Use Precaution: The Fracking Boom Comes with Risk of the Resource Curse

Paper Prepared for the National Science Foundation Subsurface Workshop
University of Colorado, Boulder, Colorado
May 22-23, 2017

Joe Kerkvliet[1] and Pete Morton

Hydraulic fracturing may portend major changes to our environment and America's energy future. As the pros and cons are debated, citizens and decision makers would do well to consider what economists have discovered in studying the economic consequences of relying heavily on the extraction of natural resources, such as oil and gas. Economic theory suggests that an abundance of natural resources should promote economic growth by providing economies with ''natural capital'' (James and Aadland 2011). However, many studies have found that economies relying heavily on natural resource extraction are poor performers in terms of growing income, decreasing poverty, and improving lives. This poor performance has become known as the "resource curse". Avoiding the resource curse is a worthy goal for responsible oil and natural gas development.

The earliest studies found evidence of the resource curse in nations such as Nigeria, where dramatic increases in oil production was followed by declining per capita incomes and increasing poverty (Sala-i-Martin and Subramanian 2004). Examining a sample of 75 countries from 1980-2004, Bleaney and Halland (2009), found that countries with a higher percent of natural resource exports had slower per capita income growth and "higher volatility of output and government consumption".

Ross (2015) found robust evidence to support three broad claims about the resource curse with respect to oil: "that higher levels of petroleum income lead to more durable authoritarian rulers and regimes; that more petroleum income increases the likelihood of certain types of government corruption; and that moderately high levels of petroleum wealth, and possibly other types of resource wealth, tend to trigger or sustain conflict when they are found in regions dominated by marginalized ethnic groups, particularly in low- and middle-income countries."

Davis (2011) using data from 148 countries found slower growth in economies highly dependent on minerals due to a "resource drag" associated with static or declining mineral production and possibly an equally important "crowding out effect". During boom times resources and labor are pulled away from non-extractive businesses and affects the mix of jobs. Higher wages in extractive industries, for example, can crowd out and displace other businesses from the economy due to higher labor costs.

Recent studies of the economic performance of U.S. states and counties also find evidence of a resource curse. Johnson (2006) found that states with a higher share of their economies in natural resources extraction grew at a slower rate between 1977-2002. For example, Wyoming and Louisiana had the highest shares of gross state product (GSP) in resource extraction and had two of the three lowest state growth rates in real per capita GSP.

[1] Joe Kerkvliet, Ph.D. Professor, Oregon State University. joe.kerkvliet@oregonstate.edu ; Pete Morton, Ph.D. Senior Economist, Conservation Economics Institute, pete@conservationecon.org; peteinboulder@gmail.com

Another study of U.S. states found evidence of a resource curse (Papyrakis and Gerlagh 2007). For each one percent increase in dependence on resource extraction, a typical state lagged .047 percent in per capita income growth between 1986 and 2000, compared to the average state's per capita income growth of 2.47 percent. The lag in per capita income growth may not seem like much, but remember these are annual growth rates and get compounded each year. In 20 years, a state with a five percent greater resource reliance than average would have $1400 less per capita income. In 40 years, the difference would be $4600 of per capita income.

Using more finely scaled data from U.S. counties, James and Aadland (2011) found that a typical resource rich county whose economy was 20 percent dependent on resource extraction experienced slower per capital income growth compared to a county with 5 percent dependency. The primary econometric results of James and Aadland (2011) for the baseline sample period 1980–1995 is negative and statistically significant at the 1% level, supporting the resource curse hypothesis at a county level.

James and Aadland (2011) estimate that an increase in the percent of natural resource earnings from 1% to 25% lowers income per capita growth from 1.3% to 0.8%, all else equal. On an annual basis, the lower growth rate when compounded over generations, results in substantial differences between counties. For example, extrapolating these growth rates over a 70-year period, the standard of living will be nearly 50% higher in the county that chose not to rely so heavily in natural resource extraction.

In addition, all twelve states with more than 5% of state earnings derived from natural resource extraction experienced negative economic growth during the 1980–1995 period. For example, Wyoming's specialization in natural resource extraction appears to have limited its relative potential for economic growth, at least for the sample periods since 1980.

James and Aadland (2011) conclude "Although the resource curse appears to be waning over the sample period 1980–2005, it is always negative and statistically significant. The coefficient estimates imply sizable differences in standards of living if one extrapolates the annual growth differences to future generations."

Resource booms are often followed by busts and sectors of the economy that sell locally are likely to be affected differently by booms and busts than sectors that compete in national and international markets. Two recent studies estimate these more complex effects by comparing U.S. counties and Canadian provinces that did and did not experience coal or oil booms and busts. Black et al. (2005) estimate the effects of the1970-1980's coal booms and busts in Kentucky, Ohio, Pennsylvania, and West Virginia counties. Compared to non-boom counties, employment, but not earnings per worker, increased in the local goods sectors. Jobs and earnings per worker fell in the mining and local goods sectors during the 1980's bust. The authors found the non-local (manufacturing) sector were little affected by either the boom or bust.

Marchand (2012) finds that the direct employment impacts in energy extraction jobs were large during Canada's oil booms (1971-1981 and 1996-2006). Energy jobs also contributed to non-energy sector jobs during booms. During the bust, employment and earnings decreased in energy and local sectors, but employment and earnings continued to increase in the manufacturing sector.

Jacobsen and Parker (2014) examined the resource curse using county level data from 1969 to 1998 in the U.S. Rocky Mountain' region. The authors found that in the short term the boom had both positive

effects (e.g. increases in employment, wages, dividends and non-farm proprietor income), and negative effects (e.g. reduced farm proprietor income). However, in the long run, local per capita income was about 6% lower than it would have been if the boom had never occurred. The long-term hardships associated with joblessness and depressed local incomes continued into the 1990s -- long after the bust with no clear signs of recovery.

In explaining their results Jacobsen and Parker (2014) found that the boom induced local residents to over-specialize in boom-specific capital and skills in the non-tradable (e.g. construction, services, retail) and resource extraction sectors. The drop in per capita income during the oil and gas bust was a result of two forces:

> "First, per capita demand for extraction sector services and non-tradable goods contracted …. Second, the skill and capital acquired by the pool of local proprietors during the boom (e.g. operating boomtown restaurants, owning equipment to service mobile home parks, organising the transportation of drilling equipment etc.) became sunk and this limited the extent to which proprietors could change practices or relocate their businesses during the post-bust era." (page 1119)

Their results provide robust evidence of the resource curse in the Rocky Mountain West.

There are five potential causes of the resource curse. First, the vast promise of short-term wealth from energy development may siphon investments, talent, and innovation away from other economic sectors, which are more productive in the long run. Second, the wealth from extracting resources may induce a false sense of security in business and government -- and weaken the perceived need for investments, a highly skilled labor force, and growth-promoting strategies. Third, the prices of resource-based commodities are unusually volatile and increase the risk of boom and bust cycles. Booms and busts decrease the incentive to invest in communities for the long term. When prices are high, energy booms can also siphon workers away from local businesses. Fourth, the quick wealth from resource extraction encourages corruption and "rent seeking" – where rent seeking is defined as resources spent on getting political favors, including unfair or illegal access to natural resource assets. Indeed, the study of U.S. states found that resource reliance is correlated with an increasing number of public officials prosecuted for corruption. Finally, resource extraction may result in environmental damage, which may discourage in-migration and new businesses and reduce health and quality of life for local residents.

It is important to note that the long term economic costs associated with the resource curse are not accounted for by the Input-Output models used by economists to estimate the short-term oil and gas jobs associated with changes in oil and gas policies. In addition, Input-Output models can produce dramatically different results depending on the assumptions and parameters used. For example, in Colorado two consulting reports - both paid for by the oil and gas industry - came up with dramatically different results simply by changing the assumptions and parameters of the Input-Output model. Lewandowski and Wobbekind (2013) estimated total employment for Colorado's oil and gas industry (direct, indirect, and induced jobs) at 111,476 jobs[2]. In the same year, Price Waterhouse Cooper (2013) estimated total jobs for the oil and gas industry in Colorado at 213,097 – nearly double the estimate by

[2] Direct jobs are created by direct hiring to perform the activity (i.e. drilling); indirect are jobs created by spending to support the work of direct jobs (e.g. pipe used by drillers to drill wells); and induced jobs are created when direct and indirect job holders spend their wages. So, jobs in the drilling pipe industry are indirect jobs, while bar and restaurant workers are induced jobs.

Lewandowski and Wobbekind (2013). The large uncertainty in oil and gas job estimates between the two consulting reports comes from the variation in the assumptions chosen, how direct jobs were classified, and whether primary data were collected (Morton and Kerkvliet 2014). Decision-makers would do well to better understand not only the assumptions and limitations of these short-term job estimates but how these models are incapable of accounting for the resource curse which is a long run phenomenon[3].

The strong evidence of a resource curse shows that energy development is not a panacea. Instead it is a risky business that must be done wisely. If done irresponsibly, energy development threatens the economic well-being of our children and grandchildren. Citizens should be aware of these economic risks as they debate the right of local communities to take precautions through regulations and/or issue moratoria or bans on oil and gas extraction technologies such as hydraulic fracturing.

One promising strategy for avoiding the resource curse is to slow the pace of energy development (Haefele and Morton, 2009). A reduced pace will moderate the deluge of energy wealth and the hyperactivity that disrupts normal patterns of business and government. A reduced pace will promote carefully considered regulations that allow energy extraction to proceed with less health and environmental damage.

Avoiding the resource curse is a worthy long-term goal for economic development. Communities cannot control energy price volatility, but they do have some control over other causes. Clear and enforceable regulations will certainly help. Citizens can insist that energy development pay its way by providing the increased funds necessary to help communities collect and monitor baseline data, inspect wells, enforce regulations, and maintain other public services. They can also strive to keep politicians accountable to citizens and not too accommodating to energy producers' demands. Additional recommendations to mitigate the chances of a resource curse include strengthening of institutional frameworks, well-defined resource funds and the promotion of transparency with citizens (Daban and Helis 2009).

References

Black, D., T. McKinnish, and S. Sanders. 2005. The Economic Impact of the Coal Boom and Bust. The Economic Journal. 115. 449-476.

Bleaney, M. and H. Håvard. 2009. The Resource Curse and Fiscal Policy Volatility, CREDIT Research Paper, No. 09/09

Dabán, T. and J. Hélis. 2009. A Public Financial Management Framework for Resource-Producing Countries. IMF Working Paper. Fiscal Affairs Department, International Monetary Fund

Davis, G. 2011 The Resource Drag. International Economics and Economic Policy, http://www.springerlink.com/content/5616136h56165282/

[3] The IMPLAN Input-Output model relies on many questionable assumptions to estimate short term jobs including: 1) it's a static model attempting to model a dynamic economy (e.g. assumes labor is not mobile); 2) prices are assumed to be static – which is not true as oil and gas prices are dynamic and change all the time; 3) no change in technology is allowed despite advancements in directional drilling technology; 4) fiscal and environmental costs are assumed to be zero; and 5) the crowding out-economic displacement effects are not considered.

Haefele, M. and P. Morton. 2009. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains. Western Economic Forum, Winter 2009.

Jacobsen, G.D. and D. P. Parker. 2016. The Economic Aftermath of Resource Booms: Evidence from Boomtowns in the American West. The Economic Journal, 126(June), 1092–1128.Doi: 10.1111/ecoj.12173©2014 Royal Economic Society.

James, A. and D. Aadland. 2011. The Curse of Natural Resources: An Empirical Investigation of U.S. Counties. Resources and Energy Economics. 33: 440-453.2012.

Johnson, R. 2006. Economic Growth and Natural resources: Does the Curse of Natural Resources Extend to the US states? In Explorations in Environmental and Natural Resources. R. Halvorsen and D. Layton, eds. Edward Elgar. Cheltenham, UK.

Lewandoski, B. and R. Wobbekind. 2013. Assessment of Oil and Gas Industry: 2012 Industry Economic and Fiscal Contributions in Colorado. Business Research Division, Leeds School of Business, University of Colorado Boulder. Report prepared for the Colorado Oil and Gas Association.

Marchand, J. 2012. Local Labour Impacts of Energy Boom-Bust-Boom in Western Canada. Journal of Urban Economics. 71. 165-174.

Morton, P. and J Kerkvliet. 2014. Redefining responsible oil and gas development. Presentation at University of Colorado, Center of the American West, FrackingSENSE Lecture Series, Boulder, CO. https://www.youtube.com/watch?v=lTzEmxkzoCE

Papyrakis, E. and R. Gerlagh. 2007. Resource Abundance and Economic Growth in the United States. European Economic Review. 51: 1011-1039.

Price Waterhouse Cooper 2013. Economic Impacts of the Oil and Natural Gas Industry on the US Economy in 2011. Report prepared for the American Petroleum Institute. Washington DC.

Ross, M.L. 2015. What Have We Learned about the Resource Curse? Annu. Rev. Polit. Sci. 2015. 18:239–59.

Sala-i-Martin, X., Doppelhofer, G., Miller, R.I., 2004. Determinants of Long-term Growth: a Bayesian Averaging of Classical Estimates (BACE) Approach. American Economic Review 94 4: 813–835.