The U.S. Shale Boom Takes a Break

Life as the World’s Swing Producer

By Jim Krane and Mark Agerton

Texas used to be the world’s swing producer of oil. In the first half of the twentieth century, the Texas Railroad Commission enforced production quotas to balance markets and keep prices and profits stable. Texas lost that job to OPEC in the 1970s, though, and never gained it back—until now.

The momentous shift became evident in the weeks after OPEC’s November decision to hold oil production steady in the face of weakening prices. It was time, Saudi oil minister Ali Naimi said, for another producer to idle his rigs. With Saudi Arabia standing firm, prices plummeted. Crude lost half its value between June and December 2014. Within a few weeks, it became apparent that someone would heed Naimi’s command, and that OPEC’s do-nothing strategy would succeed, at least in the short term.

Starting in January, scattered roughnecks toiling on thousands of dusty pads across the Middle American heartland began moving rigs into storage, cutting back on well drilling, and, in doing so, bringing less new oil to market. The cutbacks only accelerated through February and March. Estimates show that new volumes of American oil coming onstream continued to drop, albeit at a slower pace than the steep cutback in drilling.
A few years ago, low prices would have induced Saudi Arabia to shut off a few valves in Abqaiq. Today, it is U.S. producers that are reducing investment. The effect is the same. Prices of West Texas Intermediate crude, the U.S. benchmark, climbed 14 percent during April. What is exceptional in this story is that shale producers were willing—and able—to reduce their activity so quickly, so collectively, and without the intervention of cartel bosses or a regulatory agency. This time around, the world’s oversupplied oil markets are getting respite because thousands of competitive firms, all of them small players compared to the national oil giants in OPEC, are reacting to market signals.

Across the continental United States, estimates of new oil production show a 30 percent decline, from about 570,000 barrels per day (bbl/d) in November 2014 to just under 400,000 bbl/d five months later, in March 2015. Drilling has dropped even more, by 45 percent, from around 1,750 wells drilled in November 2014 to some 970 in March. Drilling was down by 23 percent in January alone, as oil prices tested new lows.
The shale industry’s timely reaction is a product of its unique characteristics. In terms of complexity and longevity, shale is like blackjack. You bet in hopes of a quick payoff. If you succeed, you bet again. In contrast, conventional oil, with its multi-billion-dollar mega-projects that play out over decades in ever-wilder geography, is more like a pinochle tournament.

With shale, project and investment time frames are short. There are low barriers to entry, and, as the slowdown indicates, low barriers to exit. Some 60 percent of U.S. rigs have been idled since last summer, mostly in the shale plays. That kind of reaction is impossible for, say, a deepwater offshore platform that keeps producing no matter what because the cost of shutting it down is enormous.

Shale wells are also characterized by steep declines in production volume over time. That means companies invest in real time, drilling and producing oil when prices warrant. When prices are too low to support drilling, oil production is soon strangled by the natural limits of fluid flows within low-porosity rock. Without constant investment, the shale game winds itself down.

The rising prominence of shale in oil sector, then, heralds a new economic dynamic—one in which the short-run U.S. supply response to price fluctuations is much more elastic. All else constant, that means oil markets can rebalance more quickly and avoid some of the more dramatic price swings from shortage and oversupply.

SHALE SLOWDOWN

To tell this story, we combined two primary data sources, both of which provide mutually reinforcing indicators of upstream investment.

Data from the Austin-based analytics firm Drillinginfo track new onshore wells that have been drilled across most of
the lower 48 U.S. states since May 2014. The Drillinginfo index predicts peak monthly production from each new well by averaging actual results from neighboring wells. The index thus provides a short-term indicator of drilling activity and probable output at precise locations.

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It is worth emphasizing that Drillinginfo estimates maximum monthly new oil production that is likely to flow from a given well drilled in a given month. This “new production” is a fraction of overall U.S. oil production. Thus, even if the index showed zero new production for March, production could still rise, as wells drilled earlier in the year come online. Given the recent spate of drilling wells that are left uncompleted, data for recent months may actually overestimate production.

Our second source, the standard Baker Hughes rig count, details the number of drilling rigs operating in each U.S. county in a given week. Rigs are classified as drilling for either oil or gas with either horizontal or vertical wells. The rig count comprises the industry’s main indicator of activity, despite offering no indication of the number of wells drilled or expected production.

Among major oil-rich shale plays, the reactions to OPEC’s late-November decision appeared first in the Permian Basin of West Texas and the Bakken formation in North Dakota. New production in January was down eight percent from December in the Permian and 11 percent in the Bakken. (In the smaller Niobrara play in Colorado, new production in January was 17 percent below that of December.) By contrast, the falling price of oil did not appear to affect production in South Texas’ Eagle Ford formation. There, predicted new production rose by nine percent in January over the previous month.

By March 2015, however, falling global oil prices had undermined activity in all three major light tight oil plays—the
Permian, Bakken, and Eagle Ford—by nearly equal amounts. Each play saw predicted new production drop by 24 percent below previous levels in May 2014.

It bears emphasizing that the monthly drop in new oil production, where it applies, represents a slowdown in growth, not a decline in overall U.S. oil production. For now, production growth is occurring at a decreasing rate. However, the U.S. Energy Information Administration (EIA) forecasts that overall onshore U.S. production will shift into decline sometime in the current quarter because of low returns, dwindling credit availability, and few prospects for the resurrection of high oil prices.

Other signs of a slowdown are evident in the falling rig count, as well as rising average well productivity. Data from Baker Hughes show the number of U.S. rigs drilling for oil plunging from nearly 1,600 on November 26, 2014 just before the OPEC decision to just over 650 this May—a drop of nearly 60 percent.

At the same time, productivity was up by 13 percent in horizontal oil wells of the sort that dominate in shale. On average, Drillinginfo’s predictions of peak production from new oil wells have risen from roughly 500 bbl/d apiece in May 2014 to 560 bbl/d in March 2015. Rising well productivity is another sign of firms altering their activity due to price pressure, shifting away from low-producing wells in non-core areas and concentrating on their best.

BARE BASINS
Among the major U.S. oil formations, the earliest fall-off in drilling appears to have occurred in the Permian Basin. After a strong October, a steep 65 percent reduction in vertical drilling took place, from 364 oil wells drilled in October to 129 in March 2015. Many of these vertical wells are in the eastern Permian’s Midland Basin, where production is linked to vertical “infill” wells drilled into mature fields, some of which were part of enhanced oil recovery operations. Vertical infill wells are relatively simple and inexpensive to drill, which allows producers to pull back production when prices drop. Producers had been reducing vertical drilling before November 27, 2014, but the declining rig-count accelerated markedly immediately after the OPEC decision.

Horizontal drilling in the Permian remained on the upswing until January, when it, too, began to decline. By March 2015, horizontal drilling was down by 32 percent from its peak in December 2014.

Production in the Permian was an early casualty of the OPEC decision, down 24 percent overall between May 2014 and March. However, estimates of new production from vertical wells dropped by a much larger 57 percent, with
horizontally drilled wells down by just 15 percent over the same period.

The Eagle Ford shale of South Texas was initially at an advantage given its proximity to transport infrastructure and Gulf Coast refineries. Drillinginfo data show that predicted new oil production actually increased in December and January, when other regions were beginning to pare back. However, as low prices persisted, drilling and new production fell dramatically. From February to March, oil-directed drilling in the Eagle Ford dropped by 33 percent, from 250 wells to 167 wells. New oil production dropped by 28 percent.

The story in the Bakken Formation, concentrated in North Dakota, also reveals a steady downward trend in drilling and new production. Between last June and March, 45 percent fewer wells were drilled, and new oil production was down by nearly 40 percent. The fall-off in drilling between January and February was particularly steep.

The North Dakota Department of Mineral Resources’ mid-April report describes an atmosphere of continuing decreases in the number of operating rigs and well completions. Due to the high cost of shipping oil to market from
North Dakota, crude prices at the wellhead hovered just above $30/bbl at a time when West Texas Intermediate was selling above $55 in Cushing, Oklahoma. “Oil price is by far the biggest driver behind the slowdown,” the report states. “Operators report postponing completion work to avoid high initial oil production at very low prices.”

Decreases in oil production and drilling rates are also in evidence in some smaller tight oil plays, as well as areas that lie outside the boundaries of the major shale formations.

![New Oil Production from Minor Plays](https://www.foreignaffairs.com/articles/united-states/2015-05-26/us-shale-boom-takes-break)

Four areas in particular underwent sharp declines in wells drilled and new oil production, Drillinginfo data show. Those were the Eaglebine formation in East Texas, the Mississippian Lime formation in Kansas and Oklahoma, the Granite Wash in Oklahoma and Texas, and areas that comprise locations outside of defined formations.

OIL’S WELL

The statistics tell the story of shale’s quick reaction to market signals, driven by OPEC’s decision to hold onto its share of the market, rather than prop up oil prices on behalf of competing producers. There are solid economic and geologic reasons why North American shale oil is well-suited to this swing role, but these should be tempered by caution that production might not fall as much as OPEC and other competitors might hope.

A number of factors have allowed shale producers to stubbornly continue producing in the face of lower prices. Costs of oilfield services and land have come down, which has allowed some operators to keep fracking. In addition, some firms have hedged production or sold volumes forward, which insulates them against current prices and requires them to keep drilling. Likewise, some producers remain at work because they have already paid crews or find it costly to cancel contracts.

Finally, wells drilled in different parts of a formation produce different quantities of oil. Wells in “sweet spots” might remain profitable at prices that bring layoffs in the neighboring county. Firms are incentivized to cut their most profitable projects last. This phenomenon is borne out in the data: The drop in new production is smaller than the fall in drilling. Put another way, falling prices have driven up average well productivity.
At any rate, the U.S. shale sector has been an early responder to energy prices driven down by OPEC’s November decision. Few other producers have responded the same way. Among those which have scaled back, only the slowdown in Canada's shale basins appeared related to falling oil prices.

The swing producer role held by Saudi Arabia since the mid-1970s appears to be in flux. At times when the Saudis decline to adjust production in line with market signals, that role may revert to higher-cost areas of production, including North American shale.
In contrast to the production quotas orchestrated by OPEC—and in an earlier era, by the Texas Railroad Commission—the ongoing response is being driven by independent actions of many firms responding to price signals. But U.S. shale will probably be unable, by itself, to assume the mantle of global swing supplier. For one thing, U.S. crude tends to serve domestic markets; producers are currently prohibited by law from exporting U.S. crude oil. For another, falling costs have allowed firms to reach profitability at lower prices. The CEO of one shale producer announced in May that steady oil prices of $65/bbl would allow his firm to resume production in Texas and North Dakota.

The price-responsiveness of shale production may include yet another benefit for oil producers. It might help to reduce the duration of the current bust. By contrast, the last oil downturn extended for nearly two decades, between the mid-1980s and early 2000s. It was exacerbated by the onset of huge projects in Alaska, the North Sea, and the Gulf of Mexico that could not respond to falling oil prices.

Shale’s low barriers to entry, which allowed small companies and investors to quickly move into the oil business, are complemented by low barriers to exit, which allow them to move away when prices reverse. If OPEC and Saudi Arabia shift away from their swing producer roles, the nimble characteristics of U.S. shale producers appear ready to provide global markets with alternate and useful source of spare supply. Given those sorts of attributes, who needs an orchestrating body to set production quotas anyway?