



You may be interested.

PIRINC has prepared the enclosed report, *Gasoline Prices: Balancing Supply and Demand*.

In free markets, prices serve to balance demand against existing supply and, when supply is particularly tight or loose, to send signals to correct those conditions. In normal conditions, prices tend to reflect costs, including normal profits, taxes, etc., of producing and bringing the product to market. Hurricanes Katrina and Rita created supply conditions for gasoline that were decidedly not normal. Losses of refining capability and disruptions to the distribution system meant immediate, substantial losses of gasoline supply in what was already a tight market. The balancing mechanism between demand and suddenly reduced supply was price. The resulting price increases were particularly large because consumers do not easily modify their use of gasoline, a near-necessity for many, in response to price changes. That is to say, price elasticity of demand for gasoline, especially in the short term, is very low and therefore, a disproportionate increase in price is required to achieve a modest reduction in demand.

This report reviews price developments on a week-by-week basis to focus as closely as possible on immediate supply and price relationships. The report finds that immediate price movements as a result of the hurricanes were, if anything, below what typical estimates of price elasticity indicated would be required. While there is no good time for a hurricane, Katrina struck at a particular moment when there was more flexibility among suppliers and consumers that would have been the case even a week or two earlier. Labor Day marks the end of the peak driving season and refineries typically schedule seasonal turnarounds for maintenance and shifts to winter fuels production. Post Labor Day schedule adjustments could be made at undamaged refineries to keep up production in the aftermath of Katrina. Although the Labor Day weekend is a peak driving period, a larger than usual proportion is discretionary, leaving more room for consumer cutbacks in response to price spikes and supply concerns. While price movements were disproportionate on the way up, small improvements in supply also led to rapid, disproportionate, price declines. The continuous availability of supply (apart from some very brief, localized instances) to those willing to pay the market prices, and the self-correcting actions encouraged by the initial price surges, helped minimize the total time the markets were under stress and the economic fallout from the initial supply losses.

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Gasoline Prices: Balancing Supply and Demand

Summary

Although gasoline prices are now far below the peaks of September the question remains as to just why they got so high in the first place. The question was prominently raised at the November Senate hearing where the chief executives of the country's largest oil companies came to testify, with some Senators noting public suspicion that the industry was somehow “---taking unfair advantage of current market conditions.”¹

In free markets, prices serve to balance demand against existing supply and, when supply is particularly tight or loose, to send signals to correct those conditions. In normal conditions of adequate supply, prices tend to reflect costs, including normal profits, taxes, etc., of producing and bringing the product to market. Hurricanes Katrina and Rita created supply conditions for gasoline that were decidedly not normal. Losses of refining capability and disruptions to the distribution system meant immediate, substantial losses of gasoline supply in what was already a tight market.² The balancing mechanism between demand and suddenly reduced supply was price. The resulting price increases were particularly large because consumers do not easily modify their use of gasoline, a near-necessity for many, in response to price changes. That is to say, price elasticity of demand for gasoline, especially in the short term, is very low and therefore, a disproportionate increase in price is required to achieve a modest reduction in demand.³ A sharp increase in price also means a sharp increase in profits for those who have product to sell and, for many who see both happening at once, raises the suspicion of “price gauging.” But price gauging flourishes when there are outright shortages, as occurred under price controls in 1973-74 and again in 1979-81, that leave consumers struggling to find supply at any price. Free-market pricing means supplies are always available. While consumers may be unhappy at the prices, they won't be desperate.

This report reviews price developments on a week-by-week basis to focus as closely as possible on immediate supply and price relationships. The report finds that immediate

¹ Joint Hearing on Energy Pricing and Profits, held by the U.S. Senate Committee on Commerce, Science and Transportation and the U.S. Senate Committee on Energy and Natural Resources, November 9th 2005. Quotation taken from the opening remarks of Senator Pete V. Domenici.

² Between the week ending August 26th and the week ending September 2nd, refinery crude runs in PADD 3 fell by nearly 1.5 MMB/D while production of finished gasoline fell by about 0.7 MMB/D. Typically, production in the run-up to the Labor Day weekend would be more-or-less stable at high levels. Hurricane Rita had an even larger effect on PADD 3 refining, with crude runs in the immediate aftermath down by about another 3 MMB/D and finished gasoline production in the region by about another 1.1 MMB/D. But by then higher refinery runs and gasoline yields at undamaged refineries, as well as higher imports, moderated the overall supply loss.

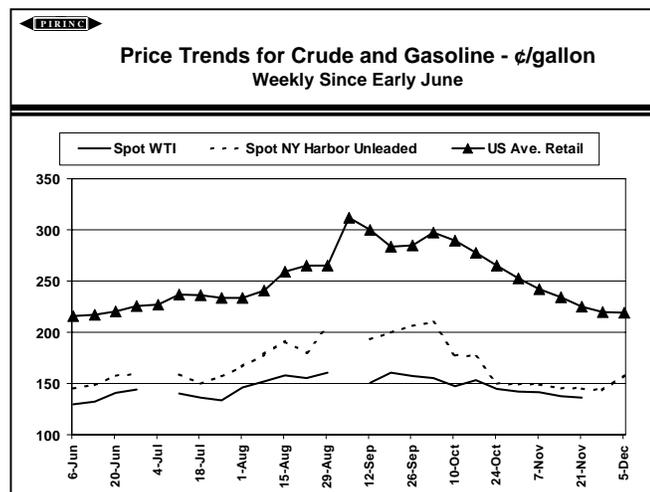
³ For the industry, higher profits on remaining supply are partly offset by the current and prospective costs of repairing damaged facilities. Higher profitability created strong incentives to maximize runs and gasoline yields at undamaged facilities and to shop the world for increased imports, both of which helped first moderate and then reverse the initial run-up in prices. For a detailed discussion of industry and government responses to the initial supply losses, see the PIRINC report, **Lessons from the Hurricanes**, released November 2005.

price movements as a result of the hurricanes were if anything, below what estimates of price elasticity indicated would be required. While there is no good time for a hurricane, Katrina struck at a particular moment when there was more flexibility among suppliers and consumers that would have been the case even a week or two earlier. Labor Day marks the end of the peak driving season and refineries typically schedule seasonal turnarounds for maintenance and shifts to winter fuels production. Post Labor Day schedule adjustments could be made at undamaged refineries to keep up production in the aftermath of Katrina. Although the Labor Day weekend is a peak driving period, a larger than usual proportion is discretionary, leaving more room for consumer cutbacks in response to price spikes and supply concerns. Moreover, while price movements were disproportionate on the way up, small improvements in supply also led to rapid, disproportionate, price declines. The continuous availability of supply (apart from some very brief, localized instances) to those willing to pay the market prices, and the self-correcting actions encouraged by the initial price surges, helped minimize the total time the markets were under stress and the economic fallout from the initial supply losses.

Trends in Crude and Gasoline Prices

The chart below summarizes weekly price trends for crude and gasoline from early June of this year through the beginning of December. Spot prices for WTI, New York Harbor unleaded gasoline, and average U.S. retail gasoline prices are shown in cents/gallon.

Prices were already moving up before the first hurricane, Katrina, made landfall on the Gulf Coast on August 29. By mid-August, the price of WTI had risen nearly 28 cents/gallon (or nearly \$12/barrel) from its 130 cents/gallon (\$54.48/barrel) level in early June. However, the increases in gasoline prices far outpaced the gains for crude. New York Harbor spot prices for gasoline rose by 43 cents/gallon over the same period while the retail price rose by 46 cents to an average pump price of \$2.59/gallon. During this period rising demand both in the US and worldwide was pressing against the limits of domestic and global refining capability, especially for production of light products.⁴



⁴ The futures markets were also expressing these concerns. The January 2006 contract price for New York Harbor gasoline rose by about 38 cents/gallon from early June to mid-August, not much less than the 46 cent rise in the spot gasoline price. However, future concerns were less relevant for the hurricane related period. Between August 26th and September 1st, the spot price of New York Harbor gasoline rose by \$1.16/gallon to just over \$3 while the January futures price rose by only 19 cents. Clearly prices at that time were driven by the immediate need for product.

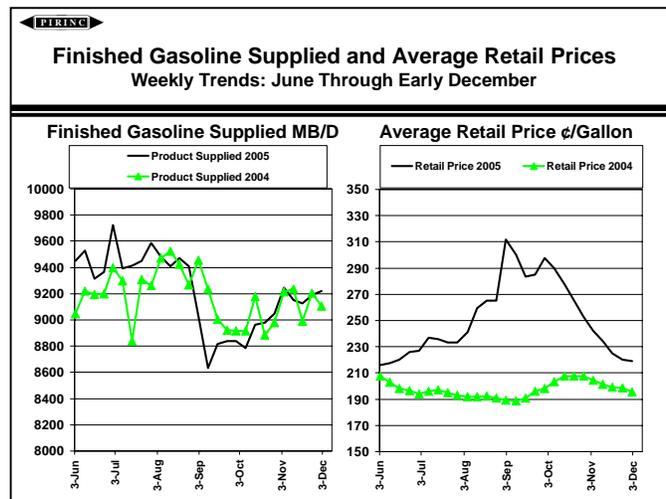
In early September, a few days after Katrina had struck the Gulf Coast, the average retail gasoline price reached a peak of \$3.12/gallon, a 46 cent jump from the week ending August 29th, and 53 cents above the mid-August level.⁵ All three prices fell back until the approach of hurricane Rita, which made landfall on September 24th, triggered a new, but less dramatic run-up in prices, even though the loss of refining capability was even greater than in the aftermath of hurricane Katrina. In the immediate aftermath of Hurricane Katrina, refinery production of finished gasoline in PADD 3 was down 0.7 MMB/D versus the year earlier---after running slightly above year-earlier levels in previous weeks. For the week ending September 30th, PADD 3 finished gasoline production was down 1.4 MMB/D versus the year before.⁶ After an early October peak in retail prices of \$2.98/gallon, gasoline prices moved steadily downward, and by far more than the decline in crude prices. In late November, New York Harbor and retail prices had moved close to the levels of early June---and to similar differences versus crude prices.

The pattern of first sharply rising gasoline prices followed after a few weeks by their retreat reflects primarily changing supply constraints over the period. There is however, a complication in assessing supply availability versus demand over this period. It should be kept in mind that the first hurricane struck on the eve of the official end of the summer driving season, Labor Day weekend. Gasoline demand shows a seasonal decline after the holiday weekend, as do refinery runs as industry prepares to meet winter requirements.

Supply Availability and Retail Gasoline Prices

The next chart attempts to allow for seasonal factors by tracking weekly for both product supplied and retail prices for this year versus last year.

The left panel shows weekly trends in finished gasoline supplied as published by the Department of Energy for June through early December of this year and 2004. Even allowing for volatility in the weekly data, product supplied in June and July was clearly above the same period in 2004---by about 3%. The differences narrowed to near zero



⁵ Markets for WTI and New York Harbor unleaded were closed September 3rd through the 5th for the Labor Day holiday weekend so no comparable prices were available for September 5th, the date for retail prices. Prices for days when these markets were open reached their peaks on September 1. The WTI price reached \$69.27/barrel (or \$1.65/gallon), about \$3/barrel (7 cents/gallon) above its mid-August level while the price for New York Harbor unleaded reached \$3.11/gallon, an increase of \$1.09 above its mid-August level.

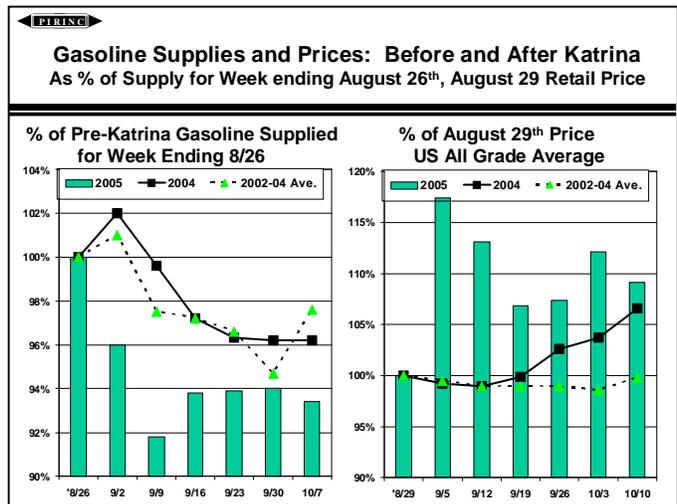
⁶ Higher utilization rates and gasoline yields at undamaged refineries, and a surge in gasoline imports helped offset much of the negative supply impact of hurricane Rita. Between end-September and end-October, gasoline imports were up versus the previous year by 476 MB/D, a 56% increase.

in August before turning sharply negative in early September. Note that product supplied fell back last year after the first weekend of September, reflecting normal seasonal patterns, but the immediate decline this year was much sharper. For the week ending September 2nd, product supplied was 4.5% below the year-earlier level, and the following week, 6.5% below. Product supplied improved to within 1% of prior year levels by late September. The gains were interrupted by hurricane Rita but late October, supply had caught up with year-earlier levels.⁷

Other things equal, demand for gasoline should have been running ahead of year earlier levels. The economy was strong, with real personal consumer spending in the second and third quarters averaging nearly 4% above 2004 levels. Nor were there ongoing gains in fuel economy to offset growth in the nation’s vehicle fleet and miles driven. However, other things, notably the price of gasoline did not stay equal. As shown in the right panel, the average retail price of gasoline at the beginning of June was close to its level for the same period in 2004, \$2.16 vs. \$2.08/gallon. But the gap widened to about 30 cents by end-June, 40 cents by end-July, and about 70 cents by mid to late August, as the average prices reached about \$2.65/gallon. The difference rose to \$1.22 on September 2nd as the average price of gasoline rose to \$3.12/gallon and then narrowed slightly the following week as the price eased to \$3. These peak prices corresponded to the largest declines versus the year before in product supplied. Thereafter, with the exception of a brief upward movement of about 12 cents at the time when Hurricane Rita interrupted the improvement in supply, prices have given up most of their gains since early June. At the beginning of December, the average price was only three cents/gallon above its early June level. The early December 2005 price was about 23 cents/gallon above its year earlier level, identical to the average year-on-year difference in WTI crude price for November (\$58.26/barrel vs. \$48.43).⁸

Demand, Supply, and Prices Needed to Balance

Hurricane Katrina made landfall in Louisiana on Monday, August 29th, one week before Labor Day, September 5th, the final day of the peak-driving season. Thereafter, typically, gasoline demand, and product supplied fall off as refineries schedule turn-arounds in preparation for winter fuel requirements. Prices tend to ease somewhat as well. In estimating the impact of Katrina on prices, it is first



⁷ For the week ending October 21, finished gasoline supplied was running about 1% or 100 MB/D above year-earlier levels despite lower refinery production in PADD 3 of 420 MB/D. Higher imports, higher refinery runs outside PADD 3, and higher gasoline yields together contributed to this result.

⁸ The difference in crude price widened to about 40 cents/gallon in the first two weeks of December as WTI reached \$60/barrel versus an average of about \$43.20 for the first weeks of December 2004.



necessary to separate effects of the hurricane on supply from normal seasonal patterns. To do so, the columns of the left panel of the next chart show product supplied for the week ending August 26th, 10 days before Labor Day, and product supplied during subsequent weeks, all in percentage terms with product supplied for the week ending August 26th set at 100%. The lines of the panel show, also in terms of percentages, product supplied, figures for the comparable weeks of 2004 and three-year averages for 2002-2004.

As shown by the 2004 and the 2002-04 average patterns, gasoline supplies normally tend to increase for the Labor Day weekend and then fall back to slightly below the late August level right after. By late September the prior patterns show a fall-off of about 4% from the late August level and of about 6% from the week ending just before Labor Day. This year was very different. Instead of rising by 1% to 2% as before, product supplied just before this Labor Day weekend fell back by 4%, indicating a supply shortfall of 5 to 6% versus the norm. A week later, the week ending September 9th, supply was 8% below late August levels, although versus the previous patterns shown, the gap not much wider than the week before. Thereafter, the gap between this year’s supply pattern and the earlier patterns narrowed to about 2 percentage points by late September. Hurricane Rita led to only a slight widening of differences thanks to growing availability of alternative sources of supply. The higher prices had acted as a magnet that attracted plus supply from imports and increased output from the non-impacted refineries.

The right panel shows retail gasoline prices on a similar percent of late August price basis, (with in this case August 29th average set at 100%) based on the EIA weekly retail price survey dates. In 2004 and for the average 2002-04 period, prices eased slightly in the early September weeks.⁹ This year, the US average retail price on September 5th was 17% above its late August level, or about 18% above what the two prior period patterns indicated. The following week, the difference versus late-August narrowed to 13% and then drifted lower to about 7% before Hurricane Rita temporarily moved the difference up to 12%.

Clearly prices in the immediate aftermath of hurricane Katrina moved up sharply relative to the loss of supply but some disproportionate price effect was to be expected. The issue is whether the price increases that did occur were in any sense “excessive.” Given the likely range of price elasticities applicable in the very short term, the answer would appear to be negative. Indeed, immediate price increases were less than might have been expected. The table below considers for a range of price elasticities from -0.1 to -0.3, the price increases required to reduce consumption from initial

% Retail Price Increase Needed to Reduce Demand by:			
	2.5%	5%	7.5%
Price Elasticity			
-0.1	+29%	+67%	+118%
-0.2	+13%	+29%	+ 48%
-0.3	+9%	+19%	+30%
Note: Actual retail price increase 8/29 to 9/5 +17%			

⁹ The EIA surveys of gasoline prices are done on Mondays. Thus the first September survey takes place on Labor Day.

levels by 2.5%, 5% and 7.5%, with the top of the range about in line with the immediate, post-Katrina supply loss. The range of price elasticities brackets the approximate -0.2 estimate cited in a recent FTC study of gasoline price changes and the results of regression analysis of pre-and post-Katrina data.¹⁰

With a price elasticity of -0.2 , prices would have to rise by between 29% and 48% to cut immediate demand by the 5% to 7.5% level required by the loss of product supplied. The actual price shown above immediately after Katrina was less, about 17%.

In effect, the initial increase in the average US retail gasoline price was less than what would have been expected given a reasonable range of price elasticity estimates. Price increases were moderated by unexpectedly large voluntary consumer cutbacks (or involuntary in those limited cases where there were temporary outright shortages), in particular by curtailing Labor Day weekend trips. Since it was a holiday weekend, there was a greater discretionary component to driving than would be the case during a normal workweek. Thereafter, consumer responses appeared to move back into the ranges for price elasticity shown in the table.

In summary, not only were the price increases following Katrina not “excessive,” but they were more moderate than prior estimates of price responses would have predicted---and as it turned out, very short-lived.

¹⁰ **Gasoline Price Changes: The Dynamic of Supply, Demand and Competition**, released by the Federal Trade Commission in June 2005. The report cites the study by Hilke A. Kayser, “Gasoline Demand and Car Choice: Estimating Gasoline Demand Using Household Information,” *Energy Economics*, Vol. 22 (2000), pp. 331-348. Log linear regression analysis of weekly June through end-November product supplied and price data with allowance for the driving vs. non-driving season observations yields price elasticity estimates of about -0.1 to -0.2 .