

Journal of Rural and Community Development

Employment and Compensation in the Marcellus Shale Gas Boom: What Stays Local?

Authors: Mark Suchyta & Timothy W. Kelsey

Citation:

Suchyta M, & Kelsey, T. W. (2018). Employment and compensation in the Marcellus Shale gas boom: What stays local?. *The Journal of Rural and Community Development*, 13(4), 87–106.

Publisher:

Rural Development Institute, Brandon University.

Editor:

Dr. Doug Ramsey

Open Access Policy:

This journal provides open access to all of its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. Such access is associated with increased readership and increased citation of an author's work.



**BRANDON
UNIVERSITY**
Founded 1899



RURAL
DEVELOPMENT
INSTITUTE

Employment and Compensation in the Marcellus Shale Gas Boom: What Stays Local?

Mark Suchyta

Michigan State University
East Lansing, Michigan, USA
suchytam@msu.edu

Timothy W. Kelsey

Pennsylvania State University
State College, Pennsylvania, USA
tkelsey@psu.edu

Abstract

Much of the public interest about the recent boom in shale natural gas development is due to expectations that the activity generates significant economic benefits within host communities, such as increases in employment and compensation. Numerous studies have examined the economic impacts of this activity and generally find mixed results; some studies find such impacts, while other studies find little evidence of an economic boom. An equally important, but much less frequently asked question is what portion of employment and compensation benefits from shale gas development stays local. Sociological literature on uneven development and economic literature on the natural resource curse provide reasons to be skeptical and suggest that these benefits are distributed unevenly and are often dispersed to recipients outside of the community. In this case study, we compare federal and state employment, compensation, and business data from four Pennsylvania counties experiencing rapid Marcellus Shale development to consider what portion of these benefits stay within their respective counties and what is awarded to out-of-county recipients. We then draw on focus group data for individual community leader accounts of how benefits are distributed and the possible mechanisms that explain the trends identified in the employment, compensation, and business data. Our findings suggest that a substantial portion of employment and compensation benefits associated with natural gas extraction have gone to out-of-county recipients, suggesting much more limited direct benefits for residents than previously described in economic projections. We conclude that this outflow of benefits is a form of uneven development that may partially explain the natural resource curse.

Keywords: natural gas; shale; Marcellus Shale; community development; natural resources; resource curse; uneven development

1.0 Introduction

The Marcellus Shale, a large geological formation that covers parts of the U.S. States of Pennsylvania, New York, Ohio, Maryland, and West Virginia, has seen some of the most rapid development among U.S. natural gas shales (Kargbo, Wilhelm, & Campbell, 2010). Considered an ‘unconventional’ resource, the Marcellus Shale contains large quantities of natural gas embedded in the fragile sedimentary rock

known as shale formations. Unconventional gas resources, which also include tar sands and coal bed methane resources are differentiated from more conventional resources because they require different production methods to be cost-effective, including horizontal drilling and hydraulic fracturing. As a result, unconventional natural gas development tends to be more costly than conventional development. A sharp rise in natural gas prices in the mid-2000s, however, as well the development of hydraulic fracturing technologies, created conditions in which shale gas development was profitable (Anderson & Theodori, 2009; Jacquet & Kay, 2014; Rahm, 2011). These conditions corresponded with large-scale development in the Marcellus Shale region. Since 2005, the Marcellus Shale has been one of the United States' most active shale "plays"¹ and Pennsylvania has been the most active state, with 10,896 unconventional natural gas wells drilled as of the beginning of 2018 (Pennsylvania Office of Oil and Gas Management, 2018).

Promoters of shale and other forms of unconventional natural gas development emphasize two types of economic benefits that will accrue to host communities: lease and royalty payments made to landowners who sign leases for the resource to be extracted and economic growth and jobs for local people. Research on uneven development, however, cautions that natural resource exploitation is associated with poor economic and social indicators in the communities where extraction is taking place. Also, a cause for concern is what economists call the natural resource curse—a well-replicated phenomenon in which higher resource dependency tends to be associated with slower economic growth (James & Aadland, 2011; Corden & Neary, 1982).

Most studies on the economic impacts of Marcellus Shale development have focused on changes in total employment and compensation through wages and salary. Only one study to date has sought to estimate what portion of these benefits stay within the communities where extraction is taking place (Wrenn, Kelsey, & Jaenicke, 2015). They found a substantial portion of employment gains were going to individuals who resided outside the county from which the gas was extracted.

In this study, we examine federal and state employment, compensation, and business data in four Pennsylvania counties experiencing rapid Marcellus Shale development in order to assess what portion of benefits from shale gas development remain inside the county where the extraction is taking place and what portion is awarded to out-of-county (or even out-of-state) recipients. We then draw on focus group data for individual community leader accounts of how benefits are distributed and the possible mechanisms that explain the trends identified in the employment, compensation, and business data.

2.0 Background

2.1 Estimating Economic Benefits of Shale Gas

There have been various attempts to report the economic impacts of shale natural gas extraction. Kinnaman (2011) and Weber (2012) review reports regarding various shale plays, including the Marcellus Shale. After close scrutiny and comparing estimates with existing data, both conclude that most reports have overestimated

¹ A "play" refers to a group of oil fields subject to the same set of geological circumstances (Stoneley, 1995).

employment and compensation benefits, overall and to local economies where the extraction has occurred.

Two economic impact reports that were industry-funded and highly cited (and criticized) by Considine, Watson, and Blumsack (2010, 2011) used survey data about industry spending and the economic model IMPLAN to estimate Marcellus Shale employment in Pennsylvania. They estimated that the shale gas industry created or supported 44,098 jobs in Pennsylvania in 2009 and 139,889 jobs in 2010. Other researchers were critical of the methodology and assumptions of the Considine et al. studies. Kelsey, Shields, Ladlee, and Ward (2011) used a methodology similar to Considine et al. (2010, 2011), but took into account the residence of mineral right owners and the proportion of workers from out-of-state to consider what portion of lease and royalty dollars are saved versus spent locally. They estimated that the Marcellus Shale development created or supported 23,884 jobs in Pennsylvania, about half of Considine et al.'s figure for 2009. They also suspected that a large portion of leasing and royalty dollars do not stay in Pennsylvania because many mineral right owners reside outside the state. In an attempt to predict the economic impacts of shale gas development in Ohio, Weinstein and Partridge (2011) compared employment and income data from the U.S. Bureau of Economic Analysis across six high-drilling and six non-drilling counties in Pennsylvania and found no noticeable differences. Weber (2012) found similar results based on reviewing reports about shale gas development in Colorado, Texas, and Wyoming.

In examining the economic impacts of gas development in the Eagle Ford Shale in South Texas, Tunstall (2015), found a positive correlation between per-capita income and the number of gas wells drilled at the county level. Cosgrove, Lafave, Sahan, & Donihue (2015) use data from the U.S. Census Bureau, Bureau of Labor Statistics, and Bureau of Economic Analysis to compare counties in New York, which has a moratorium on hydraulic fracturing, and Pennsylvania to investigate employment and wage impacts from Marcellus Shale development. They document that the Pennsylvania counties experiencing development saw increases in employment and wages in the natural resource, mining, and construction sectors, but these gains were largely offset by losses in manufacturing. Overall, they observed no statistically significant effects on employment and wages from shale gas development.

One of the challenges in estimating the economic impacts of shale gas development is that most studies rely on data provided by employers as opposed to local residents. As a result, it is difficult to identify what portion of employment and compensation benefits go to residents within the local community and what portion is awarded to recipients outside of the community. In an attempt to overcome this challenge, Wrenn et al. (2015) used both federal employer-provided data and resident-provided state tax return data to estimate the employment effects of Marcellus Shale development at the county level in Pennsylvania. They found that the employer-provided data demonstrate a modest positive effect on local employment, but that when using the resident-provided data, this effect is cut in half. This suggests that a substantial portion of employment gains are going to individuals who reside outside the county from which the gas is extracted, and that federal employer-provided data may overestimate local employment impacts.

The variation between reports that estimate large employment benefits and those that identify few employment benefits demonstrates a need for additional research

to identify changes in employment and compensation associated with recent unconventional shale gas development. It also demonstrates a need to distinguish between resident and non-resident economic benefits to estimate the economic impacts on host communities.

2.2 Uneven Development

Studies of uneven development in the United States and Canada suggest a relationship between natural resource exploitation and dependency and higher inequality, lower incomes, higher poverty rates, and lower educational attainment of residents. Places where natural resource exploitation is occurring often invest less in educational systems and economic development, suggesting a more nuanced explanation for lower educational attainment of residents and fewer alternative job opportunities because of their dependence on one industry (Billings & Tickamyer, 1993; Galston & Baehler, 1995; Luloff & Nord, 1993; Barnes & Hayter, 1992).

Uneven development suggests that both the location of activity and distribution of benefits are uneven. The distribution of economic benefits from extraction is key to the effect on the local community (Galston & Baehler, 1995; Lyson & Falk, 1993) and has been an issue of local controversy in Pennsylvania communities (e.g., White, 2012). Residents, policymakers and others ask: “Do the benefits stay local? Are they broadly distributed? Are they concentrated locally in the hands of a few, or do they accrue to non-resident landowners or corporations?”

Uneven development associated with extraction of natural resources is often linked to external ownership and control of the natural resource, coinciding with external control of the timing, nature, and extent of the resource extraction, which often includes determining wages paid to workers in a small local economy. Local officials have little control over or input regarding the pace or location of the natural resource extraction activity. The industry also decides whether to hire local people or rely on workers brought in from outside the community for a range of occupations associated with natural resource extraction (Gaventa, 1982).

Gylfason (2001) theorizes that excessive social confidence created from a boom in the natural resource sector can lead to a lack of investment in human capital, such as education, which can limit growth and result in a reduced quality of life when the resource boom tapers off. Furthermore, the high wages offered by extractive industries during a resource boom encourage individuals to take jobs in the industry and delay education and entrepreneurship (Sachs & Warner, 2001).

Research on natural resource and energy boomtowns in the American West suggest that the sudden exploitation of a natural resource stock creates social and economic disruption (England & Albrecht, 1984; Freudenburg, 1984; Little & Lovejoy, 1979). This research also applies to shale gas development (Brasier et al., 2011; Jacquet, 2009). The boomtown effect is most pronounced in rural communities reliant on natural resource extraction as urban areas usually have larger economies with other significantly established sectors and can better absorb a resource boom’s effect on employment and compensation (Weber, 2012; Galston & Baehler, 1995; Task Force on Persistent Rural Poverty, 1993).

In responding to changes that result from rapid development, Michaels (2010) and Marchand (2012) emphasize that the quality of institutions can shape the economic effects of natural resource industries. The impact also is affected by the extent to which natural resource extraction dominates the local economy through the share of

the local population that actually participates in the employment opportunities or unearned income (lease and royalty income or sale of natural resources) generated by the natural resource extraction (Galston & Baehler, 1995). In a study of energy development near small towns in Northern Arizona and Southern Utah, Little and Lovejoy (1979) demonstrate that the need for skilled labor for many energy jobs results in migration of workers from other places, limiting local employment benefits. When locals do obtain energy-related jobs, the employment is often less desirable, low-paying, and seasonal. Halseth (2008), in a study of small resource-dependent towns in rural British Columbia, Canada, also found a largely transient workforce which moved from town to town due to limited work opportunities. This can create additional pressures on locals seeking to benefit from a resource boom.

Hardy and Kelsey (2015) have examined local income related to Marcellus Shale development. They find that a significant portion of income benefits is in leasing and royalty payments to mineral right owners. Since land ownership is highly concentrated, and in some cases, the land is owned by nonresidents, they emphasize that the direct economic benefits are similarly concentrated and received by a relatively small portion of the population.

2.3 The Natural Resource Curse

The natural resource curse was initially identified at the international level. Researchers demonstrate that the more natural resources a nation has, the lower growth rate they experience even after controlling for geographical, demographic, political, and economic differences (Sachs & Warner, 1999, 2001; Corden & Neary, 1982). Papyrakis and Gerlagh (2007) demonstrated that the natural resource curse is also present at the state level and James and Aadland (2011) tested for the resource curse at the further disaggregated county level. They conducted a longitudinal study from 1980 to 2005 examining economic growth across counties in U.S. states of Wyoming and Maine and found a clear negative association between resource earnings and economic growth.

The most common economic explanation for the natural resource curse at the local level is that when a community specializes in natural resource extraction, other economic activities are “crowded out” (Sachs & Warner, 2001; Brown, 2014; Corden & Neary, 1984). The increase in relative wages and labor from the extractive sector pulls work from other sectors and also increases prices of local goods, making it more expensive for businesses to operate. Also, when the resource extraction declines, unemployment increases. Therefore, while natural resource dependency may create a ‘boom’ in short-term economic growth, communities largely reliant on natural resource sectors will lag behind those less reliant on natural resources.

Brown (2014) tested this crowding-out effect in counties experiencing shale gas development across nine states in the south-central United States and found little support for the phenomenon. While many new jobs were in construction and mining, the gains were not associated with losses in other sectors. He hypothesized that most counties experiencing shale gas development are rural with historically small manufacturing bases and many of the jobs created by development go to individuals from other counties or new residents who have not yet established residency or do not intend to do so.

In summary, although some studies demonstrate short-term employment and compensation benefits from shale gas development, the distribution of those benefits

is less clear. Theories related to uneven development and the natural resource curse imply that in the long run, benefits will be limited and may even result in communities heavily dependent on natural resource extraction lagging behind those invested in industries more conducive to longer-term local employment and compensation gains. An examination of what portion of employment and compensation benefits associated with Marcellus Shale natural gas extraction stays local will help to better understand its economic benefits, as well as whether the dispersion of economic benefits from local communities is a form of uneven development that helps to explain the natural resource curse.

In this study, we provide a detailed analysis of what portion of economic benefits stays within the local community using several indicators from four Pennsylvania counties that have experienced rapid Marcellus Shale development. We begin by examining employer-provided and resident-provided employment, compensation, and business data. We then draw from focus group data gathered from individuals representing local economic development organizations and businesses to better understand and interpret the aggregate data.

3.0 Methods

Data from four Pennsylvania counties are examined to determine what employment and compensation benefits from Marcellus Shale gas development stay in each of the respective counties. The four counties examined, which are depicted on the map below (see Figure 1), are Bradford and Lycoming counties, located in Pennsylvania's 'Northern Tier', and Greene and Washington counties, located in the extreme southwest of the state.

Figure 1: Study Counties.



Since 2007, when Marcellus Shale development largely began, these four counties have seen some of the most active development in Pennsylvania's Marcellus Shale region. Washington County, in Southwest Pennsylvania, has been the most active, with 1,705 unconventional natural gas wells drilled as of the beginning of 2018 (Pennsylvania Office of Oil and Gas Management, 2018). Bradford County, in the Northern Tier, has the second most wells with 1,438, while Greene (Southwest) and Lycoming (Northern Tier) counties have 1,246 and 955 wells drilled, respectively. Together, these counties account for 49 percent of all Marcellus Shale unconventional natural gas wells in Pennsylvania.

The U.S. Department of Agriculture's Economic Research Service (2013) and the U.S. Census Bureau (2010a) classify Lycoming and Washington counties as metropolitan and Bradford and Greene as nonmetropolitan. Washington County is part of the Pittsburgh metropolitan area and per the 2010 Census has a population of 207,820. Lycoming County includes the Williamsport, Pennsylvania metropolitan area and has a population of 116,111. Bradford and Greene counties are nonmetropolitan and have populations of 62,622 and 38,686, respectively.

Federal and state employment, compensation, and business data from 2007 to 2010 are examined. This timeframe is chosen because it encompasses the most active period of Marcellus Shale development.² Federal data are drawn from three sources: the U.S. Census Bureau's County Business Patterns, the U.S. Department of Commerce's Bureau of Economic Analysis Local Areas and Personal Income and Employment, and the U.S. Department of Labor's Bureau of Labor Statistics Quarterly Census of Employment and Wages. All three sources consist of data provided by employers in each county. County Business Patterns (CBP) data on employment and compensation are released annually and are based on an extension of the Census Bureau's economic census released every five years. Bureau of Labor Statistics (BLS) data are collected from unemployment and worker's compensation reports that employers file quarterly. Bureau of Economic Analysis (BEA) data relies upon the BLS data but then adjusts it for occupations and wages not covered by these programs. Therefore, the numbers can vary across data sources, but they are all employer-provided. State data from the Pennsylvania Department of Revenue is collected from state residents' tax returns and is therefore resident-provided. These tax returns are aggregated and then summarized by taxpayers' county of residence, regardless of the taxpayer's county of employment.

For our purposes, the main difference between federal and state employment, compensation, and business data is that the federal data report the number of people employed, compensation paid out by employers, and number of businesses in the four counties without regard to the county of residence for employees and business owners. State income tax data provide the employment, compensation, and number of businesses owned by county residents reported by residents, without regard to the county in which they work or own a business. Those who do not report wages or business compensation are not included.

An examination of these two data sources allows for comparison of trends in employment, compensation, and the number of businesses reported by residents in

² This timeframe was particularly active because of high natural gas prices, which rendered unconventional gas development particularly profitable. The price of natural gas, most notably around 2009, dropped dramatically, which corresponded with much slower development throughout the 2010s.

the four counties relative to what employers in those counties report. The ratio between these numbers provides a good indication of employment and compensation awarded to county residents compared to those residing outside the county. For the number of businesses, this can tell us what portion of businesses county residents own versus those owned by individuals outside of the county.

We expect some differences between the employer-provided and resident-provided data because of differences in the extent to which individuals live in the county in which they are employed. Residents of the study counties who commute out of their respective counties to work are included in the employer-provided data for the counties in which they are employed. Those who commute in from a non-study county to work in one of the four study counties are included in the employer-provided data for the county in which the employer is located. Finally, those who live and work in the same study county are included in both the employer and resident-provided data. The employer-provided data sets and resident-provided data set from the Pennsylvania Department of Revenue may report quite different numbers for the counties that have a large share of residents who commute out to work and/or have a large share of non-residents commuting in to work.

This study also draws upon data from two focus groups with local economic development groups and businesses in the four counties conducted in 2012. The goal of these focus groups is to provide possible explanations for trends identified in the employment, compensation, and business data. One focus group was conducted with individuals from the Northern Tier counties (Bradford and Lycoming) and one for the counties in Southwest Pennsylvania (Greene and Washington). Potential participants for the focus groups were identified through the creation of lists of informants knowledgeable about local business and economic activity, developed in consultation with the appropriate advisory committees, personal contacts, and focused Internet searches of local organizations and businesses. Invitations were extended by email to those knowledgeable in small business development, local economic development, workforce development, real estate, and tourism. A total of nine individuals participated across the two focus groups. These individuals represented local chambers of commerce, county government programs, job training programs, and other business associations. Institutional Review Board approval was secured and is on file at the Pennsylvania State University. All focus groups were recorded and professionally transcribed.

4.0 Results

First, we present findings from our comparison of employer and resident-provided employment, compensation, and business data. We then describe findings from the focus groups with individuals from local economic development groups and businesses.

4.1 Comparison of Employer and Resident-provided Employment, Compensation, and Business Data

From 2007 through 2010, federal employer-provided data showed a decrease in employment for the Commonwealth³ of Pennsylvania ranging from 1.8 (BEA) to 4.2 percent (CBP) (see Table 1). Resident-provided data collected by the Pennsylvania Department of Revenue also report a 1.6 percent decrease in the

³ The U.S. State of Pennsylvania is officially known as ‘The Commonwealth of Pennsylvania.’

number of tax returns reporting compensation (i.e., employment). While this trend was mostly consistent across the state, the four study counties tended to fare much better than the state overall.

According to employer-provided data, three of the four study counties (Bradford, Washington, and Greene) saw increases in employment. Greene County experienced the largest percentage increase with reports ranging from 4.3 (BEA) to 10.1 percent (CBP), demonstrating that during the time of the most active Marcellus Shale development, Greene County saw substantial employment gains. Resident-provided data, however, tell a different story with a 3.9 percent decrease in the number of residents employed in jobs in Greene County. This discrepancy suggests that while employers in Greene County reported increases in the number of jobs and people hired, fewer county residents reported gross compensation on their tax returns, suggesting residents did not fill these newly created jobs

Washington County demonstrates a similar, although more modest trend. Employer-provided data show an increase in employment ranging from 0.2 percent (CBP) to 2 percent (BEA). Resident-provided data, on the other hand, indicate a 1 percent decrease. Again, this suggests that while 2007 through 2010 was a time of employment growth, most of the new opportunities were awarded to out-of-county recipients. In Bradford County, however, both employer and resident-provided data show an increase in employment. Employer-provided data report increases in jobs ranging from 1.2 (CBP) to 5.9 percent (BLS) and resident-provided data indicate a comparable 2.8 percent increase. These data suggest that some Bradford County residents have benefited from employment gains during Marcellus Shale development, a different experience, overall, when compared to that of residents of Greene and Washington counties.

Lycoming County is unique in that it is the only one of the four counties with employer-provided data demonstrating a loss in employment reported from 1.5 (BEA) to 4.4 percent (CBP). As expected, resident-provided data also show a loss in employment (1 percent). These findings suggest Lycoming County either did not experience the same employment gains that the other counties did from shale gas development, or that they were offset by larger employment losses in other industries.

Compensation data (wages and salaries) tell a similar story (see Table 2). Only one of the three employer-provided data sources, the BLS, reports changes in total wages. For the years 2007 through 2010, both employer and resident-provided data report a decrease in wages and compensation in the state of Pennsylvania. The four study counties, however, are exceptions to that trend.

Table 1: *Employer-Reported Employment Changes Compared to Resident-Reported Changes, 2007 through 2010*

	Wells Drilled '07- '10 ^a	Employer-Provided Data			Resident-Provided Data
		Bureau of Labor Statistics (BLS) ^b	County Business Patterns (CBP) ^c	Bureau of Economic Analysis (BEA) ^d	PA Department of Revenue ^e
		Change in Average Annual Employment (percent change)	Change in Total Paid Employees (percent change)	Change in Total Full- and Part-Time Employment (percent change)	Change in Number of Tax Returns with Gross Compensation (percent change)
Pennsylvania	2,876	-194,443 (-3.9%)	-219,625(-4.2%)	-128,238 (-1.8%)	-72,255 (-1.6%)
Bradford	563	1,087 (5.9%)	221 (1.2%)	1,246 (3.9%)	597 (2.8%)
Washington	379	506 (0.7%)	134 (0.2%)	2,132 (2%)	-816 (-1.0%)
Greene	285	947 (9.5%)	1,160 (10.1%)	763 (4.3%)	-498 (-3.9%)
Lycoming	159	-1,288 (-2.9%)	-2,052 (-4.4%)	-1,051 (-1.5%)	-462 (-1.0%)

Sources: Pennsylvania Office of Oil and Gas Management (2018)^a; United States Department of Labor, Bureau of Labor Statistics (2012) Quarterly Census of Employment and Wages 2007 and 2011^b, United States Census Bureau (2012), 2007 through 2011^c; United States Department of Commerce, Bureau of Economic Analysis (2012), 2007 through 2011^d; Pennsylvania Department of Revenue (2012)^e.

Table 2: *Employer-Reported Wage/Gross Compensation Changes Compared to Resident-Reported Changes, 2007 through 2010 (Inflation adjusted to 2007 U.S. dollars)*

		Employer-Provided Data	Resident-Provided Data
		Bureau of Labor Statistics ^b	PA Department of Revenue ^c
	Wells Drilled '07- '10 ^a	Change in Annual Total Wages (percent change)	Change in Total Gross Compensation (percent change)
Pennsylvania	2,876	-\$7,626,449,170 (-3.6%)	-\$6,008,520 (-2.6%)
Bradford	563	\$69,766,044 (11.4%)	\$39,683,000 (4.9%)
Washington	379	\$173,113,037 (6.5%)	\$7,959,000 (0.2%)
Greene	285	\$101,961,547 (24.3%)	\$8,791,000 (1.7%)
Lycoming	159	\$14,532,514 (1.1%)	-\$22,467,000 (-1.3%)

Sources: Pennsylvania Office of Oil and Gas Management (2018)^a; United States Department of labor, Bureau of Labor Statistics (2012) 2007 and 2011^b; Pennsylvania Department of Revenue (2012)^c.

According to employer-provided data, Greene County experienced the highest percentage increase in total wages among the four counties, an impressive 24.3 percent. Resident-provided data, however, report a much more modest 1.7 percent increase in gross compensation. This difference suggests that residents did receive compensation benefits during the period of peak Marcellus Shale development, but the majority of new compensation was awarded to out-of-county recipients. While the case of Greene County is extreme compared to the rest of the state, the other three counties report similar, although more modest, trends of compensation benefits leaving the county.

Employer-provided data for Bradford County demonstrate an 11.4 percent increase in total wages. Resident-provided data report a smaller increase in gross compensation, 4.9 percent. Employer-provided data for Washington County show a 6.5 percent increase in total wages, with resident-provided data indicating a meager 0.2 percent increase in gross compensation. Finally, employer-provided data for Lycoming County show a 1.1 percent increase in total wages, but resident-provided gross compensation data indicate a 1.3 percent decrease. Again, it appears that the majority of compensation benefits are not going to county residents.

The final indicator examined is the number of businesses (see Table 3). Two employer-provided data sources, the BLS and CBP, collect business data. These two datasets disagree as to whether the state of Pennsylvania saw an increase or decrease in the number of businesses from 2007 through 2010. The BLS reports a 0.4 percent increase while the CBP reports a 2.7 percent decrease. This disagreement stems from several differences in terms of the data definitions, scope, and methods of data

collection between the two data sets (Becker et al., 2005). State resident-provided data use the number of tax returns that report net profits and show a slight decrease in the number of businesses of 0.1 percent, more consistent with the BLS data.

Table 3: *Employer-Reported Changes in the Number of Businesses Compared to Resident-Reported Changes in Tax Returns with Net Profits, 2007 through 2010*

	Wells Drilled '07-'10 ^a	Employer-Provided Data		Resident-Provided Data
		Bureau of Labor Statistics ^b	County Business Patterns ^c	PA Department of Revenue ^d
		Change in Total Private Sector Establishments (percent change)	Change in Total Private Sector Establishments (percent change)	Change in Number of Tax Returns with Net Profits (percent change)
Pennsylvania	2,876	1,332 (0.4%)	-8,322 (-2.7%)	-684 (-0.1%)
Bradford	563	52 (3.7%)	81 (6%)	-53 (-1.4%)
Washington	379	132 (2.6%)	5 (0.1%)	-104 (-0.9%)
Greene	285	41 (5.8%)	-35 (-4.7%)	-120 (-8.2%)
Lycoming	159	64 (2.2%)	13 (0.5%)	-104 (-1.7%)

Sources: Pennsylvania Office of Oil and Gas Management (2018)^a; United States Department of Labor, Bureau of Labor Statistics (2012) 2007 and 2011^b; U.S. Census Bureau County Business Patterns (2012), 2007 and 2011^c; Pennsylvania Department of Revenue (2012)^d.

Employer-provided data for the four study counties appear to demonstrate a better business climate. Resident-provided data, however, report decreases in the number of businesses owned by residents in all four counties. Employer-provided data for Bradford County report increases in the number of businesses of 3.7 (BLS) and 6 percent (CBP). Resident-provided data, on the other hand, indicate a loss of 1.4 percent. Employer-provided data for Washington County show increases of 2.6 (BLS) and 0.1 (CBP) percent while resident-provided data report a decrease of 0.9 percent. Employer-provided BLS and CBP data disagree as to whether Greene County lost or gained businesses, but resident-provided data reflect a loss of 8.2 percent. Finally, employer-provided data report increases in the number of businesses in Lycoming County of 2.2 (BLS) and 0.5 (CBP) percent, but resident-provided data indicate a decrease of 1.7 percent. Collectively, these data demonstrate that from 2007 through 2010, the study counties saw new businesses, but most were owned by non-residents.

4.2 Focus Group Results

What is to be made of this difference between employer-reported and resident-reported employment and compensation, as well as business data? Could these

findings simply be a result of migration of workers from adjacent counties? To understand these gaps between federal and state employment, compensation, and business data, we conducted focus groups consisting of individuals from local economic development groups and businesses from the four counties. Participants acknowledged that the local economy was booming because of Marcellus Shale development. Regarding the effect of development on local businesses, one participant stated:

We did see an effect [on] a huge majority of our businesses. For suppliers for the industry, their business had grown locations. A couple of them really upgraded their locations. [A local store] sells Carhartt's, Red Wing boots, and men's clothing. It's a generational business, has been there for years and years and years. They are doing quite well.

Participants cited low unemployment and industry-sponsored training opportunities for those looking for a career change, which was common due to the enticing compensation offered by companies associated with Marcellus Shale development. In fact, one participant expressed concern that the opportunities were so attractive that they thought it would become difficult to fill jobs in other sectors. They mentioned an example of a school administrator leaving their job to drive a truck for the industry.

These benefits also came along with some challenges. For example, high housing prices were frequently mentioned as a problem the community was grappling with due to a rapid influx of out-of-town workers. Regarding this matter, participants echoed the findings from the federal and state data and provided possible explanations for the apparent outflow of benefits to out-of-county recipients.

One of the common themes was the transient nature of the gas industry workforce. Many mentioned that workers were from other states, living in temporary housing such as recreation vehicles or hotels. Multiple participants discussed a rapid increase in housing prices, a shortage of housing units, and an abrupt appearance of new campgrounds. A participant from Southwest Pennsylvania stated, "If somebody had [land] that wasn't being used for pasture and cows, they were putting in camping hookups, and they popped up all over our county." Another individual discussed the many calls they received from "wives calling ahead for their husbands to find a place to park their campers." Participants mentioned the prominence of new residents with Southern⁴ accents and trucks with license plates from Texas, Oklahoma, Arkansas, and Louisiana, suggesting that many industry employees were from further away than just the next county over. A county official stated:

We just got a call last week. There's 100 guys coming, and could we send them information on lodging and all of that, and I mean they're coming in this week. We had to overnight them information last week because they had no clue where they were coming from. They were coming from Wisconsin, but they were gonna be here at least throughout the summer.

⁴ Referring to accents associated with Southern U.S. states

One respondent stated that even locals who were hired would join a transient workforce, possibly moving to Ohio or another state experiencing unconventional natural gas development when their tasks in Pennsylvania were complete. If the workforce is living in trailers, the workers are likely not filing county taxes, much less viewing themselves as having a long-term commitment to the county. A substantial transient workforce may partially explain why county residents are not claiming employment and compensation benefits employers located in the county report paying out.

In discussing the impact on local businesses, many focus group participants acknowledged that business was booming. One individual stated: “Local businesses, I guess, I’ll comment on that. Positive, I think the economy is—local economic activity as a result of [natural gas development] is stable and positive.” The participant went on to say that unemployment was low in his county and that one restaurant that was struggling just a few years ago was now very successful. Another participant described how local restaurants were “tweaking their menus” to give it a “Southwest flavor” to accommodate the gas workers coming from Southern states. Participants also acknowledged that many of the businesses moving into the area were large national and transnational energy companies, such as Halliburton and Chesapeake. When asked for examples of local economic benefits, they often mentioned hotels, restaurants, and retail establishments that are national chains and typically provide low wage jobs. In addition, hotels and restaurants are the sectors most likely to be particularly affected by a large increase in the number of non-residents, suggesting the new businesses and any associated jobs will be as transient as the influx of non-local workers. Some respondents alluded to this, mentioning that while businesses were not at the point of shutting down, gas development was at least tentatively slowing down and many workers were moving on to different locations, often in other states. This was largely due to a rapid decline in the price of natural gas beginning in 2009. Describing a local campground, someone mentioned:

There’s [a campground] near my home that I can see so I’ve been keeping an eye on it. It was completely full for months and months and months. In fact, it was brand new, built just for this purpose. I mean the camper spots are just one right on top of each other on gravel. It’s now down to maybe 10 or 12, and I think it had close to 50 spots. They’re moving on. They’re going out west into Ohio.

Participants did not discuss this decline as a ‘bust’ but rather a ‘slowdown’ and demonstrated some optimism that things would pick up and more opportunities were forthcoming.

5.0 Discussion

We compared federal and state employment, compensation, and business data from four Pennsylvania counties experiencing Marcellus Shale natural gas development to assess what portion of benefits from development stays local. Federal data are collected from employers in the county while state income tax data are collected from county residents’ state income tax returns. A comparison of these data identifies disparities between employer-reported employment and compensation and

resident-reported employment and compensation. These disparities in findings across employer- and resident-provided data sources and counties partly may reflect the extent to which residents of the study counties commute to other counties to work, and residents of other counties commute into a study county to work. Higher levels of commuting (both in and out) are likely to result in larger differences between the employer-provided and resident-provided data. Based on the U.S. Census Bureau's (2010b) American Community Survey five-year (2006-2010) commuting data, Greene and Washington counties had the highest percentage of employed persons who commuted to work outside of the county, 41 percent for both. This figure was only 25 percent for Bradford County and 14 percent for Lycoming County. Greene and Washington counties also had larger percentages of individuals who commuted into the county to work than did Bradford and Lycoming counties, suggesting one explanation for the large differences in employer-provided and resident-provided employment and compensation figures for Washington and Greene counties. Population changes could also possibly confound these findings, but the estimated population of the four counties remained relatively stable throughout the years examined, and three of four counties actually saw a decline in their populations (United States Census Bureau, 2010a).

From 2007 through 2010, employer-provided employment, compensation, and business data demonstrate that the four study counties experiencing Marcellus Shale development performed much better economically than Pennsylvania as a whole. While Pennsylvania saw losses in employment, total compensation, and the number of businesses, the four counties mostly experienced increases. Three of the four counties experienced increases in employment, all four experienced increases in total compensation and three had an increase in the number of businesses. Resident-provided data, on the other hand, tell a different story, with three out of four counties reporting decreased employment. All four counties demonstrate more limited compensation gains than reported by the employer-provided data, with one (Lycoming County) reporting a decrease. Finally, all four counties show a decrease in the number of businesses from 2007 through 2010.

Together, these data suggest that from 2007 through 2010, a time of rapid shale gas development, the four counties saw an increase in economic activity, but the benefits from these activities largely went to out-of-county recipients. To understand the causal mechanisms behind these quantitative findings, we drew on data from focus groups with individuals from local government, economic development groups, and businesses. Common themes identified among focus group participants include the transient nature of the natural gas workforce and the influx of large national businesses moving into the county, such as chain restaurants. Participants reported that new locally owned businesses tended to be hotels or restaurants seeking to cater to the transient workforce.

It should be noted that in 2012, the Commonwealth of Pennsylvania enacted Act 13, which authorizes county governments to impose an annual impact fee on natural gas producers within their county. Since 2012, the Commonwealth of Pennsylvania has collected approximately \$200 million (US dollars) per year in the form of impact fees (Marcellus Shale Coalition, 2018). These impact fees are collected at the state level and are then returned to counties and municipalities based upon a statewide formula which includes the number of wells there, as well as other factors. The dollars go to local governments, not directly to citizens or employees. Funds must be dedicated to one of thirteen approved uses, which include infrastructure,

emergency preparedness, environmental programs, tax reductions, and so forth. For this reason, we are skeptical that workers and residents directly receive significant benefits from the impact fees, although it is possible that employment opportunities have been created as a result, as well as non-monetary benefits, such as improvements to local sewer systems. We recommend the effect of this policy and similar policies in the U.S. and Canada as an area for further study.

Overall, our findings suggest that many of the new jobs and compensation did not benefit county residents, but rather went to a workforce that claims permanent residency in other counties and states. Additionally, many of the new businesses that opened were likely to be national chains or companies associated with natural gas extraction from other parts of the country. These findings are significant as politicians and proponents of shale gas development cite economic gains, frequently in the form of employment, compensation, and entrepreneurship based on reports from employer-provided federal data sources, in order to gain support for development projects. However, these employer-provided data sources do not account for what portion of benefits stay in the community which results in an overestimation of the impacts going to local residents, businesses, communities, and various levels of government.

Our findings are consistent with literature on uneven development that demonstrates many of the economic gains from extractive industries accrue to those living outside the community and that some benefits (e.g., lease and royalty income) are concentrated in the hands of a small portion of the population (Gaventa, 1980; Hardy & Kelsey, 2015; Little & Lovejoy, 1979; Galston & Baehler, 1995; Lyson & Falk, 1993; Brown, 2013).

Understanding uneven development in the context of shale gas can help us theorize about the natural resource curse more generally. At the local level, the natural resource curse states that extractive industries can crowd out industries more conducive to long-term economic growth, such as manufacturing (Sachs & Warner, 2001; Corden & Neary, 1984). We amend this theory by drawing from our findings to suggest that the outflow of economic benefits from the place of extraction further explains why communities dependent on resource extraction lag in economic growth—many community members do not benefit from development and, therefore, have few resources to invest in the development of local economic opportunities. While we examine this theory at a county level, the same logic could be extended to the transnational level where the resource curse is most commonly tested.

Of course, our research is a case study that focuses on one particular shale play in one region of the United States. Further research in locations where shale gas or other extractive activities are taking place is warranted, as well as larger scale, more generalizable research. Another limitation of this study is that we examined employment, compensation, and business data across all economic sectors in the study counties. Future research on changes across specific sectors can provide a more detailed account of how shale gas development is uneven and how this may contribute to the natural resource curse. Finally, the development of the Marcellus Shale is a relatively new phenomenon, but the natural resource curse is a long term-trend that becomes more apparent as time goes on. This issue is further complicated by the fact that shale natural gas extraction may not be defined by just one ‘boom’ that tapers off, but many. As Jacquet and Kay (2014) demonstrate, unconventional natural gas reservoirs, such as shale plays, encompass large geographic areas and

can be extracted over a long period of time. In the case of shale natural gas, wells often need to be re-fractured in order to stimulate additional production. As a result, communities experience not one large boom, but several modest booms with periods of decline in between. This, too, warrants a long-term examination as effects on employment, compensation, and businesses will be a continuing issue.

6.0 Conclusion

Most studies on the economic impacts of shale natural gas development have focused on changes in total employment and compensation through wages and salary. Only one previous study, by Wrenn et al. (2015), has examined what portion of these benefits stay in the community where extraction is taking place. They found that a substantial portion of employment gains were going to individuals who resided outside the county from which the gas was extracted. In our study, we draw upon focus groups to further understand these trends. Our findings also suggest that the economic benefits of Marcellus Shale gas development for residents of the counties in which drilling occurs may be much more limited than what reports and proponents of development have emphasized. Further research is recommended to better understand the economic benefits of shale gas development and to determine the costs from infrastructure, quality of life, and natural environment impacts to contribute to sound policymaking that promotes the interests of the communities where extraction occurs.

Acknowledgements

We would like to acknowledge the Center for Rural Pennsylvania, a legislative agency in the Pennsylvania state government whose funding made this project and many others possible. We also would like to acknowledge the contributions of several individuals who helped this paper come to fruition whether through inspiring us or contributing in some way to the data collection necessary for this study. These individuals include Diane McLaughlin, Kathryn Brasier, Kirsten Hardy, Leland Glenna, Kai Schafft, Lisa Davis, Kristin Babbie, Catherine Biddle, Anne Delessio-Parson, and Danielle Rhubart.

References

- Anderson, B. J., & Theodori, G. L. (2009). Local leaders' perceptions of energy development in the Barnett Shale. *Southern Rural Sociology* 24(1), 113–29.
- Barnes, T. J., & Hayter, R. (1992). 'The little town that did': Flexible accumulation and community response in Chemainus, British Columbia. *Regional Studies* 26(7), 647–663.
- Becker, R., Elvery, J., Foster, L., Krizan, C. J., Nguyen, S., & Talan, D. (2005). A comparison of the business registers used by the Bureau of Labor Statistics and the Bureau of the Census. Retrieved April 28, 2016, from <https://www.bls.gov/ore/pdf/st050270.pdf>
- Billings, D., & Tickamy, A. (1993). Uneven development in Appalachia. In T. A. Lyson & W. W. Falk (Eds.) *Forgotten places: Uneven development in rural America* (pp. 7–29). Lawrence, KS: University Press of Kansas.

- Brasier, K. J., Filteau, M. R., McLaughlin, D. K., Jacquet, J., Stedman, R. C., Kelsey, T.W., & Goetz, S. J. (2011). Residents' perceptions of community and environmental impacts from development of natural gas in the Marcellus Shale: A comparison of Pennsylvania and New York cases. *Journal of Rural Social Sciences* 26(1), 32–61.
- Brown, J. P. (2014). Production of natural gas from shale in local economies: A resource blessing or curse? *Federal Reserve Bank of Kansas City, Economic Review*, 99(1), 119–147.
- Considine, T., Watson, R., & Blumsack, S. (2010). *The economic impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An update*. University Park, PA: The Pennsylvania State University.
- Considine, T., Watson, R., & Blumsack, S. (2011). *The Pennsylvania Marcellus Natural gas industry: Status, economic impacts and future potential*. University Park, PA: The Pennsylvania State University.
- Corden, M. W., & Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The Economic Journal*, 92(368), 825–48.
- Cosgrove, B. M., Lafave, D. R., Sahan, T. M., & Donihue, M. R. (2015). The economic impact of shale gas development: A natural experiment along the New York/Pennsylvania border. *Agricultural and Resource Economics Review*, 44(2), 20–39.
- England, J. L., & Albrecht, S. L. (1984). Boomtowns and social disruption. *Rural Sociology*, 49(2), 230–246.
- Freudenburg, W. R. (1984). Boomtown's youth: The differential impacts of rapid community growth on adolescents and adults. *American Sociological Review*, 49(5), 697–705.
- Gaventa, J. (1982). *Power and powerlessness: Quiescence and rebellions in an Appalachian Valley*. Urbana and Chicago, IL: University of Illinois Press.
- Galston, W. A., & Baehler K. J. (1995). *Rural development in the United States: Connecting theory, practice, and possibilities*. Washington, DC: Island Press.
- Gylfason, T. (2001). Natural resources, education, and economic development. *European Economic Review*, 45(4–6), 847–859.
- Halseth, G. (2008). “We came for the work”: Situating employment migration in B.C.'s small, resource-based, communities. *The Canadian Geographer*, 43(4), 363–381.
- Hardy, K., & Kelsey, T. W. (2015). Local income related to Marcellus Shale activity in Pennsylvania. *Community Development*, 46(4), 329–340.
- Jacquet, J. (2009). *Energy boomtowns and natural gas: Implications for Marcellus Shale local governments and rural communities*. State College, PA: Northeast Regional Center for Rural Development. Retrieved from <https://aese.psu.edu/nercrd>
- Jacquet, J. B., & Kay, D. L. (2014). The unconventional boomtown: Updating the impact model to fit new spatial and temporal scales. *Journal of Rural and Community Development*, 9(1), 1–23.

- James, A., & Aadland, D. (2011). The curse of the natural resources: An empirical investigation of US counties. *Resource and Energy Economics*, 33(2), 550–453.
- Kargbo, D. M., Wilhelm, R. G., & Campbell, D. J. (2010). Natural gas plays in the Marcellus Shale: Challenges and potential opportunities. *Environmental Science and Technology* 44(15), 5679-5684.
- Kelsey, T. W., Shields, M., Ladlee, J. R., & Ward, M. (2011). *Economic impacts of Marcellus Shale in Pennsylvania: Employment and income in 2009*. Williamsport, PA: Marcellus Shale Education Training Center.
- Kinnaman, T. C. (2011). The economic impact of shale gas extraction: A review of existing studies. *Ecological Economics*, 70(7), 1243–1249.
- Little, R. L., & Lovejoy, S. B. (1979). Energy development and local employment. *Social Science Journal*, 16(2), 27–49.
- Luloff, A. E., & Nord, M. (1993). The forgotten of Northern New England. In T. A. Lyson & W. W. Falk (Eds.) *Forgotten places: Uneven development in rural America* (pp. 125-167). Lawrence, KS: University of Kansas Press.
- Lyson, T. A., & Falk, W. W (Eds). (1993). *Forgotten places: Uneven development in rural America*. Lawrence, KS: University of Kansas Press.
- Marchand, J. (2012). Local labor market impacts of energy boom-bust-boom in Western Canada. *Journal of Urban Economics*, 71(1),165–74.
- Marcellus Shale Coalition. (2018). *Pennsylvania's impact fee: Benefiting communities all across the Commonwealth*. Retrieved from <http://marcelluscoalition.org/wp-content/uploads/2015/12/Impact-Fee-Fact-Sheet-1.pdf>
- Michaels, G. (2010). The long term consequences of resource-based specialisation. *The Economic Journal*, 121, 32–57.
- Papyrakis, E., & Gerlagh, R. (2007). Resource abundance and economic growth in the U.S. *European Economic Review*, 51(4), 1011–1039.
- Pennsylvania Office of Oil and Gas Management. (2018). *Wells Drilled by County*. Retrieved from <https://www.dep.pa.gov/dataandtools/reports/oil%20and%20gas%20reports/pages/default.aspx>
- Pennsylvania Department of Revenue. (2012). *Personal income tax statistics. 2007 through 2011*. Retrieved from <https://www.revenue.pa.gov/GeneralTaxInformation/News%20and%20Statistics/ReportsStats/PIT/Pages/default.aspx>
- Rahm, D. (2011). Regulating hydraulic fracturing in shale gas plays: The case of Texas. *Energy Policy*, 39(5), 2974–2981.
- Sachs, J. D., & Warner, A. M. (1999). The big push, natural resource booms, and growth. *Journal of Development Economics*, 59, 43–76.
- Sachs, J. D., & Warner, A. M. (2001). The curse of natural resources. *European Economic Review* 45, 827–38.
- Stoneley, R. (1995). *Introduction to petroleum exploration for non-geologists*. Oxford, United Kingdom: Oxford University Press.

- Task Force on Persistent Rural Poverty. (1993). *Persistent poverty in rural America*. Boulder, CO: Westview Press.
- Tunstall, T. (2015). Recent economic and community impact of unconventional oil and gas exploration and production on South Texas counties in the Eagle Ford Shale area. *Regional Analysis and Policy*, 45(1), 82–92.
- United States Census Bureau. (2012). *Bradford, Greene, Lycoming, and Washington counties, Pennsylvania, Census County Business Patterns. 2007 through 2011*. Retrieved from <https://www.census.gov/programs-surveys/cbp/data/datasets.html>
- United States Census Bureau. (2010a). *Bradford, Greene, Lycoming, and Washington counties, Pennsylvania QuickFacts*. Washington, DC: United States Census Bureau. Retrieved from <https://www.census.gov/quickfacts>
- United States Census Bureau. (2010b). *Estimated numbers of county residents commuting to work out of county and out of state, and nonresidents commuting to work in the county, American community survey, 2006-2010*. Retrieved from <https://www.census.gov/data/tables/2010/demo/geographic-mobility/county-to-county-migration-2006-2010.html>
- United States Department of Agriculture Economic Research Service. (2013). *Rural classifications*. Washington, DC: Author. Retrieved from <https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/>
- United States Department of Commerce, Bureau of Economic Analysis. (2012). *Local areas personal income and employment, 2007 through 2011*. Retrieved from <https://www.bea.gov/data/by-place-county-metro-local>
- United States Department of Labor, Bureau of Labor Statistics. (2012). *Quarterly census of employment and wages database*. Washington, D.C.: Author. Retrieved from <https://www.bls.gov/cew/>
- Weber, J. G. (2012). The effects of a natural gas boom on employment and income in Colorado, Texas, and Wyoming. *Energy Economics*, 34(5), 1580–1588.
- Weinstein, A. L., & Partridge, M. D. (2011). *The economic value of shale natural gas in Ohio*. Columbus, OH: The Ohio State University. Retrieved from https://aede.osu.edu/sites/aede/files/publication_files/Economic%20Value%20of%20Shale%20FINAL%20Dec%202011.pdf
- White, J. (2012). Why aren't there more Marcellus jobs for Pennsylvania workers? Retrieved from <http://patch.com/pennsylvania/canon-mcmillan/why-aren-t-there-more-marcellus-shale-jobs-for-pa-workers>
- Wrenn, D. H., Kelsey, T. W., & Jaenicke, E. C. (2015). Resident vs. nonresident employment associated with Marcellus Shale development. *Agricultural and Resource Economics Review*, 44(2), 1–19.