

Is the Shale Revolution Here to Stay?

by Xander Snyder - May 15, 2019

Summary

U.S. shale oil is a booming business. As it drives up global oil supply and puts downward pressure on oil prices, U.S. production of shale oil poses a geopolitical threat to other oil-producing states. But critics say that the boom won't last. If true, that changes the geopolitical calculus.

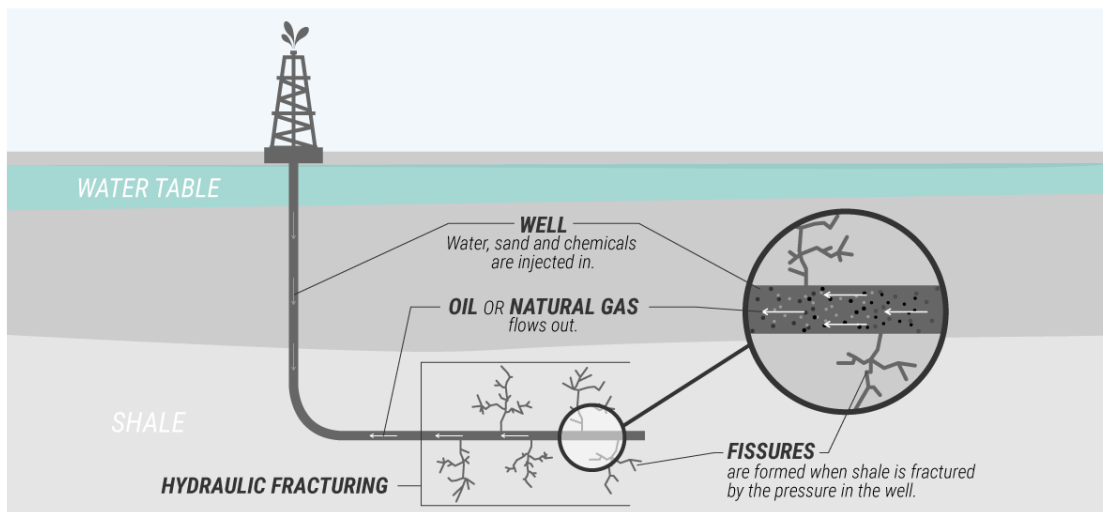
How much longer will shale oil be a booming business? The answer to that question, while fuzzy, has long-term geopolitical implications. U.S. shale oil production has grown steadily, putting downward pressure on the global price of oil. We've written before about the **power of shale oil** and the **impact it has on other geopolitically important oil producers** like Russia and Saudi Arabia, which rely heavily on oil revenue to either fund their government spending or support their economies. Our forecasts for these countries are built in part on the assumption that, as the global supply of oil increases, its price will hit a ceiling that could strain these countries' public finances, which in turn would have political ramifications. But shale skeptics maintain that the industry is not sustainable. If they're right, and if the shale industry were to die out in the next couple of years, tanking oil supply and spiking oil prices, the geopolitical calculus for Russia and Saudi Arabia would change substantially.

The critics' argument is threefold. First, they claim that the shale boom depended on huge amounts of debt that was doled out without serious consideration for whether shale producers would be able to pay it back. Second, critics are worried that there's less shale oil available than originally believed, reflected in shale wells' depletion rates. Third, they see limited room for growth in the profitability of shale production as shale's break-even price has stagnated. Combine these factors, the critics say, and you get an industry that will not endure. This Deep Dive will take a closer look at these criticisms and explore whether, in fact, U.S. shale really is an economically sustainable industry.

Shale: A Primer

To understand the criticisms of the industry, it's important to understand what shale is and how oil is extracted from it – a technically complex and expensive process. Shale rock, embedded thousands of feet under the Earth's surface, is less permeable than other types of rock. And yet it's here that shale oil, or "tight oil," is found. The extraction process for this oil is known as hydraulic fracturing – or "fracking" – and it requires drilling down to the shale deposits, and then drilling horizontally through the rock. The drillers then inject a water-based solution at high velocity to break apart the rock, creating fissures through which oil can flow. (This process can also be used to extract natural gas from shale deposits.)

Shale Extraction Process



Note: Fracking process simplified; illustration not to scale.
Sources: BBC, Al Granberg

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The U.S. shale industry really took off in 2009. Thanks to the United States' extensive shale formations, it has benefited hugely from the shale revolution. The combined technologies of hydraulic fracturing and horizontal drilling vastly increased the productivity of shale wells, and overall U.S. oil production has increased apace. In 2018, the U.S. produced an average of nearly 11 million barrels per day of crude oil, almost 60 percent of which came from shale. It's helped the U.S. surpass Russia and Saudi Arabia in the production of hydrocarbons and is pushing the U.S. toward becoming a net energy exporter, a benchmark it's expected to reach next year.

Financing: The Catalyst

Financing was, in many ways, the engine that drove the rise of shale oil, but the industry's reliance on debt has also threatened to bring it down. In the wake of the 2008 financial crisis, interest rates fell,

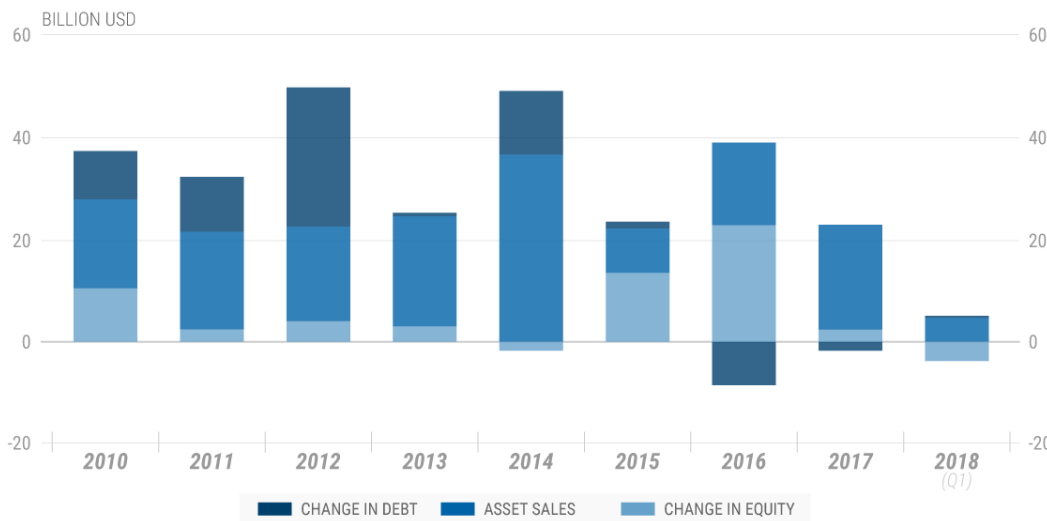
making debt cheaper and borrowing easier. In the low-interest rate environment, investors were looking everywhere for yield. Shale looked particularly appealing for debt investors since reserves could be used as collateral – if companies failed to pay their debts, the banks could simply take control of the reserves. This created the appearance of added security.

The availability of cheap, accessible debt coincided with two other important moments that created a turning point: skyrocketing oil prices and technological developments that had made the economics of shale drilling viable (though still expensive). Shale production took off, reversing a decadeslong decline in U.S. oil production that had begun in the 1970s.

Debt, however, is a double-edged sword. In exchange for immediate access to capital, firms assume higher operating costs down the road. This can lead to firms becoming over-leveraged as they assume so much debt that they cannot afford to both pay off the debt and pay regular operating expenses. So when oil prices tanked in 2015-16, many over-leveraged companies went out of business, causing U.S. oil production to drop from about 9.4 million bpd in 2015 to 8.8 million bpd in 2016. Notably, this was not an accident. Global oil supply had been climbing thanks to shale production. When supply is too high, OPEC typically cuts production to drive prices back up. But in 2015-16, OPEC chose not to cut supply, hoping that low prices would drive shale producers out of business and thus allow OPEC countries to reclaim market share they had lost to shale.

This downturn threatened to prove right concerns that, without high oil prices and access to cheap, plentiful debt, shale is not an economically viable industry. Companies had taken on unsustainable amounts of debt to fuel growth. When interest rates began to climb, the need to service that debt was a further incentive for shale companies to continue production – even if operations were barely or not at all profitable. These firms’ lending used to set up new wells created debt service expenses, which led to total operating expenses exceeding cash coming in from operations for too long; if interest rates had continued to rise, the entire industry would be, if not sunk, at least forced to slow production. This was not lost on debt investors, who of course feared that bankruptcies would wipe out most of their investment. As oil prices fell, access to debt capital decreased, forcing cash-strapped shale companies to turn instead to equity financing (that is, to issue more stock).

Sources of Financing for the U.S. Shale Oil Industry



Source: IEA

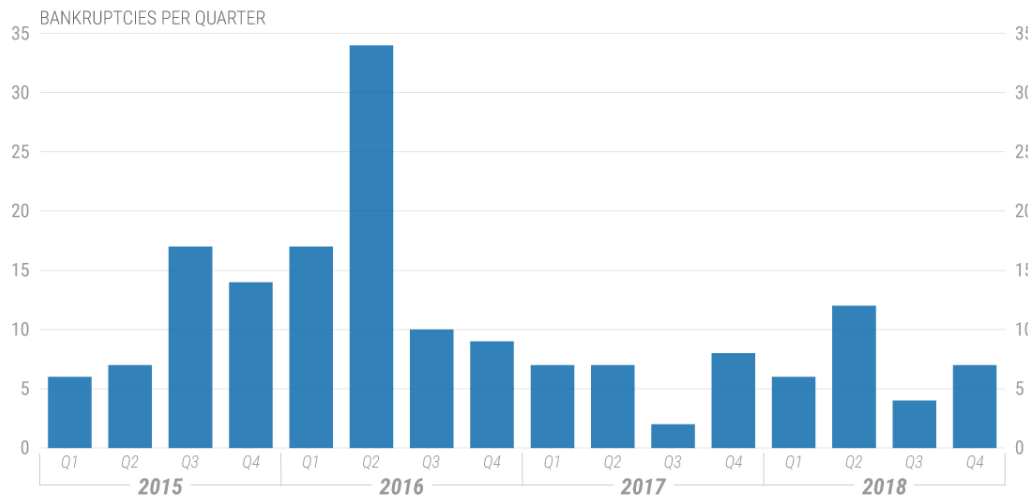
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Bankruptcies did, in fact, increase substantially when oil prices plummeted in 2015-16. Banks, as they are wont to do, had offered loans based on current or recent conditions, without consideration for what would happen when oil prices dropped – an inevitability in a cyclical industry like oil. Meanwhile, larger companies bought up the assets of the smaller, less efficient ones, leading to industry consolidation.

But the cycle continued, despite OPEC’s best efforts to keep prices down long enough to destroy the shale industry, and conditions improved. As a number of companies went bankrupt, oil supplies decreased, and prices rose once again. The companies that survived were forced to cut their capital expenditures, which actually led to an improvement in cash flow. Since 2016, bankruptcies have declined significantly.

North American Oil and Gas Producer Bankruptcies



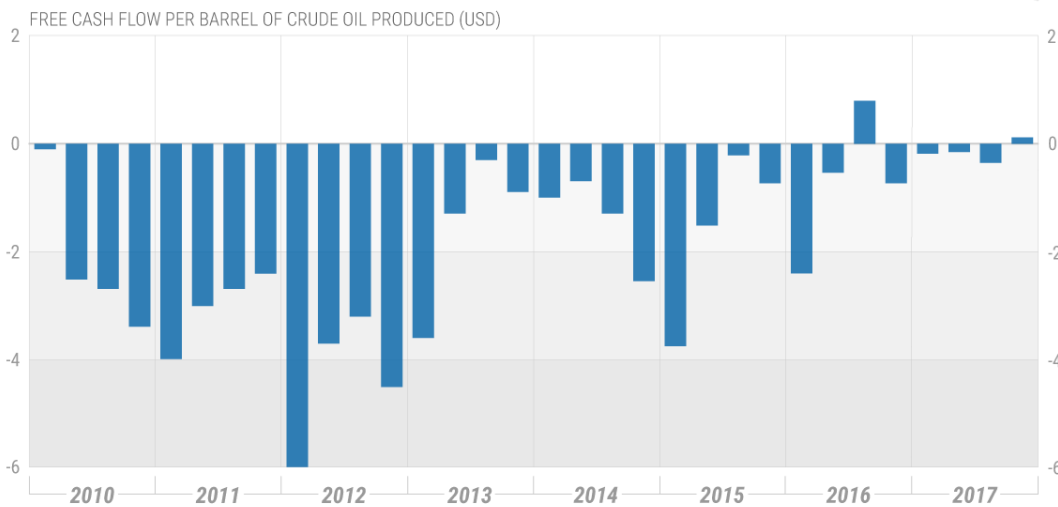
Source: Haynes and Boone - Oil Patch Bankruptcy Monitor

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Still, some industry observers continued to insist that the economics of the industry itself – not just of individual companies – were fundamentally unsustainable because they relied too heavily on debt. They claimed that debt was not just one factor in shale’s growth but in fact the decisive factor. Without it, they said, the industry couldn’t survive, because total expenses, including debt services fees, would continue to exceed revenue. Since 2016, however, shale drillers have moved toward positive, or at least neutral, cash flow. As of early 2018, a greater share of shale companies was beginning to cover the cost of new wells with operating cash flow, rather than debt. Rystad Energy, an oil and gas market research firm, anticipates that in 2019 shale drillers will generate enough cash to cover capital expenses and pay dividends, though just barely.

Climbing Out of the Shale Oil Money Pit



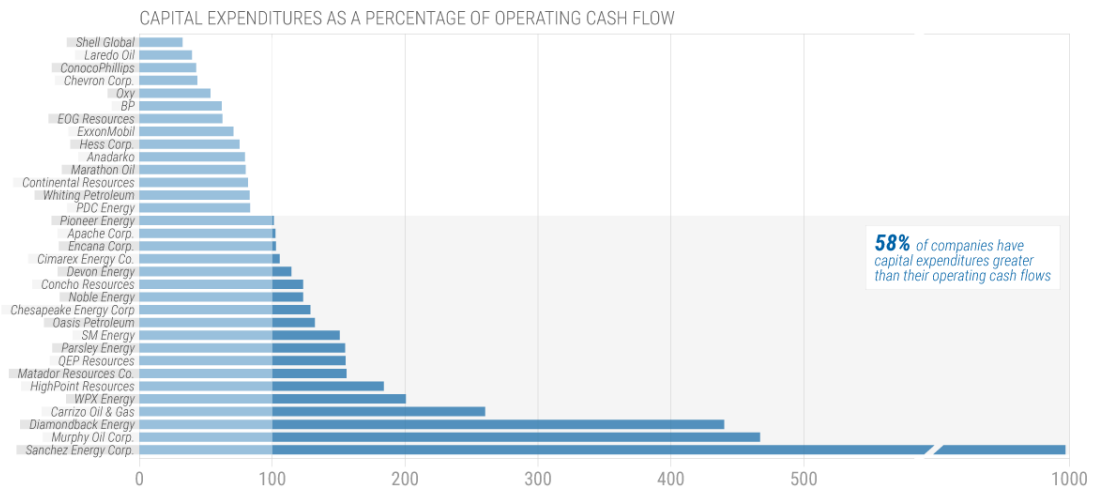
Note: Data produced from a sample of leading U.S. shale companies.
 Sources: Financial Times, Wood Mackenzie

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If shale companies have enough cash remaining to pay dividends – even just a little bit – it’s a sign that they have enough cash on hand to better pay their debts. As of the fourth quarter of 2018, about 40 percent of companies in a 33-company sample of shale producers were cash-flow positive. To be economically viable, more companies will need to at least break even – in the case of shale, that means they need to generate enough cash from operations to cover their operating expenses without external capital.

Cash Flow in the U.S. Oil Industry



Note: Data sample from the fourth quarter of 2018
 Source: Company filings, GPF Analysis

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So, while a good number of shale companies do seem to be in precarious financial situations, many are trending toward positive cash flow. And just because some companies are at risk of going out of business doesn’t mean that shale oil production will cease. Truly cash-strapped companies can sell their assets to major international oil companies that have diversified revenue streams and can keep shale machinery offline until oil prices rise. In other words, as time goes on, the shale industry will mature and, like any industry, experience both bankruptcies and consolidation as some companies prove to be more efficient operators than others.

Oil Reserves: Estimating What’s Out There

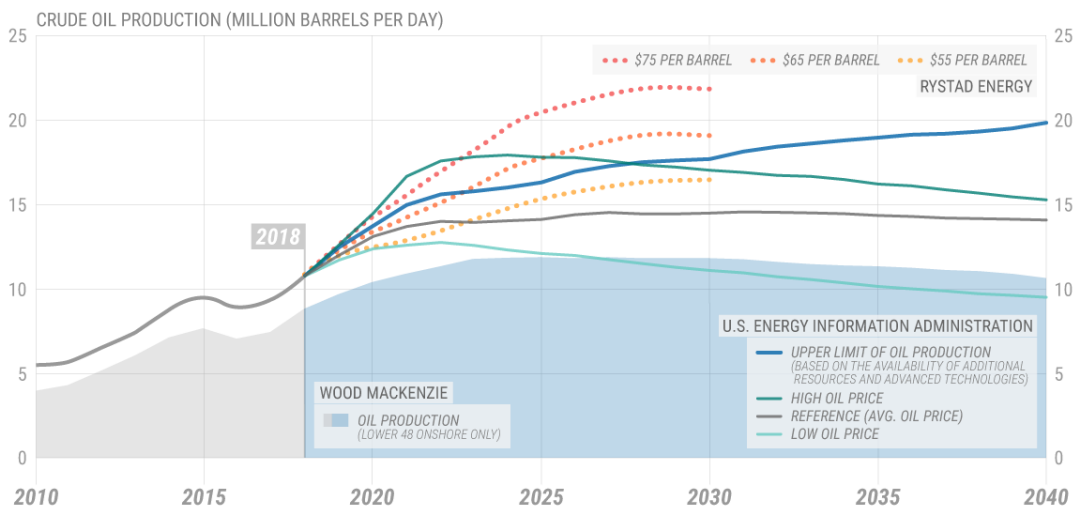
But it's not just financing that shale skeptics criticize. They're concerned, too, that shale companies substantially overestimated their reserves. They're not wrong; many oil companies have had to revise their total reserve estimates downward, and it seems their initial overestimations were directly related to the question of financing. If companies had higher reserves – a form of collateral – they could take on more of the debt they needed to get underway. Similarly, when debt financing dried up in 2015-16 and companies started to issue stock, they overestimated their reserves so that it would be easier to raise money from investors.

How were oil companies able to convince banks and investors that their oil reserves were larger than they actually were? Oil-producing companies in the U.S. are required to file with the Securities and Exchange Commission estimates of their “total proven oil reserves” – the reserves for which there is a 90 percent chance that the oil will be recovered. But as the fledgling shale industry was starting to raise money, companies began to use a metric called “estimated ultimate recovery” instead. EUR simply refers to existing reserves, without indicating the likelihood of recovery. The metric is also based on the assumption that, as time goes on, companies would be able to replicate their early success – that additional wells would produce as much as already tapped wells. In retrospect, this was flawed logic; the initial wells are almost always the most productive ones. Shale drillers also assumed they could pack shale wells close together. But packed too tightly, the wells would pull from shared reserves, decreasing the amount that each could draw. Both assumptions contributed to overly optimistic EUR numbers.

In response, investors are now scrutinizing shale producers' claims. They began by questioning shale companies' estimates of their reserves – and therefore whether they were worth investing in – and have started pushing for greater accountability in firms' capital expenditures and demanding higher returns. As a result, shale companies are now exercising more oversight of capital expenditures, cutting spending, moving toward positive cash flow, and using that cash flow to return dividends to investors or to buy back shares. All of this is bolstering the economic sustainability of the industry.

Shale producers' estimates affect more than just financing. Market research firms and the U.S. Energy Information Administration (which is responsible for collecting and reporting economic data on the energy industry that is used in policymaking and economic forecasting) take into consideration the reserve estimates that companies put out. Historically, forecasts of U.S. shale oil production have been outstripped by actual production, and current forecasts are almost uniformly positive – the EIA and industry consulting firms Rystad Energy and Wood Mackenzie all anticipate substantial increases in oil production over the next 10 years, even with lower oil prices. That's good news for the shale industry – even with more conservative estimates of their reserves, shale oil isn't going anywhere.

Long-Term U.S. Oil Production Forecasts



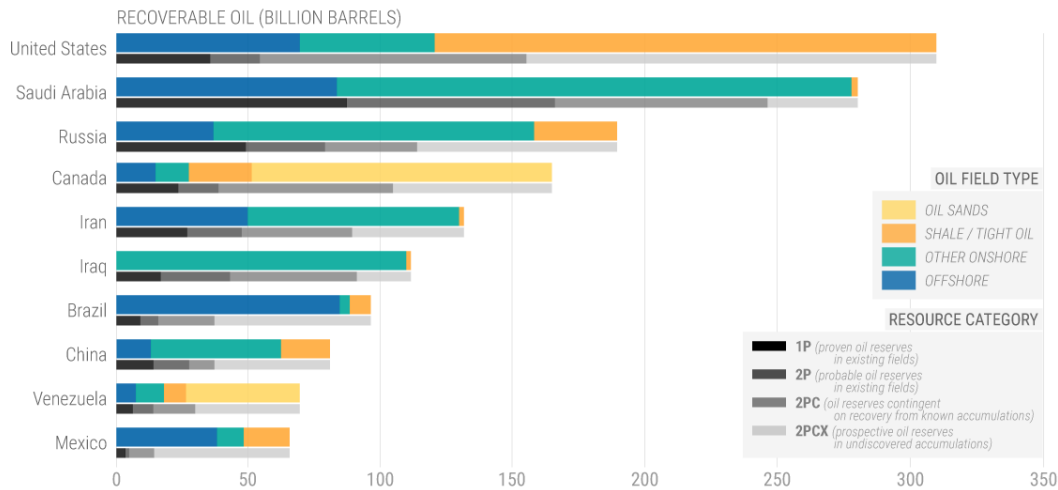
Sources: U.S. Energy Information Administration (EIA), Rystad Energy, Wood Mackenzie

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The industry also stands to benefit from pipelines scheduled to come online in late 2019 and early 2020. Production has been constrained by a lack of transportation infrastructure in the U.S., and these pipelines will facilitate transport of resources from the Permian Basin, the source of nearly one-third of U.S. oil output, to refineries and export centers in places like the Gulf Coast. It seems shale oil production will continue growing, though at a somewhat slower pace than the industry initially anticipated.

Global Oil Reserves



Note: Top ten countries listed.
 Sources: Rystad Energy - UCube

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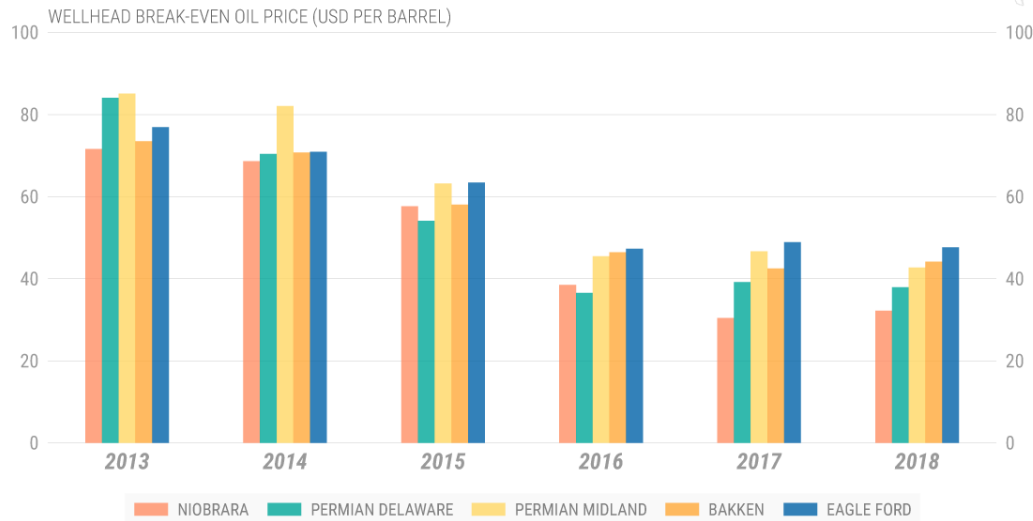
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Supply and Profitability: The Geopolitical Question

Ultimately, what affects geopolitics is not the durability of one shale company or another – it is the price of oil and whether the supply of oil continues to increase. And even if the growth in U.S. shale oil production slows, the industry will likely persist for at least the next decade. Skeptics have questioned the shale industry’s ability to sustain high levels of production since it took off over a decade ago. But U.S. production has often outperformed forecasts, and we have to keep this in mind when examining claims that the shale industry is not financially viable.

One of the primary concerns here is the industry’s profitability. As the industry has grown and matured, the break-even price per well has come down. But some doubters claim that there are fewer gains to be made through technological advances. If true, this would mean that the break-even point will not come down much further, leaving little room for growth in the profitability of shale. This may be a valid criticism. But that still puts the profitable oil price for a lot of shale companies well below Saudi Arabia’s fiscal break-even point (the point at which the government can balance its budget), which the International Monetary Fund says is currently about \$80-\$85 per barrel.

The Cost of Profitable U.S. Shale Oil Production



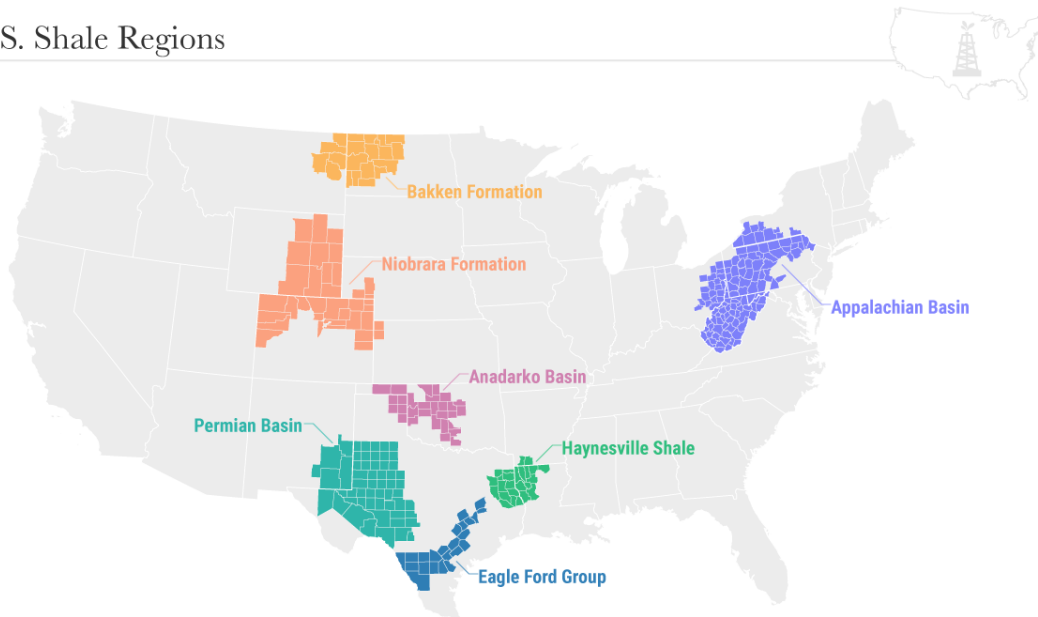
Sources: Rystad Energy - ShaleWellCube

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Another, more convincing critique examines the relationship between long-term supply and profitability. It's based on comparing production rates in the Bakken Formation and the Eagle Ford Group, some of the earliest shale basins to be tapped, with the Permian Basin, whose development only took off in 2013. The U.S. has seen net oil production gains since 2016, and much of those gains were from new wells, especially in the Permian Basin. Meanwhile, however, production in Bakken and Eagle Ford has declined following the 2015-16 downturn. (Eagle Ford has stagnated, while Bakken has only recently inched above its pre-2015 production levels.)

Key U.S. Shale Regions



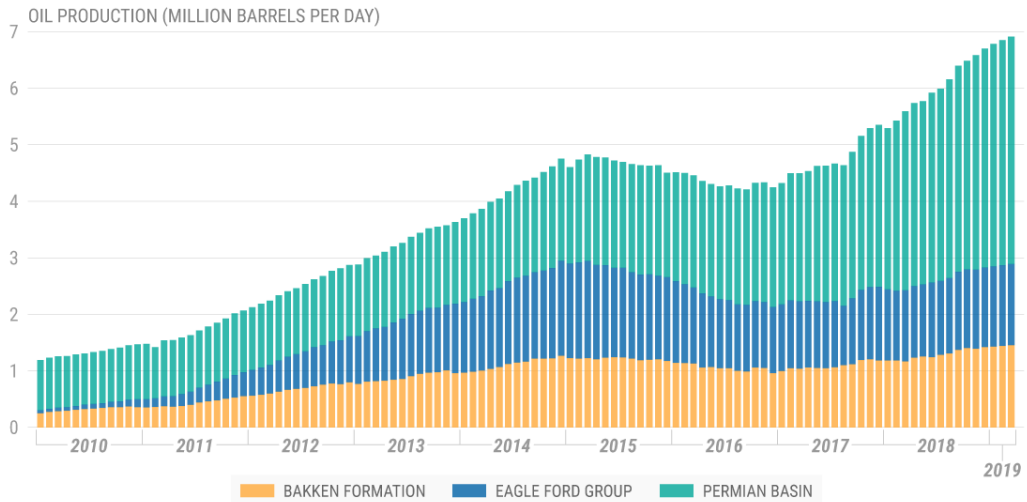
Sources: EIA - Drilling Productivity Report

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Since Eagle Ford and Bakken are older discoveries than the Permian, critics suggest that the former are more representative of what shale basins will be capable of producing after several years of drilling, and that those production levels will be much lower than following the initial discovery, when only the choicest wells were being drilled. The Permian’s production has an outsize effect on total U.S. production. If it follows the trend of its predecessors, that effect would be problematic.

Bakken, Eagle Ford and Permian Oil Production



Sources: EIA - Drilling Productivity Report

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New wells usually produce more oil at the outset, and the rate at which oil flows thereafter is called the decline rate. The Permian’s decline rates are rising faster than expected. Take, for example, Wolfcamp – one of the drilling areas within the Permian Basin. When drilling in the Permian got underway in 2013, observers expected decline rates of 5-10 percent; but Wolfcamp’s rate is now closer to 15 percent annually. Shale companies will need to drill more wells just to keep producing the same volume of oil. If Eagle Ford, Bakken and Permian production all stagnate or decline, that could constrain the amount of oil the U.S. is able to produce in the long run.

That’s assuming no new reserves are discovered. But, in fact, new reserves are discovered often – even in the Permian itself. In December, the U.S. Department of the Interior reported that the Permian’s Wolfcamp and Bone Spring Formations contain the most oil and gas resources of any location ever assessed. Still, that was not an assessment of proven reserves – those that can be recovered using existing technology – but rather of undiscovered reserves – defined by the department as “resources postulated, on the basis of geologic knowledge and theory, to exist outside of known fields of accumulations” – and technically recoverable reserves – defined as “resources producible using currently available technology and industry practices.” For now, companies are poised to continue producing enough to fuel growth in U.S. oil production. But if Permian production

stagnates, they may well have to keep finding more reserves – and ways to extract them – to make it last.

What's Ahead for Shale

The cycle of the oil industry goes on. Demand for oil may decline as countries shift toward fuel-efficient and electric vehicles. But demand for petrochemicals (chemical products for which oil is an input) will continue to grow as more people in the world's most populous countries – namely, India and China – move into the middle class. The growing demand for oil will drive prices up, enabling shale drillers to increase production and, therefore, producers to rely less on debt – and even to start paying dividends.

It's no surprise, then, that countries that rely heavily on the oil industry are having to rethink the underpinnings of their economies. (Saudi Arabia, for example, is working to reconfigure its economy to depend less on oil.) The U.S. could also become energy independent, which could have significant geopolitical implications.

The combination of hydraulic fracturing and horizontal drilling, which paved the way for the shale revolution in the U.S., is out of the box and can't be put back in. The technology will continue to allow the U.S. to produce large quantities of oil for the foreseeable future. Shale isn't going anywhere – and it will have a major influence over the global economics of oil for at least the next decade.

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