

FUNDAMENTALS

All hail shale?

The disruptive change of the 'shale revolution' has forced existing producers to adapt while reducing OPEC's pricing power. We expect further far-reaching changes to take effect in the coming years.



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As a result of rapid productivity improvements, US shale oil has revolutionised the oil industry. Born out of cheap financing following the global financial crisis, it now challenges the Organisation of Petroleum Exporting Countries (OPEC) as the world's swing producer and has reduced prices to the benefit of consumers. But disruptive

technologies seldom lead to smooth transitions and it's important to understand the risks shale poses both up to 2020 and beyond.

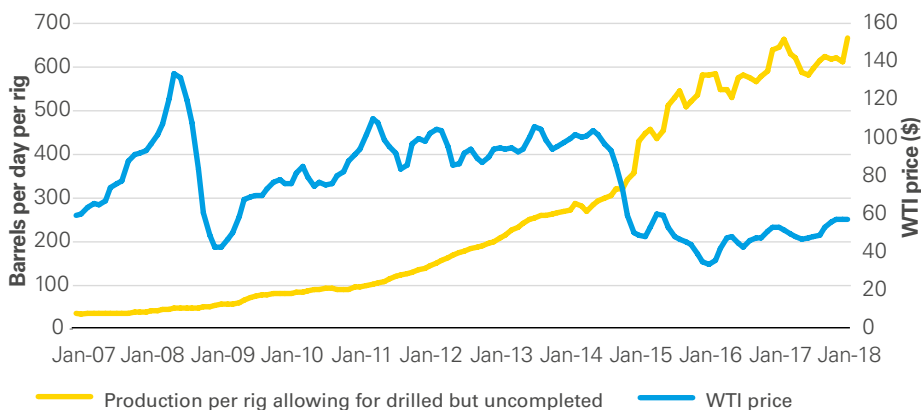
SHALE: BLACK MAGIC?

Shale producers have undergone a rapid learning process due to the nature of extraction. They have been able to continually evolve and

improve as they rapidly drill more wells. Unlocking deposits of shale oil has required two noteworthy technological developments. The first of these is directional drilling: the ability to steer a drill bit onto a horizontal plane to drill along and through a shale deposit. The second is hydraulic fracturing (commonly known as fracking): the ability to use injected fluid under pressure to open up fractures, or channels, through the shale so the hydrocarbon molecules can flow to the well and then up to the surface.

US shale productivity improvements have been continuous and fast since 2007. For example, multi-well pad

Figure 1: High productivity helped US shale survive crude oil price fall



Source: LGIM, EIA, Bloomberg LLP

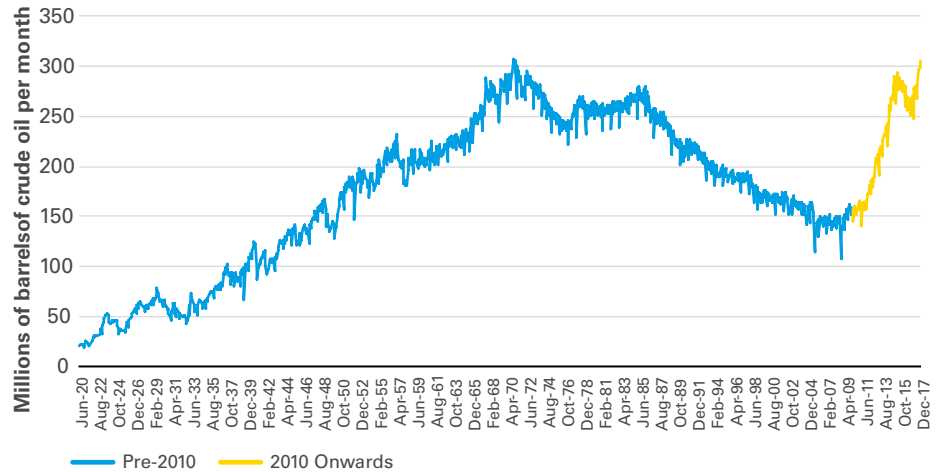
drilling (the practice of constructing multiple wells from a single surface site) radically reduced infrastructure costs while still increasing productivity. So impressive were these rapid productivity improvements, even the 50% crude oil price fall in 2014 and the 75% peak-to-trough fall to February 2016 failed to halt shale's rise.

It is unclear how many more 'step change' innovations lie ahead and there is a high probability of meaningful future innovation and productivity improvement still to come for shale.

A DECLARATION OF ENERGY INDEPENDENCE

Prior to the shale oil disruption, the US was consistently concerned about the dangers of oil dependence, through an over-reliance on oil imports. Oil dependence was a common concern and the military cost of protecting these imports often deemed excessive. The Rand Corporation has estimated that the cost of US forces focused on protecting the global flow of oil was between \$68 billion and \$83 billion in 2009 alone. On account of shale, US reliance on imported oil and petroleum product has halved

Figure 2: Reversing the decline in US supply



Source: EIA

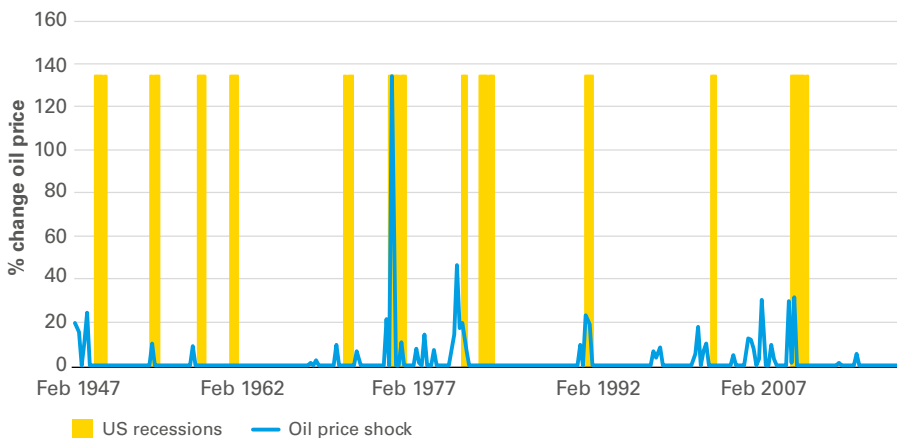
since 2011 and fallen to a degree not seen since the early 1980s. From a sustained period of declining domestic supply, shale production provided a rapid path to temporary energy independence.

In the space of less than a decade, shale has upended the state of energy geopolitics. The foreign policy implications of dramatically increased energy independence include less need to accommodate other producing countries' leaders, a reduced chance of consumer price disruption and increasingly competitive US petroleum products. Shale has opened a lot of new doors

for the US, including potentially selling a large proportion of the emergency fuel storage of petroleum, the Strategic Petroleum Reserve¹.

The benefits of shale go beyond potential energy independence for the US; shale's rapid response and scale means it's become an effective swing producer that can react to higher oil prices and help counteract them. This is crucial as it reduces the risk that high oil prices contribute to recessions in the US, the world's largest economy, and elsewhere. A report from the Federal Reserve Bank of St Louis showed that positive oil price shocks preceded or coincided with almost every US recession post-World War II (see Figure 3). Oil price volatility affects key parts of the US economy including fixed investment, consumption, employment and the unemployment rate². One of the most important effects of the shale revolution has therefore been the market balance it provides, a necessary counterweight to the price setting power of oil production juggernaut OPEC.

Figure 3: Oil price shocks and their influence on US recessions



Source: Macrobond, St Louis Fed, NBER Business Cycle

1 Budget for the U.S. Government, A New Foundation for American Greatness, Fiscal Year 2018, Office of Management and Budget
 2 Federal Reserve Bank of St. Louis Review, November/December 2005, 87(6), pp. 669-83

OPEC: THE ELEPHANT IN THE ROOM

OPEC’s ability to act as a swing producer, increasing and decreasing supply to avoid excessive price swings, has had broad benefits for the oil industry. Oil demand at any point in time is insensitive to price, which could hypothetically have led to long-term supply overhangs had OPEC not stepped in to react; this in turn could have limited investment and the long-term availability of oil at acceptable prices.

However, OPEC’s support of oil prices has led to significant real oil price rises and eventually encouraged shale and other oil investors to intervene, finally leading to downward price pressure.

Alarmed by increased supply and falling prices, OPEC changed strategy in November 2014 with the aim of increasing market share at the expense of higher cost producers. It successfully reduced investment by both traditional and shale producers, but failed to stem production as much as anticipated due to cost deflation and shale productivity improvements.

Figure 4: Real oil prices increased by over 200% in the fifteen years before shale’s emergence



Source: Macrobond, St Louis Fed, NBER Business Cycle

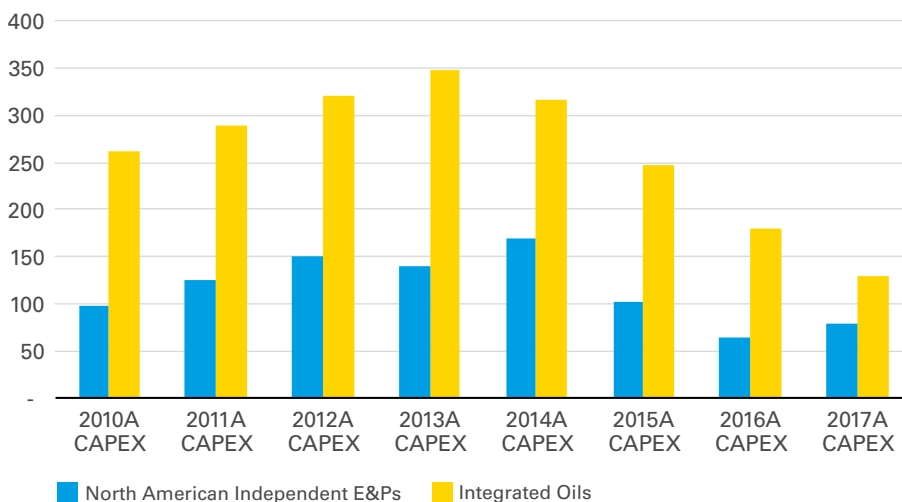
WHAT COULD DERAIL THE REVOLUTION?

The nature of shale production is very different to conventional oil wells. Conventional wells require many years of planning and preparation but keep producing for a long time. Conversely, shale oil wells can be drilled relatively quickly but after an initial burst of production in the first year, wells soon decline. Shale oil production is therefore dependent on continuous short-term capital investments and drilling a significant number of wells each year to replace lost production.

The conditions for shale oil capital have been strong thus far. The revolution coincided with a sustained period of low interest rates and easy liquidity. In a world of gradual monetary tightening, however, a reduction in the available capital could have an almost immediate and outsized effect on shale production volumes. There was evidence of this in 2016 when lower prices put strain on shale producers, increasing their capital costs and reducing production.

Apart from the risk of lower prices, future shale costs are likely to rise for additional reasons. Currently most shale companies reinvest their revenues, to sustain production and unlock further productivity improvements. The aim is that it will lead to more long-term shareholder value. As the industry matures, though, there will likely reach a point where investors want dividends and in turn that increases the breakeven cost for producers.

Figure 5: Falling capital expenditure spending



Source: Bloomberg LLP

TREADING A DIFFICULT PATH

To date, the benefits of shale for the US and global oil consumers have been clear. However, given shale producers’ incentive to step in whenever prices rise, the future path that global oil producers must tread is fraught with danger. Since December 2016, oil price volatility has collapsed thanks to an OPEC deal with Russia to jointly limit production. However, given likely production growth elsewhere this deal will need to be extended to keep prices supported through the next few years; if not, then a return to volatility and increased strain on producers’ fiscal positions and stability will be likely.

Production not originating from OPEC or shale wells (‘non-OPEC non-shale’ or ‘NONS’) is the most predictable source of oil production over the medium term. Unless there are unexpected supply disruptions, production is largely a function of how quickly oil production at existing wells declines, coupled with new projects that are completed. It is estimated that already sanctioned or producing projects will add eight million barrels of oil per day (mbd) – about 8% of global oil demand – by 2020.

That implies limited ability for shale and OPEC to grow production until the next decade. With shale seemingly able to produce at ever lower breakeven prices that will likely test OPEC’s resolve and potentially

lead to the end of their production cuts and renewed volatility and downward price pressure.

Beyond 2020, the opposite risk exists, that there are production shortages as existing NONS producers limit investment in new projects given lower prices and uncertainty over future long-term demand due to renewables and environmental concerns over plastics. In due course, the short-term benefits of shale could then undermine the long-term availability of oil at current prices, as well as leave consumers reliant on US shale and its associated financing needs.

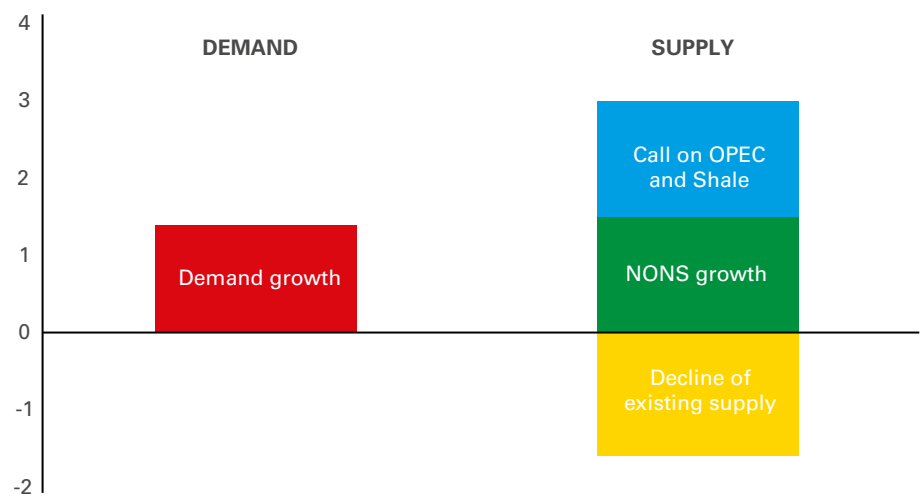
THE DUAL IMPACTS OF DISRUPTIVE TECHNOLOGIES

The shale revolution seen over recent years has been a testament

to the power of technological productivity improvements. In the short to medium term, shale oil has provided a positive supply boost that limits OPEC’s control over the market and can reduce the cost of this vital commodity. For the next few years then that will likely continue to be the case, as long as shale remains viable and capital continues to flow into the industry.

However, over the longer term its benefits are less clear-cut. The disruptive impact on traditional oil producers risks undermining their long-term investment. As a result it could be that beyond 2020 the market becomes dependent on shale and predictable, traditional sources of production are displaced, making production much more reliant on short-term US financing conditions.

Figure 6: The annualised call on OPEC and shale to balance oil supply-demand to 2020



Source: LGIM, for illustrative purposes only

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