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A Tale of Two Shale Plays

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Abstract: This paper offers insights into the role for regional science and regional scientists in analyzing shale-energy development. The stories described are drawn from popular press accounts of the Bakken Basin in North Dakota and the dry-gas-producing counties of the Marcellus Shale in Northern and Central Pennsylvania. The comparison of the two shale plays highlights housing, labor market, and fiscal issues for these two locations.

Keywords: hydraulic fracturing, local economic development, local fiscal policy

JEL Codes: Q33, R23, R11

1. INTRODUCTION

I stand before you today a deeply grateful but reluctant fellow. As I moved from session to session; prepared for this address; visited with Southern Regional Science Association (SRSA) colleagues I have seen at these meetings for nearly 25 years, or met young scholars for the first time, I felt both gratitude and humility. My hunch is that I am at this podium today as acknowledgement of my service to an organization in which service has been heavily valued.

We can serve a specific institution in many ways: organizing sessions, acting as discussants, offering comments, mentoring, and holding offices within the organization. Another form of service, one that I see diminishing in its importance, is service through research that informs public policymakers and local communities. The heritage of regional science, especially SRSA, is grounded in high quality, independent research with clear public policy implications. It is a legacy that I believe is worthy of preserving. My comments today will give an example of why I believe this legacy is important.

As I struggled with a topic for this address, I was reminded of the great strength of regional science, one that I have perhaps taken for granted: we are a big tent of agricultural economists, geographers, economists, rural sociologists, urban economists, economic geographers, planners, and local public finance specialists, to name a few.

I am sometimes very slow to learn. I went through at least ten ideas for this Fellows Address—some of them philosophical, some applied, some personal, and some cautionary. However, the topic I chose came to me as my husband Tom and I boarded a plane from Harrisburg, Pennsylvania, to Bismarck, North Dakota, where we observed that many of the young male passengers to both locations wore t-shirts from universities in Texas, Oklahoma, and Louisiana. There were other men on the flights wearing polo shirts bearing familiar, recurring logos. The subject of this talk was sealed when I asked a young man, who was sitting in the seat

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across the aisle from me as we made the descent into Bismarck, if he was studying for the bar exam. He said, “No, I’m studying for certification as a surveyor. The two hot spots now are the Marcellus Shale in Pennsylvania and the Bakken Basin here in North Dakota.”

To disclose a bit about myself is to understand why the topic today is both professionally interesting and personal. I am the great-granddaughter of a gold prospector whose pursuits took him to the Utah and Wyoming Territories, as well as British Columbia. He was one of the prospectors who discovered what some have called the richest placer mine in Virginia City, Montana. Today he might have been one of those young men wearing a University of Texas t-shirt and trying to better his life by working on a gas or oil drilling crew. My paternal grandmother was born in Cheyenne, Wyoming Territory, and was one of the first children of European descent to settle in Foster County, Dakota Territory. I have relatives who live near Superfund sites in the American West. In the early 1980s, I was a graduate student at the University of Colorado in Boulder as the Colony Oil Shale project ground to a halt in Western Colorado, leaving thousands out of work and communities in turmoil and debt. In 1986, I wrote a dissertation on interstate tax competition and moved to central Pennsylvania. In 1988, I met SRSA and began to learn from many of you. My 84-year old mother and all of my siblings currently reside in North Dakota. My current residence is Lycoming County, Pennsylvania, near Williamsport, an old factory and lumber town that is now a service-providing hub to the natural gas industry.

I assure you that there will be something in this talk from several research areas in regional science: labor markets, housing markets, local public finance, infrastructure, transportation, taxation, the natural resource curse, impact analysis, and regional and rural development. When I am finished with my tale of two shale plays, some of you may be inspired to pursue high quality, independent research on shale energy extraction and public policy.

I will begin with a discussion of hydraulic fracturing and horizontal drilling. I will briefly suggest why these techniques are controversial from an environmental perspective. Environmental issues are important, but they will not be addressed in any depth in this paper. Nor will I directly speak about U.S. energy policies or the federal, state, and local government subsidies to the oil and gas industry. I will not address the important social costs that tend to accompany natural resource booms such as increases in methamphetamine use, domestic violence, driving under the influence, and other personal and community social upheaval. My focus is on rural and regional issues that I believe should take their rightful place with scientific and environmental impacts, issues that we as regional scientists are uniquely qualified to address.

2. SHALE ENERGY AND COMMUNITIES

2.1 General Introduction

A location’s resources come into “play” when it is profitable for the industry to extract. There are oil and gas shale plays around the United States and the world. This paper focuses on the Marcellus shale counties in Pennsylvania (Bradford, Tioga, Lycoming, and Susquehanna) that tend to be either adjacent or in close proximity to the New York border. These counties are the source of “dry” natural gas, which is primarily methane. The Bakken region of North Dakota produces shale oil (not to be confused with oil shale) and extends across the western one-third of North Dakota into Montana, and across sections of Saskatchewan and Manitoba, Canada.

There are common features in these two shale plays. The shale play begins with geologists' estimates of the location and magnitude of the available resource, with considerable disagreement on how much and how long the resource can be profitably extracted with current technology. These estimates are used to attract investors, and to determine where to acquire the mineral rights to extract the resource. In the communities in Pennsylvania near me, it has been decades since mineral rights have been exercised. Newer residents learned the difficult lesson that ownership of the mineral rights is decoupled from ownership of surface rights, the so-called "split estate." There is a need for financial capital to fund exploration and extraction and the initial workforce must be mobilized from outside the region. In rural, remote locations, the demand for residential structures poses challenges that are resolved with temporary dwelling places or with permanent housing that is vacated when resource extraction is no longer profitable. Today's energy production has been shaped by technological change in the oil/gas industry and is occurring in an economic climate of global capital markets, advancements in transporting oil and gas around the world, low interest rates, a weak dollar, and a sluggish world economy.

Hydraulic fracturing and horizontal drilling are widely used in today's unconventional shale plays. Drilling vertically for 5,000-10,000 feet, then horizontally for another several thousand feet, casings are perforated by explosives. Under high pressure, a mix of water, sand, and chemicals creates fracturing in the earth that releases the oil and gas. Each well requires between 2-4 million gallons of water, transported by truck. Each well produces oil or gas, transported by truck to pipelines or rail.¹ Under the Energy Policy Act of 2005, hydraulic fracturing was excluded from the Safe Drinking Water Act, except when diesel fuel is used in the hydraulic fracturing process. The EPA is currently studying fracking and is scheduled to release a report in 2012, with a final report at the end of 2014.

Hydraulic fracturing creates a flurry of activity in communities, particularly obvious in small towns and rural locations. This activity gives the welcome impression of jobs creation. Whether that activity is long lived or not is an open question. The housing and workforce requirements in the pre-drilling, drilling, and production phases of a shale play are generally well known.² The pre-drilling and drilling phases account for most of the jobs; when the drilling and infrastructure work is complete, these workers are no longer needed. As a result, these workers tend to be mobile, moving from drilling "hotspot" to "hotspot," often living in temporary housing or motels, hotels, or vehicles. Many of these jobs require little or no post-secondary education. The production phase requires little labor, limited to that which is necessary to manage a given number of wells. These jobs tend to require some specialization and workers are more likely to be tied to a particular geographic location with stable residency. The result can be that local residents accept long run costs, such as loss of a nonrenewable resource and potential environmental degradation, for the promise of jobs in the short run.

2.2 Tales from the Marcellus Shale Region in Pennsylvania

Until recently, Pennsylvania was the only major gas-producing state that has no production (severance) or extraction tax (impact or environmental tax). While Governor Ed

¹ See Department of Energy publication with basics at http://www.netl.doe.gov/technologies/oil-gas/publications/EPreports/Shale_Gas_Primer_2009.pdf

² Discussed in depth by the Marcellus Shale Workforce Needs Assessment team, available at http://www.msetc.org/docs/PennsylvaniaStatewideWorkforceAssessmentv1_Final.pdf#zoom=75

Rendell, a Democrat, was in office, the state legislature failed to pass a severance tax. The change in political leadership with the election of Governor Tom Corbett, a Republican, altered the political discussion from a severance tax to an impact fee. According to Levy (2012a), Governor Corbett opposed taxing the industry, which meant that Republicans in the state legislature pursued an impact fee, which, it has been reported that “he views as being fundamentally different than a tax.” What was passed into law, called Act 13, is a per-well fee that varies with the years of production activity, price of natural gas and inflation. The maximum impact fee per well, based on a limit of 15 years of paying the tax, is \$190,000 at a price of \$0-2.25 per Mcf and \$355,000 at a price of \$6 or higher per Mcf. Counties have 60 days to vote on whether they will impose the impact fee; however, if a county board votes against the fee, a critical mass of municipalities have another 60 days to impose.³ Revenues from the impact fee and the state forest drilling royalties will cover expenditures such as bridge repairs, water and sewer plant upgrades, clean-up programs, purchase of natural gas vehicles, judicial services, social services, emergency preparedness, and local or regional planning initiatives. The original legislation is being challenged in the courts because it preempts zoning ordinances by municipal governments that would hinder drilling. Yes, you understood that correctly: residential drilling is not prohibited by law in Pennsylvania; rather, municipalities are allowed to apply zoning standards on lighting, noise, and structures used for other industrial activities.

If all current gas-producing counties adopt the impact fee, which many already have, the total estimated revenue for the first year of the fee is estimated at \$180-200 million, of which 60 percent is scheduled to benefit local government.

In Governor Corbett’s \$27 billion Pennsylvania state budget for fiscal 2012-2013, Levy (2012b) reports that there are \$230 million in cuts to higher education, and \$100 million reduction in grants for full-day kindergarten and other public school programs. This same budget provides \$7.9 million to the Pennsylvania State Police Academy for a new class of 115 cadets, leaving the agency with 500 vacancies by June 2013.

Reuther (2012) reported of some reluctance from at least one major gas-producing county to adopt an impact fee at this time, expressed by one state representative who argued against too much regulation or too many fees on the industry because “there is competition for natural gas, not only in western PA and Ohio, but worldwide.”

Housing in the northeastern counties of the Marcellus region is a consistent local news topic. Thompson (2012a) reported that average housing rents, especially three and four bedroom units are rising and investors are reportedly purchasing moderately priced homes to rent to industry workers. Homelessness among working families has been identified by Lycoming County focus groups.

Infrastructure is stressed on two-lane roads: Water and sewer planners already report that they did not anticipate the extraordinary demands on these services by the industry. Rodgers et al. (2008) assert that a well site in Lycoming County was reported to have required 77 tractor trailer loads of drilling equipment. These same authors cite a report from Denton, Texas, that estimates 364 water truck trips for a single well.

³ For a full description of Act 13 see Pennsylvania Public Utilities Commission presentation at http://www.puc.state.pa.us/NaturalGas/pdf/MarcellusShale/Act13_Implementation_Presentation.pdf

According to Clarke (2012b), Tioga County is experiencing an increase in crime, with outstanding warrants, and “states like Texas won’t extradite them.” The District Attorney’s office has experienced a 25 percent increase in cases from 2009-2010. Traffic-related accidents involving alcohol were up over 30 percent nonalcohol-related accidents increased 77 percent from 421 in 2009 to 602, to 749 in 2010.

Place-based policy is alive and well in the Rust Belt. An Associated Press article in the local paper entitled, “Senators Lobby Shell to Build Plant in Keystone State,” described the fiscal competition between Pennsylvania and our neighbors Ohio and West Virginia, which all were offering tax and other incentives to Shell’s Houston subsidiary to site an ethylene plant. Ethylene is widely used in production of plastic and is produced from ethane, a product of wet natural-gas production in southwestern Pennsylvania. (Shell is already invested in the Marcellus Shale. In 2010, the company purchased East Resources, a Pennsylvania-based drilling company.) At the request of West Virginia’s Governor Tomblin, the Associated Press on February 3, 2012, reported, the West Virginia state legislature passed a bill that offered Shell property tax forgiveness for 25 years in exchange for an investment of at least \$2 billion. The governor had promised additional measures that would involve “location and regulation.”

On March 16, 2012, an Associated Press article appeared in the local paper entitled, “Site Chosen for Major Refinery,” where it was reported that Shell plans to locate near Monaca, Pennsylvania, about 35 miles northwest of Pittsburgh. Shell has indicated that it will spend billions, but construction is years away. Over two months later, Detrow (2012) reported that Shell was offered \$1.7 billion in Pennsylvania tax preferences over 25 years.

2.3 Downturn—“Bust” in Pennsylvania?

Clarke (2012a) writes that in the past three months, five major gas companies have pulled drilling rigs from northeastern Pennsylvania. A Talisman Energy spokesperson reported that the company is pulling five of its drilling rigs out of the area “because of the sluggish economy and partly because of a glut of its own making due to the Marcellus Shale.” Rigs are reportedly being moved to Ohio, because wet gas is more profitable.

Anadarko Petroleum, according to Runkle (2012), which added 20 wells in 2011, plans to add 12 in 2012. The company plans to develop water pipelines to reduce truck traffic, make road improvements, and “develop its holdings in the Marcellus Shale.”

Bartizek (2012) asserted that Chesapeake Energy plans to reduce natural gas drilling in Northeastern Pennsylvania by 30 percent and shift to wet gas production, adding that the Pennsylvania reduction is less of a cut back than in Texas and Arkansas because of proximity to markets along the eastern seaboard. Hutchinson (2012) reported that Range Resources, according to Pennsylvania State University’s Tom Murphy, co-director of the Marcellus Center for Outreach and Research, plans to allocate only about 25 percent of its \$1.6 billion capital budget on dry gas. Chief Oil and Gas “may include reducing the number of rigs in the region.”

Williamsport, Pennsylvania, the home of the Little League World Series, is a service-providing hub for the industry. The city has plans for a \$31.8 million convention center. In 2006-2010, according to the U.S. Census, 28.2 percent of the population was below the poverty line, 82 percent of the population has a high school degree (compared with state average of 87.4 percent) and 18.3 percent of the population has a bachelor’s degree or more (compared with state average of 26.4 percent). Vincent Matteo (2012), Williamsport/Lycoming Chamber of

Commerce President and Chief Executive Officer (CEO), claims the Chamber “will work in the best interests of economic growth and job creation” and that the current slowdown in industry activity is not “a bust cycle.”

2.4 Tales from the Bakken Shale Play in North Dakota

At this time, energy is not the largest sector of North Dakota’s economy. Agriculture accounts for about one-third of economic activity, energy about one-quarter. The state’s well known recent budgetary surpluses can be attributed to both high agricultural commodity prices and energy.

The western one-third of North Dakota is geographically isolated, even by Western U.S. standards. As an example, McKenzie County is one of the top oil-producing counties in North Dakota. In 2010, the county population was 6,360, with a population density of 2.3 persons per square mile. The largest town in McKenzie County is Watford City, with a population in 2010 of 1,744 persons. This example illustrates the local limitations of supplying a labor force, housing stock, and infrastructure to support the scale of extraction that is occurring on the industry’s timeline. Williston, with a city population in 2010 of approximately 15,000 is the largest city in closest proximity to the heaviest Bakken activity. It is in Williams County, with a 2010 population of slightly more than 22,000. The unemployment rates before the oil boom are typically low. Decades of out-migration have served to keep unemployment low in North Dakota. Unlike the northeastern region of the Marcellus shale play in Pennsylvania, Western North Dakota has an ongoing history with natural resource extraction and was greatly affected by oil boom of the late 1970s and early 1980s; it produces coal, oil, natural gas, and wind energy. However, the scale of oil extraction is new to the state. The favorable stories of the “Rockin’ Bakken” emphasize scale of recoverable oil reserves, housing and labor shortages, wage earnings, and billion dollar annual budget surpluses for the state of North Dakota.

Gruley (2012) provides an example of the anticipated scale of the Bakken shale play with a story of “The Man Who Bought North Dakota,” featuring Harold Hamm, CEO of Continental Resources.

Hamm is the man who bought the Bakken, the shale formation that’s the biggest U.S. oil find since Alaska’s Prudhoe Bay in 1968... Today, Continental, with a stock market value of \$13.5 billion, vies with oil giants such as Hess for the most Bakken acres under lease (more than 900,000), the most drilling rigs (24), and the most wells (more than 350). Continental’s revenue has nearly tripled from two years ago to an expected \$1.76 billion in 2011, while profits have grown sevenfold to an estimated \$538 million... Continental Resources released its own estimate of the Bakken’s recoverable reserves: 24 billion barrels. By comparison, Prudhoe had 13.6 billion barrels of recoverable crude when discovered, according to the Energy Department.

Environmental violations are rarely reported in the popular press. When they are, the issues tend to be used to criticize government regulation and federal oversight of the industry. Moore (2011) quotes Hamm, whose company is accused of violating the Migratory Bird Act, as “It’s not even a rare bird...there’re jillions of them...” The state legislature has set aside \$1 million to sue EPA if a moratorium on hydraulic fracturing occurs as a result of the agency’s ongoing studies.

At this time, North Dakota reportedly produces 560,000 barrels of oil per day, surpassing the output of OPEC member Ecuador. Indeed, it is rapidly advancing toward becoming the

second largest oil-producing state, behind Texas. It is apparently is very high-quality oil, and much of it can be extracted. Economic friction is associated with distance: moving drilling equipment, moving extracted oil, acquiring labor, and securing housing. North Dakota is a location that presents both opportunity and challenge.

The national media focuses on \$80,000 incomes of truck drivers, \$15 per hour unfilled jobs at Taco John's, job vacancies at incomes between \$40,000-60,000, and labor shortages at local hospitals (Ellis, 2011a). The McDonald's in Dickinson was reported to be paying \$300 signing bonuses (Gruley, 2012). According to Gunderson (2012), David Flynn, the Director of the University of North Dakota Bureau of Business and Economic Research, states, "[t]he state allocated nearly \$1 billion for infrastructure, like roads damaged by heavy energy-related truck traffic. Counties struggle to find enough workers to build or repair roads because they can't compete with the paychecks workers earn in the oil field."

Shactman (2011) appeared on a CNBC segment that begins with "a place borderline out of control...a modern-day gold rush, black gold." He speaks with a home builder as the two men stand in an open field. "This looks like a lot of nothing, but in two years, this will be hundreds of homes, thousands of apartments, a school, and even a mall. That's one development...less than a mile away, three more with workers and machines in constant motion. Then, there are the 'man camps' run by companies such as Target Logistics, which charge companies like Halliburton and Schlumberger an average of \$120 per person per night to house and feed their workers. Undeveloped land two miles out of Williston sold for \$15,000, now \$200,000."

The Williams County Commission met on March 2, 2012, and voted 3-2 to indefinitely extend a moratorium on new applications for temporary housing that accommodates oil patch workers, which are known as "man camps." Mountrail and Dunn counties have also imposed man-camp moratoria. According to Donovan (2012), Williams County commissioner Dan Kalil said "the reasons for it being put in place haven't changed. We're still out of water, we're still out of sewage capacity, we're short of electricity and there's no room on the highways for anyone else." Williams County has already approved 9,777 beds, and approximately 6,600 of those have actually been built. Kalil said "If these companies need places for workers, they can build apartment buildings. They can make long-term investments. If this (oil development) is going to last another 20 to 30 years they can add some value to the community rather than set out more of these temporary beds."

There is an abundance of stories about the Walmart parking lot in Williston, which has been filled with campers and pick-up trucks in which people live and of police finding people sleeping on the street outside of banks and churches. Ward Koeser, Mayor of Williston, is prominently shown in interviews urging job-seekers to put housing first before coming to North Dakota.

Ellis (2011a), reporting for *CNN Money* in a segment entitled "Double Your Salary in the Middle of Nowhere, North Dakota" quoted the workplace development coordinator for the City of Williston as follows "[w]e've probably seen 2,200 housing units come online this year, but we probably have demand for more than 5,000...one-bedroom apartments can run at around \$1,500 a month, while two to three bedroom apartments are often around \$3,000."

In a subsequent article, Ellis (2011b) featured a Williston State College English professor who has lost some of his best students to the labor force in the industry. The employee turnover rate at the University is currently 25 percent. Professor Stout's yearly salary is \$56,000. Some

of his students drive a truck 12-18 hours a day and are paid \$100,000. In an observation indicative of boom-town human initiative, Ellis reports that enrollment at Williston State has reached a record 993 full-time and part-time students, a 6.5 percent increase from 2009. One hypothesis for the increase is that new workers enrolled in two-year degree programs are taking classes to advance more quickly in the oil industry; however, another explanation is that Williston State housing is a bargain. Family housing costs about \$715 a month and single or shared rooms are \$1750 per semester.

Ellis (2011c) reports that the head of job development for McKenzie County, in the center of Bakken activity, said “towns make building and infrastructure decisions on the assumption that the boom will last between five to ten years. And they expect—and hope—that 20% to 30% of the workers there will stay to maintain wells after the boom ends.”

3. FOR REGIONAL SCIENTISTS’ CONSIDERATION

As these tales are being told, there are emerging opportunities for high quality, independent research that utilizes the expertise of regional scientists. Areas of relevant, policy related work for us that come to mind include, but are not limited to, the list in the following sections.

3.1 Local/rural/regional economic growth is not synonymous with local/rural/regional economic development.

Shale plays, which tend to foster growth, have the *potential* to induce economic development, which can potentially yield *future* economic growth. Irwin et al. (2009) make the distinction between rural growth and rural development as follows: rural “growth usually means more of everything: more population, more resource employment, and more aggregate income without a significant change in industry mix, technology, productivity or income per capita.” They continue “rural development entails more varied nonfarm rural industry and land uses, new rural occupations, and higher income per capita.” A similar perspective on growth comes from Greenwood and Holt (2010). The latter authors, however, define economic development as “a broadly based, sustainable increase in the *overall standard of living for individuals within the community*.” Therefore, growth does not necessarily improve the standard of living if it compromises the quality of life and does not lead to sustainable development. This view of development includes valuing all capital that is used in producing income and calls for locally based indicators that can be used to evaluate changes in capital stocks and quality of life factors, where capital includes physical capital, public capital, natural resources, human capital, and social capital.

The increase in physical capital (infrastructure, housing) during a boom is generally not sustainable, especially in remote locations without natural and built amenities with long histories of out-migration. Furthermore, volatility in energy markets and the mobility of inputs moving from one “hotspot” to another is very likely to create unsustainable, poorly planned development.

Nonrenewable resources are eventually exhausted, calling for careful planning in a boom that facilitates further development when the resource is depleted. Conflict between mineral and surface rights holders, fixed income seniors and energy workers in competition for apartments has the potential to diminish the social capital of communities.

Diversification of a location's economic base is limited in isolated rural communities, even with carefully targeted policies. Only time will tell whether cities such as Williston will be a future ghost town or whether enough of the current population will find it an attractive location once the shale play ends. Unless the determinants of migration in the United States change remarkably in the next decade or two, it is unlikely that Williston will be a bustling metropolis in the future.

3.2 Careful Application of Research Methods

Impact analysis currently plays an important role in community planning and in workforce development. These studies measure short-run impacts on jobs or income and, as such, of limited use in economic development as defined above.⁴ Impact studies have well known limitations; the method was intended to evaluate marginal changes, not the kinds of changes that occur in natural resource plays. An issue, especially relevant with hydraulic fracturing, is that the pre-drilling and drilling phases, when the industry is most labor intensive, are short-lived for a given well. Employment and income calculations and local/state tax revenues in the beginning of a shale play cannot be expected during the production phase. It is not known how much profitable re-fracturing can occur in a given location, especially when oil and gas production follows the well-known hyperbolic function that is consistently found with hydraulic fracturing technology. [See Weinstein and Partridge (2011) for alternatives to impact analysis. Also see Kinnaman (2011) for a useful critique of several specific impact studies.]

If impact studies continue to be performed and appropriately used for short-run workforce-development and community-planning purposes, there are two unknowns that confront researchers: the percentages of mineral leases held by local and out of state residents and the percentages of lease and royalty payments that are spent in the year the payment is received. Bangsund and Leistritz (2010) base impacts on an estimate that 54.4 percent of payments in North Dakota are to state residents. Kelsey et al. (2011) provide compelling evidence from Pennsylvania that mineral rights holders save a greater portion of lease/royalty compensation than from wage income. It has been generally assumed that lease and royalty payments are spent in the year they are received, which inflates the impacts.

3.3 Long Run and Short-run Distinctions

There is a great deal of difference between (long run) local or regional economic development and (short-run) rent seeking that exploits current opportunities. Recognizing these distinctions leads to many questions:

Does the natural resource curse exist regionally/locally? Has the presence of coal, oil, or gas in communities influenced the education decisions of young people, causing them to discontinue education for higher pay in the extractive industry? How do communities with natural resources distribute revenues from the severance tax or other extraction taxes? More important, are revenues committed to long term investment that will diversify the local economy

⁴ If researchers continue to use impact analysis, there is great need for careful, tempered discussion of results. In Pennsylvania, the industry favors the results of Considine et al. (2009), as the definitive and credible—Pennsylvania State University's seal was featured prominently on the title page—research on jobs creation—175,000 annually by 2020. A subsequent study, by Kelsey et al. (2011), a collaboration of Pennsylvania State University Extension System and Pennsylvania College of Technology, (available at www.msetc.org) estimates a total employment impact of 44,000 in 2010, which includes 23,000 jobs supported by the industry in 2009.

once the oil or gas is depleted? Will concentrated oil and gas profits divert investment activity from existing industries and small businesses, leading to displacement effects?

Structural change in has been repeatedly found in oil-producing locations (see, e.g., Harris et al., 1987). Research from these two shale plays is in its incipient stages. Using data from 2007-2010, Adams and Kelsey (2012) found that Pennsylvania counties with 150 natural gas wells or more have experienced an 18.7 percent decrease in the number of dairy cattle compared to an average 1.2 percent decrease for counties with no gas wells.

Migration, as we know, is self-selecting. Careful studies of migration during a resource boom need to be performed. The features of the population and the industry mix will shed light on the long run fiscal viability of communities. It is unclear what optimal population size and demographic distribution is that will generate a revenue base and set of expenditures that allows for a sustainable community.

3.4 Possible Roles for Public Policy

At present, where the moratoria are—upstate New York counties with a moratorium on hydraulic fracturing and three North Dakota counties with a moratorium on temporary housing—suggest that uniform policy recommendations are not appropriate. Place-based policy by itself in rural isolated regions is likely to fail. Such policy (e.g., education) often fails to enhance local employment opportunities and, instead, typically facilitates out-migration, which already is a chronic issue in rural areas without adjacency to cities.

It has been argued that state tax policy will influence drilling locations. It is time to revisit the use severance and impact taxes. Are the current marginal tax rates efficient? Are the tax revenues being distributed in a manner that compensates for localized impacts? Are the revenues distributed in a manner that is conducive to sustainable development? Headwaters Economics (2012) compared the fiscal policy of five energy-producing states in the American West. Those authors suggest that states flush with severance tax revenues from unconventional oil plays should allocate revenues to mitigate impacts at the local level, develop permanent trust funds as natural resource wealth leaves the community for making long term investments and must diversify the economic base of the state's economy to create viable communities when the non-renewable resource is depleted.

4. CONCLUSION

There are shale plays within these two shale plays. The tales of these shale plays illustrate the spatial issues that arise when many benefits are diffused and costs are concentrated. How states and local communities respond is likely to determine their futures.

At present, my sense of the shale plays in these two locations is best articulated with a quote that is attributed to the late oilman J. Paul Getty, “[t]he meek may inherit the earth, but not the mineral rights.”

REFERENCES

- Adams, Riley, and Timothy Kelsey. (2012) “Pennsylvania Dairy Farms and Marcellus Shale 2007-2010,” Penn State Extension Marcellus Shale Fact Sheet. Last accessed in January 2013 at <http://pubs.cas.psu.edu/FreePubs/PDFs/ee0020.pdf>.

- Associated Press. (2012) “West Virginia Reaches Standstill on Plant Chase,” *Williamsport Sun-Gazette*, February 3.
- Bangsund, Dean A. and F. Larry Leistritz. (2010) “Petroleum Industry’s Economic Contribution to North Dakota in 2009,” *Agribusiness and Applied Economics Report* 676. Available online at <http://ageconsearch.umn.edu/bitstream/99252/2/AAE676.pdf>.
- Bartizek, Ron. “Plan Now for Ups and Downs of Gas Drilling,” *Wilkes-Barre Times Leader* Available online at <http://www.timesleader.com>. January 29, 2012.
- Begos, Kevin. “Most of Marcellus Drilling in 11 Counties,” *Williamsport Sun-Gazette*. March 15, 2012.
- Clarke, Cheryl R. “Gas Industry Sees ‘Downturn,’ According to Talisman Official,” *Williamsport Sun-Gazette*. January 15, 2012.
- Clarke, Cheryl. “More People, More Crime,” *Williamsport Sun-Gazette*. March 4, 2012.
- Considine, Timothy, Robert Watson, Rebecca Entler, and Jeffrey Sparks. (2009) “An Emerging Giant: Prospects and Economic Impacts of Developing the Marcellus Shale Natural Gas Play.” Report from The Pennsylvania State University College of Earth and Mineral Sciences, Department of Energy and Mineral Engineering. Last Accessed in January 2013 at <http://marcelluscoalition.org/wp-content/uploads/2010/05/EconomicImpactsofDevelopingMarcellus.pdf>.
- Detrow, Scott. “Legislators Have Questions About Corbett’s Tax Break,” *State Impact A Reporting Project of Local Public Media and NPR*, posted on June 5, 2012. Last accessed in January 2013 at <http://stateimpact.npr.org/pennsylvania/2012/06/05/legislators-have-questions-about-corbetts-shell-tax-break/>.
- Donovan, Lauren. (2012) “Williams County Extends Man Camp Ban,” March 3. Last accessed January 2013 at http://bismarcktribune.com/news/state-and-regional/williams-county-extends-man-camp-ban/article_87024584-6505-11e1-8140-001871e3ce6c.html#ixzz1p2knRoHj.
- Ellis, Blake. (2011a) “America’s Biggest Boomtown: Double Your Salary in the Middle of Nowhere, North Dakota,” *CNN Money*, October 20. Last accessed in January 2013 at http://money.cnn.com/2011/09/28/pf/north_dakota_jobs/index.htm.
- _____. (2011b) “America’s Biggest Boomtown: My Students Make Twice My Salary,” *CNN Money*. November 1. Last accessed in January 2013 at http://money.cnn.com/2011/11/01/pf/America_boomtown_education/index.htm.
- _____. (2011c) “When A Boomtown Goes Bust, Sudden Desertion,” *CNN Money*, December 6. Last accessed in January 2013 at http://money.cnn.com/2011/12/06/pf/oil_boom_bust/index.htm.
- Greenwood, Daphne T. and Richard P.F. Holt. (2010) *Local Economic Development in the 21st Century*. M.E. Sharpe Armonk, New York.
- Gruley, Brian. (2012) “The Man Who Bought North Dakota,” *Bloomberg Businessweek Magazine*. January 19. Last accessed in January 2013 at <http://www.businessweek.com/magazine/the-man-who-bought-north-dakota-01192012.html>.
- Gunderson, Dan. (2012) “Oil Boom and the North Dakota Economy,” *Minnesota Public Radio*, January 4. Last accessed in January 2013 at <http://www.commerce.nd.gov/news/detail.asp?newsID=1063>.

- Harris, Anthony H., Michael G. Lloyd, Alistair J. McGuire, and David A. Newlands. (1987) "Incoming Industry and Structural Change: Oil and the Aberdeen Economy," *Scottish Journal of Political Economy*, 34, 69–90.
- Headwaters Economics (2012) "Benefitting from Unconventional Oil: State Fiscal Policy is Unprepared for the Heightened Community Impacts of Unconventional Oil Plays," Last accessed in January 2013 at http://headwaterseconomics.org/wphw/wp-content/uploads/ND_Unconventional_Oil_Communities.pdf.
- Herzog, John. (2012) "Impact Fee Implementation," unpublished presentation to the Pennsylvania Public Utilities Commission. Last accessed in January 2013 at http://www.puc.state.pa.us/NaturalGas/pdf/MarcellusShale/Act13_Implementation_Presentation.pdf.
- Hutchinson, Matt. (2012) "Loyalsock: Gas Industry Spurs Housing, Business Advances," *Williamsport Sun-Gazette*. March 14.
- Irwin, Elena, Andrew M. Isserman, Maureen Kilkenny, and Mark D. Partridge. (2009) "A Century of Research on Rural Development and Regional Issues," *American Journal of Agricultural Economics*, 92, 522–553.
- Kelsey, Timothy, Martin Shields, James R. Ladlee, and Melissa Ward. (2011) "Economic Impacts of Marcellus Shale in Pennsylvania: Employment and Income in 2009," joint report by *Marcellus Shale Education and Training Center, a collaboration of Penn State Extension and Penn College*. Available at www.msetc.org.
- Kim, Catherine and Jessica Hopper. (2011) "Now Hiring: North Dakota Oil Boom Creates Thousands of Jobs," aired by *NBC* on October 27. Last accessed in January 2013 at http://rockcenter.nbcnews.com/_news/2011/10/27/8495501-now-hiring-north-dakota-oil-boom-creates-thousands-of-jobs.
- Kinnaman, Thomas. (2011) "The Economic Impact of Shale Gas Extraction: A Review of Existing Studies," *Ecological Economics*, 70, 1243–1249.
- Konigsberg, Eric. (2011) "Kuwait on the Prairie," *The New Yorker*, April 25, 42–54.
- Levy, Marc. (2012a) "Drilling Fee May Bring in Quick \$180 Million," *Williamsport Sun-Gazette*. February 7.
- _____. (2012b) "Holding the Line: Corbett Unveils \$27 billion State Budget," *Williamsport Sun-Gazette*. February 8.
- Marcellus Shale Education and Training Center. (2011) "Pennsylvania Marcellus Shale Workforce Needs Assessment," Last accessed in January 2013 at http://www.msetc.org/docs/PennsylvaniaStatewideWorkforceAssessmenttv1_Final.pdf.
- Matteo, Vincent J. (2012) "The Chamber View," in the *Chamber Connection, a cooperative effort of the Williamsport/Lycoming Chamber of Commerce and the Williamsport Sun-Gazette*. February.
- Moore, Stephen. (2011) "How North Dakota Became Saudi Arabia," *Wall Street Journal*. October 2. Last accessed in January 2013 at <http://online.wsj.com/article/SB10001424052970204226204576602524023932438.html>.
- _____. (2012) "ND County Extends Ban of 'Man Camps,'" March 3. Last accessed in January 2013 at <http://www.wday.com/event/article/id/60045/group/News/>.

- Partridge, Mark D. and Dan Rickman. (2006) *A Geography of American Poverty: Is There A Need for Place-Based Policy?* W.E. Upjohn Institute for Employment Research. Kalamazoo, Michigan.
- Regan, Elizabeth. (2012) "Too Much Gas; Too Little Access," *Williamsport Sun-Gazette*. January 22.
- Reuther, Mike. (2012) "Lawmakers Split on Impact Fee," *Williamsport Sun-Gazette*. February 10.
- Rodgers, Michele, Neal Fogel, Timothy Kelsey, Stan Lembeck, Ross Pifer, Walt Whitmer, and Peter Wulfhorst. (2008) "Marcellus Shale: What Local Government Officials Need to Know," Report by Penn State College of Agricultural Sciences, Agricultural Research and Cooperative Extension.
- Runkle, Jim. (2012a) "Anadarko Alerts Clinton County Leaders to its Future Plans," *Williamsport Sun-Gazette*. January 26.
- _____. (2012b) "Senators Lobby Shell to Build Plant in Keystone State," *Williamsport Sun-Gazette*, January 12.
- Shactman, Brian. (2011) "The Fueling Future: The Bakken Boom," aired on *CNBC* August 24. Last accessed in January 2013 at <http://video.cnbc.com/gallery/?video=3000041194>.
- _____. (2011) "Site Chosen for Major Refinery," *Williamsport Sun-Gazette*. March 16.
- Thompson, David. (2012a) "Understand the IMPACT: Focus Groups Consider Housing Crunch, Water, and Sewer Issues," *Williamsport Sun-Gazette*. January 21.
- _____. (2012b) "Gas Exodus? With the Price of Natural Gas Low, Area Drilling Slowing," *Williamsport Sun-Gazette*. March 4.
- U.S. Department of Commerce, Bureau of the Census. *Quickfacts*. Last accessed in January 2013 at <http://quickfacts.census.gov/qfd/states/42/4285312.html>.
- Weinstein, Amanda L, and Mark D. Partridge. (2011) "The Economic Value of Shale Natural Gas in Ohio," *Swank Program in Rural-Urban Policy and Summary and Report*." Last accessed in January 2013 at [http://aede.osu.edu/sites/drupal-aede.web/files/Economic Value of Shale Dec 2011.pdf](http://aede.osu.edu/sites/drupal-aede.web/files/Economic%20Value%20of%20Shale%20Dec%202011.pdf).