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Daily Observations

March 31, 2016

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Thoughts on the Oil Investment Cycle

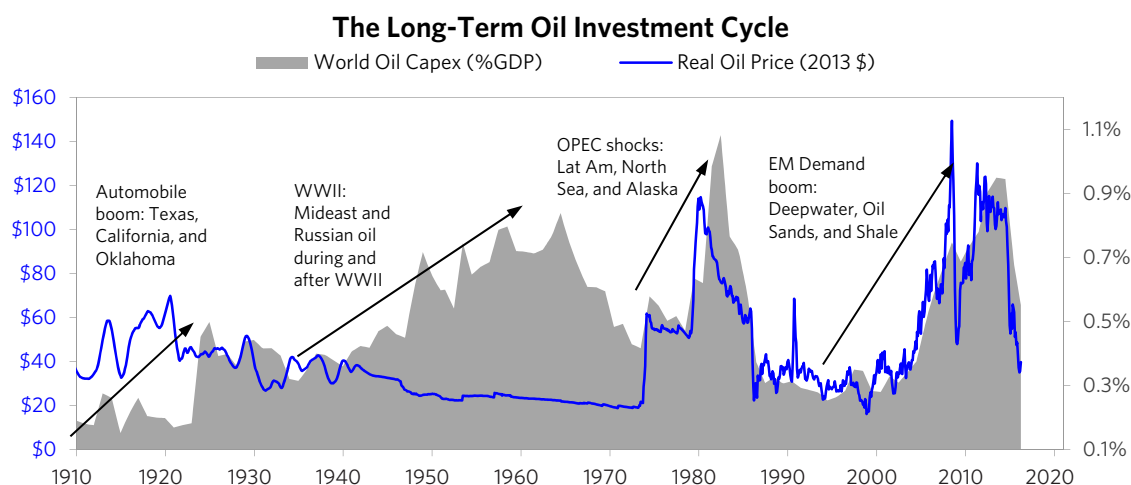
We are in the midst of the fourth major oil investment bust since 1900, and while this cycle is different in some critical ways (particularly the speed at which investment translates into output), the big picture process is the same as in previous cycles.

Commodity investment cycles tend to follow a broadly classic process:

- 1) In the first phase, a pickup in commodity-intensive growth causes a global **surge in demand** for commodities to outstrip supply. As demand pushes up against capacity limits, prices rise.
- 2) In the second phase, high prices caused by the supply and demand imbalance induce large amounts of capital expenditure. As prices rise, margins for commodity producers widen and profits increase. These producers, flush with cash and looking at high prices, invest in profitable opportunities to expand production. There is a massive **investment boom**. This acts as a support to growth and inflation as capital expenditure accelerates.
- 3) The third phase is typically marked by a slowdown in commodity demand that occurs when the original growth that sparked the cycle fades and high prices incentivize reductions in demand growth, by encouraging substitution and efforts to improve efficiency. Simultaneously, the investment boom begins to bring new supply online, demand/supply imbalances ease, and prices stabilize. Thus, high prices help set in motion the increase in supply and reduction in demand that eventually lead to the **turning of the cycle**.
- 4) In the fourth phase, there is a **supply glut**. The balance between demand and supply swings sharply in the other direction, as production is much greater than demand. This phase is typically characterized by large price declines.
- 5) As prices fall, margins for commodity producers are squeezed. And, in the fifth phase, producers respond to low prices by slashing investment and in some cases shutting down production permanently. This decline in supply eventually brings the market back into balance, as the **low investment deteriorates capacity**, sowing the seeds for the next cycle.

We are currently in stage 5 of the most recent cycle, where years of investment have left the market oversupplied and prices at the lowest level in a decade. The move in oil prices has resulted, as one would expect, in a collapse in investment that is no longer profitable. For most of 2016, there will likely continue to be a significant spot oil glut, as the lag between production and investment means that cuts will only gradually bite into production. However, unless prices rise significantly, supply will likely fall short of demand some time in 2017, leading to one of the most significant shortages in the history of the oil market soon thereafter. At this point, the forward price of oil does not appear high enough to create the needed investment, and the longer oil prices remain low, the larger the future gap between supply and demand is likely to be.

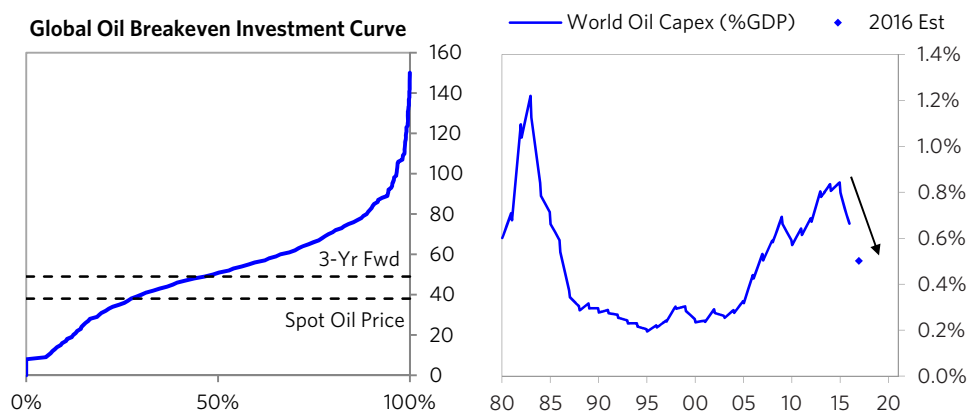
Before we dig into where we stand in the current oil investment cycle, it is worth offering some perspective on the major oil investment booms and busts over the last 100 years. The chart below shows the four major oil investment booms since 1900 and the price levels that spurred them. In the appendix, we describe each of these past booms. While the details of each cycle are different, the cause and effect linkages that drive them are the same.



The current leg down in the commodity investment cycle (and accompanying decline in prices) has severely impacted the medium-term outlook for oil supply. While there is lots of uncertainty around exactly how long the market will remain out of balance, a particularly large reduction in supply could leave the market undersupplied as soon as 2017. In the near term, cuts in shale investment have and will continue to bite into production, and the supply issue is amplified going forward, as massive capex cuts from more traditional producers (with longer lag times between investment and production) flow through to supply. As described above, the supply glut phase of the cycle sows the seeds for a price rebound, which is necessary to allow supply to catch up with demand. Below, we walk through our picture of the current supply and demand dynamics in more depth.

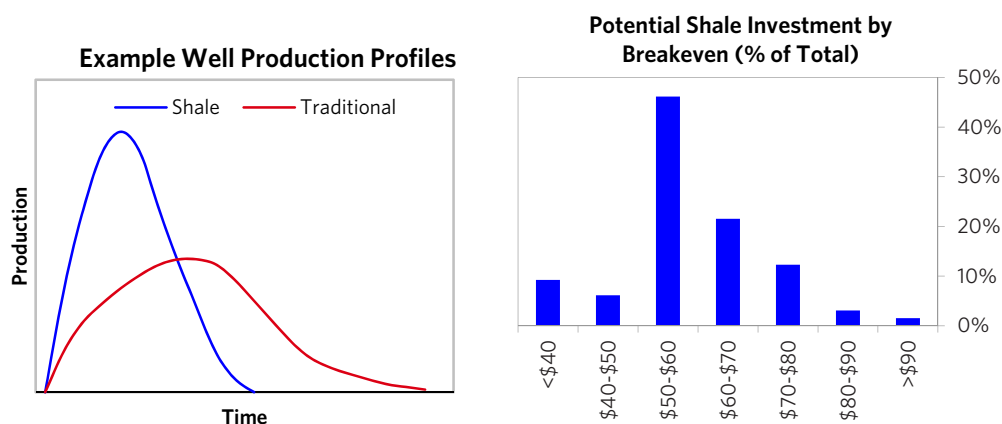
Low Oil Prices Have Led to a Sharp Pullback in Investments

At current spot and forward prices, most of the world's investment opportunities are uneconomical. Consistent with this picture, over 20% of global oil capex was cut in 2015, and further cuts of at least 15% are likely this year. If prices remain low, we are likely to see capex collapse even further.

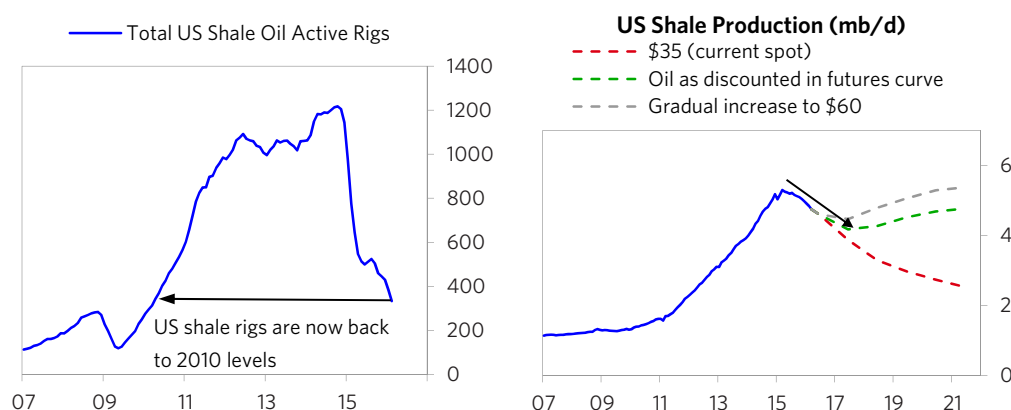


US Shale Production Has Already Turned and Will Continue to Decline in the Coming Year

So far, US shale is the main source of oil supply where production has already turned, and production is likely to continue to decline over the next year. US shale production is much more responsive to prices than traditional sources of production—high decline rates mean that practically continuous reinvestment is required to maintain production levels. The time between initial investment and oil extraction is also significantly shorter for shale, meaning that capex cuts hit production faster in current (and future) cycles than has been the case historically. The dynamic nature of shale, combined with its relatively high cost of production, makes it particularly vulnerable in today's price environment.

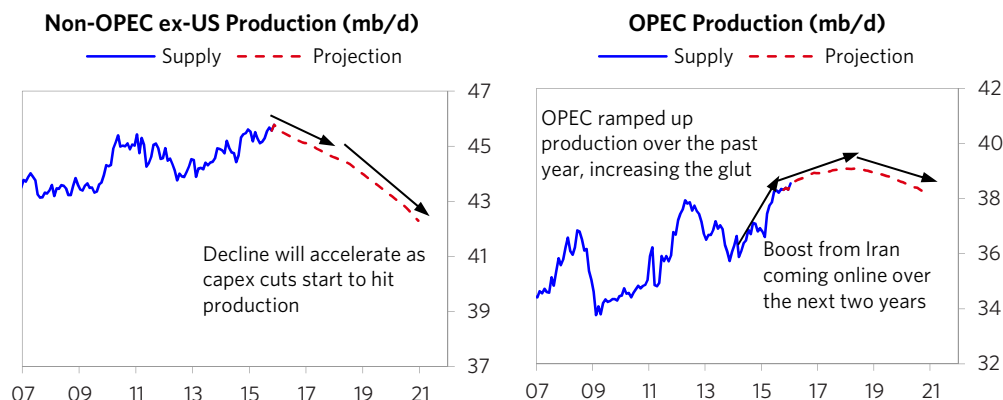


As a result, rig counts have plummeted to 2010 levels and production started to decline in the second half of last year, ahead of traditional counterparts. Declines in shale production thus far have actually been smaller than many expected, in large part because companies have managed to focus on only their most productive wells and to tighten their belts in typical cyclical ways (by firing employees, squeezing service providers, etc.). However, there are limits to how long companies can fight the tide of falling oil prices with this type of cost cutting. Additionally, because many of these cost-saving measures are tied to oil prices and associated activity levels, the positive impact of a price increase on shale production is somewhat muted by the fact that these costs would also increase.



Outside of Shale, Production Has Not Yet Turned but Will Likely Decline Meaningfully in the Coming Years

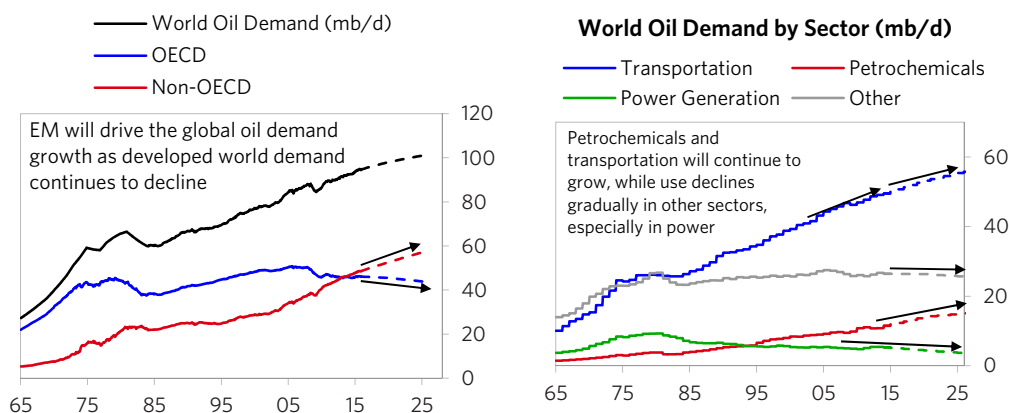
While investment has been cut across all sources of production, non-shale supply has not yet turned, as past investments continue to come online. Non-OPEC supply outside of the US is set to start declining gradually in the coming months, and we are likely to see a meaningful acceleration in supply declines beyond 2017, as the massive cutback in investment over the past year flows through. OPEC production has actually increased over the past year, as OPEC stepped away from its role as swing producer and chose instead to produce at nearly full capacity. The return of Iranian production following the lifting of nuclear sanctions is expected to provide a near-term boost to production, but OPEC output is otherwise expected to remain flat at high levels over the next few years.



While Low Oil Prices Have Led to a Bleak Supply Outlook, Demand Is Expected to Grow at a Moderate Pace

Global oil demand will continue to grow at a moderate pace, driven entirely by the EM world, against a backdrop of modest global growth. While oil demand is driven primarily by economic growth—which typically accounts for around three-quarters of the change—it is also affected by the oil price itself. Demand has received a boost from this cycle's price decline, which will fade over the coming years.

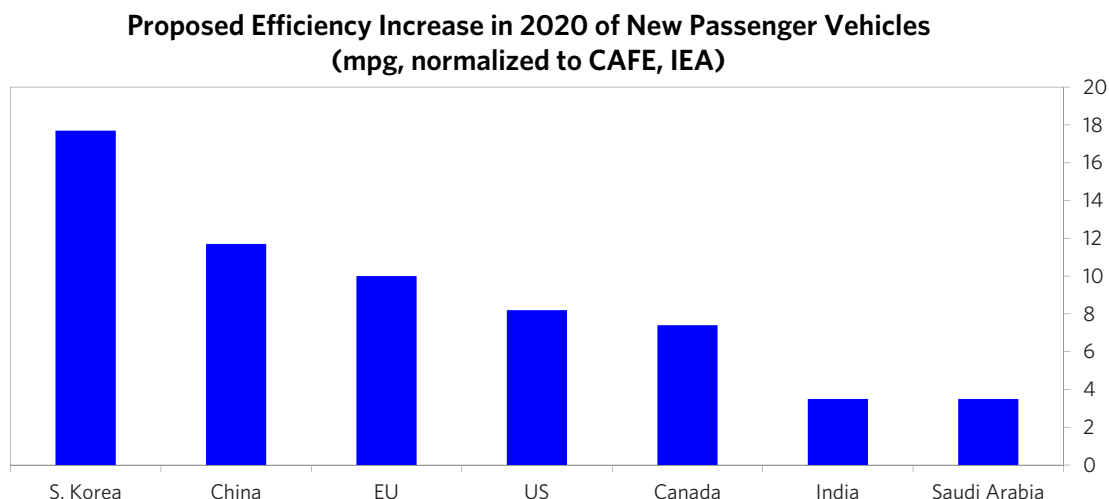
From a sector demand perspective, the transportation and petrochemical sectors are likely to account for the majority of demand growth. The transportation sector, which accounts for 55% of global oil demand, is likely to grow at a modestly slower pace in coming years, as pressure from rising fuel efficiency regulations (such as CAFE standards in the US) is somewhat offset by continued vehicle fleet growth in the EM world. Feedstock demand from the petrochemical sector is expected to be strong, as past investments in chemical plants come online to meet rising EM demand for plastics. Oil is also expected to continue to lose market share to renewables and other sources of energy in the power sector, though the impact will be fairly small as little oil is used for power generation at this point.



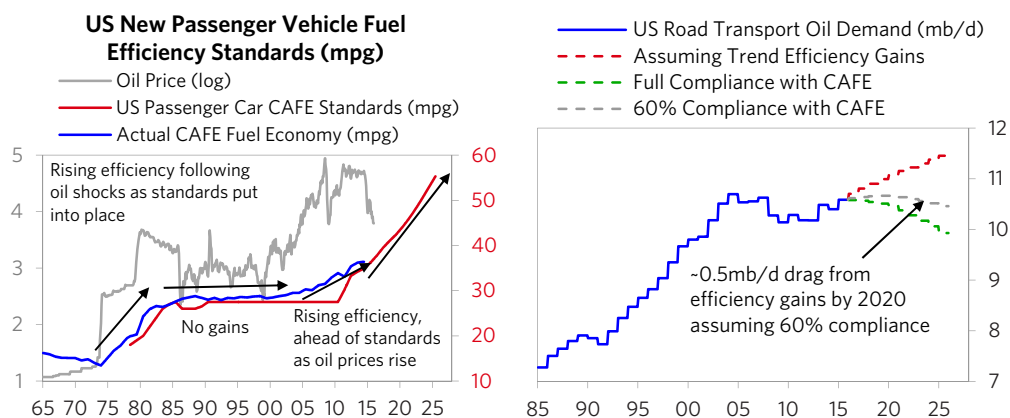
Below, we highlight some of the dynamics affecting transportation sector demand.

Rising Fuel Efficiency Standards Will Be a Drag

As environmental concerns mount, governments across the globe have made a big push to increase fuel efficiency, manifesting in lofty standards for carmakers and penalties for non-compliance. For example, US CAFE standards call for roughly 4% annual efficiency gains in new cars, twice the rate we've seen over the past decade. Other regions, such as China, the EU, and Korea, have set similarly aggressive targets, as shown below.

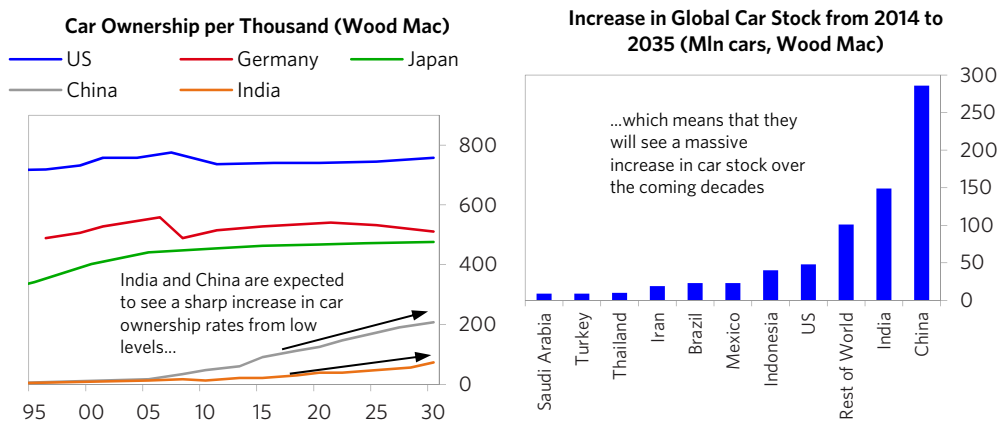


To illustrate the point, full adherence to CAFE standards in the US would result in a reduction of oil demand by about 0.5 mb/d by 2020. If other countries follow a similar pattern, the impact has the potential to be meaningful for global demand. That said, it's hard to know to what extent companies will actually adhere to standards if consumer preferences are at odds with policy objectives. The chart on the left below lends some historical perspective to the case at hand. Past increases in fuel efficiency have been accompanied by large increases in oil prices—in this instance, standards are competing with low fuel prices. In addition, current CAFE standards call for more sustained and faster improvement than we've seen at any point over the past 35 years. The stated regulations appear to be a high target (and could change in upcoming reviews if the goal winds up being too lofty).



But Rising Vehicle Penetration in Emerging Markets Is Exerting Upward Pressure on Demand

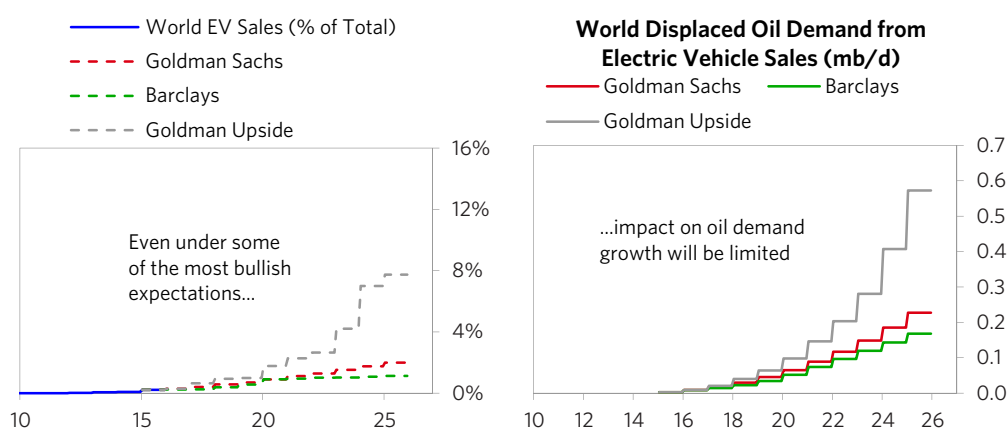
Increasing demand for vehicles from emerging market consumers is likely to somewhat offset the downward pressure from rising efficiency standards. Most of the demand growth within the transportation sector is likely to come from EM economies, such as China and India, which are seeing growing middle classes. In particular, these countries are expected to see a rapid increase in vehicle penetration off of very low levels. The charts below illustrate this dynamic for cars, though it is equally valid for light trucks and heavy vehicles as well.



And the Impact from Fuel Switching Will Be Limited in the Next Few Years

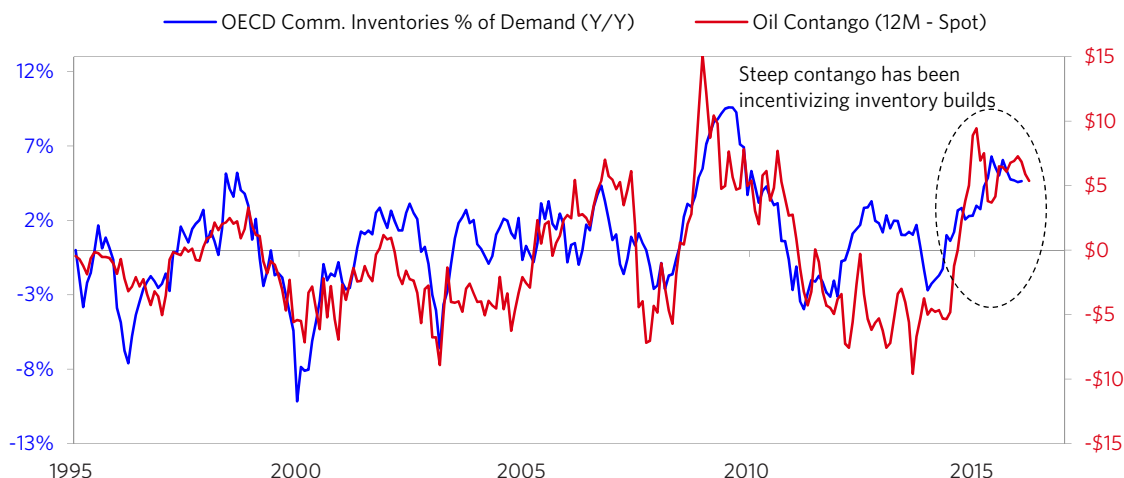
Disruptive technologies like electric- and natural gas-powered vehicles have the potential to displace a significant amount of oil demand in the longer term, but current economics are unfavorable and logistical bottlenecks stand in the way of near-term mass adoption. For electric vehicles, the necessary battery technology to incentivize mass adoption is likely at least a few years away. Additionally, the lag between investment in battery factories and production is sufficiently long (and the current investment level is sufficiently low) to make expectations of mass adoption within the next five years impractical, barring a technological breakthrough in the production process. In the case of natural gas vehicles, high upfront costs (which are only slowly improving), infrastructure bottlenecks (e.g., fueling stations), and the current limited availability of natural gas/LNG shipping in many regions present major near-term roadblocks.

For example, the charts below show a range of possible paths for electric vehicle demand—in even the most bullish scenarios, only 0.2-0.3 mb/d of oil are expected to be displaced over the next five years.

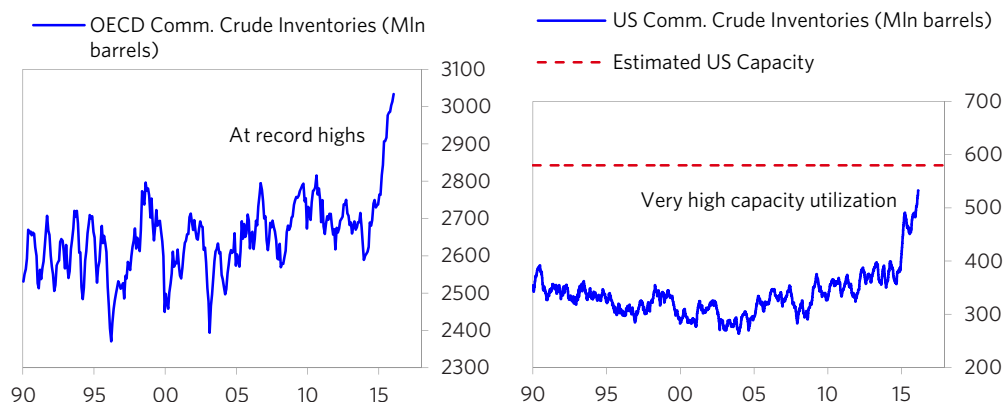


Inventories Are Helping to Bridge the Gap, but Limited Cheap Storage Capacity May Be a Downward Pressure on Prices in the Near Term

Oil supply can be met by demand or stored as inventory. The price of oil will reflect how these net out. Inventories today are helping to smooth an oversupplied market, as they move supply from today into the future. For this mechanism to work, market participants have to be willing and able to buy oil today and pay the costs associated with storing it, because they can sell at a future date for a price where they make a profit. Over the past year and a half, the steep oil futures curve has incentivized a rapid build in oil inventories.

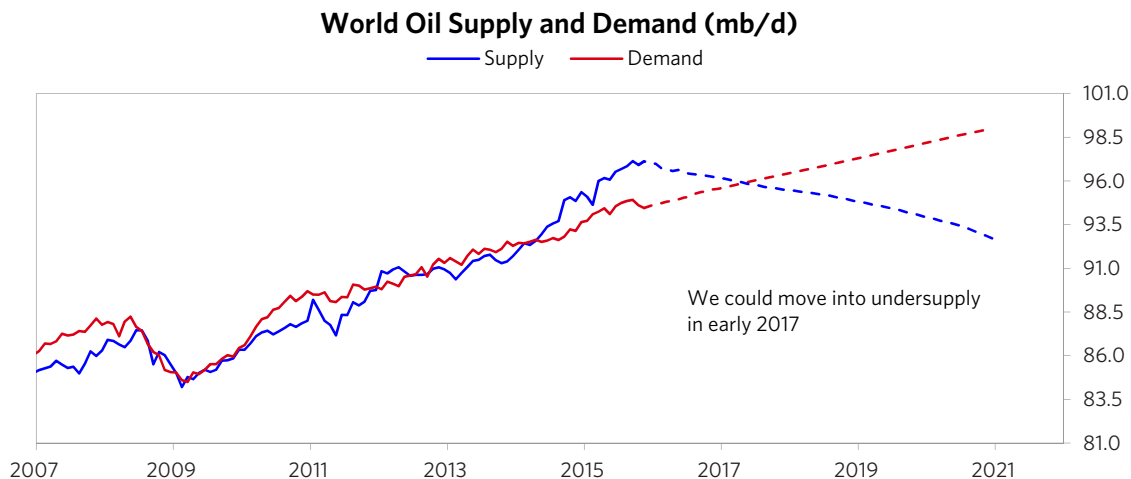


Reported OECD inventories are at record highs, and US commercial storage (especially Cushing) is operating at close to 90% utilization rates. While it's difficult to know precisely how close we are to actual capacity limits, there is a risk that this storage capacity fills and oil has to be increasingly stored in more expensive offshore tankers or even shut in, which would be a downward pressure on oil prices and likely require even lower prices than are discounted for the upcoming year



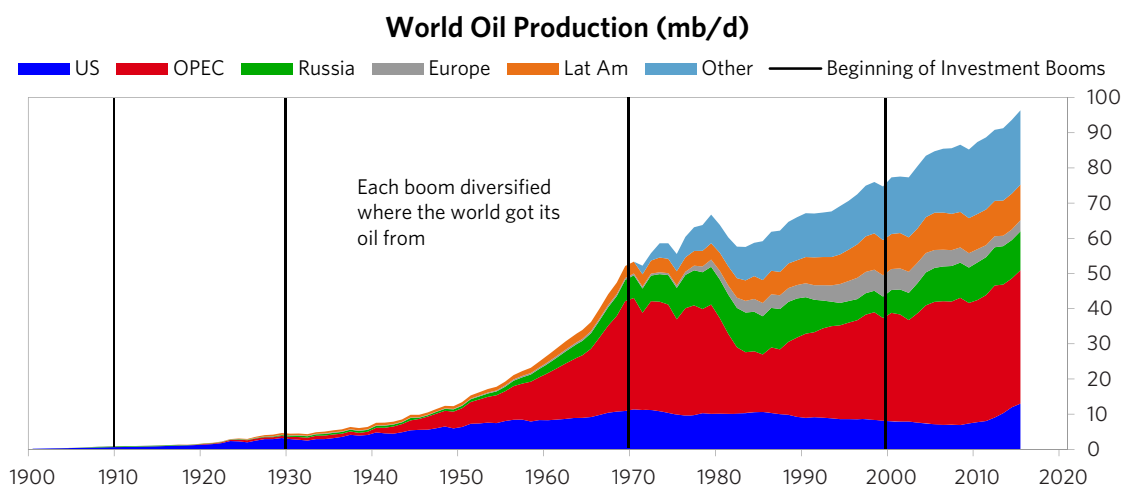
Barring a Significant Price Increase, Oil Markets Will Likely Shift to Undersupply by 2017

Overall, unless prices change, we expect the oil glut to lead to a major shortage starting at some point in 2017. The following chart shows what we expect for oil supply and demand, given the prices prevailing in forward markets. If the price move to change the investment comes too late, the price moves could be large and disruptive.



Appendix: A Brief History of Oil Investment Cycles

Below, we walk through some historical examples of oil cycles to show how oil investment cycles have played out over time, in order to provide some perspective on the current cycle and what we might see going forward. Each cycle brought online new sources of production and diversified where the world got its oil from.



There have been four major investment cycles in the oil market, where high prices have incentivized investment that eventually unlocked new sources of supply. Indeed, in the same way that high oil prices have unlocked unconventional oil sources in the most recent boom, crude oil production was initially developed as an alternative lighting fuel to whale oil, the dominant source of the day, whose price escalated as the result of decades of overfishing. Each oil boom brought on new supply to the market, either from the discovery of new fields or from tapping known fields that previously weren't economically or technologically feasible.

- The first real investment cycle in oil occurred in the 1910s, as the automobile age ushered in a new source of demand for oil. The surge in demand was dramatic—US motor vehicle registrations rose from 0.1 vehicles per 1,000 residents in 1900 to 87 by 1920—and oil prices rose with it, doubling in real terms over the course of the decade. This dynamic incentivized a wave of investment that unlocked new fields in Texas, Oklahoma, California, and Louisiana. All this supply came online at the same time that the Great Depression was hitting demand, and prices fell by more than 70% in the early 1930s.
- Demand growth from WWII, in combination with the discovery of the massive East Texas oilfield (the largest in the US), kicked off an investment boom that lasted decades. During and after WWII, the price of oil was largely government regulated, which limited the degree of overheating and overinvestment. Starting in WWII, this boom saw the development of new sources of production in the emerging world, in particular the USSR and the Mideast. During this time, the US share of global production halved, as supply came online from these new regions. This supply built over time and, in combination with a slowdown in demand growth resulting from the US recession in the early 1960s, pushed the market into surplus. While the US, led by Texas, moderated production in order to sustain flat nominal pricing, the real price of oil declined by a third in the 1960s.
- The OPEC price shocks (in '72 and '79), coupled with a flood of liquidity in the wake of the Bretton Woods breakup, led to a boom in investment in novel resources in Alaska, Russia, Latin America, and the North Sea. However, demand waned in the face of skyrocketing prices, and the market had to work through significant oversupply, with prices falling by 50%. Higher-cost producers cut investment spending in the face of compressed margins and deteriorating balance sheets, and credit problems emerged in Latin America, where governments had not only pushed to invest in new sources of oil but had taken on foreign borrowing to finance this investment.

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