The Dynamics & Structure of Modern Crude Markets

The New Paradigm for Physical & Financial Oil: An Exchange Perspective

3rd Joint IEA-IEF-OPEC Meeting

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Introduction to ICE

A Global Exchange Partner and Benchmark Innovator

Intercontinental Exchange (NYSE: ICE) builds, operates and transforms global markets through information, technology and expertise.

We bring transparency, efficiency and market access to participants around the globe.

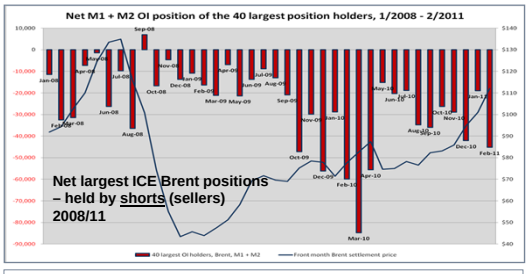
Oil Markets and Benchmarks – Why we should care

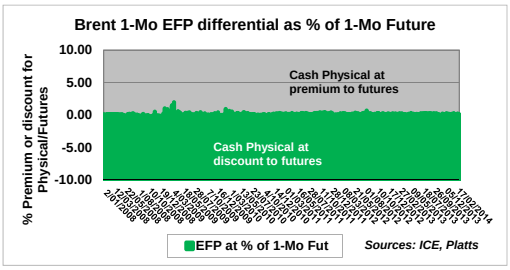
Benchmark is as Benchmark does: Price Discovery Risk & Liquidity

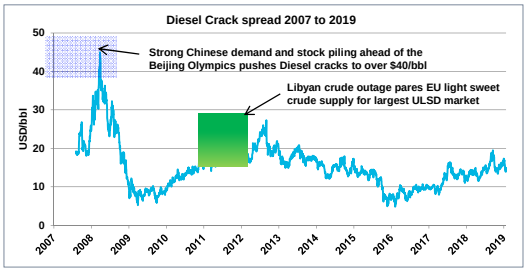
- Price benchmarks do the 'heavy lifting' for oil price discovery, enabling other grades to be traded in reference to the most liquid flat price instruments, providing security and liquidity to the whole market
- Most oil is sold on an unknown forward average flat price, suiting all parties
- Spot physical trade only represents around 5% of the total; the remainder is contract or 'term' pricing (on a monthly average typically)
- Price is a key driver to producers, refiners and end-users. Determines whether fields are explored, developed or closed down; and refineries built/sold
- Price reporting agencies help to re-fix those floating average prices, and risk management tools enable values to be discovered, tested and secured
- Modern risk tools like screen-based futures provide price discovery in flat price terms and potentially exact hedges for all physical types of oil

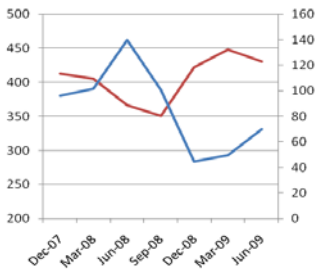
Oil Benchmark evolution a multi-year process, multiple drivers

A decade since the financial crisis, fundamentals and regulatory drivers in motion: a backwards look









Crude Oil Index Fund Activity 2008/9: ***NEGATIVELY*** Correlated Crude Index fund position vs. Price

Interagency Task Force on Commodity Markets

2008 Forensic Examination of Commodity markets exonerated derivative markets

"The Task Force's preliminary assessment is that current oil prices and the increase in oil prices between January 2003 and June 2008 are largely due to fundamental supply and demand factors….analysis to date does not support the proposition that speculative activity has systematically driven changes in oil prices…. Any upward price pressure exerted by the long positions of future dealers commodity index clients has largely been offset by the short positions of the dealers' other clients."

"*The Task Force has found that the activity of market participants often described as "speculators" has not resulted in systematic changes in price over the last five and a half years. On the contrary, most speculative traders typically alter their positions following price changes, suggesting that they are responding to new information – just as one would expect in an efficiently operating market. In particular, the positions of hedge funds appear to have moved inversely with the preceding price changes, suggesting instead that their positions might have provided a buffer against volatility-inducing shocks."*

Interagency Task Force participants include the Commodity Futures Trading Commission, staff from the Departments of Agriculture, Energy, and the Treasury, the Board of Governors of the Federal Reserve System, the Federal Trade Commission, and the Securities & Exchange Commission.

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Oil Benchmark evolution a multi-year process, multiple drivers

Oil Instrument Evolution: Fundamental and Price Drivers (Arbitrage)

Time has moved on, but historical echoes in current conditions

1. Major changes in crude going on right now - interesting parallels with 2008 in terms of degree of mismatch between the crude that is available and the ideal slate
2. Hard to recall a time of greater change globally - need our core benchmarks as anchors
3. Product rotation, crude production growth, refinery capacity growth/upgrading, fuel desulphurisation

Benchmark evolution multi-year process:

1. Oil benchmarks evolved into composite 'brands'
2. From local entities to being global assets, though still subject also to their local fundamentals as well as global ones:
3. 3 primary ones- Brent, Dubai and WTI
4. Have effectively become 'brand' names - names not necessarily helpful
5. Composite benchmarks, not a weakness but a strength

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Perceptions around Price volatility drove regulatory change

Mismatch between available marginal crude barrel (AG Sour then, LTO now) vs. clean product demand (esp. Diesel, IMO FO components vs. light ends)

Some Parallels with 2018/9 in that respect

Dodd Frank (2010) and other legislation a response to swap regulatory concerns from 2008

- **OTC bilateral went on-exchange and cleared as futures**
- Margin requirements, initial and variation: Intraday margining up to 6 times a day is very reactive to stress conditions
- Multilateral netting in Clearing Houses a more accurate and diversified alignment of risk with trading cost
- Price transparency through daily settlements of OTC instruments
- All contributed to an enhanced safety margin for such valuable commercial instruments alongside the largest futures benchmarks such as Brent and WTI

De-risking Vertical model features include:

- Vertically integrated exchange/clearing
- Model allowed effective warehousing and aggregation of risk
- Cleared instruments and margin to cover off risk rather than allowing bilateral counterparty risk. Intraday margining up to 6 times a day is very reactive to stress conditions
- Inherent diversification of risk within very regulated clearing houses with multiple contingency funds. Exchanges a gold standard for centralised regulation, transparency, data

See: "ICE shifts OTC energy swaps to futures" (FT 31/7/2012)
https://www.ft.com/content/6a915f24-db12-11e1-8074-00144feab49a

Linkages – Benchmarks as 'Anchor' points for related prices

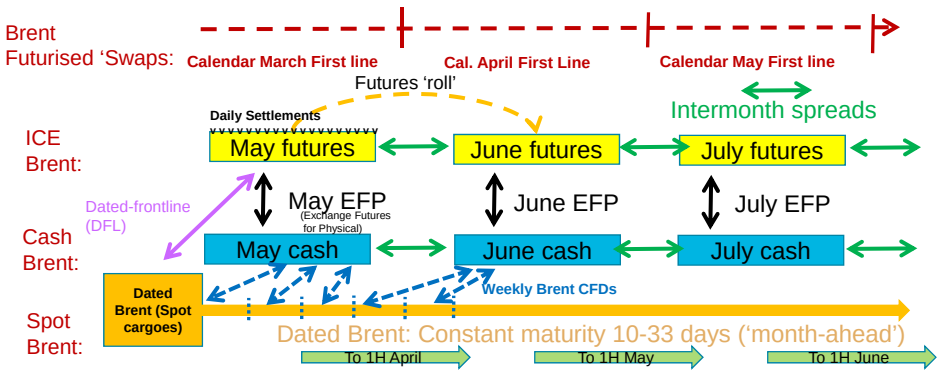
A co-dependency of price through fundamentals

Global oil & refined product inter-relationships in liquidity and price

Region	Global			Asia		US		
Primary Crude (*Future)	(ICE) Brent Crude *			Dubai *		WTI *		Permian LTO *
			Sweet/sour diff					
Ancillary crude			Urals		ESPO			LLS, Mars, ASCI
Price/liquidity Link				Cracks to..				
Primary product (*Future)	ICE Gasoil* (EU)	Euro-Bob Gasoline Barges	Fuel Oil 3.5% Rdam Barge	Singapore 0.5% Gasoil	Singapore 180CST FO	NYH RBOB*	NYH Heat*	USGC 3% FO
Price/liquidity Linkage	Spreads/diffs			(including some cracks) to...				
Secondary product examples Price/liquidity Linkage up/down and across chains/regions and via cracks to crudes	10ppm Diesel barges Rdam 0.1% NWE Cargoes Jet CIF NWE Jet Cargo CIF NWE	Naphtha CIF NWE Gasoline FOB NWE Cargoes	FO 1% Cargoes NWE FO 1% CIF MED Cargoes	Jet (Regrade) FOB Sing Singapore 0.05% Gasoil	Singapore 380CST Fuel Oil	RBOB to Euro Oxy Gasoline	USGC Jet NYH Heat Barge	USGC 1% FO

The ICE Brent Complex

Price Interdependency between physical and financial: ensuring convergence



Crude benchmark landscape evolving by quality and location

1. Brent the Global Standard

Brent has two major benchmarks, each evolving, in physical and derivative forms

- Dated & ICE Brent (+ related instruments)

Physical markets evolution

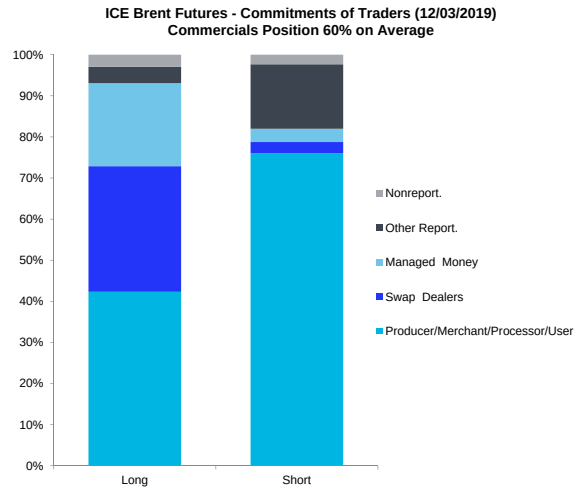
- Dates out to month-ahead
- BFOET and now CIF indications also accepted

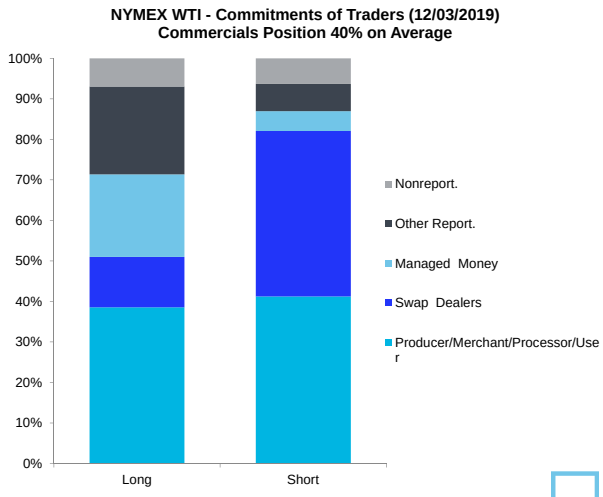
Futures

- ICE Brent Index saw first changes in 30 years late last year:
- capture twice as many relevant indications in the process, easier to hedge
- 5 mini-windows ensure less volatile expiry process
- without moving away from the core M1 full cargo physical cash market for which it solves
- EFP market ensures evergreen convertibility between physical & futures markets
- ICE Futures to 2028, more use of secondary derivatives - supreme confidence in benchmark

ICE Brent futures market

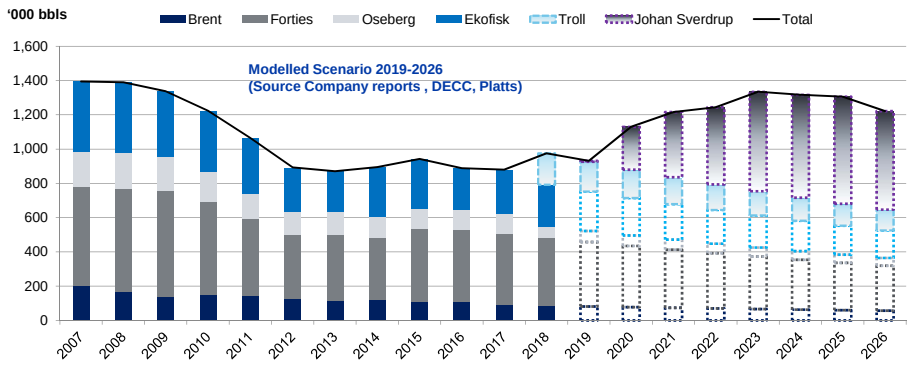
Most closely aligned with global physical crude





Brent: A benchmark scenario 2019-2026

The Anglo-Norwegian option

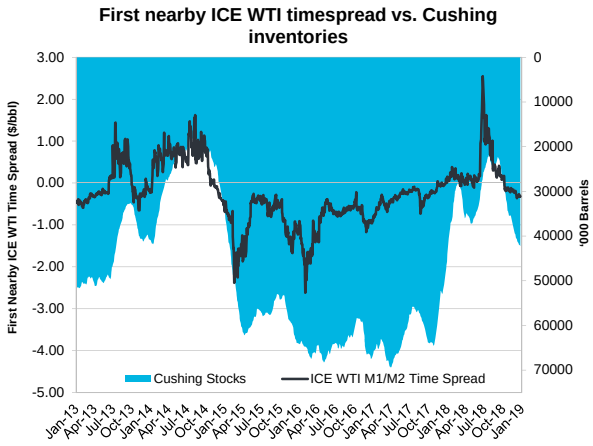


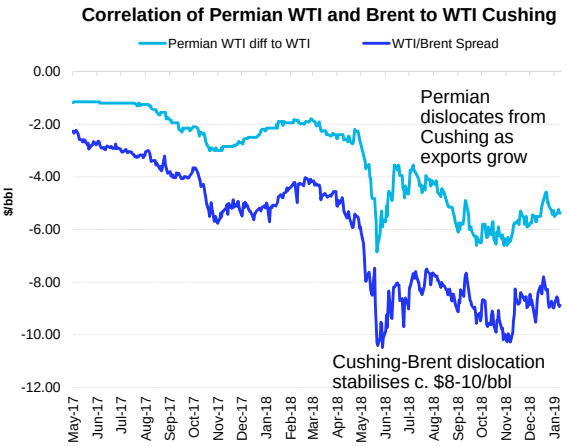
Assumptions:

- Decline rates for legacy BFOE and Troll of 12% p.a. after 2017 (Pre-Buzzard maintenance level)
- Johan Sverdrup added from 2020 (Largest N.Sea candidate for medium-term impact)

2. WTI: Fastest changing benchmark

US production growth, export and infrastructure catch-up (still..)





WTI in motion

U.S. Export barrels pricing – the switch from Cushing to Gulf Coast

ICE Permian WTI Futures (HOU)

- A predictable quality specification that reflects Permian WTI crude delivered directly from the Permian Basin.
- Deliverable into the MEH Terminal off the Bridge Tex and Longhorn pipelines and tested at the origin and destination.
- Full quality specifications are published in the Magellan Tariff for the above mentioned pipelines.

WTI in motion

Cushing's era time-bound as takeaway capacity grows?

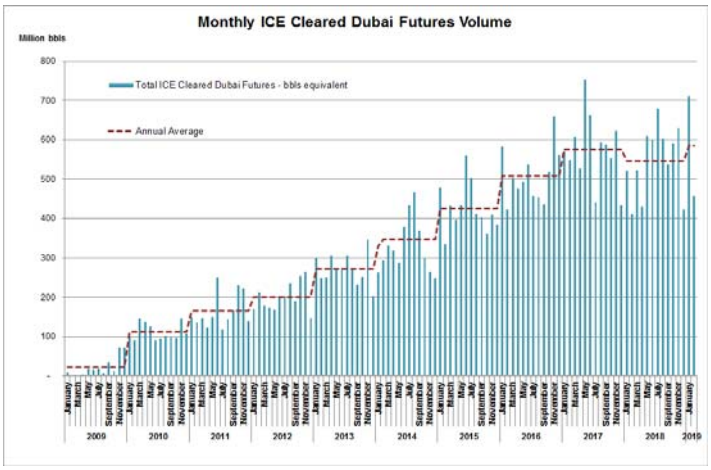
WTI changing as US infrastructures key pivot moves to USGC from mid continent, more change to come, takeaway capacity for Cushing may bring more volatility there

- For WTI-Brent the 'real' diff is Brent-Permian, expressed through our tradeable diff
- When WTI reaches the water it is competing globally with and contributing to Brent-pricing waterborne liquidity
- WTI Cushing is the darling of US retail futures trade but less and less important for commercial hedgers
- Dynamic change in WTI also - US LTO revolution has added 5 mil b/day and 2 m b/day exports finding their way to Europe and even Asia - lots of 'light sweet', OPEC conserving its heavier grades - IMO influence critical
- LTO crude exports at 2 mil b/day changing the global equation, but can't assume it will be a baseload like other regional FOB stems, rotation in fields and qualities

3. Dubai

Taking its place as global benchmark into Asia

- Composite of grades, aligned in our global crude benchmark package
- Dubai futures saw 10-fold growth in volumes over 5 years, and still growing - far and away the most consistently liquid instrument for the ME barrel
- Open interest averages 20+ times its closet Asian competitor, genuine forward curve
- Expect more innovation and growth in ME/AG market places
- NOCs on modernising influences- downstream, more product orientation and trade



Refined products - Crude linkages

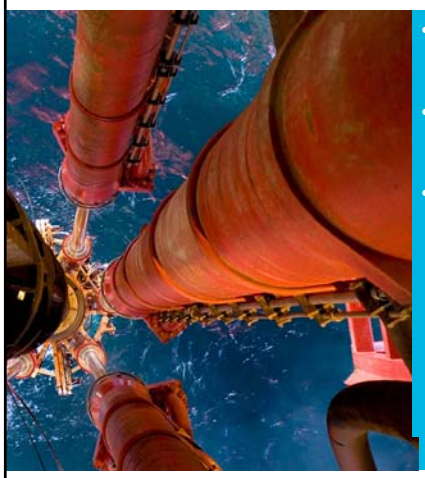
Critical fundamental convergence, where 2008 and 2019 echo - Despite LTO growth, Crude slate/product mismatch

Crude takes its cue from which products we value most highly and where

- All about the refined products
- LTO push to absorb very light ends, gasoline blending, shortage of heavier Naphtha
- Distillate drive essential for positive margin,
- Skew between deep conversion and skimmers reversed for a while
- Still some confusion about how will get to 0.5% requirement

Where next for Transport Fuels - the crude slate mismatch?

Distillate context amongst refined products



- Global crude slate versus clean product demand, different stresses in regions - EU close to 45%, US only 30%, much lower cetane
- Inherent tension between what changes are taking place in the global crude slate and what the product markets are looking for from the refining complex
- **Big changes afoot in US markets, have consequences in Distillates too:**
  - Brent always been a distillate crude, JS will help, but extra LS from US will have a bearing on Distillate and LS equation too, esp. to and beyond IMO
  - Upgrading capacity, distillate margin the only positive part of the barrel in early 2019, although gasoline was oversold and approach of driving season is correcting that imbalance

The Future(s) of Marine Fuel: Products and Crude prices in dynamic linkage

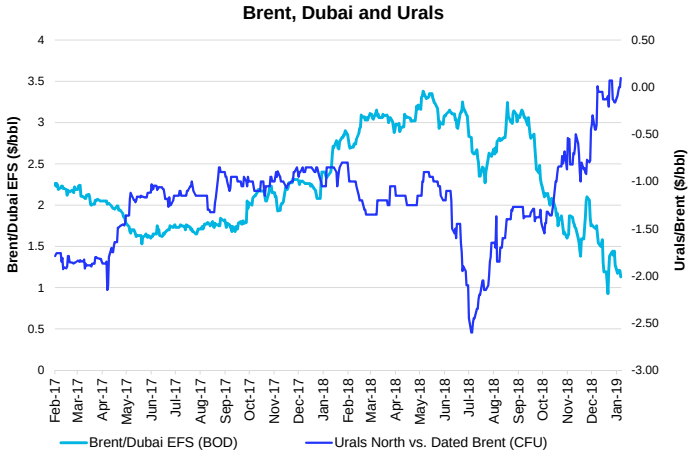
A slice of history to here and now

Available Crude Slate Influence? The 'shale' impact

- US LTO a godsend at this point
- But new refinery conversions a complicating factor
- Destroying fuel oil - drive to extract trapped value in those previously less valuable crudes and products
- FO increasingly a secondary feedstock with secondary units - more and more gasoil, not much FO left

IMO a major influence in narrowing Sweet/Sour Spread

In the face of IMO change and global slate shift to light sweet , Distillate-rich Urals at par to sweet-ish Brent, East-focused Dubai strengthens vs plentiful LTO

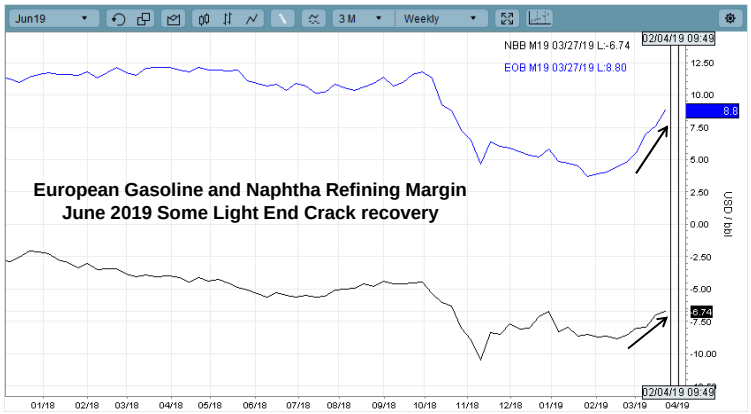


What it means

- Medium sour strengthening: Urals inverted
- Global surplus of light sweet depress Brent's premium to Dubai ; sweet-sour switch would worsen gasoline glut
- 1.1m bpd refining capacity in Q2 2019 to increase tightness of medium sour?
- **So everyone is competing for cheaper, Marine-fuel oriented crudes..**

European Refining Margins

Cross barrels views and yield switching



What it means: crude prices underpinned now?

- **Gasoline:** Until March **-** slow demand growth in Asia, US and Europe, complicated by rising gasoline supply from increasing refining capacity in Mid-East and Asia, and lightening crude slate
- **Naphtha**: Was dragged down by both competing petchem feedstock LPG's collapsing price, and weak gasoline blending

So all positive margin had been concentrated in Gasoil/Distillates (Gasoil down, FO up in price)

Questions?

Contacts and Resources

For more information on ICE oil products and data

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