McCullough Research

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To: McCullough Research Clients

From: Robert McCullough

Subject: Seeking the Causes of the July 3rd Spike in World Oil Prices

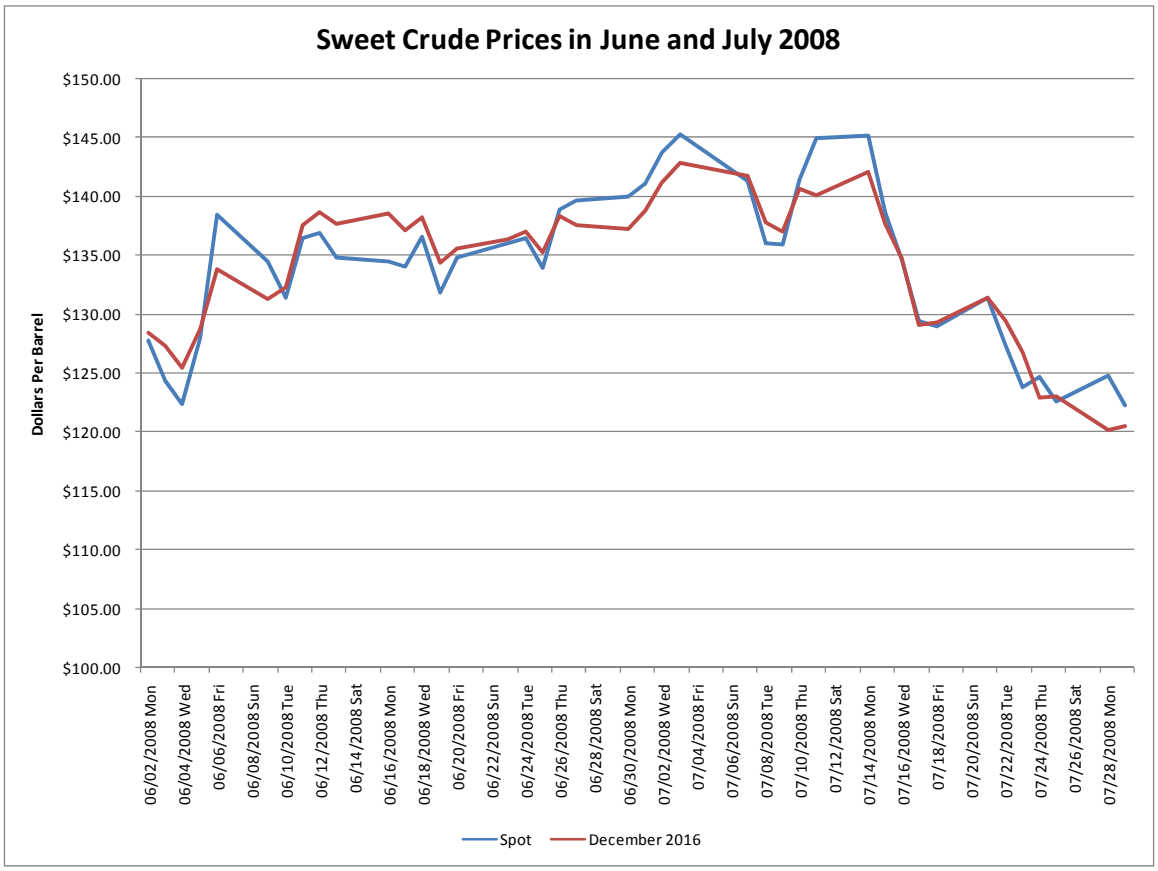
Over the past two years the price of oil has roughly doubled. The increase has surprised both the markets and official forecasters such as the Energy Information Administration ("EIA"). This is a situation where the savviest traders and the most sophisticated modelers have equally failed to predict the rapid increase.[1]

While an enormous public debate has emerged concerning the causes of the price increase, little substantive work has been done. There are three reasons for this: first, a steady climb in oil prices does not provide a good basis for most econometric modeling; second, data is scarce and difficult to interpret; and third, three different Federal agencies share inconsistent mandates concerning oil prices. More bluntly, we have the wrong tools, we lack even the most elementary data, and no one clearly has the job.

While symptoms may be uncomfortable to the patient, they are useful tools for the internist. The price spike of July 3rd, 2008 was so sharp that it provides an opportunity to seek causes. A central advantage in reviewing June and July of this year is that the traditional explanations for oil price increases -- exchange rates, storms, or major geopolitical events -- were absent. Relatively little happened in June and July of 2008 in any of these areas. Even more significantly, the future price curves followed the spike in spot prices in a lock step. On June 2, 2008 the price of oil on the New York Mercantile Exchange ("NYMEX") was $128.43 a barrel for December 2016. By July 3rd, the price for December 2016 had increased to $142.18 a barrel. By the end of July it had fallen to $117.67 a barrel.

[1]July 2008 NYMEX oil futures settled on June 1, 2006 traded for $70.95 a barrel. The contemporaneous EIA forecast predicted a lower price of $67.00 per barrel at the end of their forecast period.

Any competent economist would take that as the critical question. What happened in June 2008 that raised the future prices of oil so significantly? And, what happened later in July that caused the forward price of oil for deliveries years in the future to fall just as precipitously?



All available evidence indicates that the price spike of July 3rd was a form of market failure -- most likely due to the significant concentration in the energy sector in recent years. There is no evidence that a significant long term change in oil consumption or production took place in June and then faded away in July.

Oil

The U.S. is both the single largest consumer and a major domestic and international producer. Traditionally, the seven sisters -- Exxon, Mobile, Gulf, Socal, Texaco, Shell, and BP have long dominated the industry. Five of the seven were U.S. companies. Industry consolidation has reduced the number of sisters dramatically. Exxon,

Mobile, Gulf, Socal, and Texaco have all merged or been acquired over the past decade. Today, we are down to five sisters -- three U.S. based.[2]

Oil is a storable commodity. In economic theory this means that market participants can choose to sell oil today or wait for a better market tomorrow. OPEC, the Organization of Petroleum Exporting Countries, exploits that facet of the oil market by setting production targets -- spacing out the production of oil over time.

A purely theoretical analysis evaluates oil like the consumption of a prime, irreplaceable, vintage of wine. The consumer will calculate the benefit of opening a bottle after considering a desire to hold a reserve against his needs in the future. In a perfect world, future prices would reflect long term expectations of supply, technology, and demand. The relationship between spot and future prices would reflect the time value of money.

In practice, the theoretical model asks too much of real life consumers, producers, and traders. Technology changes the rules frequently. Reserves are difficult to evaluate and consumers change their preferences continuously. Substitutes for oil were not even considered possible until the last few years. Today, ethanol comprises an increasingly large proportion of retail gasoline for most drivers in the U.S.

In practice, the basic fundamentals are well known. New markets for gasoline like those in the Far East are well understood. The emergence of India and China as major consumers is not news to the market, or, at this point, even news to the man on the street. While price shocks such as changes in OPEC policy, civil unrest in Nigeria, or major storms that disrupt production in the Gulf of Mexico cannot be easily predicted, longer term impacts are well understood. Thus, we are unsurprised to find that spot prices are more volatile than prices in longer term markets.

Because oil is so important, future markets for oil are critical to the operation of the economy. The two most significant future markets are the NYMEX and the Intercontinental Exchange ("ICE"). Due to the two Enron loopholes, only one of these exchanges, the NYMEX, is fully regulated by the Commodity Futures Trading Commission ("CFTC"). Future trades also take place in the over the counter market -- also unregulated by the CFTC.[3]

[2] The Energy Information Administration has produced an excellent history of industry consolidation in the oil business. This has been reproduced as Attachment A to this report.
[3] For a detailed discussion of the Enron loopholes see my testimony entitled "Regulation and Forward Markets Lessons from Enron and the Western Market Crisis of 2000-2001". May 8, 2006.

Concerns about the efficiency of the market include the increasingly important role of speculators. In theory, speculators add liquidity to future markets by taking risks that producers and consumers might not wish to accept. In practice, it is possible that a sufficiently large speculative position will change future prices and even affect spot prices. In 2006, a hedge fund named Amaranth had accumulated a massive position in March and April natural gas futures. From evidence collected by later investigations, Amaranth was attempting to support a significant differential in future prices by repeated intervention in the market. Amaranth failed, but its impact on the relatively large North American natural gas markets has created fears that larger and better funded entities could effectively set future prices.

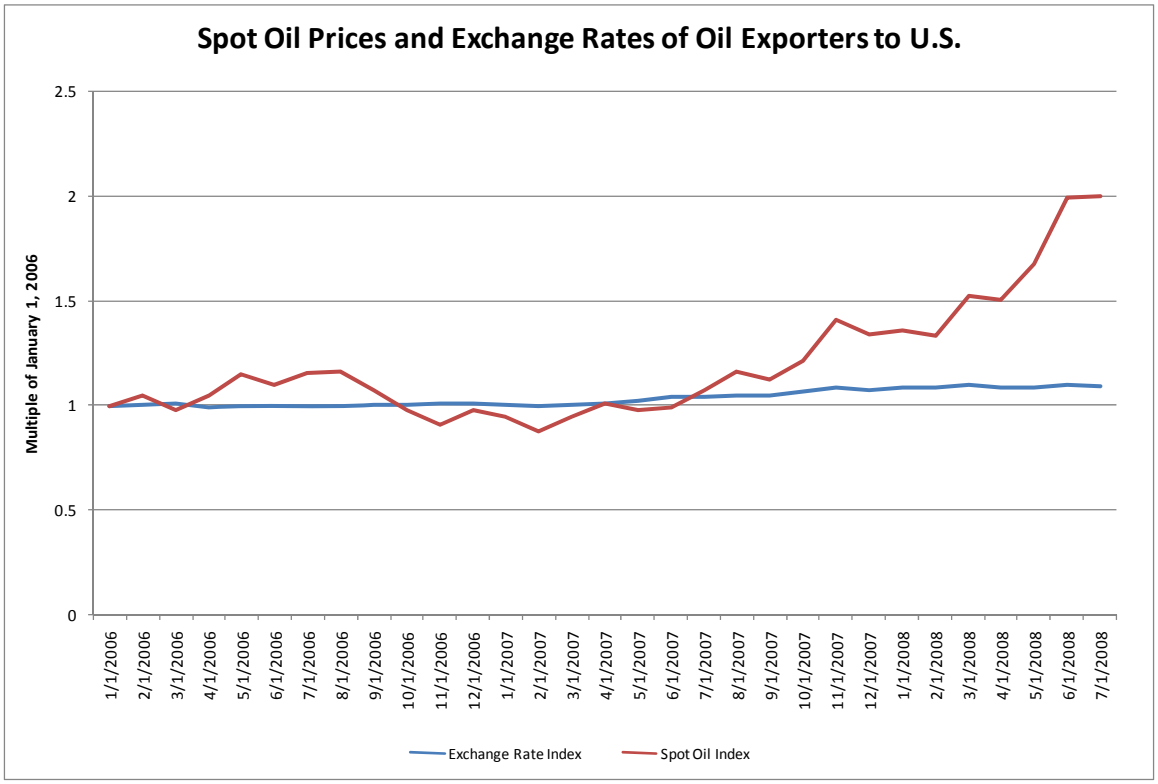
The U.S. government has regulated commodity trading since the 1930s. Responsibility for oil is split haphazardly between the Federal Energy Regulatory Commission ("FERC"), which has authority over pipelines, the Federal Trade Commission ("FTC") which operates the Oil and Gas Industries Initiative, and the CFTC which views oil as one small part of a large portfolio of commodities. The responsibility for forecasting and understanding the oil markets lies with the Energy Information Administration. As noted above, no one agency has a clear mandate to accumulate data, oversee markets, and evaluate factors that affect consumers.

The CFTC regulates part of the future market in oil. FERC has traditionally focused on electricity and natural gas. The FTC Oil and Gas Initiative has been more directed towards mergers and depends on OPIS, a market data firm, and the EIA for data.[4] The EIA accumulates some data and issues periodic forecasts. This disorganized approach makes it difficult to obtain consistent data and even harder to determine the cause of price increases.

The Current Debate

A high pitched debate currently rages over the causes of recent price increases. An amazing degree of misinformation fuels the debate. For example, a frequent explanation is that the increase in the price of oil is due to the decline of the dollar relative to the Euro. While exchange rates are a small factor, the U.S. does not buy oil from the European Union, so the exchange rates relative to Europe are not a significant factor. The market basket of currencies used by the ten major nations that provide oil to the U.S. has not changed markedly over time.

[4] See http://www.ftc.gov/ftc/oilgas/gas_price.htm for a description of their data collection efforts.

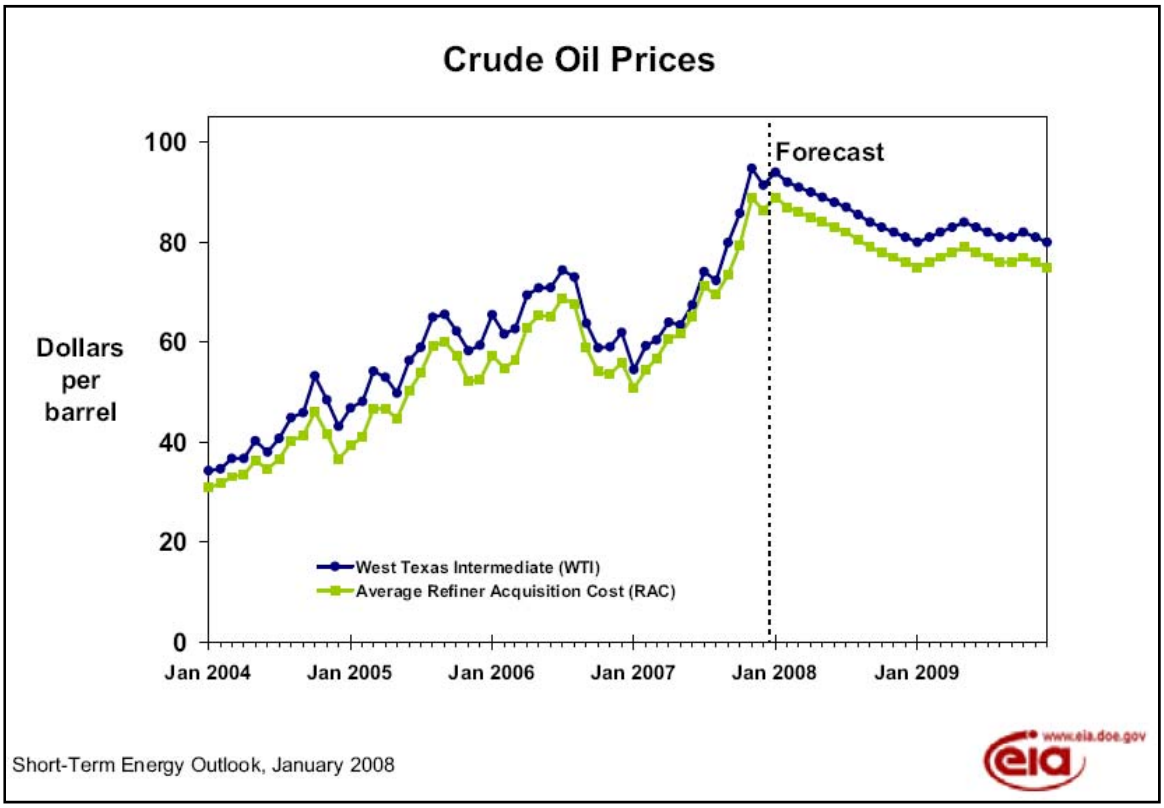


Overall, the U.S. dollar has only declined 10% relative to the currencies of our primary oil suppliers.

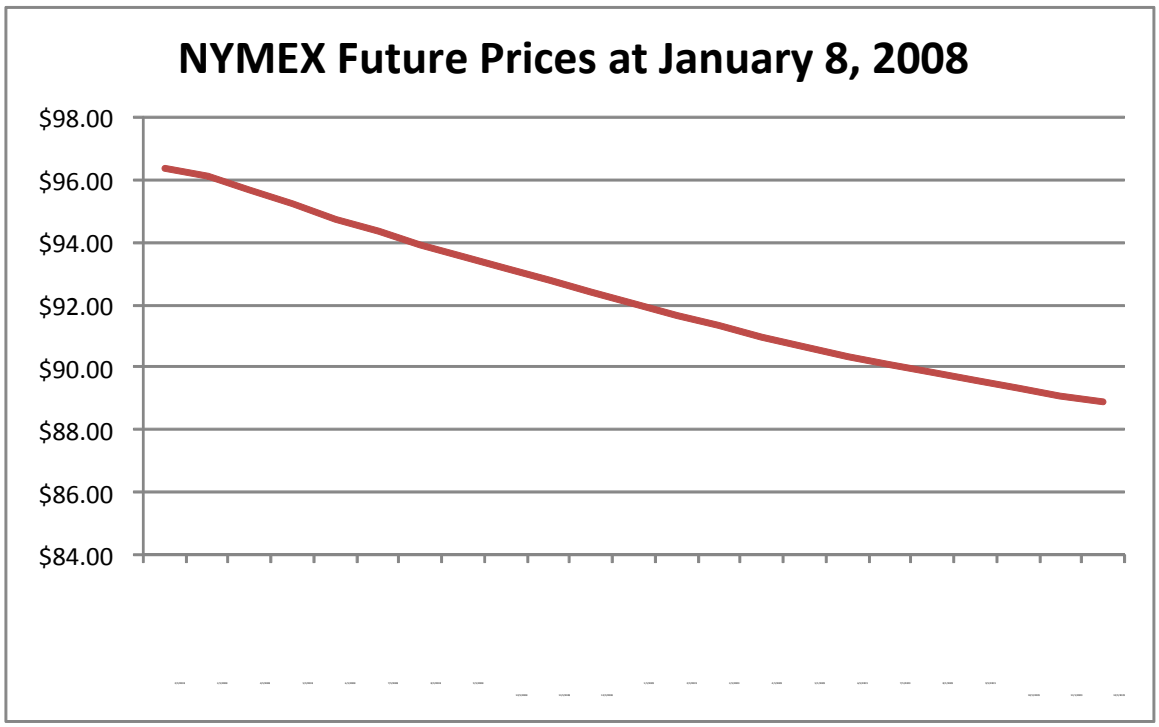
Shifts in world consumption are a significant factor. A wealthier world consumes more oil. Growing economies elsewhere are providing consumers with the opportunities to purchase automobiles for the first time. An analysis of the impacts of international demand has been a central part of every recent EIA forecast. Regardless of the focused attention paid to China and other growing markets for oil, each EIA forecast has significantly under run actual oil prices.

The January 2008 EIA forecast, for example, predicted a steady fall in oil prices in 2008, even after a detailed consideration of international demand.[5]

[5] Short Term Energy Outlook, January 8, 2008, page 9



As noted above, the future markets have done little better. The NYMEX prices for January 8, 2008 also did not predict a sharp increase in the price of oil.



If the price of oil reflected basic fundamentals, both the EIA experts and the savviest traders failed to consider them carefully. Obviously, with untold billions at stake, both the traders and the forecasters did review the fundamentals.

On the other side of the debate are those who blame the price increases on excess speculation. As yet, there is relatively little data accumulated on the significance of excess speculation in the market for petroleum. As noted above, future oil markets are subject to only partial market surveillance. The one report that gives some insight into the future market for oil at the NYMEX is an outdated and difficult to interpret report known as the "Commitments of Traders Report." If speculators have taken a commanding position by purchasing large future positions in oil, it is virtually impossible to detect given the CFTC's current powers and procedures.

One interpretation is that banks and hedge funds have gambled on the future oil market -- bidding up the price of future contracts. Their impact on spot prices isn't very easy to understand unless speculators have either colluded with producers or their activities are obvious enough that the producers are restricting spot sales in order to sell the oil at a later date at higher prices. This argument does not fit well with the facts of the July 3rd price spike which took place soon after Saudi Arabia an-

nounced a significant increase in oil production.[6] The logical impact of the production increase would have been a reduction in the future curve for oil.

A better model for the July 3rd price spike would seem to be the Enron market manipulation of the Henry Hub future market on July 19, 2001.[7] In this case Enron purchased a large quantity of spot gas and took advantage of the price increase to sell at an artificial price in the future markets. Enron's positions dramatically exceeded the levels that would provide legitimate economic hedges.

There is a strong possibility that the high level of concentration in the spot and future oil markets have made the market strategies of the principal market participants more significant than fundamentals -- at least in the short term. This is consistent both with the inability of forecasters and traders to foresee major market movements and also explains the very tight correlation between spot and future prices.

What Did Happen in June and July?

A careful review of the industry, plus a review of proposed legislation, provides little insight into the July 3rd, 2008 price spike. As noted above, the most significant change in fundamentals, the decision by Saudi Arabia to increase oil production in July, took place immediately before the price spike.

The most significant events over this two month period were:

3-Jun	Senator Cantwell chairs a Senate Commerce Committee hearing on oil market manipulation and federal authorities. Experts, including George Soros, testify that the CFTC has been slow to react to the energy crisis and that speculation could be adding as much as 20%-50% to the price of oil per barrel.
13-Jun	Fourth fall in US reserves pushes up oil prices
17-Jun	US Air Transport Association asks Congress to impose new restrictions on "rampant oil speculation"
17-Jun	Iranian President Mahmoud Ahmadinejad tells OPEC meeting in Isfahan the rise in oil consumption is lower than the growth in production; certain powers are controlling the prices in a fake way for political and economic gains; blames weakening of the US dollar
18-Jun	Bush calls for end to US offshore drilling ban

[6] Saudis offer to boost oil production, USA Today, June 23, 2008.
[7] U.S. CFTC v. Enron Corporation and Hunter Shively, Complaint for Injunctive and Other Equitable Relief and Civil Monetary Penalties Under the Commodity Exchange Act, March 11, 2003.

19-Jun	Movement for the Emancipation of the Niger Delta blows up Chevron pipeline; Chevron declares force majeure, halts output by 120,000 bpd; attacks Shell's offshore Bonga oilfield
20-Jun	China raises petrol and diesel prices by more than 16% to reduce the gap with soaring international oil prices; Organization of Islamic Conference meeting in Kampala says, "If we [the Islamic world] produce the bulk of the oil, why can't we be party to deciding what is a fair and equitable price? Unless OPEC returns to arrest the situation, mankind will cross the border of self destruction."
23-Jun	Saudi Arabia hosts summit attended by 36 nations in Jeddah; announces plans to increase output by more than 200,000 bpd to 9.7 million starting in July
23-Jun	Movement for the Emancipation of the Niger Delta announces ceasefire
23-Jun	Congressman Stupak holds eight hour hearing on energy market speculation. Experts testify that the explosion of speculation in the oil futures market could be driving up prices from $20 to $60 per barrel
26-Jun	EIA sees $70/b average crude price by 2015
26-Jun	By 402 to 19, the House by-passes legislation to direct the CFTC to use its emergency powers to take immediate action to curb speculation in energy market
27-Jun	Senate Republicans object to Unanimous Consent to pass the House passed emergency powers legislation
30-Jun	Russian oil exports fell 5.3% to 757mln bbl in January-May; world oil prices drop on unexpected US stockpile rise
9-Jul	House Agriculture Committee holds 3 hearings on increasing CFTC authority
9-Jul	Iran test-fires nine missiles, including ones capable of hitting Israel
15-Jul	OPEC revises 2008 world oil demand forecast to 1.20 percent from 1.28 percent, citing an economic slowdown and high fuel prices
15-Jul	Majority Leader Reid introduces the Stop Excessive Energy Speculation Act of 2008
15-Jul	Federal Reserve Chairman Ben Bernanke tells Senate Banking Committee that the US economic downturn would prove more persistent, and potentially more severe, than initially thought
22-Jul	Iran's Oil Minister Gholam Hossein Nozari says that it is unnecessary for OPEC to change the current output
22-Jul	US Senate invokes cloture on the motion to proceed to debate on Reid's Stop Excessive Energy Speculation Act of 2008
24-Jul	CFTC charges Optiver Holding BV, two subsidiaries, and high-ranking employees with manipulation of NYMEX crude oil, heating oil, and gasoline futures contracts
24-Jul	House Agriculture Committee reports the Commodity Markets Transparency and Accountability Act of 2008
25-Jul	US Senate fails to invoke cloture on the Commodity Markets Transparency and Accountability Act of 2008
30-Jul	House fails to pass the Commodity Markets Transparency and Accountability Act of 2008 on a required 2/3 vote on suspension of the rules

30-Jul White House announces its opposition to legislating new position limits to be developed by the CFTC

While many of these events might affect the price of oil, a number of them are more likely to affect long term markets rather than spot transactions. Congressional hearings, for example, presage changes in national policy which will most likely take place at a later date. Civil unrest in Nigeria and production decisions by Saudi Arabia are more likely to have short term impacts.

A quick inspection of the events in June and July reveals no easy explanation why there would have been a spike on July 3rd. Arguably, the most significant event during this period was the June decision by Saudi Arabia to unilaterally increase production in July. However, immediately following this announcement, prices increased, rather than fell. As one trader remarked when price fell sharply after the 3rd "No news is good news, or in this case, no news is bearish news."[8]

To test the statistical significance of these events on the price of oil, we have developed two different models:

Spot:	A regression using EIA weekly data and events with short term impacts to explain spot prices; and,
Future:	A regression using spot prices and longer term events to explain future prices.

Time series data, especially time series data from complex markets with unobserved variables, is inefficient. A central assumption of regression is that the error terms are independent and identically distributed. This is seldom the case in economic time series.

Time series analytical methods provide reasonable tools that can show useful results for a variety of economic time series that possess a particular kind of non-standard error distribution. Among the most useful of these methods employs the Generalized Autoregressive Conditional Heteroskedastic time series model ("GARCH").

We considered a model for spot oil prices that used refinery utilization and U.S. petroleum stockpiles as fundamentals. It also included proxy variables for three short term events: the unrest in Nigeria until the cease fire announcement, the Saudi production increase announcement, and the change in Chinese retail petroleum pricing.

[8] Oil Drops Sharply, Associated Press, July 8, 2008.

The statistical results for the model are excellent overall with significance far better than the .01 level. Unfortunately, the proxy variables for the three short term events are not significant at any acceptable level. In the highly careful language of the statistician, we cannot reject the hypothesis that these announcements had no impact on spot oil prices. The results are reproduced in Attachment B to this report.

The future model uses spot prices as a fundamental and the Saudi announcement, the Russian production report, and the period between introduction and the failure to pass the Commodity Markets Transparency and Accountability Act of 2008 as proxy variables. The high degree of correlation between the NYMEX future contracts makes results for different delivery periods largely unnecessary. In this study we used future contracts for delivery in December 2016.

The results for the second regression were also highly significant. As before, the proxy variables for the Saudi production increase and Russian production news were insignificant. The proxy for the short lived Commodity Markets Transparency and Accountability Act of 2008 was highly significant. Interestingly, this was the only variable that would have affected excess speculation as opposed to supply and demand fundamentals.[9]

The conclusion to be drawn from these statistics is that the news stories cited by pundits to explain the dramatic spike in oil prices have little or no explanatory power. While we can construct a sufficiently complex explanation to explain any result, we have very little evidence that explains the massive spike that occurred on July 3rd.

A second conclusion is that the best forecast for future prices in 2016 is the daily spot price today. This is likely to occur only if the daily spot price has more information than any set of fundamentals.

A consumer in a town with only one or two grocery stores will be better advised to study the food prices in the advertisements than to access forecasts from the U.S. Department of Agriculture. This simply represents the reality that market power and the strategy of pivotal suppliers will dominate over market fundamentals when monopoly or oligopoly are present.

[9] No alternative specifications of these models were analyzed. This decision was not made lightly. Statistical tests are based on the submission of a specific hypothesis for testing. Repeated testing of alternative hypotheses is a practice almost certain to eventually stumble on an apparently significant result.

As economist Paul Samuelson has taught generations of undergraduates "it takes more than the existence of a competitor to create perfect competition."

Pivotal Suppliers

As a general rule, a competitive market will require more excess capacity than the market share of the largest market participant. Stated more directly, a market where supply and demand are in close balance, with no quickly available substitutes, is in danger of seeing non-economic pricing if one supplier can withhold enough to create a temporary shortage. As we also learned in college, the student with the car gets to choose the movie.

The economic term for markets where the decisions of one supplier can set prices is called monopoly or oligopoly. The supplier with the ability to set prices is called the pivotal supplier.

We should, but we do not, have data to help us determine whether we currently have one or more pivotal suppliers in the oil markets. We do know that if pivotal suppliers exist, the market decisions of the pivotal supplier will be more important than changes in fundamentals. Like the grocery consumer in the small town with few choices, the best forecast of the pivotal suppliers' strategy is the current price. If the pivotal suppliers are aggressively setting high prices, a wise trader would forecast this state of affairs to continue to dominate the market for the immediate future.

A trader who based his future price quotes on fundamentals would quickly go bankrupt in the face of a pivotal supplier. A sudden 14% price increase unmatched by market fundamentals means that the market strategy has changed. An intelligent trader would factor the market strategy into long term prices. And, in fact, this is exactly the behavior which occurred during the July 3rd price spike.

If data on spot market transactions was routinely collected and reported, as it is in other energy markets, we would be able to check whether there is evidence of increasing market concentration. If well head price data was routinely collected and reported, we could check whether the increased prices were being paid directly to oil producers or to pivotal suppliers in the U.S. market.

We can glean some information about market concentration and markups relative to well head prices from CFTC and industry sources. The information is not sufficient

to conclusively answer the question, but it is interesting enough to propose the need for additional investigation by FTC, the CFTC, or the EIA.

As mentioned above, the CFTC provides a weekly report named the Commitments of Traders Report. The most recent report is reproduced below.

CRUDE OIL, LIGHT SWEET - NEW YORK MERCANTILE EXCHANGE — Code-067651
Commitments of Traders - Futures Only, July 29, 2008

	Total	Reportable Positions							Nonreportable Positions	
	Open Interest	Non-Commercial Long	Non-Commercial Short	Non-Commercial Spreading	Commercial Long	Commercial Short	Total Long	Total Short	Long	Short
	(CONTRACTS OF 1,000 BARRELS)									
All	1,220,537	201,622	202,282	328,020	629,322	616,483	1,158,964	1,146,785	61,573	73,752
Old	1,220,537	201,622	202,282	328,020	629,322	616,483	1,158,964	1,146,785	61,573	73,752
Other	0	0	0	0	0	0	0	0	0	0
	Changes in Commitments from: July 22, 2008									
	3,162	3,603	623	5,381	-11,943	-10,045	-2,959	-4,041	6,121	7,203
	Percent of Open Interest Represented by Each Category of Trader									
All	100.0	16.5	16.6	26.9	51.6	50.5	95.0	94.0	5.0	6.0
Old	100.0	16.5	16.6	26.9	51.6	50.5	95.0	94.0	5.0	6.0
Other	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	# Traders	Number of Traders in Each Category								
All	307	88	111	126	82	99	248	264		
Old	307	88	111	126	82	99	248	264		
Other	0	0	0	0	0	0	0	0		

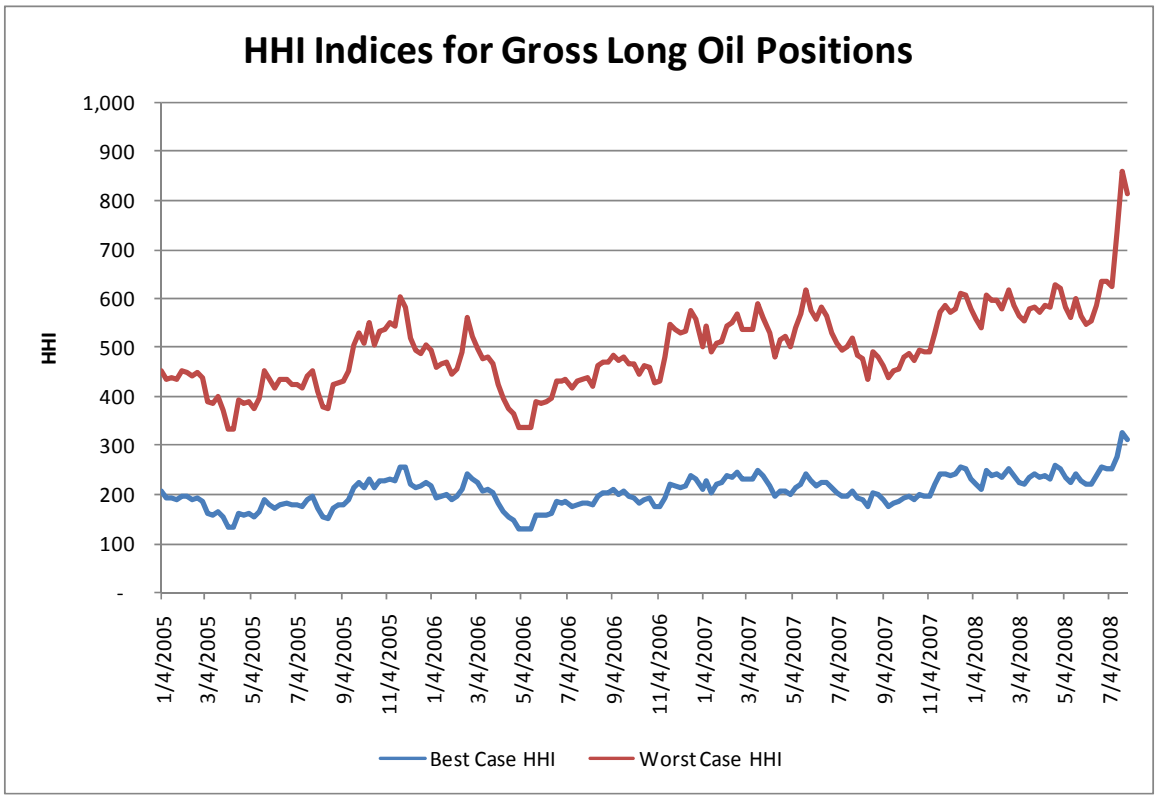
	Percent of Open Interest Held by the Indicated Number of the Largest Traders							
	By Gross Position				By Net Position			
	4 or Less Traders		8 or Less Traders		4 or Less Traders		8 or Less Traders	
	Long:	Short	Long	Short:	Long	Short	Long	Short
All	32.8	22.8	43.4	33.0	15.8	8.2	20.5	11.9
Old	32.8	22.8	43.4	33.0	15.8	8.2	20.5	11.9
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

The report is neither user friendly or substantially detailed. The last block of data in the report shows the degree to which the four largest traders dominate the "long" or supply positions. In the July 29, 2008 report, the top four traders held 32.8% of the long positions.

One of the problems with this report is that the measure of concentration used by the CFTC is very different than the standard measure in use by the FTC, the U.S. Department of Justice and the FERC. While one is not necessarily superior, the more widely used Herfindahl-Hirschman Index (HHI) has the virtue of being more readily understood.[10]

[10] A simple explanation of the HHI can be found at the U.S. Department of Justice web site at http://www.usdoj.gov/atr/public/testimony/hhi.htm.

While it is possible to translate the Commitments of Traders data into the HHI, it is not possible to get a specific value. The best that can be accomplished from the CFTC data is a range where, mathematically, the actual HHI will be found. The following chart shows the HHI range for the NYMEX crude since 2005.

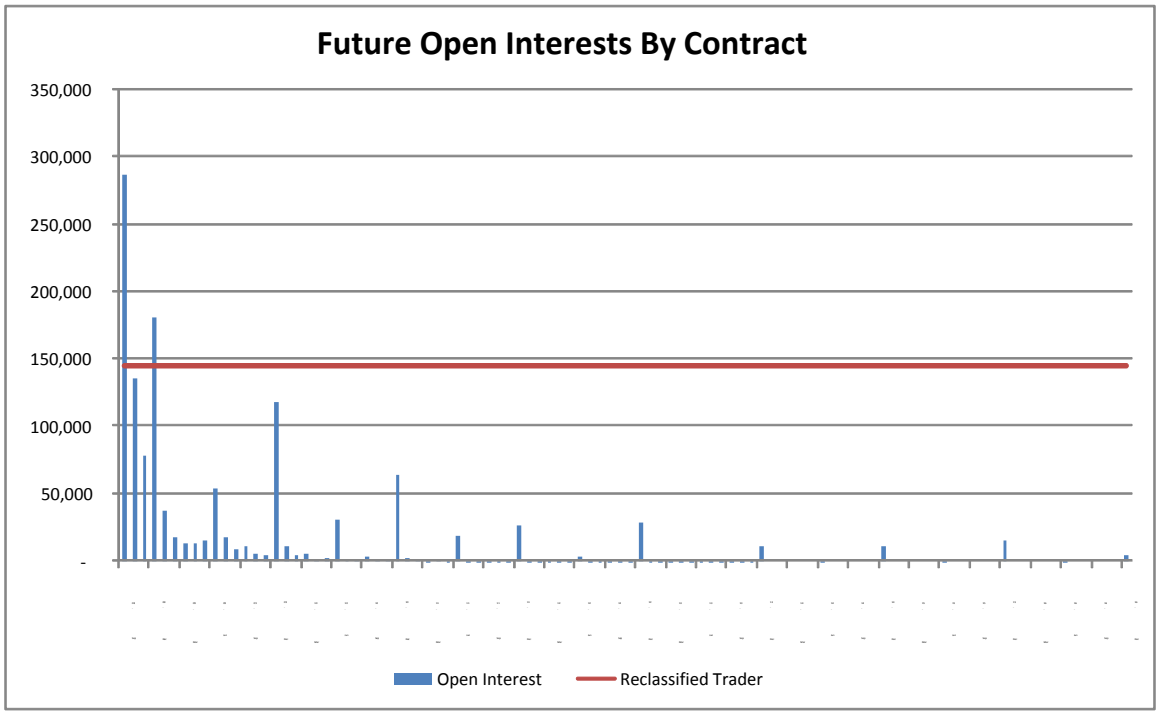


Neither the low nor the high HHI bounds are close to the U.S. Department of Justice guidelines for a concentrated industry. In fact, given the lack of reporting outside of the NYMEX, a substantial degree of market concentration could occur that would never show up in the Commitment of Traders Report. It is significant, however, that the HHI appears to be increasing over time, with a significant increase in July 2008. In the worst case, it is mathematically possible that one trader could hold as much as one quarter of the open long positions on the NYMEX from the data reported at the CFTC. If so, this trader would have a commanding position and could well be a pivotal supplier.

An unusual opportunity to analyze the impact of a single trader on the Commitments of Traders Report took place recently when the CFTC reclassified a single firm from Commercial to Non-Commercial. The reclassified report indicates that the trader

held 144,856 open interests. These positions are classified as "spread positions" since they represent long positions in one contract, and corresponding short positions in another contract. Since the total open positions in the NYMEX crude market is only 1,249,914, this indicates that this trader has more than 10% of the NYMEX market.

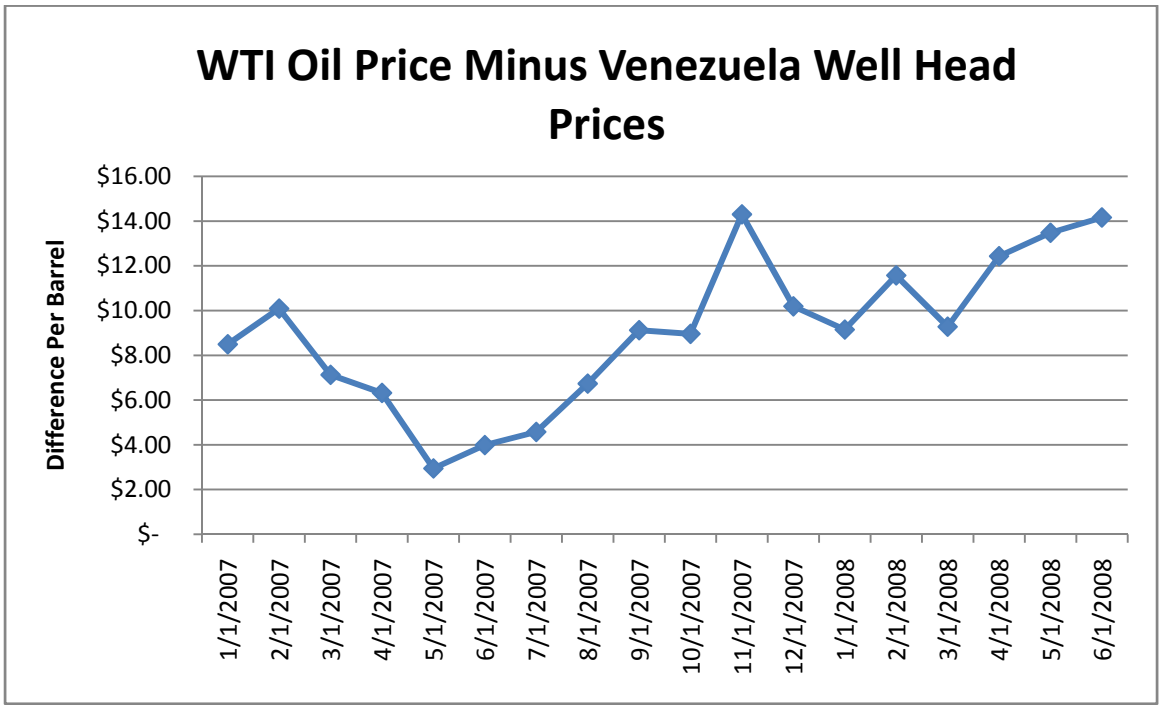
Although CFTC reports do not indicate which contracts are held by the reclassified trader, the scale of their position is larger than all but two of the NYMEX contracts:



This corroborates the HHI calculations above – a substantial degree of concentration may be present in the NYMEX future markets.

A pivotal supplier would also have the ability to increase oil prices above the well head prices paid to suppliers. Recent statements by OPEC representatives clearly seem to indicate that they have some concerns in this direction.[11] Supplier production and pricing is not transparent. Saudi Arabia, the world's largest producer, provides relatively little data. Venezuelan well head receipts do indicate that there is some increasing differential.

[11] See, for example, the comments of OPEC Secretary General Abdullah al-Badri on June 24, 2008 reported in OPEC president sees no easing of oil prices, Xinhua News Agency, June 28, 2008.



Though the data indicates an increasing differential, Venezuelan crude is a very different product from U.S. crude, so a number of alternative explanations could be made for the differential.

Overall, a powerful case can be made for market power, not fundamentals, as a contributing factor to the July 3rd price spike. The July price spike has the following characteristics that cast doubt on fundamentals and speculation as causes:

1. The short duration, reflecting no specific supply disruption or increase in demand.
2. Events in June, to the degree they were present, should have lowered the prices in July, not increased them.
3. Long term prices followed the very brief spike in a lockstep fashion.
4. Evidence exists, both anecdotally and statistically, for increased concentration in the NYMEX long positions.
5. Evidence exists that may indicate an increasing differential between some well head receipts and market prices.

Recommendations

While uninformed debate is both passionate and entertaining, good facts are more likely to create solid policy recommendations.

The FTC and the CFTC should accumulate data on spot and future markets for oil that will allow the identification of market shares. If the supply and demand are tight, this is exactly the situation where economic theory would predict the existence of pivotal suppliers. Given the probability that market participants have a very good idea of the market shares and pricing, there is no logical public policy reason why this information should not be accumulated and provided to regulators and decision makers.

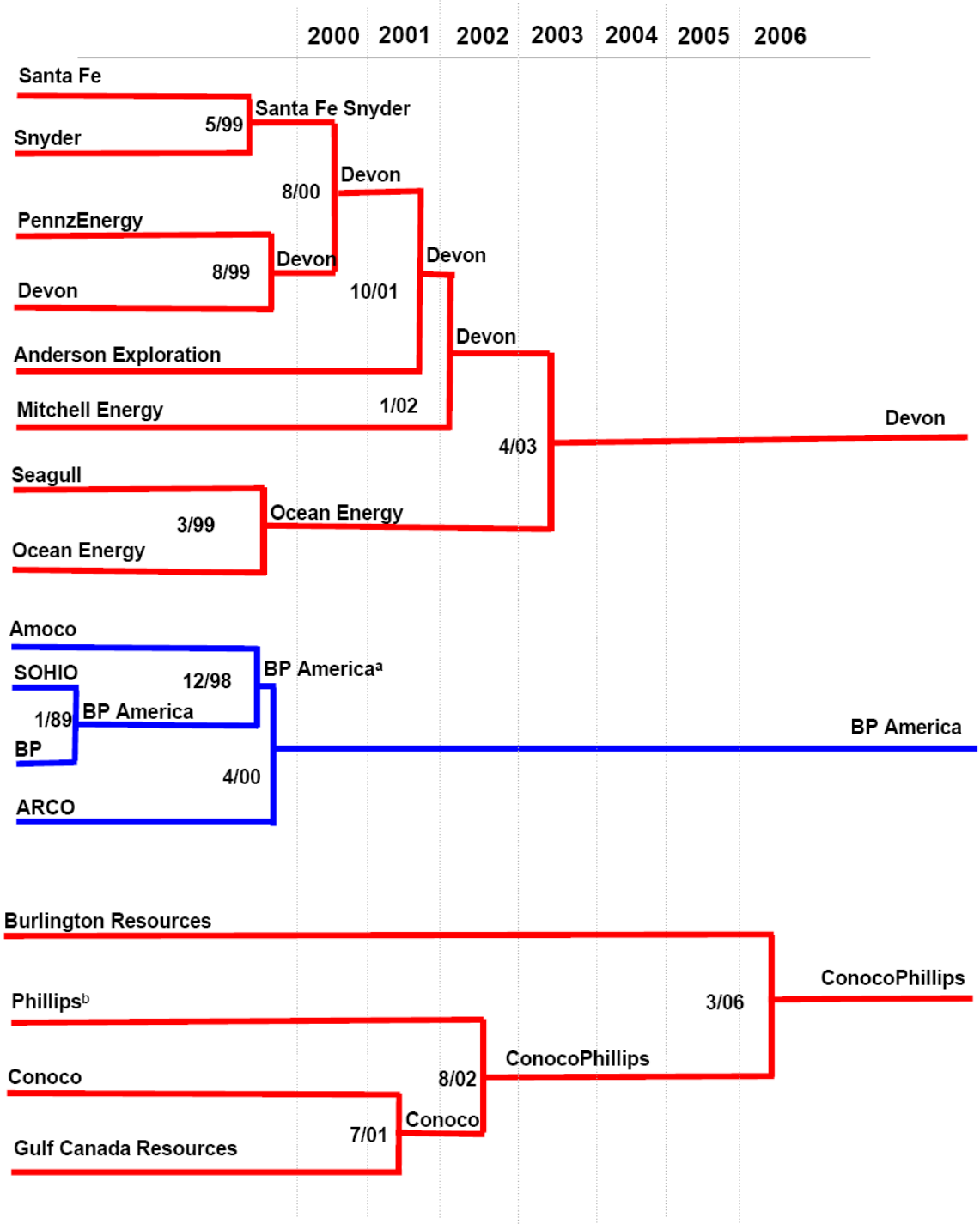
The current chaotic state of CFTC market surveillance needs to be corrected. At the moment, the store detective only watches one exit from the department store. This is worse than useless because it provides the illusion of market surveillance while allowing sufficient room for any offender to escape observation.

The Commitments of Traders Reports should be expanded and recast using the same concepts and measures used elsewhere in the industry. Specifically, the report should provide HHI for both the NYMEX and the ICE. It is very important to include data on future trades in the OTC transactions. In sum, we will only be able to detect the influence of excess speculation if we have the measure of the entire market – not a portion.

The EIA should develop a methodology for reporting well head prices for the ten largest suppliers to the U.S. This report should be issued on the same frequency as other EIA reports so that regulators and decision makers can make contemporaneous judgments concerning price spikes like one that took place on July 3rd, 2008.

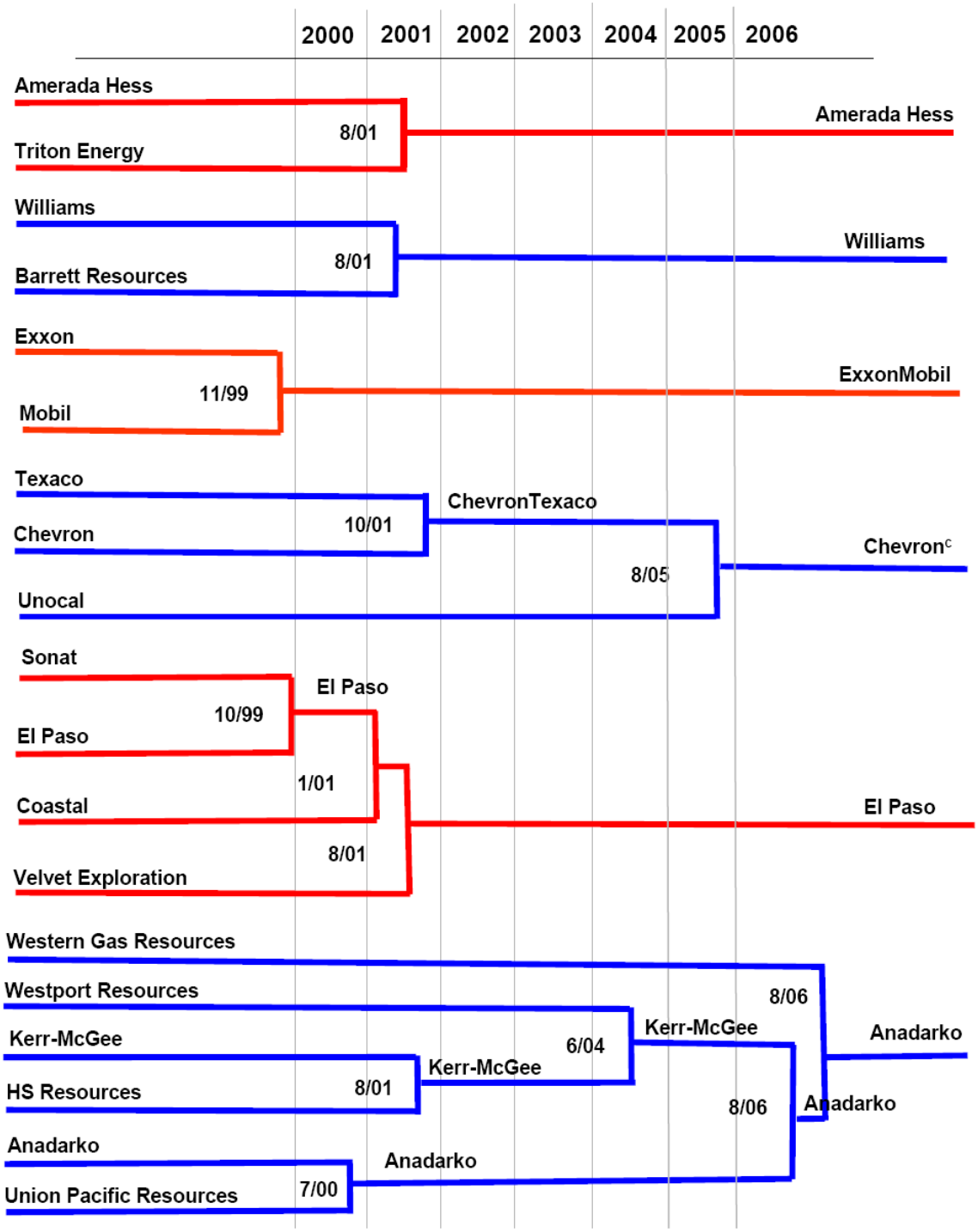
Attachment A:

Genealogy of Major U.S. Oil and Gas Producers



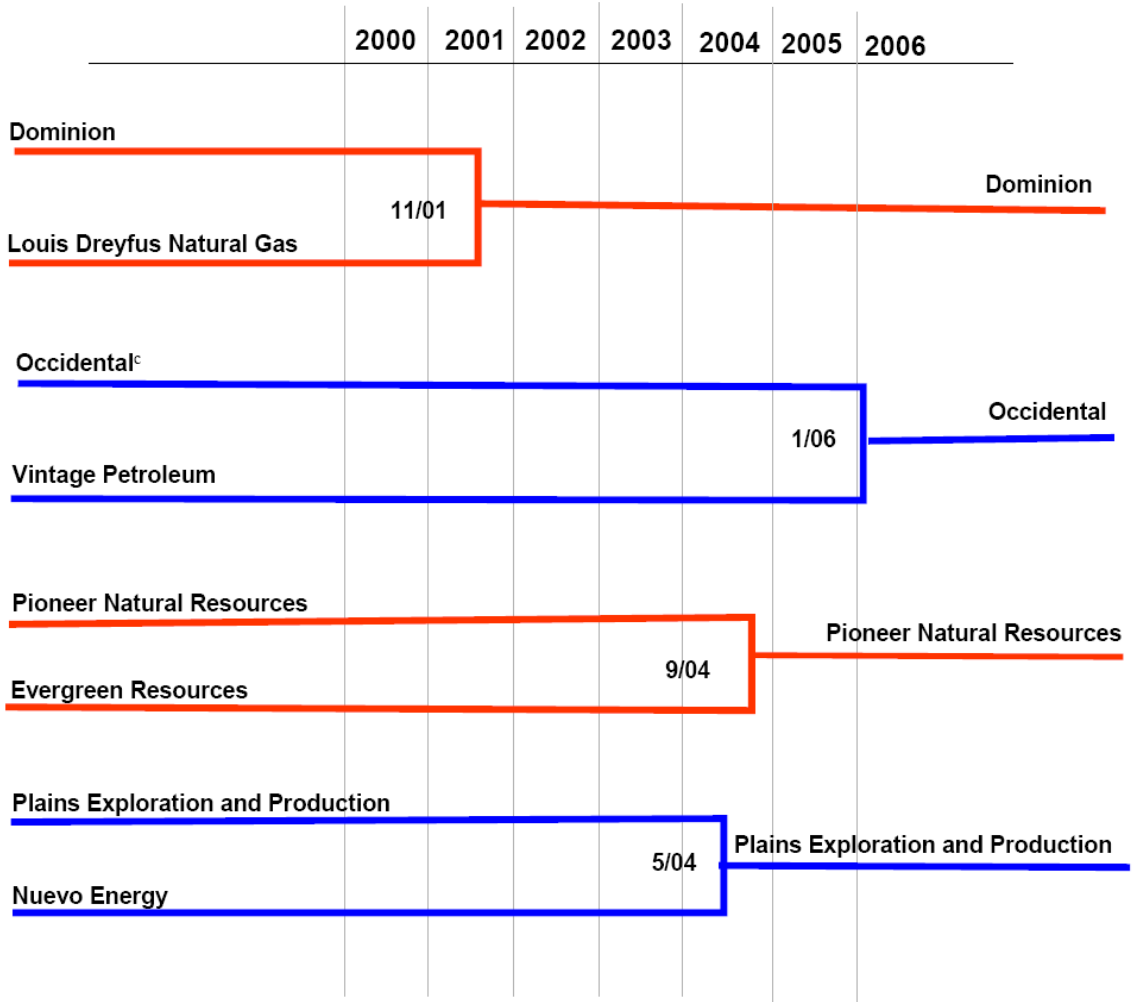
Footnote and source notes are at the bottom of these figures.

Genealogy of Major U.S. Oil and Gas Producers (continued)



Footnote and source notes are at the bottom of these figures.

Genealogy of Major U.S. Oil and Gas Producers (continued)



[a]The company resulting from BP's merger with Amoco was called BP Amoco initially (including at the time of the acquisition of ARCO), but subsequently reverted to BP America.
[a]Phillips acquired control of ARCO's Alaska assets from BP America in April 2000 as part of the consent agreement that was part of the U.S. Federal Trade Commission's approval of BP Amoco's acquisition of ARCO in April 2000.
[b]ChevronTexaco renamed itself Chevron on May 9, 2005.
[c]Occidental acquired control of Altura Energy, a limited partnership owned by BP Amoco and Royal Dutch/Shell (through Shell Oil) at approximately the same time as it acquired ARCO Long Beach. Altura Energy was the largest oil producer in the state of Texas at the time of the transaction. See Energy Information Administration, "Aspects of Occidental Petroleum's Purchase of Altura Energy and ARCO Long Beach" (April 18, 2000). This is available on the Internet at http://www.eia.doe.gov/emeu/finance/mergers/oxyindex.html (as of November 28, 2006).
Sources: Company news releases and other public disclosures.

Attachment B: Statistical Results

ARCH family regression

Sample: 1 - 43 — Number of obs = 43
Distribution: Gaussian — Wald chi2(5) = 170.88
Log likelihood = -116.7598 — Prob > chi2 = 0.0000

	Coef.	OPG Std. Err.	z	P>|z|	[99% Conf.	Interval]
spot						
utilization	4.808101	.6070383	7.92	0.000	3.244474	6.371728
stocks	-.000444	.0001157	-3.84	0.000	-.000742	-.000146
emancipati~r	-1.23323	1.32833	-0.93	0.353	-4.654782	2.188322
saudiincre~e	.1071586	11585.26	0.00	1.000	-29841.54	29841.75
chinawillr~i	6.527547	11585.76	0.00	1.000	-29836.41	29849.46
_cons	449.2628	228.2324	1.97	0.049	-138.6248	1037.15
ARCH						
arch						
L1.	1.352897	.5912113	2.29	0.022	-.1699627	2.875756
_cons	1.868268	3.037674	0.62	0.539	-5.956261	9.692798

ARCH family regression

Sample: 1 - 43 — Number of obs = 43
Distribution: Gaussian — Wald chi2(4) = 5226.78
Log likelihood = -84.65834 — Prob > chi2 = 0.0000

	Coef.	OPG Std. Err.	z	P>|z|	[99% Conf.	Interval]
dec16						
spot	.7629325	.0227878	33.48	0.000	.7042351	.8216299
saudiincre~e	-.6430962	.6771591	-0.95	0.342	-2.387342	1.10115
russianpro~n	-1.482364	.6302147	-2.35	0.019	-3.10569	.1409614
commoditym~y	-5.703386	.4450542	-12.82	0.000	-6.84977	-4.557003
_cons	33.44583	3.083366	10.85	0.000	25.5036	41.38805
ARCH						
arch						
L1.	2.147227	.7847901	2.74	0.006	.1257415	4.168712
_cons	.3651205	.4092933	0.89	0.372	-.6891493	1.41939