RISK PREMIA & SPECULATION

Risk Premia

- A forward price is often described as the market's expectation of the future spot price
- NO!
- An expectation is a mathematical concept, not a traded price
- A forward price is a traded price
- A forward transaction involves the transfer of risk, so the forward price also incorporates a price of risk—the risk premium
- Risk premium=profit from speculation/cost of hedging

Theories of the Risk Premium

- "Keynesian Normal Backwardation"—nomenclature alert: this use of the term "backwardation" is different than the common market usage
- Keynes posited that hedging pressure determines the risk premium
- Hedgers want to go short: forward price must be below the expected spot price to attract specs to take the opposite side ("downward bias/upward trend")
- If hedgers want (on net) to go long, get upward bias
- In the Keynes theory, idiosyncratic commodity price risks determine risk premia

The "Normal" Situation

- Producers & inventory holders have large flat price exposure, and want to hedge
- Refiners are largely self-hedged: able to pass on most input price changes to purchasers of refined products
- Many consumers of refined products (e.g., motorists) too small to hedge
- Together, these factors create net short hedging

Risk Premia in the Normal Case

- Short hedging pressure puts downward pressure on futures prices: futures price below the expected spot price
- This risk discount (a) discourages some short hedging, encourages more long hedging, attracts long speculators
- Risk discount falls to the level required to compensate the marginal speculator for the risk he bears

Commitment of Traders Reports

- CFTC produces Commitment of Traders reports weekly
- These give an indication of net hedging pressure
- This is a weak indication of future price direction, but must be interpreted carefully
- Are speculators pushing into a market, or being pulled into it

COT Cotton

COTTON NO. 2 - ICE FUTURES U.S. Code-033661

Disaggregated Commitments of Traders - Futures Only, March 07, 2017

	Open Interest	Reportable Positions: Producer/Merchant/ Processor/User Long	Producer/Merchant/ Processor/User Short	Swap Dealers Long	Swap Dealers Short	Swap Dealers Spreading	Managed Money Long	Managed Money Short	Managed Money Spreading	Other Reportables Long	Other Reportables Short	Other Reportables Spreading	Nonreportable Positions Long	Nonreportable Positions Short
	(CONTRACTS OF 50,000 POUNDS)													
	Positions													
All	273,357	15,331	209,855	64,711	5,240	4,969	113,694	8,400	12,985	29,613	8,240	13,676	18,378	9,992
Old	212,445	10,623	166,593	37,475	2,050	3,428	99,477	11,519	7,577	29,061	5,813	8,733	16,071	6,732
Other	60,912	4,708	43,262	28,291	4,245	486	19,399	2,063	226	5,276	7,151	219	2,307	3,260

COT CL

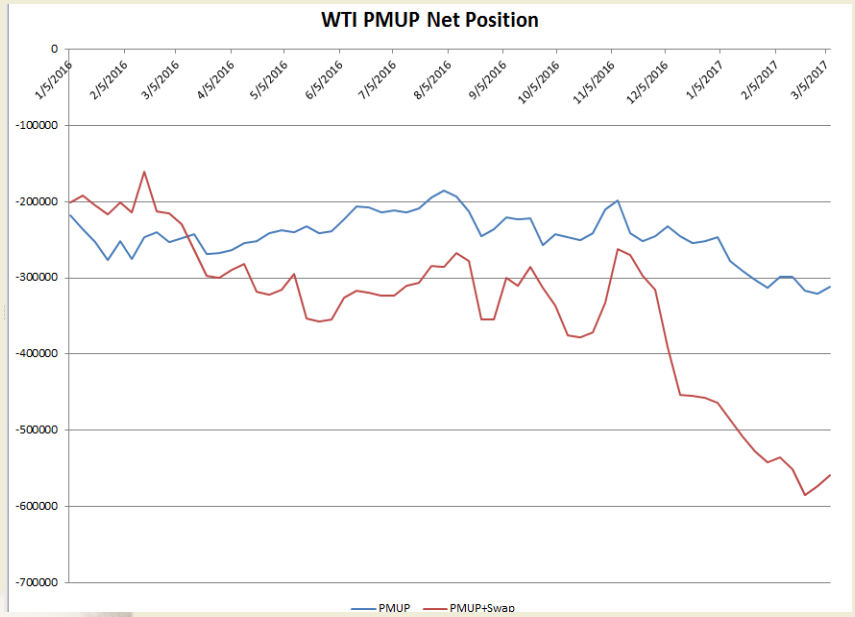
CRUDE OIL, LIGHT SWEET - NEW YORK MERCANTILE EXCHANGE — Code-067651

Disaggregated Commitments of Traders - Options and Futures Combined, March 07, 2017

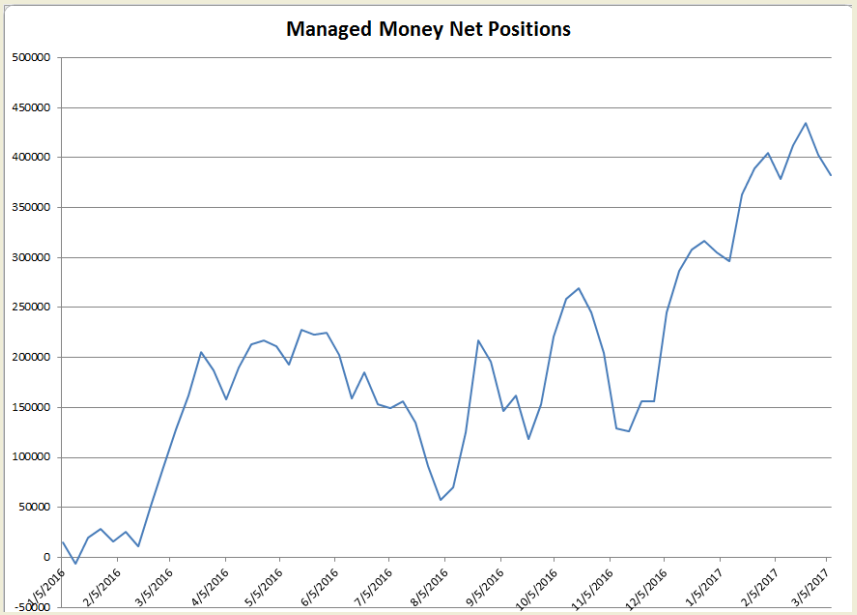
	Open Interest	Reportable Positions: Producer/Merchant/ Processor/User Long	Producer/Merchant/ Processor/User Short	Swap Dealers Long	Swap Dealers Short	Swap Dealers Spreading	Managed Money Long	Managed Money Short	Managed Money Spreading	Other Reportables Long	Other Reportables Short	Other Reportables Spreading	Nonreportable Positions Long	Nonreportable Positions Short
	(CONTRACTS OF 1,000 BARRELS)													
	Positions													
All	2,803,226	416,686	710,781	136,750	427,836	419,433	424,549	48,991	449,299	266,882	86,523	568,772	120,856	91,59
Old	2,803,226	416,686	710,781	136,750	427,836	419,433	424,549	48,991	449,299	266,882	86,523	568,772	120,856	91,59
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	

Interpreting COT

PMPU Net



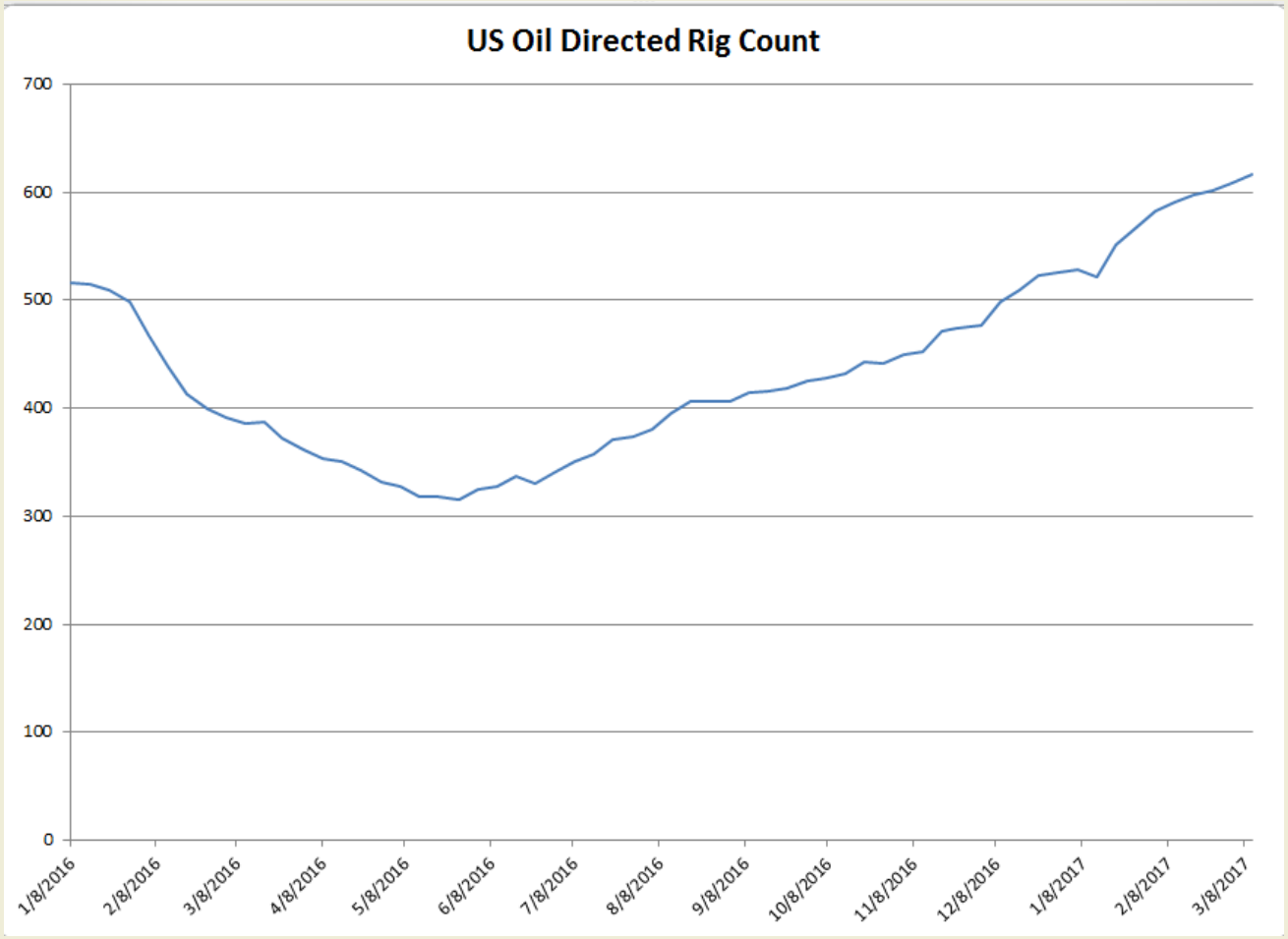
Managed Money Net



Bullish, Bearish, Neither?

- See a big increase in short PMPU and long MM positions starting in mid-2016
- Why did specs and hedgers increase positions?
- This is when it was widely anticipated OPEC would cut output. US shale drillers immediately ramped up, and increased their hedging activity
- Speculators accommodated increased hedging demand

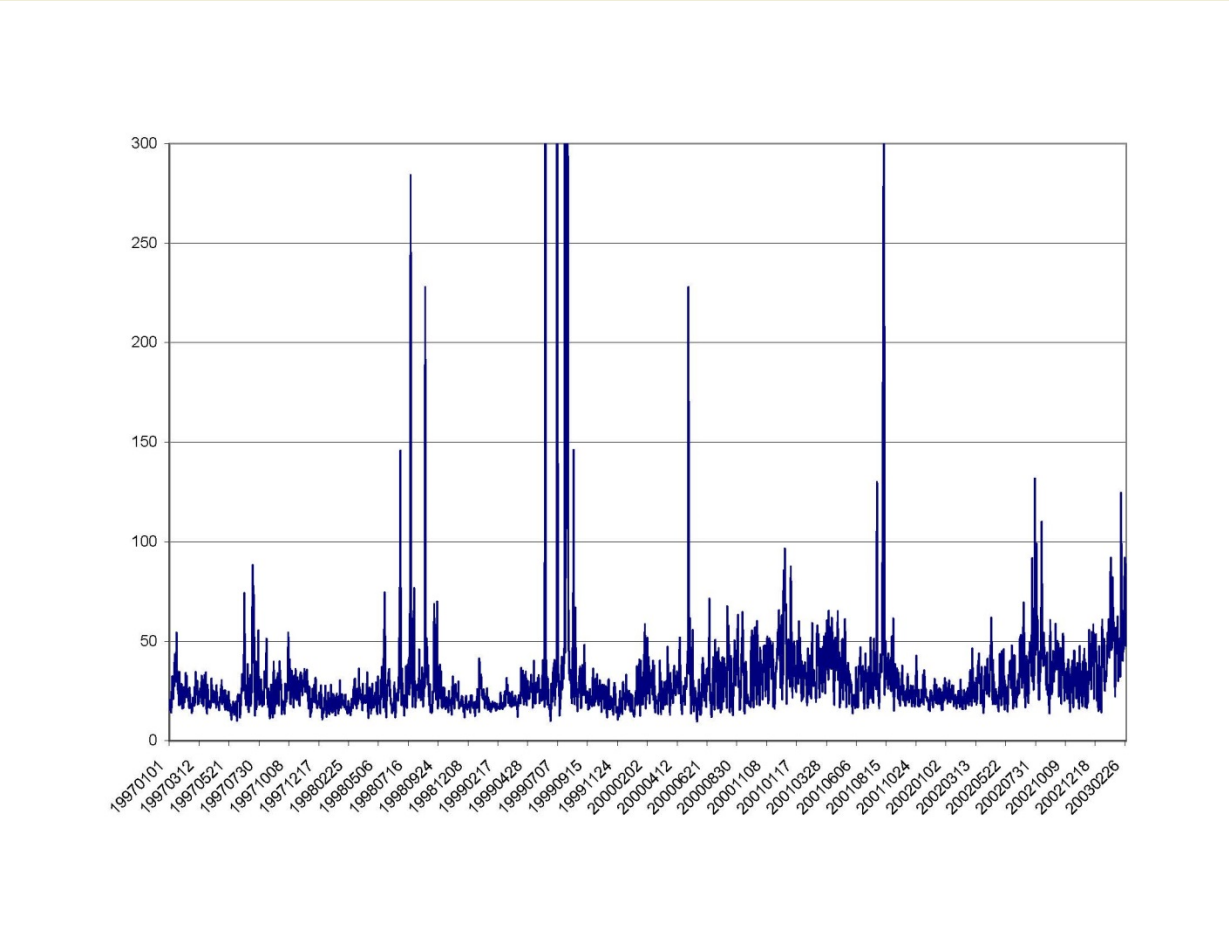
Oil Directed Rig Count



Long Hedging Pressure

- Electricity provides an example of the opposite case
- Those long generation have relatively little incentive to hedge because price downside limited, and they give up opportunity to sell into spikes
- Those short power (e.g., those serving load at regulated rates) can be severely hurt by price spikes, so have a strong incentive to buy forward to hedge
- This imbalance creates a large risk premium

Electricity Behavior



Evolution of Electricity Markets

- In early days of electricity trading, no speculators
- Huge risk premia: on the order of 50 percent of the forward price, i.e., $F=2E(P)$
- This encouraged speculators to enter, and market operators made adjustments to encourage speculation
- Risk premia dropped substantially

Implications

- Speculation affects the risk premium (the price of RISK), not the overall level of prices (except to the extent that speculators are informed and their trades cause prices to reflect that information)
- Some hedgers don't like speculators: specifically, hedgers on the same side of the market as speculators don't like the competition

Speculation and Price Levels

- Commonly asserted that speculation distorts price *levels*
- EG, oil prices in 2006-2008, Grains 2006-2007
- Hard to disprove: if we knew what prices *should* be, wouldn't need markets ("knowledge problem")
- Evidence on quantities is important

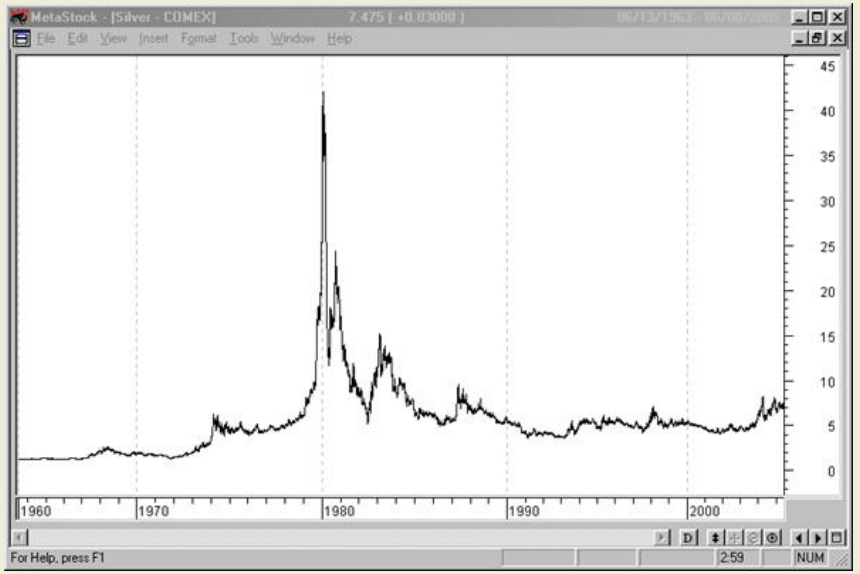
Evidence on Quantities and Speculation

- Prices send signals about how to allocate resources: distort prices, quantities should be distorted
- Driving prices up should lead to higher inventories in hands of speculators
- EG, Hunts, government price supports
- No evidence of quantity distortions during commodity price boom
- Inventories of oil fell when prices rose, and fell when prices plummeted in '08-'09
- Similar experience in metals markets

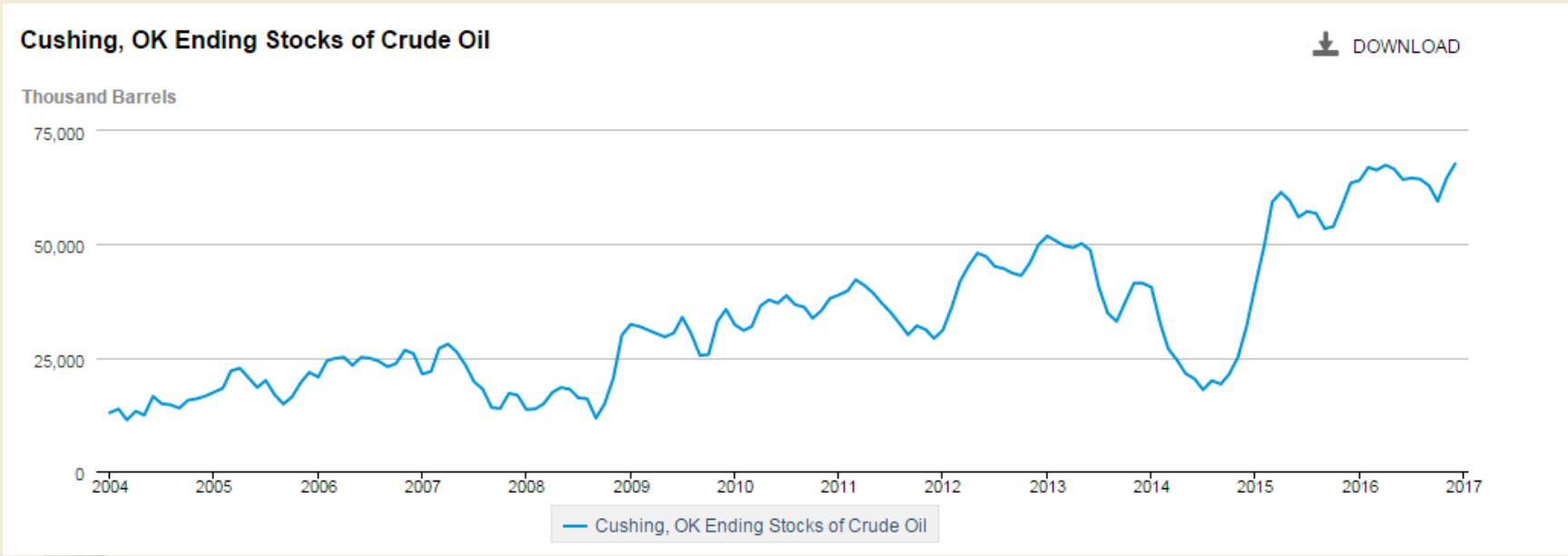
The Hunts: An Exception That Proves the Rule

The Brothers

Their Impact



Oil Inventories During Booms & Busts



ETFs

- Exchange Traded Funds are one commonly cited speculative culprit
- ETFs trade like stocks, hold positions in futures
- Don't add buying pressure to physical market: never hold physical positions; roll when positions near prompt
- Hold T-bills and cash, not physical commodities

USO ETF Holdings

Holdings as of 03/10/2017, subject to change

Security	Quantity	Price	Market Value
Commodity Interests			
NYMEX WTI Crude Oil CL APR17	13,500	48.49	$654,615,000.00
NYMEX WTI Crude Oil CL MAY17	40,054	49.03	$1,963,847,620.00
US Treasuries			
US T BILL ZCP 03/16/17	75,000,000	99.99	$74,994,765.62
US T BILL ZCP 03/23/17	75,000,000	99.99	$74,988,875.01
US T BILL ZCP 03/30/17	75,000,000	99.98	$74,982,979.16
US T BILL ZCP 04/06/17	75,000,000	99.97	$74,975,354.14
US T BILL ZCP 04/13/17	75,000,000	99.96	$74,967,687.51
US T BILL ZCP 04/20/17	75,000,000	99.95	$74,962,083.30
US T BILL ZCP 04/27/17	100,000,000	99.94	$99,939,291.76
US T BILL ZCP 05/04/17	75,000,000	99.92	$74,941,499.95
US T BILL ZCP 05/11/17	75,000,000	99.91	$74,930,739.53
US T BILL ZCP 05/18/17	75,000,000	99.89	$74,915,708.21
US T BILL ZCP 05/25/17	100,000,000	99.87	$99,873,437.70
US T BILL ZCP 06/01/17	75,000,000	99.86	$74,898,354.02
US T BILL ZCP 06/08/17	75,000,000	99.85	$74,885,968.63
US T BILL ZCP 06/15/17	75,000,000	99.83	$74,871,000.13
US T BILL ZCP 06/22/17	75,000,000	99.82	$74,862,666.48
US T BILL ZCP 06/29/17	75,000,000	99.82	$74,862,500.15
US T BILL ZCP 07/06/17	75,000,000	99.80	$74,850,093.59
US T BILL ZCP 07/13/17	75,000,000	99.80	$74,848,875.00
US T BILL ZCP 07/20/17	75,000,000	99.78	$74,834,885.48
US T BILL ZCP 07/27/17	75,000,000	99.77	$74,828,937.24
US T BILL ZCP 08/03/17	75,000,000	99.75	$74,811,198.05
US T BILL ZCP 08/10/17	75,000,000	99.74	$74,806,833.27
US T BILL ZCP 08/17/17	75,000,000	99.71	$74,784,687.57
US T BILL ZCP 08/24/17	75,000,000	99.69	$74,768,291.82
US T BILL ZCP 08/31/17	75,000,000	99.64	$74,727,885.73
US T BILL ZCP 09/07/17	75,000,000	99.58	$74,684,999.76
Cash			
MORGAN STANLEY LIQ GOVT-INST	150,000,000	1.00	$150,000,000.00
FIDELITY GOVERNMENT PORT-INS	300,000,000	1.00	$300,000,000.00
GOLDMAN SACHS FIN SQ GOVT-FS	100,000,000	1.00	$100,000,000.99
Interest Receivable	86,423	1.00	$86,423.95
US DOLLARS	163,627,417	1.00	$163,627,417.69

USO Roll Dates

Roll Dates

Roll Dates are projected and subject to change without notice. Roll Dates are the expected dates on which the composition of the Benchmark Futures Contract is changed or "rolled" by selling the near month contract and buying the next month contract. The change occurs over four days.

CLICK HERE to download a CSV file with the most recent USCF Commodity Fund Roll/Rebalance Dates.

Fund	Roll Begin	Roll End
USO	6-Jan-2017	11-Jan-2017
USO	7-Feb-2017	10-Feb-2017
USO	7-Mar-2017	10-Mar-2017
USO	6-Apr-2017	11-Apr-2017
USO	8-May-2017	11-May-2017

Commodity Index Funds/Swaps

- Commodity Index Investors another culprit
- Trade cash settled instruments: do not and cannot hold physical supply
- Roll prior to expiration ("the Goldman Roll")
- Roll can cause temporary movements in spreads: this is driven by demand for liquidity

S&P GSCI Weights

Table 1: S&P GSCI Reference Percentage Dollar Weights *		
Commodity	2016 RPDW **	2017 RPDW
Chicago Wheat	3.531%	3.902%
Kansas Wheat	0.879%	1.087%
Corn	4.231%	5.491%
Soybeans	2.950%	3.785%
Coffee	0.938%	1.029%
Sugar	1.593%	2.467%
Cocoa	0.452%	0.585%
Cotton	1.186%	1.538%
Live Cattle	4.786%	5.084%
Feeder Cattle	1.550%	1.490%
Lean Hogs	2.300%	2.656%
WTI Crude Oil	23.04%	22.80%
Brent Crude Oil	20.43%	16.49%
Gas Oil	5.822%	4.908%
Heating Oil	5.207%	4.056%
RBOB Gasoline	5.307%	4.666%
Natural Gas	3.241%	3.317%
Aluminum	2.877%	3.251%
LME Copper	3.850%	4.061%
Lead	0.600%	0.741%
Nickel	0.697%	0.659%
Zinc	0.882%	0.999%
Gold	3.245%	4.388%
Silver	0.405%	0.545%

Do "Roll Returns" Affect Performance

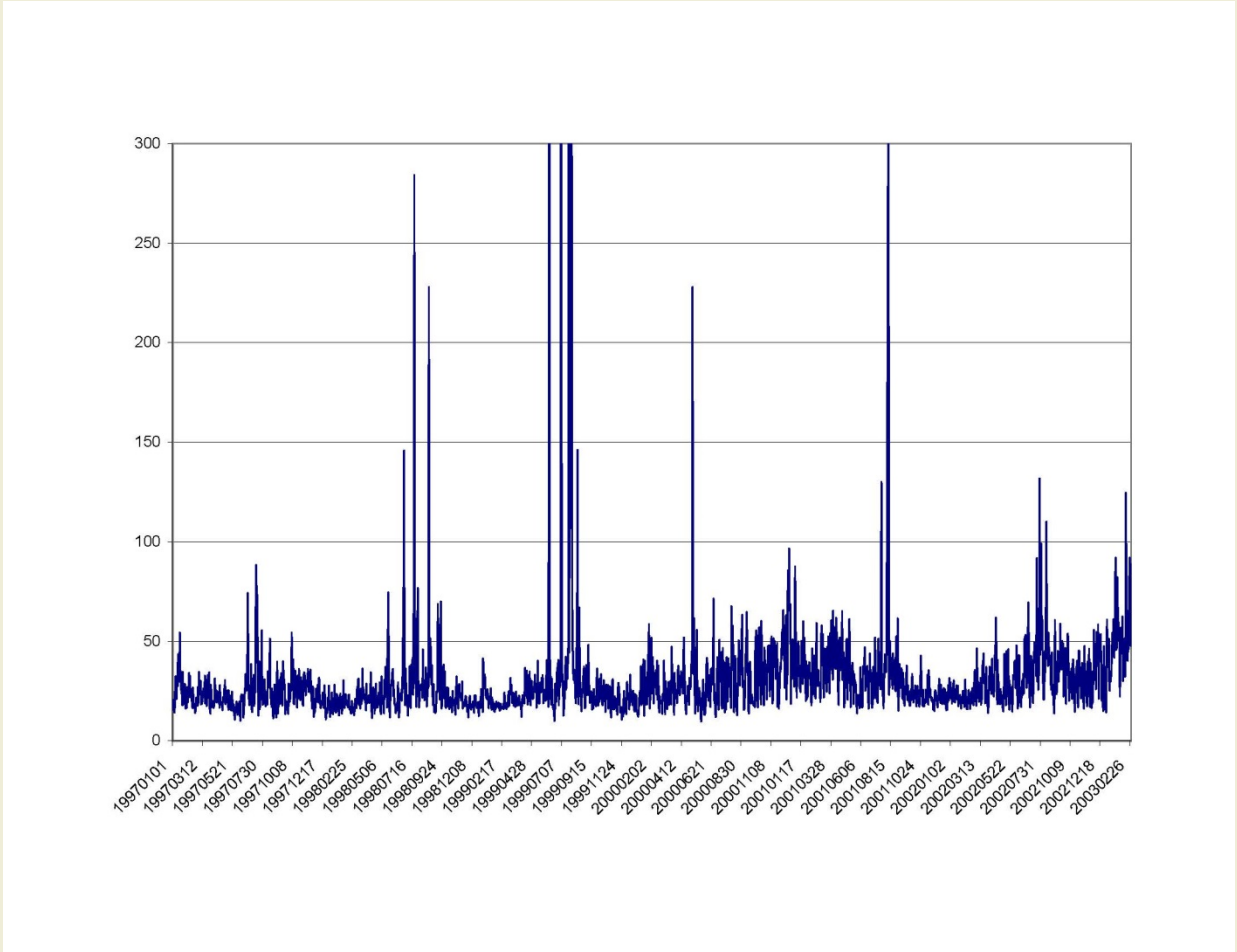
- Commonly asserted that indexes & ETFs do poorly in contango markets: sell low-priced nearby, buy high-priced deferred at the roll
- Apples-to-oranges comparison: True P/L based on the change in price of each individual contract
- ETF/Index trader earns the risk premium, which is completely different than calendar spread
- Confusion between market backwardation & Keynesian backwardation

NON-STORABLES

Power Forward Curves

- Power prices exhibit behavior that is not well captured by standard reduced form models
- Structural approaches have some advantages: exploit the transparency of fundamentals
- Structural approaches (relatively) straightforward in fossil fuel dominated markets, more difficult in hydro dominated ones

Spot Power Prices



Structural Modeling Tools—Non-Storables

- In some respects, non-storables are much easier to deal with; dynamic programming considerations absent
- E.g., Pirrong-Jermakyan (2008)
- For some non-storables, structural models can actually be used for contingent claims valuation
- Market price of risk (market incompleteness)

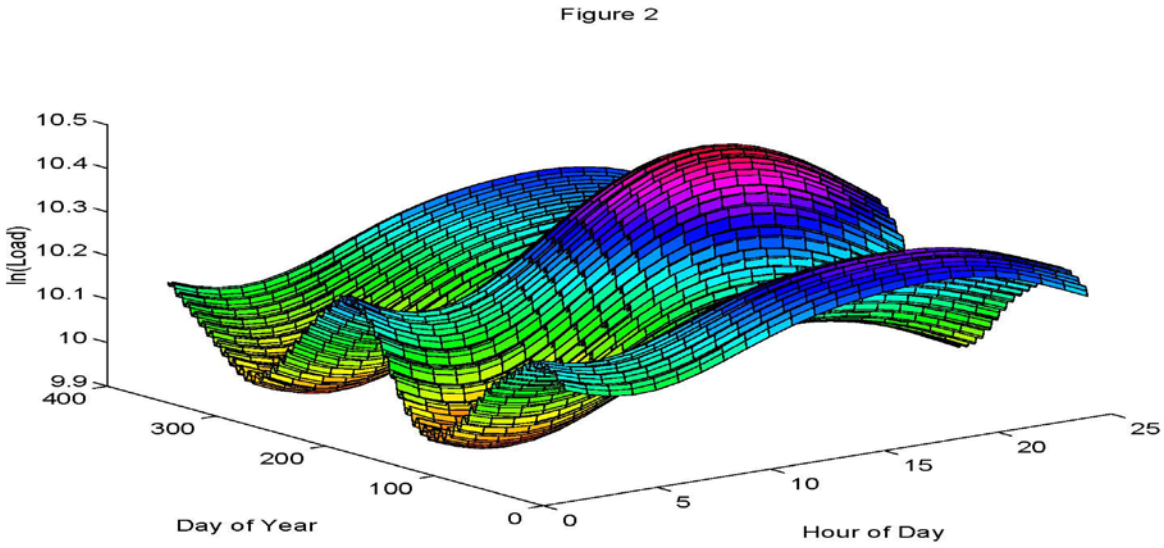
Some Challenges

- For markets with strong hydro presence, there are intertemporal linkages that require dynamic programming tools
- Even primarily fossil fuel driven markets are high dimensional
- Oh, if only the whole world were like Texas
- Still, the one eyed man is king in the land of the blind—even a crude structural model is likely to be better than feasible reduced form ones

Basic Approach: Spot Price Modeling

- Identify major drivers of power prices
  - Load (weather)
  - Fuel prices
  - Outages
- Estimate relationship between power spot prices (e.g., hourly prices) and the major drivers
- Estimate the dynamics of the drivers
- Given driver dynamics and driver-price relationship, can determine price dynamics

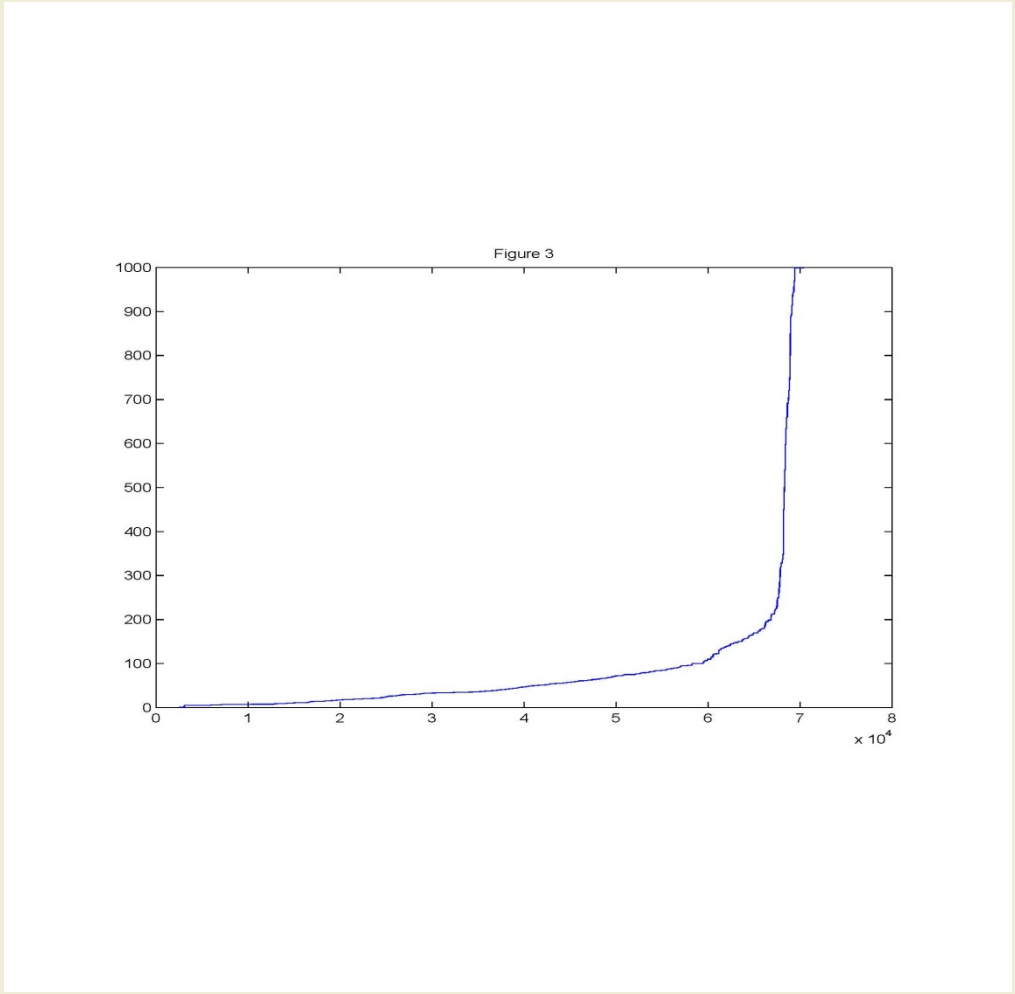
Seasonal Load Patterns



Relation Between Spot Prices and Fundamentals

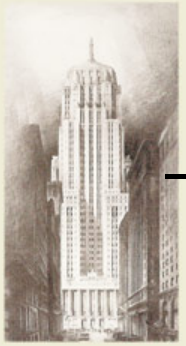
- Power markets relatively transparent: good data on main drivers and prices (at least in markets with RT markets)
- Econometric approach: use data on prices, loads, fuel prices, and outages (if available) to fit a (nonlinear, perhaps non-parametric) relationship
- Bid stack approach: some markets report (on a delayed basis) the actual generator bids that gives the relationship between loads and prices

Load-Price Relation



Driver Dynamics

- Load (or temp):
  - Estimate mean loads as a function of time of day, day of year
  - Use econometric methods to estimate the dynamics of deviations between observed and mean loads (mean reversion)
- Fuel:
  - Challenge in multi-fuel markets: use fuel that is usually at the margin
  - Standard models (e.g., GBM)



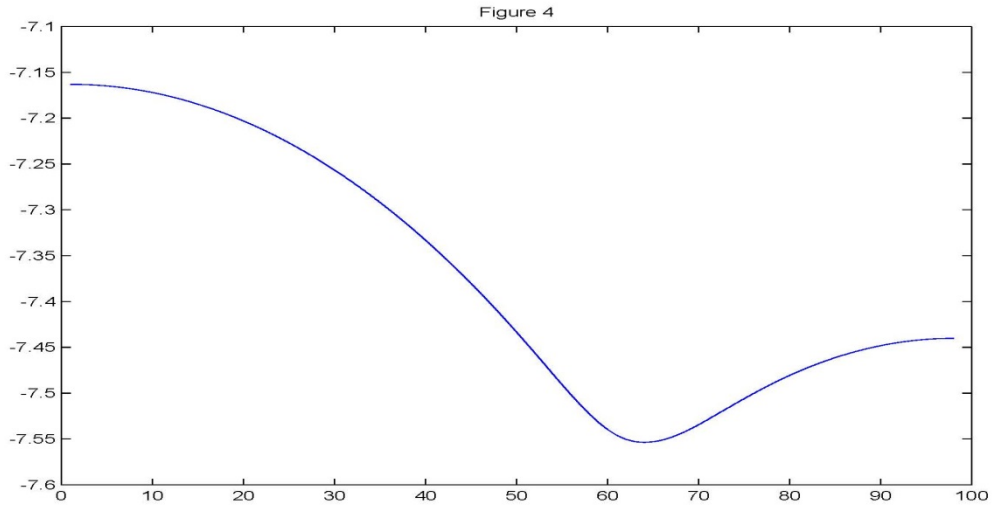
Forward Curves

- Given the price-drivers relationship and a specification of the dynamics of the drivers, possible to forecast spot power prices
- But remember, a forward price is NOT a price forecast/expectation
- Forward prices embed a risk adjustment
- Indeed, in power this adjustment is very large

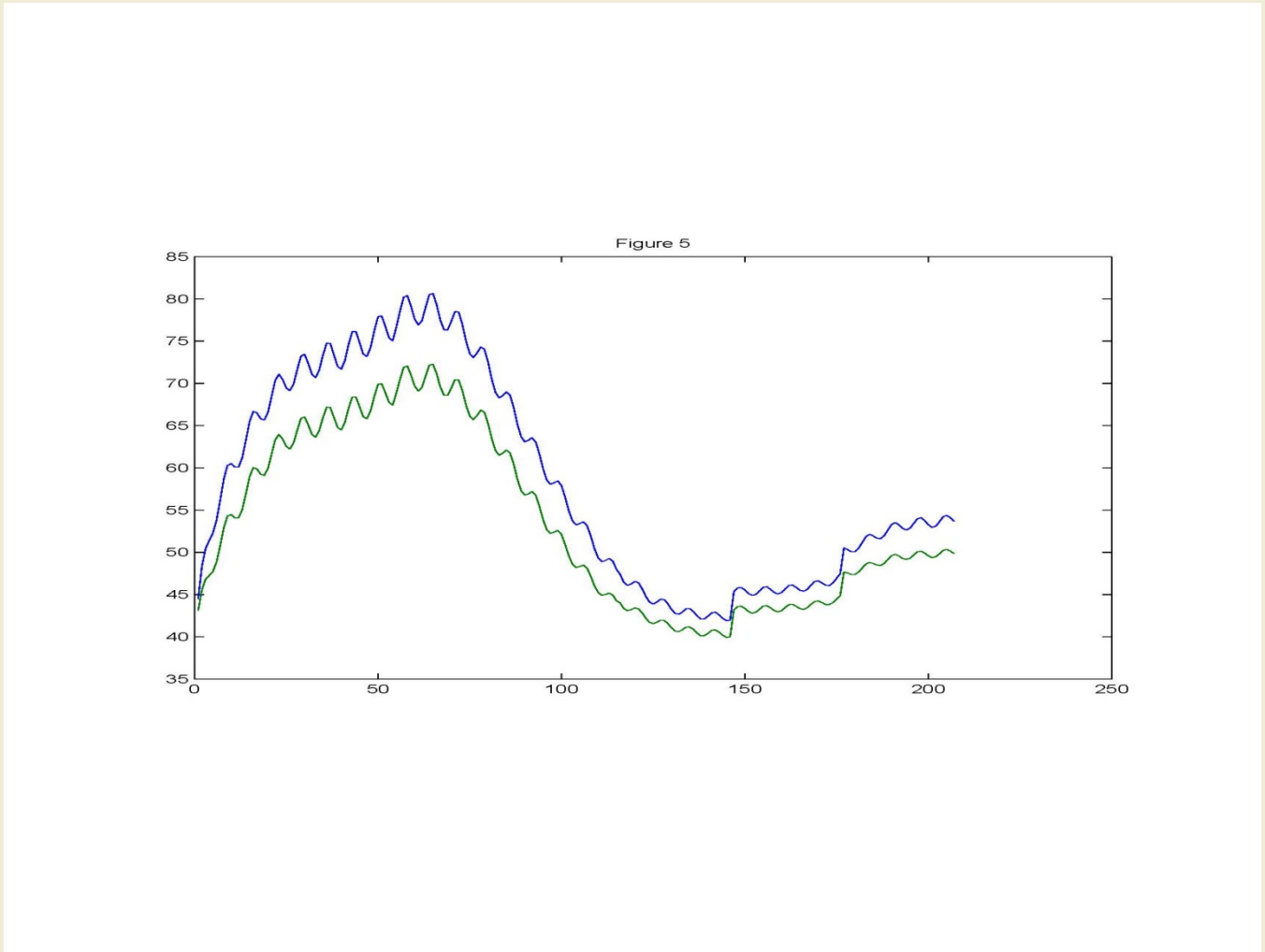
Market Price of Risk

- Power markets "incomplete": power price is not an asset, and important drivers (notably load) are not traded either
- Can use relatively advanced quantitative methods to determine the risk premium—the "market price of risk"—associated with non-traded load
- This MPR is very large
- Big deviation between forward prices and expected spot prices

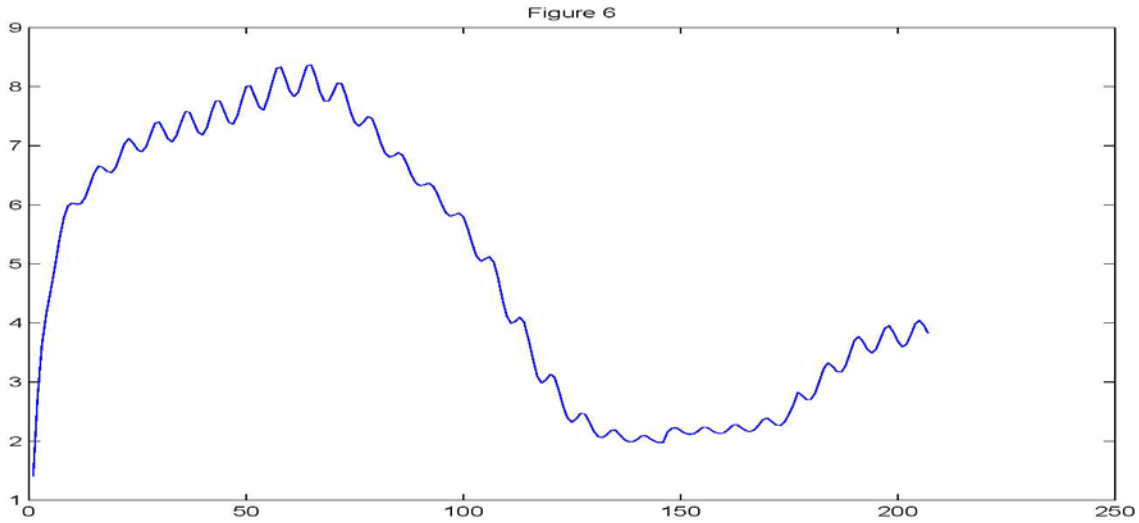
Market Price of Risk Function



Forward & Expected Spot Prices



Risk Premium



Sources of the Risk Premium

- In some respects, large risk premium surprising given that the relevant risk is idiosyncratic (e.g., temperature shocks not correlated with asset prices
- Probably reflects incomplete integration of power markets and broader financial markets
- As markets have become more integrated, premia have declined
- Keynes-type story: "spike-o-phopia"
- Power prices can spike, imposing big losses on shorts: they demand a big premium to sell forward

Hydro Markets

- In the PNW of the US, and in northern Europe, hydro is a major source of generation
- Although power can't be stored, water can be
- Optimal use of water over time is like a storage problem—need to use dynamic programming methods
- Presence of hydro affects price dynamics: more autocorrelation, slower mean reversion