup>8</sup> and beyond that an increasing share of global oil production will occur in OPEC nations. Estimates show that between 70% and 80% of the world’s remaining oil reserves

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<sup>5</sup> The London Financial Times, August 31, 2005

<sup>6</sup> The most significant unconventional crude oil source is the Athabasca tar sands in Canada.

<sup>7</sup> See “Long-Term World Oil Supply Scenarios” at

[http://www.eia.doe.gov/pub/oil\\_gas/petroleum/feature\\_articles/2004/worldoilsupply/oilsupply04.html](http://www.eia.doe.gov/pub/oil_gas/petroleum/feature_articles/2004/worldoilsupply/oilsupply04.html).

<sup>8</sup> *The End of Easy Oil*, Paul Roberts, Houghton Mifflin Co., Boston, 2005, page 59.

are to be found in OPEC nations.<sup>9</sup> As OPEC's share of global oil production increases, the price of oil will be increasingly determined by political factors and OPEC's policies rather than by a competitive market.

- *Optimists on energy issues suggest that as oil costs increase, energy companies and consumers will be motivated to develop and utilize alternative energy sources. Through market forces a relatively smooth transition away from oil dependency will occur. Do you agree with this perspective?*

## **Conclusion: Combining Supply and Demand Factors**

The long-term trend of increasing global oil demand must sooner or later press up against supply limitations. Recent price increases seem to be the result of increased demand and limited supply, but we cannot say for certain whether the price will moderate or continue to increase in the short term. There are two important responses to increased price: consumers tend to reduce their quantity demanded, and suppliers tend to produce more. These market responses can stabilize prices, at least for a while. But if demand continues to grow over time, prices will rise once again – and if global production does peak, prices would have to rise quite sharply to cause demand to decrease in step with supply.

For these reasons, it makes sense to develop energy policies that anticipate a shift away from global oil dependence. Note that in this analysis we have so far not even mentioned the external costs of oil use (see Chapter 3) or the problem of global climate change resulting from fossil fuel use (Chapter 18). Taking these into account would suggest that the true price of oil, including health and environmental costs, is significantly higher even than recent market prices.

- *What kinds of policies would be effective in promoting a lessened dependence on oil? Should governments intervene in markets in ways that will affect supply and demand for oil? How do current government policies (such as taxes and subsidies) affect the market for oil and other energy sources?*

This last set of questions raises many issues which go beyond the brief analysis presented here. These issues will be discussed in more detail in:

### ***Environmental Policy Update #2: Formulating Effective Energy Policies***

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[http://www.ase.tufts.edu/gdae/publications/textbooks/env\\_nat\\_res\\_economics.html](http://www.ase.tufts.edu/gdae/publications/textbooks/env_nat_res_economics.html)

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<sup>9</sup> U.S. Energy Information Administration, International Energy Annual 2003, Energy Reserves, <http://www.eia.doe.gov/emeu/iea/res.html>. The difference between the 70% and 80% estimate is primarily a result of whether the Canadian tar sands are counted as reserves.