Cyclical behaviour of oil prices
“there is no new thing under the sun”

JOHN KEMP
REUTERS
4 Jun 2018
Outline

Cyclical nature of oil market

Current position in the cycle

Next steps on the journey

Sources of uncertainty

Long-term outlook
Oil prices since the start of the modern petroleum industry

Real crude oil prices 1861-2018
(2016 U.S.$/barrel)

Source: BP Statistical Review of World Energy 2017 Reuters calculations for 2017 and 2018
@JKempEnergy
Oil market fundamentals

Oil industry has always been subject to **deep and prolonged cycles** of boom and bust and there is no reason to think the future will be any different

*Cyclical behaviour* is the distinguishing characteristic of oil markets and prices and rooted in the industry’s structure

- Low price elasticity of supply and demand
- Backward-looking expectations and behaviour
- Positive and negative feedback mechanisms
- Complex adaptive systems

Multiple markets for crude, fuels, refining, services, engineering, construction, drilling, skilled labour, raw materials etc

Each market subject to its own feedback mechanisms, operating at different speeds and timescales, with constantly changing balances between supply and demand

Balancing “the oil market” actually means balancing all these markets simultaneously

Oil market is never really “balanced” or in equilibrium except accidentally and not for very long
Feedback mechanisms operate in oil markets and can delay as well as accelerate process of adjustment.

Oil industry is characterised by a multiple feedback loops

Initial conditions $\rightarrow$ Outcomes

**Negative feedback** loops dampen impact of an initial change and are therefore stabilising and promote rapid return to “equilibrium”

**Positive feedback** loops amplify the impact of an initial change and are therefore destabilising and delay return to “equilibrium”

Feedback concept was popularised by communications experts at Bell Telephone Laboratory in the 1920s.

Long (implicit) history in economics: Adam Smith’s “invisible hand” and David Hume’s “price-specie-flow” mechanism are both instances of negative feedback loops.
Examples of feedback mechanisms acting on oil supply and demand
Positive feedback deepened slump, now accelerating rebound

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<td>Fiscal terms (taxes and royalties)</td>
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Oil market is cyclical: no bust (or boom) lasts forever
Best advice on oil business comes from *Book of Ecclesiastes (Ch 3)*

To every thing there is a season,
and a time to every purpose under the heaven:
a time to be born, and a time to die;
a time to plant, and a time to pluck up that which is planted;
a time to kill, and a time to heal;
a time to break down, and a time to build up;
a time to weep, and a time to laugh;
a time to mourn, and a time to dance;
a time to cast away stones,
and a time to gather stones together;
a time to embrace, and a time to refrain from embracing;
a time to get, and a time to lose;
a time to keep, and a time to cast away;
a time to rend, and a time to sew;
a time to keep silence, and a time to speak;
a time to love, and a time to hate;
a time of war, and a time of peace.
Oil prices in long run perspective
Long boom, wrenching slump, now back to boom

Real crude oil prices 1861-2018
(2016 U.S.$/barrel)

Source: BP Statistical Review of World Energy 2017
Reuters calculations for 2017 and 2018
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Oil prices are no longer low in real terms
Real oil prices now well into the upper half of the post-1973 distribution

Source: BP Statistical Review of World Energy, 2017 and author calculations
Real oil prices again in the upper half of the cycle
Current oil price now slightly above the $75 average for the last cycle

Brent crude price
One complete price cycle (1998-2016)
Front-month futures, real U.S.$/bbl

Mean + 1 S.D. ($110)
Mean ($75)
Mean - 1 S.D. ($39)
Dec 1998 $15
Jan 2016 $32
May 2018 $76

Brent price (real U.S.$ 2018 monthly average)
Brent price (U.S.$ monthly average)
Oil market alternates between periods of over- and under-supply. Calendar spreads cycle between contango to backwardation.

Shape of the futures price curve in Brent crude
Contango (-) or backwardation (+) from months 1 to 7 (US$/bbl)

Price difference between 1st listed contract month and 7th listed contract month for Brent futures (U.S.$/bbl)
Contango (-) or backwardation (+) averaged over 30 days

Source: Thomson Reuters Eikon, ICE Futures @JKeppEnergy
Oil market calendar spreads now in upper half of distribution
Stocks are relatively tight and expected to tighten further

Brent calendar spread from month 1 to month 7
Frequency distribution (daily) 1990-2018, US$ per barrel
Contango (-) or backwardation (+)

Source: ICE Futures Europe
Spot prices and calendar spreads are part of the same cycle

Cyclical indicators in the oil market
Brent crude: front-month futures prices and calendar spreads

- L-axis: Brent front-month futures prices (U.S.$/bb1)
- R-axis: Brent calendar spread (1st month - 7th month future price, U.S.$ per bb1)

Both series are averaged over 30 trading days to smooth short-term volatility  
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Spot prices and calendar spreads closely correlated
Both currently point to a recovery that is relatively mature

Cyclical indicators in the oil market
Brent crude: front-month futures prices and calendar spreads

- L-axis: Brent front-month futures prices (percent change year-on-year)
- R-axis: Brent calendar spread (1st month - 7th month future price, U.S.$ per bbl)

Both series are averaged over 30 trading days to smooth short-term volatility
Oil prices are now well above expectations at the start of the year.

Energy market professionals expected prices to average $70 by 2020.

**Expected Brent crude oil prices 2018-2022 ($US/bbl)**

Frequency distribution of results from price survey

Source: Survey of *Best in Energy* readers in early Jan 2018
(Population size 7000+, responses 1000+)
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Oil market has rebalanced in 2017/18 after slump in 2014/15

Production restraint by OPEC and allies

Involuntary production losses especially in Venezuela

Strong growth in consumption for fourth year running
Rebalancing: what do we mean?
At least five elements

Closer balance between supply & demand (Yes – market now in deficit)
Normalisation of crude & product stocks (Yes – back to 5yr average)
Forward price curve (Yes – shift from contango to backwardation)
Sustainable flat price (Yes – back to cyclical average)
Sustainable investment (Yes – shale growth but offshore lagging)

Market has rebalanced on nearly all criteria
Now moving from rebalancing/recovery phase to tightening/boom
Excess oil inventories have been eliminated. OECD oil stocks back in line with five-year average.
Higher oil prices have encouraged resumption of drilling
U.S. oil rig count has almost tripled since May 2016

Number of rigs drilling for oil in the United States

Source: Baker Hughes

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Rising rig count has brought a big increase in production
U.S. output up +1.3 million b/d year-on-year to record 10.5 million b/d in Mar

U.S. crude oil production, 1920-2018
000 b/d

Source: U.S. Energy Information Administration
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U.S. crude output forecast to rise almost +1.4 million b/d in 2018
And another +1.1 million b/d in 2019
Synchronised global growth has boosted oil consumption

World trade volumes rising at fastest rate since 2011

Volume of World Trade

Year-on-year percent growth, 3-month average

Source: Netherlands Bureau for Economic Policy Analysis, World Trade Monitor, @JKempEnergy
Rising oil prices are a signal
Rebalancing in 2018/19 will mean precisely the opposite of 2016/17

More production from OPEC+
More production from U.S. shale
More production from non-OPEC non-shale
Slower growth in oil consumption
Next steps in the price cycle
Familiar from previous cycles

Rising output from U.S. shale producers

Relaxation of OPEC output curbs

Rising non-OPEC non-shale output

Renewed interest in fuel-efficient transport

Behaviour changes to cut fuel consumption

Growing interest in electric vehicles

Renewed interest in alternative fuels e.g. LNG/CNG
Hedge funds anticipated and accelerated rise in prices
Record bullish position helped push prices higher but presents liquidation risk

Money managers' total long and short positions in Brent, WTI, U.S. gasoline, U.S. heating oil and European gasoil (million bbl)
Hedge funds were never before so overwhelmingly bullish
Crowded trade risks sharp reversal if/when funds try to realise profits

Ratio of money manager long to short positions in petroleum
(Brent+WTI+gasoline+heating oil+ gasoil) (log-scale)

Source: U.S. Commodity Futures Trading Commission, ICE Futures Europe  @JKempEnergy
U.S. macroeconomy now at relatively late stage in cycle
Economic downturn in the advanced economies is key risk for oil in 2019-2021

Duration of U.S. business cycles (expansion phase) since 1858
months from trough to peak for expansions starting in years shown

Source: National Bureau of Economic Research  
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Half of energy professionals expect recession before end 2020
Based on a survey conducted at the start of Apr

Probability United States will enter recession before end 2020
Distribution of responses

Percent of respondents
20

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Assessed probability
Warning from Rex
Predictions notoriously unreliable, better to focus on coping strategies

Former Exxon Mobil Chief Executive Rex Tillerson (2 March 2016):

“We’ve never been any good at predicting these [price] cycles, neither when they occur nor their duration. We don’t spend a lot of time even trying.

“How the future is going to look, we take no particular view on it, other than to recognize that whatever it is today it will be different sometime in the future, and after that it will be different again.

“In my nearly 41 years [with Exxon], that’s been my experience. I didn’t learn anything about my ability to foresee that. I learned a lot about how you deal with it”
Oil industry through 2050
Long-term trends beyond the cycle of boom and bust

Projections are not forecasts

Long-term projections are very sensitive to small changes in assumptions

Need to avoid confusing cyclical position with long-term trends

We should be very humble about our ability to predict the future

What can we really say about the long-term outlook for the oil industry?
Growing energy use has been critical to social development
Social opportunities depend on harnessing large amounts of energy

Energy capture per person in the western core
000 kilocalories per day

Energy capture includes energy used for food, animal feed, in the home, commerce, agriculture, industry and transport. Humans need a minimum of around 2,000 kcal per day just to survive

Source: Why the West Rules -- For Now, Morris, 2011
Enormous unmet energy demand in developing economies
World energy consumption will grow strongly through 2050

Annual energy consumption for selected countries
kg of oil equivalent per capita, 2014

<table>
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<tr>
<th>Country</th>
<th>Consumption (kg of oil equivalent)</th>
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<tbody>
<tr>
<td>United States</td>
<td>6,957</td>
</tr>
<tr>
<td>Japan</td>
<td>3,471</td>
</tr>
<tr>
<td>European Union</td>
<td>3,080</td>
</tr>
<tr>
<td>China</td>
<td>2,237</td>
</tr>
<tr>
<td>Mexico</td>
<td>1,513</td>
</tr>
<tr>
<td>Brazil</td>
<td>1,485</td>
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<tr>
<td>Indonesia</td>
<td>884</td>
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<tr>
<td>Egypt</td>
<td>815</td>
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<tr>
<td>Nigeria</td>
<td>763</td>
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<tr>
<td>Vietnam</td>
<td>655</td>
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<tr>
<td>India</td>
<td>637</td>
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<tr>
<td>Pakistan</td>
<td>484</td>
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<tr>
<td>Tanzania</td>
<td>475</td>
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<tr>
<td>Bangladesh</td>
<td>222</td>
</tr>
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Source: World Bank
@JKempEnergy
Growing middle class in emerging economies
Consumers want same modern conveniences as their counterparts in OECD

Registered motor vehicles in India, 1980-2016

Source: Road Transport Yearbook (2015-16), Ministry of Road Transport and Highways, Government of India; @JKempEnergy
Economic development is unleashing enormous energy demand
Consumers want motorcycles, cars, refrigerators, airconditioners etc

India gasoline consumption: actual and forecast (million tonnes per year) (fiscal years Apr-Mar)

Source: Central Statistics Office, Government of India
Petroleum Planning and Analysis Cell, Ministry of Petroleum

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Centre of gravity in global economy is moving east to Asia
Centre of energy consumption will also move east
Oil and the grand energy transition
Energy sources have become more convenient

<table>
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<th>Energy transitions:</th>
<th>Transitions favour increased convenience</th>
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<td>Muscles</td>
<td>Cheaper</td>
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<tr>
<td>Wood/biomass</td>
<td>More efficient</td>
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<tr>
<td>Coal</td>
<td>More accessible</td>
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<tr>
<td>Oil (Nuclear)</td>
<td>More secure</td>
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<tr>
<td>Natural gas</td>
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<td>Renewables</td>
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<td>Electrification</td>
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Transitions take a long time (50 years +) due to inertia in energy systems
Old energy sources tend to linger even as new ones emerge
Oil consumption set to remain very high through at least 2050
If renewables and electrification are to gradually replace oil they will have to compete on convenience
Some concluding thoughts
Offered with appropriate humility

Oil is a cyclical industry and no reason to think future will be different

Current cycle is at or beyond the half-way point

Focus will now shift to production growth and consumption restraint

Current rise in oil prices will create conditions for next slump

Biggest short term risk is crowded hedge fund positioning

Biggest medium run risk is U.S./global slowdown

Enormous unmet demand to support oil consumption in coming decades

Centre of oil consumption is moving east and south

Transition to other forms of energy will happen only if they offer greater convenience