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**Excessive Volatility in Oil and Gasoline Prices? Economic Research Shows that Many Price Spikes and
Other Patterns, Often the Subject of Antitrust Concern, Are In Fact Consistent With Competition**

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More so than most industries, the petroleum industry has been the subject of many investigations by the FTC over the past several decades. Former FTC Commissioner William Kovacic said recently he counted 40 investigations into the petroleum industry in just the past 30 years alone. As petroleum comprises a significant portion of consumers' expenditures and is a significant input across many industries, it is important to the economy as a whole that oil and gasoline prices are competitively set.

Investigations conducted by the FTC are often triggered by consumer complaints or requests from Congress in response to prices that rise or fluctuate unexpectedly. Recently, in June 2011, the FTC opened an investigation into possible price manipulation and quantity fixing by oil refiners after refining margins increased abnormally in April and May of that year. More recently, in September, the FTC released a separate report investigating competition in the industry generally since 2005, with special attention to the causes of four large price spikes during that period.¹ Other investigations were conducted in 2004, 2005, and 2006. In fact, the FTC now monitors oil and gasoline price data daily and reports its petroleum market activities to Congress on a twice yearly basis. Yet even with this high degree of scrutiny, the FTC is yet to uncover evidence of significant antitrust wrongdoing as alleged in the complaints.

Interestingly, it is not just high prices that draws concerns from consumers and politicians – similar arguments were raised when gasoline prices were half of what they are today – but rather the volatility in gasoline prices that draws concerns. While it is important to investigate unexpected price movements to ensure competition is at work, economic research can tell us much about the kinds of price volatility that can normally be expected in petroleum pricing. Many price spikes or other patterns that may cause antitrust concern have been shown through economic research to be consistent with normal competition among firms in the petroleum industry. In this article, I review the findings of recent economic research to understand the characteristics of pricing in a competitive petroleum market, and identify conditions that may warrant closer examination by antitrust authorities.

The Economics of Oil and Gasoline Pricing

There are many stages to gasoline production and the final price is made up of several key components. Easily the largest, representing 76% of the price of a gallon as of Jan 2012, is the cost of crude oil. In spite of the importance of crude in gasoline price setting, relatively few antitrust concerns have surrounded crude price determination. There are no antitrust issues regarding the second largest component, government taxes, which accounts for another 12%. Most surround the latter two

components: refining costs and profits which account for 6% and distribution and marketing costs and profits which account for the remaining 6%.² I consider each in turn.

Crude Oil. The upward trend in gasoline and diesel prices over the past decade and the vast majority of price volatility is directly traceable back to the price of crude. After hovering around \$20 per barrel (\$/bbl) throughout the 1990s, crude hit a low of \$11/bbl in late 1998 during the Asian financial crisis and then from 2003 began its sharp and recent rise. It reached a high of \$146/bbl in mid 2008 before collapsing to \$30/bbl at the onset of recession in late 2008 and finally recovering to around \$100/bbl in the last few years.

The decade-long rise in crude prices has several causes. First, and most obvious, is a structural change in demand. While demand in developed countries like the U.S., Japan, and in Western Europe has flattened and even declined some in the latest recession, demand in developing countries, such as China, India, and countries in the Middle East and southeast Asia, has been surging. Over the past ten years, world demand has increased by over 10 million barrels per day (Mbbbl/d) to 87 Mbbbl/d. For perspective, Europe consumes about 19 Mbbbl/d per day, about the same as the world's largest consumer, the U.S. Therefore the increase in demand over the past ten years is like adding another continent half the size of Europe with the same petroleum demand to the planet.

Global production has struggled to keep up. Production from OPEC countries has increased some, but the biggest increases in production come from Russia and the former Soviet republics. Production in the United States and Canada is down over the past decade as conventional sources deplete though it has recovered some the past few years with the development of the Bakken Shale development in North Dakota and the Athabasca Oil Sands of Alberta, respectively. Overall, the result of lower production on costlier wells is higher crude prices.

The FTC has found no evidence that U.S. firms have combined to restrict the supply of crude on international markets, or that they could. In fact, efforts by firms to increase production domestically, onshore and off (e.g. drilling in the Arctic National Wildlife Refuge or the Outer Continental Shelf), have been opposed by environmentalists who cite economic studies showing such development would affect crude prices little, given the size of global demand. Increased development of unconventional oil sources (e.g. oil sands, shale oil by fracking), which are more land intensive, less energy efficient, and result in higher CO₂ emissions, face some of the strongest opposition. Similarly, the Keystone XL pipeline to bring more higher-carbon Canadian Oil Sands into the U.S. was denied approval for concerns about both its routing and its payload.

Overall, crude production remains unconcentrated – the FTC reports the Herfindahl-Hirschman Index (HHI) to be 890 – and the largest U.S. firm, ExxonMobil, holds just 3% of world production and less than 1% of world reserves. U.S. firms can be described as price takers, not price makers, in world crude markets.

Against this backdrop, volatility in crude prices should be expected. Crude oil is a commodity traded on the open market and prices continually adjust to equate supply and demand. Both the supply and demand for crude are inelastic – that is, buyers are relatively unresponsive to changes in price and

sellers cannot adjust supply quickly after a change in price. As a result, when demand exceeds supply by even a modest amount, a large price increase is required to bring the market back to balance, and vice versa. For example, supply shortages that result from conflict, revolution, and acts of terrorism in oil producing regions in the Middle East (Iraq, Iran, Libya) and North Africa (Egypt, Nigeria, Sudan), or from changes in OPEC targets, can significantly increase price in a short time. Conversely, a sudden drop in demand can cause prices to plummet, for example, the record \$115 decrease in price that took place over just a few months at the sudden onset of the 2008 recession. Because many price shocks originate overseas, the causes of the volatility are often less evident to consumers back in the U.S.

Consumers and politicians in the past few years have also expressed concern about record profits reported by U.S. oil companies and suggest this as evidence that oil companies are not acting competitively. However, high profits do not necessarily indicate a lack of competition in an industry with a cost structure like crude oil production. The market price for crude oil is determined on the margin – i.e. by the cost of bringing oil to market from the last, and generally most expensive, oil well needed to meet demand. Different wells have different costs and different breakeven prices. High profits come in part from past investment decisions and sales of crude from the lowest-cost wells still producing. Oil that is more expensive to extract, like the Oil Sands of Alberta, Heavy Oil of Venezuela, or Bakken Shale Play of North Dakota (which requires controversial fracking techniques), is relatively less profitable but feasible when prices rise above its break-even levels. High prices further incentivize development of these sources and of new R&D and exploration activities. Because exploration, development, and permitting is a long process that can take many years, significant profits can persist in the industry for a long time.

It should be noted, however, that there are many varieties of crude and occasionally distribution bottlenecks cause a decoupling of prices across different varieties. For example, in 2011, West Texas Intermediate crude (WTI) traded at a historic discount to Brent North Sea crude, and Bakken crude traded at a further discount to WTI. The decoupling is caused by increased crude supplies from Canadian Oil Sands and the Bakken shale bottlenecking in the Midwest and unable to reach Gulf Coast refineries and other markets. Since infrastructure improvements to resolve these bottlenecks take significant time and resources to complete, divergent prices can exist for some time. Meanwhile, bottlenecks can affect the degree of competition present on one side or the other.

A different and often overlooked cause for the increase in crude oil prices over the past eight years is the depreciation of the U.S. dollar vis a vis other currencies. In 2003 alone, the U.S. dollar depreciated 20% against the euro and other major currencies, and by 2012, the U.S. dollar was priced almost 30% below 2002 values. Since crude oil is denominated in U.S. dollars, when the U.S. dollar falls, the price of crude oil must rise to maintain its value vis a vis other currencies, and it becomes more expensive for U.S. refineries to purchase oil. Depreciation of the U.S. dollar may account for up to a third of the increase in crude oil prices paid by U.S. consumers since 2002, relative to a euro-denominated crude oil price.

Finally, a popular concern is that the price of crude oil has been artificially raised by illegal price manipulation on the oil futures market. It is well known that the vast majority of trades in the crude

futures market are not by commercial participants – those who physically deliver or take delivery of oil - but by speculators who will neither make nor take delivery.

In its latest report, the FTC found no evidence that speculation in futures markets was responsible for the oil price run-up over the past years, and in particular during the record setting run-up of 2008, the last non-recession summer peak in the U.S. The Commodity Futures Trading Commission (CFTC) expressed a similar view in its 2008 report, but has since raised concerns about excessive speculation in futures markets, and have passed position limits to limit concentration in futures contracts.³

Futures markets serve an important purpose by providing liquidity to commercial participants and allowing them to hedge risk against unfavorable price changes. Speculators seek to predict the market price of oil in future periods and buy or sell contracts to assume the risk of price changes. A number of economic studies have examined the linkages between future prices, spot prices, crude inventories, and speculation activity, with particular attention to how futures prices impact spot prices. The studies are mixed in their conclusions, and even where a linkage is found, it is difficult to identify any artificially manipulated component and establish the link between that component and spot prices, or to show that spot prices no longer reflected an efficient assessment of current (and expected) supply and demand conditions.⁴ The debate on this topic is sure to continue.

Refining. The refinery segment is at the center of the latest antitrust investigation by the FTC. There are 148 refineries in the US, down from 319 in 1980, though overall capacity has gradually increased through expansion. The refinery business remains unconcentrated in most regions but is relatively concentrated in a few and generally more concentrated than production. Refining costs and profits – proxied by the “crack spread” (the difference between the wholesale price of unblended but otherwise finished gasoline and the crude price) – make up about 6% of the price of gasoline.

In response to a request by the Senate Democratic leadership, the FTC is investigating whether refiners have reduced output to raise the price of finished gasoline. If done in concert, this would be in violation antitrust laws. The complaint states that profit margins increased 90% over the previous year, while the utilization rate was at all time low of 81%.

Like crude prices, crack spreads vary for many reasons. The crack spread varies with the seasons, with the changeovers between summer to winter blends, with supply changes from planned and unplanned maintenance operations, and have in past years been impacted by the switch from MTBE to ethanol as a blending agent. In April and May 2011, crack spreads were unusually high due to a reportedly higher number of unplanned shutdowns and concerns about possible Mississippi River flooding. Both earlier and again later in the year crack spreads were below historic averages and were at times negative. Capacity utilization was lower in April and May, consistent with an increase in unplanned shutdowns, but utilization generally has been on a long term decline, in part because of increased overall capacity, increased use of ethanol, and the current recession which reduced gasoline demand. The FTC investigation is expected to address the unplanned outages and examine whether firms coordinated in making these shutdown decisions.

Refiners have been the subject of similar quantity-fixing concerns in the recent past. In 2005, the FTC investigated whether refiners were manipulating prices from 2002 to just before the 2005 hurricanes by restricting domestic output and creating a bottleneck in production that inflated prices.⁵ The FTC found no evidence of foul play at that time, however.

The same 2005 report also addressed the possibility of “price gouging” by refiners in the wake of Hurricane Katrina. “Price gouging” is a term now often heard in the public debate, and carries a clear anti-competitive connotation to it. However, it does not imply coordination and is not an antitrust violation if refiners set prices independently. In fact, economists largely agree that “price gouging” is nothing more than adherence to supply and demand economics and is efficient and welfare improving, in spite of its anti-consumer moniker.

In 2005, Congress instructed the FTC to look for “price gouging” in the refined petroleum products segment, where Congress defined price gouging is any situation where a refiner’s profit margins were higher in the month following Hurricane Katrina than in the month before. Using this definition, the FTC did find profit margins of many refiners increased during the post-hurricane gasoline shortage and were therefore “price gouging”, but also stated that the increase in margins was consistent with what would be expected in a competitive market given the supply and demand situation.

Before and since Katrina, a majority of states have passed anti-price-gouging laws prohibiting businesses from charging “unfair” or “unconscionable” prices, typically following natural disasters or declarations of a state of emergency. Proponents argue such laws protect consumers from abuses by opportunists while critics point out the laws, often vaguely written, exacerbate supply shortages following disasters and inhibit market rebound.

Distribution and Retailing. Many recent antitrust concerns and complaints have focused on the distribution and retailing segment of the industry, which contributes 6% of the price of gasoline. Distribution and retailing is generally unconcentrated but can be relatively more concentrated in smaller towns and outlying neighborhoods. In recent years, the nature of retailing has been changing – integrated oil firms have been divesting their retail businesses, and gasoline is increasingly being used as a loss leader to drive traffic into convenience stores or attached businesses. There are about 159,000 retail stations in the United States, and 80% of gasoline sold in the U.S. is sold by convenience store operators.

Two sources of price volatility at the retail level have raised concerns of anti-competitive behavior. First is the well-documented “Rockets and Feathers” phenomenon. “Rockets and feathers” is so named since retail prices seem to go up like “rockets” after an increase in wholesale costs but fall like “feathers” after a decrease. In practice, cost increases are passed through to prices in 1-3 weeks, while decreases in costs take 3-6 weeks to reach consumers.⁶

Some consumer advocates argue that this pattern of price movements reflects tacit collusion among retailers, resulting in higher profits and harm to consumers. If such collusion were stopped, the argument goes, retail gasoline prices would fall after a cost decrease just as fast as they currently rise after a cost increase, and margins and gasoline prices would be lower overall. Some observers estimate

the loss to U.S. consumers to be 2.6 cents for each time costs rise and then fall by a penny.

However, economic research sheds light on the “Rockets and Feathers” pattern and shows there is little reason to suspect the pattern is collusive or even harmful to consumers overall. Rather, the pattern is consistent with unilateral pricing decisions made by rational retailers based on consumers’ search behavior. It turns out that consumers are more sensitive to price changes when gasoline prices are rising than when they are falling. Rising gasoline prices means tighter budgets and many consumers’ immediate response is to search more intensely for low gasoline prices still available. Falling prices, from levels consumers have been acclimatized to, however, tend not to trigger as much search. In this case, paying less than they had in the recent past is welcome news for consumers, even if they pay a bit more than what they could have had they shopped around. This difference in consumer search is important in understanding differences in retailer markups when wholesale costs rise versus when they fall.

Retailers make little profit in the “rockets” stage as wholesale costs rise and prices rise along with them. Accounting for fixed costs, profits are often negative. It is in the “feathers” stage when retailers tend to earn enough profit on sales to cover much of the fixed costs of operating a station. Decreasing wholesale costs do not force as quick a fall in prices and allow temporarily higher margins. Some retailers serve consumers who search relatively little, at a higher price; others undercut more quickly and serve consumers who search relatively more, at a lower price. Over a short time, prices fall and margins fall with them everywhere.

Given that retailers are losing money on the way up, they cannot also lose money on the way down and still stay in business. So, is it reasonable to assume that, absent Rockets and Feathers, prices would fall as fast after a cost decrease as they currently rise after an increase? It is not. Here the fundamental assumption underlying the anti-competitive theory of “Rockets and Feathers” falls apart. What matters instead for competition policy – in this segment where costs are relatively uniform – is not margins at any one moment in time but overall margins averaged across times of rising and falling prices. According to the National Association of Convenience Stores, retail station profits on gasoline averaged just three cents a gallon over the past five years.⁷ The fact that gasoline is used as a loss leader to drive store traffic in part allows for such low margins. Competition is ensured in the long term because if there were excessive profits due to Rockets and Feathers, new entrants would be expected to enter and compete those profits away. Interestingly, this has not been the case. For example, integrated oil companies like ExxonMobil, BP, and ConocoPhillips have exited the retail market to focus on its more profitable upstream operations.

The second source of retail-specific price volatility that has raised antitrust suspicion are retail price cycles, known as “Edgeworth Price Cycles”. Edgeworth Price Cycles is an repeated asymmetric pattern in gasoline prices in which prices rise as much as 10% in a single day, usually about once a week, and then fall back down slowly over the rest of the week, even when costs do not change. They occur in dozens of cities across the Midwest U.S., as well as in Canada, Australia, and various countries in Europe.

The cycles draw understandable skepticism. Imagine the price of gasoline is about \$3.75 a gallon at most stations across town. Then, one day, some retailer suddenly raises its prices to \$4.00 and within hours,

other retailers match the price increase and by the next day, all stations are selling gasoline at \$4.00 a gallon. Yet wholesale gasoline prices remain flat. Without a cost-based justification for the price increases, these price spikes have been cited as obvious examples of collusion among retailers.

However, economic research shows that such price spikes that are part of a larger Edgeworth Price Cycle are consistent with strong price competition.⁸ Here is how an Edgeworth Price Cycle works. Where consumers are especially sensitive to small price differences, retailers compete aggressively on price and repeatedly undercut one other by just a penny or two, attracting an increase in market share. Each day retailers undercut one another further, stealing market share back and forth, until prices near the wholesale cost of gasoline. At this point, with retailers unable to lower prices further without making losses (and often making losses already after considering fixed costs), they temporarily stop undercutting. Prices must rise again to sustainable levels, but no retailer wants to risk significant lost sales to be first do so. Eventually, one retailer "relents" by raising its price, others follow and then, with prices back at the top of the cycle, retailers almost immediately begin undercutting one other again.

While the large gasoline price increases can raise alarm, less obvious is that prices are continuously falling the rest of the time. In fact, price-sensitive consumers and aggressive undercutting by retailers trigger the cycle in the first place. Research shows that Edgeworth Price Cycles are more common in markets with more retailers and more independent brand retailers in particular – all characteristics of competitive, not collusive, markets. Moreover, average gasoline prices are lower in cities with Edgeworth Price Cycles than in cities without, the opposite of what one would expect if the cycles were anti-competitive. This latter fact contradicts an underlying presumption of the anti-competition theory that, if not the large price spikes, that prices would have remained at the lowest price point of the Edgeworth Price Cycle. Finally, price-elastic consumers further benefit from the predictable cyclical pattern by being able to time purchases to periods of low prices.⁹

These cycles have a simple, pro-competitive explanation but remain controversial in many countries. Investigations by the ACCC (Australia), the FCO (Germany), the Norwegian Competition Authority, and the FTC have cited the economic research on cycles as part of recent investigations.

While economic research has demonstrated that volatility due to Edgeworth Price Cycles or Rockets and Feathers is not suggestive of antitrust wrongdoing, the FTC and other state and local authorities continue to investigate other claims of potential anticompetitive activity in retail gasoline. Retailing is generally unconcentrated and retail margins thin, but stations still enjoy some degree of local market power based on geographic location, especially in smaller towns or outlying neighborhoods. Like other retail businesses with some local market power, there is always the potential for coordination. Recently, the Michigan Attorney General obtained guilty pleas on price fixing charges against five independent station operators in Madison Heights, Michigan, who all operated within two miles of one another. In another matter, the Canadian Competition Bureau obtained guilty pleas from 21 individuals and 6 companies on price fixing charges in four towns in Quebec. Other recent investigations into gasoline price fixing in Eau Claire, WI, and Martha's Vineyard, MA resulted in no action.

While there has been little evidence of widespread antitrust wrongdoing in wholesale and retail gasoline markets, various states have nonetheless passed price and/or ownership regulation in an effort to preserve competition. For example, several states have passed divorcement laws – which prohibit vertical integration of a producer or refiner into retailing – and below-cost selling laws – which prevent integrated firms from selling gasoline to a retailer at a price below (or too close to) the price its self-owned retail stations retail it for. These regulations stem from concerns about integrated firms foreclosing upon retailers by squeezing their margins and was intended to preserve fair competition and lower gasoline prices. However, the bulk of the economic research has shown these laws to either increase gasoline prices or have no effect.

One last concern often raised is that retail gasoline operators, like refiners, have engaged in price gouging following natural disasters or other shocks to supply or demand. Again, price gouging does not mean coordination among retailers and is not an antitrust violation. Rather, the consensus in the economic literature is that price gouging is nothing more than adherence to supply and demand economics and that states' anti-price-gouging laws actually decrease welfare overall. In any event, in its 2005 report, the FTC addressed possible price gouging following Hurricane Katrina by examining a set of twenty-four retailers also targeted by state authorities. The FTC found that six of these retailers had higher margins in September 2005 compared to August 2005, satisfying Congress' definition of price gouging, but noted that in all but one case the price increases were consistent with post-hurricane supply and demand conditions.

In conclusion, the volatility in oil prices and gasoline prices has not always been well understood in the public discourse. Volatile oil and gasoline prices are sometimes interpreted as anti-competitive prices, and are certainly met with suspicion, but the economics of petroleum supply and demand show that volatility in oil and gasoline prices should be expected. Crude oil is a commodity whose price is determined on a world market and is responsible for much of the volatility and climb in gasoline prices. Refinery, distribution, and retailing operations also contribute to short run volatility, but are responsible for relatively little of the recent climb in prices overall. It is important that the FTC continues to investigate unusual price movements as they occur, to ensure that oil and gasoline prices are always competitively set, but understanding the economics of the petroleum industry can help us better gauge when unusual price movements are, in fact, unusual.

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