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ECONOMIC IMPLICATIONS OF UNCONVENTIONAL FOSSIL FUEL PRODUCTION

By Mark Partridge and Amanda Weinstein (Ohio State University)

Around 2005, oil and gas markets in the U.S. experienced a revolution. For decades, oil and gas production were unable to meet domestic demand and imports steadily increased. Recent innovations in oil and gas extraction, specifically modern hydraulic fracturing and horizontal drilling, dramatically reversed these trends. Hydraulic fracturing opened up oil and gas reserves in previously uneconomical shale plays across the U.S. and the world. Today, the U.S. is expected to be the world's largest natural gas producer in 2015 and the world's largest oil producer by 2017 (Rosenthal, 2012).

Communities, especially their resource-rich landowners, located atop these shale plays have experienced a windfall in earnings, largely from lease and royalty payments from new energy production, as well as more high-paying jobs. However, there are losers from energy development as the impacts are spread unevenly. Arguably more important to these communities are the jobs that accompany shale development. This policy brief outlines the expected economic effects so that communities can make plans based on realistic expectations, though every community is a little different in what they should expect.

Many impacted communities from new shale development are rural and have long struggled. Yet, media reports of impact studies on the number of jobs that are created appear to be exaggerated (Weinstein and Partridge, 2011; Weber, 2012). These job estimates are often used to justify various tax and regulatory changes to encourage development. It is important to have an accurate estimate of the economic impact so that communities can make appropriate plans for development. There are also important potential long term impacts, many of which are not good. This is not the first energy boom the U.S. has experienced. History shows that a bust will follow this boom and there are many examples of underperforming extractive economies.

Communities need a realistic estimation of the short and long term economic impacts of shale development incorporated into a larger benefit cost analysis to determine for themselves whether to promote or slow local shale development. The economic benefits should be weighed against the costs (including environmental which may vary based on a community's unique amenities). It is possible to mitigate some of the short and long term costs of shale development. However, each community's ability to mitigate the costs of shale development may be constrained by state and federal regulatory and tax policies.

HYDRAULIC FRACTURING

Modern commercial hydraulic fracturing ("fracking") involves injecting 1 to 8 million gallons of water (mixed with sand and chemicals) into shale beds at depths between 5,000 to 10,000 feet. The pressure causes the shale to fracture while the sand keeps the fissures open, allowing the trapped oil and gas to escape. The hydraulic fracturing process takes just 2 to 5 days, but there is a significant construction period before the well can be fracked including preparing the site and building roads. Once the land is leased from the landowner, construction and rig work take 2 to 3 months (Paleontological Research Institution). There are also significant trucking requirements as water must be transported to and from the site. Often, new development is associated with one-time pipeline construction, further increasing the short term impacts. Thus, most of the economic impact of a well in terms of the employment effect to a local area occurs in the first several months even though wells may continue to produce many years without a need to re-frack.

ECONOMIC IMPACTS

Booming production has been accompanied by increased employment in shale plays across the U.S. such as Eagle Ford in Texas and Marcellus in Pennsylvania. The most pronounced effects of a shale boom on the local economy are in North Dakota's remote Bakken shale play. Pre-shale development, the Bakken region's economy was so small that new economic development that would not be greatly noticed in a medium-sized metropolitan area (in terms of numbers of new jobs) would have produced a crazy boom in the Bakken. The Bakken is the second largest play in terms of recoverable oil. All forms of North Dakota's mining employment (including coal) went from 3,600 in 2003 to 24,600 in March 2013 (U.S. Department of Labor B.L.S). However, even with impressive growth rates, the mining industry is still just a small share (under six percent) of North Dakota's relatively small total nonfarm employment of over 429,800 (BLS, CES, March 2013). Oil and gas extraction is a capital-intensive industry; thus, output is associated with fewer workers than is typical in the broader economy. Overall, using U.S. Bureau of Labor Statistics data from the Quarterly Census of Employment and Wages, the entire Bakken region in North Dakota and Montana experienced about a 49,000 increase in jobs from 2003 to mid 2012, though it is not clear if all of these are due energy development. In a sparsely populated region, such growth is amazing. Yet, for perspective, the entire U.S. economy has averaged just over new 150,000 jobs a month during this economic expansion, so in terms of U.S. overall job creation, what has happened in the Bakken is barely perceptible.

Weber (2012) finds that $1 million in shale gas production results in just 2.35 net total jobs within counties in Texas, Colorado, and Wyoming. Still, the in-flow of oil and gas workers can have especially dramatic effects on rural and remote areas such as Williston, ND in the heart of the Bakken. The influx of oil and gas workers increases the demand for services such as restaurants and hotels, creating jobs in the local non-tradable goods sector, producing a multiplier effect. Weinstein and Partridge (2011) use a "generous" multiplier of two to estimate the economic impact of shale development in Pennsylvania, which overlies the Marcellus shale play, the largest shale play in terms of recoverable natural gas reserves. They find that Pennsylvanian shale development created approximately 20,000 direct, indirect, and induced jobs from 2004 to 2010. They expect early Ohio shale development, which began in 2012, to follow Pennsylvania over the first few years. However, using more advanced statistical analysis, Weinstein (2013) finds the average U.S. multiplier for shale development to be approximately 1.3. Thus, for every shale oil and gas extraction job, just 0.3 jobs are created on net (mainly in the non-traded goods sector). Overall, the employment effect of shale development is more moderate than initial reports and nearly one-half the corresponding impact on earnings (Weinstein and Partridge, 2011; Weinstein, 2013). Additionally, many of the oil and gas workers are temporary and may come from out of state, reducing the benefits to the local residents (Kelsey et al., 2011). Yet, there are clear earnings impacts due to lease and royalty payments and additional high-paying jobs.

Industry funded impact studies often find significantly larger economic impacts than studies that rely on the most modern statistical approaches. For example, an industry funded study authored by Considine et al. (2011) suggests that shale natural gas extraction was associated with 140,000 Pennsylvania jobs during 2010. A similar study by Kleinhenz & Associates (2011) predicted that the natural gas industry would create and support 200,000 jobs in Ohio by 2015, though drilling did not begin in earnest until 2012. These estimates though large, pale in comparison to a recent study that finds California's Monterey shale play could create up to 2.8 million jobs by 2020 (USC Global Energy Network, 2013; Vekshin and Nash, 2013). It is hard to see how medium-term employment growth could greatly exceed what happened in North Dakota given the massive scale of the Bakken and the fact there are so few population/environmental constraints on energy development, unlike say California with its more dense population and strong history of environmental protection.

A general problem regarding impact studies-including those regarding energy—is that they overestimate the economic effects for many reasons such as making unrealistic assumptions about the share of expenditures that will remain in the region from both households and businesses purchasing inputs. Moreover, many impact studies also fail to account for possible offsetting negative effects from energy development that may offset the positive effects such as any crowding out of other economic activity that would have occurred otherwise (e.g., entrepreneurs outside of energy may try other locations with more stable labor markets). Higher prices (especially for housing) may also offset some of the benefits of higher wages potentially negatively affecting quality of life in the area. In addition, many of the benefits may trickle away to other areas due to commuting workers, purchases outside the region, and absentee landowners receiving the lease payments (e.g., see Kelsey et al., 2011). Finally, perceived or real environmental degradation may frighten some current residents and potential residents away—especially in the long-run. The take-away is that communities should be wary of industry funded economic impact studies (regardless of the industry) and should try to verify economic impact estimates with independent experts.

> Specialization in one industry, especially one that is closely linked to volatile energy prices, leaves a local economy more vulnerable to shocks. Efforts to diversify the economy are crucial for long run growth such as programs to support innovation and small businesses or lower taxes or other costs of doing business in the community for other sectors.

THE NATURAL RESOURCE CURSE

The long term economic implications of natural resource extraction are often ignored in impact studies. There is hope that a natural resource boom will provide sufficient agglomeration economies for economic growth to take off (Michaels, 2010). Williston, ND provides a good case study as it experienced an energy boom in the late 1970s and early 1980s when oil spiked and a bust when prices fell. Williston's economy subsequently greatly lagged the U.S. up until the most recent shale boom. Williston (Williams County) did not surpass its 1981 peak in employment until 2010 (U.S. BEA). Generally, poor long-term economic performance is common in extractive resource based economies. This natural resource curse has been documented at every level of geography from countries (Sachs and Warner, 1995) to U.S. states and counties (Papyrakis and Gerlagh, 2007; Kilkenny and Partridge, 2009; James and Aadland, 2011). Some reasons for this include weak or corrupt governance, lack of economic diversity, a weak climate for innovation and entrepreneurship in the broader economy, and a reduced human capital development. Hence the general lesson is that short-term energy booms do not necessarily translate into long-term economic prosperity.

POLICY IMPLICATIONS

It is important for affected areas to understand and mitigate the effects of factors that contribute to the natural resource curse and to better take advantage of the short-term boom. Specialization in one industry, especially one that is closely linked to volatile energy prices, leaves a local economy more vulnerable to shocks. Efforts to diversify the economy are crucial for long run growth such as programs to support innovation and small businesses or lower taxes or other costs of doing business in the community for other sectors. Specialization in resource extraction may also crowd out other industries such as coal as natural gas replaces coal and low wage industries as local wages are bid up. The availability of high wage jobs that do not require a higher degree decreases the incentive for educational attainment. This in turn reduces human capital in the area, critical for long run growth, especially after a bust sets in. Hence, affected communities should ensure their local schools are high quality and they need to think about quality of life concerns of more educated households including potential residents. Finally, they need to provide accurate information to students considering forgoing education to work in the fields, especially the fact that energy booms do not last forever.

Because shale energy is an exhaustible resource, shale development involves the permanent depletion of natural capital. The Solow-Hartwick Rule states that it is important to offset the loss in natural capital through investment in either human capital or public capital, as well as counteract the environmental consequences and offset the degradation on infrastructure and public services (Hartwick, 1977). Hence, industry taxes must be set appropriately to account for both the short term and long term costs of shale development. State governments may need to intervene in setting an adequate tax and regulatory environment including setting reasonable severance taxes and in ensuring that local governments bearing the costs of development receive adequate funding. Local government institutions are critical to ensure funding is spent appropriately, and that the government doesn't become accustomed to an unsustainable higher level of spending.

CONCLUSION

The short-term impacts of energy development often include increased employment, though the largest impact appears to be on local incomes of select groups. An accurate estimate of the short and long term economic impacts of shale development is essential for a community to manage its economic future. In particular, communities should take steps to mitigate the long-term effects associated with the resource curse and ensure they benefit from energy development in the long term. These include taxing the industry to account for negative spillovers, diversifying their economies, building enhanced infrastructure, and investing in education and training. Likewise, local communities need to ensure the environment is adequately protected in order to promote long-term sustainable growth after the boom ends.

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