

2. Spring '96 Gasoline Price Runup: An Example of Petroleum Market Dynamics

The rapid increase in gasoline prices during spring 1996 focused attention on petroleum markets. Petroleum product prices have not drawn much public attention since the Gulf War, but the spring increase renewed interest in the changing petroleum marketplace and raised questions about what caused the increase and the potential for more such price increases in the future.

Introduction

Retail gasoline prices in the United States rose sharply over the early months of 1996, increasing by 21 cents between mid-February and mid-May⁶ (Figure 13). While gasoline prices usually rise somewhat at this time of year, the extraordinary speed and magnitude of the increase surprised and even alarmed many consumers.

The spring 1996 price increases resulted from a confluence of factors, some of which were unusual but not unprecedented. Rising crude oil prices and the normal seasonal increase in gasoline prices accounted for most of the retail price increase. However, gasoline markets were also affected by unusual factors, including: a late-winter cold spell causing refiners to focus on producing distillate (heating oil, diesel fuel and kerosene-jet fuel) instead of gasoline longer than usual; lower-than-normal gasoline stocks; continuing high gasoline demand and high refinery capacity utilization; and persistent expectations that both crude oil and gasoline prices would fall several months in the future, which discouraged production of gasoline in excess of demand to build stocks.

In order to assess the main factors influencing gasoline prices, crude oil price movements are separated from the gasoline prices, and spot prices will be explored separately from retail prices. The difference between gasoline price and crude oil cost is referred to as the price spread. Figure 14 shows the relationships between spot and retail prices and the underlying costs that prices must cover, excluding taxes. The full retail price of gasoline paid by consumers provides the revenues to cover the costs of crude oil, refining, storage and distribution, marketing and retail expenditures, taxes (federal, State and local), and to generate a return on investment (profits). The two largest single costs are crude oil and taxes (Figure 15). For example, West Texas Intermediate spot prices averaged 45.3 cents per gallon

during December 1995. Taxes averaged 40.8 cents per gallon.

Average monthly spot prices peaked in April at over 65 cents per gallon, and retail prices, which lag spot price changes, peaked a month later in May at \$1.24. Figures 15 and 16 show that the crude oil price increase explains a large part of the gasoline price increase. However, gasoline spreads also increased. Spot gasoline spreads normally increase between December and May, followed shortly by increases in retail prices. Figure 16 shows what spot prices would have been, had average spot spreads been experienced.⁷

This chapter describes the influence of various market factors on gasoline prices and how these factors combined to cause the unusual price increases in the spring of 1996. The analysis focuses on the changes that occurred from December, the normal seasonal low point for spot gasoline markets, through April, when spot prices peaked, follows the progress of gasoline markets prices through the summer driving season, and concludes with the price reversal in spring 1997.

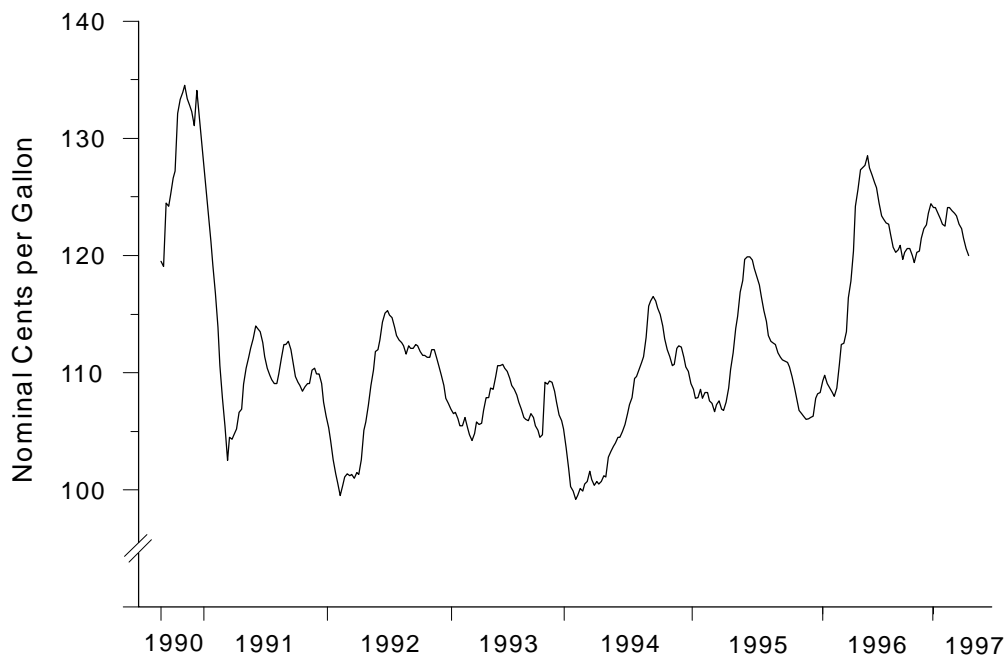
Crude Oil Market in Spring 1996

Crude oil, the raw material for gasoline and other petroleum products, represents by far the largest cost component of those products. The increase in crude oil prices from December 1995 through April 1996 explains about half of the increase in retail gasoline prices. Light and heavy crudes alike rose rapidly in March and April (Figure 17). West Texas Intermediate (WTI) crude oil averaged \$19.03 per barrel in December, fell back to under \$18 towards the end of January, and peaked at \$25.15 per barrel during April

⁶Regular gasoline, all formulations: Energy Information Administration (EIA), Form EIA-878, "Motor Gasoline Price Survey."

⁷Different data series (e.g., Platts versus Reuters) and different crude oils (e.g., Brent versus WTI) will produce different numbers, but the trend and conclusion remain the same. That is, crude oil and normal spread patterns explain most of the price increase. Other combinations of gasoline and crude oil prices were inspected and more in depth analyses were performed and discussed in *An Analysis of Gasoline Markets Spring 1996*, DOE/PO-0046 (June 1996).

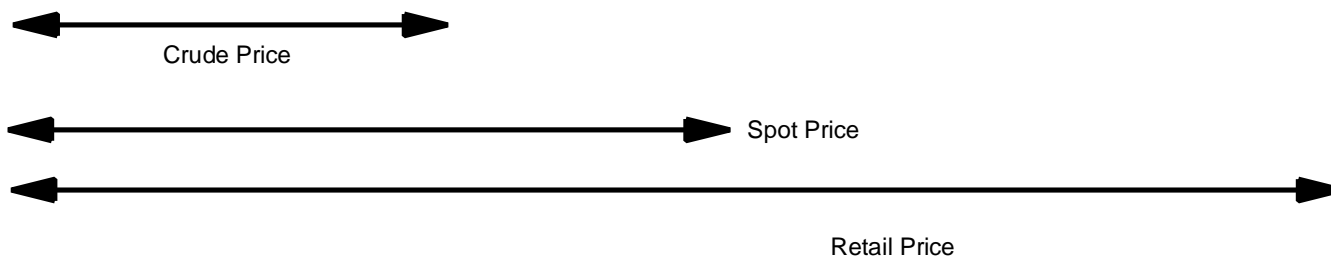
Figure 13. U.S. Average Retail Regular Gasoline Price



Source: Energy Information Administration, *Annual Energy Review 1995* (January 1996), pp. 17, 161, and 179.

Figure 14. Price and Cost Relationships

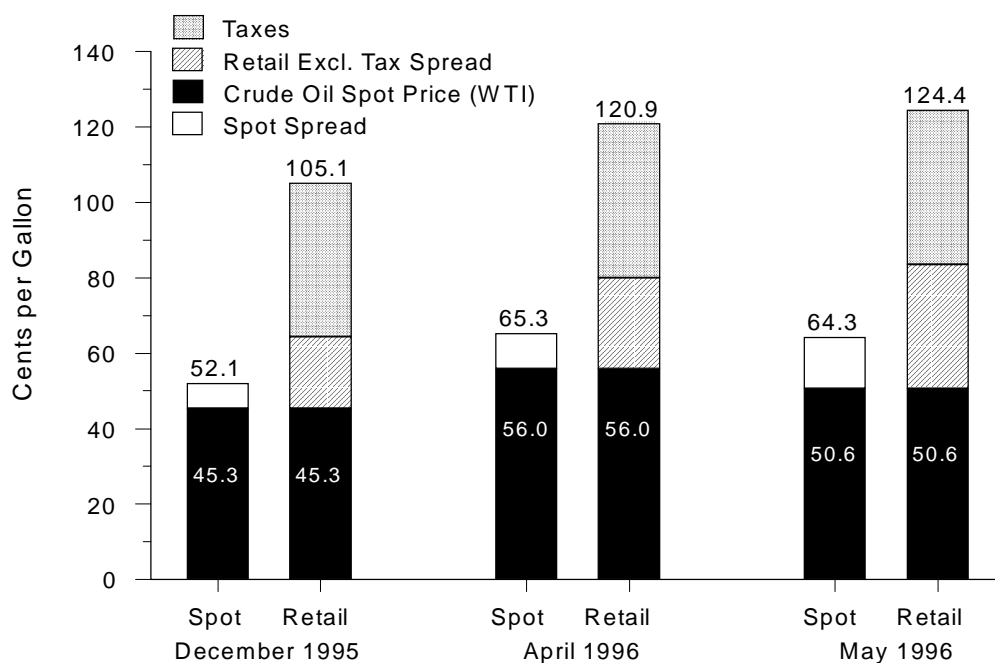
Crude Oil Costs	Refining Operating Costs	Refining Profit (1)	Storage and Distribution Costs	Delivery Costs	Marketing Operating Costs	Marketing Profit (1)
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(1) Profits may be positive or negative, based on market conditions.

Source: Energy Information Administration.

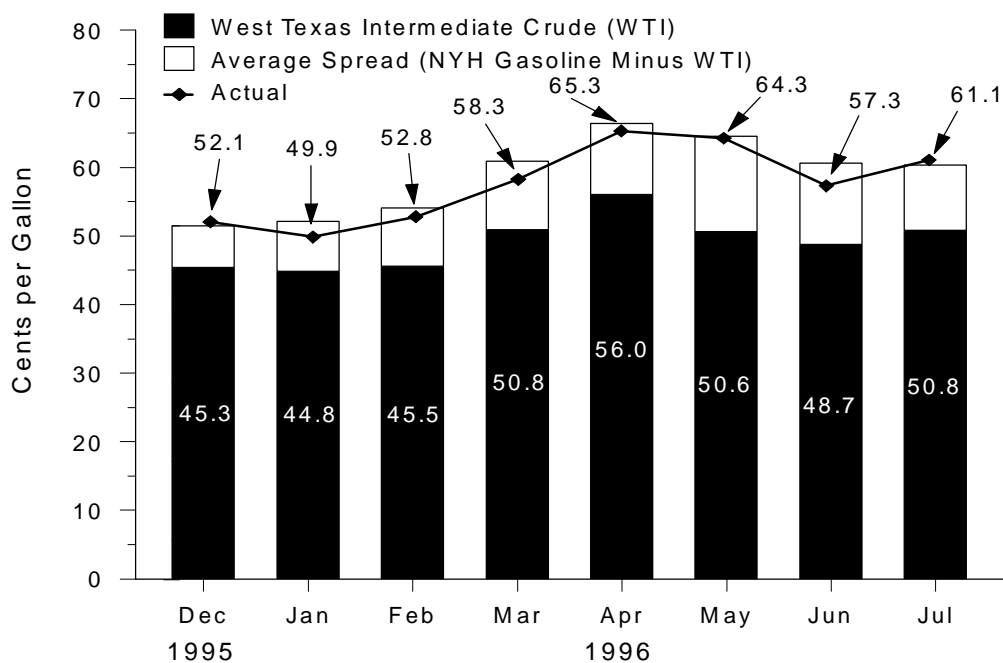
Figure 15. Crude Oil and Gasoline Prices



Note: Retail Excl. Tax Spread = retail price excluding taxes minus crude oil price. Spot Spread = spot price minus crude oil price.

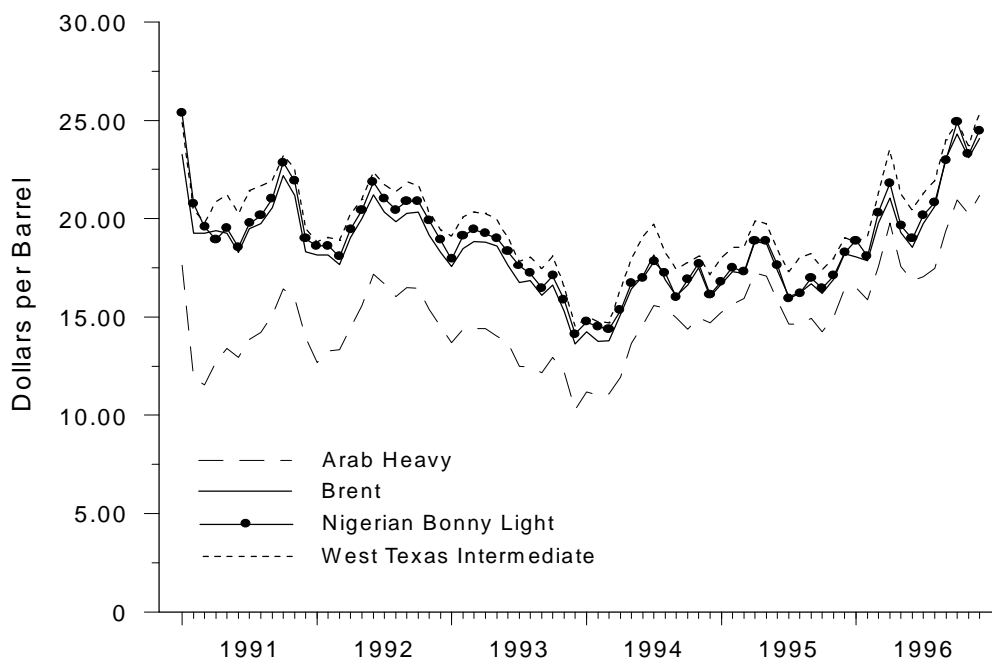
Sources: **Spot Prices:** Standard & Poor's Platts. **Retail Prices:** Energy Information Administration (EIA), Form EIA-878, "Motor Gasoline Price Survey."

Figure 16. Gasoline Price Summary
(NY Harbor Spot Conventional Regular)



Source: Standard & Poor's Platts.

Figure 17. Monthly Average Spot Crude Prices



Source: Standard & Poor's Platts.

before starting to fall again. Although a similar increase in crude oil prices occurred in 1994, consumers were not as sensitive to the change because gasoline prices were very low at the start of the climb, and the increase occurred more gradually.

The rise in crude prices in the spring of 1996 can be attributed to a tight crude oil supply/demand balance in world markets. A tight petroleum balance occurs when demand exceeds production and when crude oil and product stocks are low, providing little cushion to meet unexpected demand surges or supply disruptions.

Importance of Supply/Demand Balance to Prices

As in all commodity markets, crude oil prices respond to the fundamental market forces underlying the crude oil supply/demand balance. For example, when little or no excess short-term supply exists to satisfy demand, markets tighten, producing upward pressure on prices.

Stocks are a closely watched barometer of market balance — or tightness — for both product and crude oil markets. Changes in stocks reflect imbalances in production and demand and signal when supplies might be growing short or long relative to demand. When stocks are low relative to

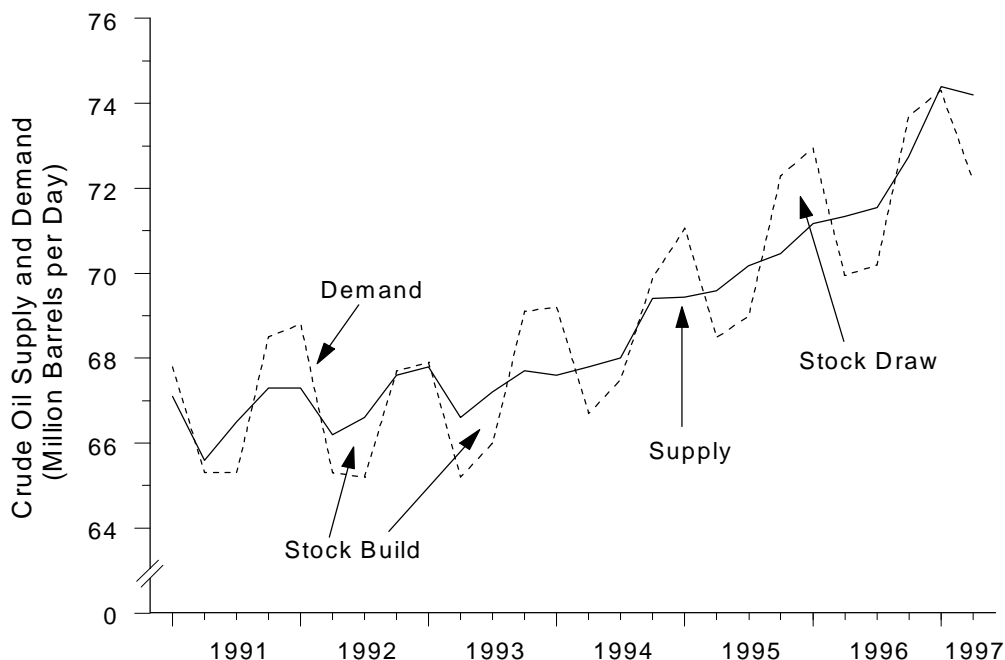
normal patterns and falling (i.e., demand is greater than production), market participants worry that production levels may be too low to meet future demand. When stocks are limited, increases in demand elevate buyers' concerns over supply availability, and cause them to bid higher prices in order to assure supply.

The Organization of Petroleum Exporting Countries (OPEC) plays an important role in the crude oil market's movement between tight and loose conditions. Non-OPEC producers generally produce at their maximum capability, but OPEC historically has members who produce at less than capacity to help maintain price levels. OPEC's success at controlling production when prices weaken has been limited. Demand for OPEC crude oil varies both as a function of world demand and non-OPEC supply. When the call on OPEC crude oil is high relative to OPEC capacity to produce, the market tends to support higher prices. When demand falls off, OPEC production does not always follow, creating downward pressure on prices due to oversupply.

Strong World Petroleum Demand Hit New Peaks in Winter 1995-96

An important factor in the spring crude price increase was expanding world demand. Figure 18 shows world petroleum supply and demand for 1991 through 1996. By the end of

Figure 18. World Supply and Demand



Sources: Energy Information Administration (EIA), *International Petroleum Statistics*. **First Quarter 1997:** Actual—*Oil Market Intelligence* (May 1997), Vol. II, No. 5, p. 3. **Second Quarter 1997:** Projected—*Oil Market Intelligence Update* (June 2, 1997), p.1.

1993, the global economy was recovering from the recession of the early 1990's. Demand began increasing and grew robustly in 1994 and 1995. Average daily consumption rates since 1993 have risen each year by about 1.6 million barrels per day (which represented 2 percent growth in 1995).

World petroleum demand is seasonal, peaking during winter in the northern hemisphere when world distillate needs are greatest. (This differs from the U.S., where demand peaks in summer because gasoline is the dominant product in the U.S. market.) In 1992 and 1993, excess supply caused petroleum stocks to build for two years in a row. Rising demand began to eat into this surplus in 1994 as stock draws exceeded stock builds for the year. As might be expected, crude oil prices dropped substantially during this time of over-supply, starting from about \$22.37 monthly average (WTI) in June 1992 and bottoming out at an average \$14.49 in December of 1993. The increases in demand in 1994 tightened the balance and brought prices up to an average of \$19.70 in July 1994.

Demand was very high during the winter of 1995-96, exceeding most forecasts for the period prepared only months before. Actual demand in the first quarter 1996 exceeded the November International Energy Agency (IEA) forecast by 500 thousand barrels per day. The demand increase during winter 1995-96 over summer and over the

prior winter was one of the highest during the last five years. The strength was attributed to an extended winter in the Atlantic Basin, continued strong Asian economic growth, and apparent stabilization of consumption in the former Soviet Union countries.

Winter 1995-96 Crude Supply Affected by Bad Weather

Demand growth alone cannot make a market tight. It is the balance between the supply and demand that determines the tightness or looseness of a market. Therefore, the explanation for increased tightness must include the inability or failure of crude oil supply to respond to demand growth.

World oil supply increased 1.5 million barrels per day during the winter of 1995-96, but fell short of predictions. Like demand, oil supply was also affected by weather. In early November 1995, the International Energy Agency predicted first quarter 1996 non-OPEC supply would be 43.9 million barrels per day. Actual supply was only 43.1 million barrels per day, or 800 thousand barrels per day short of expectations. Part of the shortfall was caused by bad weather conditions and operating problems in the North Sea and the Gulf of Mexico, areas located near markets (U.S. and Europe) where consumption was higher than expected.

While an 800 thousand barrels per day shortfall is less than 2 percent of world supply, it can put significant pressure on prices in a tight market, since the shortfall must be made up from stocks or increases in OPEC production. Stocks were low and OPEC was already producing at high levels. OPEC increased crude oil production from 25.4 million barrels per day fourth quarter 1995 to average 25.6 million barrels per day during the first four months of 1996. This was 1.1 million barrels per day over its self-imposed quota of 24.5 million barrels per day.

Tightening Winter World Petroleum Balance Set Stage for Spring Crude Runup

At the beginning of the 1995-96 winter, market analysts expected growing supply to more than offset strong demand growth. The world petroleum supply/demand balance as reflected in world stocks was not a concern. However, widespread, sustained winter weather served both to reduce some of the anticipated supply and to boost winter demand above expectations. Even with increased OPEC output over the winter, OECD countries experienced the largest decline in stocks over the fourth and first quarters in the last five years. Winter 1995-96 demand was up by 2.1 million barrels per day over winter 1994-95, while supply was up 1.5 million barrels per day. The OECD⁸ winter 1995-96 stock draw was 1.1 million barrels per day compared to the 0.8 million barrels per day the prior winter. The 1.1 million barrels per day draw is large and significant in light of the low beginning stock levels. With low stocks and demand still outstripping supply, markets tightened. WTI prices rose from \$17.44 in October to over \$19 in December. Prices relaxed a bit in January, partially due to increased OPEC production.

Another factor was at work affecting market behavior. Throughout the winter, forecasters were predicting the arrival of significant new non-OPEC supply during the third and fourth quarters of 1996. Also, the low world demand season occurs in the second and third quarters. With prompt month (near-term) oil prices high due to scarce supply relative to demand, and the market expecting increasing supplies from non-OPEC (as well as from some OPEC) sources, future prices were expected to fall, as reflected in the futures markets. The situation where near-term prices are higher than future months' prices is called backwardation.

⁸The Organization for Economic Cooperation and Development is the international organization of the industrialized, market-economy countries. The following countries are members of OECD: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, United States, Mexico, Japan, Australia, New Zealand, and Korea.

The expectation of softening prices was further strengthened in late January, as the potential for Iraq returning to the market seemed to increase with the scheduling of the initial round of UN/Iraq discussions on limited oil sales for early February. Expectations of falling prices discouraged refiners from building or maintaining stocks despite high demands.

As winter proceeded, distillate demand grew, and stocks disappeared. Prices began climbing again in February and March. Backwardation in the futures market steepened to unusual levels as the prompt market tightened and the supply outlook still reflected expectations for new supplies in the short term (Figure 19).

The late cold spell in April affected Europe as well as the U.S., and sent the already-tight markets skyrocketing. Both regions were left with low crude and product stocks following the long winter, eliminating stocks as a supply source to meet the late surge in distillate demand. Refiners responded by increasing crude oil purchases and increasing refinery runs, which pushed the WTI price up over \$25 per barrel.

Finally, in mid-April, as cold weather abated and demand for crude oil began to recede, prices began to weaken. WTI prices fell to about \$21 per barrel by the end of the month and hovered around that price until the end of August.

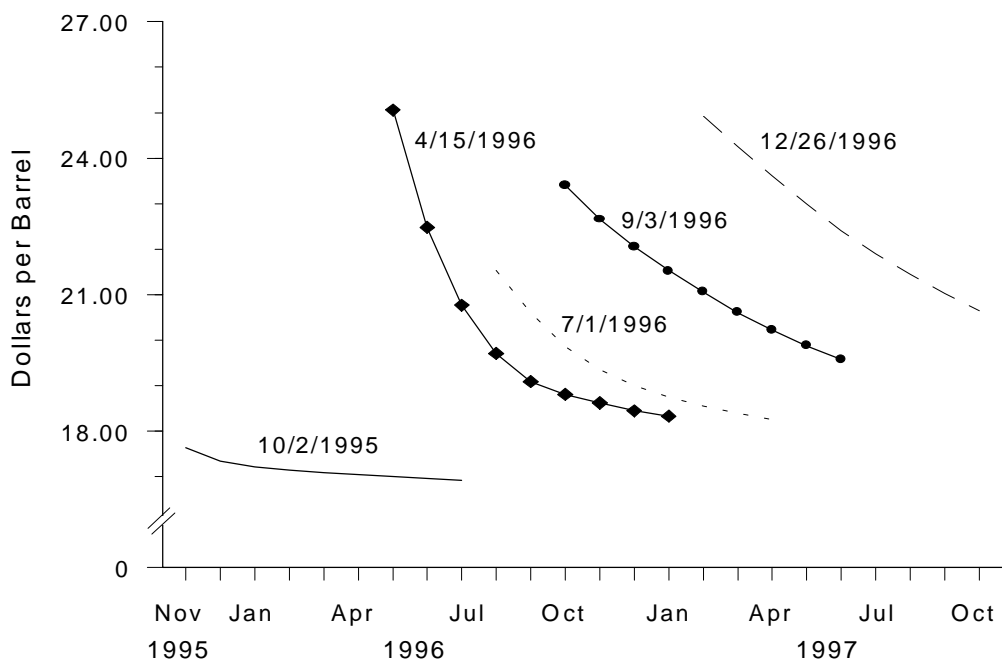
Normal Gasoline Markets

While crude oil price increases explained most of the gasoline price increase in spring 1996, the behavior of gasoline markets was responsible for the remainder. As background for discussion of the unusual gasoline market events of this past spring, a brief overview of normal market behavior is presented below. Two major characteristics of normal gasoline markets are particularly relevant: the relationship between spot and retail prices and the usual seasonal changes in the market.

Spot Spread is the Seasonal Component of Price

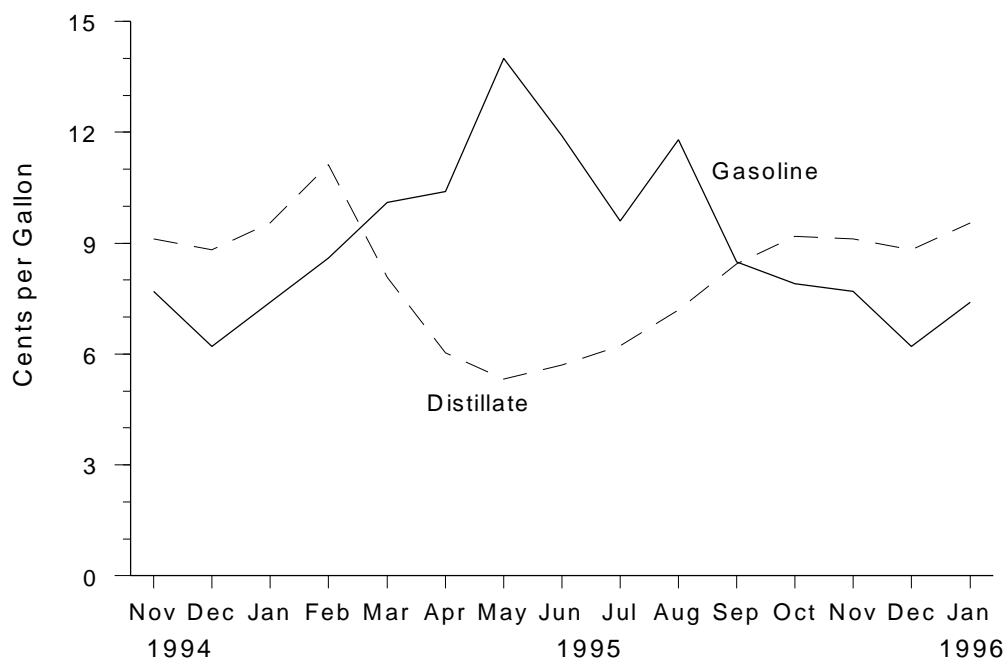
The effect of the gasoline market on prices is revealed in the spot spread (spot gasoline price minus crude price) and in the retail spread (retail price minus spot price). The gasoline spot spread gives an indication of the dollars being generated by refiners to cover their costs to process crude oil into gasoline and gasoline's contribution to refiners' taxes, financing costs, corporate overheads, and profits. Spot spreads tend to be low in winter and high in summer (Figure 20).

Figure 19. Changing Term Structure for Crude Oil Futures



Source: New York Mercantile Exchange.

Figure 20. The Seasonal Price Component (New York Harbor Spot 5-Year Average Spot Gasoline and Distillate Spreads)



Source: Energy Information Administration, data calculated using Standard & Poor's Platts.

Historically, spot spreads typically increase by 5 to 10 cents per gallon between their lows in December and their peaks in April and May. Although these spreads exhibit some regional variation, they follow a similar pattern throughout the U.S.

The seasonal pattern in gasoline spot spreads corresponds to the cyclical tightening and loosening of gasoline supply and demand. The gasoline supply and demand balance is, in turn, affected by the market for distillate (heating oil, diesel fuel and kerosene-jet fuel).

Price Seasonality Stems from Seasonality in Supply and Demand

Gasoline and distillate demands are highly seasonal, but counter-cyclical (Figure 21). Distillate demand peaks in the winter when heating oil requirements are highest, and gasoline peaks in the summer during the high driving season.

Refiners co-produce gasoline and distillate and have a limited ability to change the relative quantities being produced. Production of either product can be changed by shifting a small amount of material from the crude oil that is in a boiling range acceptable to either product, and also by changing operating conditions on process units downstream from the distillation tower. The limits of the changes require refiners to build and use stocks to meet seasonal peak demands (Figure 22).

Gasoline stocks build in the fall as distillate production is increased and gasoline co-production exceeds demand. Since the advent of clean fuels, gasoline stocks have experienced a slight drop in October as they are used to meet demand while refineries convert to winter gasoline fuel production. Gasoline stocks then continue their climb as production outstrips declining demand. Stocks usually peak in January when demand is at its lowest point. During the peak demand months of June, July, and August, stocks provide about 2 percent of demand. (Stocks play an even more important role in the distillate market, typically providing almost 12 percent of demand during the peak winter months of December, January and February).

In addition to domestic production, imports help meet U.S. gasoline demand. Some areas, such as Canada, Venezuela, and the U.S. Virgin Islands, provide the U.S. with gasoline imports on a regular basis. Europe and Saudi Arabia are examples of marginal suppliers, because their economics of selling product to the United States are not always attractive. Imports from marginal suppliers tend to increase during the second and third quarters as both demand and gasoline price spreads grow. However, import volumes can vary significantly from year to year. For example, second quarter

1995 imports averaged less than 350 thousand barrels per day after averaging 481 thousand barrels per day for the same period in 1994 (Figure 23).

Seasonal Supply/Demand Balance Impact on Gasoline and Crude Spread

In January, as gasoline production exceeds demand and stocks reach their peak, the oversupply of gasoline pushes the gasoline spreads to their lowest seasonal levels. During the first quarter, crude input to refineries declines and both gasoline and distillate production fall as refineries are shut down for routine, annual maintenance around March. Excess gasoline stocks accumulated over the fall and winter begin to decrease at this time. This pattern existed prior to environmental regulations requiring different summer and winter specifications. But now, there is even more need to draw down excess winter gasoline stocks, since winter gasoline does not meet summer gasoline specifications, and must be used before summer begins. Still, some extra gasoline stocks are required to meet peak summer demand.

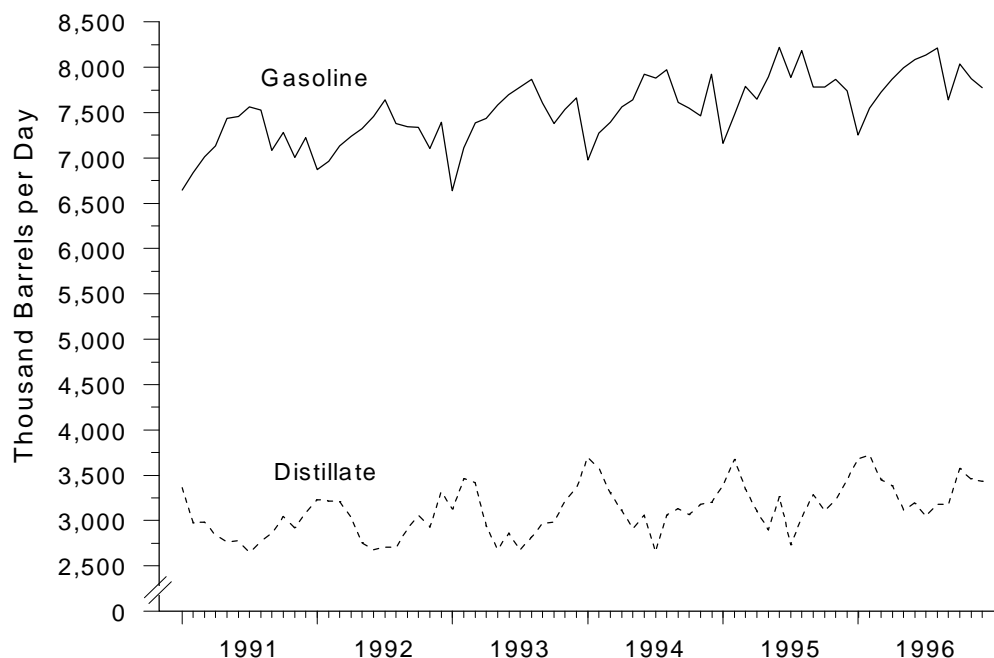
March and April are crucial months for both gasoline and distillate markets. At the end of March, following refinery maintenance, gasoline stock levels are assessed for their ability to help meet summer demand. At the same time, distillate stocks have been depleted by the end of the winter season. As a result, any extended-cold-weather distillate demand will have to be met through production, since stocks are close to minimum working levels and cannot provide additional supply.

By early April, gasoline demand begins to pick up. Gasoline stocks usually continue to fall because refiners are still coming back on stream, increasing imports lag behind the rising demand, and refiners and terminals are converting from winter to summer gasoline. With low stocks and increasing demand, buyers bid higher prices for product, thereby increasing spot spreads. These increasing spreads help to attract marginal imports. Sometime in late April or May, refiners return to full production, imports are strong, and the market is in better balance. Spreads frequently drop back, jumping again slightly in August before continuing their downward path to their December lows.

Prices Moving Through the System Show Lag Between Spot and Retail

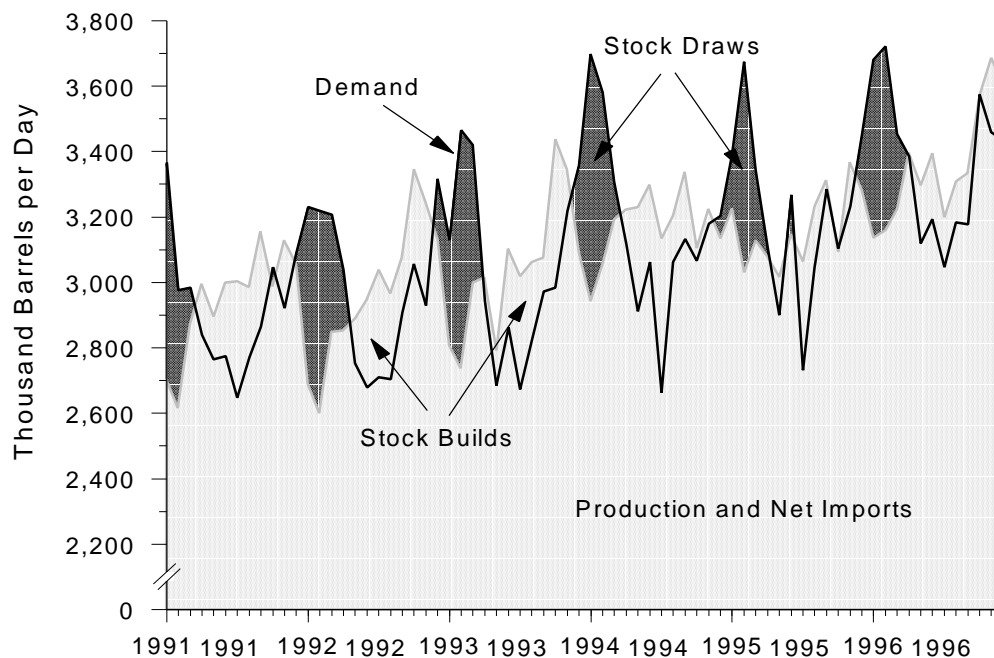
In addition to seasonality, the pace of price changes moving through the system from refineries to end users helps explain some of the timing of the 1996 spring gasoline price increase. Price changes move through the system at different

Figure 21. Gasoline and Distillate Counter-Cyclical Demand
(Thousand Barrels per Day)



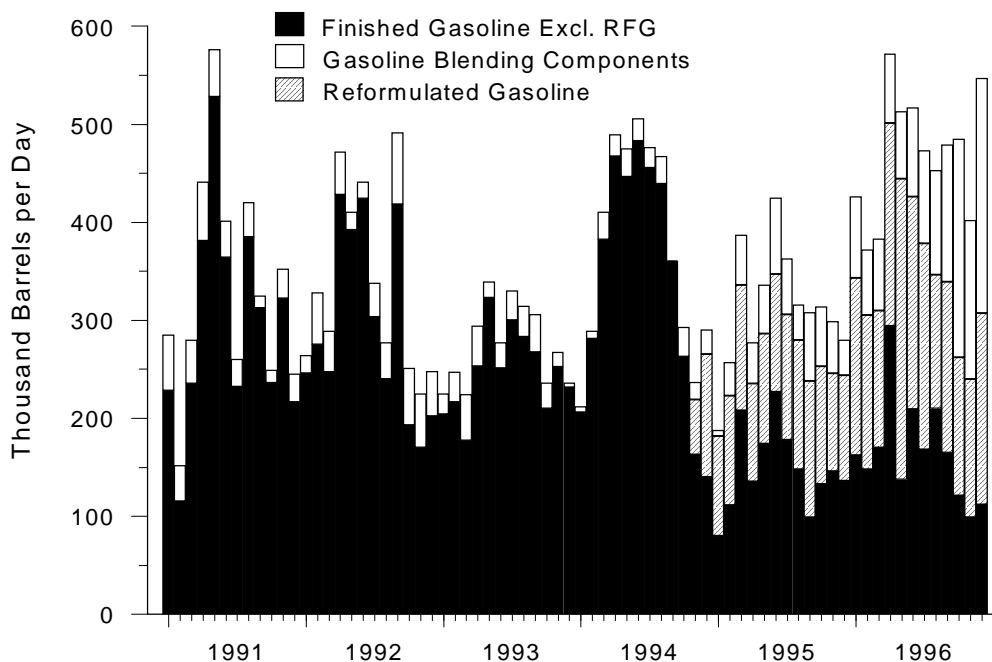
Sources: Energy Information Administration (EIA), 1991-1995: *Petroleum Supply Annual*, Vol. 2, Table 2. 1996: *Petroleum Supply Monthly* (various issues), Table 2.

Figure 22. Relying on Stocks to Meet Peak Demand: Distillate Supply and Demand



Sources: Energy Information Administration (EIA), 1991-1995: *Petroleum Supply Annual*, Vol. 2, Table 2. 1996: *Petroleum Supply Monthly* (various issues), Table 2.

Figure 23. Gasoline Imports



Sources: Energy Information Administration (EIA), **1991-1995:** *Petroleum Supply Annual*, Vol. 2, Table 2. **1996:** *Petroleum Supply Monthly* (various issues), Table 2.

rates. Spot gasoline prices, which change minute to minute, respond rapidly to crude oil price changes and reflect current perceptions of market tightness or looseness. Retail price changes, however, lag significantly behind spot price changes due both to competition and to the way in which the product works its way through the system to the consumer. This lag can be seen from the alignment of peaks in Figure 24. Activity and prices increase in wholesale markets in May in anticipation of the retail gasoline demand peak in June through August. When crude prices are stable, spot gasoline prices normally peak in May, while retail prices peak in June.

The retail price lag results in a price squeeze for retailers when wholesale prices are rising; however, the same lag keeps retail prices up while wholesale prices begin to fall.

Unusual Gasoline Market In First Quarter '96

Gasoline markets during the first quarter of 1996 were unusual in several ways. While first quarter demand was strong, and both production and imports were fairly high, stocks were unusually low. During the first quarter, marginal demand is normally met by stocks. Fairly large stock draws can occur in March as refineries undergo scheduled

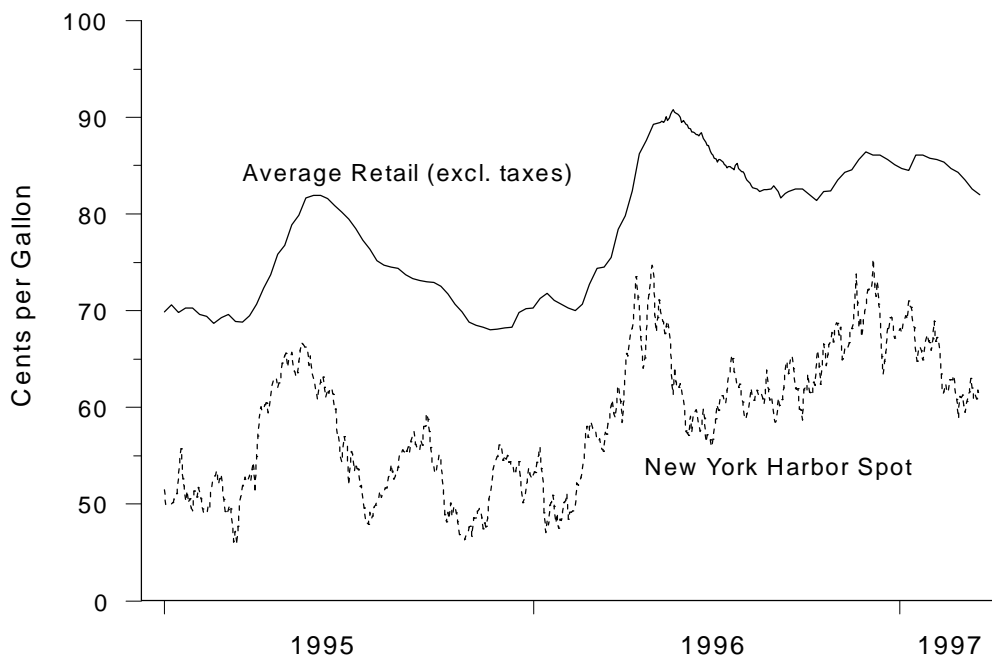
maintenance and draw down winter specification gasoline. So low stocks can become a concern towards the end of March as the market assesses the industry's ability to meet peak summer demand.

Despite unusually low stocks throughout the first quarter 1996, gasoline spreads were weak for the time of year. Through March, the unusual increases in gasoline prices could be explained by crude oil price increases alone. The seasonal spread increases through March were below normal and added very little to spot gasoline price increases.

Gasoline Demand Growth Was Modest

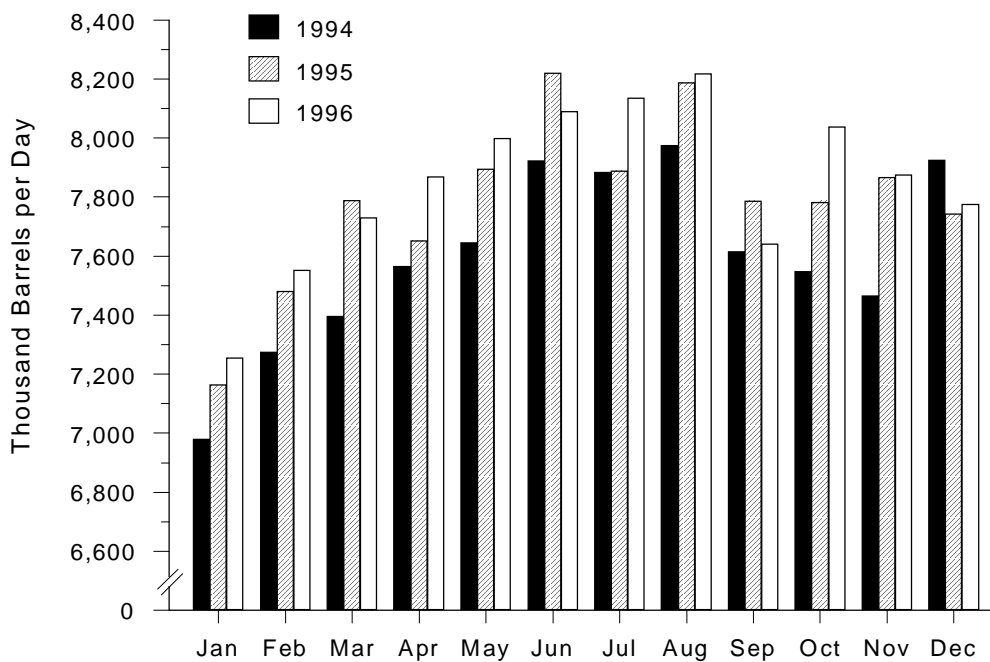
High gasoline demand is one of the factors that can contribute to upward pressure to prices. From 1992 through 1995, gasoline demand grew strongly, mainly because an increasing number of drivers and a stronger economy resulted in an increase in the total miles driven. Overall fleet efficiency (measured in miles per gallon) remained relatively flat. However, demand growth slowed in 1996. First quarter demand in 1996 was 7.5 million barrels per day, 0.4 percent higher than the high first quarter 1995 (Figure 25). Demand was higher than the previous year in both January and February, keeping a check on stock growth that normally occurs during this period. However, demand growth fell slightly in March compared to the previous year, which put

Figure 24. Spot and Retail Gasoline Prices (Excluding Taxes)



Sources: **Spot Prices:** Standard & Poor's Platts. **Retail Prices (Excluding Taxes):** Energy Information Administration (EIA), Form EIA-878, "Motor Gasoline Price Survey."

Figure 25. Gasoline Demand



Source: Energy Information Administration, *Petroleum Supply Monthly* (February 1997), Table S4.

less pressure than normal on the low stocks that help to meet demand in March.

Gasoline Production and Imports Were High

Since 1992, U.S. gasoline production has increased in conjunction with demand. Production increases are a result of higher refinery utilization, addition of oxygenates to produce reformulated gasoline (RFG), and some yield increase from process improvements. Since 1993, summer refinery distillation capacity utilization has averaged well over 90 percent.

Total gasoline production averaged 7.3 million barrels per day for first quarter 1996 (Figure 26), which was 54 thousand barrels per day over first quarter production in 1995. This production increase was only slightly higher than the gasoline demand increase of 34 thousand barrels per day for the same period. However, gasoline stocks were very low at the beginning of 1996, so production did little to improve the stock levels through the first quarter.⁹

High gasoline imports supplemented production in 1996 (see Figure 23 and box, p. 39). These imports prevented stocks from dropping as much as they normally would have dropped during the first quarter.

Gasoline Stocks Remained Low But Spreads Were Weak

Gasoline stocks started to drop below the historical seasonal range beginning in August 1995 and fell even further below this range over the winter. Gasoline stocks have exhibited a long term downward trend, partially due to companies managing inventories more efficiently (see Chapter 5). But stocks were lower in winter 1995-96 than even the long-term

downward trend might have predicted¹⁰ (Figure 27). Gasoline stock draws in spring 1996 were smaller than normal, mainly because of high imports, but stock levels remained below the average seasonal range through March.

Low gasoline stocks do not usually generate much price pressure over the winter months when supply is in excess of demand. Through March, gasoline price spreads remained weak, indicating little market concern with supply. A combination of low spreads, prospects for continued high imports, and expectations of falling crude oil feedstock cost discouraged refiners and wholesale buyers from holding any more stocks than necessary. Furthermore, winter-specification gasoline cannot be used during the summer and so must be drawn down before building summer gasoline stocks. This situation changed in April.

The April Runup: Distillate and Gasoline Markets Clash

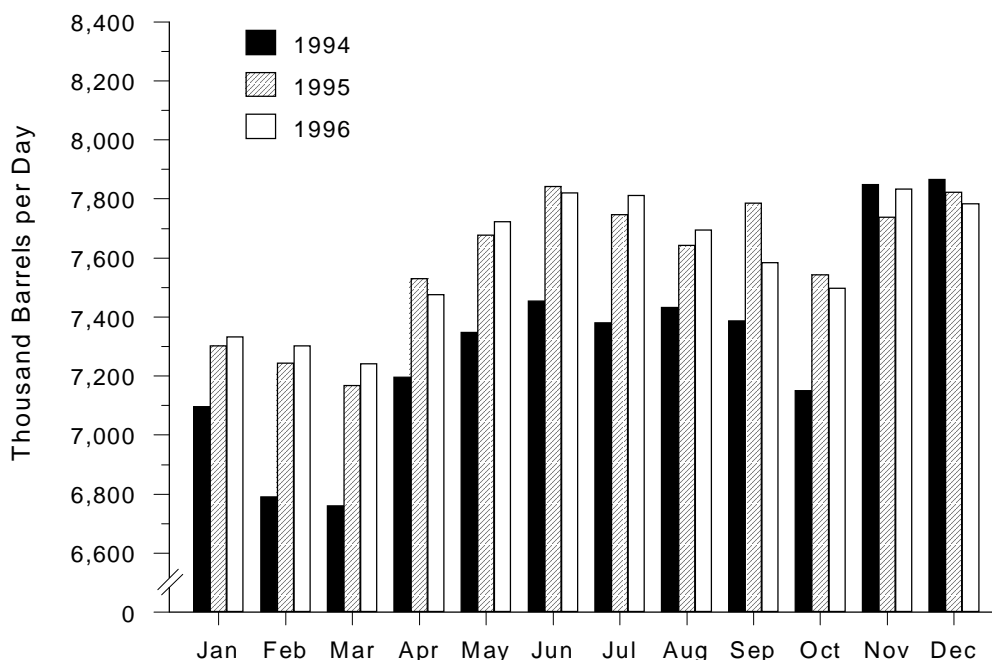
In April 1996, crude prices jumped considerably and, simultaneously, gasoline markets tightened more than expected. This drove the gasoline spread to, or above, normal levels in different parts of the country on top of the crude price increases. The following factors set the stage for the April runup:

- Crude prices had been strengthening prior to April due to low stocks and continued strong demand, which drove buyers to purchase crude oil as they waited for prices to weaken in the future.
- April began with lower than normal gasoline stocks, but gasoline spreads were a little weak in expectation that high imports and domestic production would satisfy the upcoming summer demand.
- Futures markets reflected expectations that the gasoline market would tighten as usual in April as demand increased towards its normal June-August peak season, but would decline in subsequent months, in response to declining crude prices. Expectations that prices would fall discouraged gasoline wholesalers from holding any more stocks than necessary.

⁹The shutdown and sale of the BP Marcus Hook refinery to Tosco in January was observed to have little impact on availability of fuel supplies to the Northeast. From the Bayway, New Jersey refinery, Tosco was able to supply the needs of the BP retail marketing assets acquired. Marcus Hook was a merchant refinery (i.e., sold most of its products to other companies) and buyers of its products had ample time to arrange for other supply sources, since possible shutdown had been a matter of public speculation for months. Despite relatively high utilization rates of U.S. refineries, there was still the capability to deal with the loss of capacity the size of the Marcus Hook refinery in the Northeast. Had the refinery been in operation, its production may have replaced some Gulf Coast production and some imports.

¹⁰The weak gasoline build that occurred in the fall and winter 1996 was mainly due to the combined effects of cold weather and expectations of falling prices (backwardation). The crude oil price backwardation transferred to the product markets, resulting in gasoline buyers expecting gasoline prices to fall in conjunction with crude oil price declines several months in the future. (For more discussion, see, *An Analysis of Gasoline Markets Spring 1996*, DOE/PO-0046 (June 1996).)

Figure 26. Gasoline Production

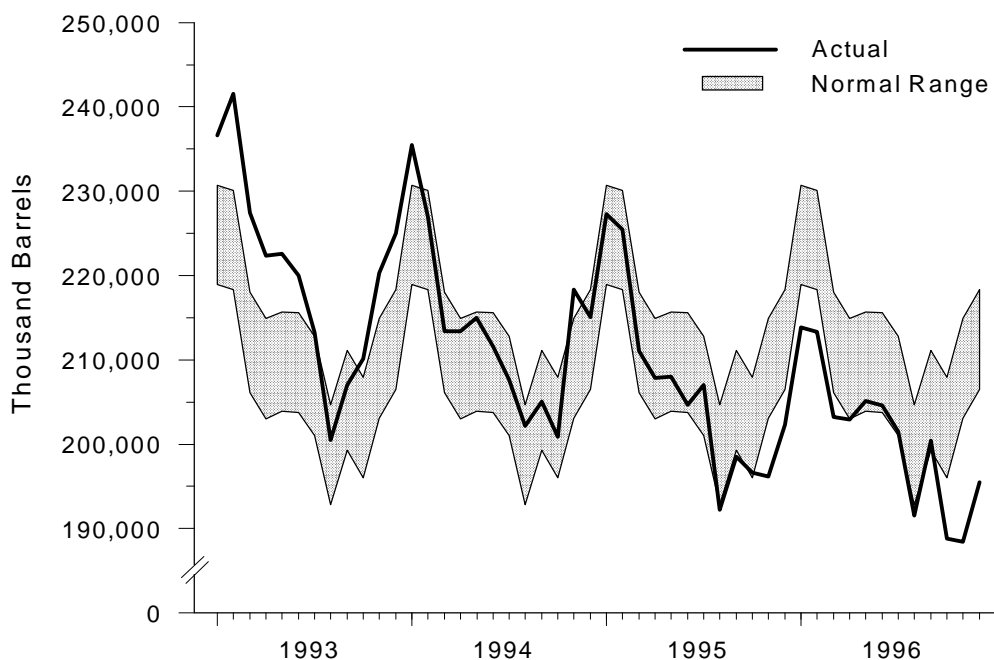


Source: Energy Information Administration, *Petroleum Supply Monthly* (February 1997), Table S4.

Gasoline Imports Were Expected to Be High in 1996, Due to Several Factors

- Europe was experiencing excess gasoline production as European refiners produced distillate products for their own markets. European refiners have been adding fluid catalytic cracking units to increase gasoline and distillate production, but they are producing too much gasoline versus distillate relative to regional demand. This provided a ready source of gasoline that flowed to the United States in 1996 when price differences between Europe and the United States exceeded transportation costs (approximately 5 cents per gallon).
- The tight U.S. gasoline market (high demand and capacity utilization with low stocks) pushed prices up relative to Europe. Although Europe was affected by higher crude prices, it did not experience tight seasonal gasoline markets affecting the spread between gasoline and crude oil prices.
- Asia has been a primary market for Saudi exports of refined products; however, Asian refining capacity has expanded rapidly, decreasing its product import needs. As a result, Saudi Arabia, a marginal supplier of product to the United States during the summer, was expected potentially to have extra product to sell here.

Figure 27. Total Motor Gasoline Stocks (End of Month)



Sources: Energy Information Administration (EIA), **1993-1995:** *Petroleum Supply Annual*, Vol. 2, Table 2. **1996:** *Petroleum Supply Monthly* (various issues), Table 2.

When the late cold spell hit the Atlantic Basin, the distillate market unexpectedly clashed with the gasoline market. The cold weather created extra demand for distillate on both sides of the Atlantic at a time when this demand is usually bottoming out (Figure 28) and distillate stocks are at their seasonal low point (Figure 29). As distillate stocks were unusually low in 1996 following the long winter¹¹, the unexpected April demand had to be met through increased production (Figure 30). Thus, refiners refocused on distillate production at a time when they normally would be maximizing gasoline output (Figures 25 and 26).

Low gasoline stocks combined with refiners focusing unusually on producing distillate in April to meet demand from the late cold spell added pressure to the gasoline markets. The New York Harbor spot gasoline spread, which had been running below normal (Figure 31), suddenly jumped from 2.6 cents below average in March to 1 cent below in April. By May, the actual New York Harbor spread was at its normal level. Given the spread's low starting point

in February and March, about 2 cents of the increase could be attributed to the tight market.¹²

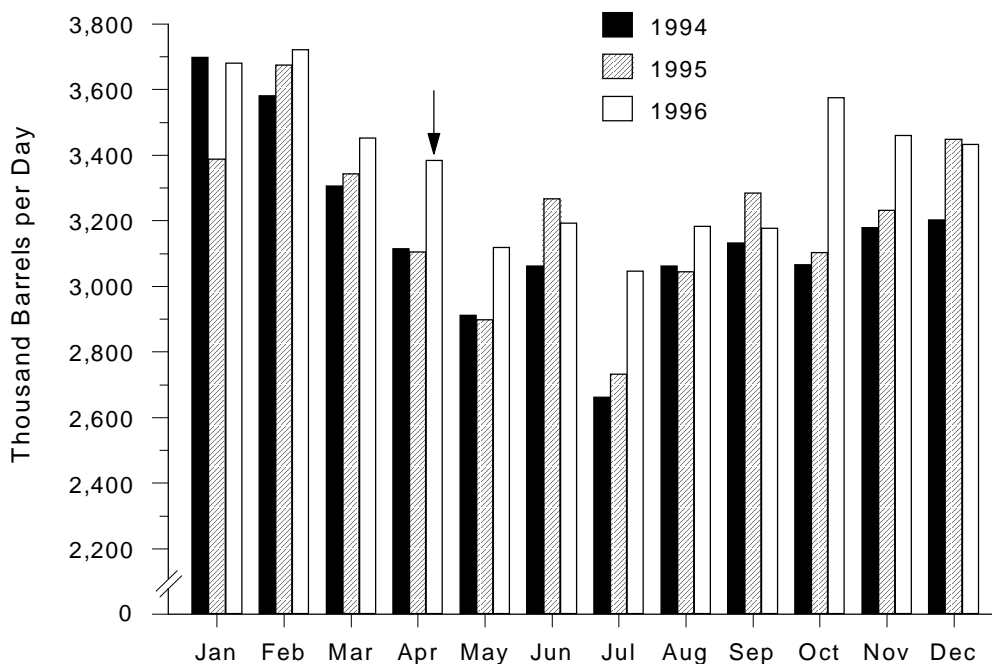
Spot gasoline prices rose with increasing crude oil prices and increasing spreads, peaking in April along with crude oil prices. These increases eventually made their way to the retail market. As retail markets lag behind spot markets, retail regular conventional prices peaked at almost \$1.29 on May 17, after the April spot price peak. Crude oil price increases accounted for about 10.7 cents of the 13.2 cent per gallon increase in New York Harbor spot prices from December 1995 to April 1996. The normal seasonal increase in gasoline prices accounted for most of the remainder, with perhaps 2 cents per gallon being attributable to unusual tightness of gasoline markets since spreads had been running low at the beginning of the year, but climbed rapidly to average levels.

The increase in gasoline prices during the spring of 1996 was more pronounced in some regions of the country. The box on p. 43 discusses the unusual circumstances in gasoline markets in California.

¹¹Distillate demand was up 4.3 percent in the first quarter over 1995 due to continued cold weather. In spite of the increase in distillate production, distillate fuel stock draw from the end of October through March was 13 percent above normal (as measured by the normal stock range published in the EIA's *Weekly Petroleum Status Report*).

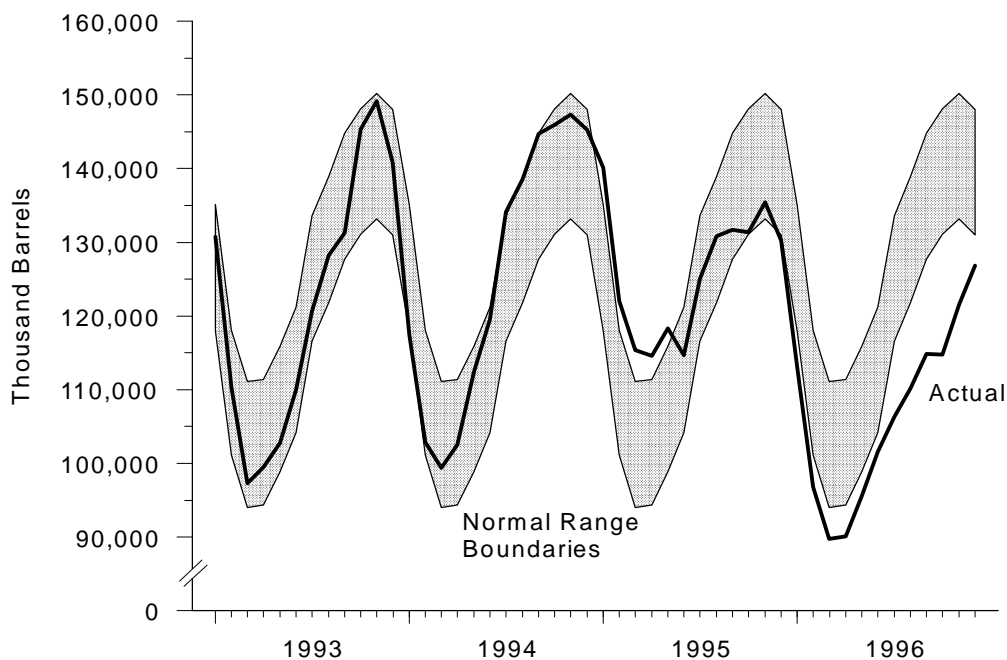
¹²This graphical New York Harbor and WTI display is supported by a more in-depth regression analysis using average resale gasoline prices and refiners' acquisition cost of crude oil. This is discussed in *An Analysis of Gasoline Markets Spring 1996*, DOE/PO-0046 (June 1996).

Figure 28. Distillate Demand



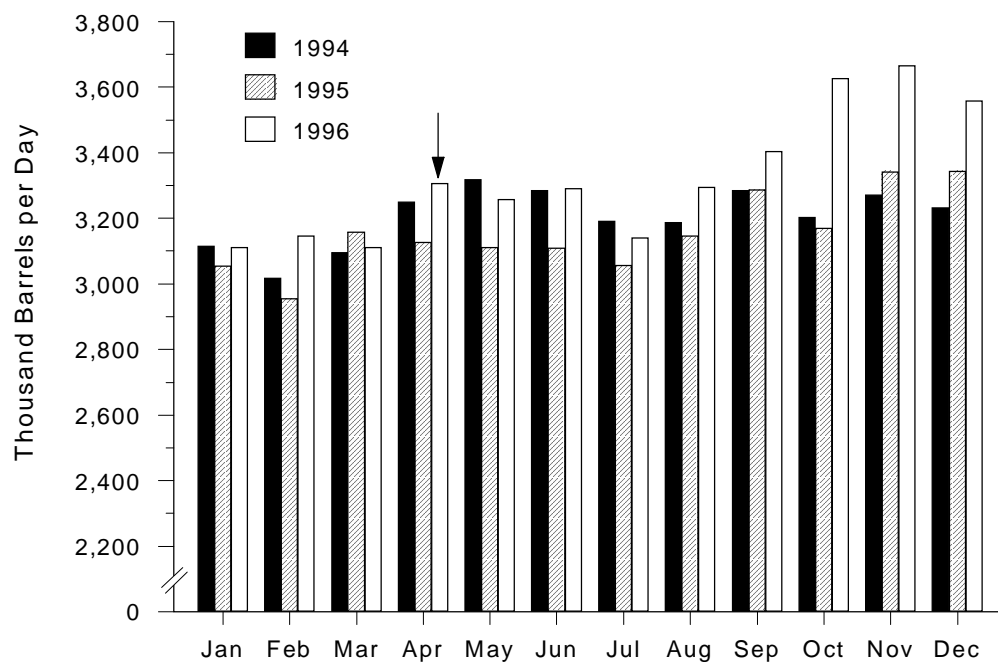
Source: Energy Information Administration, *Petroleum Supply Monthly* (February 1997), Table S5.

Figure 29. Distillate Stocks (End of Month)



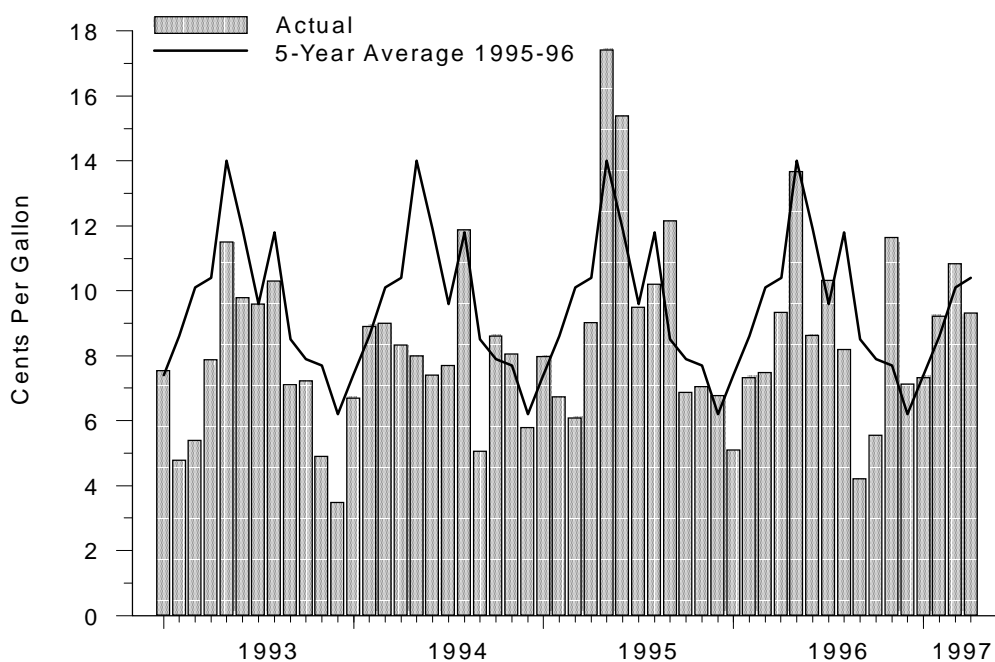
Sources: Energy Information Administration (EIA), **1993-1995:** *Petroleum Supply Annual*, Vol. 2, Table 2. **1996:** *Petroleum Supply Monthly* (various issues), Table 2.

Figure 30. Distillate Production



Source: Energy Information Administration, *Petroleum Supply Monthly* (February 1997), Table S5.

Figure 31. Gasoline Spot Spreads
(NY Harbor Spot Conventional - WTI)



Source: Standard & Poor's Platts.

A Special Case: California

California introduced its own new and unique Phase 2 reformulated gasoline (CaRFG) during the spring of 1996. CaRFG has more stringent requirements than Federal RFG, making it more difficult and more expensive to produce than Federal RFG. The California Energy Commission estimates the additional cost to produce CaRFG at between 5 and 15 cents more per gallon. Although the higher costs translate to higher prices, consumers will benefit from significant smog reduction.

Average CaRFG demand was projected at 896 thousand barrels per day for the first year (March 1, 1996 through February 28, 1997), taking into consideration the fuel efficiency loss (about 1-2 percent lower than Federal RFG). Average production was projected 906 thousand barrels per day, providing a 10 thousand barrels per day cushion. While not large, this cushion was expected to be adequate.* Some supply potential exists outside of California. However, most refiners are not equipped to produce the new fuel in any large amounts, if at all. Refineries in California are expected to use 85-90 percent of their gasoline capacity to produce the new fuel.

Unfortunately, supply problems developed as a number of California refineries experienced operating problems and had to shutdown for repairs. Spot prices shot up, driven by uncertainties around potential shortages. Unlike the rest of the country, the supply problems in California affected spreads strongly. Conventional gasoline prices were also affected by the supply problems, since California refiners also serve neighboring states.

The price increase experienced in California in 1996 reflected a market stress situation, illustrating price response when supply disruptions occur in a very tight market. With little or no immediate supply alternatives, the loss of expected supply resulted in the market bidding prices up at panic rates. Consumers paid an average of \$1.15 per gallon for regular gasoline in December 1995. By April 1996, the average was \$1.40, or 25 cents per gallon higher due to crude price increases, the changeover to CaRFG, and the refinery operating difficulties.

*California Air Resources Board and California Energy Commission's February 1996 Supply/Demand Analysis.

Gasoline Price Progress Through Summer 1996

As expected, crude oil prices fell during April after the cold weather abated, distillate demand relaxed, and the short-term demand for crude oil subsided. The decline of WTI prices ended in June, when it began hovering around \$21 per barrel, down from its peak of over \$25 per barrel in April. The \$4 per barrel decline is equivalent to about 9.5 cents per gallon. Weekly average spot gasoline prices declined over 13 cents per gallon during this time. Crude oil prices began to show renewed vigor in August and continued to climb through September, as Northern Hemisphere demand began to increase in preparation for winter heating fuel needs, putting upward pressure on all petroleum product prices.

Gasoline stocks, which began the year low, had risen to very near the normal seasonal range in May, and stayed at the low end of the normal range through September, the end of the summer driving season. Imports of gasoline and blending components in 1996 were very high, as had been expected, averaging 355 thousand barrels per day compared to 202 in

1995 and 274 in 1994, which was another year with high imports.

Gasoline price spreads reflected the gasoline supply/demand balance. They stayed below the 5-year average spreads with the exception of July, when preliminary data indicated stronger than normal demand with falling stocks. Since stocks were still at low levels, the market reacted quickly to the unexpected tightening by pushing prices higher. Still gasoline spreads in July only exceeded the 5-year average by 0.7 cents per gallon. The supply/demand balance adjusted and spreads fell well below normal in August and September, although gasoline price rose along with crude oil price.

Monthly average spot prices fell from their peak of 65.3 cents per gallon in April to bottom out in June at 57.3 cents. Prices then began to rise as crude oil prices strengthened, countering declining spreads. By September, the end of the traditional driving season, New York Harbor spot prices had increased by 4 cents per gallon over the June price, and Gulf Coast spot prices were up 2.4 cents per gallon. Retail conventional regular gasoline fell from its monthly average peak of \$1.24 in May to \$1.18 in August. But retail prices

began to increase in September with the underlying increase in crude oil price. By year end, retail prices had returned to levels seen the prior spring.

Gasoline Markets Affected Distillate

In spring 1996, distillate markets affected the normal behavior of gasoline markets. But strong gasoline imports affected distillate markets as the year progressed. Greater reliance on gasoline imports to meet gasoline demand resulted in changed gasoline and distillate production and stocking patterns in the United States. Figure 28 shows that 1996 distillate stocks have been low since the draw down during the winter of 1995-96. Although distillate stock levels were low as summer 1996 began, they increased normally in May and June. But in July, which is normally the peak re-build month, historically averaging over 11 million barrels increase, stocks only increased 2.4 million barrels.

Since part of gasoline supply in 1996 was being met from higher imports rather than increased refinery runs, refiners increased the yields of kerosene jet fuel and distillate (heating fuel and diesel) to adjust to the new balance between refinery production and demand. But the yield increase of distillate was not uniform throughout the year. In the first quarter, the yield increase provided 27 thousand barrels per day more heating fuel and diesel than in 1995; in the second and third quarters, the higher yield produced 115 thousand barrels per day more distillate; and in the fourth quarter, when distillate stocks were very low, the volume increase from higher yields was to 226 thousand barrels per day. The distillate volume in the fourth quarter versus the second and third quarters was achieved by changing the yield split between kerosene jet fuel and distillate and by increasing crude runs. The uneven increase in distillate yields over the year did not provide enough distillate production to build stocks to normal levels over the summer, but the extra jump in yield and increased crude throughput during the fourth quarter allowed production to meet distillate demand without as much stock draw as might normally have occurred.

The affect of gasoline imports on distillate stocks was only one of several factors contributing to the low distillate stock situation in 1996. Other factors included:¹³

- Distillate stocks began the year low.
- Continued backwardation in crude oil markets caused suppliers to expect distillate prices to fall in the out

months. This discouraged suppliers from building stocks because they could not lock in a profit on stocks being held, and might even have to sell stocked product at a loss.

- Unusually high demand for distillate occurred in July, which detracted from the strong build in stocks that normally occurs in this month.

In spite of increased crude runs during the fourth quarter, the increased distillate yields lowered gasoline production from crude oil over that produced from crude oil fourth quarter 1995. Only by increasing inputs of imported blending components was refinery gasoline production brought back to levels similar to those in 1995. Finished gasoline imports also added to supply, but gasoline stocks dropped much lower than normal in October and declined even further in November when they traditionally increase. December and January builds in stocks were more typical, but by this time, gasoline stocks were running well below normal levels.

Price Reversal in Spring 1997

The petroleum markets in spring 1997 completed the story of the spring 1996 runup with a price reversal, providing an excellent opportunity to watch the dynamics described in this chapter work when crude market factors moved in the opposite direction. Table 1 summarizes some major market factors for comparison. (The following box on p. 46 presents a discussion of whether the crude price increase in the spring of 1996 heralds increased volatility in the future.)

In qualitative terms, the supply/demand balance for gasoline in spring 1997 was almost the same as in spring 1996: demand growth was low to modest; levels of gasoline production from January through April supplied about 96 percent of demand in both years; imports were very high in 1996 and even higher in 1997; and stocks were low. Prices, on the other hand, behaved very differently. Prices rose dramatically during spring 1996, but fell during spring 1997, even though gasoline spot price spreads were slightly higher in 1997 (Figures 31 through 34).

The explanation of the spring 1997 price decline lies mainly with crude oil prices and normal seasonal spread changes — the main factors behind the spring 1996 price increase. WTI crude oil prices in April averaged 9 cents lower than in April 1996. New York Harbor spot gasoline prices also averaged 9 cents lower in April 1997 than in April 1996. From December 1996 through April 1997, crude oil prices fell 13.5 cents per gallon, and spot gasoline prices fell 11.3 cents as the impact from declining crudes price was moderated by normal increases in seasonal spreads.

¹³Energy Information Administration (EIA), "Distillate Fuel Oil Assessment for Winter 1996-1997," *Petroleum Supply Monthly*, DOE/EIA-0109(96/11) (Washington, DC, November 1996), pp. xv-xxiii.

Table 1. Spring 1997 and Spring 1996 Summary Market Comparison

Market Factor	January-April 1996	January-April 1997
World Petroleum Supply/ Demand Balance	Winter stock draw was high.	Winter stock draw was low.
	Strong world economy supported petroleum demand.	Strong world economy supported petroleum demand.
	Cold weather increased winter demand more than expected (3 percent higher than in winter 1994-95).	Winter demand was held in check by milder weather (1.8 percent higher than in winter 1995-96).
	Supply growth was less than expected.	Supply growth was strong.
Crude Supply	Iraqi entry into market was delayed.	Iraq began sales in December '96.
	Non-OPEC additions were expected, but did not arrive.	Non-OPEC supply increased, and more was expected.
	Light crude was abundant.	Abundance of light crude grew.
Crude Markets	Prices began 1996 under \$20.00 per barrel.	Prices began 1997 about \$26.00 per barrel after high demand fourth quarter.
	Tight: Prices rose February thru April with cold weather and lack of expected supplies.	Weakening: Prices fell January through April with strong supplies relative to demand.
	Futures market backwardation was steep.	Term structure of crude futures flattened.
	Light-heavy price differentials were modest.	Light-heavy price differentials were very small.
U.S. Winter Distillate	Winter began with stocks normal, but ended March with stocks lower than normal due to cold weather.	Winter began with stocks low. Demand was met through extra production, and winter ended with stocks at normal levels due to mild weather.
	April: With little or no discretionary stocks, late cold weather caused refiners to re-focus on distillate production.	April: Although demand was strong, no unexpected re-focusing on distillate production occurred.
U.S. Gasoline Supply/Demand Balance	Stocks were low.	Stocks were very low.
	Demand growth was modest (1.1 percent).	Demand growth was low to modest (0.8 percent).
	Demand level was high (7,601 thousand barrels per day).	Demand level was high (7,710 thousand barrels per day).
	Production growth was modest.	Production growth was modest.
	Imports were high (meeting 5.8 percent of demand).	Imports were very high (meeting 7.6 percent of demand).
Gasoline Market	Increasing crude oil prices pushed gasoline prices up.	Falling crude oil prices brought gasoline prices down.
	Spreads were mainly at or below seasonal norms.	Spreads were slightly above seasonal norms.

Source: Energy Information Administration.

Was the Spring Crude Price Increase a Sign of Future Increased Volatility?

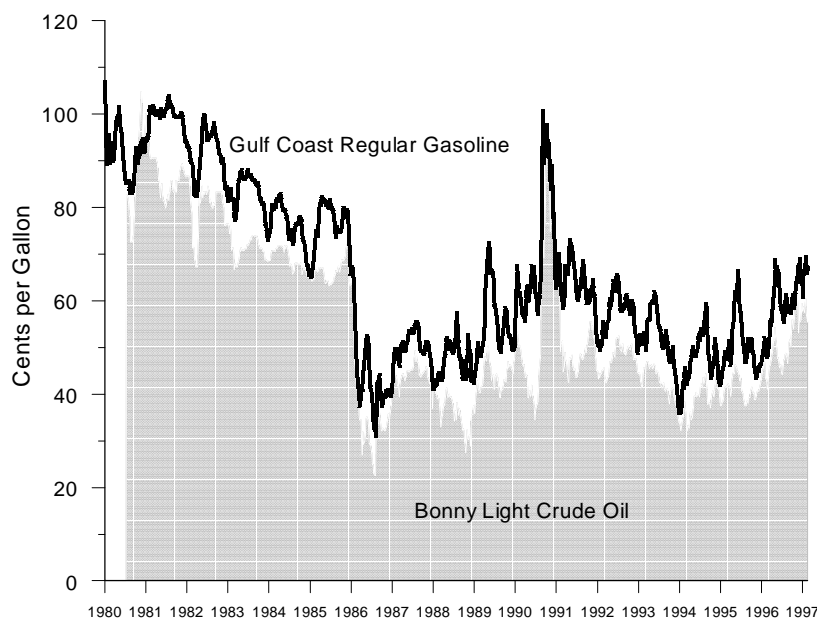
Is the situation experienced in Spring 1996 just another sign of growing price volatility, and will we see more of the same in the future? In short, the crude market supply/demand balance was fairly tight in 1996, which creates an environment for exaggerated price swings. Demand was high, excess production capacity was not available, and world petroleum stocks were lower than average. When unexpected events occur in tight markets, such as the late winter cold snap in 1996, that affect the perceived availability of crude oil, buyers are more likely to over-react, creating large price swings.

In spring 1996, a number of unusual factors acted simultaneously to increase buyers concern over crude availability, including unusual late cold weather and expectations for large price declines in the near future, which encouraged keeping low stocks. While these specific triggers may not occur again to drive prices up temporarily, other factors can create the same effect during a tight market. As discussed in this chapter, the transition time between the end of winter, when world crude and product stocks are low, and the beginning of the U.S. high gasoline demand season is a vulnerable period. Events during that crucial time period can have a large influence on the market.

In the short-term, crude inventories began to recover worldwide over the winter. World petroleum demand only increased 1.4 million barrels per day over winter 1995-96, while supply increased 2.3 million barrels per day (preliminary estimates). Crude oil prices averaged \$25.41 per barrel in December, but began falling in January. By April, WTI averaged \$19.75. Although the crude market is loosening, world petroleum stocks do not seem to be in excess, so there is still some potential for price increases. As new supply grows, the probability of sharp price movements will diminish, since buyers will perceive higher crude availability, and thus no need to bid prices higher to assure supply when unexpected events occur.

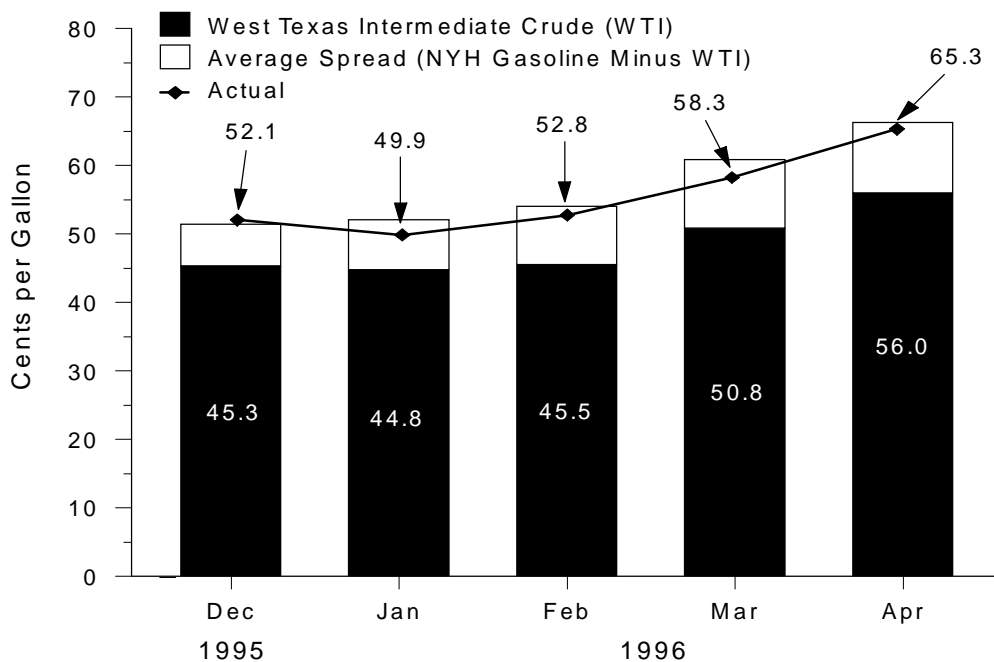
When viewed over the long term (see figure), crude prices were strong in 1996, but not especially more volatile than many other times in history. The short-term price swing that occurred last spring was a little sharper and higher than most swings seen in Figure 14, but was not dramatically out of line with past price variations. It occurred at a time that was very visible to consumers — just when gasoline prices normally increase, and the market had not seen the magnitude of such swings for several years.

Weekly Average Spot Prices



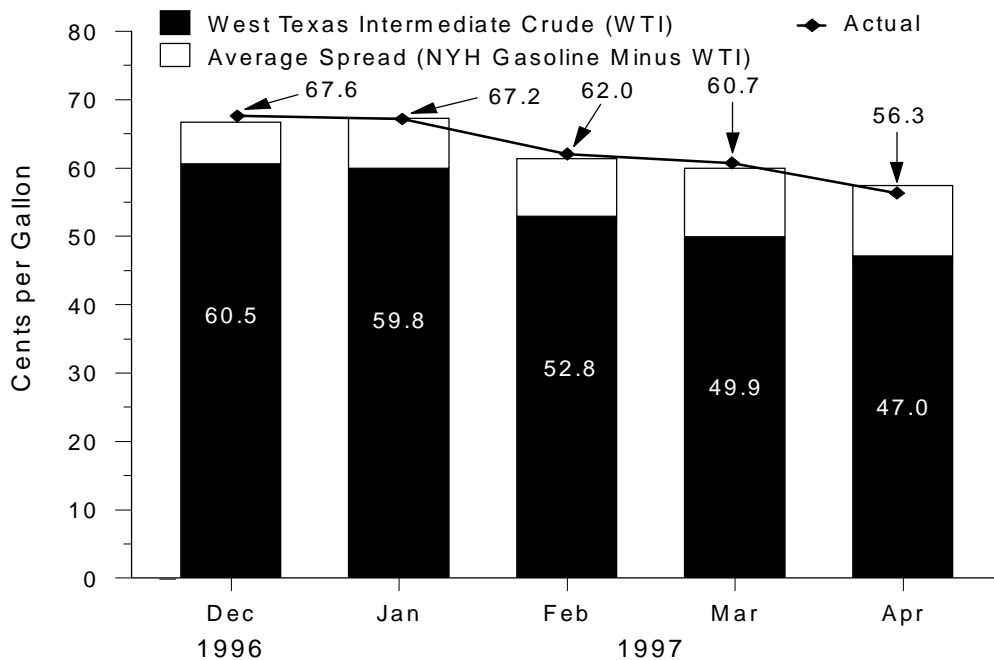
Source: Standard & Poor's Platts.

Figure 32. Spring 1996 Gasoline Price Summary
(NY Harbor Spot Conventional Regular)



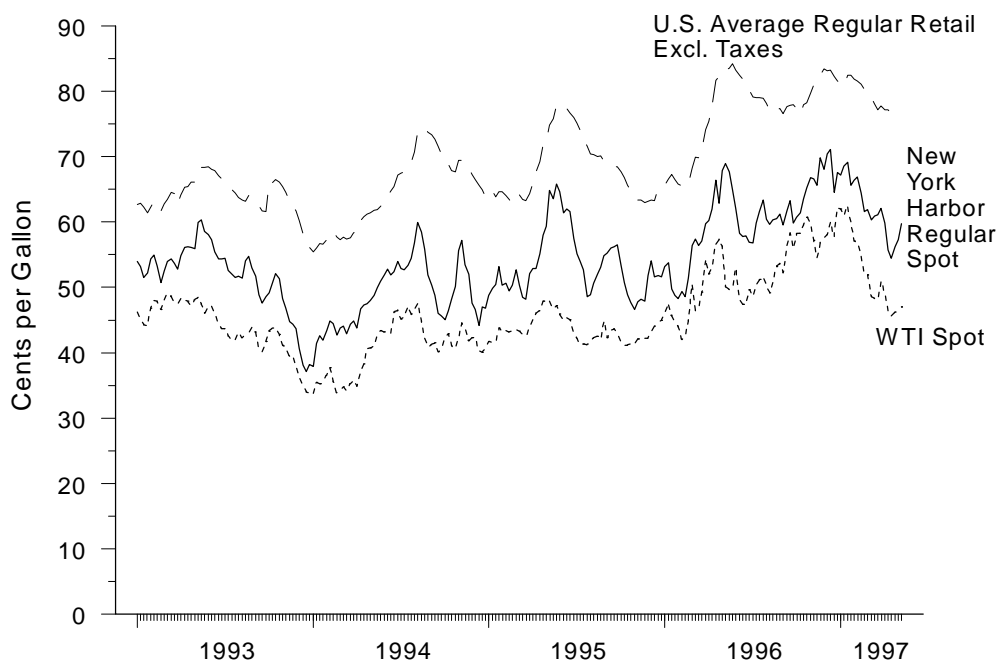
Source: Standard & Poor's Platts.

Figure 33. Spring 1997 Gasoline Price Summary
(NY Harbor Spot Conventional Regular)



Source: Standard & Poor's Platts.

Figure 34. Weekly Conventional Gasoline and Crude Oil Prices



Sources: **Spot Prices:** Standard & Poor's Platts. **Retail Prices:** Energy Information Administration (EIA), Form EIA-878, "Motor Gasoline Price Survey."

In spring 1997, crude oil markets finally seemed to be ending the tight supply/demand cycle that drove prices up in 1996. During the winter of 1995-96, oil product demand was high due to cold weather, while supplies of crude oil were less than expected. Prompt markets were tight during the spring, pushing crude oil prices higher, when a late cold snap caused prices to leap even higher to peak in April. Strong backwardation in crude oil futures persisted through 1996 as buyers kept expecting the tight prompt markets to loosen with new supplies and lower demand. With buyers expecting prices to fall, building stocks was discouraged.

Winter 1996-97 was almost a mirror image of winter 1995-96. As winter 1996-97 began, world petroleum stocks were still low, so increased demand in the fourth quarter, coupled with sluggish supply growth, again pushed crude prices up, reaching levels at the end of December higher than in April 1996. But the weather in winter 1996-97 was not as severe as the prior winter. In addition, Iraqi production entered the market in December and other supplies increased, taking the pressure off prices. EIA preliminary estimates indicate that the world petroleum stock draw was only 1.1 million barrels

per day during winter 1996-97, compared to 2.0 million barrels per day the previous winter. With world stock levels appearing to recover to more normal levels, crude oil prices fell considerably through the spring of 1997, pulling gasoline prices down. While strong backwardation persisted throughout most of 1996, crude oil term structures in March and April 1997 were relatively flat.

Gasoline stocks in spring 1997 were even lower than in spring 1996, which put more pressure on gasoline spreads in 1997 than in 1996. While gasoline spreads were relatively low during the first part of 1996, they have been at or slightly above average in 1997, reflecting the extra tightness.

Retail prices averaged 17.9 cents higher in December 1996 than in 1995, but by April, were 3.3 cents lower in 1997 than in 1996. Retail prices, which lag behind the change in spot prices, had fallen 5.5 cents from December 1996 through April 1997. Thus, consumers in the spring of 1997 experienced falling gasoline prices, after the dramatic increase in prices experienced in spring 1996.