An Analysis of Gasoline Markets
Spring 1996

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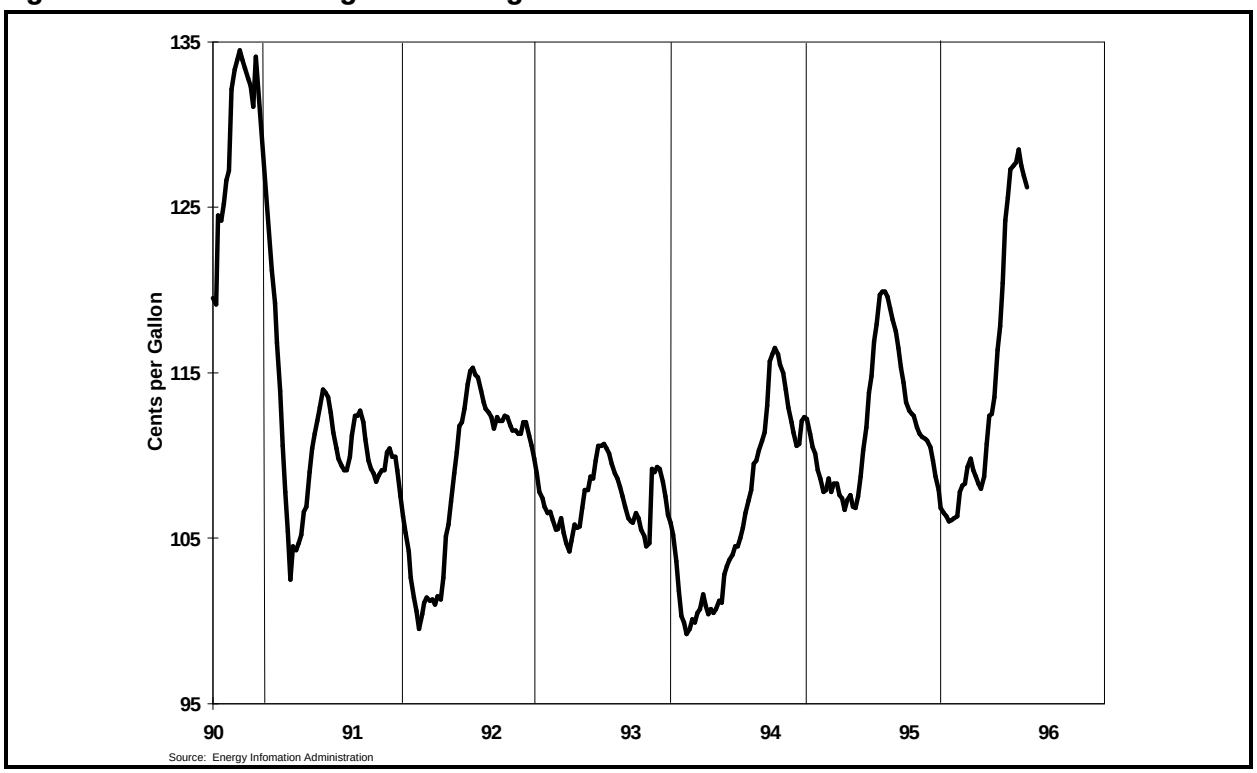
Overview

Retail gasoline prices in the United States rose sharply over the early months of 1996, impacting consumers' pocketbooks and raising questions as to the causes behind the increases. The national average retail price of regular self-serve gasoline, according to weekly data[1] collected by the Energy Information Administration (EIA), increased from a low of $1.08 per gallon in mid-February to almost $1.29 by May 17 (Figure ES.1). While gasoline prices usually rise somewhat at this time of year, the rapidity and size of the 1996 increase made it more visible and caught consumers by surprise. In response to public concern, President Clinton, on April 29, 1996, requested that the Department of Energy investigate the causes of the gasoline price runup and prepare a report on the situation within 45 days. This document is the result of that effort.

Figure ES.1 U.S. Average Retail Regular Gasoline Price



Research and analysis performed by EIA reveal that the gasoline price increases experienced by consumers in early 1996 resulted from a confluence of factors, but that crude oil price increases and normal seasonal gasoline price increases account for most of the change. Unusual factors in gasoline markets also played a role, and include: a late-winter cold spell causing refiners to focus on distillate

[1] Although officially designated a weekly survey, the EIA-878 "Motor Gasoline Price Survey" has been operating on a daily basis since May 6 due to the need for more timely data.

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 in excess of demand to build stocks.

Analytical Approach

In order to organize the analytical efforts into a logical framework, market factors that influenced crude oil prices were separated from those that influenced gasoline prices apart from crude oil, i.e., those factors that determined the margin, or spread, between gasoline and crude oil prices. The discussion of spreads was further divided into those seasonal changes that are typically seen during the period under study, and aspects of the gasoline market that were unique to early 1996. For this analysis, retail gasoline prices were separated into:

- Cost of crude oil, the primary raw material used to produce gasoline
- Refinery processing costs and margins, or *resale spread*, which is the difference between resale price and crude oil
- Marketing costs, distribution costs and retail margins, or *retail spread*, which is the difference between retail price excluding taxes and resale price
- Federal, State and local taxes.

Taxes are the only constant during the period under study. They represent about 40.8 cents, or 35 percent, of retail gasoline priced at $1.16 per gallon, which was the average retail price of all grades and formulations[2] of gasoline in December. Crude oil cost is of about the same magnitude as taxes. Last December, crude oil cost represented 41.8 cents of the total price of gasoline. Retail spreads (excluding taxes) in December were 15.3 cents per gallon, and resale spreads were 18.1 cents per gallon.

The issue centers around how and why these different components changed (Figure ES.2). The analysis looks at changes from December, the normal seasonal low point for wholesale gasoline markets, through April (the latest full-month data available). From December 1995 through April 1996, the monthly average retail gasoline price (all grades and formulations)[3] increased 14.5 cents per gallon. World crude prices increased 8.0 cents per gallon, resale spread increased 8.1 cents per gallon, and retail spreads actually declined by 1.6 cents per gallon. The increases in retail gasoline prices can be understood by focusing on the reasons behind the increases in crude oil and in resale or spot gasoline prices. (Spot prices and spot spreads, like resale prices and spreads, reflect wholesale-level changes in the gasoline market.)[4]

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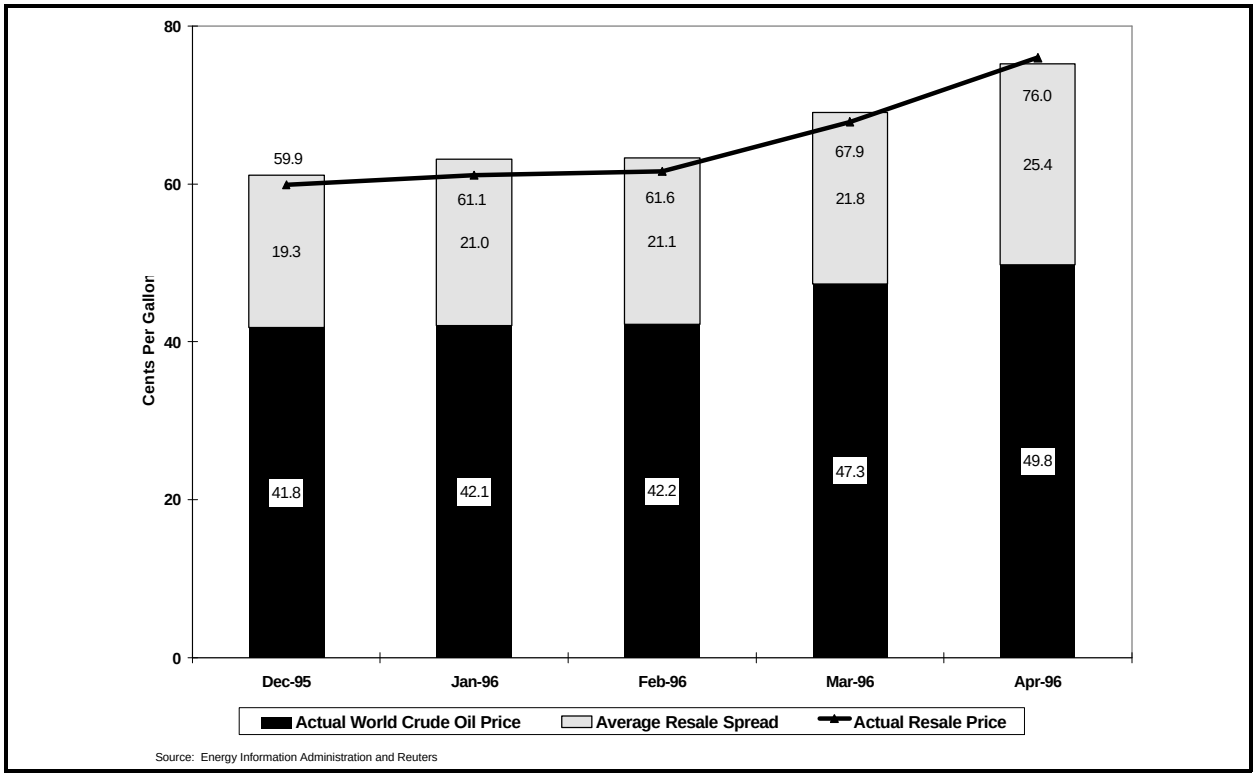
[2]Grades of gasoline are regular, midgrade and premium. Formulations refer to conventional, oxygenated, reformulated, and oxygenated reformulated gasoline.

[3]For purposes of analysis, several different types of price data were used. Weekly retail prices were used because they most accurately capture the week-to-week variations seen by consumers, and they therefore help to gauge the size of the increases seen by consumers. Daily spot prices for crude oil and gasoline were used to capture both the volatility of the markets and to take advantage of the most up-to-date information. For more comprehensive analysis over longer periods, monthly average prices and spreads were used.

[4]Spot prices do not reflect all of the storage and terminal costs contained in resale spreads, but spot prices are available more quickly than resale prices and are a good barometer of resale price behavior.

Figure ES.2 Resale Gasoline Prices



Crude Oil: An International Commodity

Crude oil, the raw material from which gasoline and other oil products are made, is by far the largest cost component for those products. Since December 1995, the increases in the cost of crude oil explain about half of the increase in gasoline prices. World crude oil prices rose considerably during February through April this year, although the increase was nowhere near the magnitude experienced during the Persian Gulf War. West Texas Intermediate (WTI) crude oil rose from $17.33 per barrel at the end of January to peak at $25.15 during April, before starting to fall. A similar increase in crude oil prices occurred in 1994, but consumers were not as sensitive to the impact because gasoline prices were very low at the start of the climb, and the increase occurred more gradually. The increases this year can be explained in terms of the basic fundamentals of crude oil markets.

The balance between crude oil supply and demand ultimately determines the direction of crude prices. During the fourth quarter of 1995 and the first quarter of 1996, widespread, sustained winter weather served to reduce some of the anticipated supply and boost winter demand above expectations. Demand significantly surpassed world production, even with increased output from the Organization of Petroleum Exporting Countries (OPEC), resulting in a very large drop in stocks of the 25 nations in the Organization for Economic Cooperation and Development (OECD). The drop of 251 million barrels was the largest in the past five years, with the next largest drop being 188 million barrels that occurred in the cold winter of 1993-94. With OPEC producing well above ts self-

imposed ceiling, and demand still outpacing supply, markets tightened. WTI prices rose from $17.43 per barrel in October to over $19.00 in December, and stayed at about that level through February, even in the face of continuing cold weather in the Atlantic Basin. Speculation over an early return of Iraqi crude to world markets may have dampened winter pressure on prices.

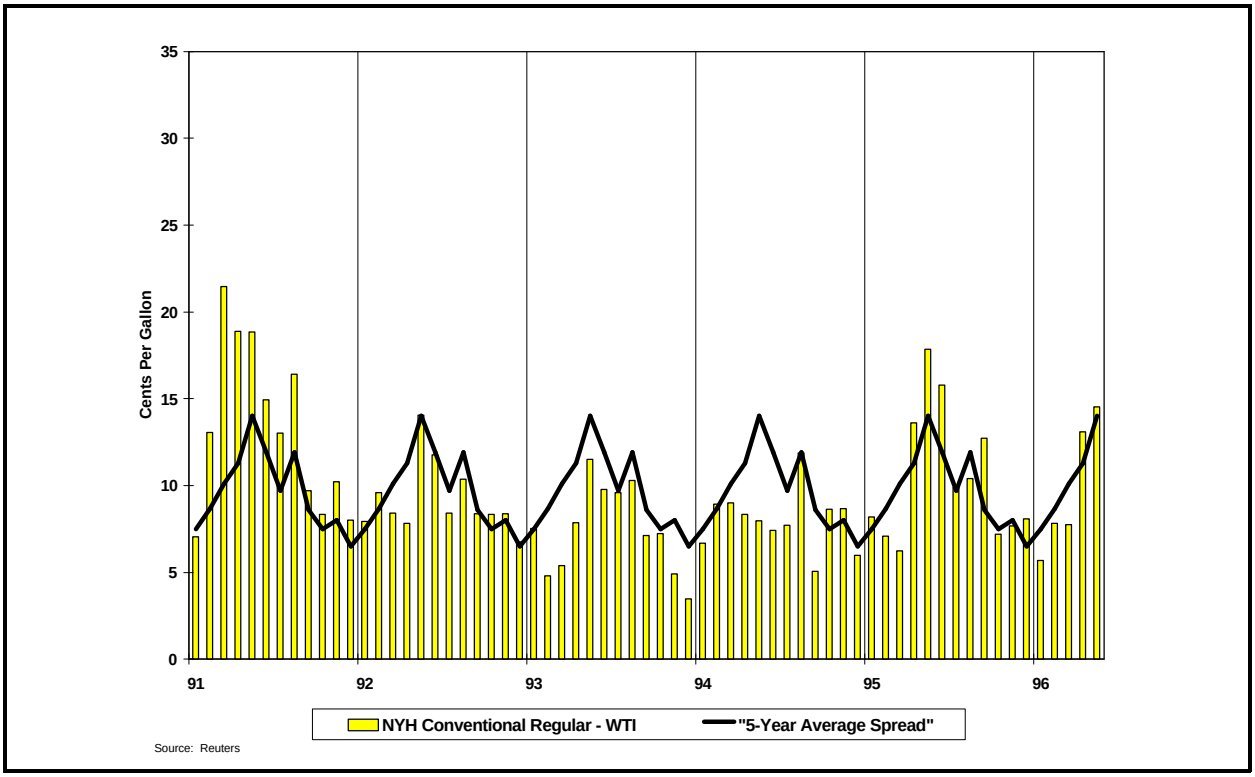
When a late-winter cold wave affected both Europe and the United States, demand for crude oil surged in late February and March. However, stocks were low worldwide both because of the tight winter supply / demand fundamentals and because crude oil prices were expected to fall several months in the future, thereby discouraging buyers from rebuilding stocks. Price declines were anticipated because of forecast increasing non-OPEC supplies and eventual seasonally weakening demand in the summer, coupled with the potential for Iraq's return to the market. With low stocks, more buyers than usual were purchasing crude oil for immediate consumption to meet the surge in demand brought by the unexpected cold weather. This created the added pressure needed to drive the price up to average $23.50 per barrel in April.

Gasoline Market Fundamentals and Normal Price Behavior

While crude oil prices explain about half of the variation in gasoline prices, the refining market as represented through resale or spot spreads also plays an important role. Either resale or spot price spread captures the refiners' processing costs and margins, and represents the incentive for refiners to alter behavior when price changes. This price component has a strong seasonal pattern and gives total gasoline prices a seasonal characteristic that can be seen in years when crude oil price changes do not counter the seasonal pattern. The seasonal pattern in resale and spot spreads corresponds with the cyclical tightening and loosening of the supply and demand balance of gasoline. The genesis of this cyclical supply / demand balance is the seasonal demand patterns of two primary petroleum products -- gasoline and distillate, which includes heating oil -- and how refiners meet both of these demands with a system that co-produces both products at all times.

Figure ES.3 illustrates a typical spot spread pattern. The seasonal changes in the supply / demand balance over a year explain these patterns. Gasoline production usually exceeds demand during the fall and through January, with excess production going to build stocks. Refiners are increasing crude oil inputs to produce more distillate at this time of year, and gasoline is being produced as a co-product. While gasoline production exceeds demand, gasoline price spreads weaken. As the winter progresses, crude oil inputs to refineries are reduced. Refiners anticipate the end of winter and reduced product requirements. Distillate and gasoline production fall. Excess gasoline stocks built over the winter begin to be drawn down in February, and when refiners shut down to do maintenance in March, stocks drop further. By the beginning of April, demand picks up as summer approaches. Market pressure builds as stock levels generally continue to fall with relatively low production. Even as refiners come back on stream, prices are bid higher and spreads increase, which may attract imports. Sometime in April or May, refiners reach full production, imports are strong, and the market rebalances. Prices recede and spreads drop back, only to jump again slightly in August before continuing their downward path to their December lows.

Figure ES.3 Spot New York Spreads



1996 Gasoline Market

National Market

Given crude oil price patterns in 1996 and normal resale and spot spread increases, the report examines the extent to which price spreads exceeded normal patterns, and if so, why? A graphical approach illustrates the magnitude of the issue. The combination of high demand, high refinery capacity utilization and low stocks that persisted in U.S. gasoline markets this year might be expected to produce upward pressure on prices, but gasoline markets generally exhibit excess supply until the end of March. Even though gasoline markets were tighter than normal through March, as represented by lower-than-normal stocks[5], gasoline resale and spot price spreads outside of California were weak up until April (Figure ES.3). Spreads rose in April, but not abnormally. The New York spot spread was less than 2 cents above average in April, similar to spread behavior last year, and in May, it was less than 1 cent above average. The Gulf Coast was actually below average.

[5]Gasoline stocks have exhibited a long-term downward trend, partially due to refiners and terminal operators attempting to operate more cost-efficiently by holding less inventory. This year, as far back as at least December, stocks were unusually low. These low stocks, in conjunction with high demand and high refinery utilization, increased market tightness above the normal spring level. While the additional tightness seemed to add little to the overall gasoline price increases, low stocks are a concern for other reasons. That is, low stocks leave little cushion for unexpected supply disruptions, thereby increasing the risk of large price run ups. This increased risk is of interest to the Department of Energy, and, as such, the Department plans to monitor stock patterns and the potential for price volatility.

This preliminary review of spot and resale gasoline price behavior implies that tight gasoline markets had little impact over normal seasonal factors (with the exception of California, discussed below).

Another approach to decomposing the effects of tight markets on prices was undertaken using the Short-Term Integrated Forecasting System (STIFS) model. Examination of the 1996 spring runup in gasoline prices from the perspective of EIA's short-term energy forecasting model shows that the gasoline price changes observed this year correspond fairly closely to what EIA would have predicted, given the actual levels of world oil prices and U.S. gasoline demand.

Most of the increase in refiner prices and retail (pump) prices for gasoline this spring are understandable in terms of increases in world crude oil costs and normal seasonal changes in such prices. However, about 2 cents (13 percent) of the increase in resale gasoline prices between December 1995 (the typical low point for spot and resale markets) and April 1996 is not so easily explained. It is estimated that at least 1 cent of the December-to-April national increase in resale prices can be accounted for by the particular gasoline supply problems encountered in California this year, due to that state's relatively large weight in the national market. The remaining shift in domestic resale gasoline prices reflects the general market tightness that developed, particularly in March and April. Still, any unexpected rise in resale prices remained relatively small and within normal uncertainty ranges.

California

California experienced a different market situation this year than did the rest of the country. The State introduced its new, unique, Phase 2 reformulated gasoline during the spring. Price increases related to this new gasoline were well in excess of those that can be explained by crude oil price increases, normal seasonal changes, and increases in the cost to make the new fuel. The additional jump in California prices appears to have resulted from explosions and mechanical problems at several refineries in April. At times, over 12 percent of California's gasoline supply was out of commission. With no other readily available source for this fuel, prices shot up. Production recovered in May, and spot prices receded. However, if production problems continue, California prices will likely fluctuate throughout the summer.

Refining Profits in 1996

Did the upswing in gasoline prices yield large increases in profits? Analysis of first-quarter profit developments indicates that gasoline price increases played only a minor role in the improvements in major oil companies' corporate bottom lines. Most of the majors' income gains stemmed from higher crude oil and natural gas prices. Their refining and marketing operations profits were only average in a historical context, posting earnings of $212 million in the first quarter of 1996, a turnaround from losses of $112 million in the first quarter of 1995. An analysis of the results demonstrates that the turnaround in first quarter refining earnings from last year was primarily attributable to the cold winter's increased distillate demand and prices rather than to gasoline market developments.

The second quarter should reflect improved gasoline spreads as illustrated in Figure ES.3. Although financial disclosures of second-quarter results will not be available until early August, preliminary

estimates can be made. Based on the EIA forecast prices and estimates of refined product margins, the statistical relationship between refining profits and margins indicates profits from U.S. downstream operations might be higher than second quarter profits achieved in 1995. But second quarter profits should remain well within the range of second quarter historical profits seen over the past 10 years.

On balance, petroleum market developments thus far in 1996 will lead to higher rates of return for U.S. downstream operations compared with last year's results. However, for most of the 1990's, U.S. refining profitability has been below the profitability of overall U.S. industry. The events in the first half of 1996 are unlikely to bring U.S. refining operations to above-normal levels of profitability.

Conclusion and Outlook

In summary, the increases in gasoline prices outside of California this year can be explained largely by normal market activities. About half of the increase is attributable to the rise in crude oil prices. Normal seasonal gasoline price increases account for a large portion of the remaining runup. Unusual gasoline market tightness in the United States this year that stemmed from high demand, high refinery utilization, and low stocks, may have contributed about 2 cents to the overall increase, including the market stress impacts of California on the national average. In California, refinery outages caused large losses of production capability of the State's new, unique Phase 2 reformulated gasoline, resulting in larger price increases there than in other parts of the country. The unique qualities of the fuel and the relative isolation of California from alternative supplies put much more pressure on the California market than was experienced in other parts of the country.

In mid-April, as cold weather subsided and demand for crude began to decline, crude oil prices began to weaken. Shortly thereafter, on April 29, President Clinton announced the expedited release of 12 million barrels of crude oil from the Strategic Petroleum Reserve, which contributed to an additional short-term decline of $1.60 per barrel. After peaking at the end of April, spot gasoline prices followed the crude oil decline, tempered by seasonal upward price pressures. In May, following maintenance, refinery production returned to full levels, and imports remained high in response to increased gasoline prices relative to foreign markets, ending the seasonal spring increase in spot prices and spreads.

Monthly average resale prices peaked in April at about 76 cents per gallon. National average retail pump prices (average of all grades and formulations), which typically lag resale prices by about one month, appear to have peaked in May at $1.38 per gallon. The lag in retail prices squeezed retailers this spring as resale prices increased ahead of and more rapidly than retail. But retailers should be

beginning to catch up in May as resale prices fall more quickly than retail.[6] With crude oil prices already down by close to $2 per barrel (May versus April average refinery cost), and with downward pressure on world oil markets expected to continue as Iraq prepares a limited return to oil exports, average crude oil prices paid by U.S. refiners could drift downward to about $18 per barrel or less by August. Based on market forces already observed and the absence of unforeseen circumstances, gasoline prices are expected to follow, with the average retail price dropping 10 cents per gallon by the end of summer from its spring peak.

[6]In addition to the lagged relationship between retail and resale prices, unbranded rack, branded rack and dealer tank wagon (DTW) prices exhibit different dynamics during periods such as this. For example, major oil companies normally sell unbranded as well as branded product. When the market is tight, less unbranded rack volumes are available, and the price difference between branded and unbranded narrows. The gap between DTW and branded rack also narrows as markets tighten (See Different Gasoline Prices Sidebar in Chapter 3).

1. Introduction

In 1996, consumers experienced a sharp increase in the price of gasoline. The national average retail price of regular self-serve gasoline, according to weekly data collected by the Energy Information Administration (EIA), rose from a low of $1.08 per gallon in mid-February 1996 to almost $1.29 by May 17. The size and rapidity of the increase caused public concern, and on April 29, President Clinton requested the Department of Energy (DOE) to investigate and report on what caused the increase within 45 days. In addition to DOE expertise, the Department used the services of EIA, an independent agency within the Department, to perform quantitative and modeling analysis. This report incorporates that analysis and constitutes the DOE response to the President's request.

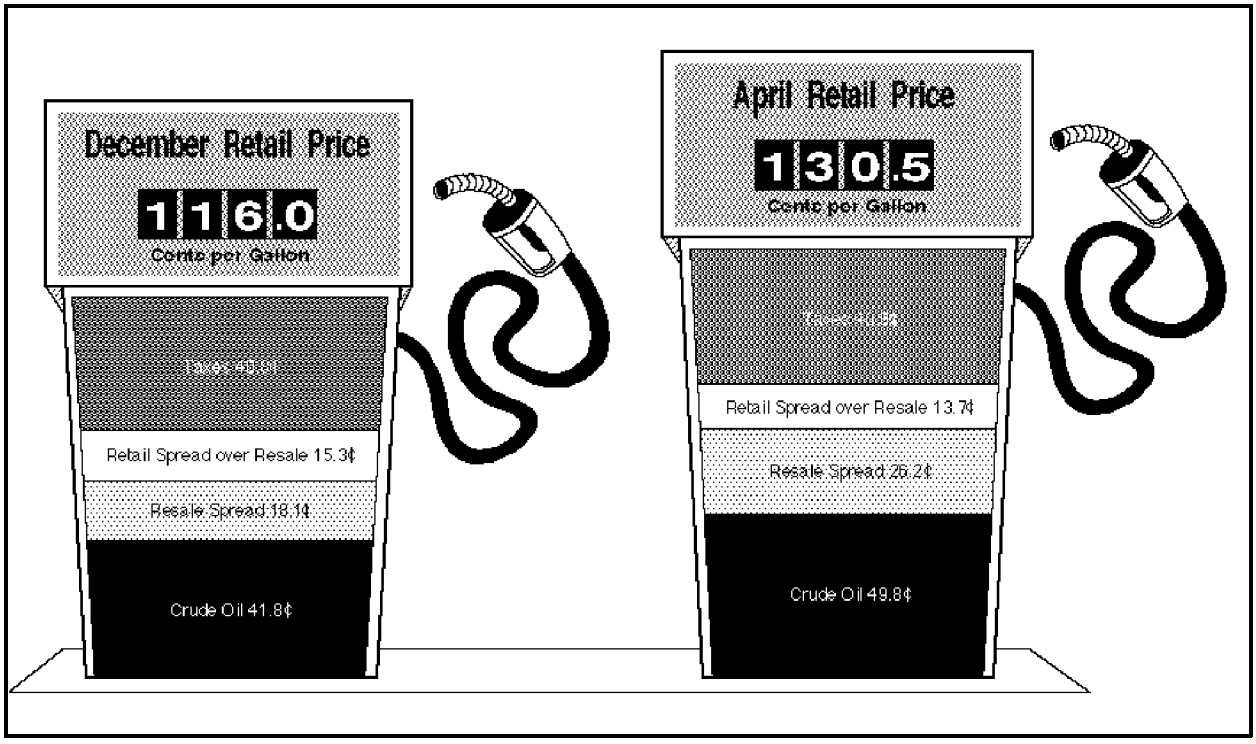
Gasoline price is the sum of the different cost components that determine the price (Figure 1.1 and Table 1.1). The values of the cost components in Figure 1.1 are determined by different oil market factors. For example, crude oil prices are determined in the international oil markets by changes in oil demand, available supply, and the success of the Organization of Petroleum Exporting Countries (OPEC) in controlling its production. Resale price spreads, which have a strong seasonal pattern, are heavily influenced by U.S. gasoline supply / demand fundamentals. Retail price spreads change with seasonal factors and local dealer competition.

Table 1.1 Price Components That Explain Retail Gasoline Price Behavior

Market	Price Component	Description of Price Component
Crude Oil Market	Cost of Crude Oil	Crude oil is the primary feedstock for producing gasoline and represents one of the largest costs.
Resale Markets	Spot or Resale Spread: price spread over crude oil price (resale gasoline price minus crude oil price)	Represents a) refining costs to produce gasoline (excluding crude oil feedstock cost), b) refiners' profit margins, c) some storage and distribution costs
Retail Markets	Retail Spread: price spread over resale price (retail price minus resale price)	Represents: a) retail station operating costs, b) dealer profit margins c) taxes d) remaining storage and distribution costs

The approach taken by DOE to analyze and describe how the petroleum market factors affected total gasoline price in 1996 was to focus on the primary price components, which are crude oil cost, the

Figure 1.4 U.S. Average Retail Regular Gasoline Price Components



resale price spread, and the retail price spread. This decomposition allows for a systematic description of the role that each element of the petroleum business played in the gasoline price increase.

The chapters in the report begin with the crude oil component and then turn to the resale and retail spreads.

Chapter 2, *Crude Oil: An International Commodity*, focuses on what affected crude oil prices, the main cost component in gasoline. This chapter describes crude oil markets in general and explains their evolution through the winter of 1995/96, leading to the period of steep price increases in February through April. It addresses how the basic supply and demand fundamentals were driven by world economies and weather to create upward pressure on prices. It also explains how market expectations of future price declines can cause near-term price increases.

Chapter 3, *Gasoline Market Fundamentals and Normal Price Behavior*, describes normal gasoline price behavior in order to examine and put into perspective what occurred in 1996. Typical resale and retail price spread components are described in detail. Chapter 3 reviews the factors underlying normal seasonal price increases. This chapter also describes the lag in retail prices relative to resale prices. This characteristic tends to be less noticeable when resale prices are rising; however, when resale prices turn and begin to fall, retail prices often draw attention as they may continue to rise due to the two-to-four-week lag.

Chapter 4, *Gasoline Markets in 1996*, builds on the principles described in Chapter 3 to describe what happened in gasoline markets in 1996, over and above the crude oil price increases. The chapter

examines graphic illustrations to determine whether resale spreads were unusually high. It then summarizes a more quantitative analysis of price behavior performed using the EIA Short-Term Integrated Forecasting System (STIFS) model.

Chapter 5, *Petroleum Industry Profits in 1996*, looks at first quarter profits of the oil industry. The impacts of the gasoline price increase on profits are explored, and potential second quarter profit implications are discussed.

Chapter 6, *Conclusion and Outlook*, recaps the main factors that drove prices up this spring, and provides an EIA update on the expected path of gasoline prices this summer.

Appendices A, B, and C provide further insights into factors underlying low gasoline stocks, display graphs of regional gasoline prices, and describe analysis of the price increase performed using the STIFS model in detail.

2. Crude Oil: An International Commodity

Crude oil, the raw material from which gasoline and other oil products are made, is by far the largest cost component for those products. Since December 1995, the increases in this feedstock cost explain almost half of the increase in gasoline prices. World crude oil prices increased considerably during February through April 1996, although the increase was nowhere near the magnitude experienced in late 1990 following the Iraqi invasion of Kuwait (Figure 2.1). West Texas Intermediate (WTI) crude oil rose from $17.33 at the end of January to peak at $25.15 during April, before starting to fall. Gasoline prices worldwide were impacted by the crude oil price increase (Figure 2.2). A similar increase in crude oil prices occurred in 1994, but consumers were not as sensitive to the impact because gasoline prices were very low at the start of the climb, and the increase occurred more gradually. The increases this year can be explained in terms of the basic fundamentals of crude oil markets. In summary, factors contributing to the rise in crude oil prices included:

- Strong world demand for crude oil this winter
- Winter world crude oil production falling short of forecasted levels, and falling short of actual demand levels, thereby resulting in large stock drawdowns
- Crude oil markets tightening, as evidenced by falling stocks and strengthening prices, despite high OPEC production levels
- Expectations that prices would fall, encouraging refiners and other crude oil buyers to reduce inventories
- An unexpected spurt of cold weather in Europe and the United States at the end of the winter which caused buyers to return to spot markets, producing the extra pressure needed to push crude oil up nearly $8 per barrel from February to April.

The remaining sections of this chapter will describe the crude oil market background and the dynamics of market fundamentals behind the crude oil prices that occurred this year.

2.1 Understanding Crude Oil Prices

2.1.1 Crude Oil's Role in the World

Crude oil is a global commodity, with most of the major crude oil supply areas being in different geographic locations than the major consuming areas. The three major consuming areas are North America (mainly the United States), Western Europe, and Asia / Australia. Non-OECD Asian

Figure 2.1 Crude Oil Spot Prices

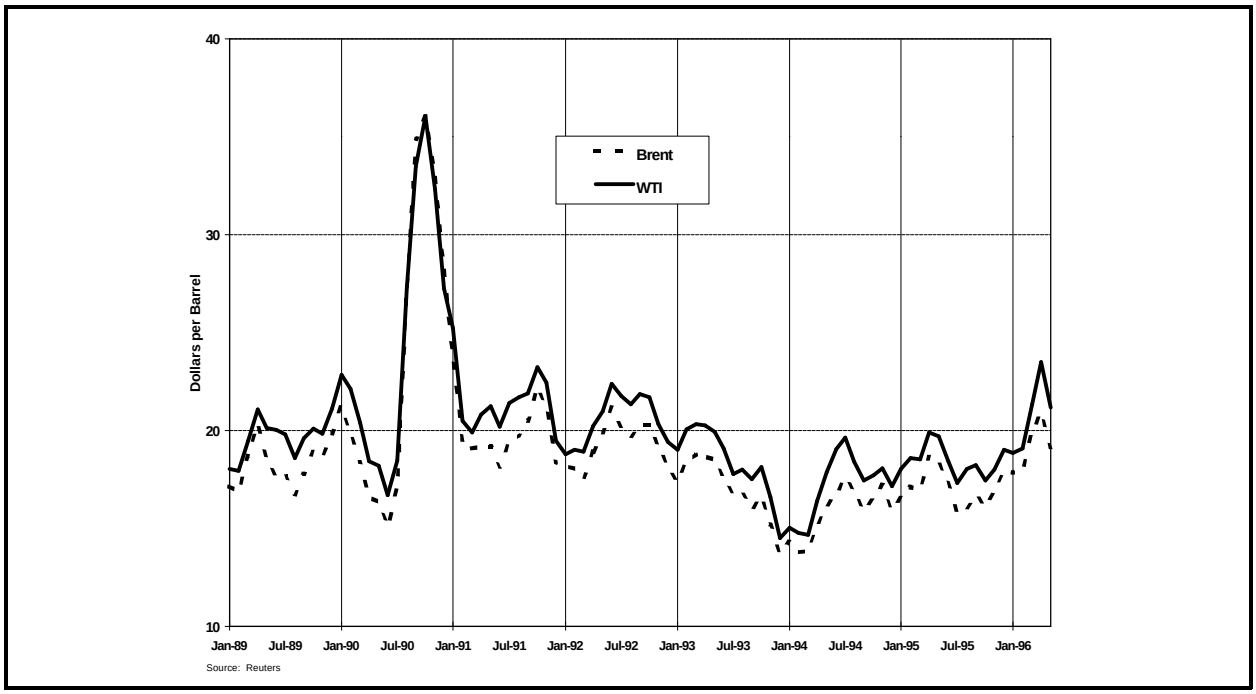
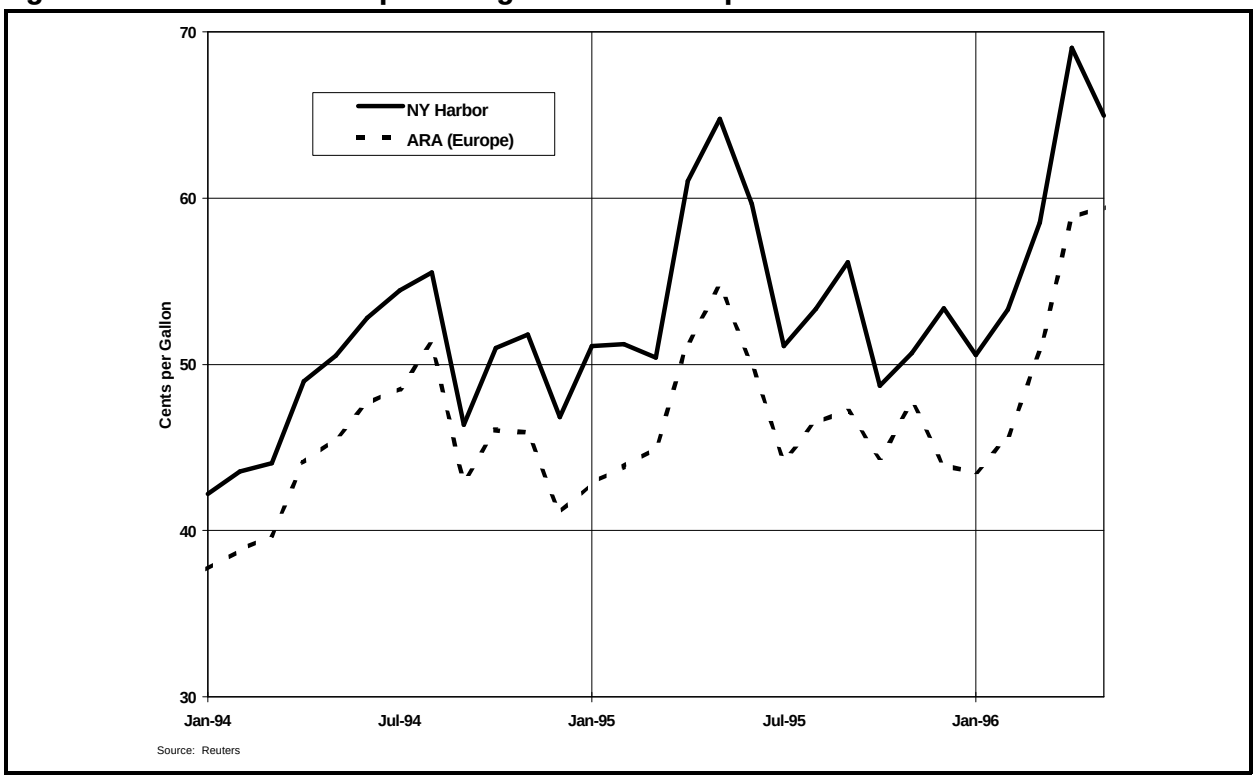


Figure 2.2 U.S. and European Regular Gasoline Spot Prices



market economies and Eastern European economies are sometimes also considered as a group, but most volumes, major trading, and pricing information centers around the first three areas. The largest producers in 1994, on the other hand, were Saudi Arabia, the United States, and the former Soviet Union, followed by Iran, China, Mexico and Venezuela.

Although the largest consuming areas prior to the 1990's were North America and Europe, the highest growth today is in the developing countries -- particularly in Asia. As a result, Asia and Australia as a region exceeded European consumption in the 1990's. The growing petroleum needs of developing countries will become more important to crude oil markets in the future.

Table 2.1 World Refinery Throughputs Compared to Crude Oil Imports in 1994
(Thousand Barrels Per Day)

	Crude Oil Imports	Percent of World Imports	Refinery Throughputs	Percent of World Throughputs
United States	7,027	25%	13,870	22%
Canada	613	2%	1,570	3%
Mexico	-	-	1,605	3%
South & Central America	1,205	4%	4,915	8%
Western Europe	8,117	29%	13,015	21%
Eastern Europe	524	2%	6,170	10%
Middle East	120	-	5,155	8%
Africa	557	2%	2,410	4%
Australia & Asia	4,429	15%	7,115	11%
China	247	1%	2,525	4%
Japan	4,667	17%	4,165	7%
Other	120	-	-	-
Total World	27,625	100%	62,515	100%

Source: British Petroleum Statistical Review of World Energy, June 1995.

Crude oil flows to serve the consuming areas are shown in Table 2.1. While the United States produces about 22 percent of world oil products, it imports about 25 percent of world crude oil flows (total world imports). Western Europe, in comparison, produces about 21 percent of world products, but imports about 29 percent of world crude oil flows. Japan, alone, uses 17 percent of the world crude oil flows. Thus, there are a number of large players in the international crude oil markets, competing for the crude oil that is traded and helping drive prices.

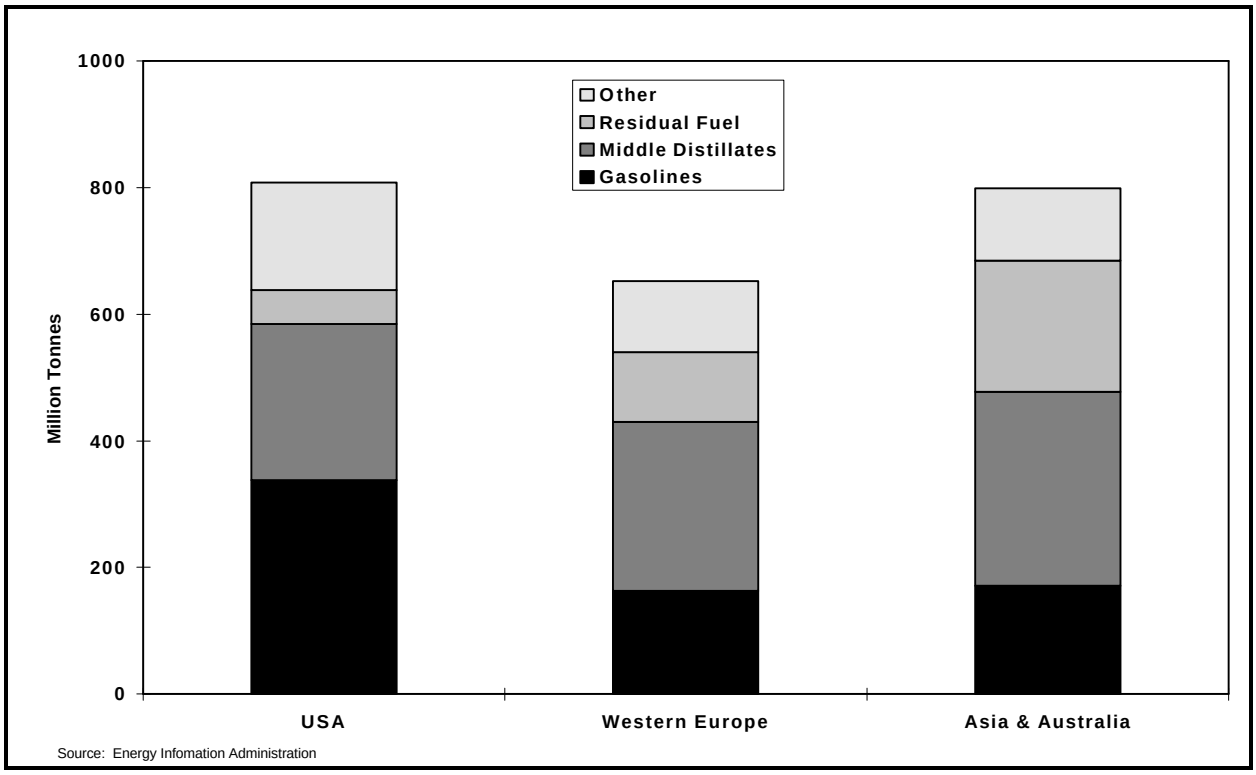
Different consuming regions of the world have different petroleum product demand patterns. Of particular interest to price increases in 1996 is the use of gasoline versus middle distillates. The demand pattern for the United States is different than for the rest of the world (Figure 2.3). The United States is unique in its heavy use of gasoline. Middle distillates (including heating oil and diesel fuel) are the principal products consumed in most countries. The world's primary dependence on distillates affects the seasonal pattern of crude oil demand. World oil demand peaks in the winter (fourth and first quarters), while oil demand in the United States is much flatter throughout the year due to its high summer gasoline needs. Crude oil demands by U.S. refiners actually peak during the summer, while the rest of the world's crude oil demand falls. This year, a late winter cold spell in both Europe and the United States generated greater than normal demand for crude oil late in the winter season. Normally, Europe's crude oil use falls off in the second quarter as winter ends, while U.S. demand picks up.

2.1.2 What Affects Crude Oil Prices

As in all commodity markets, crude oil prices respond to the basic market fundamentals underlying the crude oil supply / demand balance. For example, when little or no excess short-term supply exists to respond to demand, markets tighten, producing upward pressure on prices. When consumption exceeds production, world oil stocks are drawn down, and when production exceeds consumption, stocks build.

Stocks are a closely watched barometer of market balance or tightness. Stock changes reflect imbalances in production and demand and signal when supplies might be growing short relative to

Figure 2.3 1994 Different World Product Demand Slates



Source: Energy Infomation Administration

demand. When stocks are low and falling (i.e., demand is greater than production), market participants worry that production levels may not catch up to demand, and stocks may reach minimum permissible levels. Uncertainty over near-term perceived adequacy of supply tends to generate upward price pressure, as participants secure added supplies as a precaution to expected tightness and rising prices. Oil stocks serve several roles in addition to meeting swings in demand. For example, some minimum level of stocks is needed to keep crude oil flowing from producing fields to refineries. Much crude oil moves in "batches" worldwide, and storage must exist to deal with these batches. Ports receiving crude oil from larger crude oil tankers must have adequate tankage available to store the tanker's cargo as it is unloaded. Refiners may then move some of the crude oil from the destination port to tanks at their facilities. Pipeline fill is required to keep the system moving, even though the crude oil is not available until it comes out the other end of the pipe and is put into tanks accessible by refiners. All the while the crude oil is traveling, it is counted as stocks, even though it is not available for use much of the way.

In addition to these minimum working volumes, some governments store strategic stocks, such as in the case of the Strategic Petroleum Reserve, and/or mandate that companies keep certain stocks on hand for emergencies. These stocks are generally not available to the market on a regular basis. Discretionary stocks are those stocks in the hands of industry that serve uses such as capturing over-production and serving seasonal and unexpected demand swings. Crude oil producers may also have oil stored on tankers waiting for buyers. This level of discretionary stocks is not well defined, and is mainly deduced from historical swings in stocks and knowledge of government strategic reserves. Thus, when stocks are falling, the market may respond strongly even though stock levels are far from zero, as market concern that stocks may be approaching their minimum working (non-discretionary) levels rises.

When stocks are low, less supply is readily available to respond to unexpected changes in demand. This leaves markets jittery, and any problems in supply may generate rising prices as buyers rush to obtain supplies they perceive may be short. Increasing prices attract new supplies, resolving the problem; however, for a short period of time, a region can experience a price surge. The lack of stock "cushion" increases the risk of price runups during periods of low stocks, but does not cause them. The fundamental cause of market-stress price runups is actual or perceived supply/demand imbalances. The market recognizes the inability of low stocks to meet the shortfall, and incremental, precautionary buying increases on top of the excess demand, driving prices up rapidly.

Discretionary stock levels are also affected by price expectations, as reflected in futures markets. If crude oil purchasers think that prices will rise in the near term, futures prices are higher in the out months than current prices. During such times, crude oil purchasers will build stocks with currently "cheap" crude oil, knowing they can produce product tomorrow to sell at higher prices. On the other hand, if futures prices are lower in out months than current prices (referred to as market backwardation), crude oil purchasers do not want to be using expensive inventory at today's higher prices in producing product that must be sold tomorrow at lower prices. In this case, oil inventory would be drawn down and kept at a low level until prices dropped. Market backwardation appears to have had an influence on stocks recently, and is a factor in the crude oil price increases.

Another important element of the crude oil market that signals potential price pressures is the relationship of OPEC production levels to the "call" on OPEC crude oil. OPEC plays a significant role in determining the amount of available short-term supply. In evaluating crude oil price pressures, potential excess supply from OPEC production can be a factor. To maintain prices when

demand changes, some producers need to adjust production levels. OPEC has generally tried to perform this function. OPEC includes the only producers that do not produce near their maximum levels; however, some members tend to produce at their maximum despite agreed-upon quotas set by the organization to keep prices from falling. Thus, the potential OPEC production level relative to the call on OPEC crude oil is an indicator of market balance and crude oil price pressures.

Demand for OPEC crude oil varies both as function of world demand and non-OPEC supply. When demand for OPEC crude oil is high, the market tends to support higher prices. When demand for OPEC crude oil falls off, OPEC production does not always follow suit, creating downward pressure on prices due to oversupply. Over the past ten years, oversupply and weak crude oil prices have been reversed as a result of demand growth more often than as a result of OPEC lowering its production.

Together, the supply / demand balance with its stock barometer and actual OPEC production levels relative to the call on OPEC crude oil serve to indicate whether the crude oil market may tighten, putting upward pressure on prices. These factors were all important this past winter and through the early spring in explaining crude oil price increases.[7]

2.2 World Demand Has Been Strong In Recent Years

An important factor in tightening crude oil markets was strong world demand. Strong demand alone does not determine whether or not a market is tight. It is only demand in conjunction with supply[8] that allows for that determination. Upward pressure on prices increases during extended periods when demand is growing faster than supply. This was the case this past winter, setting the stage for the late-February-through-April crude oil price increases.

2.2.1 World Demand for Oil the Past Five Years

Demand stagnated in the early 1990's as the world experienced another recession, but by the end of 1993, world economies were improving and increased demand followed, growing robustly in 1994 and 1995. Average daily consumption rates since 1993 have been rising by about 1.6 million barrels per day each year (up 2.0 percent in 1995).

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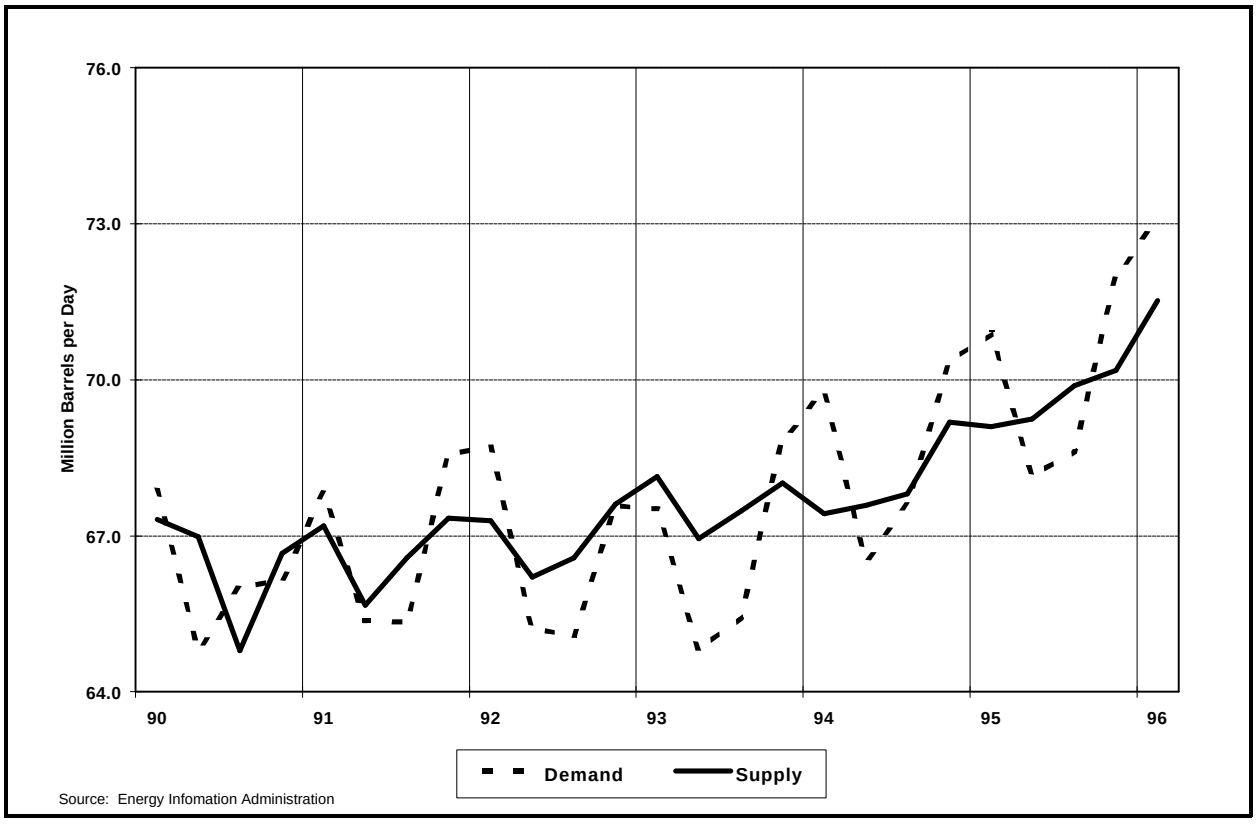
[7] In the context of a general discussion of market determination of oil prices, an informal EIA investigation showed some mixed evidence of seasonality in crude oil prices relevant to the U.S. market. Using the Commerce Department's X-ll deseasonalization routine on monthly average WTI and refiner acquisition costs of crude oil, the seasonality observed was small (varying $1 to $1.50 from the trend), and not particularly stable over time. For example, seasonal highs seem to be more prominent in the spring and summer in recent years, compared to winter and early fall months prior to the late 1980's. Using a naive statistical model, seasonal factors are not statistically significant as explanatory variables. It would not be surprising that some of the seasonal characteristics of major petroleum product markets spilled over into crude oil markets, and further investigation of the particular nature of the observable links would probably yield additional useful insights into world oil market behavior.

[8] The world oil market balances use the term supply to include production of crude oil and natural gas liquids. In general, supply in this context does not equal demand. The difference is a build or draw in stocks. Thus, when supply is less than demand, stocks must be falling. This definition is in contrast to the term "product supplied" used in product market discussions. Product supplied does include stock changes.

Figure 2.4 illustrates the seasonal nature of world petroleum demand and its relationship to supply. During the winter, when distillate needs are high, world demand is highest. During the summer, world demand is relatively low. When demand exceeds supply, world stocks fall, and when the reverse occurs, stocks build.

Figure 2.4 World Petroleum Supply and Demand



2.2.2 World Demand Last Winter

Not only was demand high this past winter, it exceeded most forecasts for the period done only months before. For example, the November 1995 International Energy Agency report forecast first quarter 1996 demand for Europe and North America at 34.1 MMB/D, an estimated rise of 500 MB/D over the previous year. Actual demand was much higher, at 34.6 MMB/D, doubling the estimated increase, and making this past winter's demand rise one of the highest during the last five years. From the third quarter of 1995 through the first quarter of 1996, demand increased 4.1 MMB/D, compared with the 5-year average of 3.6 MMB/D. The cold winter of 1993-94 was similar, with an increase in demand of 4.4 MMB/D. This year's strength was attributed mainly to an extended winter for the Atlantic Basin, to continuing strong Asian economic growth leading to increasing petroleum needs, and to apparent stabilization of consumption in the former Soviet Union countries.

Unexpectedly strong world demand this past winter was an important element in growing tightness in the crude oil markets.

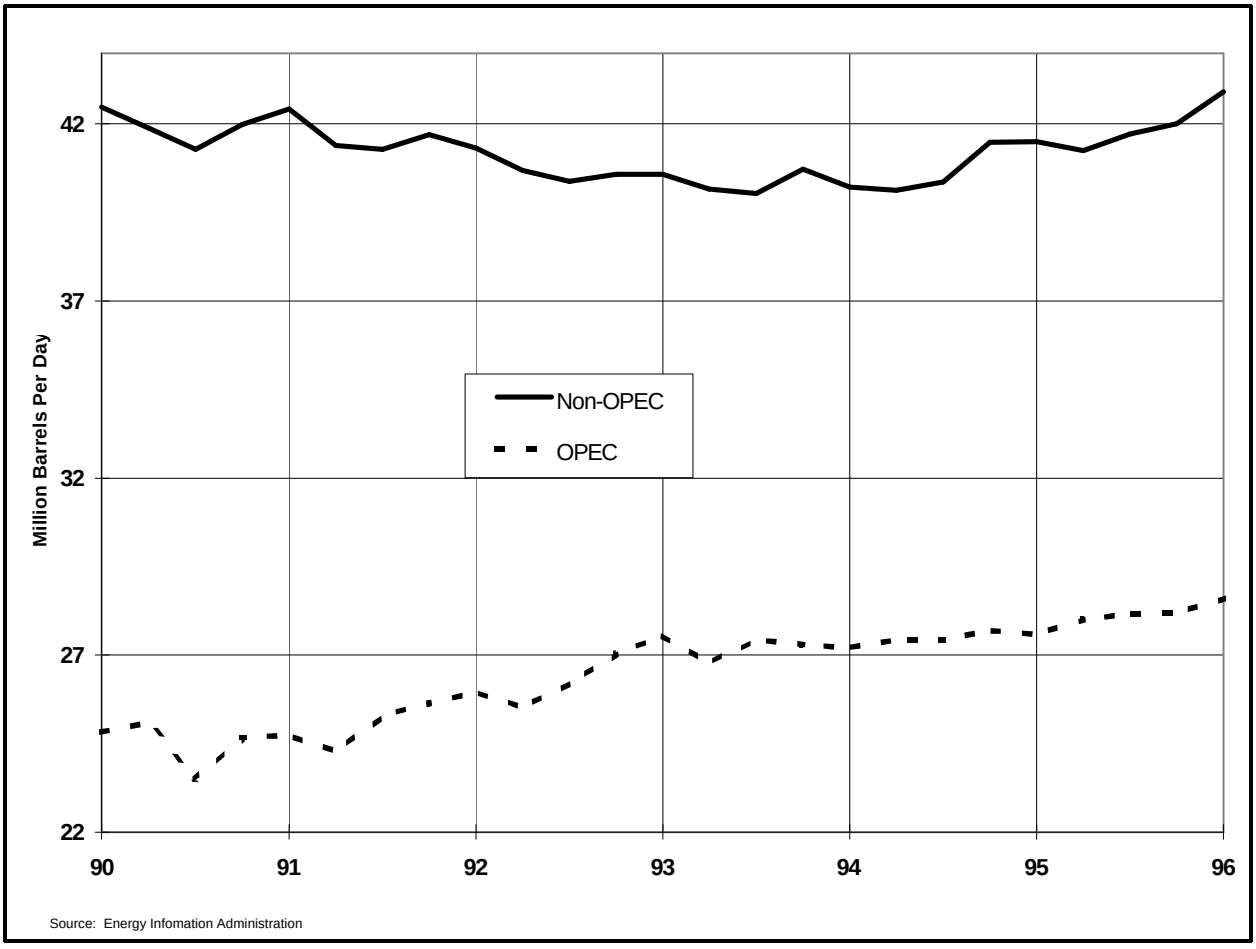
2.3 Crude Oil Supply Has Varied in Recent Years, But Was Short Last Winter

Supplies of crude oil relative to demand indicate the direction of pressure on prices. Supply has both exceeded and been less than demand at various times throughout the 1990's. This past winter, though, supplies fell short of what had been forecast to be available. When coupled with higher than expected demand, the market tightened strongly, as evidenced by high OPEC production together with some strengthening in crude oil prices.

2.3.1 Crude Oil Supply Overview During the Past Five Years

Although demand was fairly stagnant from 1990 into 1993, supply grew, increasing 1.2 MMB/D from 1990 to 1993 (Figure 2.5). OPEC gained share during this time, increasing 2.2 MMB/D, but non-OPEC supplies picked up at the end of 1994. From the third quarter of 1994 to the first quarter of 1996, total supplies grew 3.7 MMB/D, but OPEC only provided 1.2 MMB/D additional barrels to

Figure 2.5 OPEC and Non-OPEC Crude Oil Supply



supply. Even though OPEC lost share of the world market, the levels at which the organization was producing were near or over its self-imposed ceiling.

2.3.2 Recent Supply History

This past winter, world oil supply increased 1.6 MMB/D, but fell short of predictions. In early November 1995, the International Energy Agency predicted first quarter 1996 non-OPEC supply to be 43.9 MMB/D. Actual supply was 43.1 MMB/D, or 800 MB/D short of expectations. In addition, most of the shortfall came from bad weather conditions in the North Sea and the Gulf of Mexico, production areas located near two consuming areas in which consumption was higher than expected. While 800 MB/D is scarcely more than 1 percent of world supply, it can put significant pressure on prices in a tight market since the shortfall must be made up from fewer available options. During the first three months of 1996, OPEC was able to produce crude oil at 25.9, 26.0 and 26.1 MMB/D, compared to its quota of 24.5 MMB/D. In March, when crude oil prices were increasing dramatically, OPEC's supply increase probably kept prices from climbing even further.[9]

2.4 World Crude Oil Balance Tightened, Setting Stage for Price Increases

The balance between crude oil supply and demand ultimately determines the direction of crude oil prices. Was it high worldwide demand over the past six months that drove up crude oil prices from February through April, or was it the shortage of expected non-OPEC supply? The answer is that both factors combined to tighten the balance between supply and demand enough to push prices up.

Last fall, with expectations of growing supply to offset strong demand, world stocks were not a subject of significant attention. However, widespread, sustained winter weather served both to reduce some of the anticipated supply and to boost winter demand above expectations. Demand significantly surpassed production, even with increased OPEC output, resulting in a very large drop in OECD stocks (Figure 2.6). The drop of 251 MMB was the largest in the past five years, with the next largest drop being 188 MMB that occurred in the cold winter of 1993-94. With OPEC producing well above its self-imposed ceiling, and demand still outpacing supply, markets tightened. WTI prices rose from $17.43 in October to over $19 in December. Prices averaged close to $19 per barrel until March, when a late cold spell increased demand unexpectedly, providing the final boost to crude oil prices seen in March and April.

While the oil supply/demand fundamentals tightened, building or even holding stocks steady was discouraged throughout the winter and spring due to market backwardation (expectation of price declines). Market backwardation stemmed from the combination of prompt-month (near-term) strength, and the anticipation of increasing OPEC and non-OPEC supplies, as well as the eventual seasonal weakening of demand in the spring and summer. The expectation of softening prices was further strengthened in late January, as the potential for Iraq's return to the market seemingly increased with the scheduling of the initial round of U.N./Iraq discussions on limited oil sales to be held in early February.

[9]Energy Market Report, Crude Oil & Products, *Energy Economist*, April 1996.

When a late cold wave affected both Europe and the United States, demand for crude oil surged in late February, March, and April, but stocks were already low worldwide. More buyers than usual were in the market purchasing crude oil for immediate consumption, which created added pressure, driving prices up to an April average of $23.50 per barrel.

2.4.1 Historical Crude Oil Price Behavior

Supply / demand fundamentals go a long way toward explaining crude oil price behavior over the last five years. The Persian Gulf War was an example of extreme supply concerns relative to demand and the effect on price (Figure 2.1). However, the opposite situation occurred late in 1992 and through most of 1993. Supply stayed in excess of demand throughout the winter of 1992-93, unlike most other years (Figure 2.4). Demand was stagnant due to a recession, but supply grew. This period of over-supply was accompanied by crude oil price declines. WTI fell from about $22 in June of 1992 to under $15 in December, 1993. From December of 1993 through March of 1994, WTI hovered at or below $15 per barrel. Meanwhile, demand had picked up at the end of 1993 and was growing strongly, helped by the cold winter of 1993 / 94. Soon excess supply was consumed, and prices started to rise. From March to July of 1994, crude oil prices increased about $5, similar to the increase seen in February and March this year. However, from the consumers' perspective, the increase in 1994 was softened relative to the recent increase because of the very low starting point, and because it took four months to achieve, instead of two.

Figure 2.6 OECD Stocks

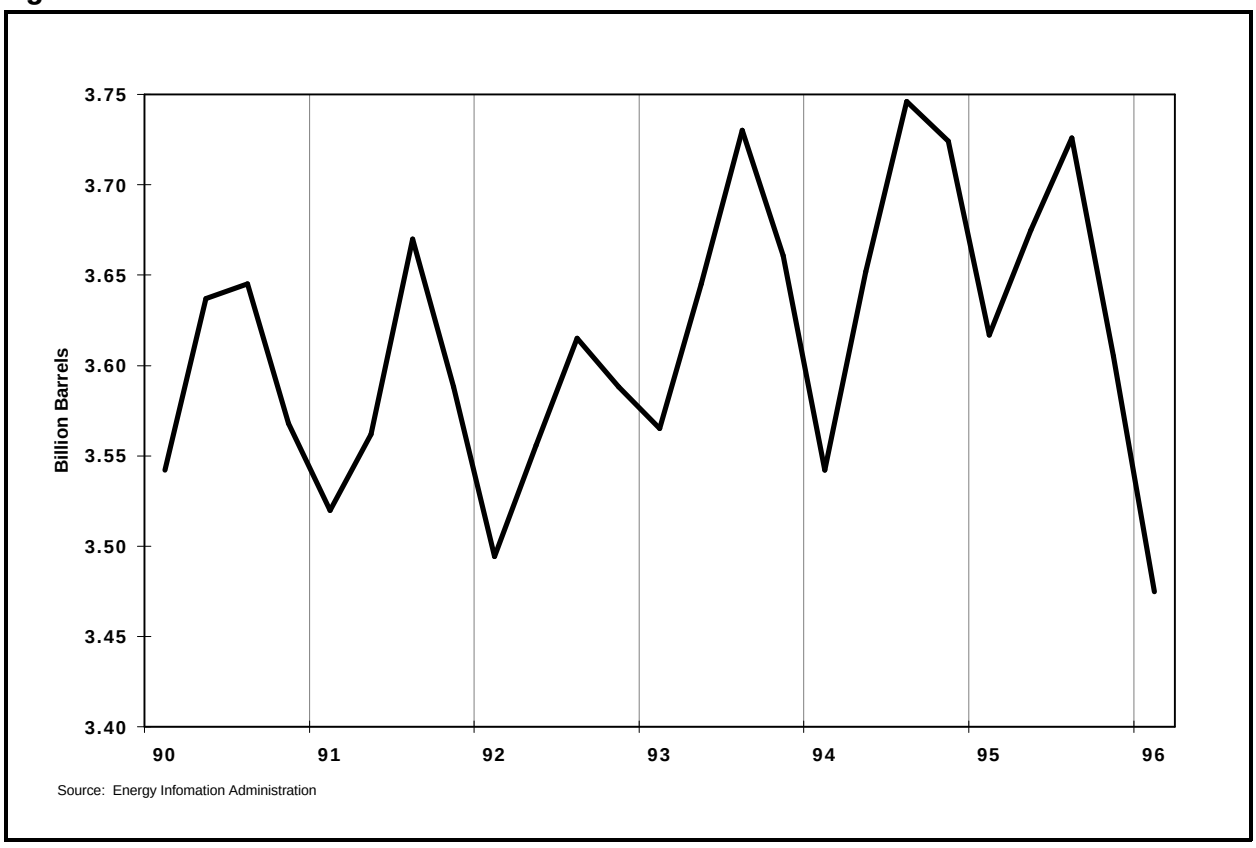
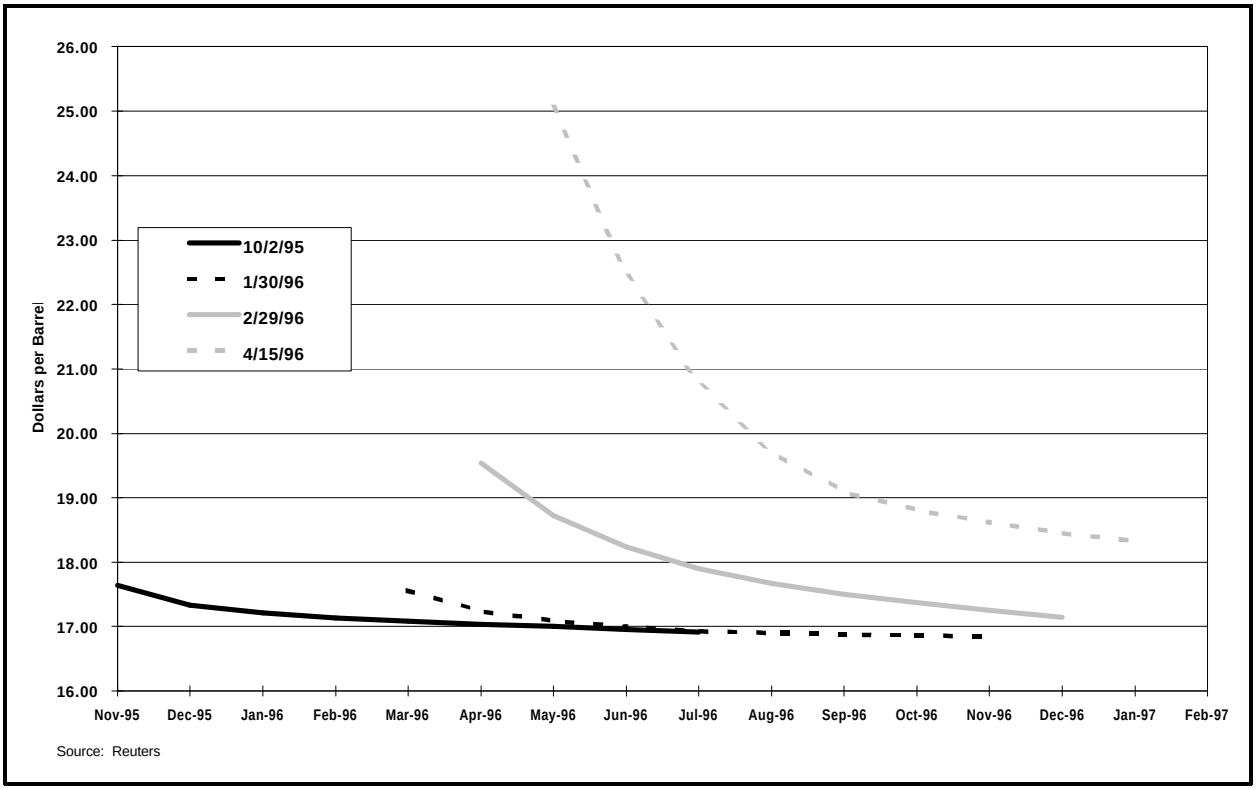


Figure 2.7 Selected WTI Futures Prices



Since July of 1994, crude oil prices have fluctuated by several dollars per barrel. Over the summer of 1995, they had softened as demand weakened with plenty of supply. By October, WTI had fallen to an average of $17.43.

2.4.2 Recent Price Increases

As last summer was ending, the general consensus was that supplies would be ample for winter. In the United States, crude oil inventories were low. They had dropped below their historic low range in June, and were even further from the historic low range by the end of August. However, markets showed little reaction, as evidenced by low prices. Global stocks were sound, and the trade press reflected the absence of fear of tight supplies in the foreseeable future.[10] Thus, the risk of having to rely on spot barrels instead of stocks to a somewhat larger extent was perceived as higher, but nevertheless, insignificant.

[10]"Marketview -- Backwardation: You Say Bullish, They Say Bearish," *Petroleum Intelligence Weekly* (August 21, 1995), p. 6.

By the end of October, market fundamentals were giving signs that perhaps the forecasts may have been wrong.[11] Initial estimates of global stocks suggested that September stocks may have declined, in contrast with earlier estimates of supply and demand that indicated they should have grown. In addition, Hurricane Roxanne had reduced Mexican crude oil exports by a total of over 25 MMB, and the start-up of Norway's Heidrun field was delayed, reducing expected supply. Soon after, cold weather began to increase demand and cause further losses of non-OPEC production.

Prices strengthened through December, averaging over $19 per barrel for the month. Although the near-term supply/demand balance was tight, the market anticipated that a lot of non-OPEC supply would soon enter the market, and likely would depress prices. In the meantime, strong demand was forcing crude oil-short refiners into the spot market to meet their needs, creating upward pressure on near-term prices relative to futures prices in the out months. This further reduced incentives for crude oil purchasers to build inventories. Backwardation in the futures market was growing (i.e., becoming steeper with an increasing difference between current and future prices) (Figure 2.7). Then, in January 1996, the United Nations and Iraq began discussions on limited Iraqi crude oil sales for humanitarian purposes. OPEC had increased production in January, and further increases were being expected throughout the year ahead apart from Iraq as various members were increasing capacity, but non-OPEC supply growth was still expected to meet all the forecast demand growth in 1996. The potential return of Iraq, which would further increase supply, heightened expectation of lower prices in the coming months. Backwardation in the futures market persisted as the news of increasing supplies continued.

The final straw in the crude oil markets was a late season cold wave that affected both Europe and the United States. Normally the crude oil volumes needed diminish in early spring, but the cold weather caught both Europe and the United States with low stocks following the peak winter months' abnormal drawdowns. Crude oil use usually increases in the spring in the United States, but not in Europe. Having both of these huge consuming areas increasing their spot purchases to meet last minute cold weather demand gave crude oil the extra push up through April.

Finally in mid-April, as cold weather subsided and demand for crude oil began to fall back, prices began to weaken. Shortly thereafter, on April 29, President Clinton announced the expedited release of 12 MMB of crude oil from the Strategic Petroleum Reserve, which contributed to an additional short-term decline of $1.60 per barrel. The signing of the U.N.-Iraqi agreement, adding 700 MB/D, ended uncertainty over extra supplies. The additional 700 MMB/D, while small, is expected to contribute to easing market pressures this summer. While some inventory building may keep prices from plummeting, there is little expectation that prices will increase.

In summary, crude oil price increases began early last winter, when higher-than-anticipated demand and lower-than-expected supply tightened crude oil markets. While prices only rose several dollars over the peak winter period, stocks were low worldwide as the season was ending. Backwardation

[11] "Global Stockbuild Slows as Autumn Arrives," *Petroleum Intelligence Weekly* (October 23, 1995), p. 11.

in crude oil markets had grown and persisted as the market expected increases in non-OPEC supply and potential sales of Iraqi crude oil to create a substantial supply surplus during the summer months, when crude oil demand normally falls worldwide. Even early in the winter, expectations for new supplies that would depress prices provided disincentives for building inventories. When a late cold spell hit both Europe and the United States, these two large consuming areas entered spot markets to meet the surge in demand. Both areas were left with low stocks after the high peak winter demand, leaving little alternative other than spot markets to get added crude oil supplies. Normally crude oil markets would be declining in early spring, but this surge in crude oil demand following a tight winter sustained and added enough pressure to push prices up in March and April.

3. Gasoline Market Fundamentals and Normal Price Behavior

While crude oil prices explain much variation in gasoline prices, the resale spread (resale price minus crude oil price) also plays an important role. Resale spread captures the refiners' processing costs and profit margins, and changes in resale spread provide an incentive for refiners to alter behavior. This component has a strong seasonal pattern and gives gasoline prices seasonal characteristics that are evident in years when crude oil price changes do not counter the seasonal pattern. The seasonal pattern in the spread derives from the seasonal patterns behind gasoline demand and refinery production.

The issue underlying the 1996 price increases is one of short-term price variation. In the long term, refiners must be able to cover the costs of producing petroleum products, or they will go out of business. But in the short term, refiners may absorb losses or receive higher-than-average profits depending on what is occurring in the marketplace. Investigation of the resale spread variation in 1996 will help us to determine if refiners benefitted unusually from the recent price increase.

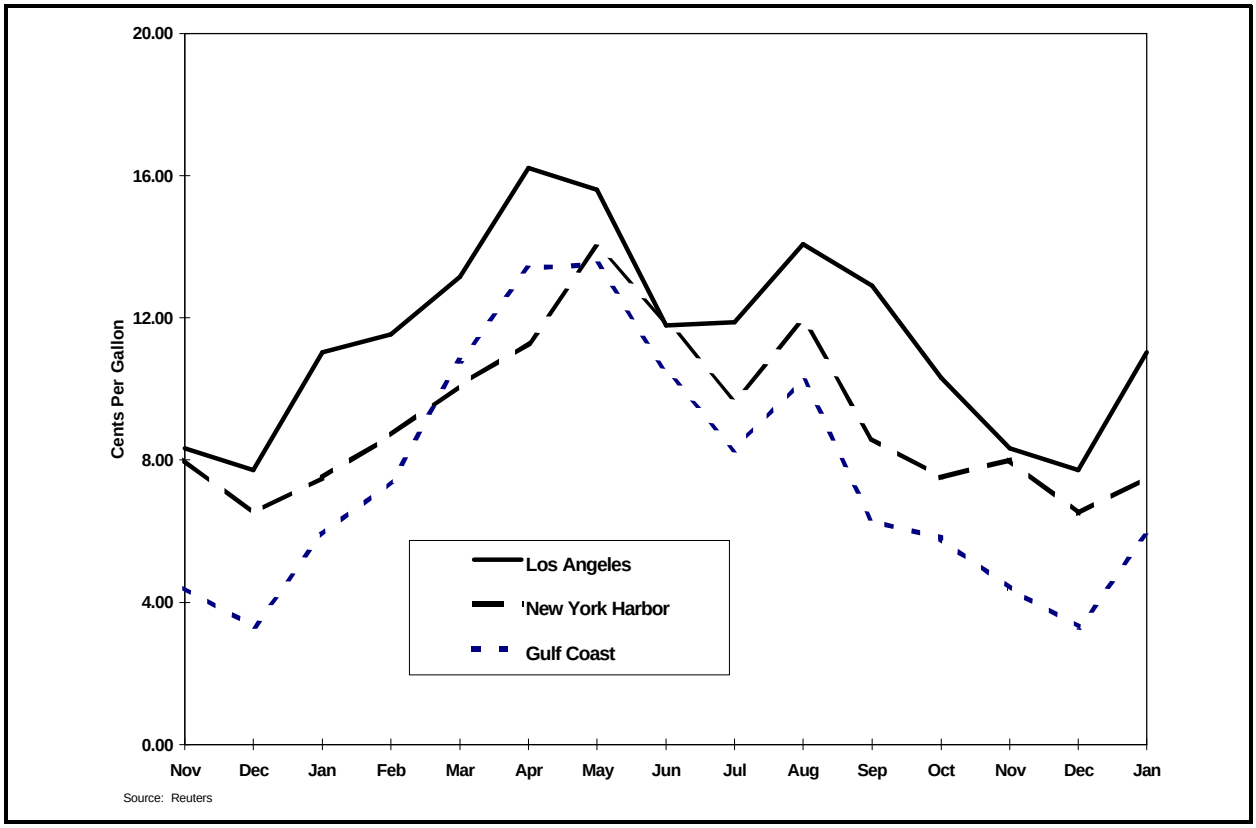
Before looking at what happened in 1996 in Chapter 4, this chapter will describe normal seasonal patterns in the gasoline market and why they exist. It will also show how retail prices lag behind resale price changes, which consumers notice most when retail prices remain elevated even after resale prices have begun to decline. Armed with an understanding of typical seasonal price variations discussed in Chapter 3, Chapter 4 will investigate how 1996 differed from normal patterns, and what impact this may have had on prices.

3.1 Resale Spread: The Seasonal Component of Price

Both spot and refiners' resale prices can be used to investigate changes that occur at the resale level of the petroleum business. (See Sidebars on Market Structure and Different Gasoline Prices.) Resale price (sometimes called wholesale price) contains some additional terminal and storage costs not captured in the spot price. When crude oil cost is removed from these prices, the resale spread that remains covers the refiners' processing costs and profit contributions or margins. As a result, both spot and resale spreads represent the incentives refiners have to change behavior when the price changes.

Spot price spreads are good barometers of market pressures. Spot prices rise and fall daily based on information and expectations regarding changes in underlying crude oil costs and product supply-

Figure 3.1 Five-Year-Average Spot Gasoline Spreads (Spot Regular Conventional Minus West Texas Intermediate)



demand balance. On a monthly average basis, spot spreads lead resale spreads slightly.[12]

Spot and resale spreads tend to be low in the winter and high in the summer (Figures 3.1 and 3.2), although in any one year, the actual spread can vary from the normal pattern. Normally spreads vary regionally somewhat in the magnitude of change from their low to high points, but the patterns are still similar, as shown in the spot spreads of Figure 3.1 representing three major regions of the country. Beginning at a low point in December, the resale spreads increase through April or May. They then decline until August, when vacation surges in demand coupled with low gasoline stocks at the end of the driving season cause a slight jump in the spreads before they begin their descent through the fall and early winter.

[12] One EIA analysis showed that resale spreads, while appearing to move up and down less than spot spreads, pick up the majority of spot spread variations, but over a three month period. A 1-cent-per-gallon increase in spot spread is accompanied by an immediate 0.5 cent increase in resale spread if other factors such as crude oil price do not change. In the next month, the resale spread gets another 0.2 cent-per-gallon boost from the same spot spread increase, and over 3 months, a total of 0.9 cents of the 1 cent per gallon increase is reflected in the resale spreads. (See Zyren, John, "What Drives Gasoline Prices," *Petroleum Marketing Monthly*, Energy Information Administration (Washington, DC, June 1995), p. xvi.)

Figure 3.1 shows that historically spot spreads typically increase by 5 to 10 cents per gallon between December and their peaks in April or May. Resale spreads generally do not increase quite as much as spot spreads. Typical U.S. average resale seasonal increases are about 6 cents per gallon.

The seasonal pattern in resale and spot spreads corresponds with the cyclical tightening and loosening of the supply and demand balance of gasoline. The genesis of this cyclical supply / demand balance is the seasonal demand patterns of two petroleum products -- gasoline and distillate (heating oil and diesel fuel) -- and how refiners meet both of these demands with a system that co-produces both products at all times.

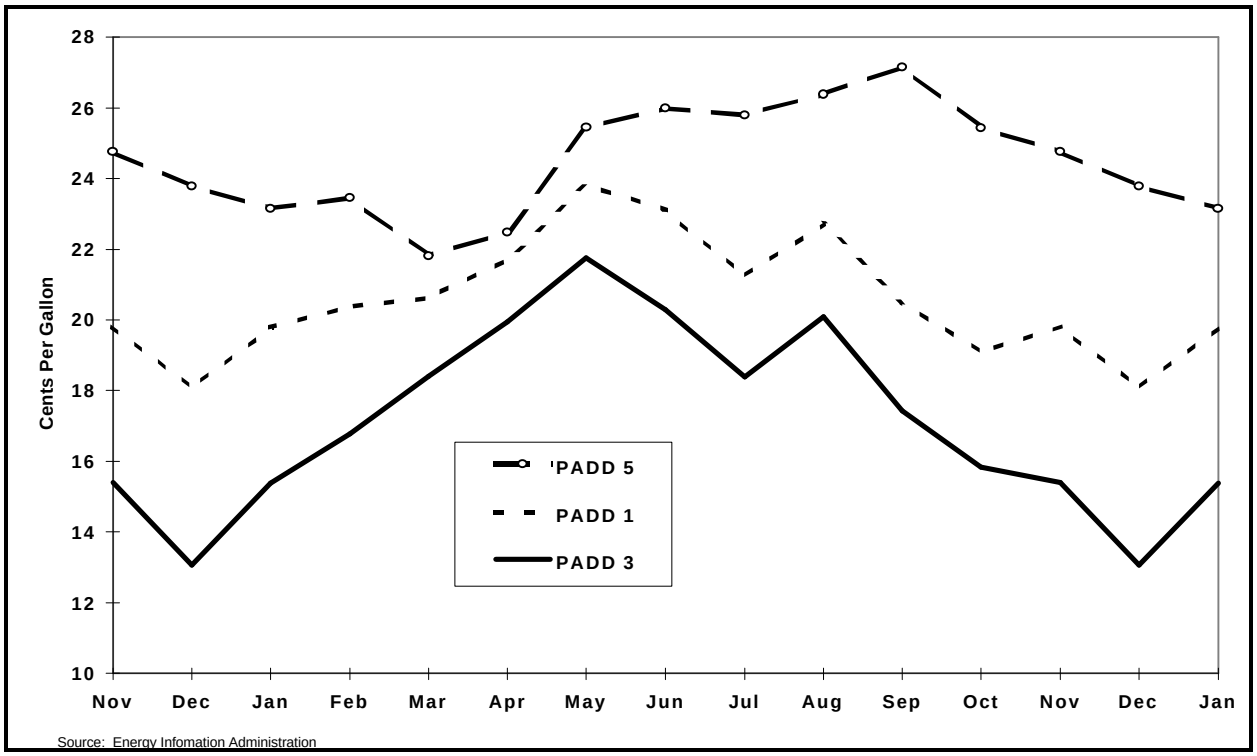
3.2. Seasonality in Supply and Demand

3.2.1 Gasoline Seasonality Ties to Distillate Seasonality

Distillate fuels (primarily heating oil and diesel fuel) and gasoline comprise the majority of a refiners' output and margin, but their production is not independent. The fundamental reason for seasonality in gasoline prices stems from the need for refiners to meet the seasonal demands of these two primary products from a system limited in its capability to control volumes of both products simultaneously. Needless to say, distillate also exhibits strong price seasonality.

The remainder of this section will discuss the interplay between gasoline and distillate that create the normal seasonal price variations in gasoline.

Figure 3.2 Five-Year-Average Resale Spreads (Resale Price less Refiners' Imported Crude Cost)



3.2.2 Seasonality in Demand, Production and Stocks

Demand: Distillate and gasoline product demands, while highly seasonal, are counter-cyclical (Figure 3.3). These demands are served from three sources of supply: production, stocks and imports.

Production: Refining is a process in which crude oil is made into an array of products, with gasoline and distillate products (heating oil, diesel, and jet fuel) accounting for 75-80 percent of the crude oil input volume. One set of refinery processes extracts the lighter portions of the crude oil barrel (materials with low boiling points) to make the gasoline and distillates, and a second set of processes converts much of the heavy portion of the crude oils (high boiling point materials) into lighter products. There are options for converting the heavy portion of crude oils: more expensive ones that give greater flexibility in the fraction of products that go to gasoline versus distillate, and less expensive processes that give very limited flexibility in the relative production fractions. Most U.S. refiners have opted for the latter, less costly processes with less yield flexibility (fluid catalytic cracking and coking).[13] The consequence is that on a month-to-month basis, refiners are not able to match their relative production with the changes in demand for both gasoline and distillate. Beyond that yield limit, the only way to make more of one product is to use more crude oil and over-produce the other product. The excess product is stored for sale in future months.

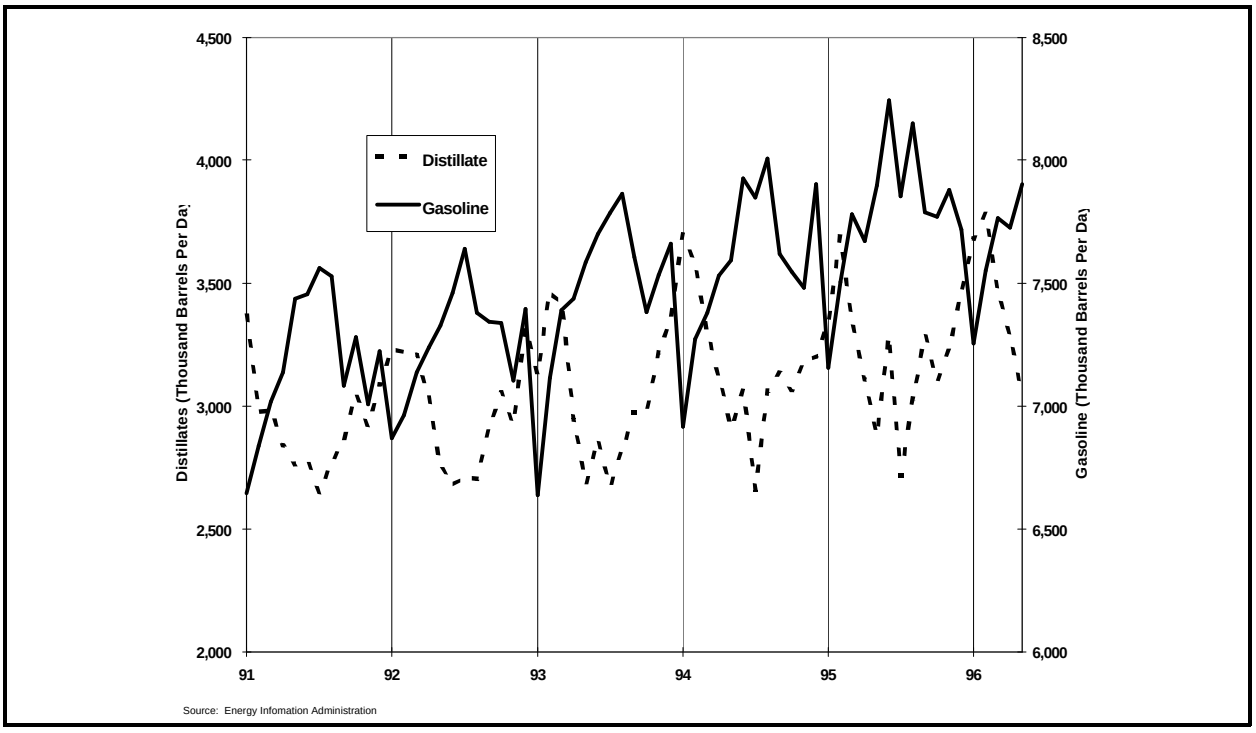
Stocks: Gasoline production does not follow exactly the increases and decreases in gasoline demand. While gasoline production is usually high in the summer to help meet the high demands, it does not drop back proportionally in the winter. Distillate demand is high during the winter months, and gasoline is co-produced with the high distillate production. Gasoline and distillate stock levels reflect the supply / demand volume imbalances that occur seasonally from this multi-product system, and thus also show strong seasonal patterns (Figure 3.4).

Figure 3.4 illustrates that distillate stocks, although smaller in overall level than gasoline stocks, swing more through a typical season. This is a consequence of distillate stocks being more important to meeting demand than gasoline stocks. On average, almost 12 percent of distillate demand during the peak demand months of December, January and February is met from stocks, while only 2 percent of summer peak gasoline demand (June, July, and August) is met with stocks.[14]

[13] Hydrocracking is a more versatile process than fluid catalytic cracking, both in terms of material that can be converted to lighter products and the control over the types of products produced. It is also a more expensive process. The United States has 4.6 MMB / D of fluid catalytic cracking (FCC) capacity versus 1.3 MMB / D of hydrocracking capacity. Most of the U.S. hydrocracking capacity is not used as an alternative to FCC, but rather as a complement to the FCC process, producing jet fuel and gasoline from distillate fuel oil, and processing the heaviest (high boiling point) portion of crude oil.

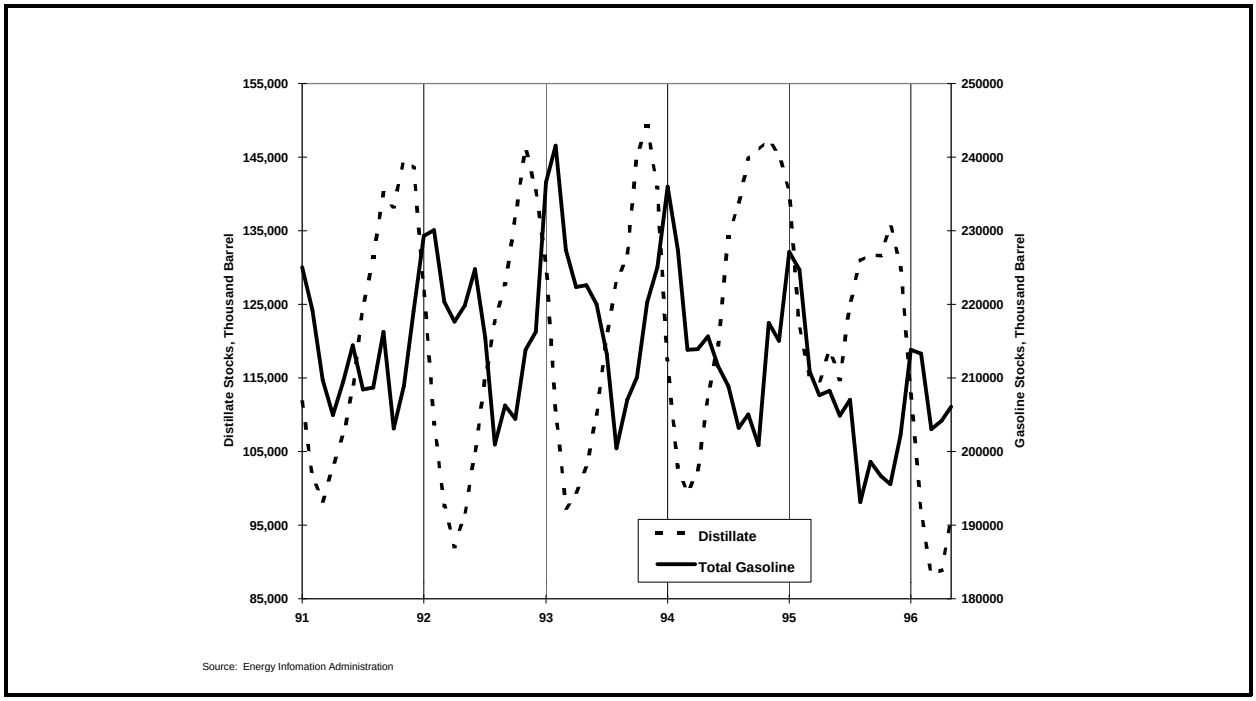
[14] Based on EIA data from 1991 through 1995.

Figure 3.3 Gasoline and Distillate Counter-Cyclical Demands



Source: Energy Infomation Administration

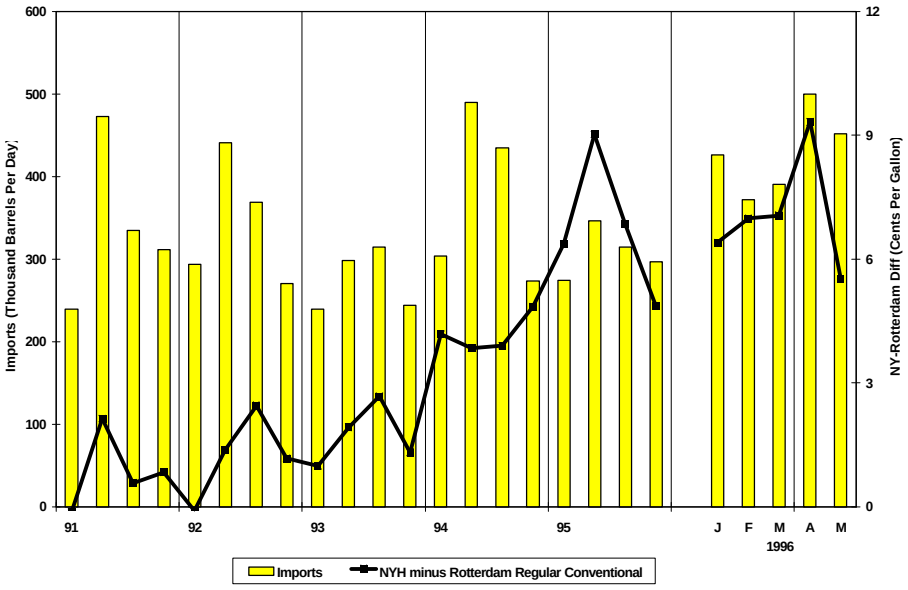
Figure 3.4 Seasonal Distillate and Gasoline Stock Patterns



Source: Energy Infomation Administration

In fact, it is not unusual for gasoline stocks to build in some summer months. As a result, a lack of build in gasoline stocks during the fall can be viewed differently than a shortfall in distillate stocks.

Figure 3.5 Gasoline Imports and New York-Rotterdam Price Differences



3.2.3 Imports

Gasoline imports supplement refinery production, but do not completely remove the seasonal volume imbalances. While the United States receives gasoline imports from the U.S. Virgin Islands and Canada on a regular basis, areas like Europe and Saudi Arabia are marginal suppliers, selling product to the United States when the economics are attractive (Table 3.1). Imports from the marginal suppliers generally increase in the second and third quarters as demand and gasoline spreads grow (Figure 3.5). However, volumes can vary significantly from year to year. For example, second quarter 1995 total gasoline imports averaged less than 350 MB/D, after approaching 500 MB/D in 1994.

A key factor influencing the economics of marginal imports from swing producers like Europe and Saudi Arabia is the difference in price between gasoline in Europe and in the United States. World markets experience the same underlying crude oil price changes, and prices in areas like Europe follow similar patterns to that of the United States (Figure 1.4). But refining costs and supply/demand balances can vary to create changes in the price relationships between regions.

The differences in prices between regions alone does not always predict higher imports. Last year, imports were low compared to imports in 1994, even though the trans-Atlantic price difference was quite large. Almost all of our gasoline imports go to the East Coast (PAD District 1), which is a primary reformulated gasoline (RFG) consuming region. U.S. production of RFG was adequate in

1995. Following "opt-outs" of a number of areas at the start of the Federal RFG program, demand was lower than expected, depressing RFG price relative to conventional gasoline price. Continued uncertainty during the summer over both prices and demand acted as a disincentive to foreign RFG producers, and low RFG imports kept the total gasoline import level down in 1995.

Worldwide availability of gasoline is high. Refinery capacity worldwide, as measured by distillation units, has been increasing, and the ability to produce gasoline has increased proportionately more as measured by the increases in capacity of the two major gasoline producing processes: fluid catalytic cracking (FCC) and reforming (Table 3.2).

Table 3.1 Gasoline Imports by Geographic Source (Thousand Barrels Per Day)

Source	1991	1992	1993	1994	1995	Jan 1996	Feb 1996	Mar 1996
Canada	67	61	54	48	62	73	94	76
Venezuela	48	52	40	31	28	28	33	23
Virgin Islands	44	41	50	113	102	121	79	100
Saudi Arabia	34	29	16	3	9	24	12	0
Europe	77	82	42	92	53	82	87	96
Other	27	30	45	69	11	16	0	14
Total	297	294	247	356	264	343	305	310

Source: Energy Information Administration, *Petroleum Supply Annual*, DOE/EIA-0340 (various issues) and *Petroleum Supply Monthly*, DOE/EIA-0109 (various issues).

Note: Totals may not equal sum of components due to independent rounding.

Table 3.2 Worldwide Refining Capacity (MMB/D)

	Distillation Unit	FCC Unit	Reforming Unit
Jan 1, 1993	73.2	10.9	9.2
Jan 1, 1996	74.5	12.7	10.9

Source: Worldwide Refining Special Issues, *Oil and Gas Journal*, December 21, 1992 and December 18, 1995, Pennwell Publishing Co., Tulsa, OK.

Generally utilization rates are lower in other world regions than in the United States. In fact, Europe has been reducing capacity because of low utilization rates.

3.2.4 Seasonal Supply/Demand Balance Impact on Gasoline Spread

The major features of seasonal variations in demand, supply and price are summarized in Table 3.3.

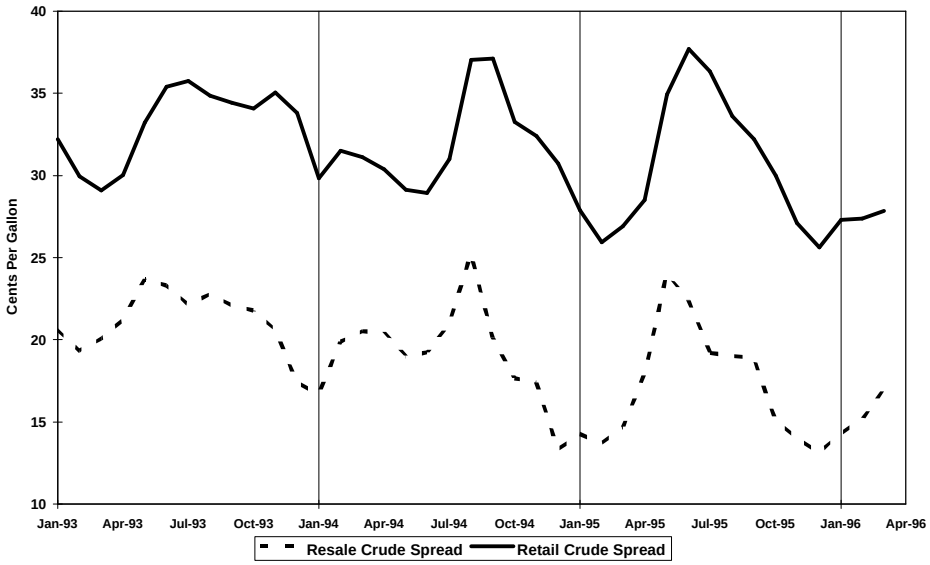
Table 3.3 Summary of Seasonal Gasoline Market Features

	Summer	Winter
Demand	High	Low (93% of summer peak months)
Production	High	Moderate
Stocks	Draw	Build
Imports	Base + Marginal	Base Only
Retail and Wholesale Spreads	High	Low

Figures 3.1 and 3.2 show average spot and resale spread patterns, which illustrate seasonal changes in the supply / demand balance over the year. Gasoline production usually exceeds demand in January, with excess production going to build stocks. During this time of excess supply relative to demand, spreads narrow. As the winter progresses, crude input to refineries is reduced, and both distillate and gasoline production fall. Excess gasoline stocks built over the winter begin to be drawn down in February, and when refineries are shut down for maintenance in March, stocks drop further. By the beginning of April, summer demand picks up. The market watches volumes closely during April as low stocks generally continue to fall and as refiners come back on stream after maintenance and shutdowns. Precautionary buying occurs during this tight market, prices are bid higher, and spot and resale spreads increase. Increasing spreads also may attract imports. Sometime in April or May, refiners are back to full production, imports are strong, and the market is in better balance. Prices recede and spreads drop back, only to jump again slightly in August before continuing their downward path to their December lows.

In their role as supply / demand balance barometer, stocks also provide a good indication of spread variations from the norm. In particular, low stock levels indicate increased risk of price volatility. Stocks are the most immediate supply source available to serve demand. Should any production or logistical disruptions occur, stocks are used to meet the shortfall. During the winter, when gasoline supply is well in excess of demand, low stocks are not a major concern. But if gasoline stocks are lower than normal during the high summer demand months, the market generally reacts strongly if a supply problem occurs. Buyers know when stocks are limited. If stocks are lower than normal during the summer, a supply disruption increases precautionary buying, which exacerbates the supply problem, thereby driving prices up sharply for short periods. However, this same price increase serves to draw supplies to the problem quickly, relieving the real or perceived shortage, and prices quickly retreat.

Figure 3.6 U.S. Resale and Retail Price Spread Over Crude



3.3 Prices Moving Through the System

Besides seasonality, the pace of price changes moving through the system from refineries to end users helps explain some of the timing of this year's gasoline price increase. Prices move through the system at different rates. Spot prices, which change minute to minute, seem to immediately reflect crude oil price changes and current perceptions of market tightness or looseness.

While refiners' resale prices also respond fairly quickly to crude oil cost changes, on a monthly basis, they tend to lag behind spot prices. Finally, retail prices experience a significant lag from resale price changes. The retail lag is due both to competition and to the way in which product works its way through the system to the consumer.

The following example illustrates how such a lag occurs. Consider two gas stations (Station A and Station B) that compete with each other and have different suppliers. Station A's supplier has incurred full average market cost increases and is charging a higher resale price to Station A. However, Station B's supplier is still running off cheaper inventory and has not raised resale rates yet. Neither station will experience any cost increase until they receive their next batch of product. Until the next batches are delivered, Station B is able to keep gasoline price unchanged, forcing Station A to either leave its price unchanged or lose market share. This competition tends to slow the wholesale cost pass-through to the consumer. However, eventually Station B experiences the higher costs, and prices increase. To continue, assume Station A's supplier again experiences the industry resale cost decline faster than Station B's supplier. Station A now receives a cheaper batch of gasoline than Station B, but Station A's tendency will be to lower prices only slightly as the station

tries to recoup some of the squeeze experienced when prices were increasing. Again, Station B will eventually receive cheaper product, and prices will continue to fall as the two stations try to gain or keep market share. Thus, retail prices generally lag behind wholesale price changes.

The lag of retail spread over crude oil price compared to resale spread over crude oil price can be seen in Figure 3.6 by comparing when the peaks occur. EIA's statistical analysis shows that monthly retail prices reflect about half of the resale price change in a given month, and half of the resale price change from the previous month.[15] Thus, in the month when wholesale prices fall, retail prices could stay level or even increase slightly during the month, depending on the size of the previous month's wholesale price increase and the current month's fall. Note that this may also explain why retail prices not only lag, but sometimes appear to decline more slowly than they increase. As markets ease, it is not unusual for the trend to be interrupted by brief upticks, which result in a mix of downward pressures from the previous month and upward changes in the current month.

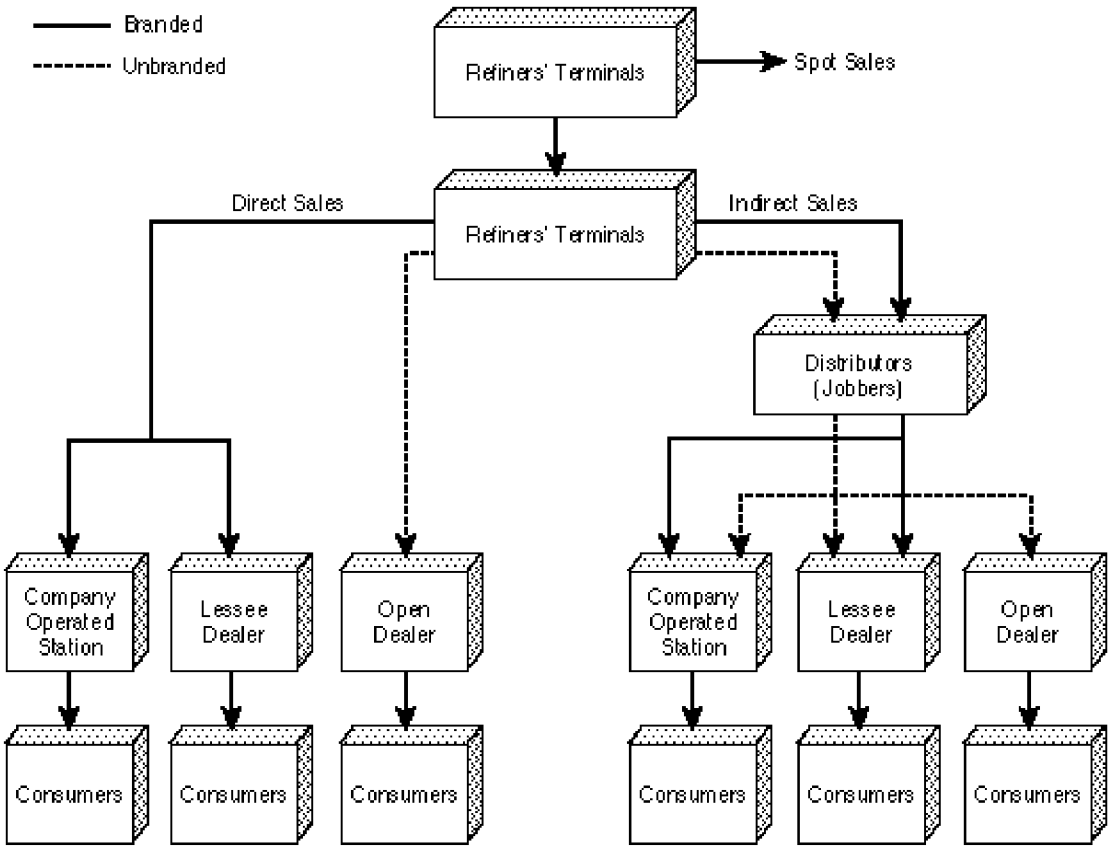
The result of the lag in retail behind resale is that retailers, on average, experience a squeeze as resale prices increase, but make up the difference when resale prices decline. The public is rarely aware of the squeeze on retailers when wholesale prices increase, but they read in the papers that wholesale prices are falling and wonder why retail prices are not following immediately.

[15]Zyren, John, "What Drives Gasoline Prices," *Petroleum Marketing Monthly*, Energy Information Administration, (Washington, D.C.: June 1995).

Market Structure

Gasoline travels through several different marketing channels to reach the end user. Refiners sell product from their own terminals to wholesale distributors (also referred to as jobbers) as well as directly to retail outlets. Both refiners and distributors may own retail outlets. Retail outlets include company owned and operated outlets, outlets run by an individual or organization that leases them from a refiner or distributor (lessee dealers), and outlets owned and run by individuals or organizations separate from the refiners or distributors (open dealers). Refiners sell branded product (i.e., product carrying their brand name) as well as unbranded (i.e., the generic label) into the market.[3] In addition, refiners sell product into the spot market when they have overproduced and have no storage for the product or when they see better opportunities selling uncommitted product than storing it.

Gasoline Market Channels



[3] General Accounting Office, *Energy Security and Policy, and Assessment of the Petroleum Industry* GAO/RCED-92-17, (Washington, D.C., March 1992), pp. 48-49, 50-55.

Different Gasoline Prices

Prices paid for gasoline follow the market structure shown in Figure 3.2. *Spot* transactions are sales of single cargoes, contractually uncommited, at a price agreed to by buyer and seller. They are a marginal source of supply, and, as such, indicate the competitive pressures on a daily basis. These markets are influenced by expectations and can vary significantly day to day. However, when averaged over a week or month, they provide good indications of refiners' resale price behavior, which is partially due to the direct consideration many wholesale contracts have to spot prices.

Refiners' resale prices include branded and unbranded rack and dealer tank wagon (DTW) prices. Generally branded product contracts carry some arrangement for security of supply, trademark, credit cards and advertising, and, as a result, bear a price premium for these services over unbranded prices. Rack prices refer to the wholesale price charged by refiners at their refineries or company terminals to open dealers and to distributors. Rack prices are usually determined on a daily basis and are based on competitors' prices as well as on spot and futures market prices. DTW prices are the prices charged by distributors and refiners to their retailers. These prices include transportation costs to the dealer's stations and other business costs (promotions, dealer incentives, etc.) beyond the basic rack price. Like rack prices, DTW prices are established considering competitors' prices, but also using spot or futures prices as a reference. Quoted DTW and rack prices, however, may be higher than prices actually paid due to rebate and discount programs offered by the suppliers.

What accounts for the differences among spot, unbranded rack, branded rack, and DTW varies over time. The price differences are not simply a function of the cost differences to provide product, but they vary with competition and market tightness. For example, major oil companies normally sell unbranded as well as branded product. If the market is tight, less unbranded rack volumes will be available, and the price difference between branded and unbranded rack will narrow. In fact, unbranded price may exceed branded rack. The gap between DTW and branded rack also will narrow and widen as markets tighten and loosen. The price differences among unbranded rack, branded rack, and DTW provide a good indication of tightness in the gasoline market.

Retail gasoline prices are the prices paid by the consumer. These prices include the wholesale price paid by the retail station, additional station operating costs and dealer margins, and taxes. Local competition is an important influence on retail prices. Consumers can find significant price variation within small geographic regions due to competitive differences alone. Changing competitive pressures over time result in changes in the difference between retail prices and wholesale prices as well.

4. Gasoline Markets in 1996

In addition to unusual prices, 1996 has seen some unusual gasoline supply / demand fundamentals, especially low stocks. Because market supply / demand fundamentals affect gasoline prices, as described in the previous chapter, they are essential to understanding the cause of this year's price increases. This chapter will review the supply / demand situation, then analyze gasoline resale and spot spreads in light of these fundamentals. The approach taken and described in this chapter is to a) review the supply and demand fundamentals underlying price movements; b) compare this year's spreads to average historical spreads to observe any unusual behavior compared to past normal behavior in light of the fundamentals; and c) use a statistical model developed for oil market forecasting to identify any unusual price behavior. The end of the chapter provides a description of what occurred in California this year, which is a unique situation that only minimally affected prices in the rest of the country.

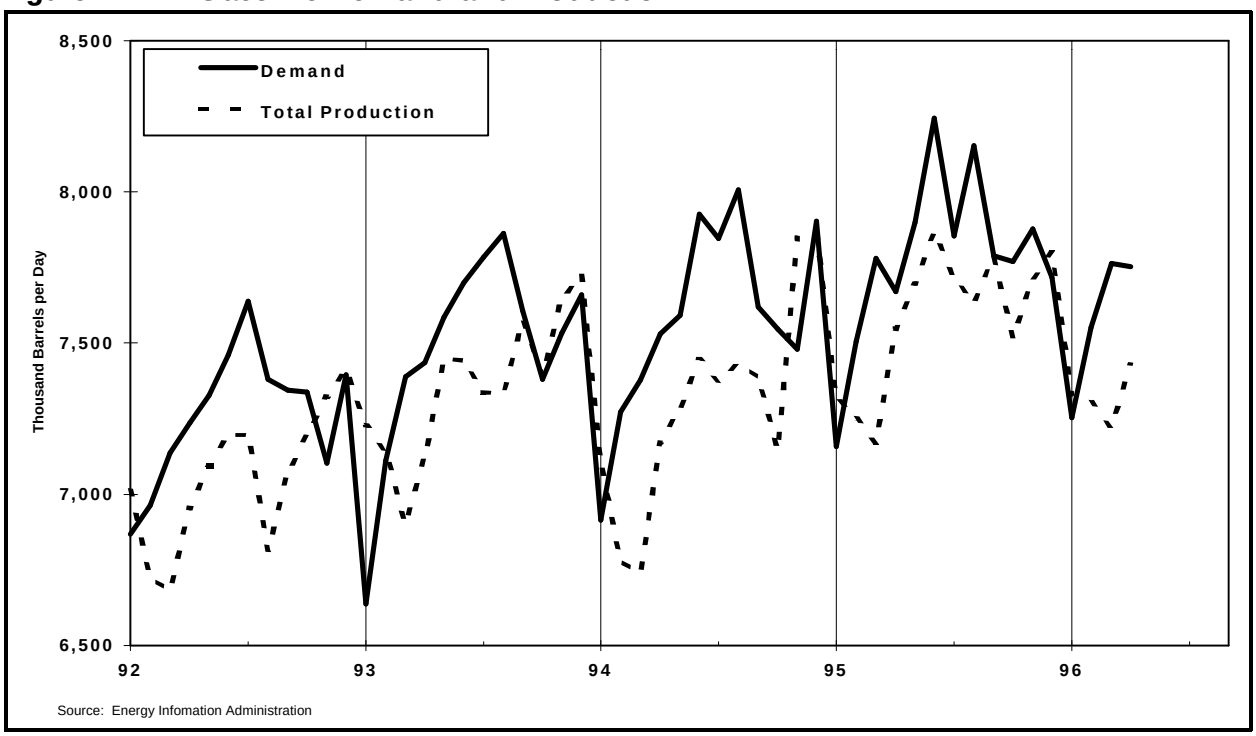
4.1 U.S. Gasoline Demand Has Been Strong

Gasoline demand has been growing strongly since 1992 (Figure 4.1), as a result of an increase in the number of drivers, along with a strong economy, resulting in an increase in the total miles driven. Overall fleet efficiency (measured in miles per gallon) has remained relatively flat. Strong gasoline demand growth is one of the factors helping to keep gasoline markets tight, which adds upward pressure to prices. First quarter demand this year, dampened by bad weather, is estimated at 7.5 million barrels per day, 0.6 percent higher than the first quarter last year. Demand began its seasonal increase this spring as the 1996 driving season got underway. Seasonal peak demand (June through August) typically adds another 400 MB / D, or about 5 percent, to off-peak consumption levels.

Gasoline is not a homogeneous product. The number of distinct types of gasoline has grown as new clean fuels emerge in response to both Federal and State requirements. Logistics have become more complex as a result of different gasoline types being required to serve specific geographic locations, and of the diminished fungibility due to the certification requirements for Federal reformulated gasoline (RFG) introduced last year.

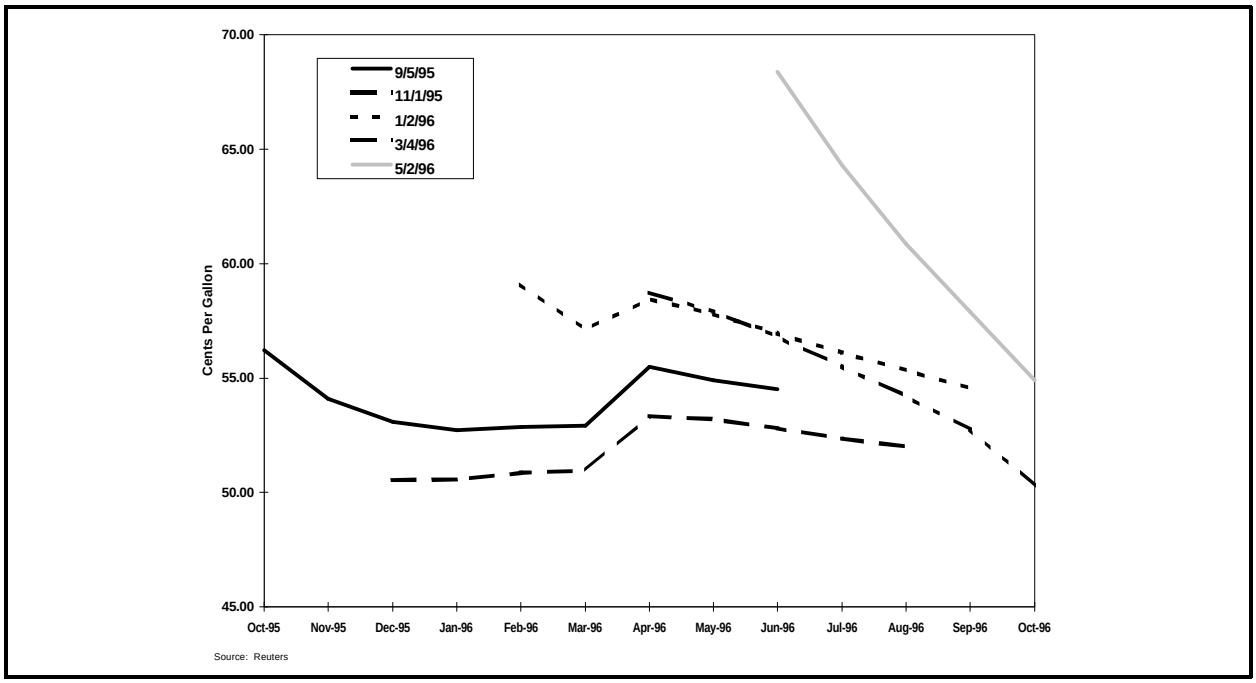
In spite of growing market complexity and strong demand, few problems have occurred. One problem this year occurred in California, which introduced its own Phase 2 reformulated gasoline (CaRFG). This fuel is unique to California, isolating the State to some degree from other gasoline markets. Demand for gasoline in California, like the rest of the country, has been strong, but several refineries had operational problems causing unexpected shutdowns, which created large supply gaps and associated price runups. As of the end of May, the supply situation has improved, and spot prices are moving back in line with the rest of the country. The California situation is described in more detail in the last section.

Figure 4.1 Gasoline Demand and Production



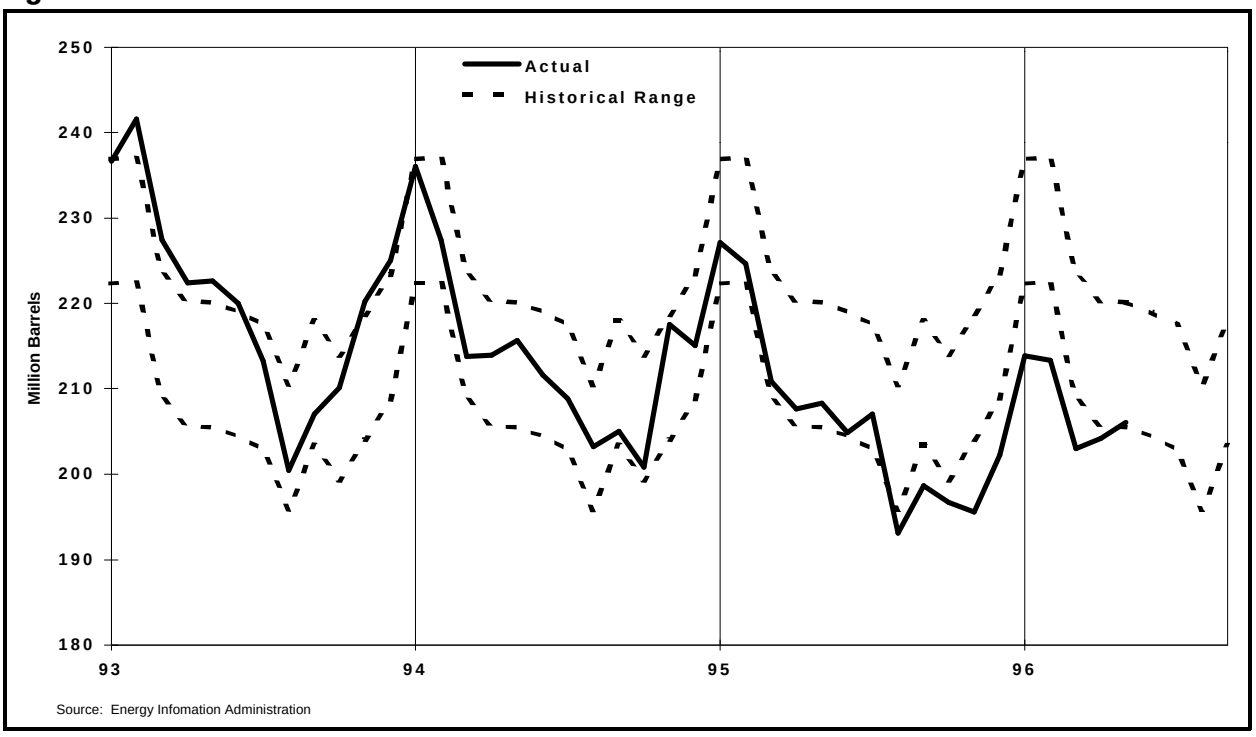
Source: Energy Infomation Administration

Figure 4.2 Selected Gasoline Futures Prices



Source: Reuters

Figure 4.3 Total Motor Gasoline Stocks



4.2 Excess Gasoline Supplies Are Discouraged In Spite of High Demand

U.S. gasoline demand is met by three sources of supply: production, imports and stocks. Stocks are the closest and thus the most readily available source of supply to meet demand changes. Production can provide extra supply in anywhere from a few days to several weeks, depending on the relative locations of the market and refinery supply source, and imports generally take the longest amount of time to respond to demand needs.

4.2.1 Production Increases in 1996 Matched Demand Increases

Gasoline production in the United States has increased since 1992 in conjunction with demand (Figure 4.1). Production increases have come both from running refineries at higher utilizations and from increasing capacity to produce gasoline through debottlenecking and even some distillation capacity increases. Since 1993, summer refinery distillation capacity utilization has averaged well over 90 percent.

Gasoline production in the first quarter of 1996 increased about 40 MB/D over the first quarter of 1995. The gasoline production increase approximately matched the gasoline demand increase over the same period. Crude oil input to refineries, however, increased in the first quarter by 160 MB/D over year-ago levels. This was due to refiners focusing on distillates this year, especially jet fuel. Distillate fuel oil demand was strong, and jet fuel demand was up dramatically compared to the first

quarter of 1995. The cold weather that began to affect distillate demand in November and December continued through the first quarter, and the distillate fuel stockdraw from October through March was 15 percent above normal.

In April, gasoline production dropped versus April of 1995, but gasoline stocks rose in spite of the decline because of high imports. Normal gasoline market and refinery production patterns were altered this April due to low distillate stocks at the beginning of the month combined with unusual cold weather. For much of April, refiners emphasized distillate fuel oil production over both gasoline and jet fuel. This unusual focus on refinery distillate production was consistent with the market pressures indicated by the spot distillate spread (New York Harbor heating oil versus West Texas Intermediate crude oil) being over 5 cents per gallon above the average April level.

Some industry observers may have expected higher gasoline production because of low gasoline stock levels this year compared to prior years.[16] But refiners have been discouraged from producing gasoline in excess of demand to build stocks, due to their expecting gasoline prices to soon fall (market backwardation). Crude oil price backwardation spilled over into the product markets due to the large impact crude oil cost has on product prices (Figure 4.2). As long as prices are expected to fall, refiners hesitate to produce more than their immediate needs, drawing on stocks and the spot market to make up any shortfalls. Also, very strong imports this year helped to cap price increases, countering the incentive to increase production. Finally, cold spring weather, which sustained distillate prices well above gasoline prices until late April, discouraged gasoline production over distillates.

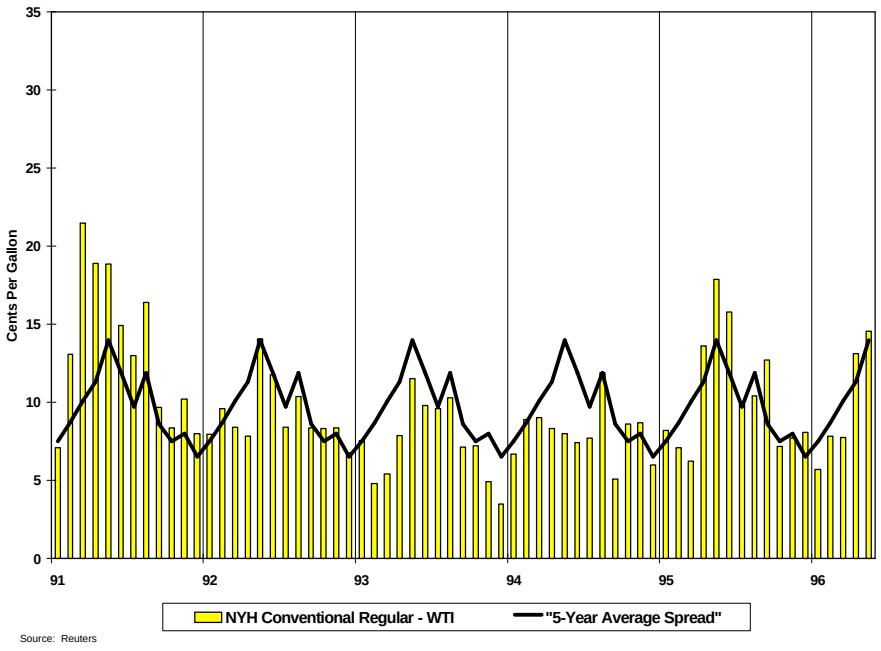
4.2.2 Imports Are Filling In As World Gasoline Capability Increases

Imports have been, and are expected to continue to be, high this year, making up for sags in production. First quarter imports averaged 319 MB/D compared to 274 MB/D in the first quarter last year, and April and May together averaged 476 MB/D. There are three factors at work this year encouraging imports:

- Europe is experiencing excess gasoline production as European refiners produce 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 based on regional demand. This provides a ready source of gasoline that will flow to the United States when price differences between Europe and the United States exceed transportation costs, which have been running about 5 cents per gallon. Purvin and Gertz, an international oil consulting firm, did a study indicating Europe will have a gasoline surplus this year that may grow to 350 MB/D, of which perhaps 175 MB/D will be RFG.

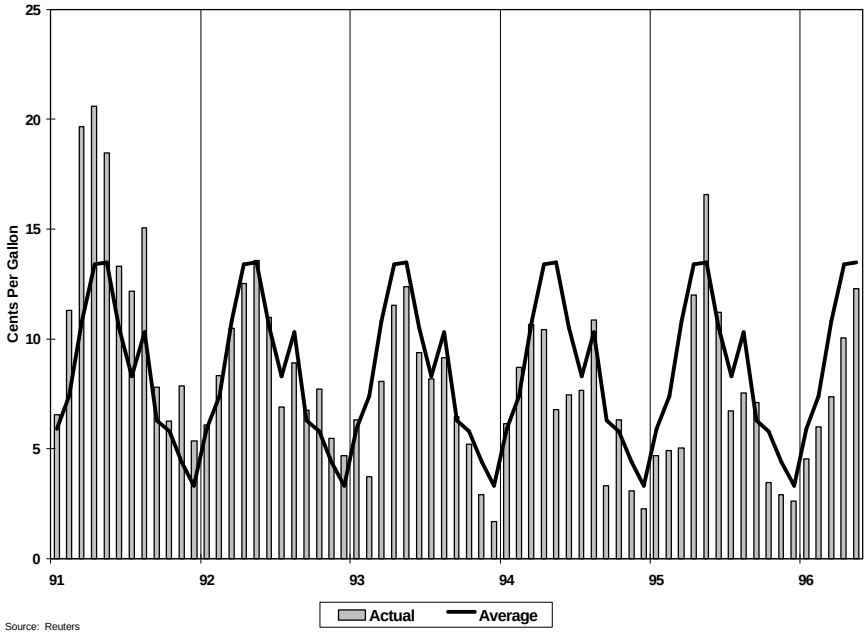
[16] The shutdown and sale of the BP Marcus Hook refinery to Tosco in January was observed to have little imact on fuel supplies to the Northeast. From the Bayway, New Jersey refinery Tosco was able to supply the needs of the BP retail marketing assets acquired. Marcus Hook was a merchant refinery (i.e., sells 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 is still the capability to deal with the loss of capacity the size of the Marcus Hook refinery in the Northeast.

Figure 4.4 NY Harbor Spot Gasoline Spread



Source: Reuters

Figure 4.5 Gulf Coast Spot Gasoline Spread



Source: Reuters

Figure 4.6 East Coast Resale Spread (Resale - Refiners' Imported Crude Price)

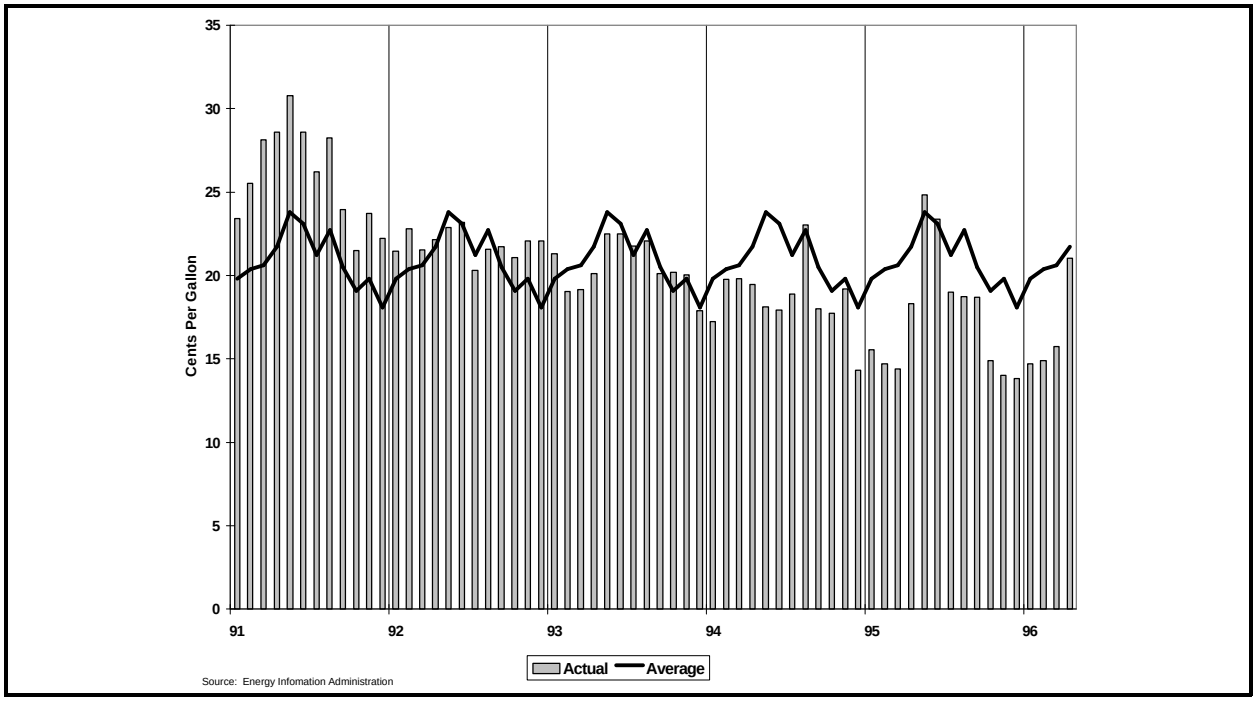
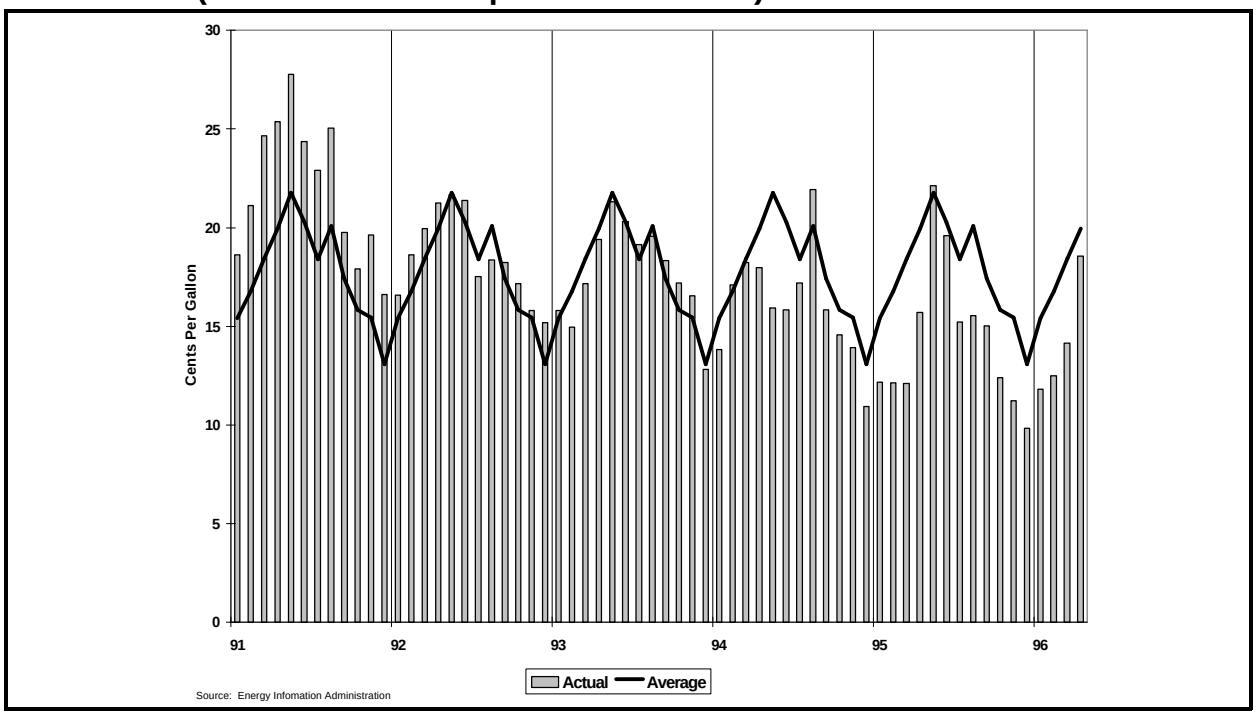


Figure 4.7 Gulf Coast Resale Spread (Resale - Refiners' Imported Crude Price)



- Asian refining capacity is expanding to fill regional market needs. Saudi Arabia used to provide Asia with product, but now Asia will be filling its own needs. Saudi Arabia has been a marginal supplier to the United States during the summer, and now may have extra product to sell here.

- The tight gasoline market in the United States (high demand and high capacity utilization coupled with low stocks) is pushing prices up here relative to Europe, where gasoline production is in excess of local demand requirements. While Europe, like the United States, has upward gasoline price pressure due to increasing crude oil prices, it does not have tight seasonal gasoline markets this year affecting the spread between gasoline and crude oil prices.

4.2.3 Stocks Reflect the Short-Term U.S. Market Tightness

The stock levels for the past five years are shown in Figure 4.3. While not strongly evident from this figure, gasoline stocks have been experiencing a long-term decline.[17] Last summer gasoline stocks were running slightly below the historical seasonal range, but fell even further below the range this past winter. The weak build that occurred last winter was mainly due to the combined effects of cold weather and expectations of falling prices (backwardation). (This is discussed in detail in Appendix A.) Although the stock draws in 1996 have been lower than normal, owing mainly to high imports, stocks remained below the average seasonal range until the end of May, and backwardation diminished incentive to change this pattern. Low stocks provide little cushion for unexpected supply disruptions, such as refinery problems, and therefore increase the probability of regional price runups if any supply problems develop. But did this situation affect resale gasoline spreads?

4.3 Tight Balance Had Little Influence on Wholesale Gasoline Price Spread

The total gasoline price increase from December 1995 through April 1996 was the result of both crude oil price increases and gasoline market pressures as measured by the increase in resale spreads. U.S. resale spreads normally increase about 6 cents per gallon from December to April, and spot spreads increase from about 5 to 10 cents, depending on the region. This year, the tight gasoline market fundamentals could lead to speculation that resale and spot gasoline spreads may be higher than average. Some simple graphs of actual spreads versus historical averages will assist in testing this hypothesis.

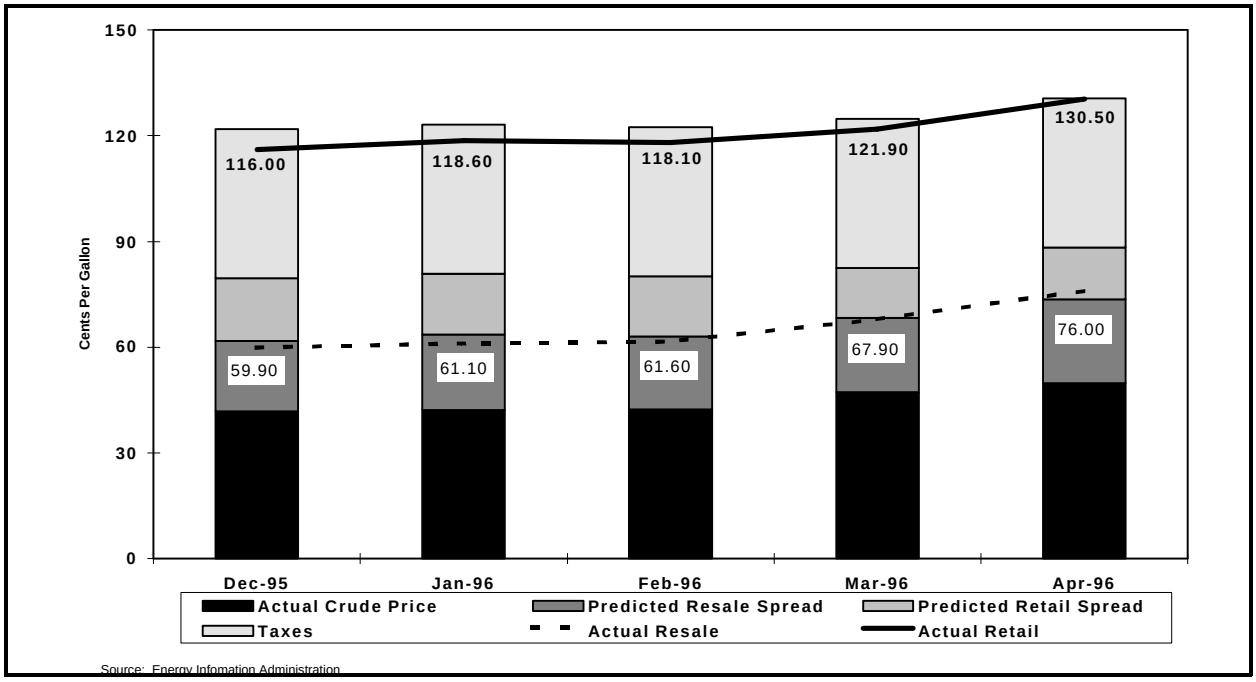
The analysis performed uses monthly average data. Weekly retail data shows consumers experienced larger swings in price than the monthly averages indicate, particularly when any problems occurred such as those experienced in California. Prices can run up sharply for a week, and then fall quickly when supplies increase to take advantage of the higher prices. The monthly average will not show the short increase and decrease in price. While averaging smooths out some of the variation in prices, it captures the net impact, and still allows for detection of abnormal behavior.

[17]Energy Information Administration, *Petroleum Marketing Monthly*, DOE/EIA-0380(96/06) (Washington, DC, June 1996), pp. xxi-xxviii.

Gasoline spot prices represented by the spot spreads in the Gulf Coast and New York Harbor markets have been weak this year up until April, in spite of the tight market reflected in low gasoline stocks (Figures 4.4, 4.5). Even in April, the New York spread was less than 2 cents per gallon over the average, similar to that experienced last year, and in May, the spread was less than 1 cent above average. The Gulf Coast did not show any unusual strength in April or May. Unlike the rest of the country, California had some unique supply problems that affected their spreads significantly, as will be described later.

Resale spreads generally vary less than spot spreads through the season (Figure 4.6, 4.7, Appendix B). For example, resale spreads in Petroleum Administration for Defense (PAD) District 3 (the Gulf Coast) historically averaged an 7-cent-per-gallon increase from December through April, and those in PAD District 1 (the East Coast) averaged about 4 cents. Actual resale spreads through April are consistent with spot spreads.

Figure 4.8 Actual versus Predicted Gasoline Prices



The graphical review of gasoline spot and resale spreads compared to average levels (Figures 4.4-4.7, Appendix B) indicates that the tight market outside of California had little impact on the price increase beyond normal seasonal increases. Perhaps several cents of the increase can be attributed to the situation.

Another analytical approach to exploring the potential abnormality of prices this spring was undertaken using the Short-Term Integrated Forecasting System (STIFS) model. With this model, it is possible to analyze how resale prices vary with crude oil costs, stock levels (represented by days supply), and seasonal factors related to normal intra-year changes in refinery spreads. The model also allows for cost distinctions between oxygenated and reformulated fuels, and it represents retail prices as a function of resale prices.

Full details of the analysis are provided in Appendix C. Examination of the 1996 spring runup in gasoline prices from the perspective of EIA's short-term energy forecasting model shows that the gasoline price changes observed this year correspond fairly closely to what EIA would have predicted, given the actual levels of world oil prices and U.S. gasoline demand (Figure 4.8).

Most of the increase in refiner prices and retail (pump) prices for gasoline this spring are understandable in terms of increases in world crude oil costs and normal seasonal changes in such prices. However, about 2 cents (13 percent) of the increase in resale gasoline prices between December 1995 (the typical low point for spot and resale markets) and April 1996 is not so easily explained. It is estimated that at least 1 cent of the December-to-April national increase in resale prices can be accounted for by the particular gasoline supply problems encountered in California this year, due to that state's relatively large weight in the national market. The remaining shift in domestic resale gasoline prices reflects the general market tightness that developed, particularly in March and April. Still, any unexpected rise in wholesale prices remained relatively small and within normal uncertainty ranges.

In summary, these observations and analyses indicate that, aside from crude oil prices, gasoline market prices outside of California were close to the normal seasonal patterns, with higher-than-normal market tightness adding several cents to the total price. This leads to the conclusion that crude oil prices accounted for about half of the increase in price, and normal seasonal increases account for most of the remaining increase except for about 2 cents, which can be attributed to the additional tightness experienced this year in the gasoline market.

4.4 California

The California gasoline market is a special case this year. California introduced its own new and unique Phase 2 reformulated gasoline (CaRFG) during the spring. As of March 1, refiners were required to produce CaRFG, and by April 15, they were required to deliver CaRFG to California terminals. By June 1, retail gasoline outlets in California could sell only the new fuel. This gasoline is significantly different from gasoline used in the rest of country, isolating the State to some degree from other gasoline markets.

CaRFG has more stringent requirements than Federal RFG, making it more difficult and more expensive to produce than Federal RFG. Estimates indicate CaRFG costs between 5 and 15 cents more per gallon to produce than conventional. Although the fuel costs more to produce, and therefore will have a higher price than conventional gasoline, actual prices will depend on relative supply and demand factors, and consumers will benefit from significant smog reduction.

Figure 4.9 California RFG Production and Estimated Demand

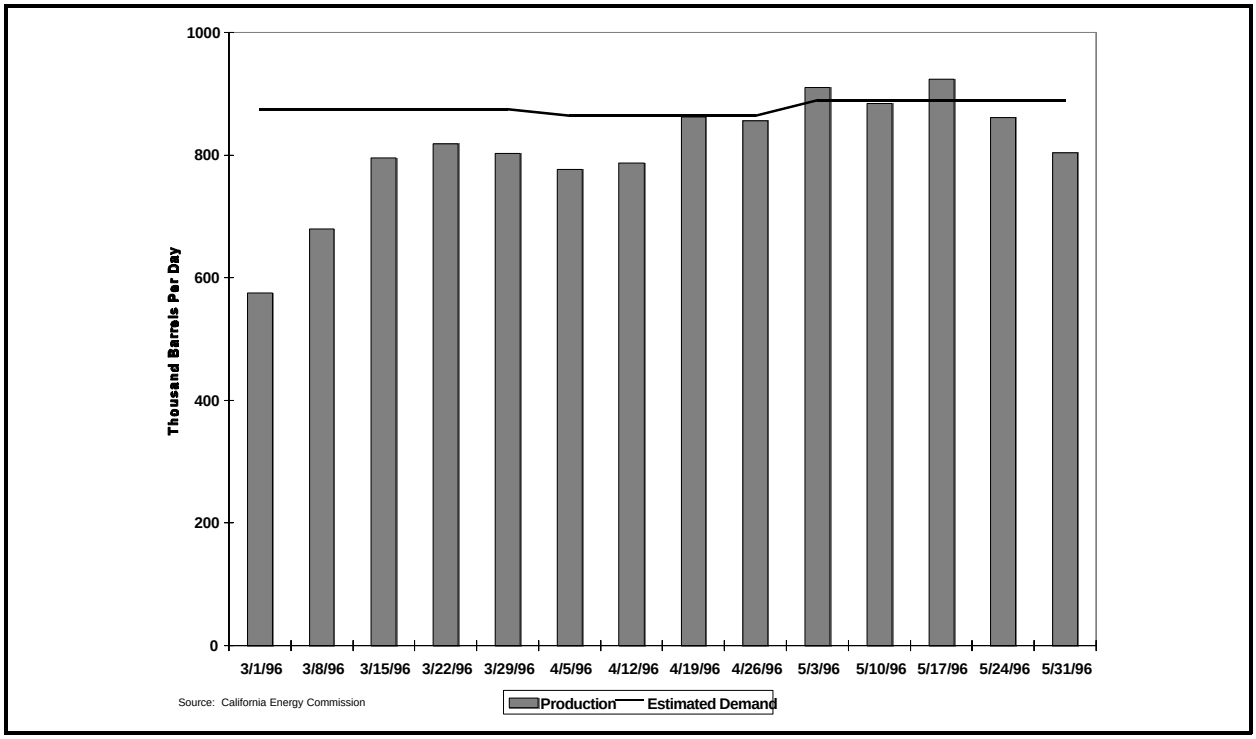


Figure 4.10 California Gasoline Prices

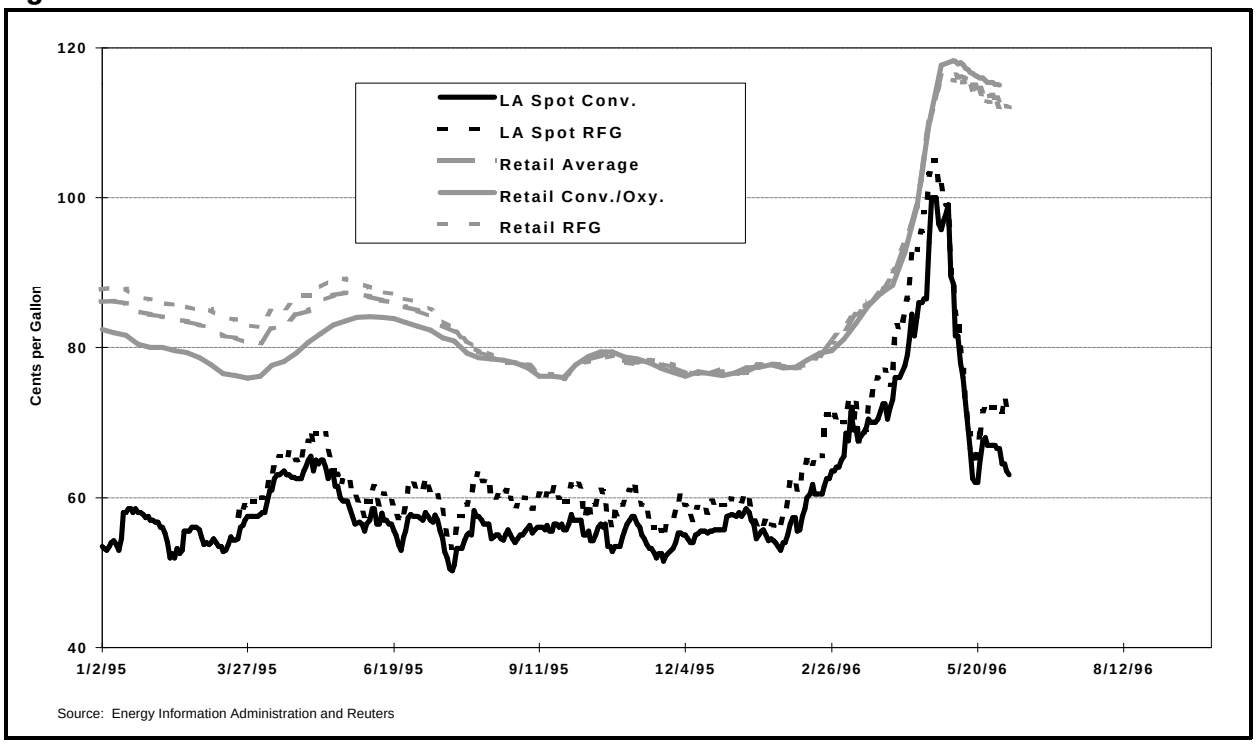


Figure 4.11 California Spot Spread

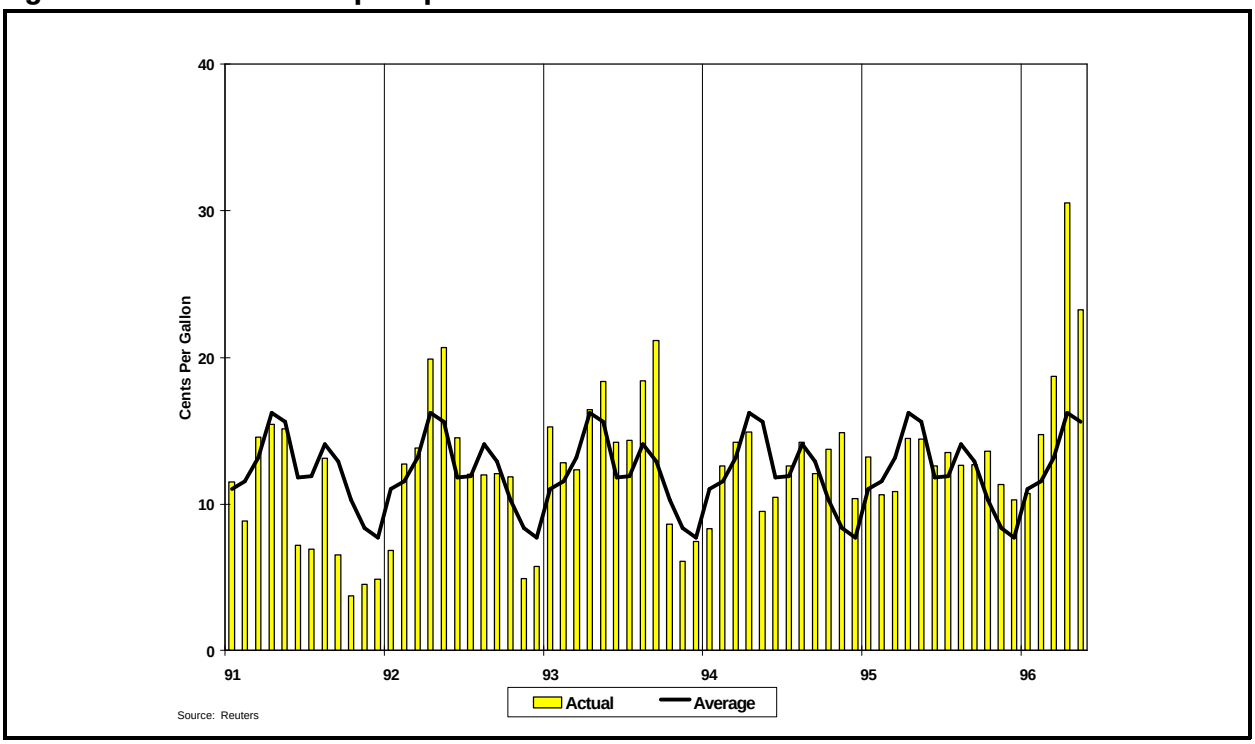
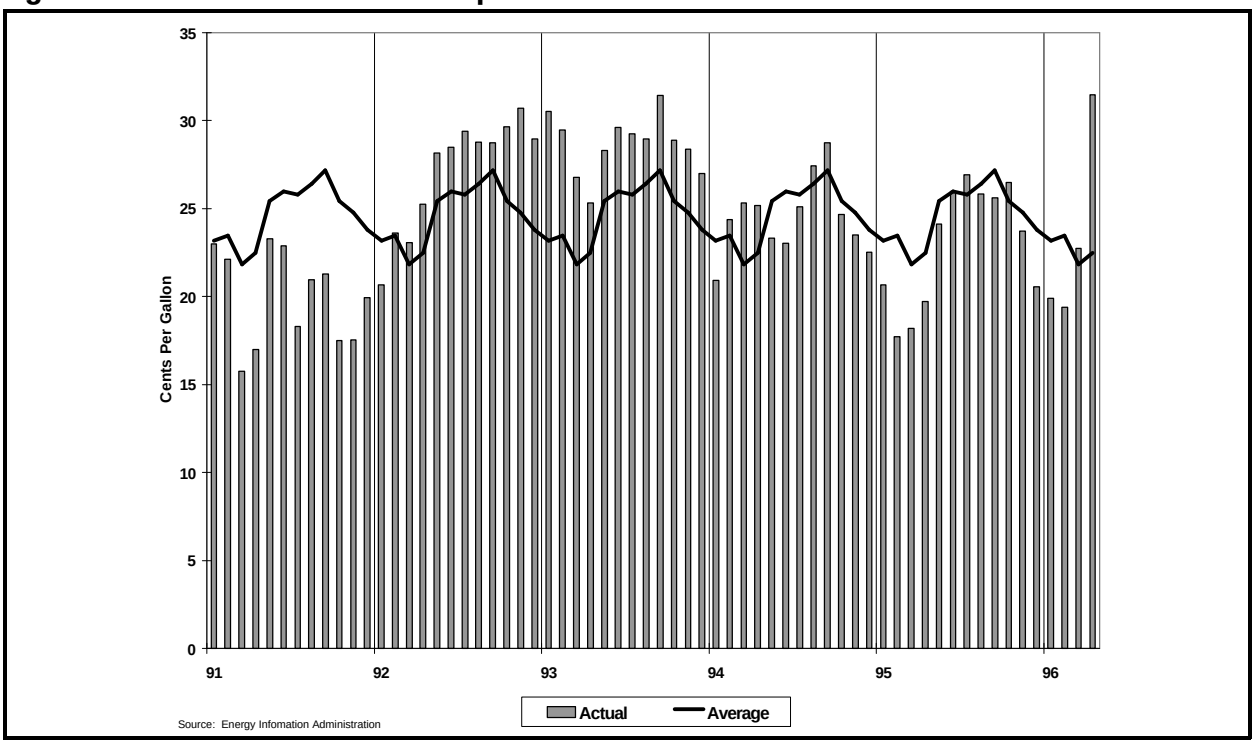


Figure 4.12 West Coast Resale Spread



Demand for CaRFG was estimated to average about 896 MB/D for the first year (March 1, 1996 through February 28, 1997), taking into consideration the energy efficiency loss (about 1-2 percent less efficient than Federal RFG). Production was predicted to average 906 MB/D, providing a 10 MB/D cushion, which, while not large, was expected to be adequate.[18] Some supply potential exists outside of California, but most refiners are not equipped to produce the new fuel in any largeamounts, if at all. Refineries in California will probably use 85-90 percent of their gasoline capacity to produce the new fuel.

Unfortunately, supply problems developed. In early April, several refineries suffered explosions and mechanical problems, which affected over 100 MB/D of CaRFG gasoline supply for short periods of time. The 100 MB/D represents almost 12 percent of California's spring demand. Figure 4.9 shows the evolution of the supply problem. Production built as expected from the beginning of the program in March through the end of the month, although total production was not up to estimated demand levels. When the refinery problems occurred in April, the industry had not yet demonstrated an ability to achieve required levels of production to meet demand for any sustained period. Strong and steady production throughout May would seemingly be required to meet CaRFG requirements through the retail level by June 1. The April production problems raised concerns over possible future shortfalls, and daily data indicated even larger shortfalls may have occurred at different points throughout this month. Spot prices shot up, driven by these uncertainties (Figure 4.10). During the second half of April, production recovered, and spot prices finally softened. Unfortunately, supply floundered slightly at the end of May, and spot prices strengthened a bit. Should supply continue to suffer setbacks, prices may fluctuate periodically over the summer. The California Energy Commission puts out regular balance reports on the Internet, keeping the industry and the public informed of progress.

Without the supply problems, conventional resale spreads would have fallen about 1 cent from December to April.[19] Consumers in California changing from conventional gasoline to CaRFG would have experienced a double price effect: one from the normal seasonal change and a second from the switch to CaRFG. Spot prices in February indicate that CaRFG was running about 6 cents over conventional. If that differential was representative of normal operations, consumers would have seen a 1-cent decline from standard seasonal effects plus a 6-cent CaRFG cost increase, all other things equal, resulting in a 5-cent increase in price from December to April, apart from crude oil price increases.

Unlike the rest of the country, shortages in California affected spreads strongly. Actual spreads derived from Los Angeles conventional prices ran well above normal for this time of year (Figures 4.11, 4.12). Conventional gasoline is still being traded in the Los Angeles area since the refiners in California serve surrounding states as well as California. The refinery CaRFG problems spilled over into the local conventional market. This is a good example of market volatility when supply

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

[19]PADD 5 experiences a different seasonal pattern than most of the rest of the country due to different distillate demand patterns and different driving patterns.

problems occur in a very tight market. With little or no quick supply alternatives, the market bid prices up at panic rates.

The price behavior in California this year reflects a market stress situation. It is similar to that seen following the Exxon Valdez oil spill on March 24, 1989. When the Valdez accident occurred, West Coast markets reacted strongly. The sudden loss of a significant supply of crude oil for the West Coast occurred when gasoline stocks were at their seasonal lows. Gasoline suppliers began to worry about meeting gasoline demand over the several weeks it might take alternative, "longer-haul" crude oil or gasoline supplies to arrive. That fear drove spot gasoline price spreads up over 30 cents per gallon in a day or two. The Valdez-stimulated supply shortage was resolved and prices fell back by about April 20, providing a classic example of market responses to supply shortages. This year's refinery problems and lack of available gasoline alternatives produced a similar crisis price response. It took a little longer to resolve the gasoline supply concerns, but once they were resolved, prices receded.

Consumers in California paid an average of $1.15 per gallon for regular gasoline in December 1995. By April 1996, due to the crude price increases, the changeover to CaRFG, and the refinery delays the average was $1.40, or 25 cents per gallon higher. With production back in balance with demand and the return of spot prices to more normal levels in May, retail prices should be following shortly.

5. Petroleum Industry Profits in 1996

Higher petroleum prices in the early months of 1996, particularly gasoline prices, have raised concerns about the profits of oil companies. Expectations are that oil company profits rose in 1996, which in fact is what happened in the first quarter of 1996, the most recent period for which financial data are available. Based on EIA estimates, profits from refining are likely to be higher in the second quarter as well. However, gasoline prices played a minor role in this recent upswing in overall oil industry profits. Higher oil and natural gas prices at the wellhead were far more important in the profit picture of petroleum companies, as were the prices of heating fuels and related petroleum products.

In this analysis, unaudited quarterly profits data were used for reviewing recent financial developments. The most recent available financial data are for the first quarter of 1996. Financial data for the second quarter are typically available in late July and the first week in August, at the earliest. The first-quarter financial data have been adjusted to remove the effects of unusual items not related to current operations, such as litigation settlements. For longer-term trend analyses, information reported annually to EIA's Financial Reporting System (FRS) by the two dozen or so major energy companies is utilized. The majors and independent petroleum companies included in this review accounted for 54 percent of U.S. oil production (net ownership basis), 49 percent of U.S. natural gas production (net ownership basis), and 70 percent of U.S. refinery capacity.

5.1 Net Income of Petroleum Companies

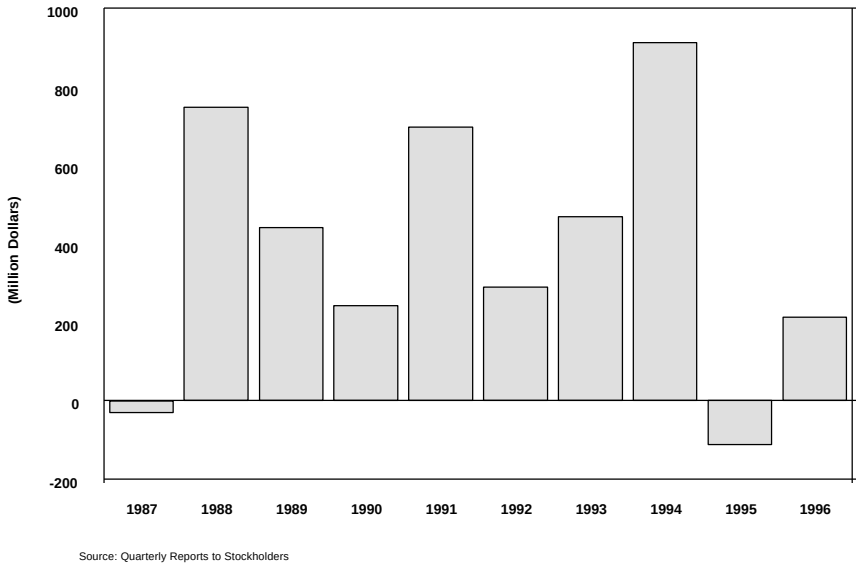
5.1.1 First Quarter Results

Compared with the first quarter of 1995, all segments of the petroleum industry registered higher profits in the first quarter of 1996. Overall net income for 19 major petroleum companies (excluding unusual items) in the first quarter of 1996 (Q196) was $6.7 billion, up 22 percent (Table 5.1) from the first quarter of 1995 (Q195). The gains were widespread among the majors with 18 of 19 companies reporting higher net income. Most of the income gains stemmed from higher oil and natural gas prices, both in the United States and abroad. Based on the line-of-business results released by the companies, income from U.S. oil and gas production was up 87 percent while foreign income rose 28 percent. Some of the companies disclosed that natural gas prices rose more in the United States than they did outside North America. This development would account for the greater gain in income for U.S. oil and gas production.

Independent oil and gas producers also benefited greatly from higher oil and natural gas prices. Of the 24 producers included in Table 5.1, 18 reported increased income. For this group of producers, net income in Q196 registered a fivefold increase over Q195 results.

Higher crude oil prices benefited oil producers worldwide. In the United States alone, crude oil purchased as input for domestic refineries during the January to March 1996 period generated an additional $2.1 billion for producers compared to the same period the previous year. No individual

Figure 5.1 First Quarter U.S. Refining/Marketing Net Income for Major Petroleum Companies



or group of producers had a role in causing this runup in revenues. Domestic and foreign oil producers, including integrated oil companies, independents, nationalized oil companies, and other leaseholders and owners, face prices that are set by market forces. The magnitude of revenues generated during this transitory run up in crude oil prices hardly compares with the transfer of wealth to foreign oil producers during the price escalations of the 1973 to 1981 period. A part of these added revenues will add to cash flow which in turn will be plowed back into exploratory activity and added oil production capability. This ultimately leads to greater crude oil supplies and to a reduction in petroleum product prices.

Income from the majors' petroleum refining and marketing operations also increased but did not come close to matching the gains from upstream operations. In U.S. refining and marketing, the majors reported income of $212 million in Q196, a turnaround from losses of $112 million in Q195. However, in historical perspective, these results were modest. As can be seen in Figure 5.1, refining and marketing income from U.S. operations in Q196 was the third lowest first-quarter result in the past 10 years. Further, the Q196 income gain is exaggerated in that the net losses in Q195 represented the worst first-quarter performance in at least 10 years.

Table 5.1 First Quarter Financial Results for Major Petroleum Companies , Independent Refiners, and Independent Oil and Gas Producers, 1995 and 1996 (Million Dollars)

Category[a]	Q195	Q196	Percent Change
Corporate Net Income			
Majors (19)	5,548	6,746	21.6
Independent Refiners (13)	-1	126	NA
Independent Oil and Gas Producers (24)	40	215	441.1
Line of Business Income for the Majors			
Oil and Gas Production			
United States (11)	1,099	2,051	86.6
Foreign (10)	1,612	2,059	27.7
Refining/Marketing			
United States (13)	-112	212	NA
Foreign (6)	510	539	5.7
Chemicals (11)	2,727	1,738	-36.3
Other Businesses (13)	696	803	15.3

NA: Non-applicable. Percent change calculated from unrounded data.

[a]The number of companies is reported in parentheses. Percent change is calculated from unrounded data. Major petroleum companies include Amerada Hess, Amoco, Atlantic Richfield, Chevron, Coastal, E. I. DuPont de Nemours (Conoco), Exxon, Fina, Kerr-McGee, Mobil, Murphy Oil, Occidental Petroleum, Pennzoil, Phillips, Shell Oil, Sun, Texaco, Unocal, and USX (Marathon). Independent refiners include Ashland, Clark USA, Crown Central Petroleum, Diamond Shamrock, Louisiana Land & Exploration, Mapco, Quaker State, Tesoro Petroleum, Tosco, Total Petroleum, Ultramar, Valero Energy, and Witco. Independent producers include American Exploration, American International Petroleum, Anadarko Petroleum, Apache, Aviva Petroleum, Basin Exploration, Berry Petroleum, Burlington Resources, Cabot Oil and Gas, Cross Timbers, Forest Oil, Gerrity Oil and Gas, Key Production, Louis Dreyfus Natural Gas, Mesa, Newfield Exploration, Noble Affiliates, Oryx Energy, Parker and Parsley, Pogo Producing, Snyder Oil, St. Mary Land and Exploration, Union Texas Petroleum, Wainoco Oil.

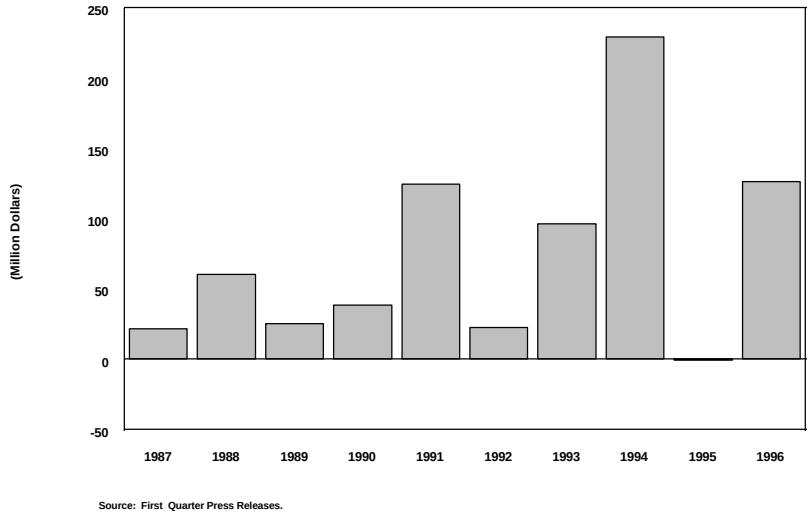
Source: Compiled from companies'quarterly reports to stockholders and"Earnings Digest," *Wall Street Journal*, April, 1996.

Financial results for 13 independent refiners were similar to the majors' U.S. refining and marketing results, in that the first quarter of 1996 represented a recovery from a very poor first quarter in the previous year. In Q196, refiners' net income (excluding unusual items) of $126 million was a turnaround from losses of $1 million in Q195 (Table 5.1). Unlike the majors' first-quarter refining and marketing results, Q196 was an outstanding quarter for independent refiners. Refiners' net income in Q196 was at its second highest level compared with first-quarter results over the past 10 years (Figure 5.2).

The majors' chemical operations registered the first year-over-year quarterly decline since the first quarter of 1994. Chemical earnings surged in 1994 and through the first half of 1995, but they have been hurt recently by shrinking price-cost margins.

What developments contributed to higher downstream profits? What role did gasoline prices and other refined product prices play in the turnaround in first-quarter refining and marketing financial results?

Figure 5.2 First Quarter Net Income for Independent Refiners



5.1.2 Refining Margins and Profits

Based on price and demand patterns, gasoline market developments had a small role in the turnaround in refining profits between Q195 and Q196. A relatively cold winter in much of the United States and Europe was the primary source of higher refiner profits.

Income from refining operations primarily depends on the spread between product prices and raw material input prices (termed, the gross refining margin), operating costs, and volumes processed and sold. The gross refining margin is an important determinant of refining profitability. For example, there is a strong positive relationship between gross refining margins and quarterly return on equity for independent refiners (Figure 5.3).[20] Although the gross refining margin in Q196 was low in comparison with the general level of margins in the 1990's, it was well above the first-quarter margin of the year before (Table 5.2). In Q195, the refining margin fell to a 6-year low, squeezed by a combination of slightly rising crude oil input costs and downward pressures on gasoline and distillate prices.

The modest recovery in the overall refining margin largely reflected the effects of an especially cold winter in 1995-1996, particularly in March. Distillate prices were up 18 percent and the price of propane rose 21 percent between Q195 and Q196. In contrast, gasoline prices were up 6 percent.

[20]The regression of refiners' quarterly return on equity (Y) on the quarterly gross refining margin (X) for Q182 through Q395 yielded the following result,

$$Y = -17.00 + 3.51X$$

with $R^2 = 0.324$ and a t-value of 5.00 for the gross refining margin coefficient.

Demand growth also favored higher refining profits in Q196 relative to Q195. The quantity of total refined products supplied was up 4 percent over this period, mainly reflecting the greater demand for space heating fuels. Improved economic conditions also contributed to overall petroleum demand, with real GDP growing 2 percent between Q195 and Q196. The total amount of distillate fuel oil and propane supplied was up 5 percent. Residual fuel oil volumes were up 7 percent, fed by electric utility demand. However, growth in gasoline demand was nearly flat.

5.1.3 Prospects for Second-Quarter Profits

Public concerns about petroleum industry profits are probably most intensely focused on the second quarter of 1996, since the rise in gasoline prices began late in the first quarter and continued into the second quarter. Unfortunately, financial disclosures of second-quarter results will not be available until early August. However, the Energy Information Administration makes short-term forecasts of petroleum product prices, crude oil input costs, and product demand. While these forecasts can be used to assess second-quarter refining profits, any such assessment must be acknowledged to be laden with uncertainties.[21] A three-step procedure was used to obtain estimates of Q296 profits. First, using regression analysis, the relationship between the majors' second-quarter U.S. refining / marketing income and the second-quarter gross refiners' margin was estimated as was a similar relationship for independent refiners' second-quarter net income.[22] Second, the *Short-Term Energy Outlook's* May, 1996 Base Case was used to obtain an estimate of the Q296 gross refining margin. Third, this latter estimate of the gross refining margin was entered into the regressions from the first step to obtain estimates of Q2 income, which are shown in Figure 5.4. Based on this procedure, the majors' income from U.S. refining / marketing operations in Q296 is estimated to be 10 percent higher than in Q295. In historical context, this level of second-quarter income is middling, being the fourth highest in the past 10 years (Figure 5.4). For independent refiners, Q296 net income is estimated to be 8 percent above net income in Q295. Should the independent refiners realize this level of income, it would be the second highest in 10 years. Thus, given the EIA's latest estimates of gross refining margins, profits from U.S. refining in Q296 are likely to post only modest rises compared with last year's second-quarter profits. Further, gasoline

[21] As in any regression analysis, and predictions therefrom, there are many sources of possible error. Also, the Q296 value of the gross refining margin, which is itself a forecast, adds a source of error to estimating Q296 profits.

[22] For the majors, the regression of second-quarter U.S. refining / marketing income per company (Y) on the second-quarter gross refining margin (X) and a dummy variable which is equal to one for 1991-1995 and zero otherwise (DUM), for the years 1987-1995, yielded

$$Y = -35.29 - 37.73\ DUM + 14.51X$$

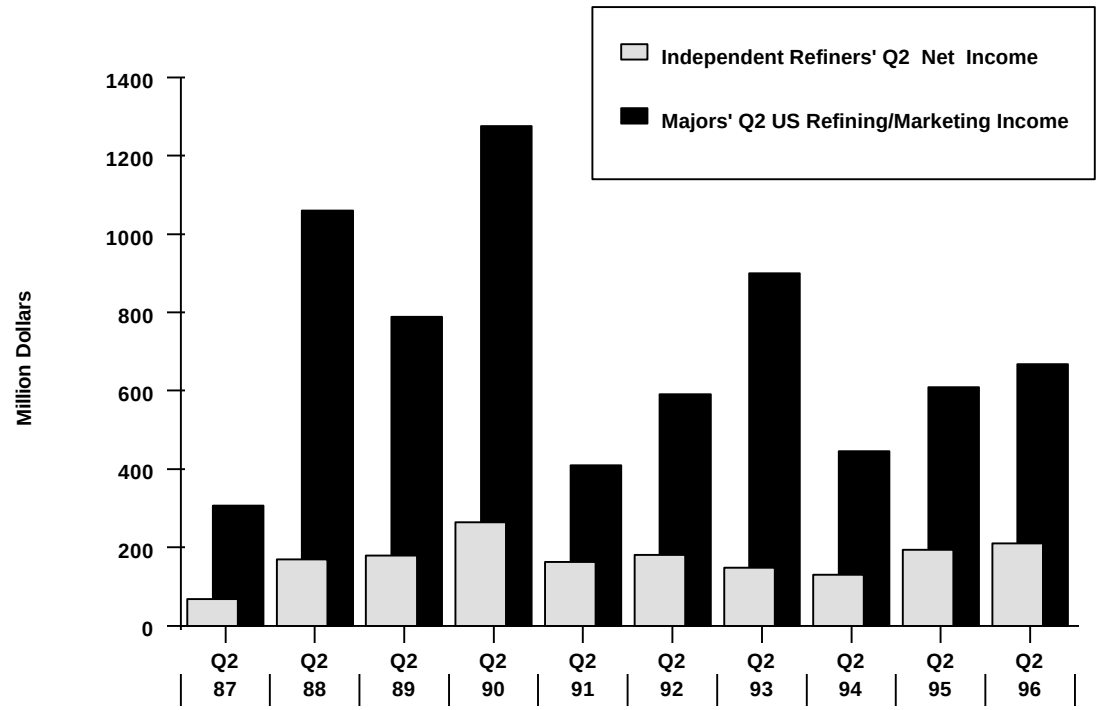
with $R^2 = 0.810$ and a t-value of 3.88 for the X-coefficient.

For the independent refiners' second-quarter net income per company (Y), the regression analysis yielded

$$Y = -9.43 - 5.55\ DUM + 3.74X$$

with $R^2 = 0.945$ and a t-value of 9.30 for the X-coefficient.

Figure 5.3 Second Quarter Net Income for Majors' U.S. Refining/Marketing and Independent Refiners



Source: Companies' quarterly reports to shareholders. Q296 amounts are estimated.

prices are of minor importance in these estimates. Gasoline and residual fuel oil prices are estimated to only keep pace with crude oil prices between Q295 and Q296. Again, the sources of improved margins come from estimated price increases for distillate-related products (heating oil, diesel) in excess of crude oil price rises.

5.2 Trends in Profitability

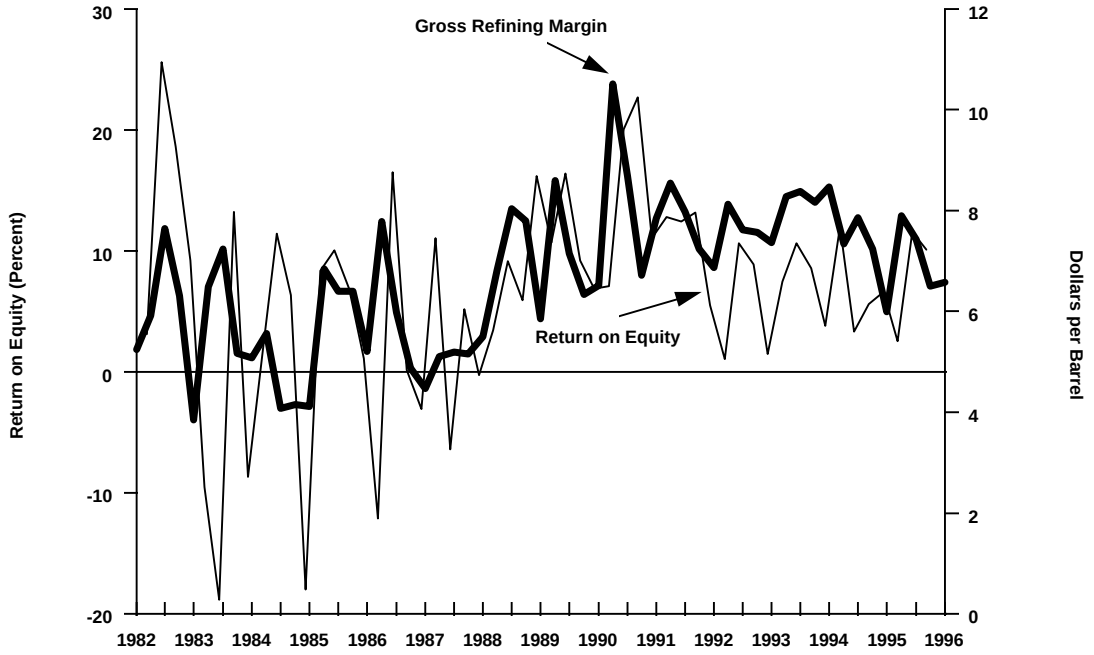
More often than not, petroleum industry profitability has been less than the profitability of overall U.S. industry. Figure 5.5 shows the return on equity, an often-used measure of corporate profitability, for petroleum companies and the Standard and Poor's (S&P) group of 400 of the largest U.S. industrial corporations (excluding energy companies). Clearly, for most of the past 10 years, the profitability of petroleum companies has not kept pace with other large industrial corporations. More recently, in 1995, reduced refining margins further depressed the profitability of independent refiners while lower natural gas prices hurt independent oil and gas producers.

Table 5.2 Refined Product Resale Prices and Products Supplied, First Quarter, 1995 and 1996

	Q1 '95	Q1 '96
Resale Prices (Dollars per Barrel)		
Motor Gasoline	25.26	26.70
Distillate	21.00	24.75
Kerojet and Kerosene	22.12	25.66
Propane	14.63	17.77
Other Products	17.19	20.11
Composite Product Price	22.92	25.15
Composite Refiner Acquisition Cost of Crude Oil	16.99	18.53
Gross Refining Margin	5.93	6.62
Products Supplied (Thousand Barrels per Day)		
Motor Gasoline	7,477	7,511
Distillate	3,463	3,616
Jet Fuels	1,513	1,605
Propane and Other Products	5,187	5,560
Total Products Supplied	17,640	18,292

Sources: Energy Information Administration, *Petroleum Marketing Monthly June 1996*, DOE/EIA-0380(96/06) (Washington DC, June 1996) and *Petroleum Supply Annual 1995 Volume 2*, DOE/EIA-0340(95)/2 (Washington DC, May 1996).

Figure 5.4 Quarterly Gross Refining Margins Independent Refiners' and Return on Equity

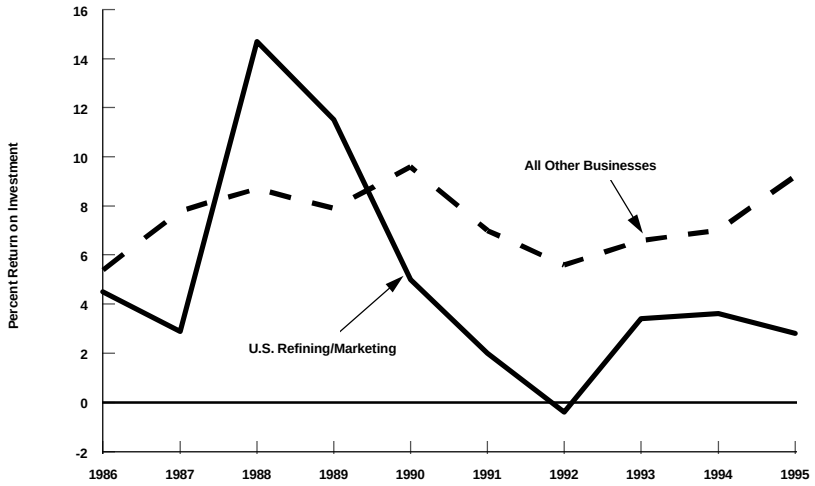


Source: Energy Information Administration, Petroleum Marketing Monthly and Companies' Quarterly Press Releases.

Major petroleum companies registered an uptick in overall profitability in 1995 largely due to an upswing in chemical profits.

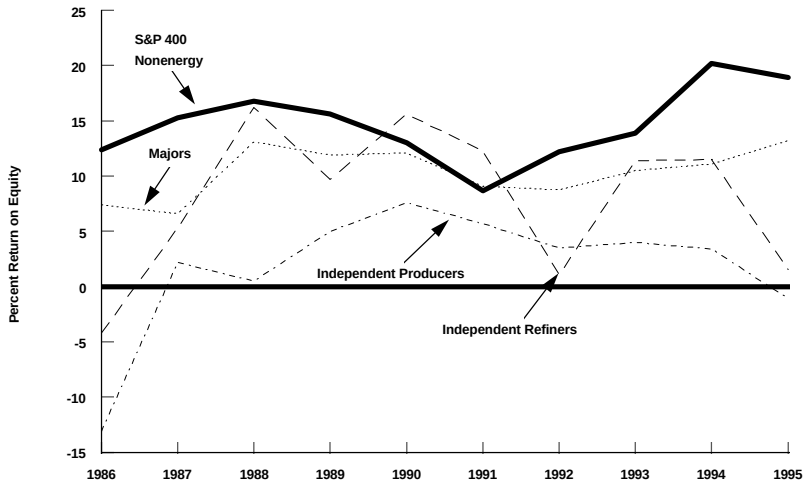
Over the past 10 years, the majors' U.S. refining and marketing profitability has been below the overall profitability of their other business segments with the exceptions of the years 1988 and 1989 (Figure 5.6). In 1995, U.S. refining and marketing profitability was hurt by lower price-cost margins while chemical operations led to higher overall profitability for their other businesses.

Figure 5.5 Major Petroleum Companies' Return on Investment in U.S. Refining/Marketing and All Other Lines of Business



Return on Investment = Net Income Divided by Net Investment in Place.
Source: Form EIA-28 and Fourth Quarter Press Releases.

Figure 5.6 Annual Return on Equity for Petroleum Companies and U.S. Industry



Return on Equity = Net Income as a Percent of Shareholders Equity.
Source: Compustat and Fourth Quarter Press Releases.

6. Conclusion and Outlook

Conclusion

Consumers experienced a rapid increase in gasoline prices in early 1996, raising concerns over the cause. The national average retail price of regular self-serve gasoline, according to weekly data collected by the EIA, increased from a low of $1.08 per gallon in mid-February to almost $1.29 by May 17. Americans are highly dependent on gasoline for transportation and have no short-term ability to switch fuels. In light of the impact on consumers, President Clinton, on April 29, 1996, requested that the Department of Energy investigate the underlying causes.

An analysis was performed beginning with December, when resale gasoline markets are normally at their lowest point seasonally. In order to compare with longer term historical data, monthly average prices were used. The increase in gasoline price between December and April (when the latest resale price data were available) indicated that the price components of gasoline had changed as follows:

Table 6.1 December through April Price Components (Cents Per Gallon)

	December 1995	April 1996	Increase (Decrease)
Retail Price (Average, all grades and formulations)	116.0	130.5	14.5
Taxes	40.8	40.8	0.0
World Crude Oil Price	41.8	49.8	8.0
Resale Price Spread	18.1	26.2	8.1
Retail Price Spread (Excluding Taxes)	15.3	13.7	(1.6)

Based on information and models provided by the Energy Information Administration and analysis by technical experts in the Department, the report reached the following conclusions:

- Normal increases in gasoline prices that occur during the spring explain a large portion of the price increase. Gasoline prices are generally lower in the winter and higher in the spring/summer driving season, when increased mileage puts more strains on the supply system. This seasonality in prices originates at the wholesale level. Even if crude oil prices did not change, average resale prices (all grades, all formulations) would typically increase 6 cents per gallon. (December is generally the low point in prices at the wholesale level.)

- Increases in world crude oil prices account for most of the remaining increase in gasoline prices. Between December and April, average world crude oil prices rose about 8 cents per gallon. Crude oil prices this year had been strengthening throughout the winter, with strong demand and less-than-expected supply. Towards the end of the winter season, when crude oil stocks had been drawn down sharply worldwide, a late, unusual cold spell throughout the Atlantic Basin increased crude oil demand unexpectedly, putting extra pressure on crude oil markets and driving prices up sharply just when gasoline prices were beginning their normal spring rise.

- A number of unusual gasoline market factors combined to add perhaps an additional 2 cents to the total price increase beyond normal seasonal increases and crude oil price increases. These factors included:

  - Gasoline demand has been growing strongly since 1992, and demand remained strong in the first quarter, although growth was not as large as forecast partially due to high prices and unusually cold weather in some parts of the country.

  - A colder and longer than normal winter kept refiners producing relatively high levels of distillate, much of which is used for heating oil, longer than usual. Although this restrained refiners from maximizing gasoline production as early as usual, high imports of gasoline kept gasoline stocks from falling as much as they usually would from December through March.

  - Inventories of gasoline stocks were unusually low by historical standards until the end of May. This is thought to be the result of a trend in that direction, the cold winter that kept refiners focusing on distillates, low gasoline spreads until April, and expectations of declining prices in future months.

California experienced a different market situation this year than the rest of the country. The State introduced its new, unique, Phase 2 reformulated gasoline. Rising prices related to this new gasoline were well in excess of increases that can be explained by crude oil and normal seasonal fluctuations as well as increases in the cost to make the new fuel. The additional jump in California prices appears to have resulted from explosions and mechanical problems in several refineries in April. At times, over 12 percent of California's gasoline supply was out of commission. With no other readily available sources of this new fuel, prices shot up. Production recovered in May, and spot prices receded. However, if production problems continue, California prices will likely fluctuate throughout the summer.

Refining and marketing profits for the first quarter were not unusual by historical standards. Analysis of the results indicated that improvements in first quarter 1996 profits over first quarter 1995 were due to increases in distillate demand and prices, not gasoline prices. Second quarter profits would reflect any gains from the gasoline price increase. Spot price spreads for April and May would indicate that these profits are likely to be attractive, but not unusual, and some preliminary analysis using EIA forecasted prices supports this observation. Unfortunately, second quarter financial information will not be available until August.

Outlook

In mid-April, as cold weather subsided and demand for crude began to decline, crude oil prices began to weaken. After peaking at the end of April, spot gasoline prices followed the crude oil decline, tempered by seasonal upward price pressures. In May, following maintenance, refinery production returned to full levels, and imports remained high in response to increased gasoline prices relative to foreign markets, ending the seasonal spring increase in spot prices and spreads.

Monthly average resale prices are estimated to peak at about 76 cents per gallon in April. (Actual May resale prices are not yet available.) Retail pump prices (average of all grades and formulations), which typically lag wholesale prices by about one month, are forecast by EIA to peak in May at $1.38 per gallon on a national average basis (Tables 6.2, 6.3). With crude oil prices already down by close to $2 per barrel (May versus April average refinery cost), and with downward pressure on world oil markets expected to continue as Iraq prepares a limited return to oil exports, average crude oil prices paid by U.S. refiners could drift downward to about $18 per barrel or less by August. Gasoline prices are expected to follow, with the average retail price dropping about 10 cents per gallon by the end of summer from its spring peak.

While record or near-record demand for gasoline is still expected this summer, so far this year, gasoline demand growth is well under earlier expectations. Through May, 1996 growth is estimated to have been less than 0.5 percent. Some of the slow growth is attributable to weak highway travel growth, now expected to be close to 1 percent for the first six months of 1996. Winter and early spring weather conditions dampened travel more than originally expected, especially in the Northeast and North Central United States. The price runup has also depressed travel demand, but year-to-year growth in excess of 2 percent is still possible for the summer, especially as retail prices retreat from spring highs.

Table 6.2 Monthly Oil and Gasoline Price Projections

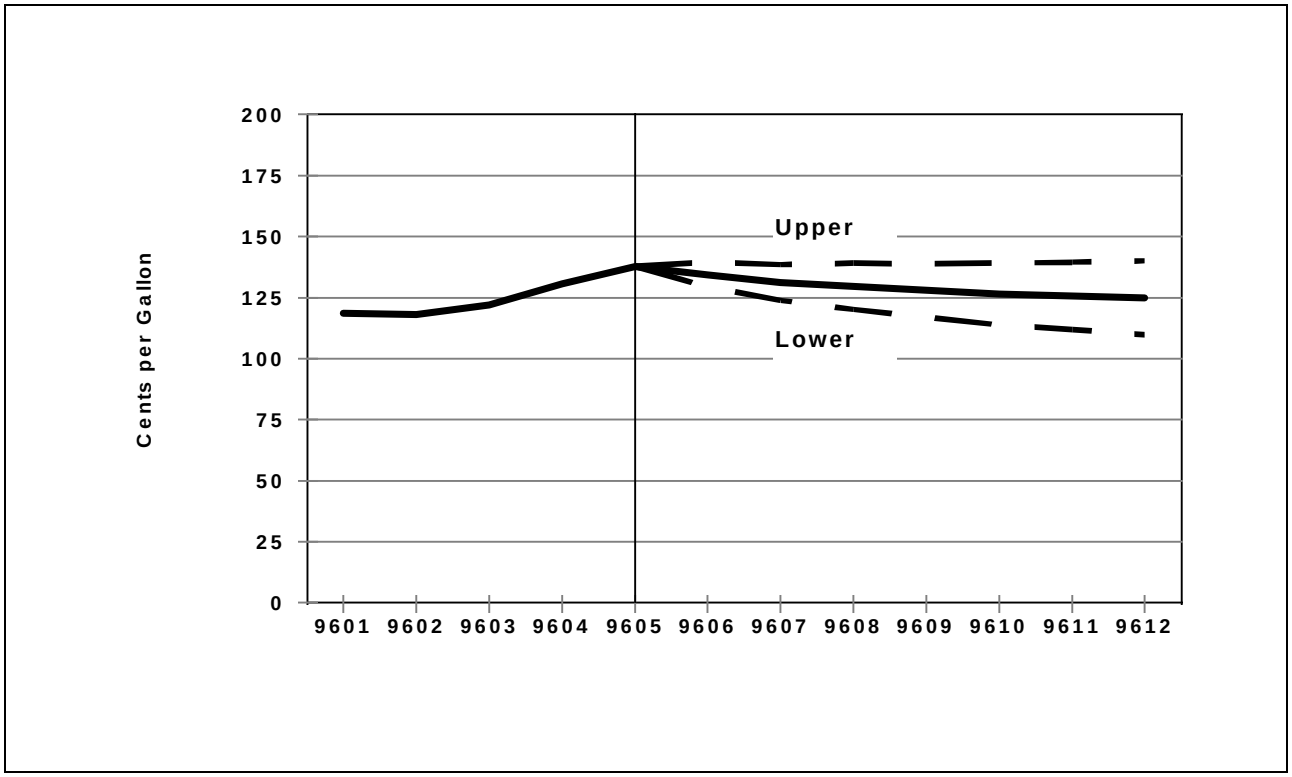
	9601	9602	9603	9604	9605	9606	9607	9608	9609	9610	9611	9612
Imported Crude Oil($/bbl)	17.510	17.730	19.850	20.900	19.250	18.750	18.250	18.000	18.000	18.000	18.000	18.000
Retail Gasoline ($/gal)	1.186	1.181	1.219	1.305	1.378	1.344	1.312	1.297	1.280	1.264	1.257	1.250

Table 6.3 Motor Gasoline Market Summary, Including Selected Indicators

	Quarterly Totals												Annual Totals			
	95Q1	95Q2	95Q3	95Q4	96Q1	96Q2	96Q3	96Q4	97Q1	97Q2	97Q3	97Q4	1994	1995	1996	1997
Prices																
(dollars per gallon)																
Retail (All Grades) ...	1.18	1.24	1.23	1.17	1.20	1.34	1.30	1.26	1.22	1.27	1.27	1.25	1.17	1.21	1.27	1.25
Wholesale	0.60	0.69	0.62	0.59	0.64	0.73	0.67	0.65	0.62	0.68	0.65	0.63	0.60	0.63	0.67	0.65
Supply																
Field Production	0.15	0.22	0.12	0.13	0.07	0.11	0.15	0.14	0.14	0.18	0.18	0.16	0.13	0.15	0.12	0.17
Refinery Output	7.10	7.49	7.59	7.55	7.22	7.59	7.59	7.64	7.34	7.60	7.63	7.66	7.18	7.43	7.51	7.56
Net Imports	0.15	0.19	0.17	0.13	0.20	0.24	0.27	0.19	0.17	0.48	0.32	0.24	0.26	0.16	0.22	0.30
Net Withdrawals	0.09	0.04	0.05	-0.02	0.02	-0.02	0.04	-0.07	0.01	-0.13	0.05	-0.03	0.03	0.04	-0.01	-0.02
Total	7.48	7.94	7.93	7.79	7.51	7.92	8.05	7.90	7.66	8.13	8.18	8.03	7.60	7.79	7.85	8.00
Disposition																
Conventional	5.04	5.55	5.35	4.54	4.93	4.98	5.28	4.70	4.84	5.33	5.31	4.78	6.53	5.12	4.97	5.06
Oxygenated	0.62	0.00	0.18	1.20	0.37	0.42	0.08	1.16	0.46	0.08	0.14	1.18	0.83	0.50	0.51	0.47
Reformulated	1.82	2.39	2.41	2.05	2.21	2.53	2.69	2.04	2.37	2.71	2.73	2.07	0.24	2.17	2.37	2.47
Total	7.48	7.94	7.93	7.79	7.51	7.92	8.05	7.90	7.66	8.13	8.18	8.03	7.60	7.79	7.85	8.00
Stocks(Million Barrels)																
Primary Finished																
Beginning	175.9	167.7	163.9	159.0	161.2	159.4	161.2	157.2	163.9	162.9	174.5	169.7	187.05	175.86	161.23	163.90
Ending	167.7	163.9	159.0	161.2	159.4	161.2	157.2	163.9	162.9	174.5	169.7	172.7	175.86	161.23	163.90	172.70
Blending Components																
Beginning	39.19	43.12	40.99	39.66	41.02	43.81	41.60	41.00	40.30	40.00	37.60	38.80	39.41	39.19	41.02	40.30
Ending	43.12	40.99	39.66	41.02	43.81	41.60	41.00	40.30	40.00	37.60	38.80	39.30	39.19	41.02	40.30	39.30
Oxygenates																
Beginning	17.15	15.30	13.80	15.13	11.70	12.63	17.10	18.71	16.59	17.88	19.85	21.05	12.63	17.15	11.70	16.59
Ending	15.30	13.80	15.13	11.70	12.63	17.10	18.71	16.59	17.88	19.85	21.05	19.46	17.15	11.70	16.59	19.46
Selected Indicators																
Vehicle Miles Travelled	6142	6793	6946	6447	6165	6928	7108	6601	6384	7093	7280	6774	6465.7	6584.2	6701.5	6885.0
MPG Proxy	19.55	20.38	20.85	19.71	19.54	20.82	21.02	19.90	19.84	20.78	21.18	20.09	20.25	20.14	20.34	20.49
Real Disposable Income	4896	4896	4950	4997	5037	5028	5066	5089	5133	5151	5181	5197	4775.6	4934.8	5054.9	5165.3
Consumer Price Index ..	1.51	1.52	1.53	1.54	1.55	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.48	1.52	1.57	1.62
Real Fuel Cost/Mile ...	4.00	4.01	3.85	3.85	3.94	4.11	3.91	3.97	3.85	3.81	3.70	3.81	3.91	3.93	3.98	3.79

Source: Energy Information Administration, Short-Term Integrated Forecasting System, JUNE 1996

Figure 6.1 Retail Gasoline Price Projections
Base Case and 95% Confidence Interval



Appendix A. Why Have Both Gasoline and Distillate Stocks Been Low This Year?

Both gasoline and distillate stocks have been lower than normal throughout 1996, for reasons that began in 1995. Going to back to July of last year, Table A.1 shows that gasoline stocks were lower than in previous years, but in keeping with a downward trend in gasoline stock levels. Distillate was within the range of previous July stock levels.

Table A.1 July End-of-Month Gasoline and Distillate Stocks (Million Barrels)

	Gasoline	Distillate
1991	208	125
1992	215	115
1993	215	121
1994	208	134
1995	207	125

Source: EIA, *Petroleum Supply Monthly*, DOE/EIA-0109 (various issues)

From this starting point, gasoline and diesel markets tightened over the next three quarters as demand outpaced supply and stock levels fell further below normal.

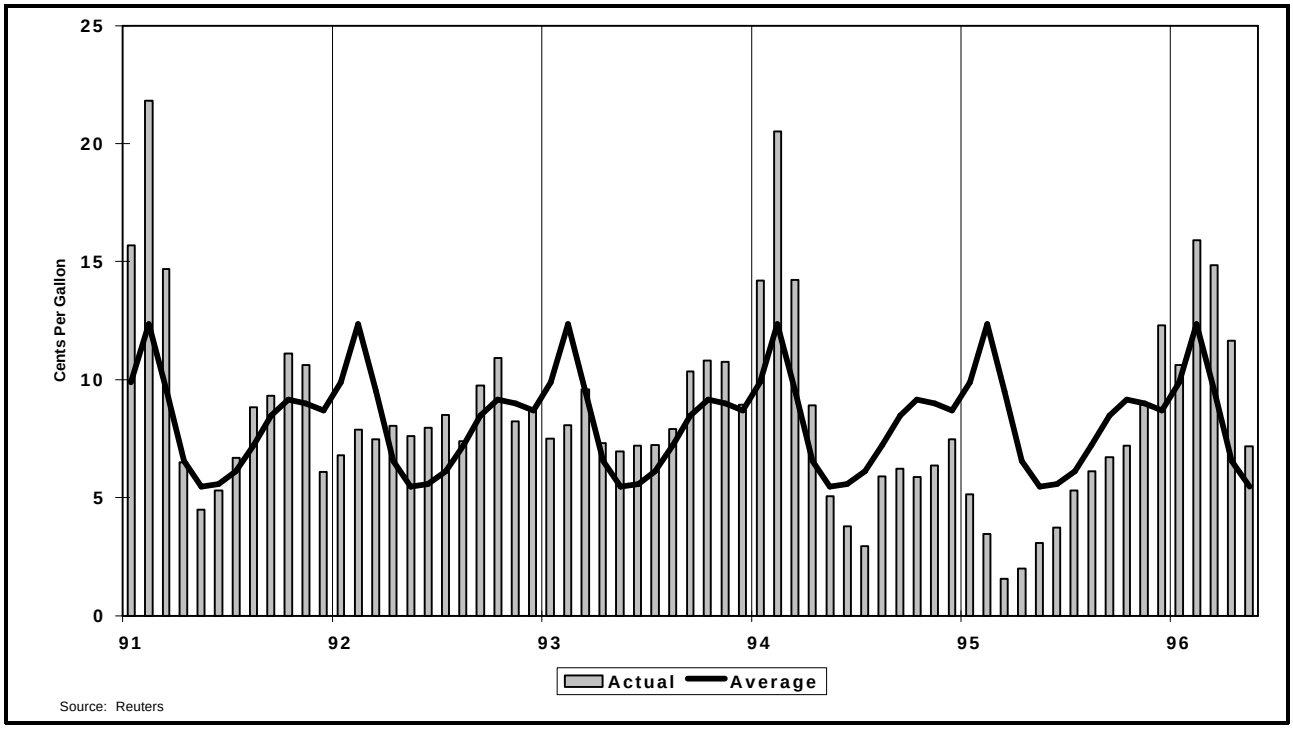
Gasoline demand in the third quarter of 1995 showed a healthy increase versus the same quarter in 1994, but production rose even more (Table A.2). This, however, was the first summer for RFG, and gasoline imports were low. Through the end of September, gasoline stocks fell further below the historically normal range. A part of the higher gasoline production was achieved by greater use of oxygenates from outside the refinery rather than higher crude oil input to the refinery. But distillate production is based on crude oil inputs. Distillate production did not keep up with the demand increases in distillates. Distillate stocks at the end of the third quarter were at the low end of the normal range at 132 MMB, or about the level seen at the outset of the 1993-94 winter period. Hence, while underproduction dampened stockbuilding during the third quarter, distillate stocks were not at a problematic or unusually low level for normal winter coverage or drawdown purposes, normally above 40 MMB.

Table A.2 Quarterly Year-to-Year Comparisons for Gasoline and Distillates
(Thousand Barrels Per Day)

	3rd Quarter 94 to 95 Change	4th Quarter 94 to 95 Change	1st Quarter 95 to 96 Change
Refinery Crude Oil Input	-25	+6	+160
Gasoline Demand	+106	+32	+42
Gasoline Production	+349	+63	+40
Distillate Demand	+48	+115	+159
Distillate Production	-77	+50	+62
Kero-jet Production	+40	+23	+169

Supply and demand for gasoline in the fourth quarter of 1995 continued to keep gasoline stocks at lower levels, while strong distillate demand pushed distillate stocks lower relative to the average pattern of previous years. Little economic incentive existed to push refiners to high crude oil runs and production levels. Distillate spreads had been below average for all of 1995 until December. Overall refinery margins were lower than normal in the fourth quarter. Also, backwardation in futures markets was discouraging production for future demand.

Figure 5.8 Distillate Spread
(NY Harbor No. 2 Heating Oil less West Texas Intermediate)



In the first quarter of 1996, distillate spreads improved as cold weather boosted demand and distillate markets tightened. Refinery crude oil input levels rose. Gasoline inventories benefitted slightly, ending March 1.1 MMB higher than in December, versus the 4.1 MMB decline seen in 1995. But strong distillate demand once again out-paced supply. While refinery crude oil input was up 160 MB/D for the quarter versus a year ago, the greatest part of the increase in light product production did not go to gasoline or fuel oil, but rather to jet fuel. Jet fuel rose an astounding 160 MB/D versus prior year levels.

Distillate stock levels fell further as cold weather continued to boost demand into April. Finally, spurred by the strong distillate demand, low stocks and higher than normal distillate spreads, refiners increased crude oil runs by over 300 MBD from the beginning to mid-April, and increased distillate production by about 250 MB/D. Most of the increased diesel production came at the expense of jet fuel production. Increased gasoline imports in April helped to keep gasoline stocks from falling in their normal seasonal pattern. Preliminary data indicate that they actually increased slightly in April.

Appendix B. Resale Spreads for the United States and Five Regions

Figure 6.1 U.S. Resale Spread (Resale - Refiners' Imported Crude Price)

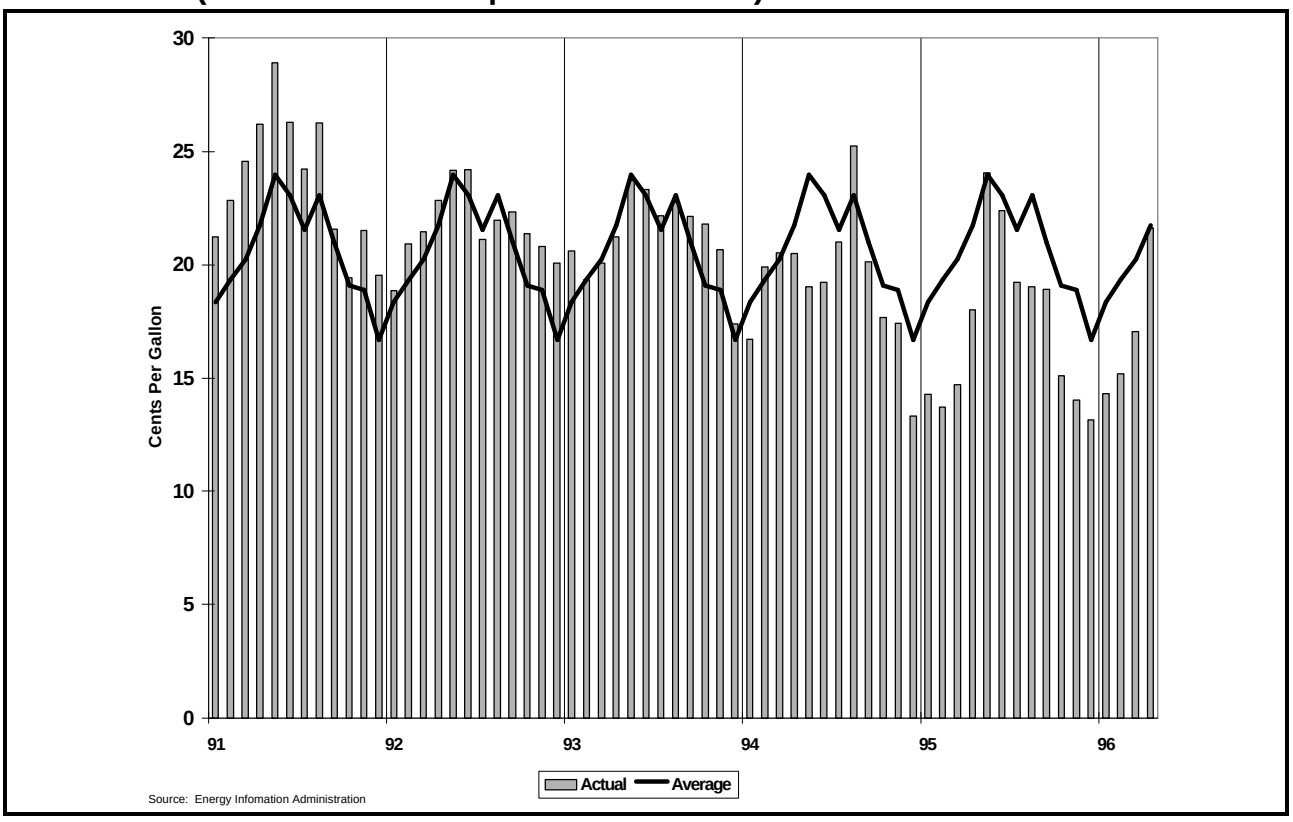


Figure 6.2 East Coast Resale Spread (Resale - Refiners' Imported Crude Price)

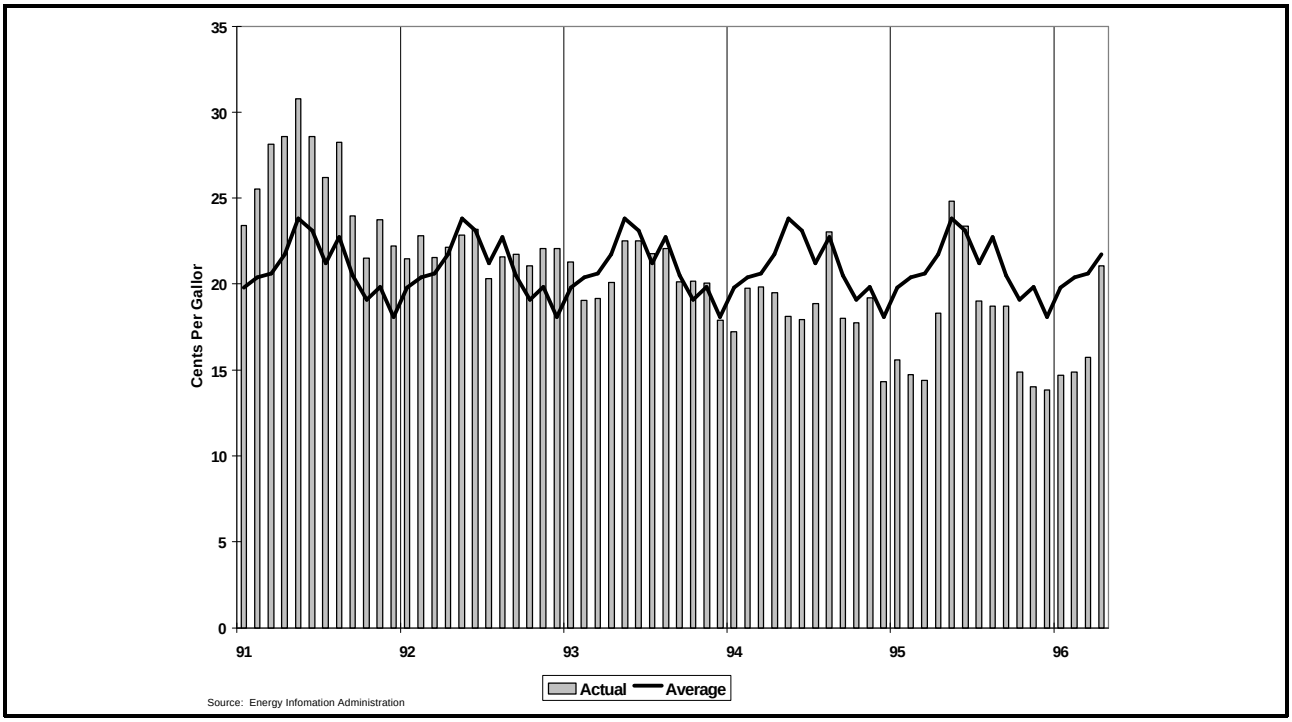


Figure 6.3 Midwest Resale Spread (Resale - Refiners' Imported Crude Price)

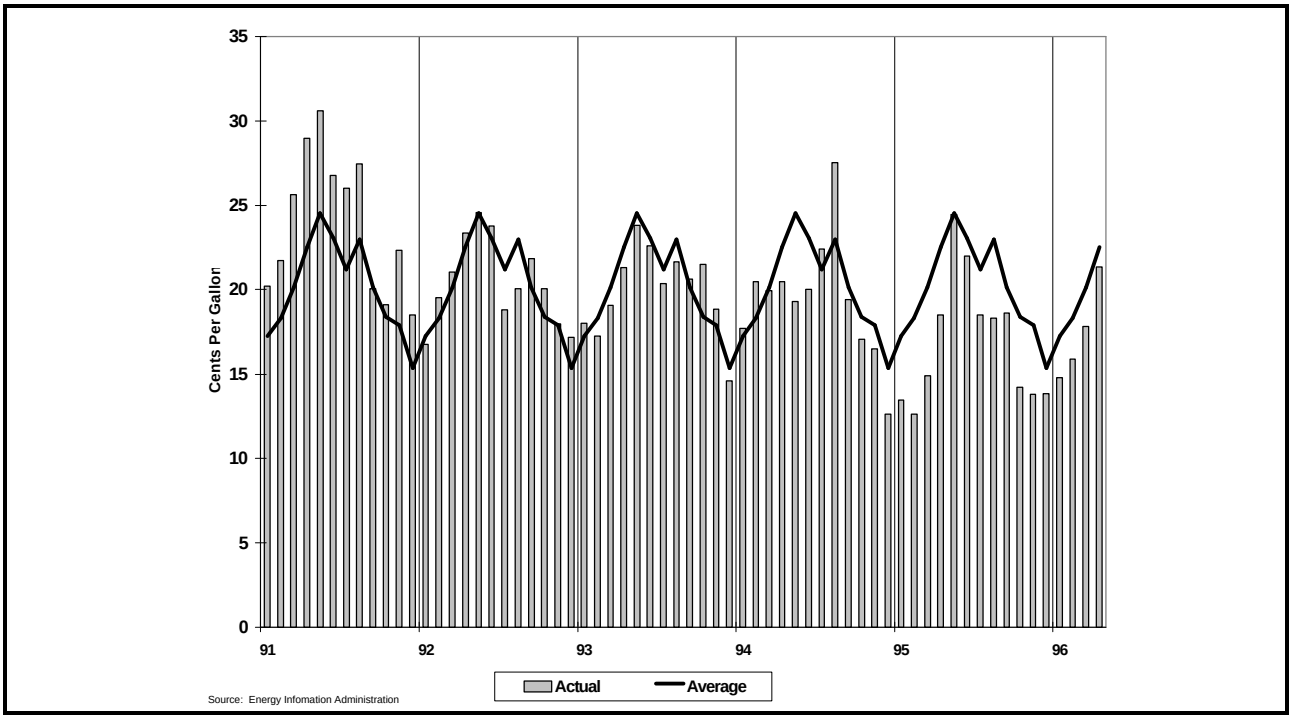


Figure 6.4 Gulf Coast Resale Spread (Resale - Refiners' Imported Crude Price)

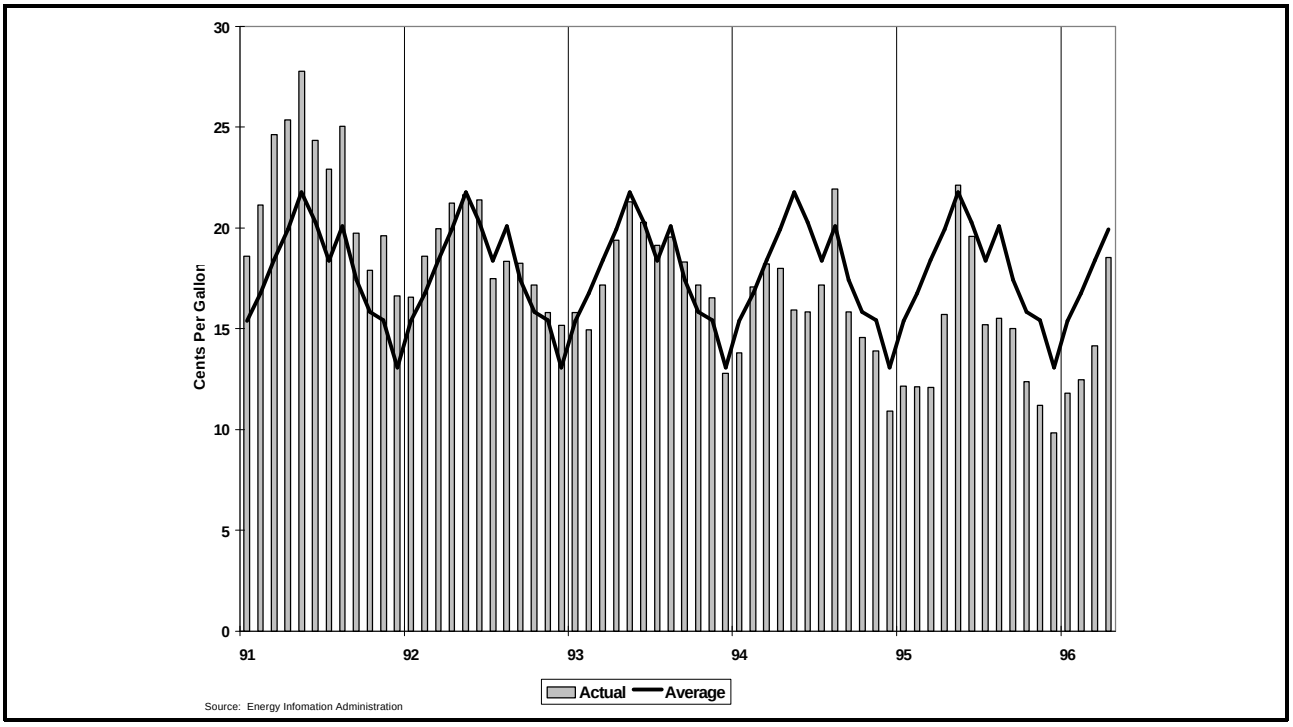


Figure 6.5 Rocky Mountain Resale Spread (Resale - Refiners' Imported Crude Price)

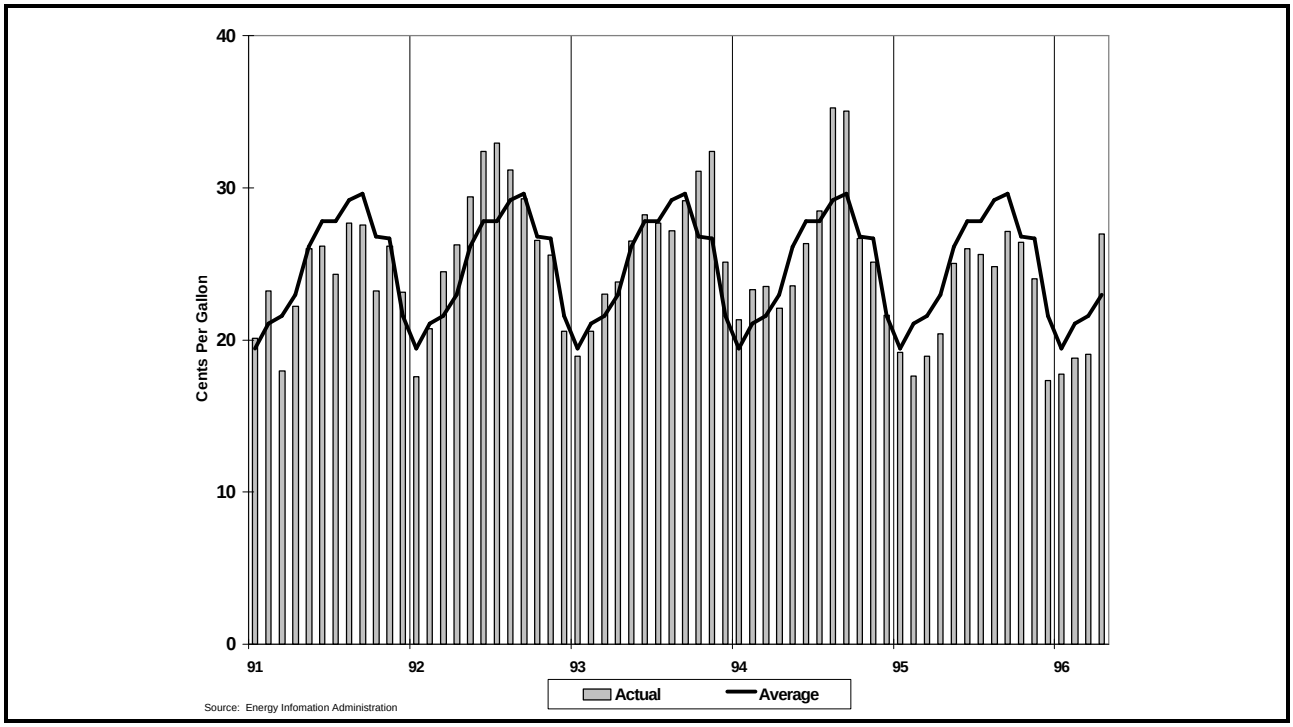
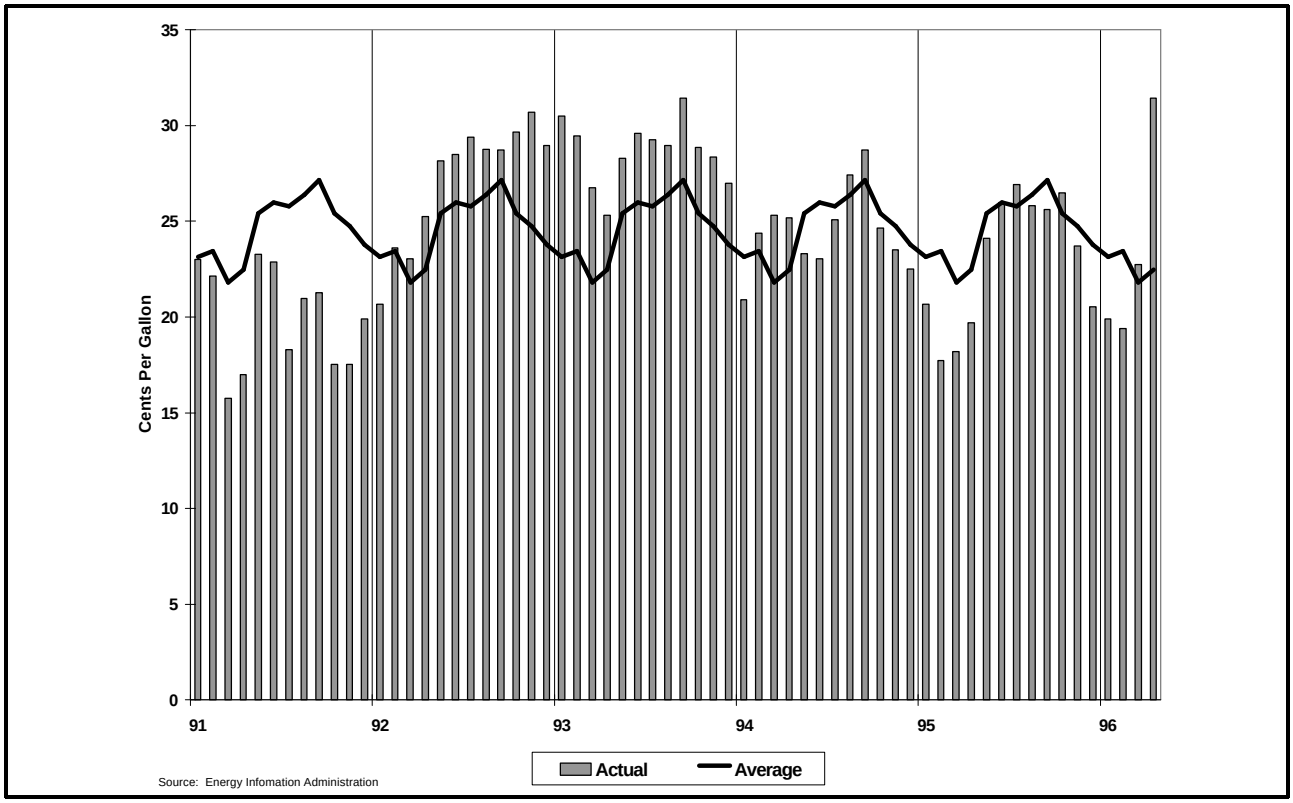


Figure 6.6 West Coast Resale Spread (Resale - Refiners' Imported Crude Price)



Appendix C. Quantitative Decomposition of the 1996 Gasoline Price Runup

Introduction

The purpose of this section, aside from reiterating briefly the circumstances surrounding the runup in gasoline prices that occurred in the United States in late winter and early spring 1996, is to address the question of whether or not the price runup can be easily explained by taking into account factors that normally influence the gasoline market. In order to do this, use will be made of the gasoline price portion of the short-term energy forecasting model maintained by the Energy Information Administration (EIA)[23] for the generation of regular short-term energy demand and supply forecasts. In addition to various demand and supply variables for all major energy sources, the model provides national-level projections of gasoline prices (as well as other major petroleum product and other energy prices) at the wholesale and retail levels. In the model, resale gasoline prices are represented by the average national refiner price of gasoline to resellers[24] , while the retail price used comes from a monthly survey of gasoline pump prices across the country and includes taxes.[25] The basic methodology is simple. The model will be used to determine if the observed prices over a specified period (in this case December 1995 to April 1996) would be predicted if the primary determinants usually considered when making gasoline price projections were known. This will help to determine if there was anything particularly unusual or abnormal about the observed price run up. In addition, the model will be used to decompose the price run up quantitatively into useful components that will help in isolating the relative importance of key determinants of the observed price changes.

Summary of Findings

Average U.S. resale gasoline prices rose an estimated 16.1 cents per gallon between December 1995 and April 1996. At the same time retail gasoline prices rose 14.5 cents per gallon. Using the EIA model, relatively little beyond the usual reaction to world oil market developments and normal seasonal price variation is needed to explain these changes. Predicted values for retail and resale prices were about what one would expect given the changes going on in the world oil market and the domestic gasoline market. Detailed results of the modeling exercise (described briefly above) include the following points: 1) crude oil price changes, which were driven by various world oil

[23]Short-Term Integrated Forecasting System model is maintained by the Office of Energy Markets and End Use, and is used to produce EIA's *Short-Term Energy Outlook*, a quarterly publication of projections for major energy market quantities and prices.

[24]See Energy Information Administration, *Petroleum Marketing Monthly*, Table 4.

[25]See Energy Information Administration, *Monthly Energy Review*, Table 9.4. The average used here is for "all grades."

demand and supply developments that emerged over the winter and in early spring, account for an estimated 48 percent of the resale price change; 2) much of the rest of this change is related to normal seasonal variation in resale prices that can be expected even when crude oil costs remain constant; 3) the remainder of the resale price shift (about 2 cents per gallon) may be characterized as additional increases in gross refiner margins due to various factors not fully captured in the model, including unusual pressures at the beginning of spring to gear up for the driving season under the conditions of an extended winter and record low gasoline inventories. As will be shown, some of this additional rise in refiner margins was the result of the particularly severe gasoline supply problems that arose in California as suppliers there were attempting to gear up to meet expanded clean air requirements set for the State by the California Air Resources Board (CARB).

Table C.1 Crude Oil and Gasoline Prices, January 1995 to April 1996

		Crude	Resale	Retail
		Oil Price	Price	Price
		(cents per gallon)		
9501		39.4	60.1	119.0
9502		40.9	60.3	118.1
9503		41.1	60.0	117.3
9504		43.9	66.5	119.7
9505		44.3	71.8	125.6
9506		42.1	68.2	128.1
9507		39.7	62.9	125.2
9508		39.9	62.0	122.2
9509		40.3	62.3	120.6
9510		39.4	58.8	118.5
9511		39.5	58.1	116.1
9512		41.8	59.9	116.0
9601		42.1	61.1	118.6

Retail prices of gasoline were affected, as usual, by the increases in refiner prices, but, in addition, seasonally adjusted retail margins (retail less resale price corrected for normal seasonal variations) improved over the December to April period. Evidently, on average, gasoline retailers and distributors were able, during the recent price run up, to reduce the extent to which their margins fell below expected or normal, a condition that fairly characterizes the late 1995 period.

Overall, the level of gasoline prices observed in April of this year was close to what would normally be expected, given the changes in crude oil costs. An exception, which appears to have affected somewhat the national average results, is California which suffered a supply shortfall due to refinery problems that took some weeks to ameliorate and which ran up marginal supply costs in the region to extraordinary levels.

A Review of Recent Gasoline Price Changes

U.S. resale gasoline prices began a rise in December of 1995 that appears to have ended in April 1996, about 16 cents per gallon later (Table C.1). Normally, if crude oil costs are held constant, from the month of December to the month of April, resale prices would be expected to rise by about 6 cents per gallon, due to typical seasonal variation. Retail gasoline prices, following their usual response to movements in resale prices, ticked up just over 14 cents per gallon over the same period. From

Table C.2 Actual and Predicted Gasoline Prices				
	Retail		Resale	
	Act.	Pred.	Act.	Pred.
		(cents per gallon)		
9501	119.0	116.5	60.1	58.8
9502	118.1	117.5	60.3	60.5
9503	117.3	118.9	60.0	61.9
9504	119.7	122.5	66.5	67.1
9505	125.6	126.5	71.8	69.6
9506	128.1	127.6	68.2	68.0
9507	125.2	124.6	62.9	63.4
9508	122.2	123.3	62.0	63.7
9509	120.6	122.9	62.3	62.4
9510	118.5	121.4	58.8	61.5
9511	116.1	121.1	58.1	62.2
9512	116.0	121.9	59.9	61.8
9601	118.6	123.1	61.1	63.6
9602	118.1	122.4	61.6	62.9
9603	121.9	124.8	67.9	68.3
9604	130.5	130.6	76.0	73.5

December to April, an increase of about 1 to 2 cents per gallon would be expected for retail prices due to seasonal variation alone. What explains the remaining 10 cents on the resale side and 12-13 cents on the retail side? The main answer to this question is rising crude oil costs.

Focusing on the resale price, which typically responds quickly to increases in average crude oil cost, at the same time that gasoline prices rose 16 cents per barrel, crude oil costs rose 8 cents per barrel. Thus, the crude oil price increase, combined with the 6 cent normal seasonal increase for this time period, appears to be most of what is required to explain the resale gasoline price runup from December 1995 to April 1996. The story isn't quite so simple for the retail price, but the main reason for the price runup there is ultimately the crude oil price increase as it worked its way through domestic refiner prices and to the pump price.

To go beyond these brief, general descriptions of how gasoline prices changed in recent months to the more detailed description of the factors moving average gasoline costs and pump prices, it will be insightful to use EIA's short-term energy forecasting model.

A Gasoline Market Modeling Exercise

Although at first blush, crude oil costs seem to be the driving force behind recent gasoline price movements in the United States, it will be useful to demonstrate with a proven statistical model of monthly domestic gasoline prices more precisely how the changes we have seen so far this spring may be broken down into identifiable components.

In the EIA model, the resale gasoline price is a function of domestic average crude oil costs (paid by refiners), days supply (seasonally adjusted) of finished gasoline stocks on hand at the beginning of the (monthly) period, seasonal factors related to normal intra-year changes in gross refiner margins, and estimated cost factors related to reformulated or oxygenated gasoline share in the U.S. total gasoline pool. Retail prices are a function of current and last-period resale gasoline prices, federal and state taxes on gasoline (assumed to be passed through 100% to consumers at all times), seasonal factors having to do with normal intra-year changes in gross retailer margins (over the average resale price), and estimated cost factors related to reformulated or oxygenated gasoline share in the U.S. total gasoline pool which are not picked up in resale price changes.

Table C.3 Refiner and Retailer Margin Analysis

	Refiner Margins			Retailer Margins		
	Act.	Pred.	Avg	Act.	Pred.	Avg
		(cents per gallon)				
9501	20.7	19.4	21.0	20.7	19.5	18.6
9502	19.4	19.5	21.1	19.6	18.8	17.4
9503	18.9	20.8	21.8	19.1	18.8	15.6
9504	22.6	23.2	25.4	15.0	17.1	14.3
9505	27.5	25.4	28.0	15.6	18.6	15.0
9506	26.1	25.8	27.6	21.7	21.4	17.1
9507	23.2	23.7	25.3	24.1	23.0	18.0
9508	22.1	23.8	25.4	22.0	21.3	17.2
9509	22.0	22.2	23.4	20.1	22.2	18.1
9510	19.4	22.0	21.6	21.5	21.7	18.3
9511	18.6	22.6	21.5	19.8	20.6	20.0
9512	18.1	20.0	19.3	17.7	21.7	23.3
9601	19.0	21.5	21.0	19.0	21.0	18.6
9602	19.4	20.7	21.1	17.9	21.0	17.4
9603	20.6	21.0	21.8	15.3	17.8	15.6
9604	26.2	23.8	25.4	15.8	18.4	14.3

Table C.4 Components of Cumulative Gasoline Price Change, December 1995 to April 1996

		Resale		Retail	
		(cents per gallon)			
Total		16.1		14.5	
Crude		7.8		7.5	
Avg. Seasonal		6.1		1.3	
Other		2.2		5.7	

Using the EIA model it is a simple matter to generate ex post predictions of average domestic resale and retail gasoline prices, over a specified historical period, given actual crude oil costs (average paid by domestic refiners), actual gasoline demand, observed motor gasoline inventories, state and federal gasoline taxes, and several other factors, including the share of gasoline demand required to meet existing oxygenation and reformulation standards.

Table C.2 and Figures C.1 and C.2 provide the results for the resale price (average monthly per-gallon refiner price for gasoline for resale) and the retail price (average monthly pump price for all grades and services). In general, the model would have predicted recent gasoline prices reasonably well given what we now know about the path of crude oil prices and other cost and demand factors in the gasoline market. The observed (preliminary) April gasoline prices are within 3 cents of the predicted values for resale and retail prices. The conditional standard prediction errors for the resale price in the model is approximately 2 cents per gallon, while the standard prediction error for the retail price is about 1.5 cents per gallon, including the effect of the error variance associated with the resale price. Thus, gasoline prices observed today are more or less what one would expect given the cost and demand forces that have come to bear on them so far this year.

Table C.5 Estimated PADD V and U.S. Refiner Margin Changes (December 1995 to April 1996)

Region		Crude Oil Price	Resale Price	Refiner Margin	
PADD V					
Dec. 1995		41.8	55.6	13.8	
Apr. 1996		49.8	84.8	35.0	
Change		8.0	29.1	21.1	
Total U.S.					
Dec. 1995		41.8	52.4	10.6	
Apr. 1996		49.8	73.0	23.2	
Change		8.0	20.7	12.7	
Total U.S. Less PADD V					
Dec. 1995		41.8	51.9	10.1	
Apr. 1996		49.8	71.4	21.6	
Change		8.0	19.5	11.5	

It is of some importance to note that, in retrospect, gasoline prices have generally been below predicted levels for much of the latter part of 1995 and early 1996, as evidenced by the "actual" line dipping below the "predicted" line in Figures C.1 and C.2. Associated with this finding is the observation that, despite the widely noted reduction in domestic gasoline inventories over the last 6 to 9 months, and despite the fact that U.S. gasoline suppliers are now meeting stricter air quality standards (a cost-enhancing factor), *gross margins* (i.e. the difference between average price and crude cost on the refiner side, and the difference between retail and resale prices on the retailer / distributor side) have been depressed relative to what would otherwise have been expected. In fact, these margins appear to have been below recent averages in nominal terms (Table C.3). A number of factors may be

responsible for this, but a leading contender is the availability of excess gasoline production capacity and supply outside of the United States, particularly in Europe and elsewhere in the Atlantic basin.

By April of this year, margins seem to have come more in line with what is normally expected, suggesting that a more typical domestic gasoline market balance has emerged, given world oil market conditions. Thus, it can be inferred that some of the gasoline price increase since December has been the result of a recovery in gasoline margins. Even though refiner margins were above expected levels in April, it is notable that they were, in the aggregate, not significantly different (less than 1 cent per gallon) from the average for that month in the previous 5 years.

Table C.4 provides a summary analysis of the components of cumulative gasoline price change between December 1995 and April 1996. Three general factors are separately identified as contributing to the observed changes: crude oil cost, normal seasonal variation, and a residual

Figure C.1 Actual versus Predicted Retail Gasoline Prices

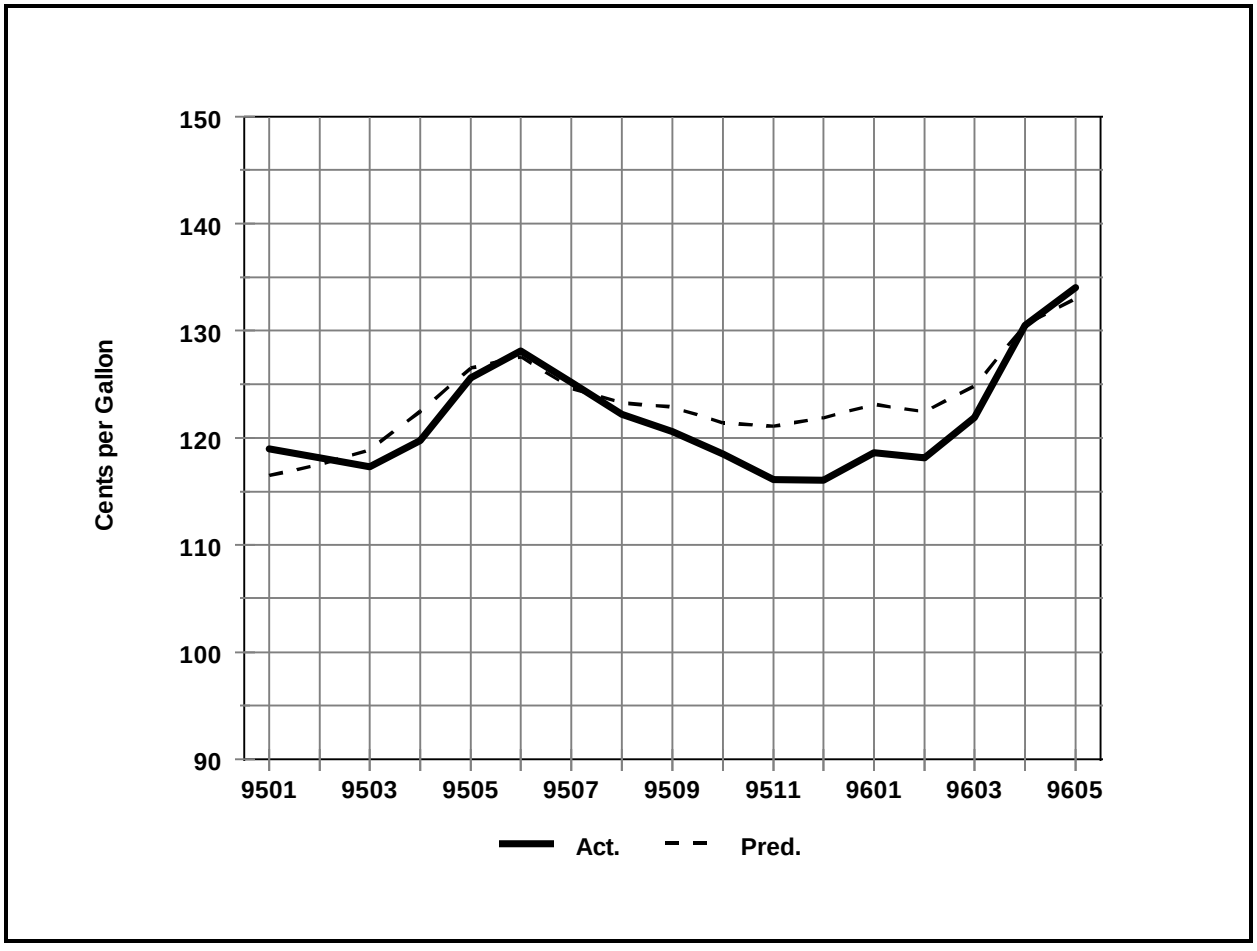
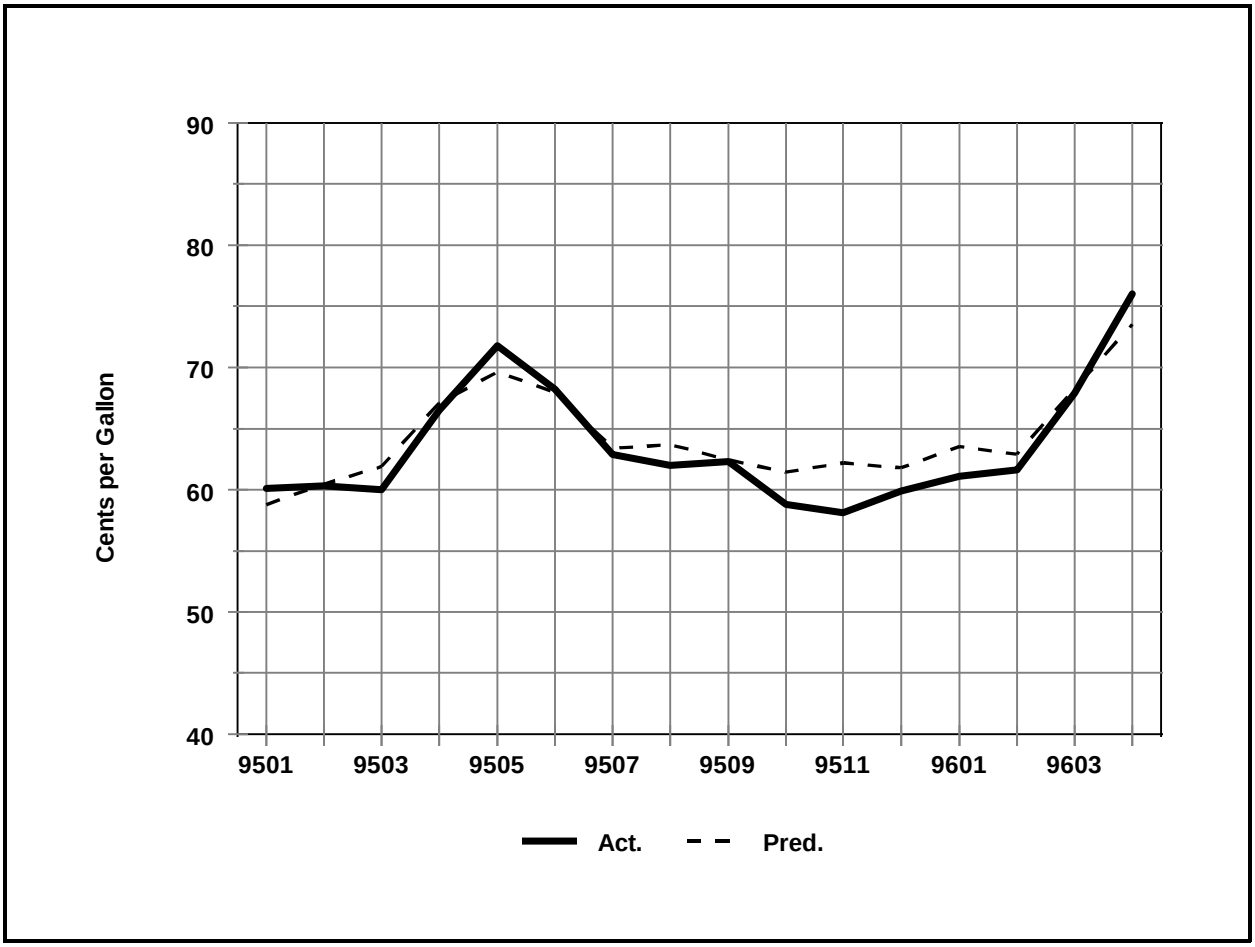


Figure C.2 Actual versus Predicted Resale Gasoline Prices



"other" category, which is essentially a component of change in gross refiner margins not explicitly accounted for in the model. These categories are quantified by performing the following modeling exercise, involving two separate runs of the model, simulating over the December 1995 to April 1996 period: 1) the model is run using predicted values for resale and retail gasoline price with crude oil price, gasoline demand, and gasoline inventories set to actual (known) values; and 2) the model is rerun as in 1) except that crude oil costs are set to the December 1995 value throughout. The crude oil cost component of the price change is then defined as the difference (for each gasoline price) between the results of runs 1) and 2). The seasonal component is (roughly) the change observed over the period in run 2). The "other" component is defined as the residual (that is, the actual change less the other two calculated components).[26]

From Table C.4, it is apparent that, at the resale level, about one half of the 16-cent increase is attributable to crude costs and 38 percent to normal seasonal variation. Thus, only about 10 to 15

[26]It should be noted that this component contains any error that may be attributable to the model specification, including those that may be related to the crude oil cost, demand pressure and seasonal coefficients. Thus, it is particularly subject to uncertainty in interpretation. Also, it should be noted that, in the model, neither crude oil costs nor inventories directly affect the retail price but work indirectly through the resale price. The retail price changes are indirectly attributed to those components in Table C.4 for convenience.

percent of the resale price change is attributable to movements in the average refiner margin not anticipated by the model. It is likely that this result stems partly from supply problems this spring not normally accounted for in the model (see the section on the California situation below), including the possibility that the unusually low inventories seen over the past several quarters exacerbated the extent of seasonal variation in the resale price between December and April. On the retail side, the net effects are: about 50 percent from crude price changes, somewhat less than 10 percent each from normal seasonal variation, and approximately 40 percent from unanticipated shifts in retailer / distributor margins. It is not entirely clear what the significance of the retail margin shift is, but, given the uncertainty surrounding the item and the fact that even though retailers seem to have at least temporarily recovered noticeably from the relatively poor spreads seen last fall, since neither the total retail price nor the retail margin have exceeded (or even reached) expected values to date, these will not be examined in any further detail here. As to the average refiner margin, it will be useful to demonstrate the role played by the California gasoline supply situation in the relatively high value observed for April.

The California Situation

Since the California gasoline market is a significant piece of the total U.S. gasoline market (approximately 12 percent of total U.S. demand), unusual events there have the ability to make themselves felt even in the national price averages. Table C.5 indicates, using available data on regional prices from EIA, how significant the events in the California region were during the recent gasoline price run up. (Since state data for California refiner prices and margins were not available, spot prices for conventional regular gasoline at Los Angeles and the national average refiner crude oil cost were used for the calculations).

Although it is clear from Table C.5 that events on the West Coast far outstripped the nation as a whole, in terms of price and refiner margin increases this year, one would infer from it that average national resale price and refiner margin increases between December and April would have been perhaps 1 cent less than they actually were if California had experienced changes similar to the rest of the country. This leaves about 1 cent in refiner margin increases that are not readily explained by the model. Whether or not the remaining increase is due to some enhanced seasonality in gasoline prices under a low inventory regime or to other factors, the fact remains that the predicted resale price for April, particularly after accounting for the peculiar situation in California, does not miss the actual price by more than one standard error, which illustrates the second-order nature of the residual.