In the Good Times and the Bad: Shale Gas Development and Local Employment

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Pressing Questions

Improved drilling technology applied to shale formations has caused production of natural gas in the United States to reach historic highs. In a time of high unemployment, policy makers see development of the many shale gas formations in the U.S., mostly in rural areas, as a much-needed source of job creation. Weber (2012) assessed the local economic effects of natural gas development on counties in Colorado, Texas, and Wyoming. He found that from 1999 to 2007 gas production added 1,780 jobs or about 27 jobs per each billion cubic feet of production to the average county experiencing a boom.

The estimated employment effects correspond to a period of increasing natural gas prices and much drilling. The finitude of shale gas reservoirs and the volatility of energy prices raise questions for rural areas with shale gas development or the potential for it. Will employment opportunities from building infrastructure and drilling wells quickly dissipate as drilling slows? What happens when natural gas prices decline? Employment data from natural gas hotspots in Texas, Louisiana, and Arkansas shed some light on the answers and raise further questions.

Natural Gas Production in Four Shale Formations

The Barnett Shale in north-central Texas was the first shale gas formation intensely developed using horizontal drilling and hydraulic fracturing (where a mix of sand, water, and chemicals is injected into the well at high pressure). Production increased dramatically in the mid 2000s, but growth has slowed since 2008. Related to the slowdown, natural gas prices at the wellhead fell by more than 50 percent from 2008 to 2009 and have remained low through 2011. The Barnett Shale is therefore a case where lower prices accompanied a slowdown in drilling. Three other shale gas formations in the south-central U.S. – the Eagle-Ford Shale in south-central Texas, the Haynesville-Bossier Shale in east Texas and west Louisiana, and the Fayetteville Shale in northern Arkansas – have been developed more recently, with production spiking after 2008. Their development occurred despite low gas prices.

I define Barnett Shale counties to be those counties within the Barnett Shale formation where substantial drilling occurred in the 2000s as evidenced by a map of wells drilled provided by the Energy Information Administration. Eagle-Ford, Haynesville-Bossier, and Fayetteville Shale counties are defined similarly. Because of similar timing of development, I combine counties in the more recently developed formations and label them as EF-HB-F counties.

For comparisons, I first identify counties that are geographically one county removed from either a Barnett or an EF-HB-F county. Such counties are less likely to be affected by development yet they share some characteristics with shale-gas counties because of their proximity. Next, I match each Barnett county with a control county in Texas that had a similar population in 2000 but where gas production did not increase over the decade. I match EF-HB-F counties using the same approach but drawing from all three states. In total there are 13 counties in the Barnett Shale, 18 matched control counties for the Barnett Shale, 28 E-HB-F counties, and 39 matched control counties for the EF-HB-F shale formations (Figure 1). Some counties are used as matched controls for more than one county and some counties are in both matched control groups.

Natural gas production almost tripled from 2004 to 2008 in Barnett Shale counties, but from 2008 to 2011 it increased by just 23 percent (Figure 2). EF-HB-F counties, in contrast, saw modest growth from 2004 to 2008 (63 percent) followed by rapid growth from 2008 to 2011 (157 percent). Matched counties had little gas production to start with and, by design, production declined slightly from 2000 to 2011.

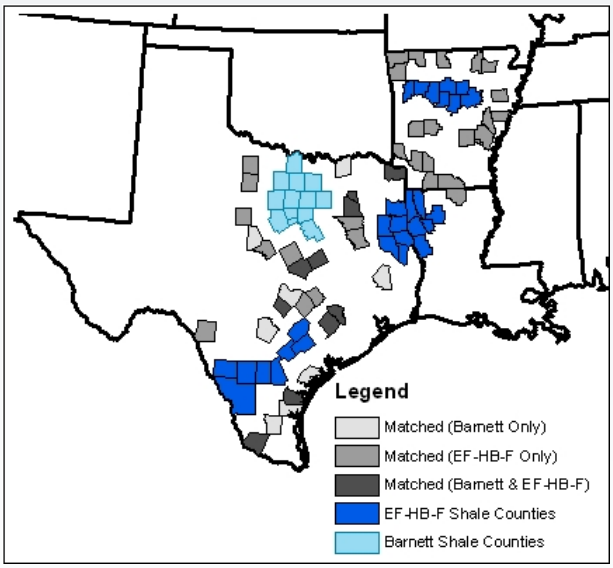

Figure 1. The Location of Barnett Shale Counties, EF-HB-F Counties, and Control Counties.

Gas Development and Employment

I compare the annual percent change in employment in Barnett, EF-HB-F, and matched control counties using total annual employment from the Quarterly Census of Employment and Wages of the Bureau of Labor Statistics. Total annual employment represents the total number of wage and salary jobs covered under unemployment insurance in the year. It does not capture the total number of workers in a county since one worker may have multiple jobs. Also, because workers are assigned to counties based on the location of the establishment, the data do not capture those who move across county (or state boundaries) but whose employer is in another county or state. Despite their limitations, the data come from unemployment insurance administrative records and are therefore timely and more reliable than most county-level economic data.

For each group of counties I calculate the average annual percent change in total employment over three periods: 2000-2004, 2004-2008, and 2008-2011. The first period corresponds to initial development of the Barnett Shale, the second to rapid growth in production, and the third to weak production growth. For EF-HB-F counties, development began in the 2004-2008 period, but most growth in production occurred from 2008 to 2011.

Barnett Shale Counties

From 2000 to 2004 Barnett Shale counties and their matched control counties experienced similar employment growth. In the following period, their growth trajectories diverged, with Barnett counties growing 3.4 percentage points faster per year than control counties. In the last period, 2008-2011, they experienced similar employment declines. Thus, despite continued increases in natural gas production, albeit at a much slower pace, the Barnett counties and matched control counties experienced similar employment declines over the Great Recession. And although Barnett counties did not lose all of their earlier employment gains with the slowdown in drilling, their experience is consistent with concerns that local economic growth from shale gas development dissipates when drilling slows.

Peak development of the Barnett Shale happened during the real-estate bubble of the mid 2000s and the slowdown in production growth happened during the Great Recession. Either macroeconomic event could have affected Barnett and matched control counties differently. Still, two facts suggest that the decline in drilling explains at least part of the weaker economic performance in the last period. First, housing prices in the Dallas-Fort Worth metro area and in Texas in general experienced similar declines during the recession (Real Estate Center, 2012). Second, drilling activity, as implied by drilling permits issued, dropped dramatically from 2008 to 2009, from 4,145 to 1,755. And although they increased slightly in 2010 and 2011, they remained well below 2007 and 2008 levels (Texas Railroad Commission, 2012).

Eagle-Ford, Haynesville-Bossier, and Fayetteville Shale Counties

Despite lower gas prices after 2008, increased drilling and production spurred employment growth in EF-HB-F counties, helping them weather the Great Recession. After growing at similar rates in the first two periods, employment contracted in control counties by 0.75 percent a year in the third period but increased by 2.48 percent in EF-HB-F counties.

Assuming that control counties represent a business-as-usual scenario – and their similar growth rates in the prior periods indicate that they do – gas development caused employment in EF-HB-F counties to be 3.23 percentage points higher than it otherwise would have been. For the average EF-HB-F county the higher growth translates into about 580 jobs per year. Over the same

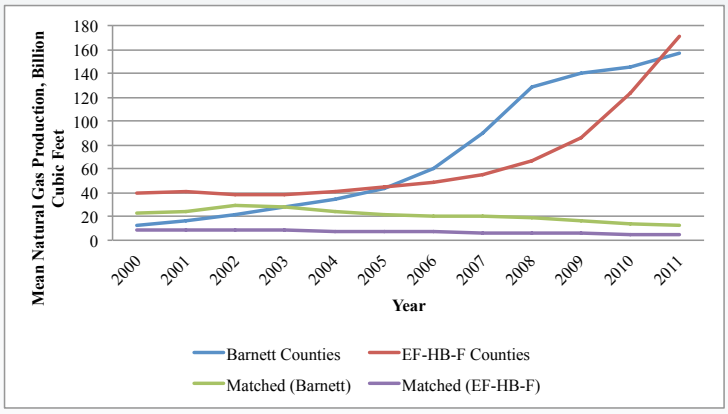

Figure 2. Production Growth Slowed in Barnett Shale Counties While EF-HB-F Counties Saw Strong Growth Through 2011. Source: Author's tabulations of natural gas production data from the Texas Railroad Commission, the Louisiana Department of Natural Resources, and the Arkansas Oil and Gas Commission.

period gas production increased by 26 billion cubic feet per year in EF-HB-F counties, implying that each billion cubic feet of gas was associated with 22 jobs. This is slightly lower than the 27 jobs that Weber (2012) estimated for counties in Texas, Colorado, and Wyoming for the 1999 to 2007 period. The difference is unsurprising – Weber looked at the total number of jobs (including self-employment) over a period with higher gas prices. Higher prices would increase royalty payments, which would likely increase consumer spending and employment.

Further Comparisons

The largest increases in production in EF-HB-F counties occurred when gas prices were low. Despite this, the associated employment effect (3.23 percent) is similar to the effect implied by the Barnett Shale County comparisons (3.40). Because Barnett counties had much higher initial population and employment than EF-HB-F counties, similar growth rates imply very different absolute changes in employment. If natural gas development accounts for all of the higher employment growth in Barnett counties, then the absolute employment effect was several times larger in Barnett counties than in EF-HB-F counties. This may reflect higher gas prices or that Barnett counties captured more employment growth associated with development since they cover a metropolitan area at the center of the regional economy.

Conclusion

Employment growth in Barnett Shale counties in recent years provides a first glance at what may happen as gas development matures. At the same time the simple comparisons raise further questions. Economies in more rural areas may respond differently to a slow-down in drilling. In rural areas, businesses formed solely to service the industry might fade as quickly as they came. In more urban areas they may reorient themselves: having poured concrete for drilling pads for several years, a business may find work with non-gas clients. The experience of the more rural EF-HB-F counties in the coming years will better indicate what may come for other, less-populated counties.

Growth in gas production in Barnett counties began slowing in 2009 and only declined in absolute terms in 2012 (Texas Railroad Commission, 2013). Thus, economic outcomes in Barnett counties in the last few years hardly reveal the long-term local economic effects of natural gas development. Long-term effects are important because extractive industries can cause environmental hangovers that persist for years. As the economic benefits of development fade, first as drilling slows and then as gas production declines, environmental side effects and their cost can become clearer. In the boom period, for example, demand for housing by temporary industry workers may cause housing values to exceed those of nearby areas without drilling. Afterwards, any negative side effects from extraction like gas infrastructure marring the landscape could lower property values below their pre-drilling level. (There is evidence that natural gas wells can lower property values, particularly for properties reliant on well water (Muehlenbachs et al., 2012)). A decline in property values lowers the wealth of existing homeowners, in addition to the already lower quality of life caused by side effects. Furthermore, the side effects behind the decline in values can shape an area's future by making it harder to attract talented workers, retirees, or tourists.

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Oil development in the south-central U.S. in the early 20th century led in general to better economic performance over the century (Michaels, 2011). The economic performance of Appalachian counties suggests that coal mining has not had the same effect. Our current limited understanding of shale gas development's effects on human health, natural amenities, and public infrastructure makes it hard to tell where the industry will fall – closer to oil in the south-central U.S. or coal mining in Appalachia. The projected growth of the industry and the prevalence of shale formations throughout the U.S. warrants working hard to answer such questions, and in doing so, informing policies for vibrant and livable communities over the long term.