Using Comparative Inventories to Predict Oil Prices

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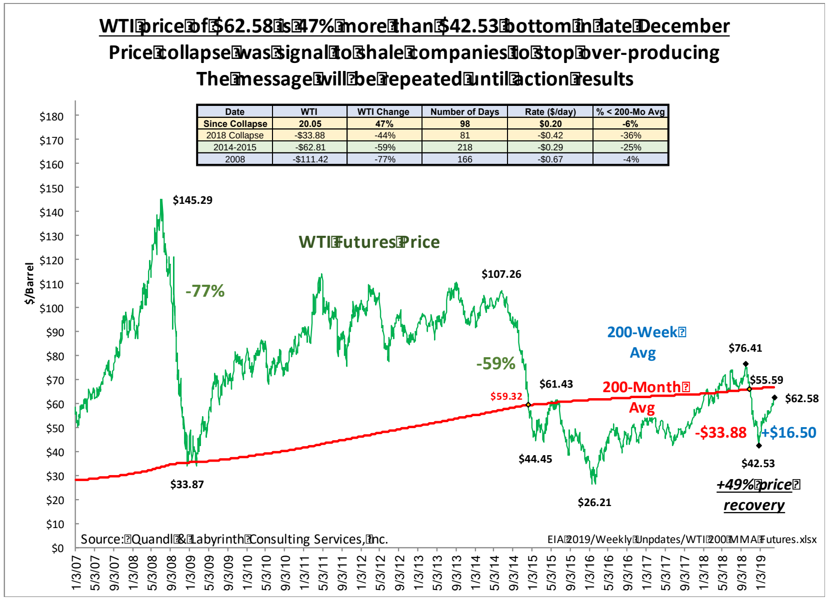
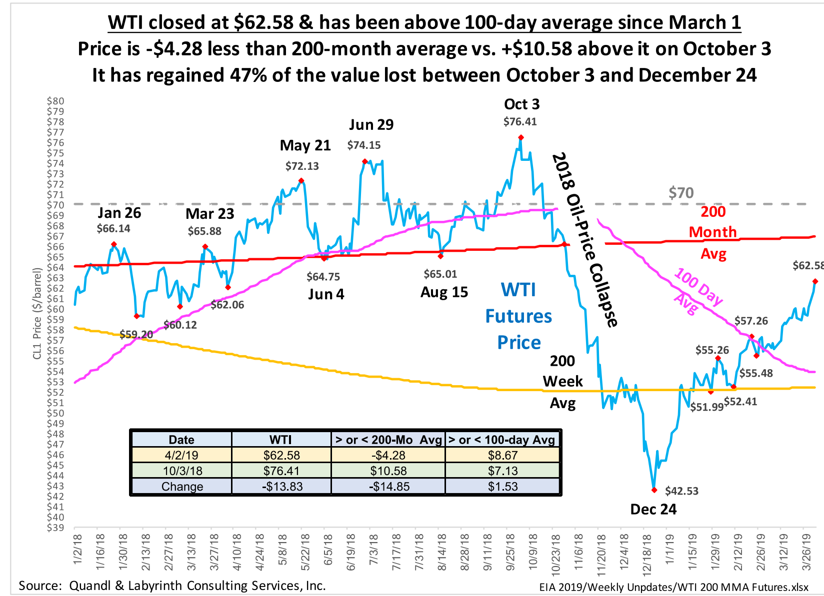
Oil Prices Collapsed in Early October but Have Recovered to Low-$60 Range



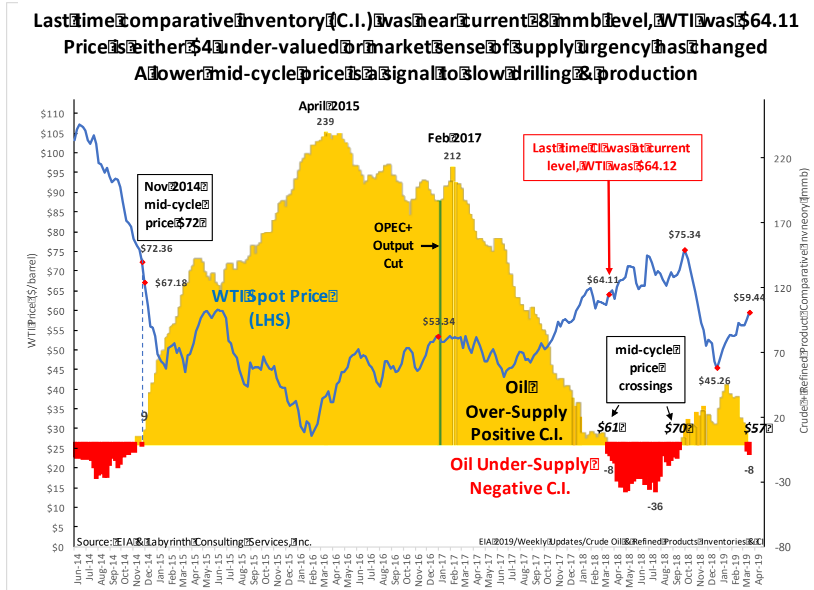
Date	WTI	WTI Change	Number of Days	Rate ($/day)	% < 200-Mo Avg
Since Collapse	**20.05**	**47%**	**98**	**$0.20**	**-6%**
2018 Collapse	-$33.88	-44%	81	-$0.42	-36%
2014-2015	-$62.81	-59%	218	-$0.29	-25%
2008	-$111.42	-77%	166	-$0.67	-4%



Date	WTI	> or < 200-Mo Avg	> or < 100-day Avg
4/2/19	$62.58	-$4.28	$8.67
10/3/18	$76.41	$10.58	$7.13
Change	-$13.83	-$14.85	$1.53

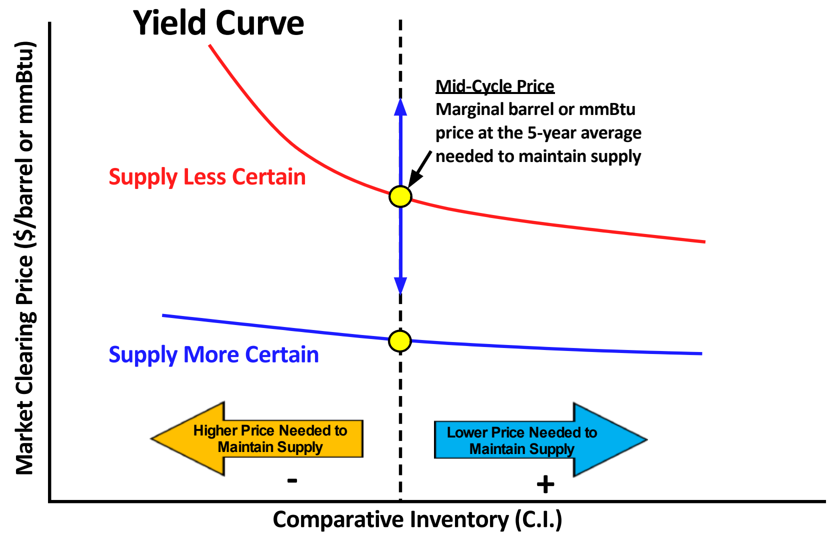
- WTI price fell -$33.88 (-44%) from $76.41 on October 3 to $42.53 on December 24, 2018.
- It has since increased +$20.05 to $62.58 and recovered 47% of the value lost.
- Price collapse was signal to shale companies to stop over-producing.
- The message will be repeated until action results.
- WTI has been above the 100-day average since March 1.
- Price is -$4.28 less than 200-month average vs. +$10.58 above on October 3.

Comparative Inventory and Oil Price



- Comparative inventory is the difference between current crude oil + refined product stocks & the 5-year average value of those stocks.
- Oil prices are relatively high when Comparative Inventory (C.I.) is negative (deficit) & prices are relatively low when C.I. is positive (surplus).
- Many observers and analysts believe that current oil prices are "too low."
- The last time C.I. was at current ~8 mmb level, WTI was $64.12/barrel vs $59.44/barrel today.
- That price was ~$3 over-valued and current price ~$4 under-valued.
- Today's WTI front-month price of $59.37 is correctly valued.
- Why isn't this generally understood?

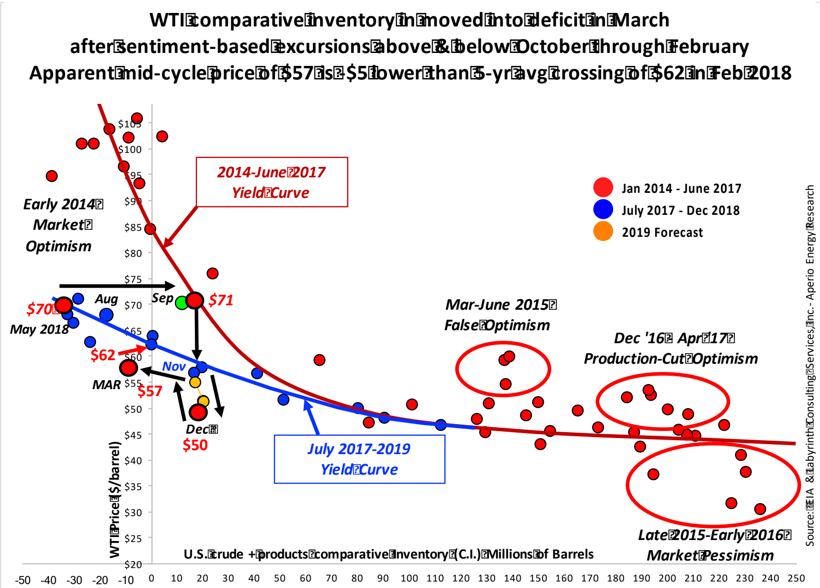
Comparative Inventory-Price Yield Curve

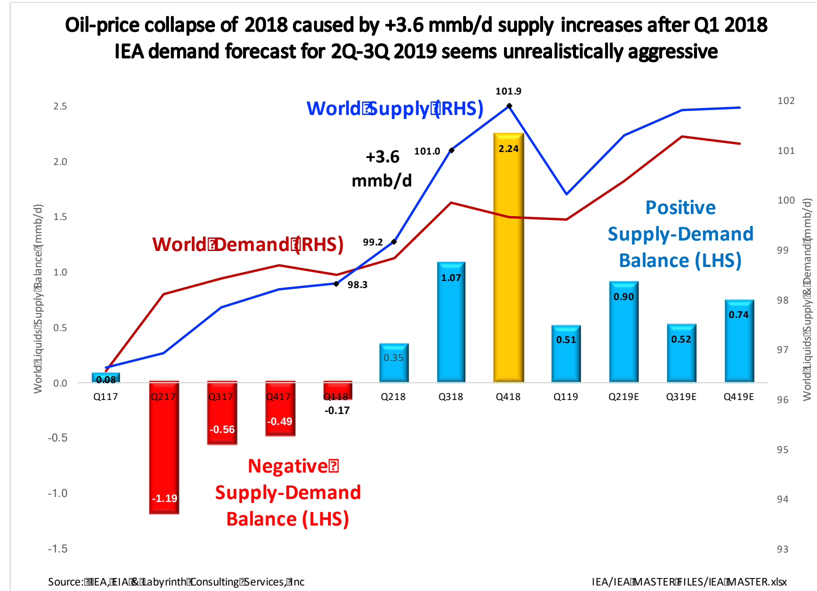


Source: Aperio Energy Research & Labyrinth Consulting Services, Inc.

- Inventory is part of supply. Demand is consumption, net imports & movements into & out of inventory.
- A cross-plot of C.I. vs price results in a yield curve.
- The comparative inventory yield curve uses C.I. instead of maturity & oil price instead of yield.
- The concept is identical.
- The yield curve crosses the y-axis at the 5-year average.
- That is the “mid-cycle” price, the market-clearing price of the marginal barrel needed to maintain supply.
- The market is short on oil price when C.I. is positive, or more than the 5-year average, & long when C.I. is negative or less than the 5-year average.
- The slope of the yield curve reflects the market’s sense of urgency about supply.

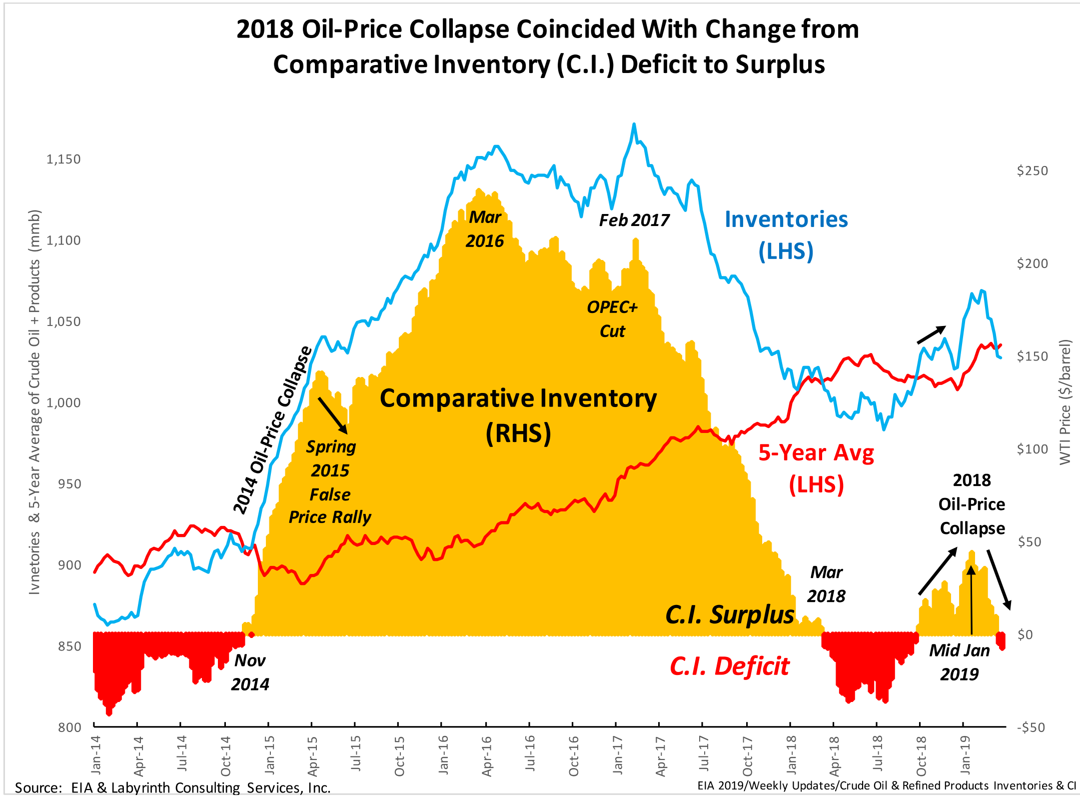
2018 Oil-Price Collapse Was More Than a Correction





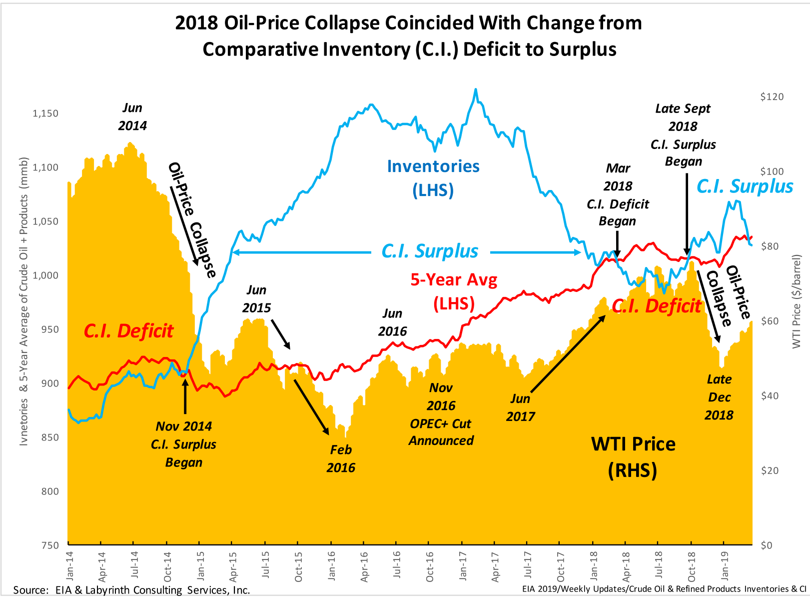
- The price collapse was in reaction to global over-supply and was not merely a correction.
- World supply increased +3.6 mmb/d in 2018 in response to higher oil prices.
- Some analysts mistakenly think that everything is back-to-normal now that prices have stabilized—comparative inventory yield curves suggest that they are wrong.
- OECD minus U.S. comparative inventory (C.I.) crossed the 5-yr avg at ~$57.
- Previous crossing in Mar-Apr 2018 was ~$72--suggests ~20% price devaluation.
- WTI comparative inventory data remains below July 2017-2019 yield curve after sentiment-based excursions above & below October – February.

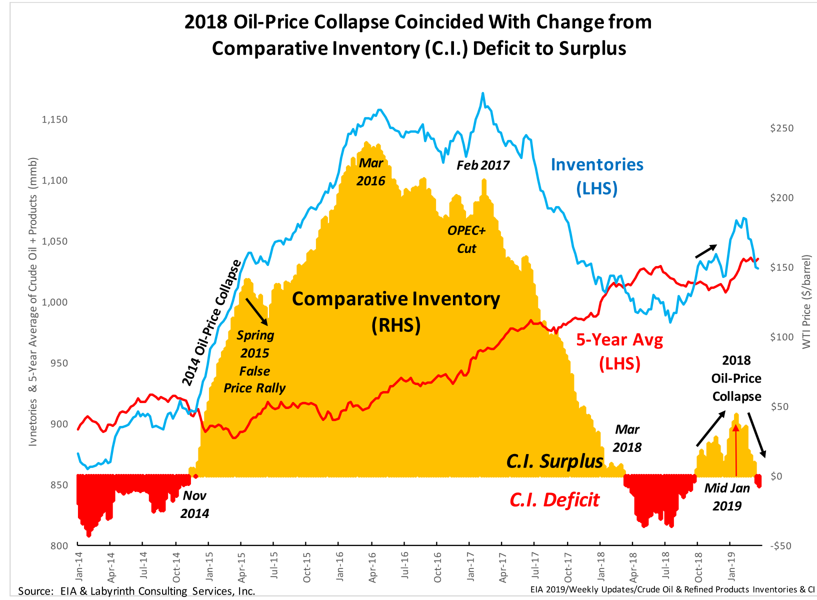
Mechanics of Comparative Inventory



- Comparative Inventory = Current Inventory Level minus 5-Year Average of Inventory Levels.
- Inventories consist of crude oil plus a basket of price-critical refined products.
- These include gasoline and diesel.
- When inventories exceed the 5-year average, C.I. is in surplus and vice versa.

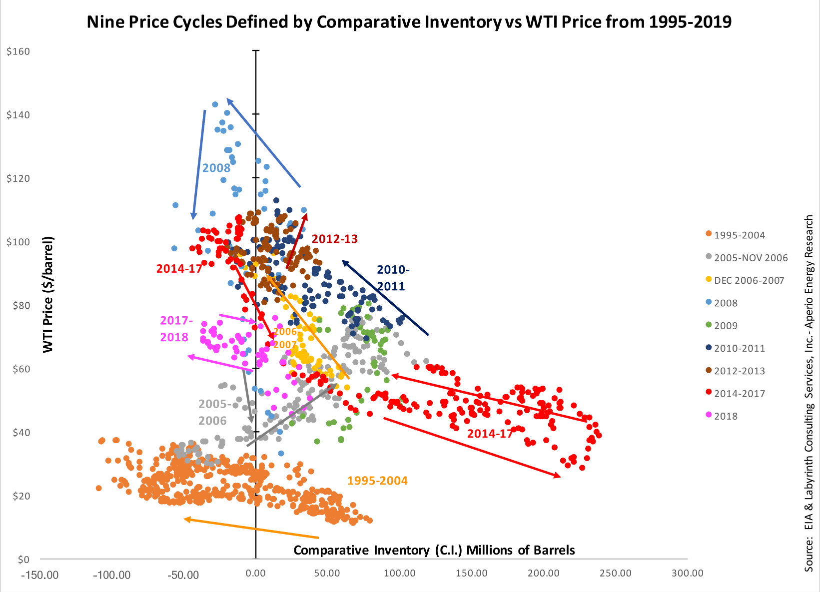
Comparative Inventory Explains WTI Price History since 2014

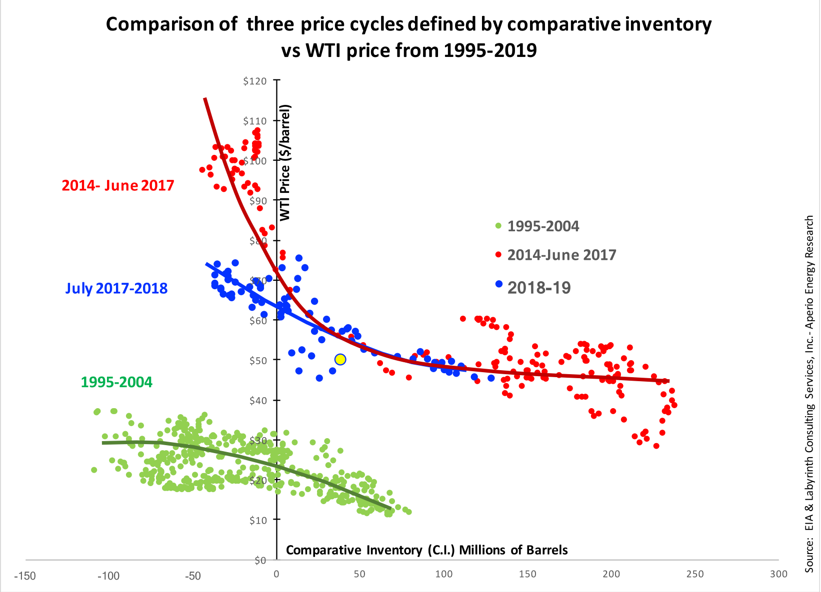




- The 2014-2015 oil-price collapse coincided with the end of C.I. deficit that had characterized 2011-2014.
- Inventories climbed relative to the 5-year average resulting in a massive C.I. surplus by early 2016.
- WTI prices fell below $30/barrel.
- The "false" oil-price rally to $60 in the spring of 2015 was because of a short-term drop in C.I.
- The surplus began to decline in the 2nd half of 2016 (reduced capital flows in 2015) & decline began in earnest after the OPEC+ production cut in early 2017.
- C.I. went into deficit in March 2018. Capital flows and oil prices increased to $75 by October.
- The 2018 oil-price collapse coincided with a change from C.I. deficit to surplus in late September.
- That surplus peaked in mid-January and C.I. moved into deficit 2 weeks ago.

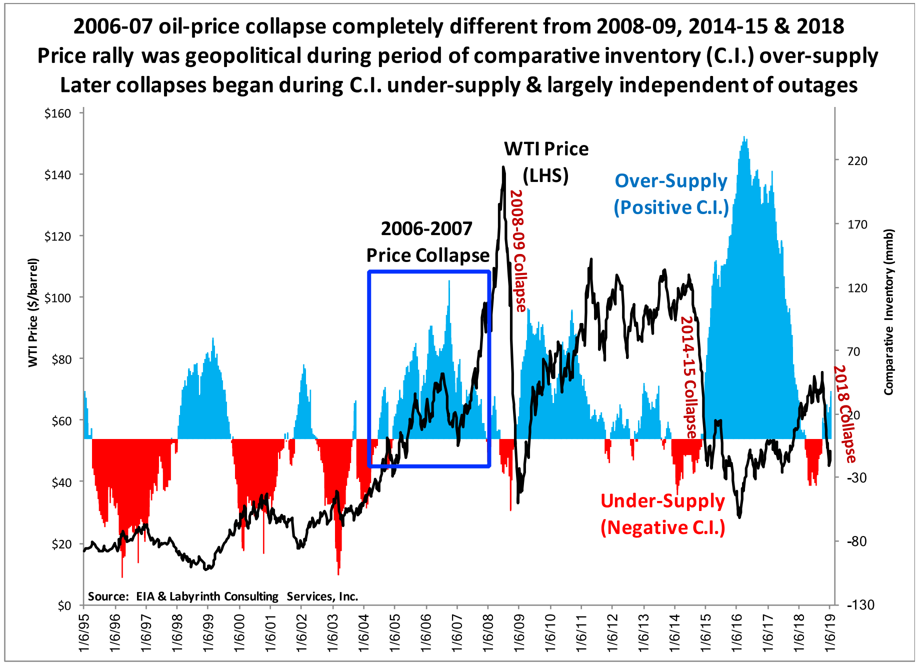
Comparative Inventory has Explained Price Cycles Since Data Was Available





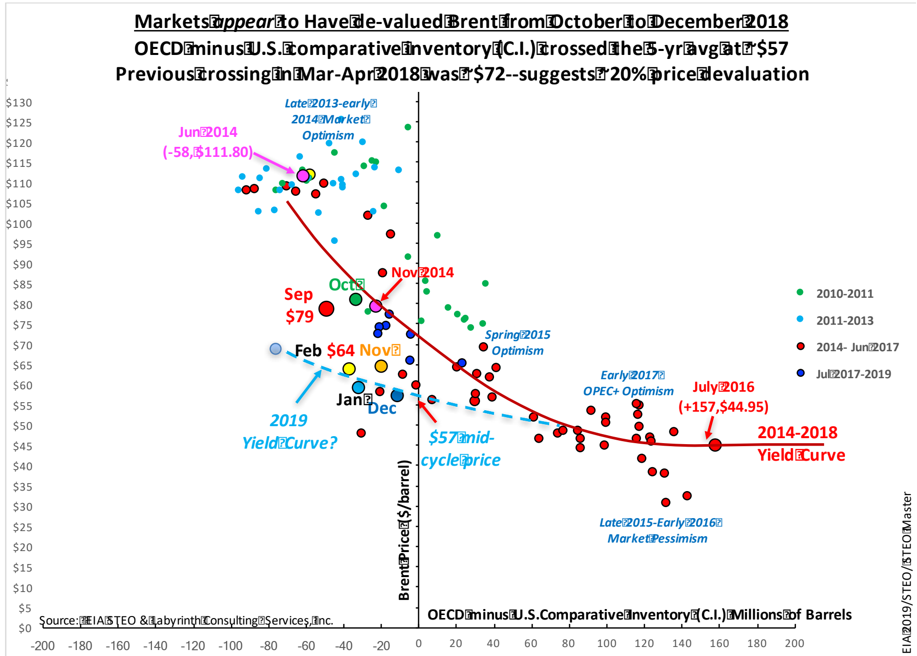
- Nine price cycles defined by comparative inventory vs WTI price from 1995-2019.
- U.S. inventory data first publicly available in 1990.
- This history shows that negative C.I. does not always result in high oil prices.
- This is best illustrated by the 1995-2004 cycle in which markets expressed little supply urgency despite strongly negative C.I. (beware of outages with just-in-time supply).
- A similar situation exists with natural gas markets today in the U.S.
- The important take-away is that the current perception of low-supply urgency suggests that price may never return to 2011-2014 levels unless that perception changes.
- Markets are ruthless & hate to over-pay.

More History Explained by Comparative Inventory



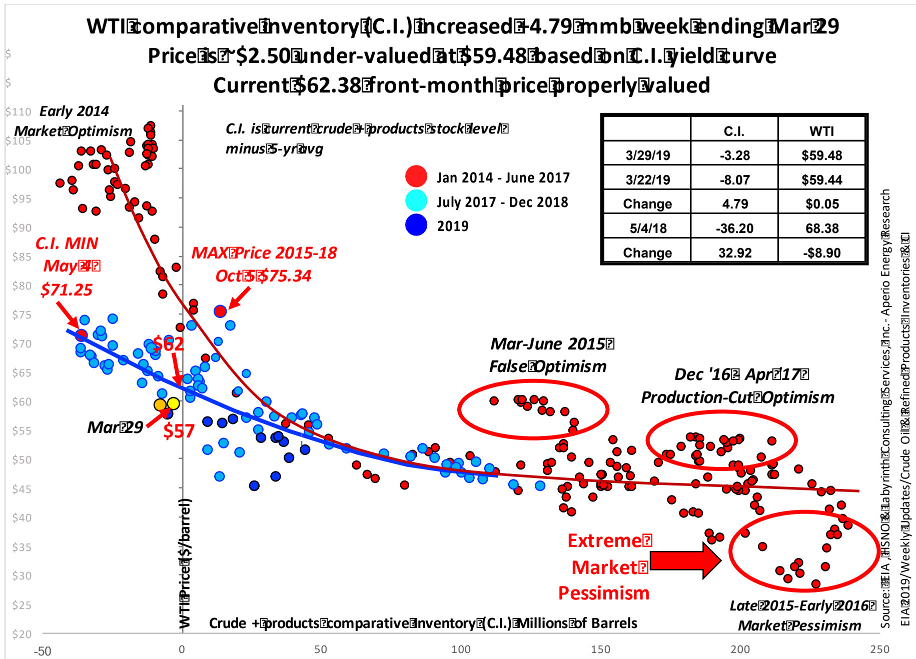
- Until about 2004, price fluctuations were low-amplitude compared to C.I. changes. Much smaller deficits after 2007 resulted in much higher prices.
- Markets became concerned about flat supply in the face of increasing demand from Asia.
- Geopolitical concerns arose about Middle Eastern oil supply with death of Saudi king, Iraq war & Iran's nuclear program. Also unrest in Nigeria, U.S. hurricanes Katrina & Rita, and refinery outages in the North Sea and U.S. contributed to supply concerns (we think there are geopolitical risks today!).
- Oil prices increased despite *growing* C.I. surplus.
- Demand destruction partly responsible for a price collapse in 2006-2007.

C.I. Just As Useful With Brent



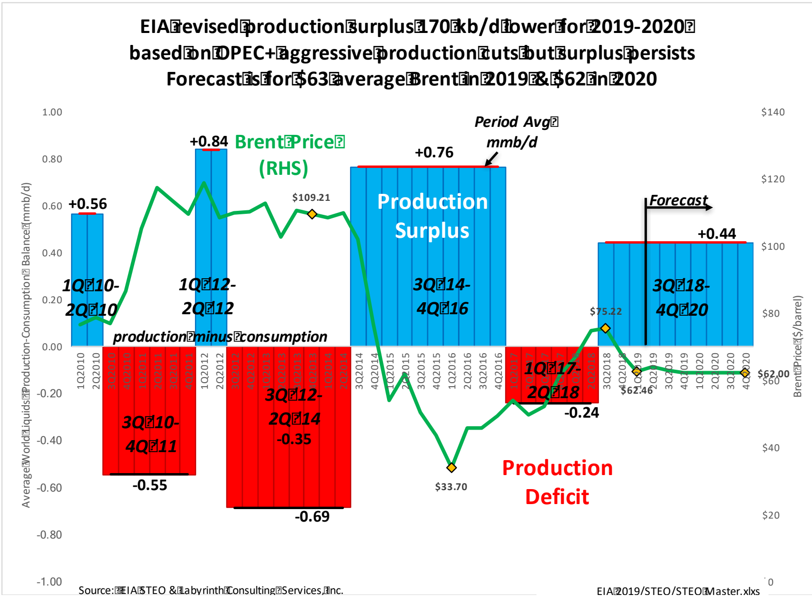
- OECD minus U.S. is the measure for C.I. vs Brent calibration.
- Different data frequency & reliability compared to WTI.
- Shape of Brent yield curve suggests similarly low supply urgency as WTI.
- Mid-cycle price is ~$60/barrel.
- September 2018 C.I. minimum almost identical to July 2014 C.I. minimum but there is a -$29 price difference. That is a measure of oil-price devaluation & effect of yield curve slope.
- February average Brent price of $64 was appropriately valued.
- Current price is $69.

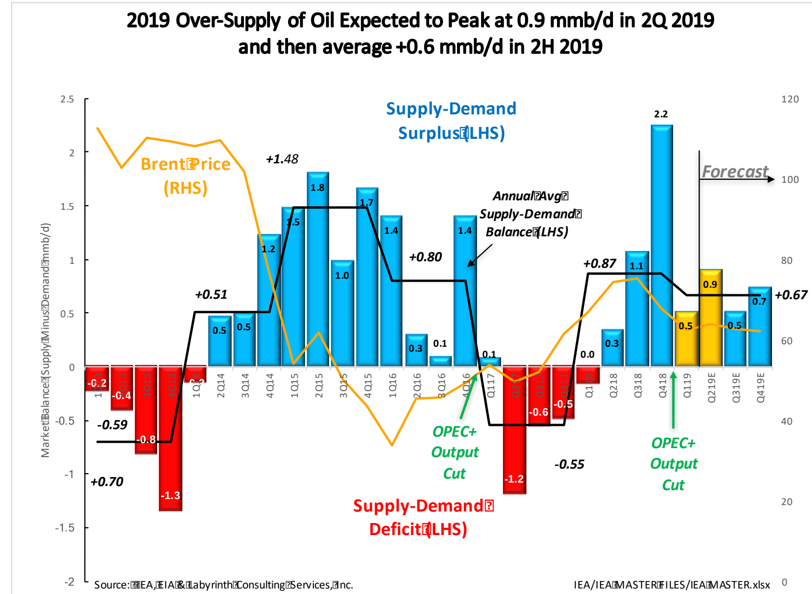
Betting Against the Market Using C.I.



- All 3 major excursions—Mar-Jun 2015, Late 2015-Early 2016 & Dec 2016-Apr 2017—were recognized as excursions as they were happening.
- The September – October 2018 & November – December 2018 were also recognized as excursions.
- Symmetry to latest excursions: December 28 price of $45.26 as undervalued as Oct 5 price of $75.34 was overvalued.
- The market is not wrong during excursions: uncertainty leads to price discovery.
- The key to betting against the market is having the calibration to know what is happening & to what level price is likely to return.

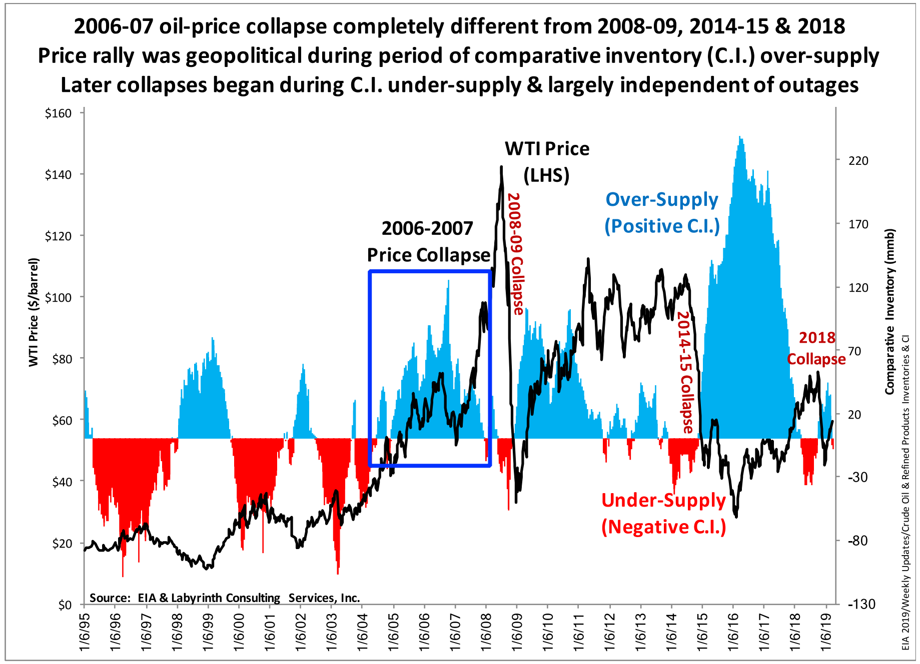
World Production Surplus for 2019-2020





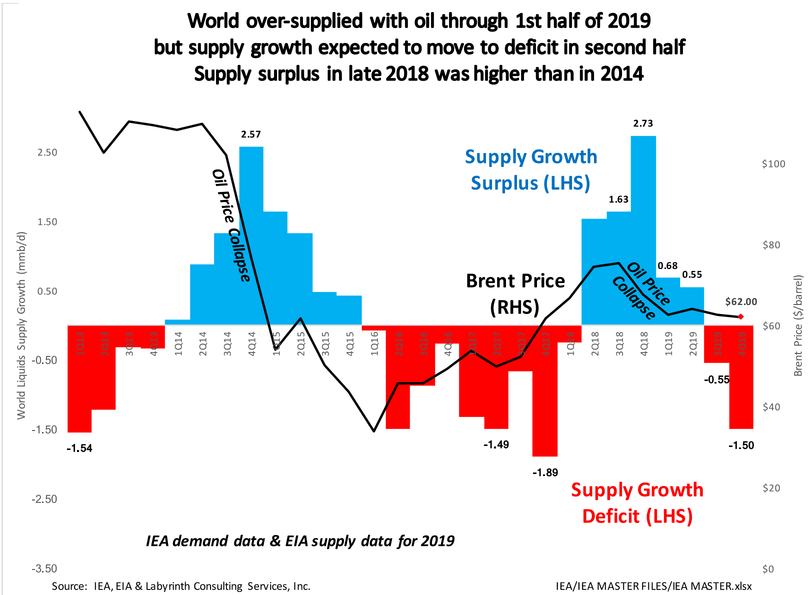
- EIA revised production surplus 170 kb/d lower for 2019-2020 based on OPEC+ aggressive production cuts but surplus persists
- Previous estimate was +610 kb/d, now at +440 kb/d.
- Forecast is for $63 average Brent in 2019 & $62 in 2020.
- 2019 world Over-Supply of Oil Expected to Peak at 0.9 mmb/d in 2Q 2019.
- It should average +0.6 mmb/d for the rest of the year.

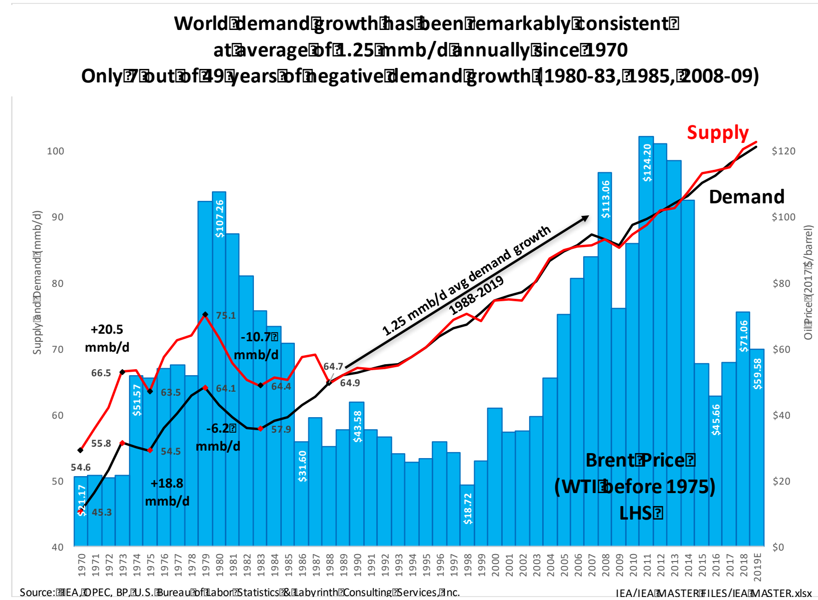
Comparative Inventory is Central For Understanding Oil Markets



- Oil markets are extraordinarily complex because oil is the master resource.
- It therefore, underlies and connects all elements of the global economy including the human psychology behind markets.
- The C.I. yield curve seems to integrate much of that complexity into two factors—price & comparative inventory.
- The approach is not a solution but it provides outstanding calibration.

The Path Forward





- Oil markets are obsessed with demand but supply growth caused price collapses in 2014 & 2018.
- Prices have been on OPEC+ life support since 2016 & higher prices will result in supply growth.
- There will be opinion leaders who proclaim a return to $90-$100 prices in the relatively near term.
- Don’t believe them.
- Proclamations about peak demand, the dominance of electric vehicles & renewable energy will persist. Neither believe the time frames nor that living standard will be more-or-less as it is today.
- Humans have never gone from a higher to a lower density source of energy.
- That path will be traumatic.
- Capital flows define oil market cycles. Supply and demand proceed naturally from capital flows.