What Goes Down Must Come Up

A Review of the Factors Behind Increasing Gasoline Prices, 1999-2006

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Executive Summary*

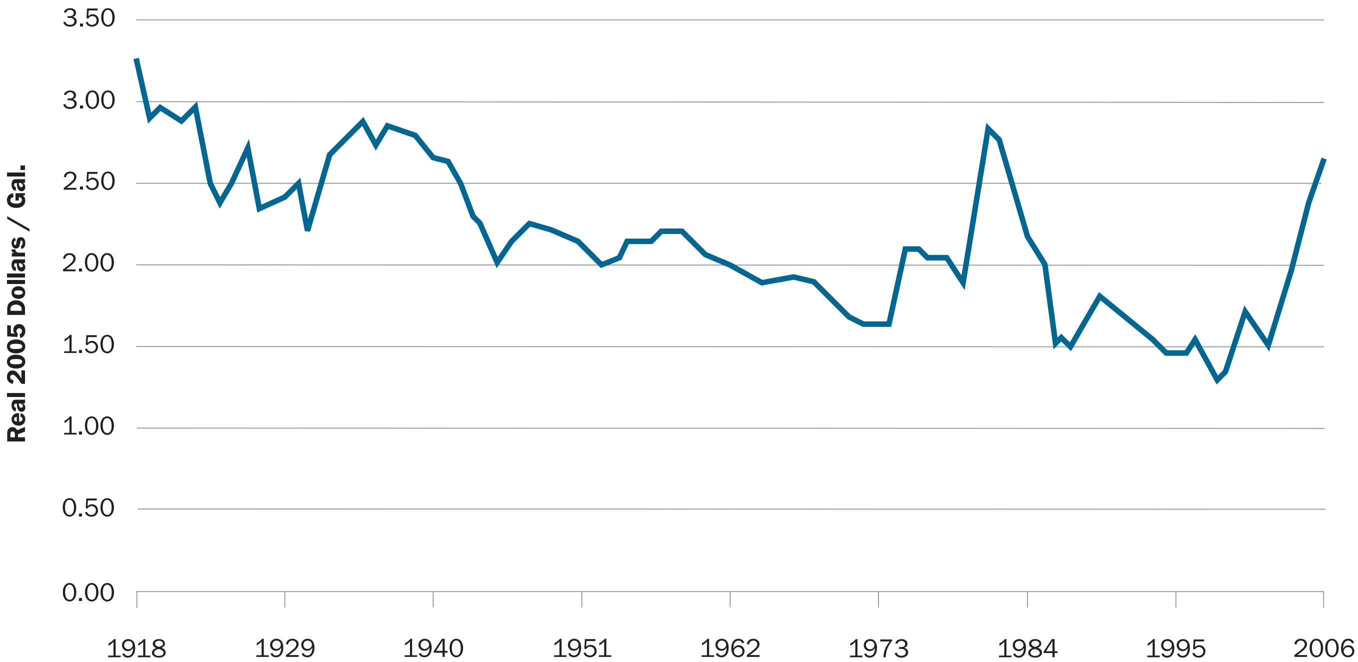
U.S. gasoline prices nearly tripled between January 1999 and July 2006. Consumers, policymakers, and the media have questioned why prices rose so quickly and why they remain so high.

In this paper, an independent expert in international energy markets reviews the available data and evaluates the various forces that have been suggested as possible causes for these price trends. She finds that recent price patterns are not unprecedented and are mirrored in the price behavior of other commodities.

There is no evidence that refiners have been able to block the behavior of a competitive market, and some of the factors that have been suggested as reasons for higher prices lack a theoretical basis or are incompatible with statistical evidence. The principal drivers of higher U.S. gasoline prices have been higher crude oil prices, higher operating costs, proliferating grades of gasoline, unexpected growth in demand, lower demand responsiveness, recovery from low and negative rates of return on investment in the 1990s, hurricanes, and regulatory uncertainty. Further, the evidence suggests that the higher profits have been accompanied by normal inventory and investment practices.

*For a complete copy of the report, please visit www.mines.edu.

Annual Real Gasoline Prices (1918–2006, September)



Note: 2006 price is weighted average through September.

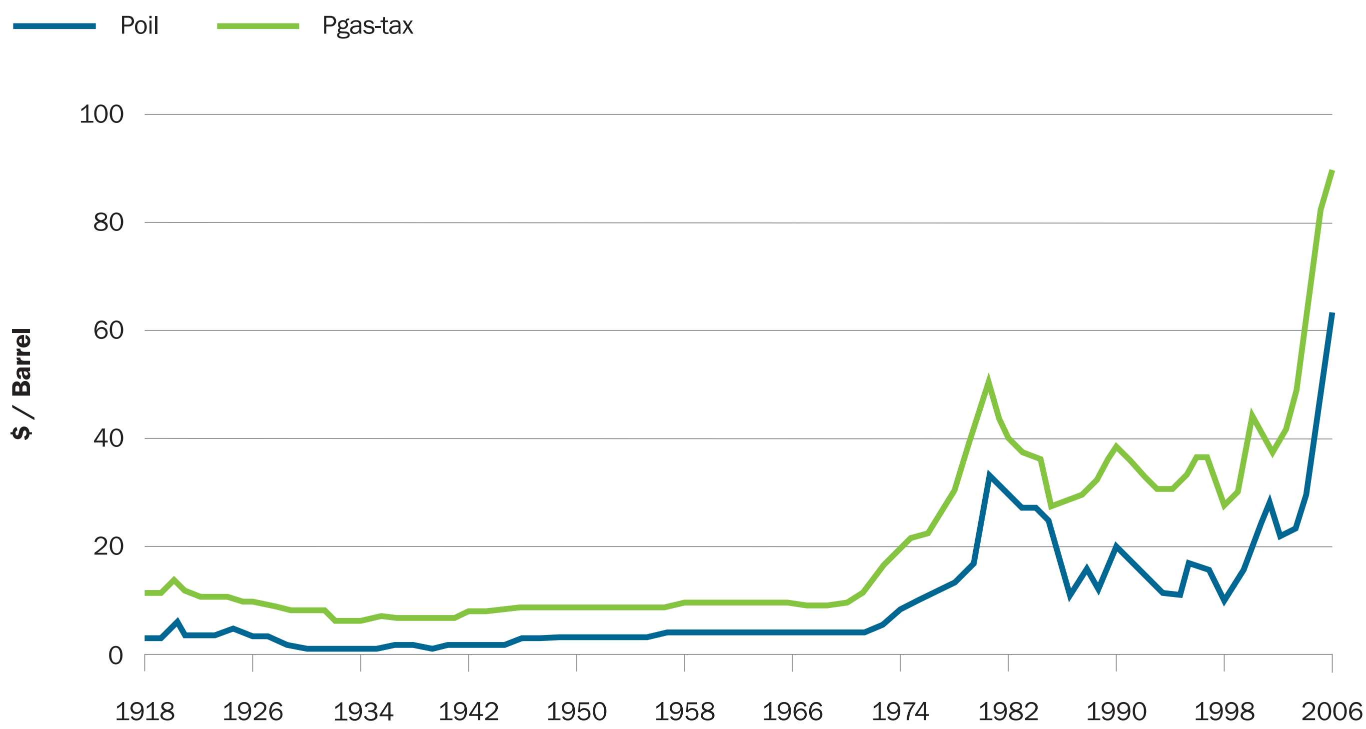
Sources: Prices from API, 1959, *Petroleum Facts and Figures* and EIA/DOE, 2006, *Annual Energy Review* updated from *Petroleum Navigator,* http://tonto.eia.doe.gov/dnav/pet/pet_pri_allmg_d_nus_PTA_cpgal_m.htm. Prices converted to real 2005 dollars using consumer price index from Department of Commerce *U. S. Historical Statistics Colonial Times to 1975* and Council of Economic Advisors, *Economic Report of the President 2006* updated from the Bureau of Labor Statistics, http://www.bls.gov/news.release/cpi.nr0.htm.

The current level of gasoline prices is not without precedent.

After adjusting for inflation, U.S. average gasoline prices in 2006 were lower than the average annual prices consumers paid in the period 1978 to 1982 and during the 1930s.

Recent price levels have been shocking primarily because consumers enjoyed unusually low gasoline prices for over a decade from 1986 to 1999.

Refinery Crude Oil Acquisition Price and Gasoline Price Less Tax (1918–2006, September)



Notes: 2006 price is weighted average through September; Poil values prior to 1947 are U.S. wellhead prices.
Sources: API, 1959, *Petroleum Facts and Figures, Petroleum Databook* (2005), and EIA/DOE, Monthly Energy Annual.

Movements in crude oil markets explain almost all of the change in gasoline prices over the period from 1999 to 2006.

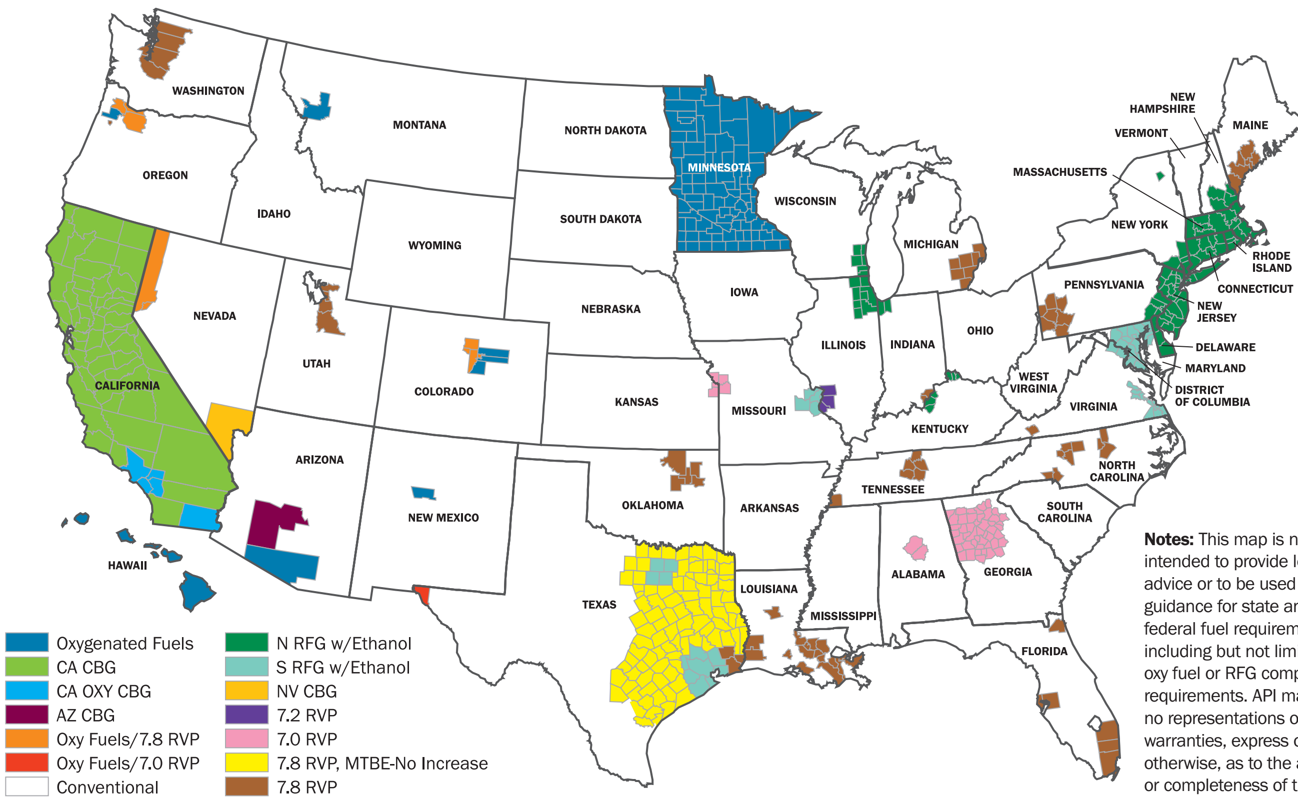
Historical analysis shows that changes in crude oil prices explain about 97 percent of the variation in the pre-tax price of gasoline between 1918 and 2006. Over that period, a $1 per barrel increase in the crude oil price consistently generated an increase in the gasoline price of about 2.5 cents. Between January 1999 and summer 2006, crude oil prices more than quadrupled from $15.50 per barrel to over $65 per barrel. Based on the historical pattern, gasoline prices would be expected to increase by more than $1.15 per gallon in the same period. The actual increase in gasoline prices was slightly lower than this forecast amount. In addition, a small percentage of the increased cost of gasoline can be attributed to the increase in refiners' costs to purchase electric power, inorganic chemicals, and organic chemicals. These costs rose by 20 percent, 25 percent, and 45 percent, respectively, from 2000 to 2005.

Higher-than projected U.S. income levels exerted demand pressure on gasoline prices. The response of gasoline prices to this demand pressure indicates a tight competitive market rather than a market in which refiners have monopolistic pricing power.

In the United States, a 1 percent increase in income induces a 0.3 percent increase in gasoline demand within one year. An unexpectedly strong U.S. economy in 2004 and the first quarter of 2006 produced higher-than-forecast income growth, and thus higher-than-expected gasoline demand. Because of high refinery utilization rates and the long lead time required to add refinery capacity, short-term gasoline supplies are essentially inelastic (i.e., not very responsive to price changes). So demand levels that are greater than projections can cause dramatic short-term price effects.

In the short run, these price effects are not self-correcting because gasoline demand is not very sensitive to price increases. A doubling in prices has been estimated to produce a fall of only 4 percent in gasoline consumption in the first month. A recent study suggests that demand responses to price increases are even weaker today than they were in the 1970s, perhaps because consumers are less likely to view higher prices as permanent.

U.S. Gasoline Requirements (as of May 2006)



Notes: This map is not intended to provide legal advice or to be used as guidance for state and/or federal fuel requirements, including but not limited to oxy fuel or RFG compliance requirements. API makes no representations or warranties, express or otherwise, as to the accuracy or completeness of this map.

The changes in gasoline standards that have improved our environmental quality have also pushed up prices. The proliferation of "boutique fuels" has had the effect of reducing the capacity of the U.S. refining industry and increasing price volatility by limiting arbitrage possibilities.

Between 1990 and 2006, the number of different grades of gasoline increased from three to fourteen. This trend made refining more complex, requiring refineries to reconfigure their operations at lower production levels or invest money to sustain the same output. This product proliferation also reduced the market's ability to mitigate temporary geographic shortages by diverting gasoline from other regions, since different regions may not use the same products.

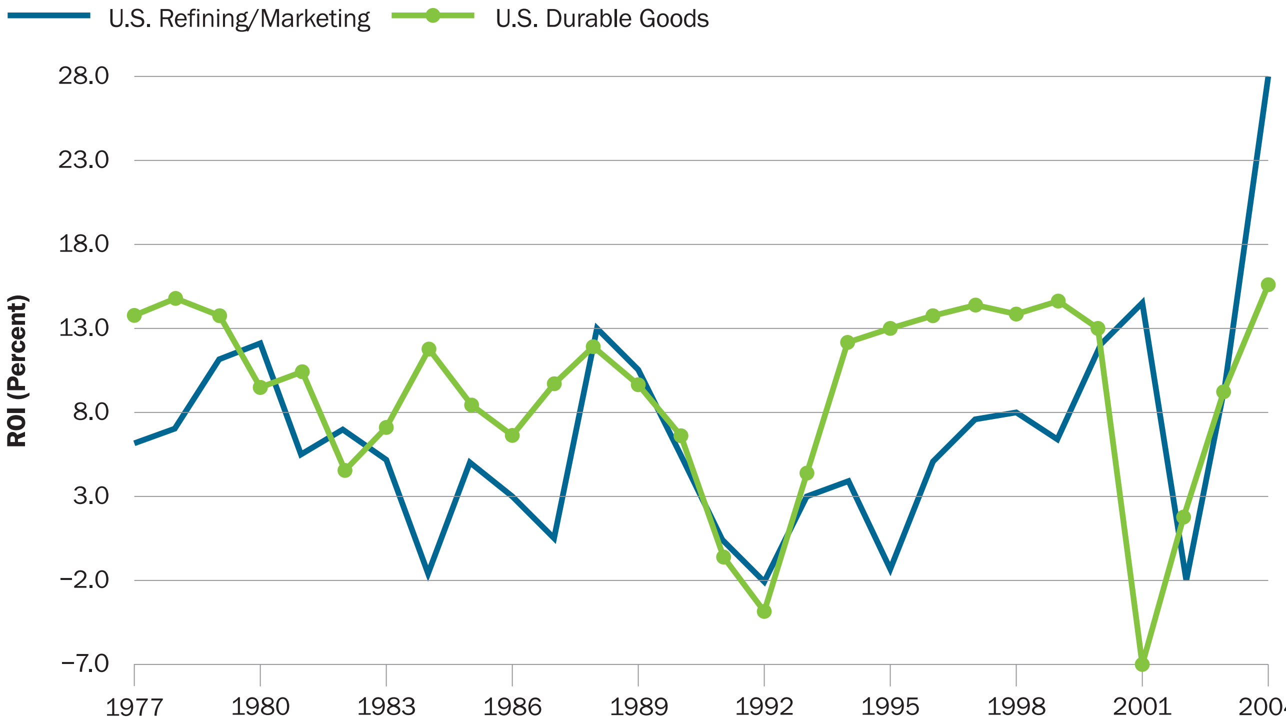
In August 2005, the Energy Policy Act removed the 2 percent oxygenate mandate effective immediately in California and after 270 days in the rest of the U.S. Many companies had been using Methyl Tertiary Butyl Ether (MTBE) as the only practical solution to meeting this mandate and chose to phase out MTBE in early to mid-2006. This Federal Act also required the use of greater volumes of renewable fuels, and so at the same time that MTBE was being eliminated from the gasoline supply, increased volumes of ethanol were being introduced. This resulted in some short-term supply disruptions due to change-over and supply logistics.

Some observers have claimed that increasing concentration in the refining industry has exerted upward pressure on gasoline prices. In fact, concentration and vertical integration have been decreasing.

A 2004 publication from the Government Accountability Office (GAO) stated that increased market concentration had led to higher gasoline prices. This report finds substantial weaknesses in the GAO methodology. In fact, the trend in the refining industry is toward slightly lower levels of concentration as refining operations are unbundled from oil companies into independent entities.

A 2004 report by the Federal Trade Commission (FTC) found that the oil industry is becoming less vertically integrated. According to the FTC (FTC, 2005), the share of U.S. refining capacity owned by independent refiners with no production operations rose from 8 percent in 1990 to over 25 percent in 2006. The FTC also found that trends in gasoline marketing are likely to increase competition and that price spikes are largely explained by such temporary and external phenomena as refinery accidents, bottlenecks, and the introduction of boutique fuels.

Return on Investment for U.S. Refining and Durable Goods (1997–2004)



Note: Accounting changes in the durable goods industry in 1992 and 2001 make those numbers inconsistent with prior years.

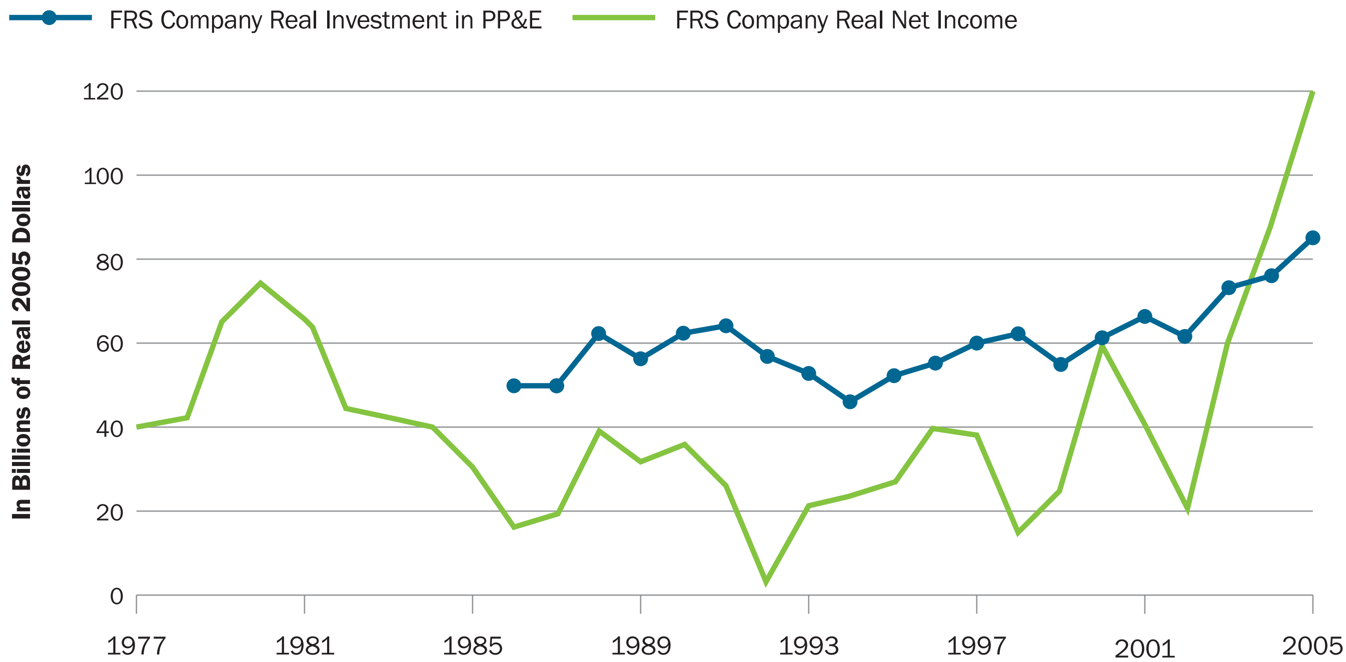
Sources: Computed from values at www.eia.doe.gov/emeu/finance/frsdata.html. The FRS companies are listed in Appendix G. Durable goods numbers come from Bureau of Economic Analysis: Current Cost of Net stock of Private Fixed assets located at www.bea.gov/bea/dn/FA2004/ TableView.asp#Mid, *Economic Report of the President:* Corporate Profits by Industry 1965-2005 table B-92/table B-93 located at www.gpoaccess.gov/eop/tables06.html, Bureau of Economic Analysis Table 3.7ES. Historical-Cost Investment in Private Fixed Assets by Industry located at www.bea.gov/bea/dn/FA2004/TableView.asp#Mid.

The magnitude of refiner profits is often exaggerated. From 1977 to 2005, the rate of return on investment in U.S. gasoline refining averaged less than 7 percent. This compares unfavorably with returns over the same period of 9 percent in durable goods and over 11.5 percent for the S&P 500 industrials.

The refinery sector is cyclical, with profits varying with capacity utilization. While a strong U.S. economy, hurricane-induced shortages, and the capacity squeeze prompted by new environmental standards created above-average profitability in 2004-2006, the industry has also experienced extended periods of low profitability and reported aggregate losses in 1992 and 2002.

The current profitability the industry enjoys is in large part the result of a massive restructuring in the 1990s that cut costs, increased economies of scale, and improved utilization rates. This restructuring has been essential to the survival of the increasing numbers of independent refiners that cannot use hydrocarbon production profits to subsidize low profitability in refining.

Net Income and Investment by Financial Reporting System Companies in Property, Plant and Equipment (1977–2005)

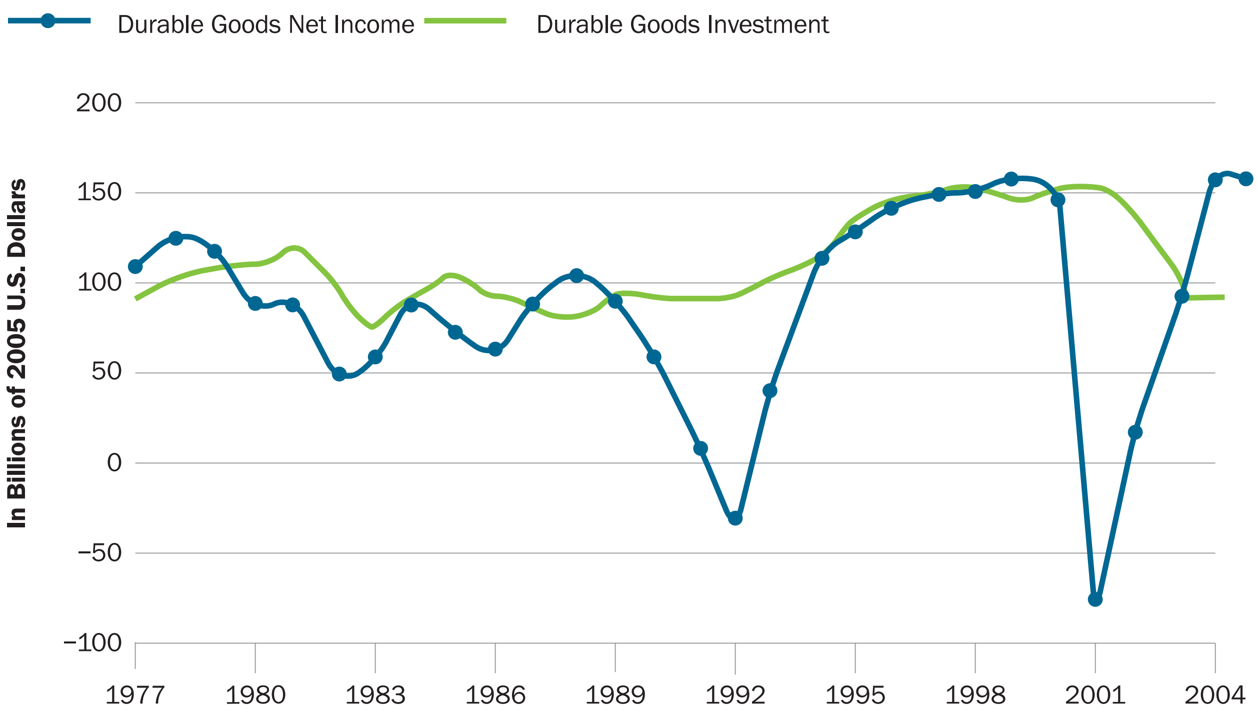


Note: Investment in PP&E taken from cash flows and excludes acquisitions and mergers.
Source: EIA/DOE www.eia.doe.gov/emeu/finance/frsdata.html. The FRS companies are listed in Appendix G.

The refining industry's investments in new capacity have been consistent with historical trends and prudent business practice. There is no evidence that investments have been artificially delayed in order to increase gasoline prices and industry profits.

Investment in capital-intensive industries does not directly track changes in profits or prices. Analysis of historical data shows that annual investments in refinery capacity are more stable than profits, with changes in profits causing a change in investment that is spread over three years. The pattern is similar in the durable goods sector where, for example, profits increased almost 75 percent in 2004, while investment in plant and equipment increased less than 1 percent. In the 1970s, additions to capacity following price increases that proved to be temporary led to years of inadequate profitability. The refining industry is now following prudent business practice by adding capacity incrementally, allowing time to gauge the long-term market response to higher prices. Refinery utilization rates in 1999 to 2006 were in the healthy 90-95 percent range, but were not generally higher than in 1992-1998.

Net Income and Investment by Property, Plant and Equipment by U.S. Durable Goods Industry (1977–2005)



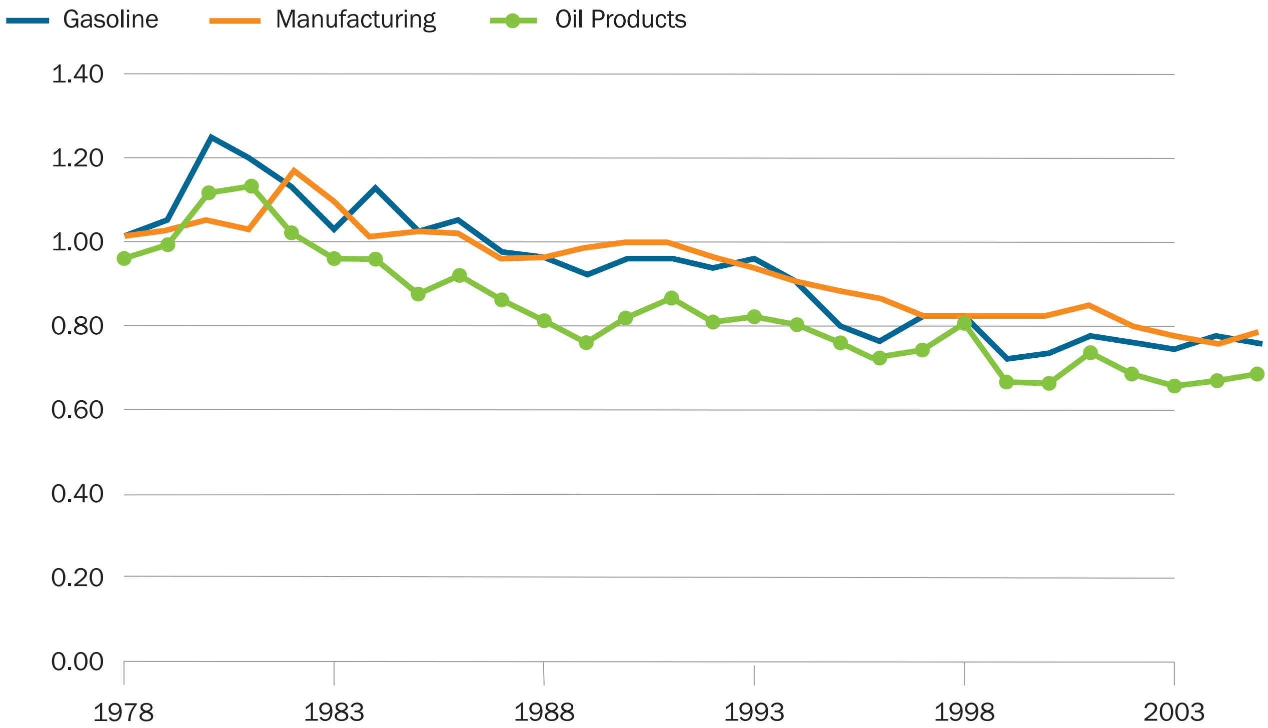
Note: Accounting changes in the durable goods industry in 1992 and 2001 make figures for those years inconsistent with prior years.

Sources: *Economic Report of the President:* Corporate Profits by Industry 1965-2005 table B-92/table B-93 located at www.gpoaccess.gov/eop/tables06.html. Bureau of Economic Analysis Table 3.7ES. *Historical-Cost Investment in Private Fixed Assets by Industry* located at www.bea.gov/bea/dn/FA2004/TableView.asp#Mid.

Some analysts have argued that refinery capacity should be substantially higher and that such increases would reduce gasoline prices to $1.50 per gallon. Given that refiners needed $1.95 per gallon to cover their costs in 2005, this theoretical combination of higher capacity and lower prices would not be sustainable. While current high prices indicate that it is desirable to add refinery capacity, analysis suggests that the required additions are in line with the more modest expansion plans that refineries have announced.

Environmental regulations may have had the effect of reducing capacity additions. To produce fuel that complies with new standards, refiners must often make substantial investments that do not increase total output. Uncertainty about future regulations may also depress investment as refiners delay expenditures until they can accurately forecast the mix of products they must produce.

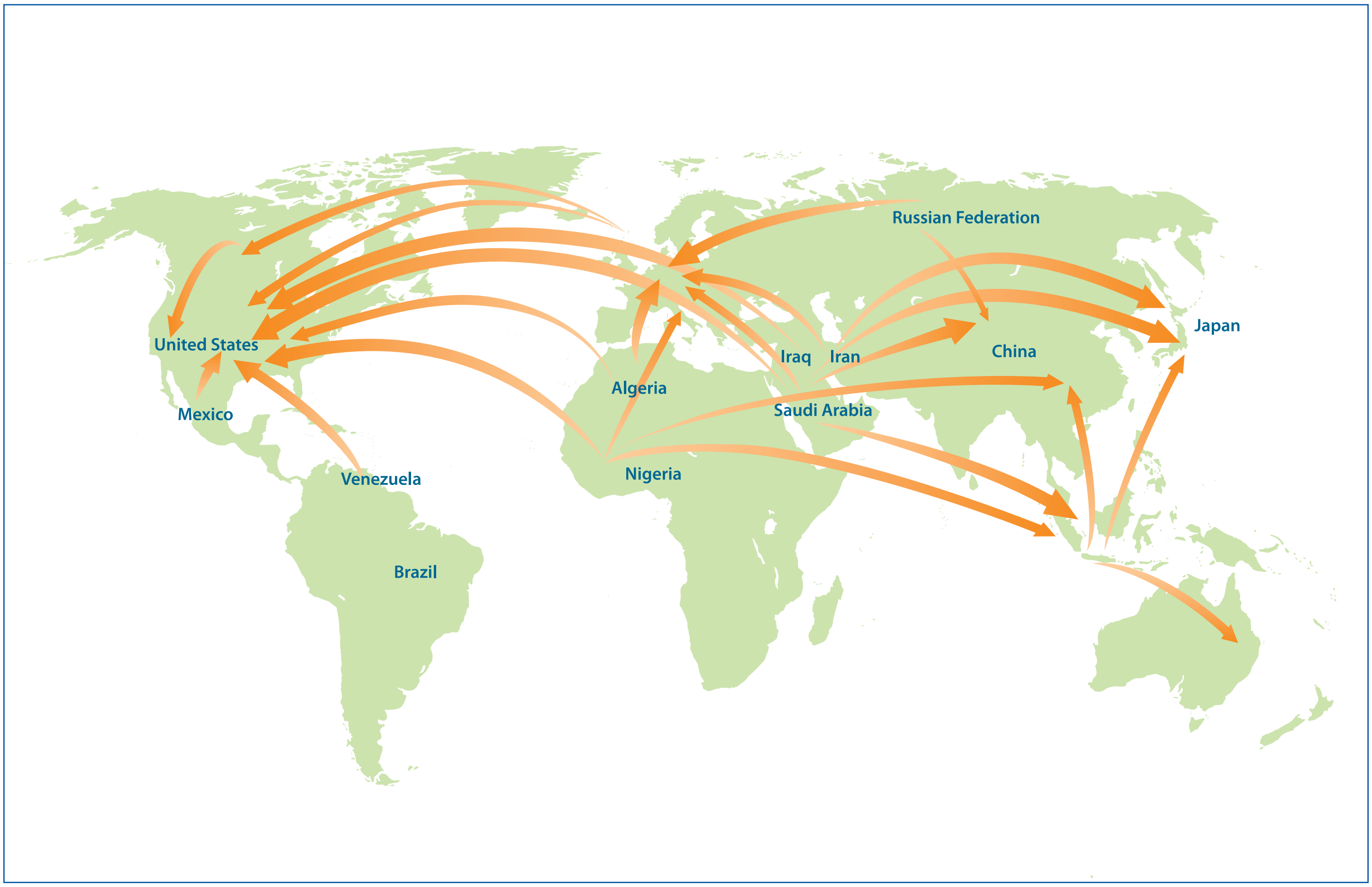
Index of Inventories to Sales for Gasoline, Oil Products and Manufacturing (1978–2005)



Sources: Manufacturing inventories and sales from the *Economic Report of the President* Gasoline stocks and sales from the EIA/DOE *Annual Energy Review.*

Lower gasoline inventories have not increased price volatility.

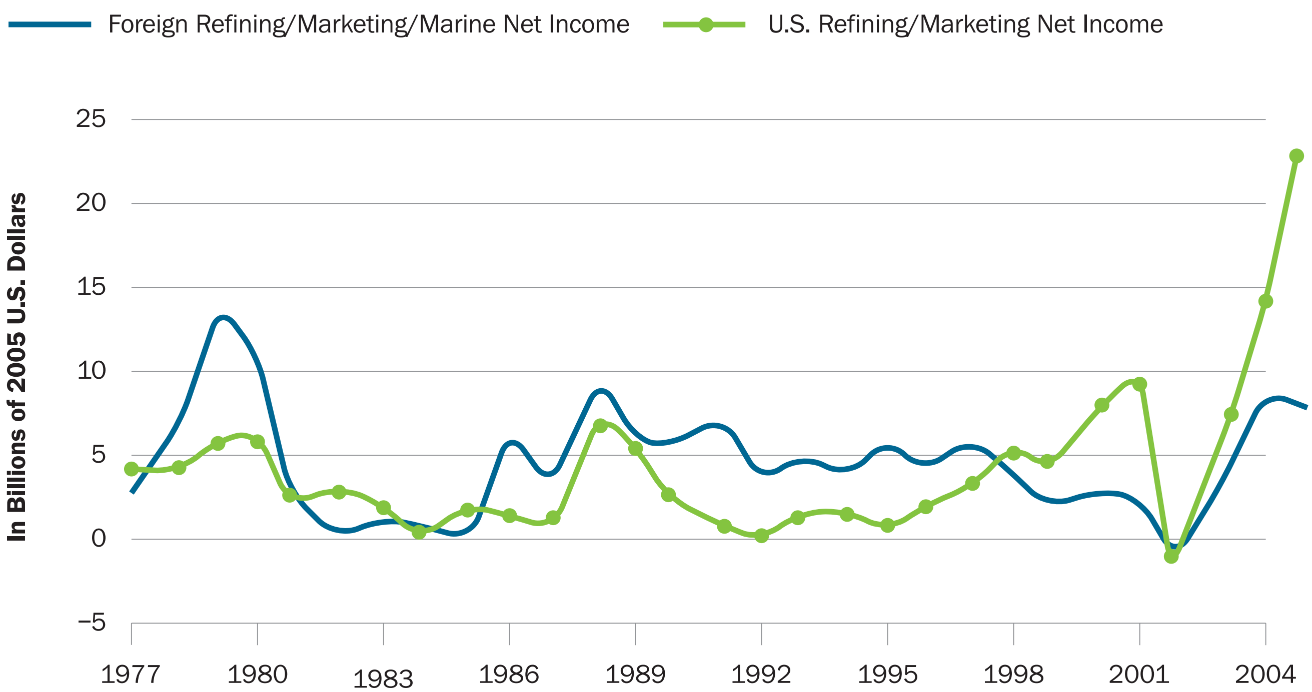
The ratio between gasoline inventories and gasoline sales has fallen steadily since 1980. The magnitude and pattern of this decline has been essentially the same in the gasoline industry as for the entire manufacturing sector, suggesting that what is responsible is continuous improvement in business practices rather than factors that are unique to the oil industry. Gasoline prices were less volatile between 1999 and 2006 than between 1979 and 1992, when inventory levels were substantially higher. The evidence suggests that it is not inventory levels, but volatile crude oil prices, that largely explain gasoline price volatility.



U.S. refiners cannot control the U.S. gasoline market. Trade and pricing patterns indicate that arbitrage moderates inconsistencies between U.S. and foreign markets.

Imports of petroleum products, although still providing only 5 percent of U.S. gasoline consumption, have grown at an annual rate of over 10 percent in the last decade. Increasing imports and highly correlated profit margins between Europe and the East Coast imply the existence of a robust arbitrage market across the Atlantic. In the Pacific, where differences in product specifications might be thought to reduce arbitrage opportunities, Asian refiners also act as a moderating influence by providing surplus product to U.S. markets as blending stocks.

Real Net Income of FRS Companies from U.S. Refining/Marketing and Foreign Refining/Marketing/Marine (1977–2006: III)



Notes: See footnote 14 for estimation methods used to compute 2006.

Source: Computed from values at www.eia.doe.gov/emeu/finance/frsdata.html update using data at www.eia.doe.gov/emeu/perfpro/news_m/consistent.html. The FRS companies are listed in Appendix G.

No evidence was found for the claim that U.S. refining is more profitable than foreign refining.

U.S. companies reported slightly higher absolute net income levels from domestic than from foreign refining operations. But their rates of return on investment in international refining averaged almost 14 percent from 1977 to 2005, compared to 7 percent domestically, and the profitability of foreign operations was also less variable. This pattern does not support the argument that refiners were able to abuse their market power in the U.S.

The argument that speculation in gasoline derivative markets bids up gasoline prices, and that these, in turn, bid up oil prices, is theoretically inconsistent and not supported by the evidence.

Studies consistently find that derivatives markets improve price stability. They are only destabilizing if speculators are wrong and have very deep pockets, a combination that cannot persist for long. A 2005 study by the Commodity Futures Trading Commission found no evidence that hedge fund and investment fund speculators bid up oil or natural gas prices. Rather, it found that they provided liquidity in the market and tempered price changes caused by underlying market fundamentals. The argument that speculative gasoline markets are "pulling up" world crude prices is also theoretically inconsistent with the argument that gasoline prices are high because of supply restrictions. The second argument would imply that gasoline consumption is lower than it otherwise would be — which would put downward, not upward, pressure on crude oil prices.

About Carol Dahl

Carol Dahl is a Professor of Economics in the Mineral Economics Program at the Colorado School of Mines, as well as the Director of the Colorado School of Mines/Institute Français du Petrole Joint Degree Program in Petroleum Economics and Management. She received her B.A. degree in economics with distinction from the University of Wisconsin and her Ph.D. in economics from the University of Minnesota. She has published around 50 articles, made over 100 conference presentations, has numerous grants, has been a visiting professor at over 20 Universities and international organizations worldwide, and has supervised numerous Ph.D. students. She recently published her second book – *International Energy Markets: Understanding Prices, Policies, and Profits.* She is currently on the list of technical experts for the U.S. Fulbright Program and is on the editorial board and is assistant book review editor for *The Energy Journal.*

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