The Unconventional Oil Supply Boom: Aggregate Price Response from Microdata

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Executive summary

The shale boom has led to the largest and most rapid surge in oil production in U.S. history. This dramatic expansion in the United States' role in oil supply suggests an enhanced responsiveness of oil production to price fluctuations. Some think that this surge could potentially allow the United States to replace OPEC's in the role of "swing producer."

To assess this, we econometrically estimate the differences in price responsiveness for unconventional and conventional oil wells using a detailed dataset on more than 150,000 wells in the five major oil-producing states of Texas, North Dakota, California, Oklahoma, and Colorado. We estimate the price responsiveness at three key stages of production: drilling, spud-to-production time, and production from existing wells.

We find that the important margin for the price response is drilling activity, estimating drilling elasticities of 1.3 for conventional wells and 1.6 for unconventional wells. However, oil production per well declines somewhat with increased drilling activity, with price elasticities of productivity (output per well) of -0.2 and -0.4 for conventional and unconventional wells respectively. As a result, the supply elasticities are somewhat smaller than the drilling elasticity. Our simulations suggest long-run supply elasticities of about 1.1 for conventional and 1.2 for unconventional, which are approximately equal to the sum of the drilling and productivity elasticities.

Despite similar elasticities, the much higher overall productivity of unconventional wells (about 10 times larger initially and 5 times larger cumulatively) magnifies the unconventional drilling responsiveness many times over. Using our estimates from microdata, we conduct aggregate oil supply simulations, showing a 13-fold larger supply response due to the shale revolution.

We conduct simulations to approximate an aggregate U.S. oil supply curve at different time horizons (6 months, 1 year, 2, years, and 5 years). The simulations suggest that a price rise from $50 to $80 per barrel could induce incremental U.S. production of 0.6 million barrels per day in 6 months, 1.4 million in 1 year, 2.4 million in 2 years, and 4.2 million in 5 years.

These magnitudes are significant in the context of the global market, suggesting a significantly larger role for the United States as an incremental producer. However, the time needed to drill and complete wells imply that the production response takes longer than is typically considered for a "swing producer", which has typically been taken to mean a supplier that can increase oil production substantially in a short period of time, such as 30 to 90 days.

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