Robinson Economic Forecasting Conference

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A Shady Tree Mechanic Meets Wall Street

August 2008

Morgan Stanley

Why a Market?

A Market: a virtual or physical location that facilitates voluntary exchange of goods or services in return for money or other goods or services

Benefits of a market

A functional market results in a better allocation of resources than that of even an informed planning process or indeed any other currently known alternative.

A "Complete" Market

A market which allows and facilitates the complete removal of any or all risk or uncertainty about the outcome of a decision such as a commitment to produce or consume that is made at any time before or even during delivery.

Spot and Forward Markets

- **When a forward market exists, commerce occurs that would not otherwise occur, especially commerce involving investments**

Forward Agreement – a binding commitment to accept or deliver at some later time, but at a price that is set now

Functioning Market - you can always buy or sell, it's just a question of price

So if you have a reliable spot market, forward contracts are mainly used to capture price movements

Why does a forward market exist?

• Producers and consumers want to remove the risk of future price movements.

• It is <u>not</u> a zero-sum game. Risk is exchanged and value added thereby.

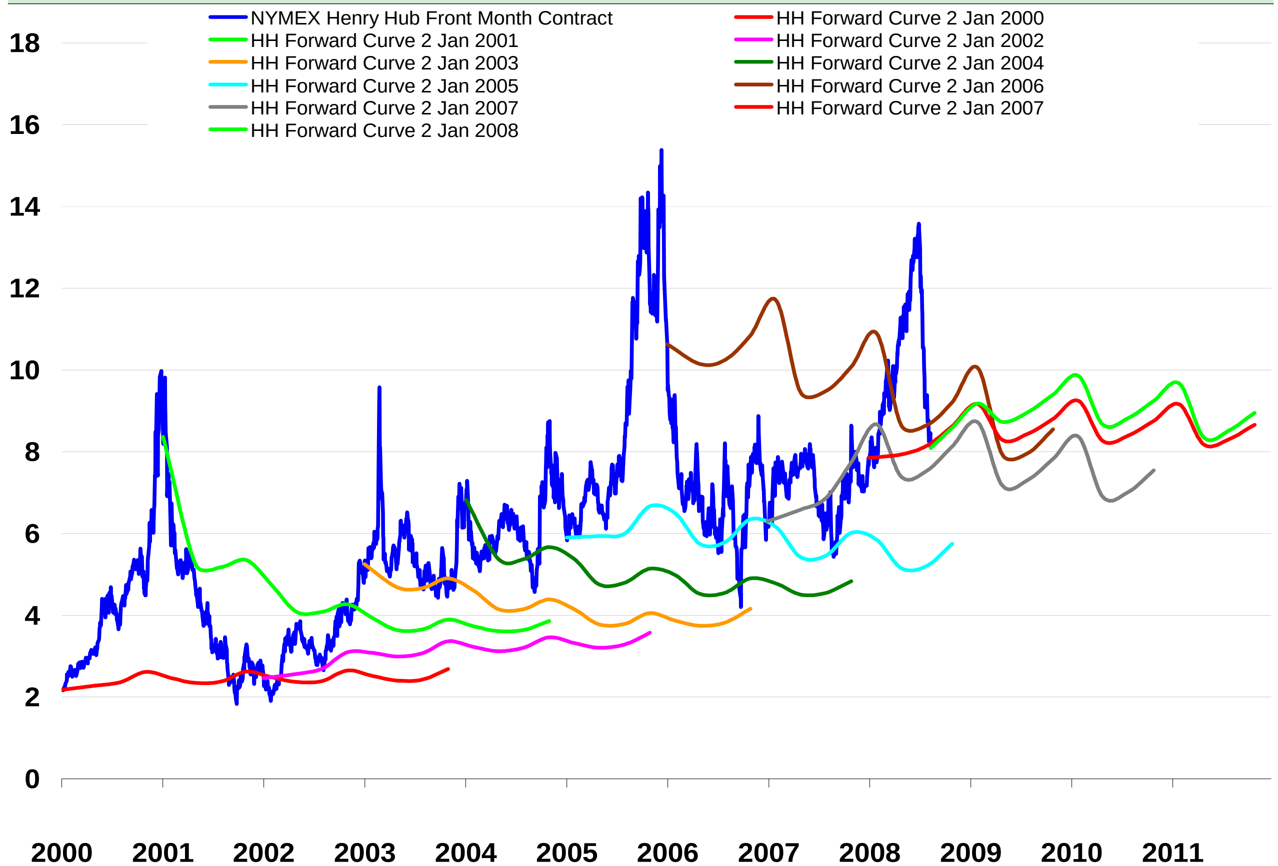
Forward Prices vs. Expected Spot Prices

Why does "bias" exist in forward markets?

- Forward markets price at the balance of forward supply and forward demand, *and*
- Forward buyers (consumers) and forward sellers (producers) almost never have the same motivation to transact, *therefore*

- Forward markets <u>do not</u> reflect expectations of future spot prices <u>unless</u> there is sufficient speculation

US Natural Gas – Historical Spot and Forward Prices
($/mmBtu)

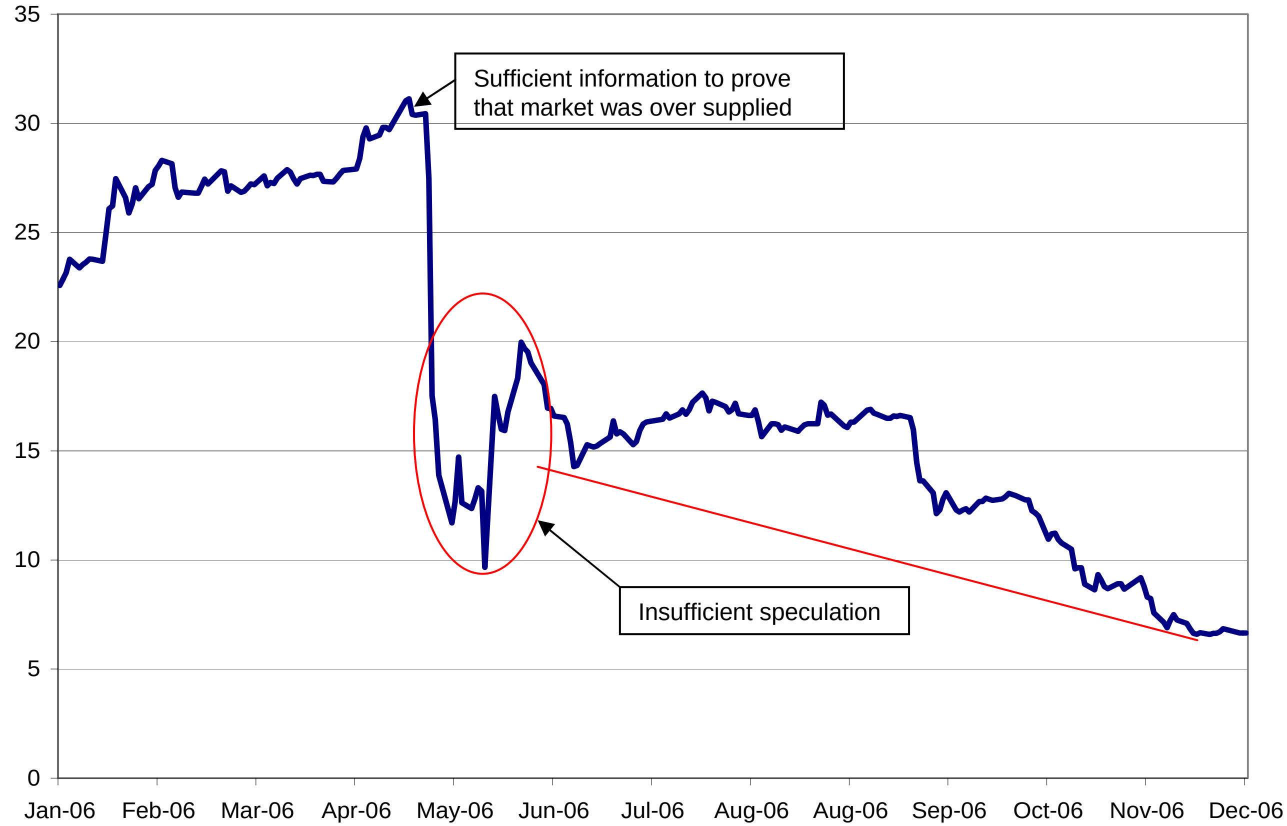


Source: Morgan Stanley Commodities, Bloomberg

Carbon Illustrates Lack of Speculators

- In April 2006, the Phase 1 (Dec 2007) EUA market collapsed
- Prices were more than €30 per tonne on the Friday
- The EU released the 2005 compliance figures, showing a larger than expected surplus of allowances
- Prices dropped dramatically over the following Monday and Tuesday
- Financial risk models showed expected duty cycle of coal plants going from around 40% up to 70% or more with a commensurate increase in emissions to be covered. Producers had to buy to cover but sellers were not as motivated to sell.
- Most independent information services had consistently predicted shortfalls based on their fundamental analysis
- There was no information released until that fateful two days in April
- The market worked in part as expected in the presence of new information. Prices dropped but not as low as expected and even bounced in the absence of speculative selling

EUA Phase 1 Forward Prices for Calendar 2007 Delivery
(€/MT)



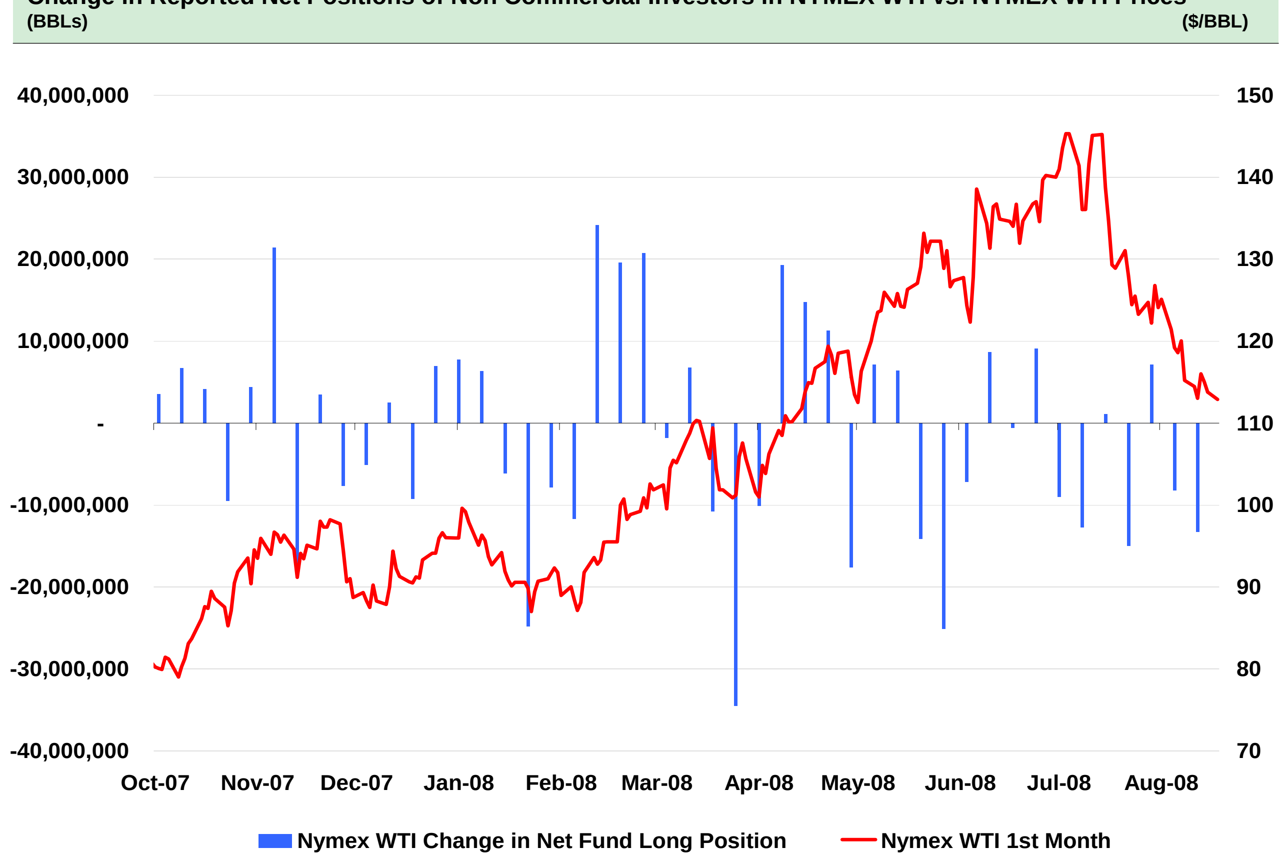
Source: Morgan Stanley Commodities

Non-Commercial Investors and WTI

• Daily global crude demand: 86.8 million barrels/day
Source IEA

*Position data is sourced from the CFTC which releases positioning in different commodities contracts traded on exchanges. This data is split by commercial positions (natural hedgers: producers and consumers) and non-commercials (funds and investors)

Change in Reported Net Positions of Non Commercial Investors in NYMEX WTI vs. NYMEX WTI Prices

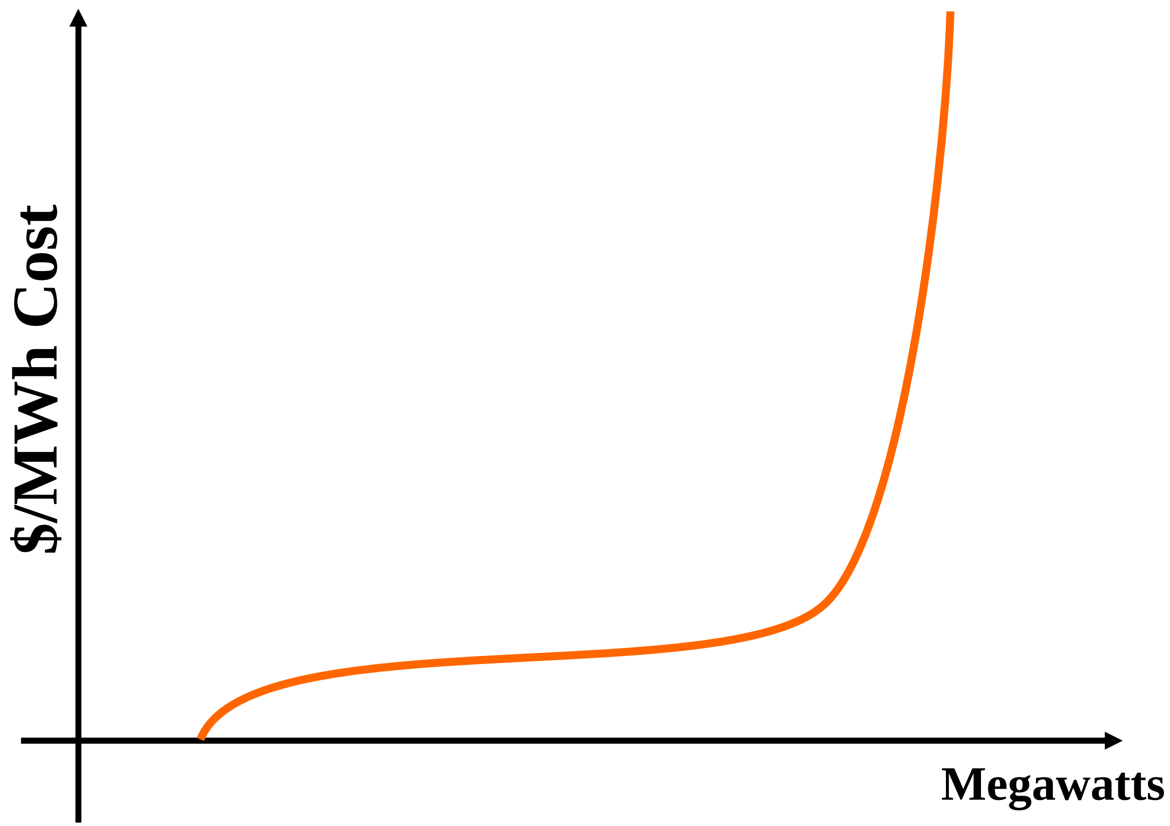


Source: Commodities Futures Trading Commission, Morgan Stanley Commodities, Bloomberg

A Typical System Supply Curve

Spot Power Market

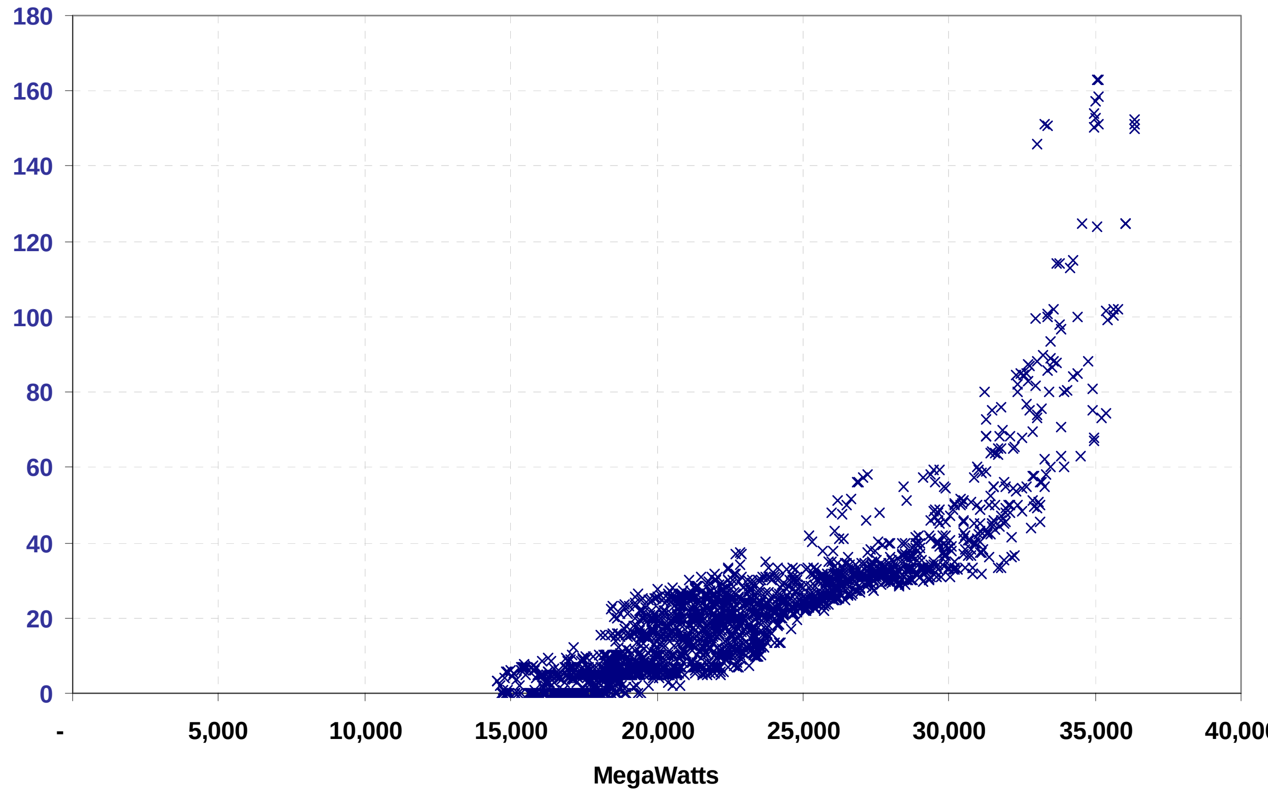
- Typical power systems have one or more relatively flat stretches on the supply curve, with a rather sharp upturn at the end of the curve
- These areas of the curve may reflect different fuel sources or technologies such as hydro or coal- or gas-fired steam generation, while the upturn may correspond to low efficiency combustion turbines or diesel generators
- At some point though, if the system becomes too stressed, supply comes from involuntary rationing, known as blackouts or brownouts in electric systems



Prices Generally Reflect the Supply Curve

- While the typical supply-curve shape is clear, some points are evidently well above the base supply curve
- These can be driven by unit outages or by increased demand in inter-connected regions
- This occurred in California which was importing 5,000-8,000 MW per hour during much of this period

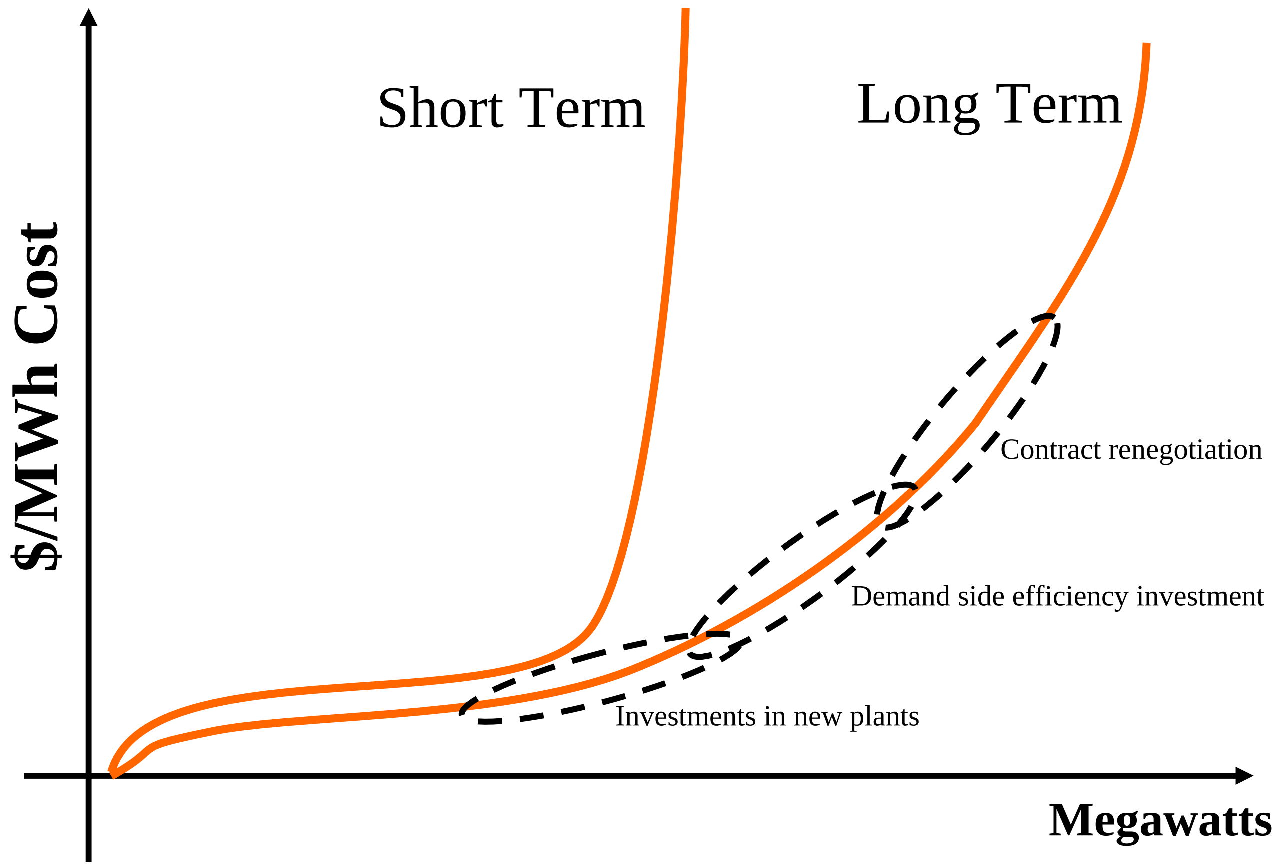
Power Supply Curve in the First Summer of California Market
Hourly Prices, from 18/05/1998 to 18/09/1998 ($/MWh)



Source: Jeffrey D. Roark

The Impact of Forward Markets on Supply

- If you have enough forewarning and can remove enough risk through forward sales, you can obtain financing for new generation or new technologies. Without a forward market this is difficult, if not impossible and you then have to use an alternative to a market-based economy



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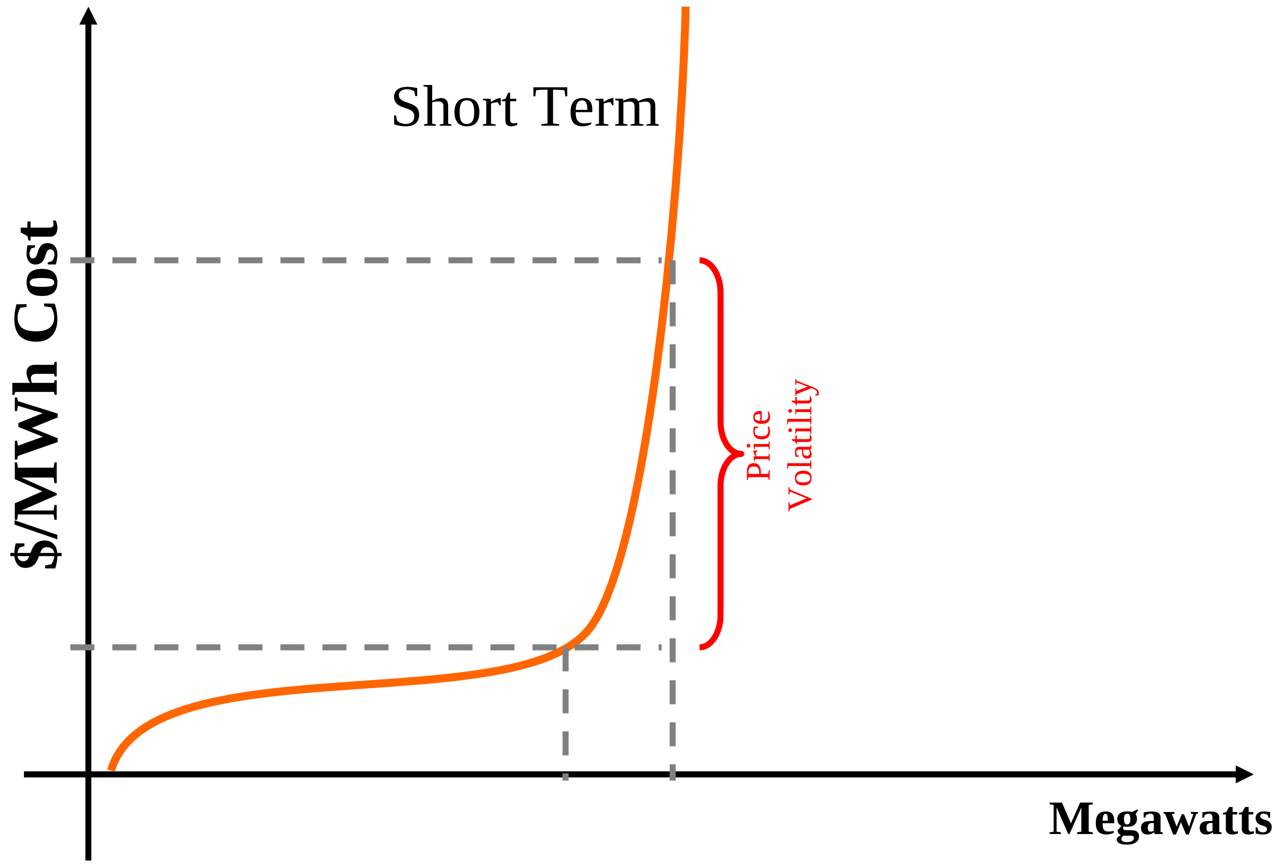

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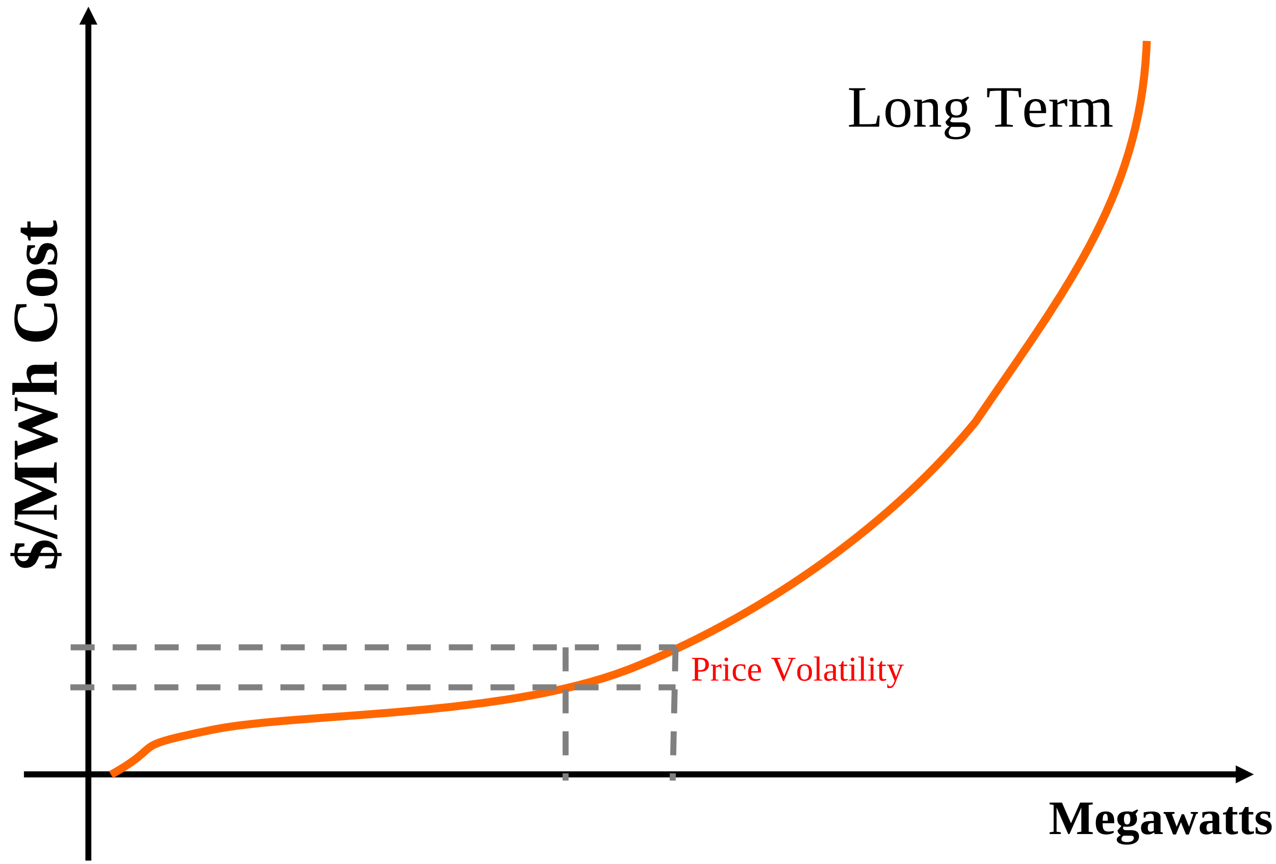
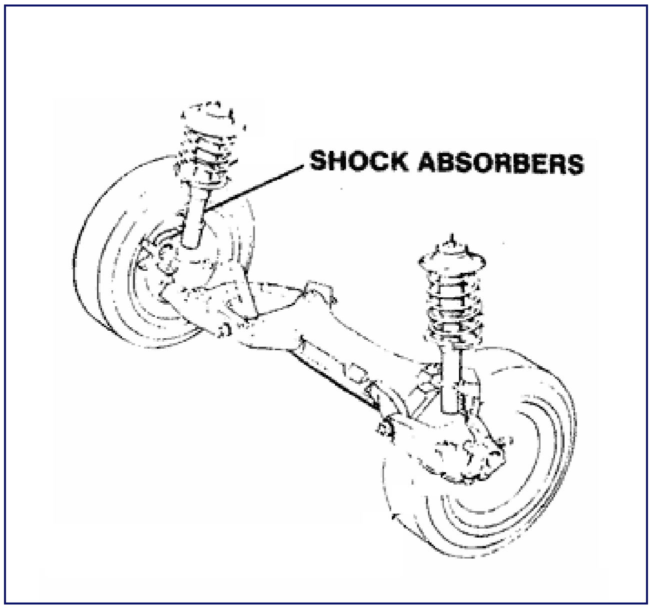
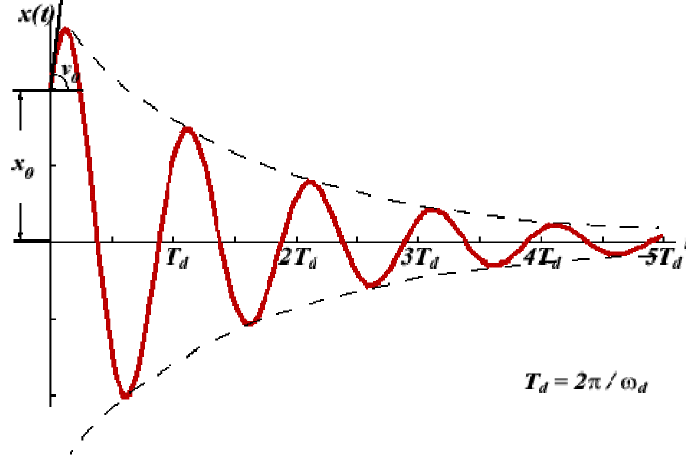


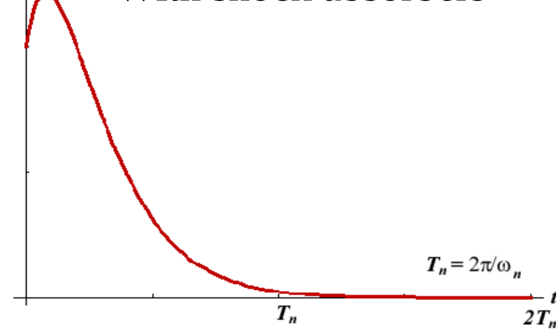
Conclusion



Without shock absorbers



With shock absorbers



Appendix A

Appendices

Arbitrage and Intermediation

And dare I say it?... Outright Speculation!

Virtual Bidding involves the submission of bids to buy or sell energy in the forward market that will not ultimately be produced or consumed by the bidder in real-time.

Virtual bids allow a participant to buy (or sell) electricity in the day-ahead market and to simultaneously assume an opposite obligation to sell (or buy) an identical amount of electricity in the real-time market.

(Footnote from the FERC Order issued 17 June 2004)

"Ofgem is wedded to the fiction that it is possible to distinguish between the cost of trades that are required to balance the system and the penal charges levied through the cash-out prices for individual imbalance, and has elaborate rules for drawing this distinction."

"Electricity Liberalisation in Britain: the quest for a satisfactory wholesale market design" Energy Journal, Special Issue on European Electricity Liberalisation, e.g.. D Newbery

"Virtual Bidding" is a term used for a mechanism that allows speculation and arbitrage between Day Ahead Market prices and Real-time or Balancing Market prices.

Lessons from the United States?

"PJM instituted virtual bidding without controversy on the same day that its markets opened for business. New York had a different constellation of interests that succeeded in postponing its introduction for over two years. New England had a substitute method available to its market participants and little controversy ever surfaced. At the other extreme, California in effect made the practice illegal."

Prof. Robert Michaels: "Market Monitoring Organizations in Electricity: what Can We Learn from the Economics of Regulation?" May 2003
(Note: The first sentence is an overstatement, PJM started locational pricing in June 1999 and virtual bidding one year later when it introduced its day ahead market on 1 June 2000)

"...in comments filed it has become clear to the Commission that the absence of virtual bidding has the potential to create many other problems in the operation of California's markets. Virtual bidding would help ameliorate issues regarding temporal market power, physical scheduling incentives, day-ahead pricing of constrained output generation, and the financial risks associated with real-time scheduling deviations."

Federal Energy Regulatory Commission. "ORDER ON FURTHER DEVELOPMENT OF THE CALIFORNIA ISO'S MARKET REDESIGN AND ESTABLISHING HEARING PROCEDURES (Issued June 17, 2004)"

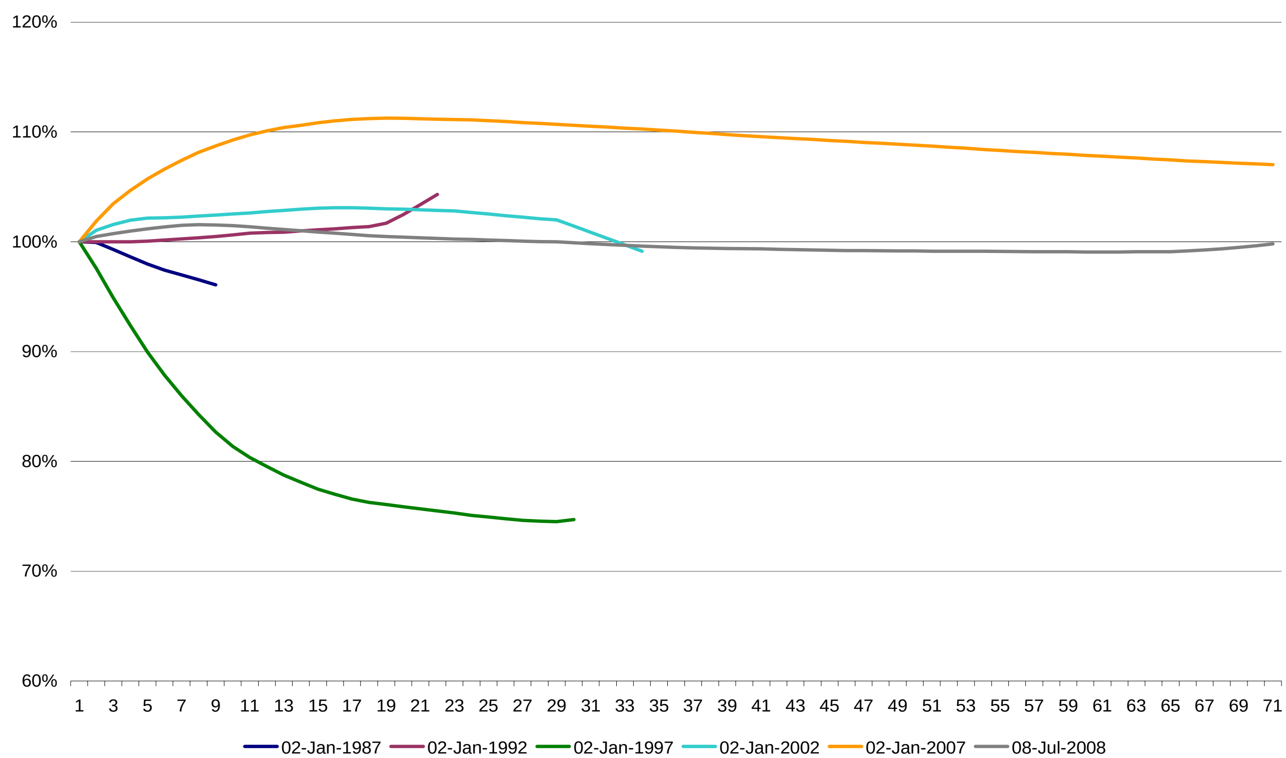
Appendices

History of the Futures Curve Shape

- Due to the physical nature of commodities, the shapes of forward curves cannot be explained alone by the time value of money
- Historically we have observed backwardated (1987, 1997 in chart) curves for NYMEX WTI. More recently these have tended to be in contango (2002, 2007, 2008 in chart). Contango markets encourage storage and development of supply buffers - especially steep contango
- The table below show the growth in total open interest and volume on an annual average basis

	Open Interest	Volume
1995	345,941	23,679,345
1996	397,335	23,131,650
1997	403,281	24,994,891
1998	467,804	30,735,040
1999	574,619	38,140,734
2000	469,136	37,067,942
2001	438,644	37,712,425
2002	488,002	46,630,277
2003	542,113	47,209,001
2004	690,350	55,621,967
2005	819,424	60,051,425
2006	1,067,921	70,973,081
2007	1,399,427	121,527,923

NYMEX WTI Futures Curves

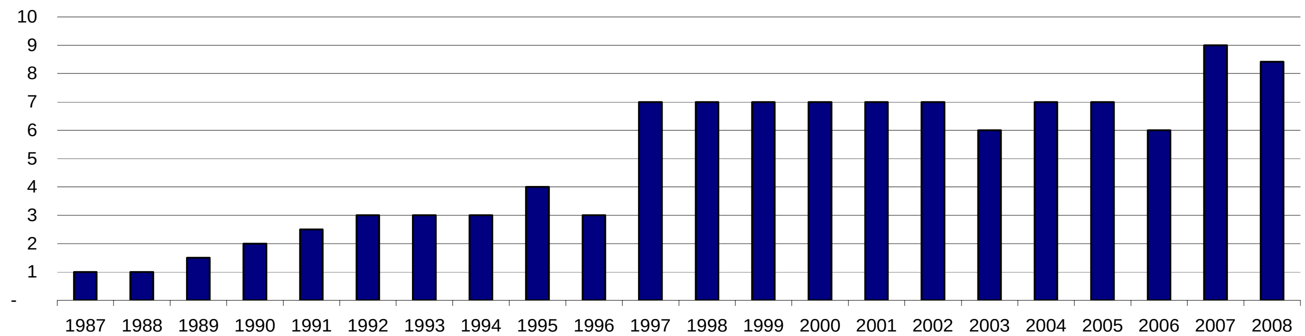


Source: Bloomberg

NYMEX WTI Market Evolution

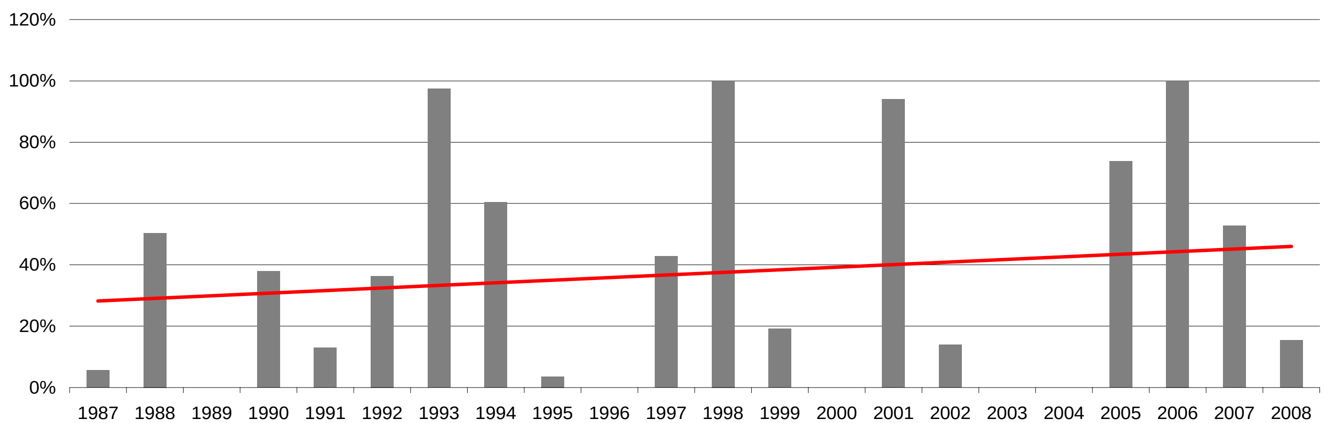
- Over time, the contracts available for trading on the exchanges have grown from less than a year out in the future to 9 years out. This offers hedgers and market participants greater flexibility to take a view on future prices of oil

NYMEX WTI – Length of Forward Contracts on the Exchange
(Years)



- Generally, in its infancy the NYMEX WTI Futures Curve tended to be more in backwardation than in contango. A longer term trend has emerged that sees a greater prevalence of contango, which encourages a build up of inventory

Proportion of Days in Each Calendar With First 12 Months in Contango
(%)

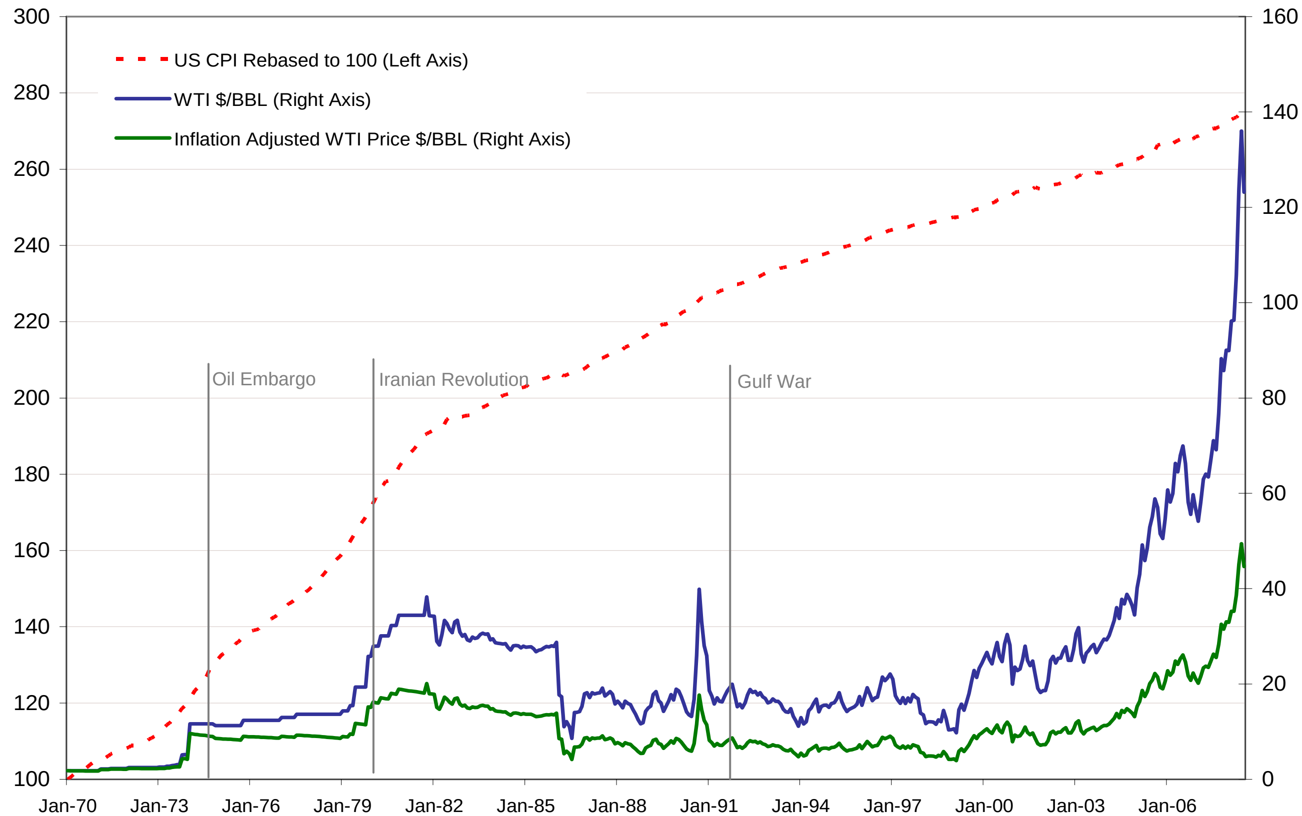


The Real Oil Price

- The oil price has risen not only nominally but in real terms as well
- When looking at the US crude benchmark West Texas Intermediate (WTI) Cushing, adjusted for US consumer price index (CPI), it is clear that in real terms the oil price is also at an all-time high
- This time period from 1970 onwards depicted in the graph also includes the two oil price shocks in the 1970s and the Gulf War

Inflation Adjusted WTI

US CPI Re-based to 100 in Jan 1970 **$/bbl**



Source: Bloomberg, NYMEX, Morgan Stanley Commodities

Common Sources of Market Failure

- **Market failures can impact spot prices**
- **The major concern is "strategic withholding" but speculators rarely exert meaningful control over spot market supply or demand**

Economists catalogue causes of market failure. Some are:

Monopoly: when some market participants have more bargaining power than others; such as when a large supplier can withhold some output to get a higher price on its remaining sales.

Externality: where the seller or buyer does not bear the full cost of performance; such as when a product causes unregulated air pollution.

Transaction cost: where the cost of actually buying or selling, whether from transaction fee or indirect cost such as regulatory compliance costs or tax, exceeds the benefit of a trade.

Imperfect information/information asymmetry: when some market participants possess more information than others.

Political and Regulatory Risk: uncertainty in ability (or outright inability) to enter into or enforce commercial agreements

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