RICE UNIVERSITY

The Price of Crude Oil: Speculators or Market Fundamentals

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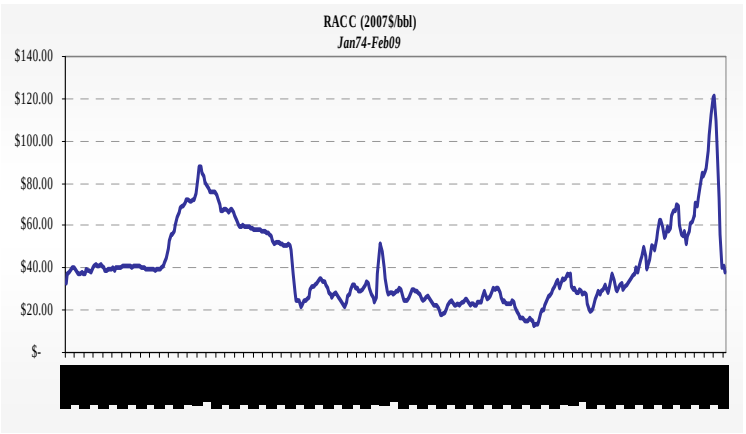
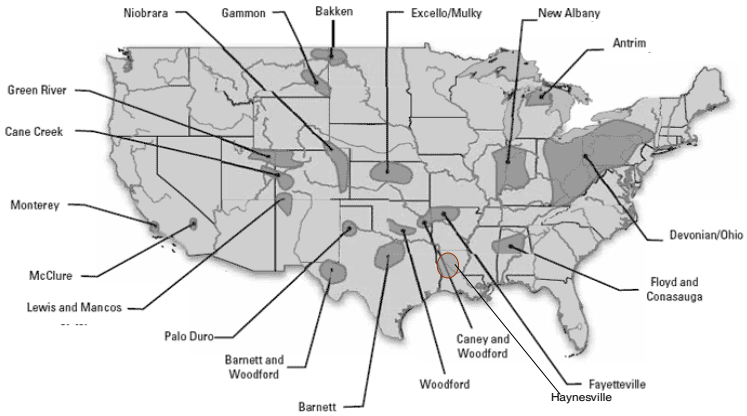


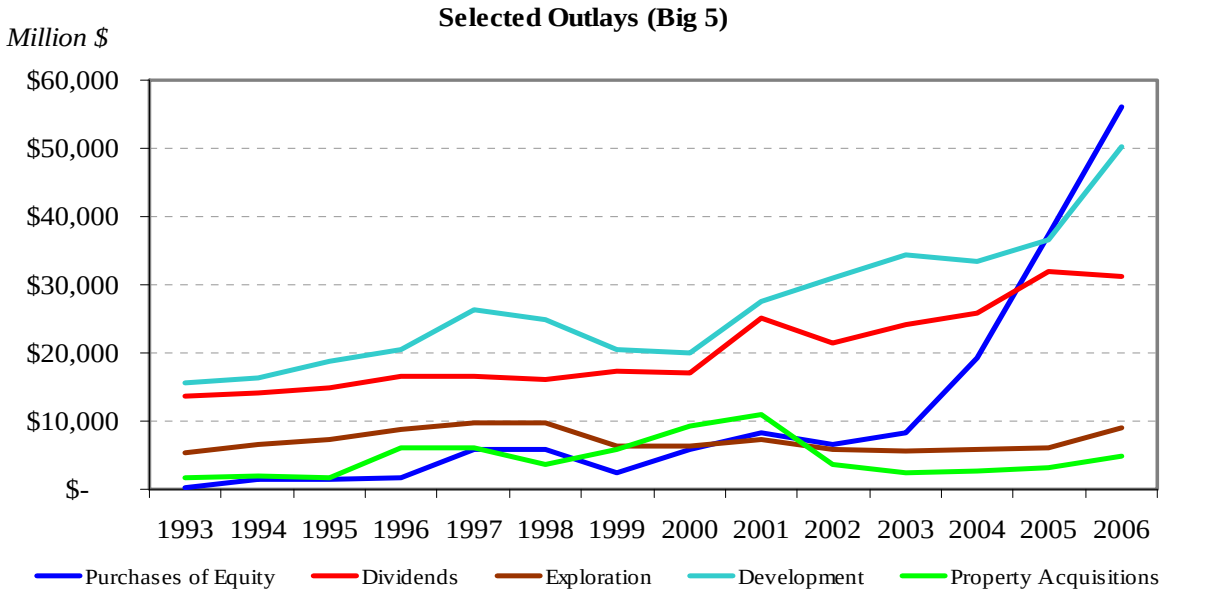


Over the past few years many factors have been "blamed" for high oil prices…

- "Big Oil"
- Rising Costs
- National Oil Companies: Increasing control of global conventional oil resources by a smaller group of countries
  - BIPP study 2007: "The Role of the National Oil Company"
- "Peak oil"
- Demand Growth in China and India
- A Weak $ and Speculation

"Big Oil" and Spending

- According to Jaffe and Soligo (2007), in 2005 the Big Five firms accounted for 56% of profits and reserves, 64% of output and 31% of expenditures on exploration of the 135 (US and foreign) companies for which the *Oil and Gas Journal* collects data.
- Exploration spending of the Big Five was flat from 1998 to 2006, while the next 20 largest traded American firms steadily increased to virtually equal to that of the Big Five in 2006.
- In 2006 the Big Five used 56% of their increased cash flow on share repurchases.

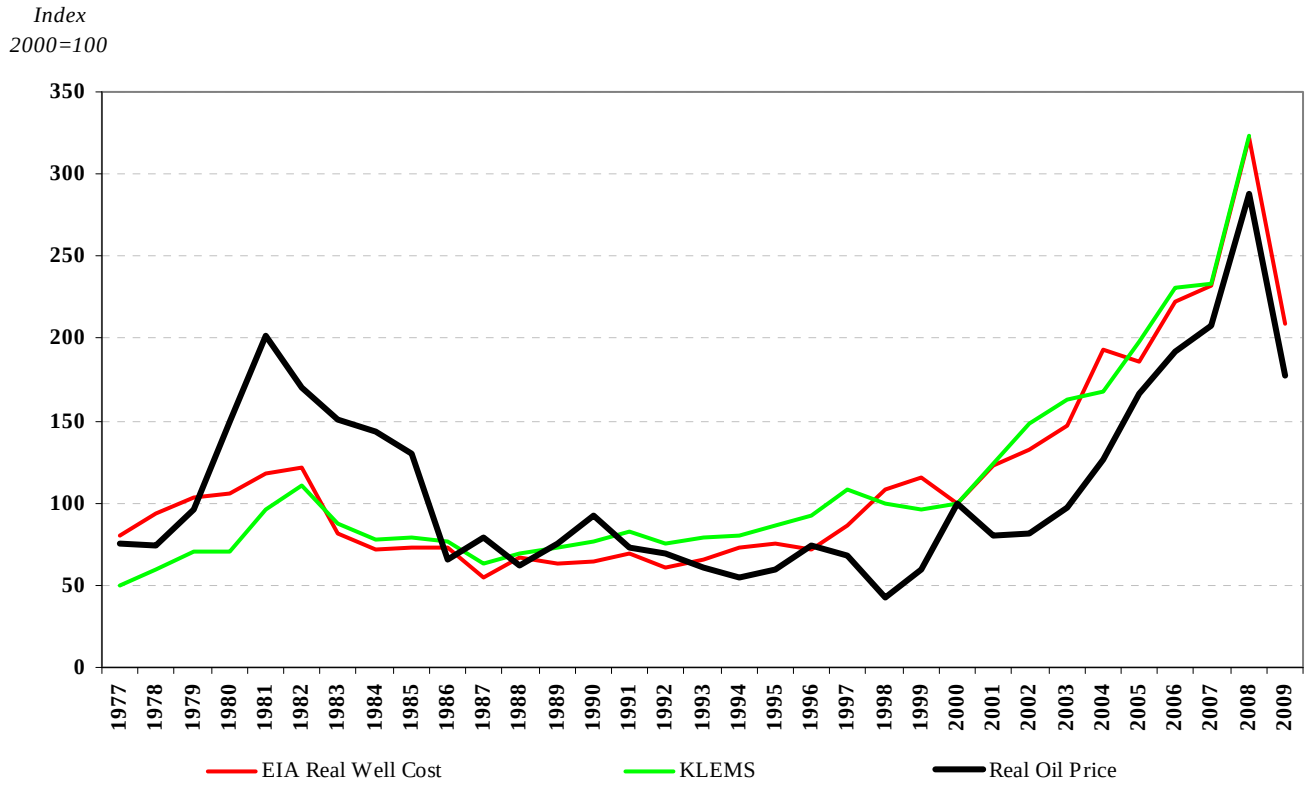


Source: "The International Oil Companies" - Jaffe and Soligo (2007)

- **Bottom line: If you are not spending, from where will the supply come?**

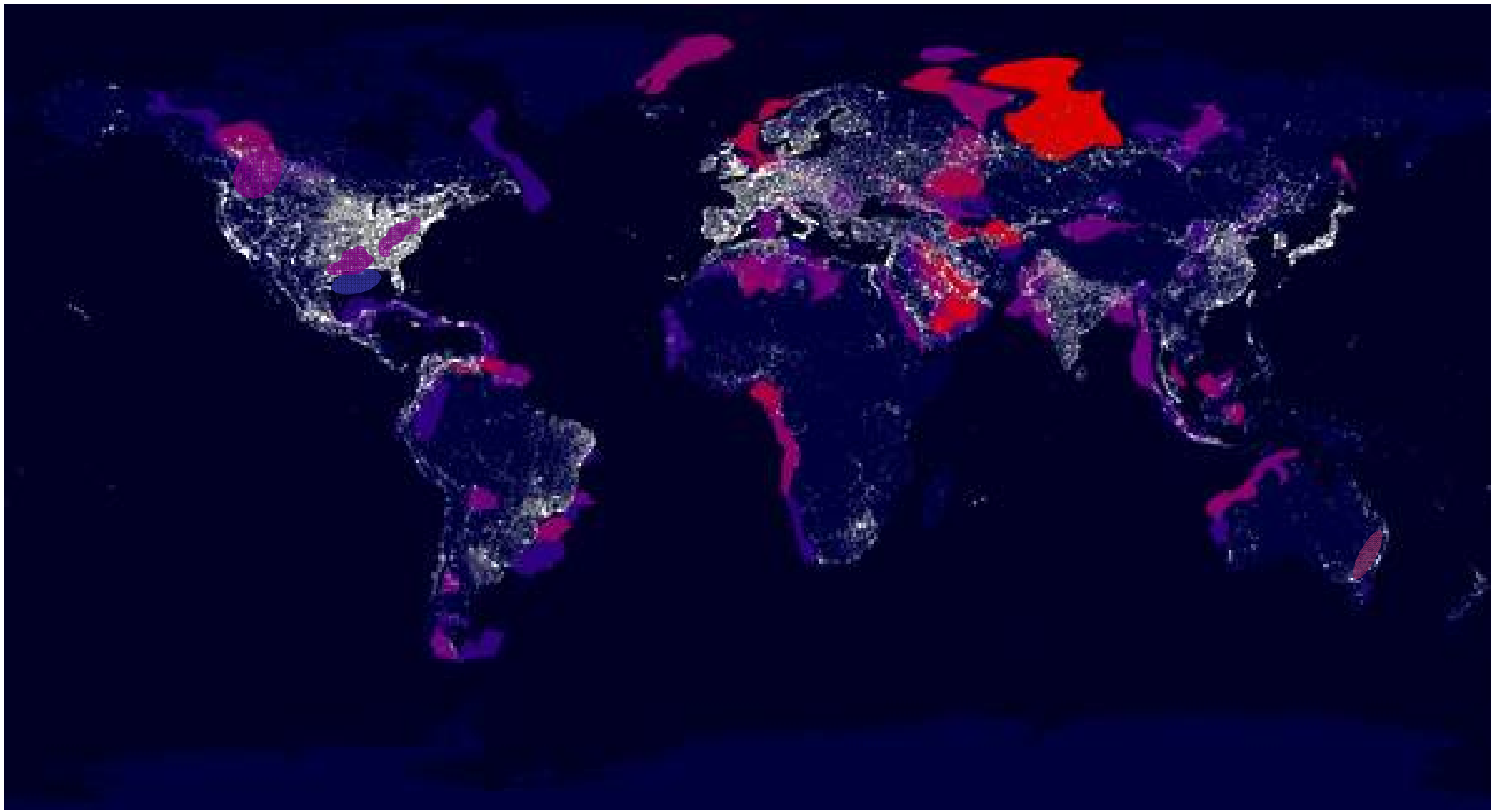
The Effect of Rising Costs

- *Rising costs* in the face of *price uncertainty* contributed to the observed investment patterns.



- **Bottom line: Uncertainty about future costs contributes to varied views of future price going forward.**

Global oil and gas resources are abundant…



… with much in the hands of NOCs…

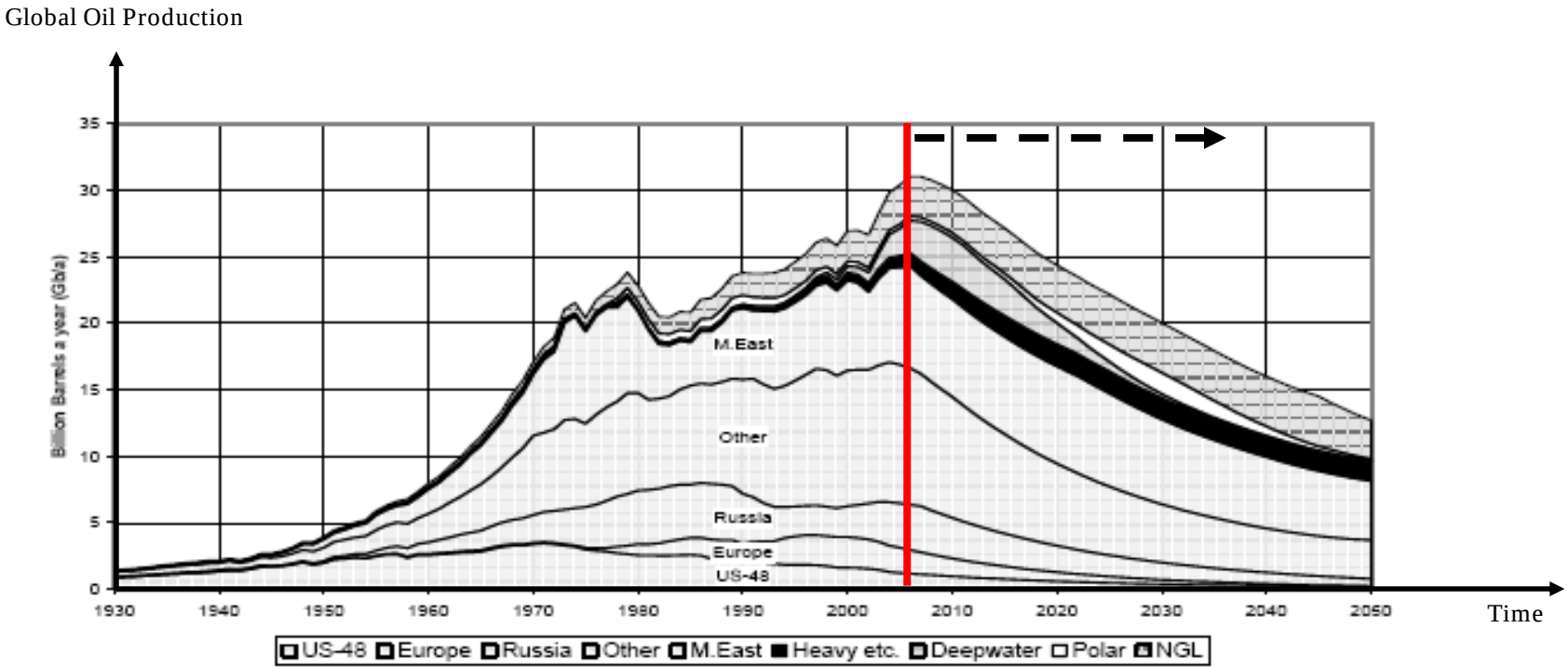
… but, are NOCs "efficient" firms?

- Non-commercial objectives influence the ability of national oil companies to function as many of the international integrated oil companies.
  - The word "efficient" should be used with care. NOCs may be "economically efficient" in the sense that they are maximizing some objective. However, the NOC likely faces a different objective than an IOC.
  - Theoretical modeling indicates these objectives skew the firm's observed behavior away from the unimpeded outcome (Hartley/Medlock, "A Model of the Operation and Development of a National Oil Company," *Energy Economics*, 30(5)).
- Empirical analysis indicates the relative revenue efficiency of NOCs is lower than that of IOCs. The results are robust to methodology
  - Stochastic Frontier Analysis (SFA); Data Envelopment Analysis (DEA)
  - Eller/Hartley/Medlock, "Empirical Evidence on the Operational Efficiency of National Oil Companies," *Empirical Economics*, forthcoming

- **Implication: higher prices are needed to maintain a given supply, much less grow production.**

"Peak Oil"

- Peak Oil theory gains mainstream traction.
- In 2007, ASPO posted a prediction of a production peak within next 5 years.
- The arguments reverberated as prices approached $100/bbl.



Note: Picture from the Association for the Study of Peak Oil (ASPO)

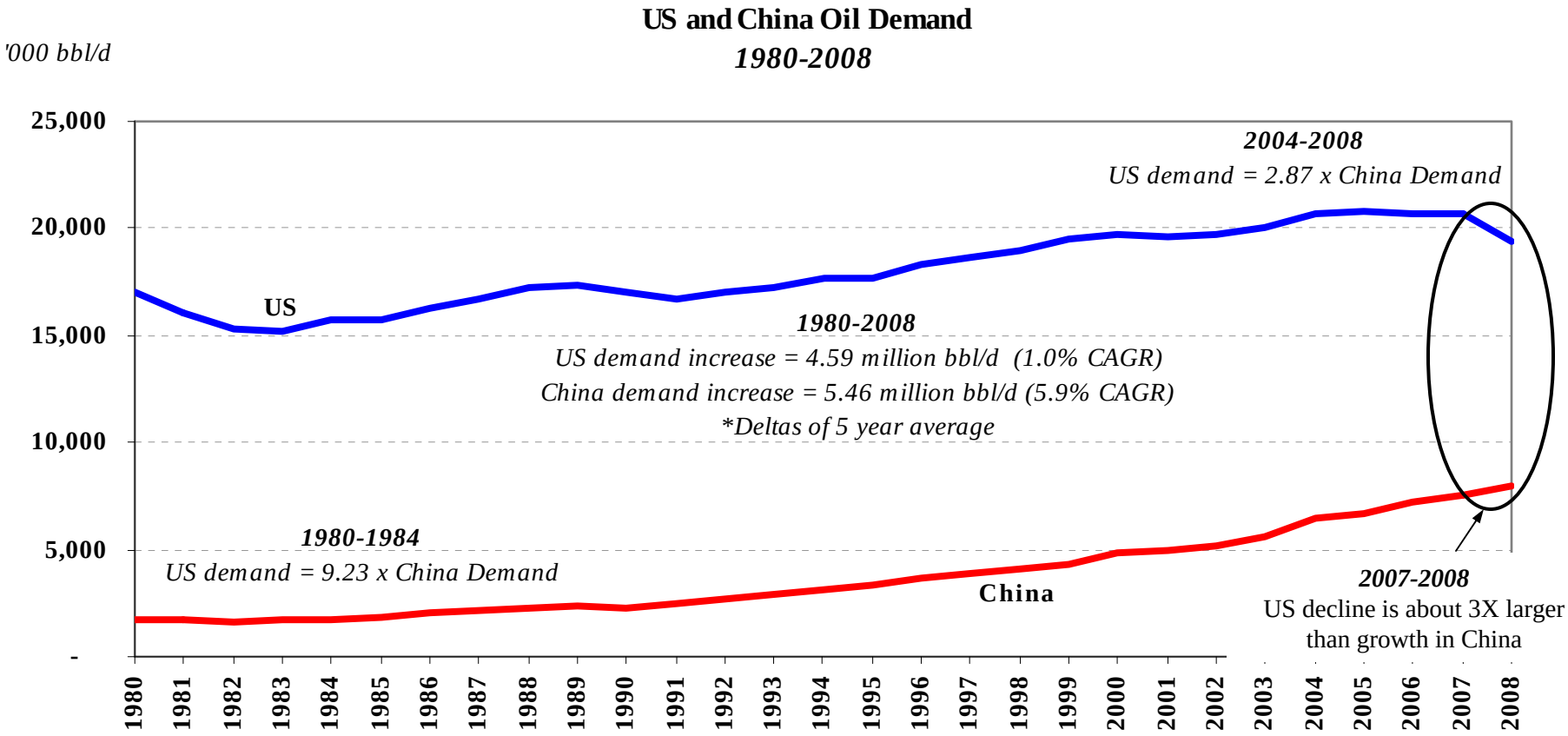
"Peak Oil" – Who is right?

- Depends on interpretation of data (is this a picture of demand or supply?)
- Common criticism: "Hubbert" curves do not have economic elements
- However, economic theory of depletable resources does not provide an answer either, only signposts
  - (1) diminishing production capacity and well productivity,
  - (2) constraints on equipment and personnel, from more drilling to sustain a given production, and
  - (3) declining exploration success.
- BUT, other factors can explain and offset the above three issues.
  - (explain) uncertainty about the location and quality of new deposits and
  - (offset) innovations that reduce development costs in more difficult environments

- **Bottom line: Uncertainty of future supply exerts a "precautionary motive" on the market.**

Demand Growth in a Mobilizing China

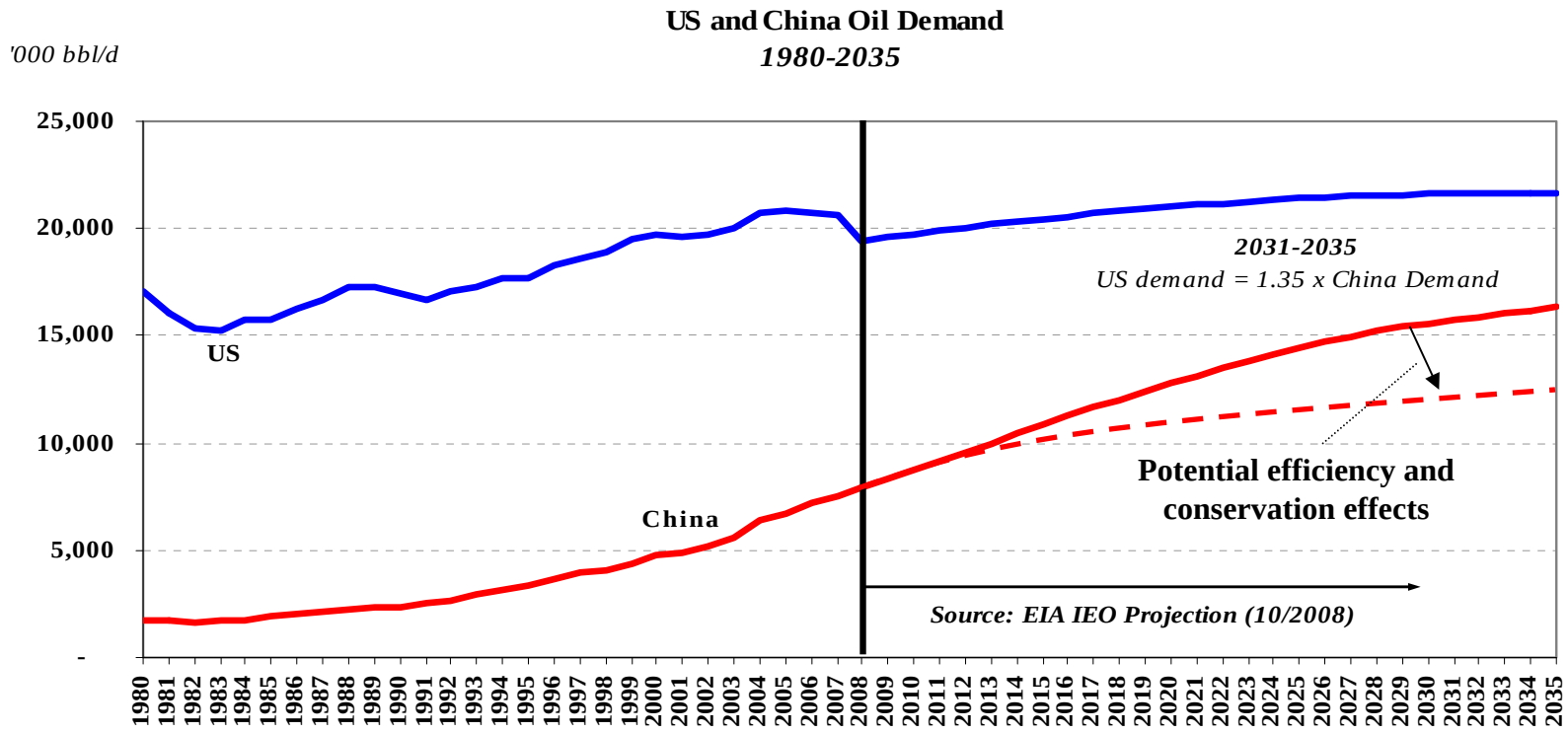
- Demand in China is growing at a rapid pace.



- Note, considering only growth rates can be misleading. We must also consider the base upon which growth is occurring. The US footprint has also grown...

Demand Growth in a Mobilizing China (cont.)

- ... but where will we be in another 28 years?
  - The forecast is credible, but we must use caution... road petroleum use in China accounts for about 1/3 of total. In US it is about 60%. The US saw flattening industrial demand, and reduced demand in all sectors except transport. Could the same thing happen in China? If so, shave the forecast by about 4.5 million bbl/d...



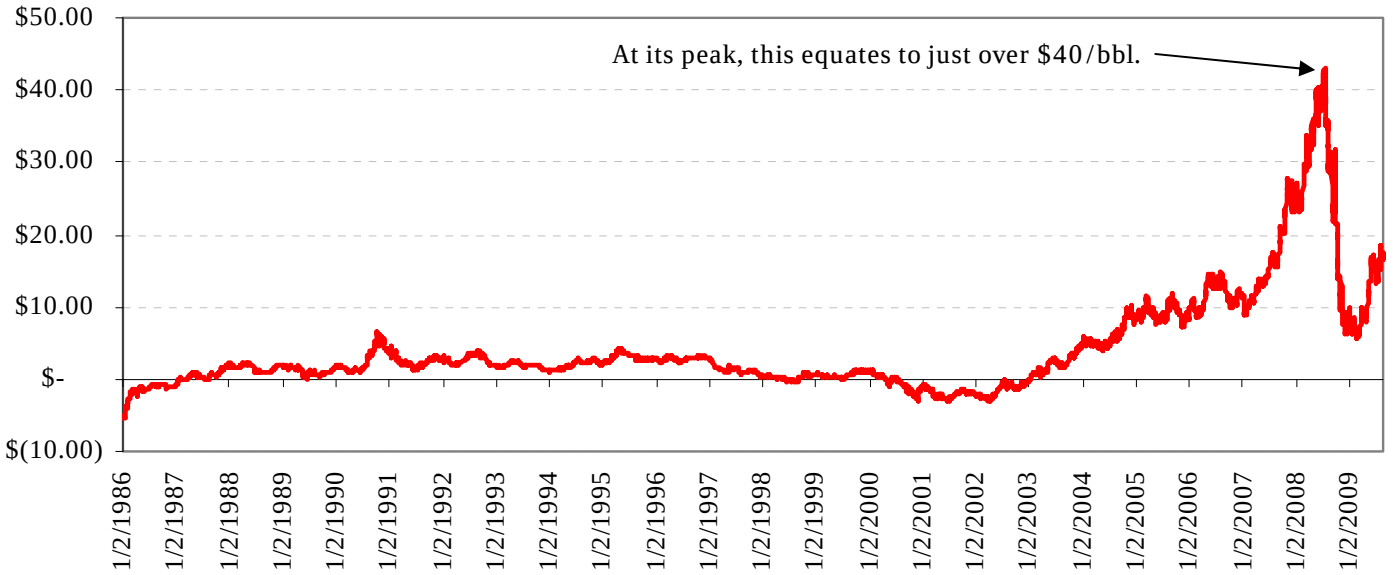
- **Bottom Line: How will we fuel mobilization in China?**

The Effect of the $

- Since Jan 2001, the correlation between the XR and the oil price is -0.82.
- From Jan 1986 to Jan 2001, the correlation is -0.08.
- Why did a strong relationship emerge for such an extended period?
  - One hypothesis asserts that it is tied to the emergence of "asset-class" investors.
  - If the concern is portfolio return, oil and the dollar can become linked via active trading.
  - Note, this also applies to other commodities.

The Effect of the $ (cont.)

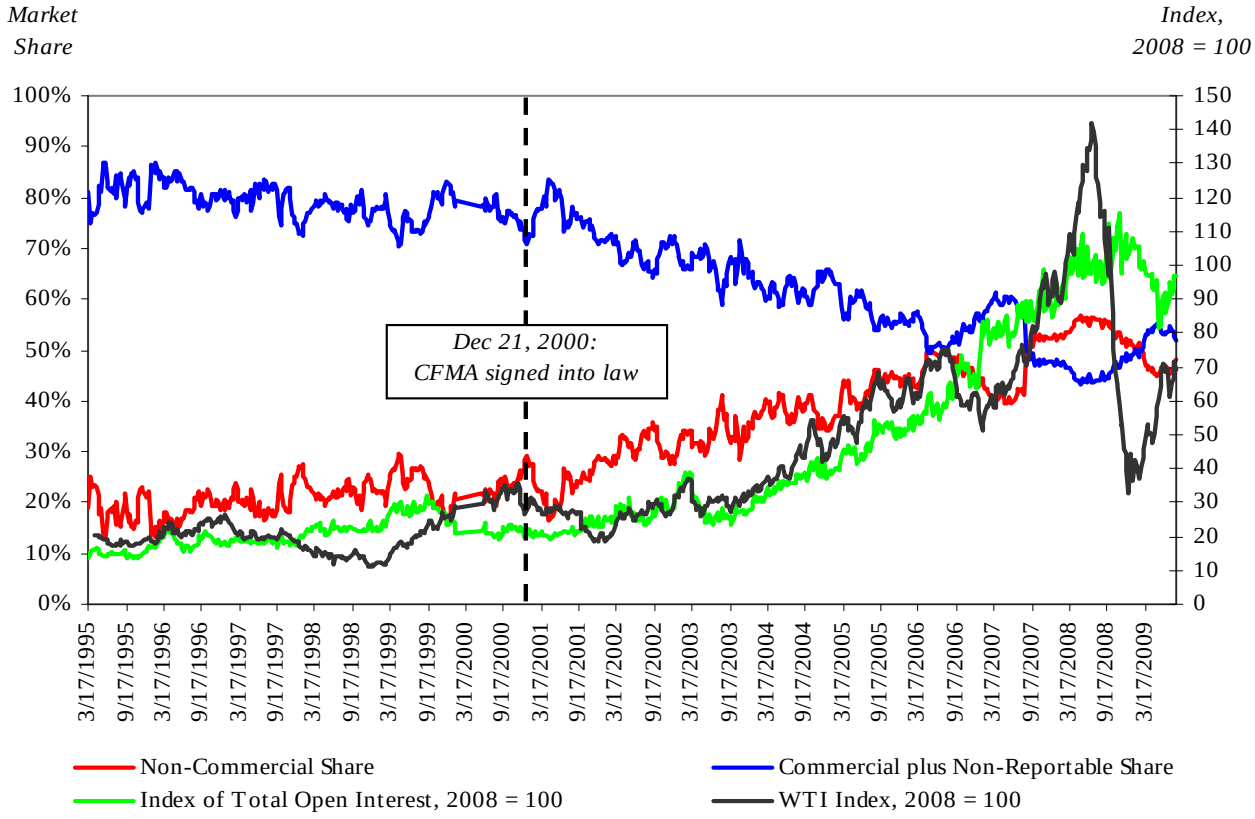
- So, how large an influence has dollar movement had on oil price?



- The graph depicts the difference between an exchange rate-normalized oil price and the actual oil price. This suggests that movements in the exchange rate explain about $40/bbl of the peak in price, although it is a *ceteris paribus* analysis.
- This can create a problem because a depreciating dollar and high oil prices lead higher trade deficits, which becomes circular. In 2008, oil imports accounted for about 49% of the trade deficit, which is up from 18% in 2002.
- **Bottom line: Where does the value of the $ go from here?**

Speculation

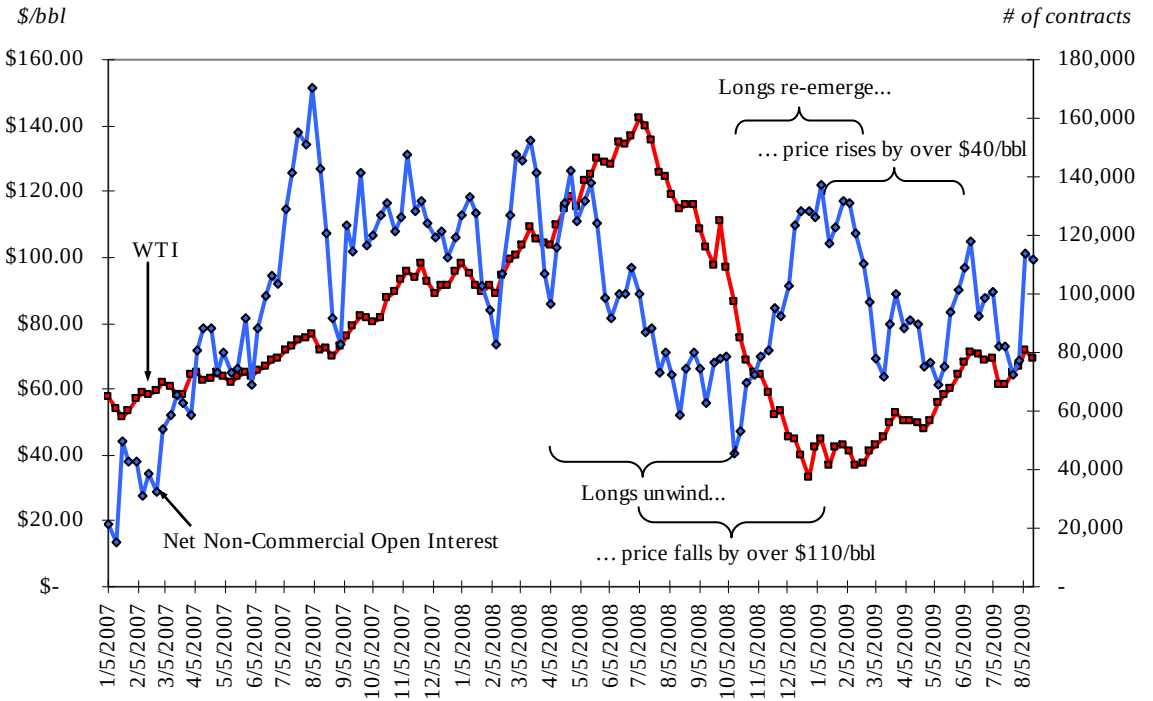
- Trading requires both speculators (demanders of risk) and hedgers (suppliers of risk).
- Market composition began to change dramatically shortly after the Commodity Futures Modernization Act was signed into law.
- Many have claimed that the increase in open interest by market players with no physical commercial position in the market pushed price higher.



Source: CFTC COT Reports – CRUDE OIL, LIGHT SWEET - NYMEX

Speculation (cont.)

- Non-commercials have been consistently net long, as a group, since 2003.
- In addition, the net long position shows evidence of leading oil price.
  - Tests of bivariate Granger causality reveal this to be the case. Omitted variables bias render this suggestive rather than definitive. For example, changes in physical market indicators could lead market positions and oil price. Multivariate analysis is forthcoming.



Source: CFTC COT Report - 'CRUDE OIL, LIGHT SWEET' - NYMEX

- **Bottom Line: Is there an additional influence, or is it all reactionary?**

More on Speculation

- The most common argument against any effect on price from speculators, "… look what happened to the onion futures market back in the 1950s."
  - Many analysts like to bring up the example of the onion futures trading, which was banned in the 1960s. Absent trading, we indeed saw extremely volatile onion prices…
  - But, this is a nonsensical analogy. Not even the CFTC is considering *elimination* of oil futures trading. These analogies are often made to make the prospect of different regulations seem unthinkably disastrous. They need not be.
  - Most understand the value of futures trading and we need to think about why the concept grew in the first place – to help markets function more smoothly. So, is that what we have today? This question must be addressed when thinking about new regulation.

More on Speculation (cont.)

- A recent analysis stated that "… government attention is being directed away from addressing the fundamental cause of increased prices. Specifically, factors such as tax policy, government intervention, access and production problems, and firm inefficiencies. The danger is that a short-run politically expedient approach will hinder lagging capacity investment."
  - It is well-researched that a lack of predictability (or uncertainty) is detrimental to long term investment activity. If we are worried about capacity expansion, price swings from $99 to $147 to $30 to $75 in 18 months do not help.
  - Many firms have had to redraft strategic plans, which are usually annual exercises, 4 times in the past 20 months.
- So, it should be reasonable to examine this issue. The trouble is we simply do not have the market transparency to make any definitive conclusions.
  - This makes the issue hotly contested, and to both sides the answer is obvious.

More on Speculation (cont.)

- In response to calls for greater transparency, the CFTC has recently changed its COT reporting and released revised historical data in the same form as the new COT report.
  - While the new data have not yet been fully analyzed, they do not appear to be very helpful.
  - First, when looking for structural changes in market data a sufficiently long time series is a necessity. The "new" data simply do not provide enough to do any useful analysis or make any meaningful conclusions along those lines. It is unlikely this will change.
  - The new data do little to expand the scope of market coverage, as OTC markets are still not covered. It would be very useful to have greater transparency in order to do better analysis, but the fact is that nobody can actually say anything definitive because too much of the market exists in a black box.

More on Speculation (cont.)

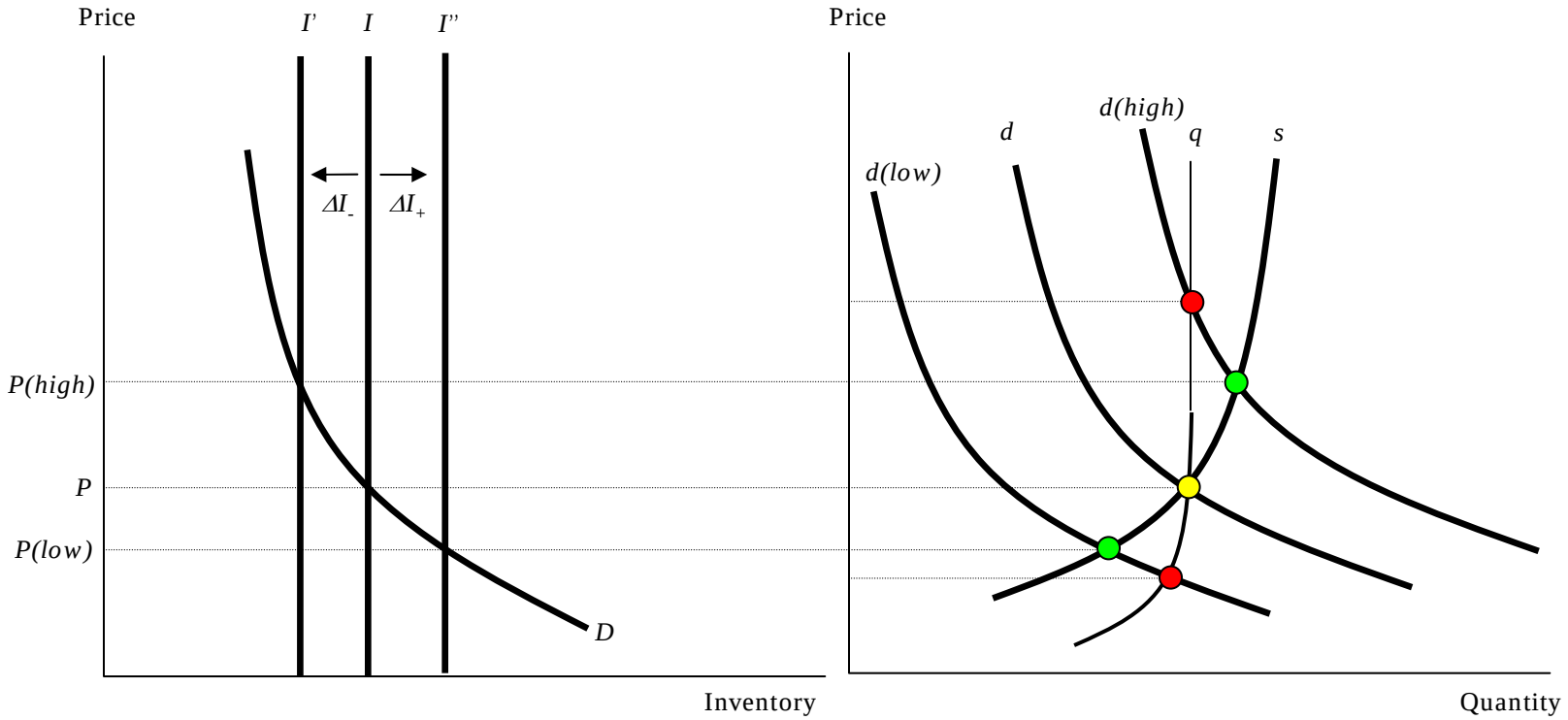
- Another dangerous misconception is that "excessive speculation is creating a bubble so vast that it has become the sole driver of oil prices."
  - This refers to the lunatic fringes of the argument.
  - A more appropriate argument is that speculation has exacerbated underlying signals in the fundamentals.
- If the story was as simple as "its all because of speculators" then it would be difficult to explain other markets, for example the natural gas market. A variety of issues must be true, which leads us to a perfect storm argument, see "Speculation: A Cause or Symptom" available at http://www.bakerinstitute.org/publications/EF-WWT-Speculation-091808.pdf.
- We need a framework for analysis.

Fundamentals or Speculation?
A "Stock-Flow" Model

A "Stock-flow model" incorporates aspects of speculation, the ability to expand production, peak oil, exchange rates, and uncertainty.

The Stock-Flow Model and Seasonal Demand

- Seasonal demand fluctuation leads to price variability. Variability is dampened with access to inventories.
- A standard application in a market with a storable commodity...

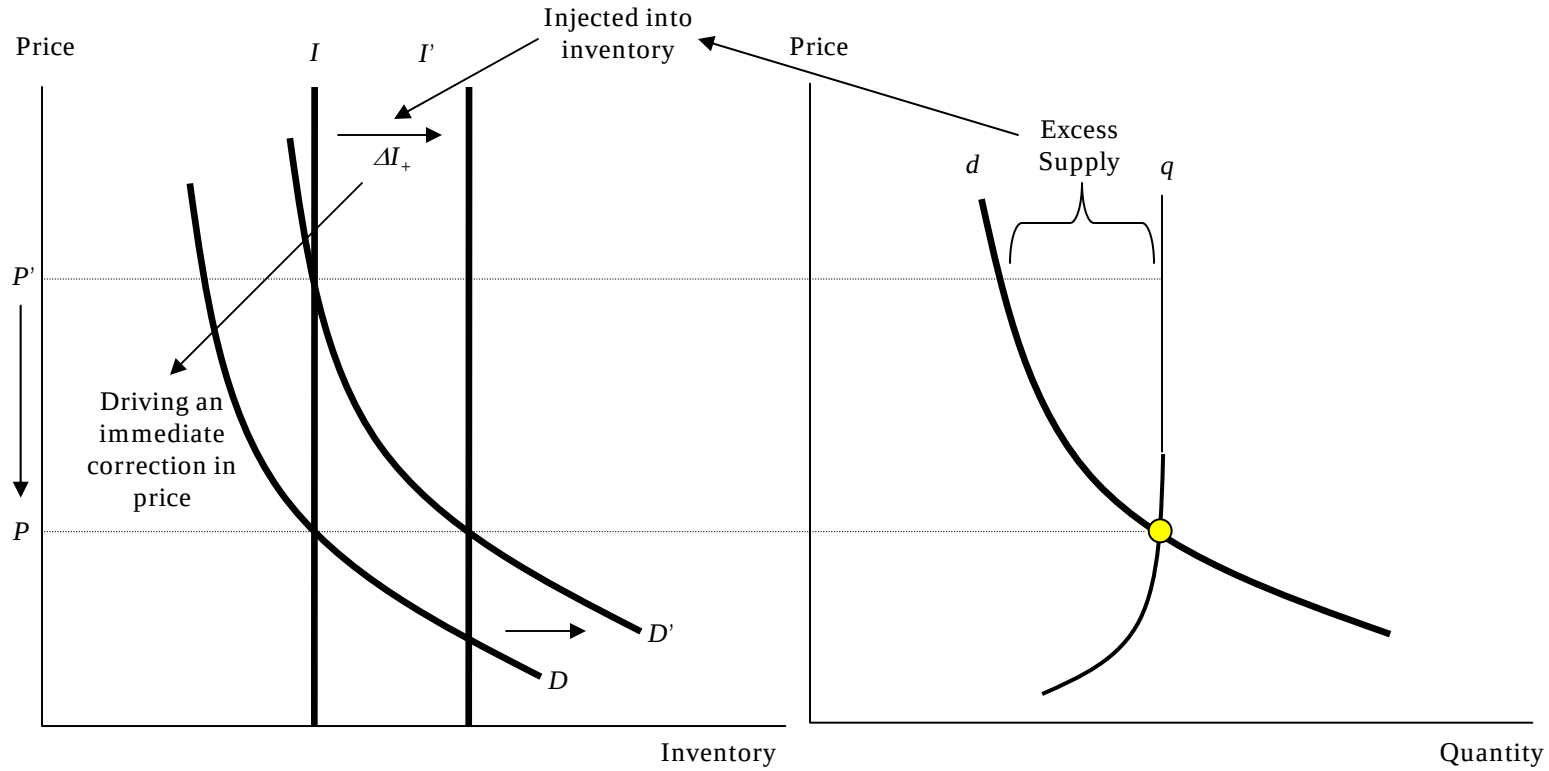


STOCK

FLOW

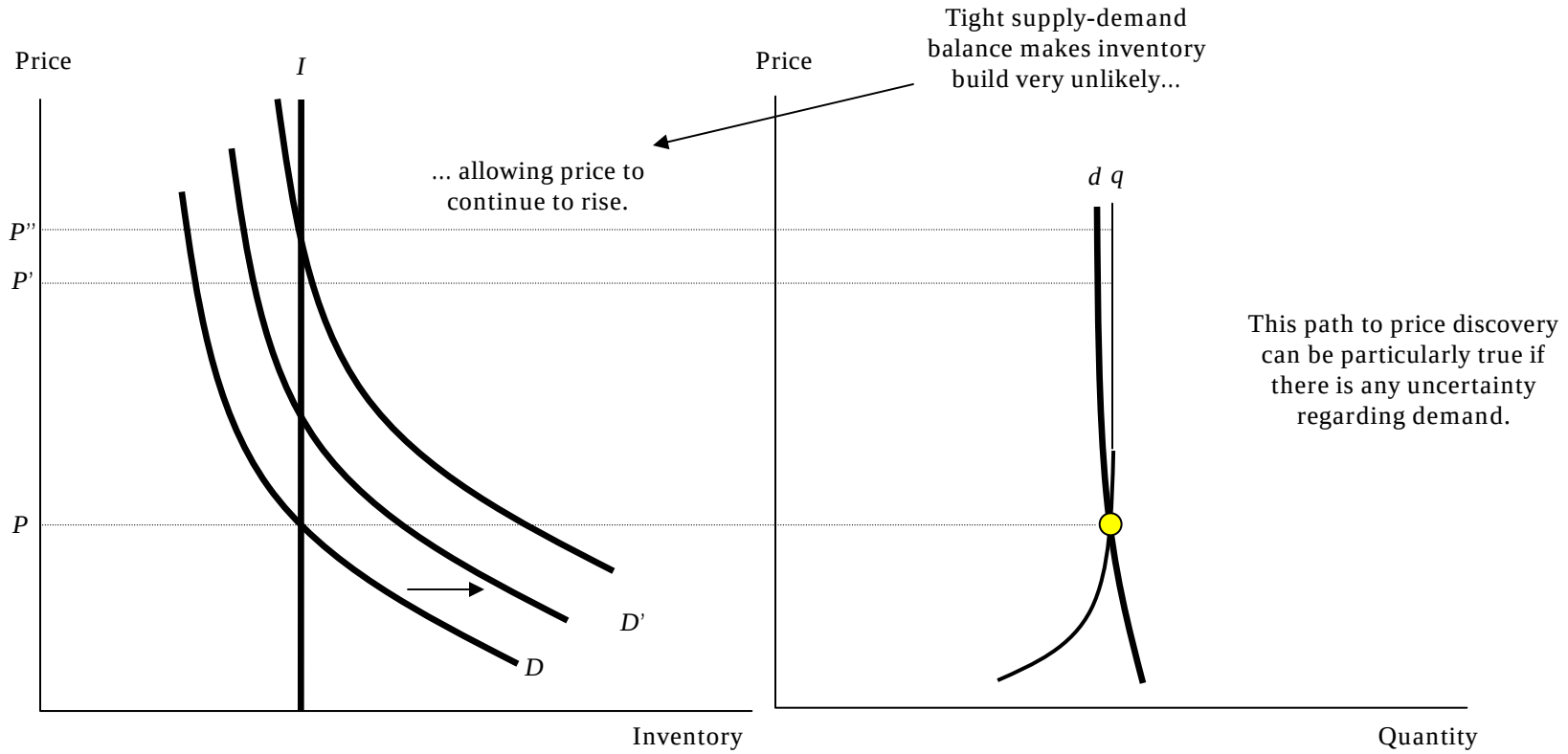
The Stock-Flow Model and Expectations

- Uncertainty about future adequacy of supplies can lead to an outward shift in the demand for inventory (a precautionary motive). This should discourage demand through higher short run price and lead to inventory build...



The Stock-Flow Model and Expectations (cont.)

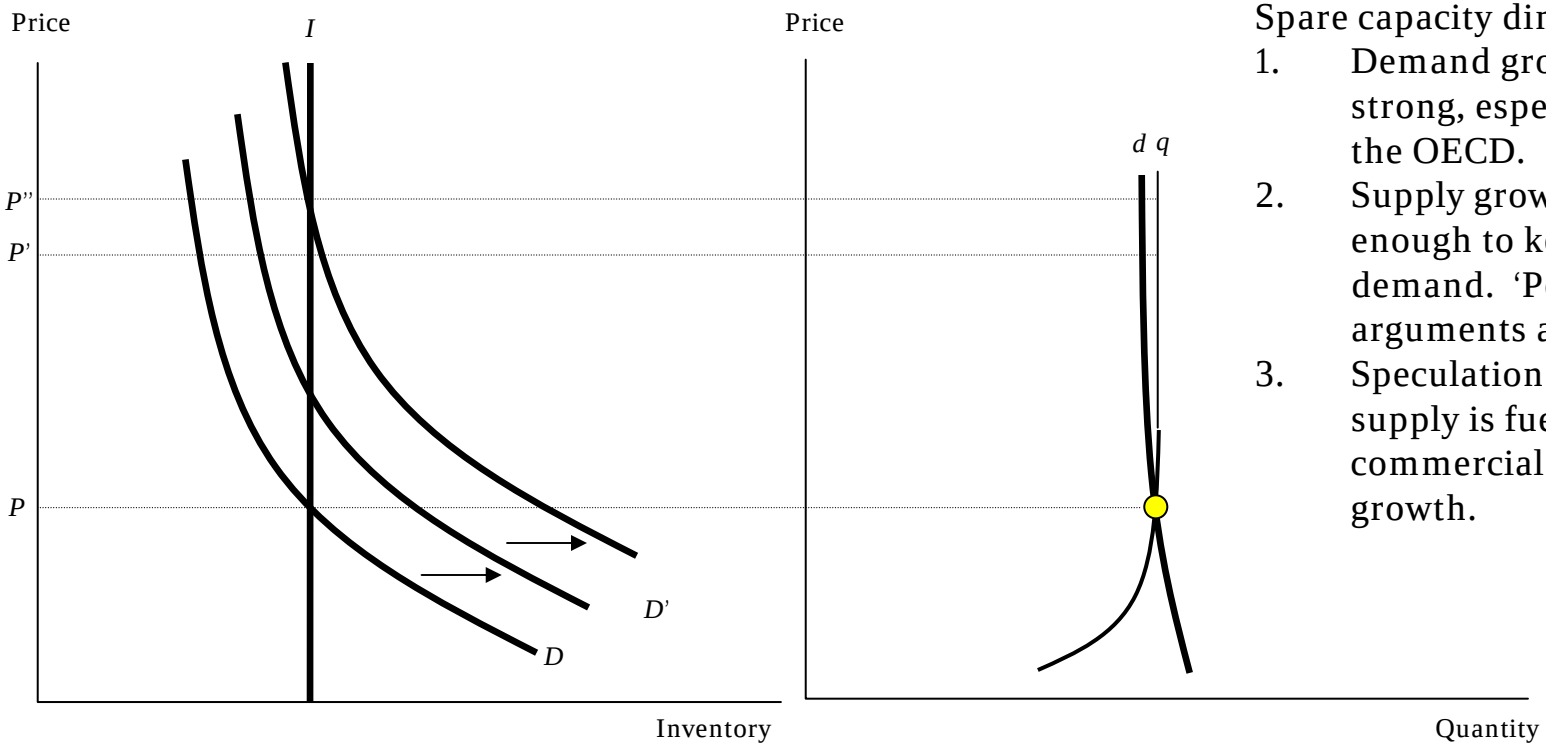
- ... or should it. The same picture with *inelastic demand* indicates an inability to build inventory. This reinforces expectations about inadequacy of future supplies, leading to additional pressure and ever higher value placed on "what we have".



The “Stock-Flow” Model applied to the Crude Oil Market

Price goes up…

- The ability to expand production, peak oil, exchange rates, and uncertainty all play a role here.
- Key point: Market fundamentals are tight, so speculation begins to exert an influence.

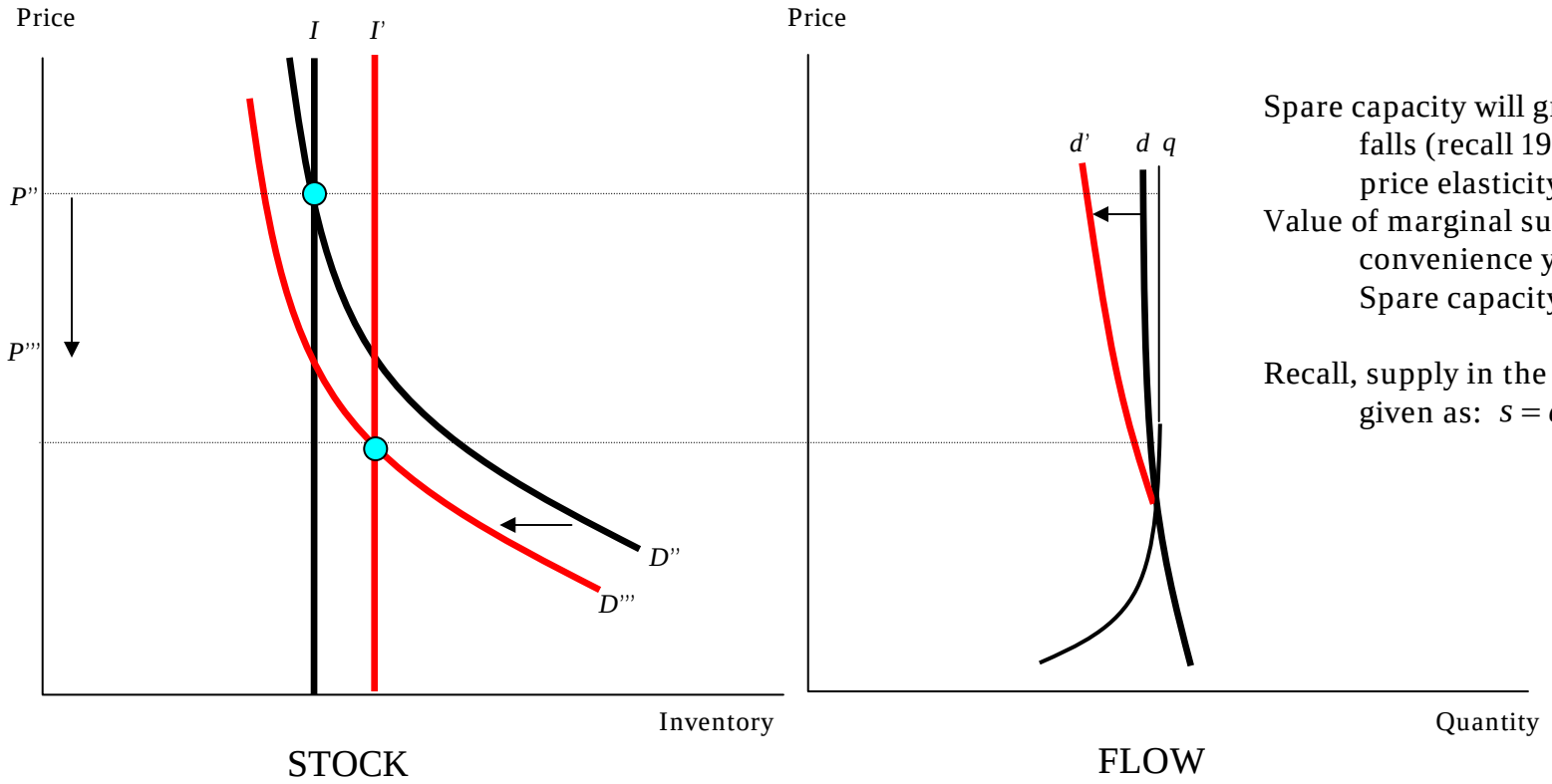


Spare capacity diminishes as:

1. Demand growth is very strong, especially outside the OECD.
2. Supply growth is not enough to keep pace with demand. 'Peak Oil' arguments abound.
3. Speculation about available supply is fueled by a lack of commercial inventory growth.

Price comes down...

- Degradation of demand and inventory build.
  - In the US alone, oil use from July 2007 to July 2008 declined by over 1.5 million b/d.
  - Olympics end and non-commercial stock (SPR injections suspended) builds end.
  - Global economic crisis and demand *forecast* revisions ⇒ lower expectations.
  - Inventories *did* build... "oil-at-sea" numbers ballooned.
- OPEC can support price now by holding back capacity.



Spare capacity will grow as demand falls (recall 1998)... SR vs LR price elasticity.

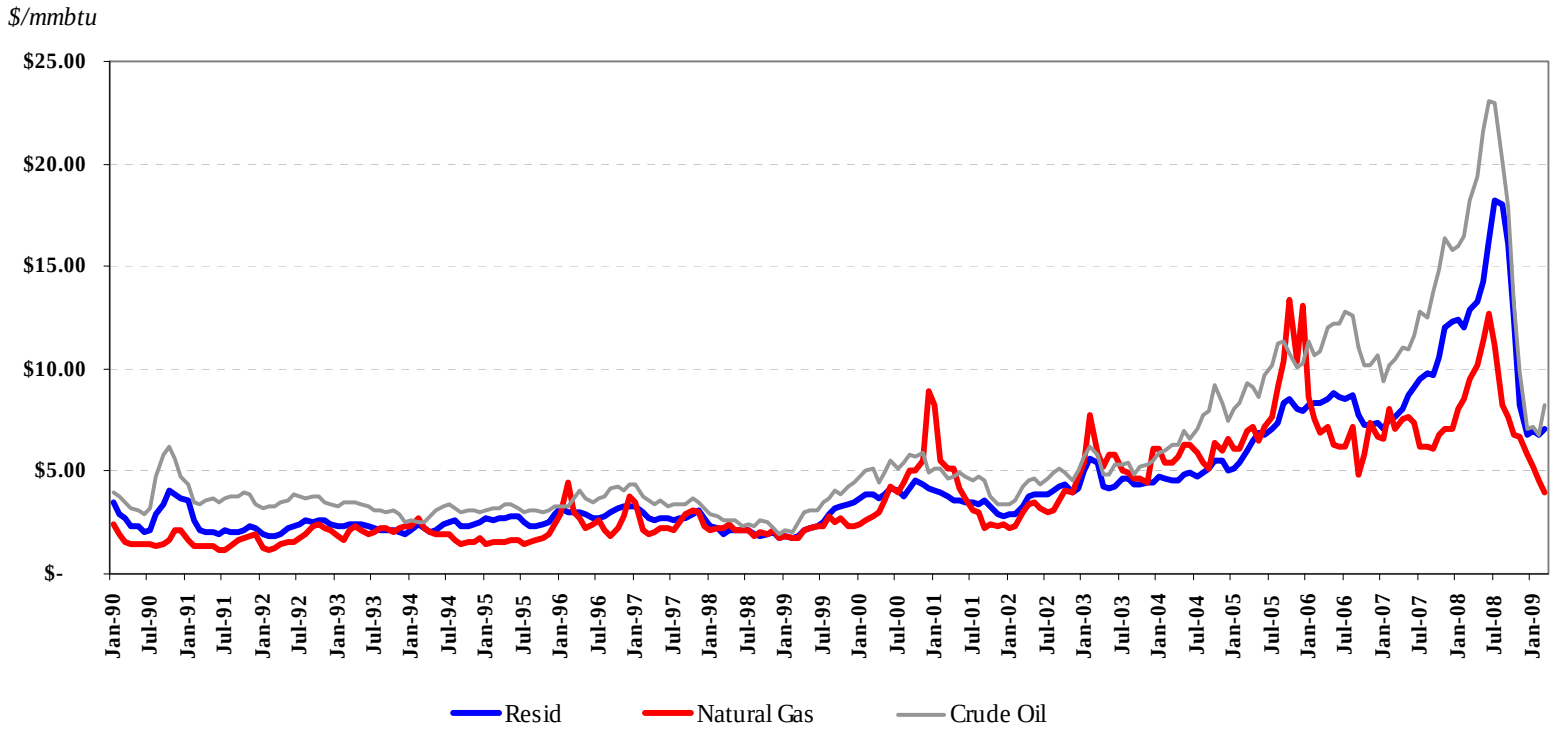
Value of marginal supply declines – a convenience yield argument. Spare capacity is inventory.

Recall, supply in the flow market is given as: $s = q + \Delta I$

The Divergence of Gas and Oil

The Prices of Crude Oil and Natural Gas

- Historically the prices of crude oil and natural gas tend to move together.
  - 10:1 ratio, 7:1 ratio, BTU parity, no relationship at all...
  - Recently, this ratio has even approached 25:1!
- How can this happen if speculation matters?
  - More elastic supply and demand curves will tend to force "corrections" faster in the stock-flow framework. This can cause temporary disconnects between markets when substitution opportunities are limited.



Comments/Questions