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MAY 2007

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The U.S. has suffered a severe supply disruption, yet the price of crude oil has increased only modestly. The disruption has not occurred as a result of a disruption in crude oil imports from war or rebellion in far off production centers, but largely through recent losses in capacity to produce refined products, notably gasoline.

The following EPRINC note, **"The Silent Disruption"** shows that rising gasoline demand in the U.S., combined with unscheduled refinery closings, looming strikes, limited spare replacement capacity, longer turn around times for scheduled maintenance, and refining factors are all contributing to an environment where "***surprises get priced.***" Note that the market environment in which these events unfolded did not see substantial reductions in gasoline imports, and only modest reductions in domestic production of gasoline. Historically, the products market could call on some combination of greater drawdown of stocks from storage and the engagement of idle processing capacity to meet demand shifts or make up lost capacity. However, over the last two months, neither ample stocks nor idle capacity were available to meet rising U.S. demand for transportation fuels. EPRINC estimates that the run up in gasoline prices of approximately 80 cents a gallon at the retail level since mid-February reflects a supply shortfall of at least 275,000 barrels per day, which is the rate of gasoline inventory decline during the past 12 weeks. The run-up in gasoline prices over the last two months can be compared to circumstances in which crude prices jump by $25-30/barrel.

Concern over energy security and price volatility historically looks at crude oil imports as the main component of risk. Hurricanes Rita and Katrina highlighted another component of risk – a surprisingly fragile processing infrastructure that could, upon occasion, yield considerable price volatility. These developments also suggest that regulatory and legislative initiatives that affect refinery investment, operations, and fuel imports must now give added attention to short and longer term consequences of the availability and cost of transportation fuels in the U.S., and the capability of that infrastructure to respond to surprises.

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Note on data sources: Data used in this EPRINC note are from the Energy Information Administration, time series data on prices can be found at: http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_d.htm

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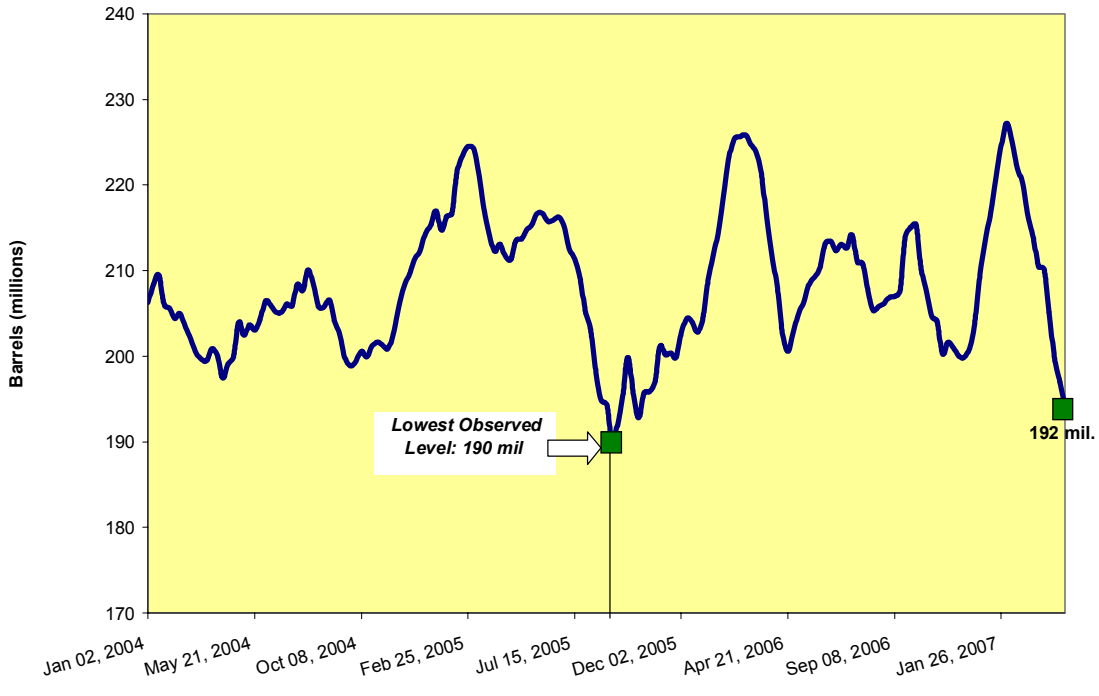
MAY 2007 – EPRINC NOTE

THE SILENT DISRUPTION

Inventories

Figure 1 shows weekly stocks of gasoline since the start of 2004. The most recent data show levels of 192 million barrels (bbls) for total gasoline inventory. In order to interpret the relative magnitude of these figures, they should be compared to some minimum operating level, the level of supply chain fill at which the system begins to experience supply run-outs at some of the nodal points along the fuel transportation and distribution chain.

Fig. 1: Weekly Gasoline Stocks: Jan 2004-April 2007 (million barrels)



Until several years ago EIA/DOE estimated minimum operating levels for fuel inventories, but ceased producing these numbers because---with the more common use of just-in-time practices--- the figures became outdated. To provide an estimate of what might be considered an operating low-point, we focused on the lowest recent experience. For gasoline, that was the Rita/Katrina stock level, which was 190 million bbls on September 2, 2005. That is as low as gasoline inventories have been recently. Some disruption of supply took place, although it may have been due more to damaged transport facilities than stock level. It may well be possible to operate the gasoline supply and distribution chain at lower stock levels without disrupting fuel deliveries, but there is no recent experience in doing so. If this is the case, there is no extra inventory beyond "pipeline fill" to day-to-day variation in gasoline needs.

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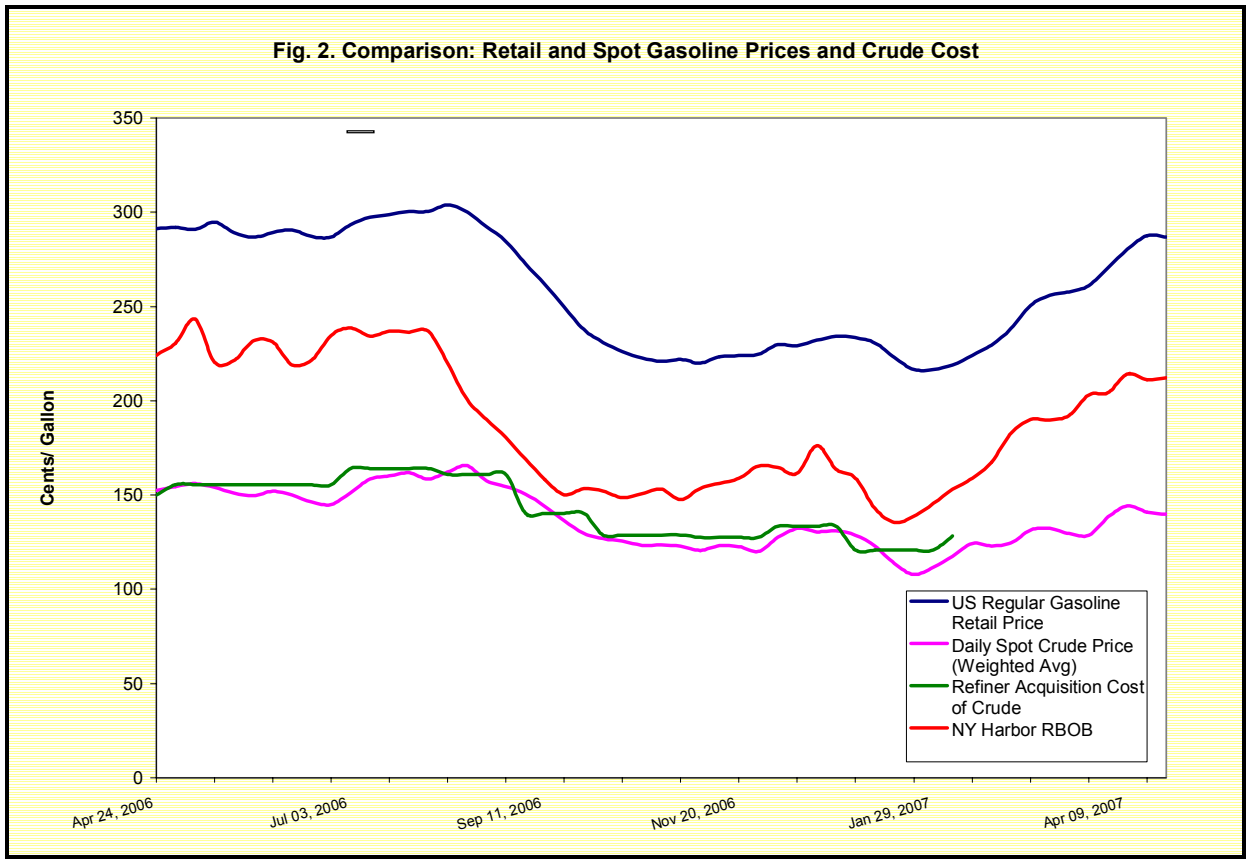
Prices

Figure 2 shows comparative gasoline and crude oil prices (in cents per gallon) for the past year. Crude prices are the refiner composite acquisition cost of crude through February 2006. To extend these comprehensive crude cost data through April, the EIA series on daily spot crude prices[1] is plotted. It shows last years high prices for both crude and gasoline, a drop in both as the driving season wound-down, and a subsequent rise in mid-winter 2007. While the history is interesting—showing high refinery margins for gasoline v. crude during the 2006 driving season---the most recent data are eye-opening. In January, 2007, pump prices had fallen to $2.17, a recent low. With NY RBOB at $1.39 per gallon and WTI at $54.01 (the equivalent of $1.39 per gallon), refiners margins on gasoline were $4.20 per bbl.



But by late-April, pump prices were $2.87 per gallon, RBOB was $2.23 and WTI $64.00 ($1.52 per gallon). At the wholesale level, refiners' margin relative to WTI was $0.71, or $29.82 per barrel. This is about $20 more than a high-normal figure for gasoline refinery margins; a strong number might be in the $10/bbl area. The current gasoline margin situation is comparable to August 2006, when retail gasoline prices spiked to $3.08. At that time, NY RBOB was $2.33 per gallon wholesale, and the refiner acquisition cost of crude was about $68 per barrel ($1.62 per gallon.) This resulted in the same refinery margin--- $30 per barrel or $0.71 per gallon---as is currently the case.

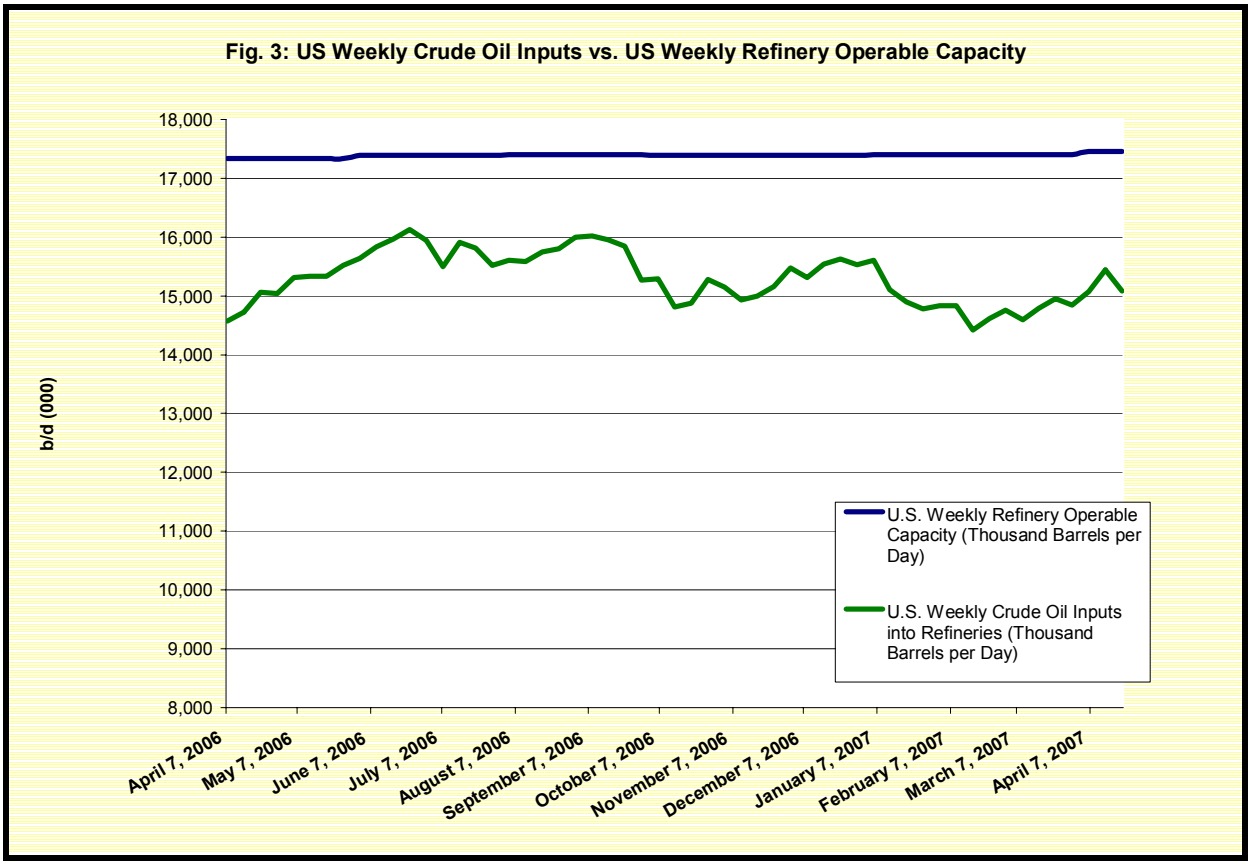
This simple calculation shows that—for 2 current episodes---gasoline markets required large price increases to ration supply. It allowed prices to increase by what EPRINC estimates to a $20 per barrel scarcity premium, an amount that many U.S. policy makers would associate with a physical threat to oil supply. Presumably,

1. weighted average

gasoline markets will seek a new equilibrium if domestic refining capacity recovers from the current rash of outages, and more gasoline flows from Europe and other offshore refiners. But that resolution might be threatened if Belgian refinery workers engage in a prolonged strike. Belgium is home to 800,000 b/d of export refineries.

Gasoline Supply--Refinery Runs and Imports

Low refinery runs were a highlight of EIA's April 25 release of the *Weekly Petroleum Status Report*, and are shown in Figure 3:



EIA data show runs at 88% of "operable" capacity; given market conditions runs in the 93% range---about maximum effective capacity for the "fleet" as a whole---would be expected. Were operating rates this high, 900,000 barrels per day of products---about 550,000 b/d of which would have been gasoline---could have been produced.

Refinery outages usually involve individual components, in contrast to a complete refinery. Analysts cannot simply sum up component outages and estimate total lost production, since the impact of these unit shut-downs may not be additive. But there has been a spate of planned and unplanned shut-downs this year. Two large refineries have experienced whole plant shut-downs; those are the 470,000 b/d (now operating at 200,000 bd) plant at Texas City, and another 170,000 b/d facility at McKee TX (which is restarting but was down for about a month) accounted for a large chunk of this year's lost gasoline supply. Another 200,000 b/d plant has just been lost in Indiana. Press reports of shutdowns have become a daily news feature; it is not surprising that gasoline supply is very tight.

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Why is so much capacity unavailable?

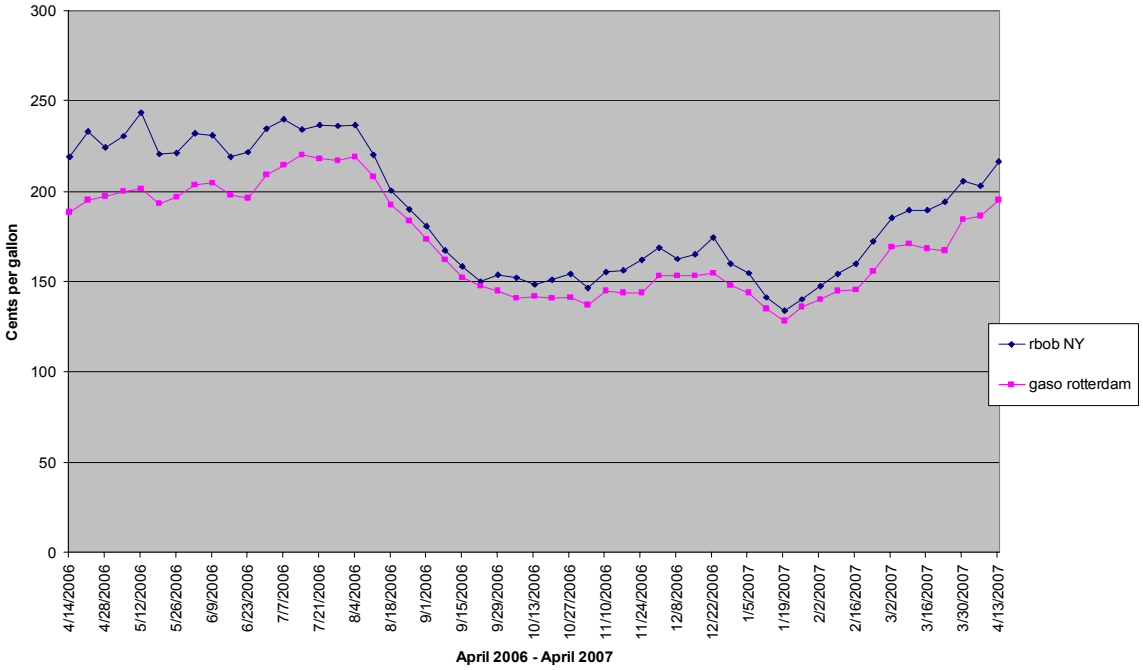
While refinery equipment is kept updated and current with the state of the art, no new refinery has been built in the U.S. in nearly 30 years. Many plants are old. And because capacity is tight relative to demand, refineries have been run harder than they might had the nation's refining capacity grown along with fuel demand.

Additionally, in the aftermath of Hurricanes Rita and Katrina, as much as one-third of U.S. capacity was off line—some for extended periods. Refineries not impacted by the storms ran at maximum output for extended periods with deferred maintenance, leaving them more vulnerable to later outage than otherwise.

Where are the foreign supplies?

Figure 4 shows the comparative price paths of gasoline prices in Europe and in NY.

Figure 4 RBOB NEW YORK vs. Gasoline Rotterdam



This spring is noteworthy because of the disequilibrium (manifested by high refiner margins and pump prices) in gasoline markets. The May 2006 situation was also noteworthy because it resulted in record 1.6 mbd of gasoline imports. In May 2006, prices averaged about $2.30 per gallon in NY, although they were extremely volatile, reaching $2.50 at one point. Rotterdam averaged $2.00; the transatlantic arbitrage premium was about 30 cents per gallon—sufficient to attract European supply to U.S. markets.

In April 2007, prices to-date averaged about $2.33 in NY and $1.95 in Rotterdam. This differential—37cents per gallon—was large enough to elicit imports averaging 1.2 mbd, but was not enough to keep U.S. gasoline inventories from declining. These comparative prices resulted in improved import flow compared to March, where imports amounted to 900,000 b/d, itself a low figure due at least in part to less favorable

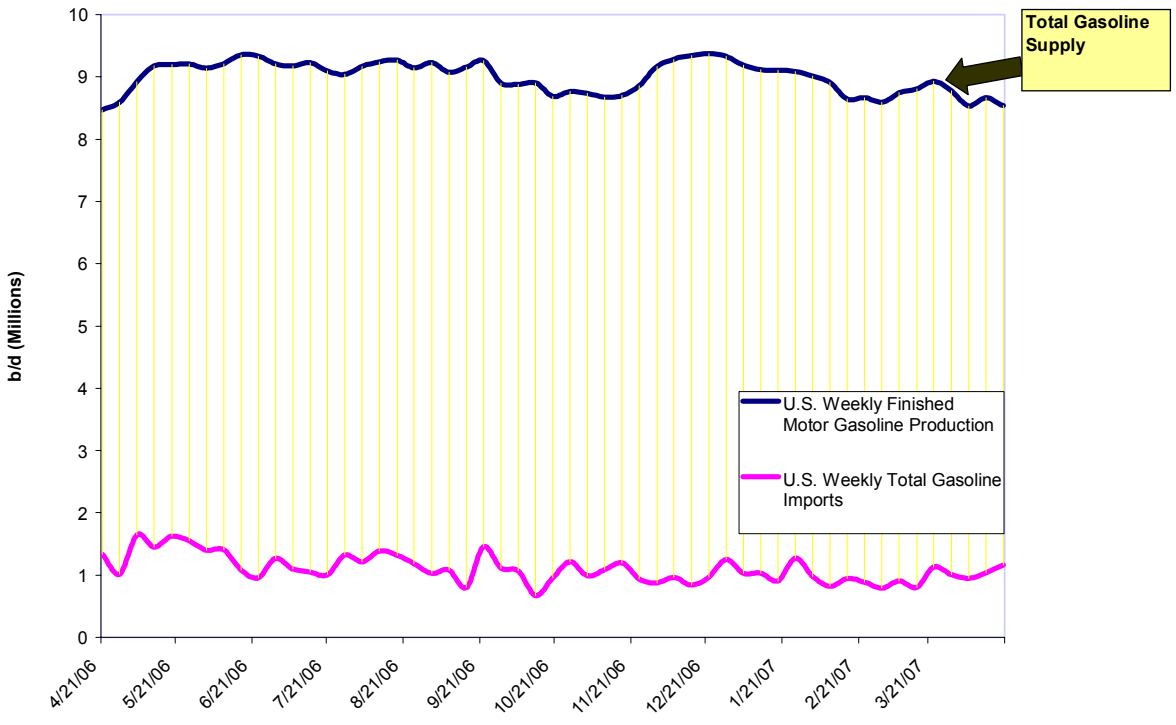
arbitrage conditions. But even with enhanced arbitrage economics---and assuming more supply is in route---the time delay in supplying domestic markets with long lead-time supply shipped from abroad is highlighted.

The extent to which the current 37 cent transatlantic premium can attract more gasoline to U.S. shores will be seen in the next few weeks. It may be sufficient to attract needed supply, but this is hardly guaranteed given world wide demand and refining constraints. If it does not, prices will likely rise. Whatever the outcome—high prices and more supply or even higher prices and lower imports---policy makers will be left to ponder the security implications of a domestic refining policy that has resulted in the nation depending on costly imported gasoline because existing capacity cannot deal with surprises.

U.S. gasoline supply is going down

Figure 5 shows U.S. gasoline supply is in a shallow downtrend at a time when inventories and market prices suggest increased stocks are called for.

Fig. 5: U.S. Gasoline Production and Imports: Apr. 2006 to Apr. 2007 (million barrels per day)



A note on growing gasoline demand

Despite higher prices, oil demand is up by a significant increment year-to-date 2007 compared to 2006. Gasoline consumption has increased 2.1%, rising to 9.137 mbd from 8.941 mbd during the period through April 20. That is an increase of nearly 200,000 b/d in the midst of a supply decline. Overall oil consumption this year has been even more robust than gasoline alone; growth has been 3.3% or 700,000 b/d. Growth—even at these relatively small percentage increases---from a high base consumption level results in large volume increments, clearly big enough to challenge a refinery fleet whose growth is constrained.

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