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Shale Public Finance:

Local government revenues and costs associated with oil and gas development

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About this report

This report is the first in a series to be produced by the Duke University Energy Initiative on shale public finance, supported by the Alfred P. Sloan Foundation. The Shale Public Finance project is examining the financial implications for local governments associated with increased domestic oil and gas production, largely from shale resources. A separate report will focus on state policies for the collection and allocation of revenue from oil and gas production, followed by detailed case studies of experiences in particular regions. For more information, to view interactive maps showing some of our key findings, or to be notified when new publications are released, visit http://energy.duke.edu/shalepublicfinance.

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Table of Contents

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Daniel Raimi* **and Richard G. Newell**

Abstract

Oil and gas development associated with shale resources has increased substantially in the United States, with important implications for local governments. These governments tend to experience increased revenue from a variety of sources, such as severance taxes distributed by the state government, local property taxes and sales taxes, direct payments from oil and gas companies, and in-kind contributions from those companies. Local governments also tend to face increased demand for services such as road repairs due to heavy truck traffic and from population growth associated with the oil and gas sector. This paper describes the major oil- and gas related revenues and service demands (i.e., costs) that county and municipal governments have experienced in Arkansas, Colorado, Louisiana, Montana, North Dakota, Pennsylvania, Texas, and Wyoming. Based on extensive interviews with officials in the most heavily affected parts of these states, along with analysis of financial data, it appears that most county and municipal governments have experienced net financial benefits, though some in western North Dakota and eastern Montana appear to have experienced net negative fiscal impacts. Some municipalities in rural Colorado and Wyoming also struggled to manage fiscal impacts during recent oil and gas booms, though these challenges faded as drilling activity slowed.

Key Words: Shale gas, tight oil, local public finance, severance tax, property tax, property values, hydraulic fracturing

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1. Report Summary

Oil and gas development has increased substantially in the United States over the past decade, largely associated with shale resources. This increase has important implications for local government's ability to provide quality services to citizens. This report describes the major revenues and service demands (i.e., costs) for local governments associated with recent oil and gas development. These revenues and costs have varied substantially from state to state, and often within states.

Our research indicates that the net impact of recent oil and gas development has generally been positive for local public finances. While costs arising from new service demands have been large in many regions, increased revenues from a variety of sources have generally outweighed them or at least kept pace, allowing local governments to maintain and in some cases expand or improve the services they provide. Some local governments, notably in Arkansas, Pennsylvania, and parts of Colorado, have entered into agreements with oil and gas companies to repair damage to local roadways, which has played a major role in limiting public costs. However, most local governments in North Dakota and Montana's Bakken region have experienced net negative fiscal effects to this point, and some municipalities in very rural parts of Colorado and Wyoming struggled to manage rapid population growth during the most active phases of development, though these challenges subsided as drilling activity slowed (see Table 1).

We observed net positive fiscal outcomes across a variety of local factors. This includes local governments in regions where heavy drilling and hydraulic fracturing activity was ongoing or had slowed in recent years, as well as regions that experienced different scales of activity. This also includes local governments in urban, semi-urban, and rural regions, where population density and government capacity vary substantially. However, in rural regions where oil and gas booms have occurred rapidly and at a large scale, some local governments have experienced net negative fiscal effects to date (such as the Bakken region), or struggled to manage fiscal issues during heavy phases of development (such as parts of western Colorado and Wyoming).

For county governments that collect property taxes on oil and gas production, these taxes have provided the largest revenue source, while the largest revenue source for counties that do not collect property taxes typically has been from allocations of state-collected production (i.e., "severance") taxes or, in the case of Pennsylvania, an impact fee. Some county governments have also generated large new revenues from oil and gas leases on county-owned land.

The leading costs for most counties have been from road maintenance and repair due to oil- and gas-related truck traffic, and to a lesser extent staff costs due to growing service demands associated with population growth such as law enforcement, emergency services, or administrative staff. Most counties we examined have experienced net positive fiscal impacts related to oil and gas

development. However, county governments in western North Dakota have thus far struggled to keep up with increased demand for services, especially road maintenance.

For many municipal governments, the leading revenue source has been sales taxes, driven by a growing population and increased economic activity associated with the oil and gas sector. For other municipalities, allocation of state severance taxes has been the largest oil- and gas-related revenue source. For municipalities with substantial land holdings, a leading source has been leasing bonuses and royalty revenues from production on municipally-owned land.

For municipalities experiencing rapid population growth, the leading costs have been upgrades to sewer and water infrastructure, along with increased staff costs. Most municipal governments we examined have experienced a roughly neutral or net positive fiscal impact related to oil and gas development, though some in rural western states have experienced (or are experiencing) net negative fiscal effects during the most active phases of development.

Table 1. Net financial impact for local governments examined in the study

State	Counties	Municipalities
Arkansas	Medium to large net positive	Small to medium net positive
Colorado	Small negative to large net positive	Small to medium net positive
Louisiana*	Medium to large net positive	[insufficient data]
Montana	[insufficient data]	Roughly neutral to large net negative
North Dakota	Small to medium net negative	Medium to large net negative
Pennsylvania	Small to large net positive	Small to large net positive
Texas	Roughly neutral to large net positive	Roughly neutral to large net positive
Wyoming	Large net positive	Roughly neutral to small net positive

Note: Impact refers to the relative, not absolute, impact on a local government's financial position. For example, $1 million may represent a large sum for one local government, but a small sum for another. The terms "small," "medium," "large," and "neutral" are our best assessment, based on interviews with local experts and analysis of local government financial documents. *For Louisiana, the "county" column refers to parish governments.

1.1 Local government revenues associated with oil and gas development

Oil and gas development has the potential to increase revenue for county and municipal governments from a variety of sources. These revenue sources vary substantially from state to state and sometimes within states. In Colorado, Montana, North Dakota, and Pennsylvania, the state government distributes to local governments a substantial amount of revenue from state taxes on oil and gas production (often referred to as severance taxes) and, in the case of Pennsylvania, from a fee based on the number of wells drilled. In Arkansas, Louisiana, Texas, and Wyoming, the state government allocates a relatively small or negligible share of revenue from severance taxes to county and municipal governments.

In states that do not allocate substantial revenue from severance taxes, many county governments raise large amounts of revenue from ad valorem property taxes on oil and gas property. In some cases, such as Montana and North Dakota, state severance taxes are designed to replace local property taxes on oil and gas production, and much of the revenue raised by the state is allocated back to local governments where oil and gas production occurs. Rules on what types of oil and gas property are taxable for local governments vary from state to state, but county governments have experienced large increases in revenue from ad-valorem taxes on oil and gas property in Arkansas, Colorado, Louisiana, Texas, and Wyoming. In Montana, North Dakota, and Pennsylvania, oil and gas production property is exempt from ad valorem property taxes, though counties in these states can generally collect property taxes from oil and gas industrial facilities, corporate headquarters and other non-production property.

For a majority of municipalities (and some counties) that do not receive substantial revenue from severance taxes, sales taxes are the key revenue source associated with oil and gas development. This revenue source tends to rise as population and economic activity increases during a surge in oil and gas activity. In all of the states we surveyed, sales taxes were a major source of new revenue for those local governments that levy a sales tax. Local governments have experienced large increases in revenue from sales taxes in Arkansas, Colorado, Louisiana, North Dakota, Texas, and Wyoming. Montana generally does not levy a sales tax, and Pennsylvania's local governments (except Philadelphia and Pittsburgh) do not levy a sales tax.

Local governments may collect revenues for leasing publicly-owned land for oil and gas production. They may also collect revenue from fees for services, such as selling unallocated water supplies to oil and gas operators, or from fees collected by the county clerk's office providing land records. Finally, local governments may receive in-kind donations from oil and gas operators who in some regions help repair roads damaged by their operations, or provide funds for local governments to make purchases such as emergency services equipment. Table 2 summarizes these key revenue sources.

Table 2. Major local government revenue sources associated with oil and gas development

Revenue instrument	Deployed by	Basis for revenue	Allocated to
Severance tax or PA impact fee	State	Value or volume of oil/gas production, number of wells drilled	Varies by state
Property tax	County	Value of oil/gas property (definitions vary by state)	County
Sales tax	State, muni, county	Value of sales (rates vary by state)	State, muni, county
Fee-for-service	Muni, county	Services rendered (e.g., county clerk fees, water sales)	Muni, county
Lease payments	State, muni, county	Negotiated lease terms	State, muni, county
In-kind	Muni, county	Negotiated agreements or donations	Muni, county

1.2 Local government costs associated with oil and gas development

Local governments often experience new demand for services when oil and gas activity increases. These service demands may increase more substantially for the oil and gas industry relative to some other industries due to the large volume of heavy trucks involved, as well as the potential for a rapid increase in local population, as many oil and gas jobs require specialized skills that may not exist in the local workforce. As demand for services increase, so too do costs for local governments. Some of these costs are observable on government financial documents, while others are not, such as service demands that go unmet (i.e., needed road repairs that are not made), or opportunity costs for government employees (i.e., time devoted to oil- and gas-related issues that takes away from other government priorities).

The largest new cost, especially for county governments, is often for road maintenance and repair. As new oil and gas wells are completed, thousands of heavy truck trips occur over a short period of time, in some cases on rural roads not originally designed to handle such traffic. In cold-weather regions such as Colorado, North Dakota, Montana, Wyoming, and parts of Pennsylvania, this damage is especially costly due to the higher expense of repairing or replacing roads designed to withstand an annual cycle of freezing and thawing. Costs for road repair have also been large in southern states such as Arkansas, Louisiana and Texas. Local governments with sturdier pre-existing road infrastructure tend to experience less substantial costs than those that maintain rural road networks originally designed for light traffic or farm equipment.

Another major potential cost, primarily for municipal governments, is increased demand for sewer and water infrastructure. Rapid population growth in parts of North Dakota, Montana, Colorado, Texas, and Wyoming has led cities to extend sewer and water lines or expand water and

wastewater treatment plants, projects that can cost tens of millions of dollars, even for small municipalities. When cities pass certain population thresholds in states such as Montana and Wyoming, regulations may require heightened standards for their sewer and water infrastructure, which can lead to an increase in costs disproportionate to population growth.

Other costs for local governments relate to staff and equipment needs associated with a growing population. These include increased staffing requirements for law enforcement and emergency services (EMS) to deal with increased traffic, accidents, or criminal activity, as well as increased staffing for administrative services such as the county clerk's office. Other costs are more specific to the oil and gas industry, such as training and equipment for first responders who may respond to emergencies at well sites. Workforce retention has also been a major issue for many local governments, as high-paying jobs in the oil and gas sector may attract government staff, which can lead governments to raise wages and other compensation, or perhaps allow some needs to go unmet.

Finally, some cases of rapid population growth can lead to quickly rising rents, forcing governments to pay housing stipends to attract or retain employees. In the case of North Dakota's Bakken region, several local governments have gone so far as to purchase real estate and construct housing to provide affordable living options for employees. Table 3 summarizes the major financial costs for local governments associated with recent oil and gas development.

Table 3. Major local government costs associated with oil and gas development

Service provided	Provided by	Connection to oil/gas industry
Road maintenance/repair	County, Muni	Increased heavy truck traffic
Sewer/water	Muni	Population growth
Police, EMS, administration	Muni, County	Population growth
EMS	Muni, County	Oil and gas response training
Staff costs/workforce retention	Muni, County	Economic growth leading to greater labor demand

There is a wide variety of benefits and costs that may be felt by communities experiencing significant oil and gas development. This report focuses on fiscal issues for local governments such as those described above. We do not focus on other costs, such as the social impact related to increased rental housing costs, the environmental impact of oil and gas development, or potential public health costs. Additionally, we do not focus on other benefits, such as increased employment opportunities or higher standards of living in the private sector.

Our main conclusions are that recent oil and gas development has mostly provided net benefits for local government finances. However, local factors play an important role. Local governments in very rural regions may face fiscal challenges associated with a rapidly-growing

population and heavy industry truck traffic. These challenges tend to be most acute at the height of drilling and hydraulic fracturing activities, rather than during the longer-lasting production phase. In-kind agreements with operators can play a large role in mitigating potential costs for local governments, especially regarding road maintenance and repair.

1.3 Summary of findings in eight states

1.3.1 Arkansas

In north-central Arkansas, where natural gas production has grown dramatically due to development of the Fayetteville shale, county governments have generally experienced substantial net financial benefits. The leading revenue source has been from property taxes, as newly valuable mineral properties came onto the tax rolls in the five counties we examined. These counties also experienced new costs associated with road maintenance and repair, but these costs were substantially limited by agreements made between county and various natural gas companies, who helped repair many of the roads that were damaged during their operations.

Municipal governments in the region experienced smaller new revenues along with smaller new costs, and reported smaller net financial benefits than county governments. The leading revenue source for these municipalities has been sales taxes, which peaked during the most active drilling years of 2007 and 2008, and remain higher than they were before Fayetteville shale activity began. One city also generated substantial revenue from natural gas production on city-owned land. These municipalities experienced modest staff costs, with workforce retention registering as a small challenge during the peak years of drilling activity.

1.3.2 Colorado

In two regions of Colorado, the Denver-Julesberg and Piceance basins, county governments generally experienced large net fiscal benefits, with one exception. New revenues were led by property taxes, and also included severance taxes allocated from the state, as well as increased sales tax revenues for some counties. Some counties also entered into in-kind agreements with oil and gas operators, which limited costs associated with road repair. Despite these agreements, road repair remained the most prominent issue, along with substantial staff costs, primarily from the addition of new staff and rising compensation to retain existing staff. One county (Rio Blanco) reported that road costs had increased faster than revenues. The county imposes an impact fee on new oil and gas wells. However, this fee has not covered associated road repair costs, and unlike other counties we examined, there is little in the way of in-kind agreements to repair roads.

The municipal governments we examined in Colorado generally experienced small net fiscal benefits. Some cities in the sparsely populated Piceance basin experienced large new revenues and large new costs, while others in more densely populated areas, or further from oil and gas development, experienced relatively little of either. For the heavily affected municipalities, primarily in the Piceance basin, sales taxes were the leading source of new revenue, along with leases on government-owned land. These governments saw rapid population growth during the peak years of drilling in 2007 and 2008, and faced large new expenditures to upgrade municipal sewer and water systems, along with local road networks. For modestly affected communities, allocations of the state's severance tax was the only major new revenue source associated with oil and gas development. Most of these municipalities experienced little to no increase in costs or service demands attributable to oil and gas development.

1.3.3 Louisiana

In the northwestern corner of Louisiana, parish governments (Louisiana does not have counties) have generally experienced substantial net financial benefits associated with natural gas development from the Haynesville shale. Parishes maintain roads and property records. Revenues and costs both increased rapidly for these local governments in 2007 and 2008, then declined almost as swiftly as drilling activity slowed in 2010 and 2011. The leading two revenue sources for these parish governments have been from sales taxes and leases of parish-owned land, which generated $20 million to $30 million each for two parish governments, nearly doubling overall revenues in certain years. These parishes also experienced substantial new costs to repair roads affected by heavy truck traffic, and experienced major challenges with workforce retention during the peak years of drilling, leading to an increase in compensation for staff.

We were not able to arrange sufficient meetings with municipal officials to report on the net fiscal impacts to municipalities.

1.3.4 Montana

Eastern Montana experienced a surge in oil activity from the Bakken shale in the mid-2000s. As much of this activity has shifted across the border to North Dakota, drilling in the region has slowed. However, population growth has been substantial, as many workers live in eastern Montana and commute to the North Dakota oil fields. We were not able to arrange sufficient interviews with county government officials to determine the net fiscal impact to counties, but did observe that counties in the region generally have experienced large new revenues, primarily from allocations from Montana's severance tax. Counties have also substantially increased their expenditures on roads and bridges, although it is unclear whether these expenditures represent a new cost brought on

by oil- and gas-related activity, an opportunity to upgrade existing infrastructure due to new revenues, or some combination.

Municipalities in eastern Montana have generally experienced net negative financial impacts. The state government allocates a very small share of severance tax revenue to municipalities and since the state does not have a sales tax, municipalities have not experienced any major new revenues associated with population growth. They have, however, experienced substantial new costs, primarily from upgrades and expansions of sewer and water infrastructure. Eastern Montana municipalities have also experienced new staff costs, as workforce retention challenges have led governments to substantially increase compensation.

1.3.5 North Dakota

Local governments in North Dakota's Bakken region have experienced mostly negative net financial effects, though some local officials expect the longer-term fiscal impacts to be positive. Bakken development has created major demands on rural roads and generated rapid population growth in this extremely rural region. While county governments have seen their budgets swell by as much as 10-fold since 2005 due to severance tax revenue (which the state imposes in lieu of allowing local governments to collect property taxes on oil and gas production) and sales taxes, they generally have not been able to keep pace with demand for services, led by road repair costs. Staff costs have also risen rapidly, with county governments in several cases doubling their overall number of employees.

Municipalities in North Dakota have experienced a similar dynamic, as severance tax proceeds coupled with sales and property tax receipts have rapidly increased government revenues. However, the scale and speed of population growth has led to even faster increases in costs, led by sewer and water infrastructure as well as municipal roads and bridges. Municipal governments have also doubled, tripled, or quadrupled their staff, along with increasing wages and other compensation to attract and retain a public workforce.

1.3.6 Pennsylvania

The local governments we examined in the northeast and southwest regions of Pennsylvania have experienced a range of net positive financial effects as a result of Marcellus shale development. The primary new revenue source for both county and township governments has been from the state's impact fee, which is paid for each unconventional natural gas well drilled in the state and allocated in large measure back to local governments where the drilling occurred. This revenue has in some cases doubled the operating budgets of townships, and provided substantial new revenue for county governments.

New costs for these local governments have been limited, and are primarily related to staff. In several counties we visited, new staff were added to manage increased service demands related to law enforcement, emergency services, and to a lesser extent social services such as assistance with affordable housing. For townships, which maintain the bulk of Pennsylvania's rural road network, costs were more limited and typically included the addition of a small number of employees to the road maintenance staff. Road repair costs have generally been small for townships, due to agreements with natural gas companies to repair township roads damaged by industry-related truck traffic.

1.3.7 Texas

Texas counties and municipalities have experienced a range of new revenues and costs, and the net financial effects of recent oil and gas development have ranged from roughly neutral to a large net positive. For counties with new oil and gas production, property tax revenues have grown significantly. For municipalities, sales taxes have been the leading new revenue source, and some have seen large new revenues from leasing municipal land for oil and gas production.

Local governments have also experienced a range of new costs. For most counties, road repair has been the leading cost, and in some cases they have roughly equaled the level of new revenue from property taxes. For municipalities experiencing rapid growth, such as those in the Eagle Ford region, sewer and water infrastructure has been a leading cost, while some larger municipalities such as Fort Worth and Midland have seen substantial road repair costs, as these cities maintain hundreds of miles of roads that are affected by heavy truck traffic. Municipalities and counties have both experienced new staff costs, primarily workforce retention challenges leading local governments to increase compensation.

1.3.8 Wyoming

Counties and municipalities in southwestern Wyoming have experienced differing financial effects related to natural gas development. The Sublette County government experienced a large net financial benefit due to rapid growth in property tax revenues in the late 2000s, along with smaller but substantial increases in revenue from sales taxes. Municipal governments in the region also experienced substantial new revenues from sales taxes associated with population growth. However, several struggled with fiscal issues during the peak of activity, and several years later describe a roughly neutral or a small net positive fiscal impact.

As in other western states, the leading cost for counties has been roads, while the leading cost for municipalities has been sewer and water infrastructure upgrades to serve a growing population. Staff costs have also been substantial for both levels of government, with workforce

retention creating major challenges during the peak years of drilling activity and local government compensation rising across the board.

1.3.9 Summary of major local government revenues and costs in eight states

Tables 4 and 5 present a summary of major oil- and gas-related revenues and costs for county and municipal governments in each state we examined. The presence of a dollar symbol indicates that the most or all governments we examined experienced either a major revenue (in Table 4) or major cost (Table 5) related to the given category.

Table 4. Major local government revenues associated with oil and gas development

		Severance tax or impact fee	Property taxes	Sales taxes	Fee-for-service or lease revenues	In-kind
AR	Counties		$			$
	Municipalities			$	$	
CO	Counties	$	$			$
	Municipalities	$		$	$	
LA	Parishes			$	$	
MT	Counties	$				
	Municipalities					
ND	Counties	$		$		
	Municipalities	$		$		
PA	Counties	$				
	Townships	$				$
TX	Counties		$			
	Municipalities			$	$	
WY	Counties		$	$		
	Municipalities			$		

Note: Based on interviews with local government officials and examination of state and local government financial records. A dollar sign indicates that most or all local governments experienced the relevant category as a major new revenue source attributable primarily to oil and gas development.

Table 5. Major local government costs associated with oil and gas development

		Roads	Sewer and water	Staff
AR	Counties	$		
	Municipalities			
CO	Counties	$		$
	Municipalities		$	$
LA	Parishes	$		$
MT	Counties	$		$
	Municipalities		$	$
ND	Counties	$		$
	Municipalities	$	$	$
PA	Counties			$
	Townships			$
TX	Counties	$		$
	Municipalities		$	$
WY	Counties	$		$
	Municipalities		$	$

Note: Based on interviews with local government officials and examination of state and local government financial records. A dollar sign indicates that most or all local governments experienced the relevant category as a major new cost attributable primarily to oil and gas development.

1.4 Summary of methodology

This report documents the fiscal impact to local governments related to recent oil and gas development from 10 oil and gas plays around the United States. While it is not a comprehensive survey of local governments in these regions, our methodology for selecting cases enables us to draw reasonably broad conclusions. Additionally, our methodology takes something of a "snapshot" regarding the net fiscal effects to date. For example, some local governments experienced fiscal challenges during the peak years of development, but now report net positive fiscal effects. An important question for additional research relates to the longer-term effects of recent oil and gas development for local governments and the communities they serve.

We selected local governments by identifying the counties that have been among the top 5 percent nationally in overall oil or gas production at any point between 2007 and 2012. We then traveled to as many of those counties as was practical, visiting county governments, municipalities within that county, and neighboring counties and municipalities. We conducted structured interviews with over 100 local government officials who were either leading elected officials (i.e., county judges, county commissioners, township supervisors, and municipal mayors), leading administrators (i.e., city managers and county administrators), or subject area experts (i.e., financial or oil and gas division administrators). We also reviewed government financial documents such as audited financial statements and annual budgets in each jurisdiction.

These local governments varied across four important dimensions: scale of oil and gas development (i.e., how much oil and gas activity has occurred or is occurring), phase of oil and gas development (i.e., is the region currently experiencing large amounts of activity and population growth, or has activity slowed), size of government (e.g., a small town or a large city), and rurality of region (e.g., population density and existing infrastructure). Examining local governments that varied across these dimensions allowed us to observe whether any or all of these variables weighed heavily on the net fiscal effect of recent oil and gas development for local governments.

In addition to these site visits and interviews, we conducted detailed analysis of state policies related to oil and gas revenue collection and allocation, collected state-level data on a variety of tax revenues, and interviewed experts from regional universities and private research firms, the oil and gas industry, and state government.

2. Introduction and Background

Since the mid-2000s, oil and gas production from shale and other "unconventional" formations has led to a surge in production across the United States. This increase in production has generated substantial discussion and debate over the economic, environmental, geopolitical, and regulatory implications of surging hydrocarbon production. The question we consider in this paper is how local governments have been affected in their ability to raise revenue and provide services when a boom in oil and gas development occurs in their region. We focus on county and municipal governments in a variety of states, and describe conditions as they currently are or recently have been. This work lays a foundation for the ultimate goal of understanding how to best manage the local government fiscal impacts of oil and gas development.

Large increases in drilling activity have occurred throughout the United States, but much of the production to date has been concentrated in a relatively small numbers of states. Some of these, such as Colorado, Louisiana, Oklahoma, Texas, and Wyoming, have a long history of hydrocarbon production and have for decades considered how to collect and distribute tax revenue associated with oil and gas activity. Others, such as Arkansas, North Dakota, Montana, and Pennsylvania, have had less recent experience with major oil and gas activity, and in some cases have seen substantial revisions in their oil- and gas-related tax policies. Additionally, local government officials in these states may have less experience managing new demands specific to the oil and gas industry.

Some recent work has gone into understanding the local government implications of shale development in western states (Macke & Gardner 2012; Upper Great Plains Transportation Institute 2012; Porter 2013), and the implications for local governments of previous "boom and bust" cycles has been well documented (e.g., Leistritz *et al.* 1981; Gulley 1982; Merrifield 1984). There has also been substantial attention paid to the local government costs associated with recent natural gas development in the Appalachian basin, where Marcellus shale development has presented new challenges for local governments (Jacquet 2009; Penn State Cooperative Extension 2011a, b; Christopherson & Rightor 2012; Costanzo & Kelsey 2012). Despite this body of regional work, little has been done to synthesize and compare experience across state lines. Reports from some organizations give overviews of state-level policies, but generally do not explore on-the-ground experiences in the affected communities (Brown 2013; Interstate Oil and Gas Compact Commission 2013; Richardson *et al.* 2013).

A variety of academic, industry, and private research organizations have estimated the broad economic and employment impacts of new oil and gas development, and some include associated estimates of state and local government revenues (Univ. of AR Center for Business and Economic Research 2009; Kinnaman 2011; Perryman Group 2011; Kelsey *et al.* 2012d, b, e, c, a; Oyakawa *et al.* 2012; Univ. of AR Center for Business and Economic Research 2012; Bangsund & Hodur 2013a, b;

Tunstall & Oyakawa 2013; Tunstall *et al.* 2013). Other work has focused more directly on the tax revenue implications of new oil and gas development, along with the implications of varying tax structures predominantly in Western states (Headwaters Economics 2008, 2012, 2013b, 2014).

Our research contributes to the discussion in two ways. First, we discuss both the revenues and costs experienced by local governments. By focusing on both sides of the ledger, we can gain a better understanding of the *net* financial impact to local governments that have recently experienced or are currently experiencing an oil and gas boom. Second, we survey a wide variety of local governments in states that vary across a number of important factors, such as state and local tax policies, experience with the oil and gas industry, rurality of region, government capacity, scale of oil and gas activity, duration of oil and gas activity (for how long has activity lasted?), and phase of oil and gas activity (is oil and gas activity at or near a peak, or has it slowed?).

2.1 Methodology

To conduct this research, we traveled to 10 major oil and gas plays in eight states and conducted structured interviews with over 100 experts, primarily local government officials but also experts from the oil and gas industry, academia, state government, and private research organizations. We identified counties that have been among the top 5 percent nationally in overall oil or gas production at any point between 2007 and 2012. We measured oil and gas activity both by overall production and by production per square mile of county land, allowing us to identify counties where oil and gas activity may be heavily concentrated within a small jurisdictional boundary. We then traveled to as many counties as was practical, visiting county governments, municipalities within that county, and neighboring counties and municipalities.

Our methodology allowed us to examine local governments that ranged across a number of key variables (King *et al.* 1994), notably: scale and phase of oil and gas development, government capacity, and rurality of region (Jacquet & Kay 2014). Scale and phase matter because costs and revenues for local governments tend to vary along both dimensions. During a phase of heavy drilling and hydraulic fracturing, increased population, heavy truck traffic, and other effects can increase local government costs as well as revenues. We examine local governments, such as those in Wyoming and western Colorado, which had experienced a rapid expansion in oil and gas development four to five years prior to our interviews. Other local governments, such as those in Pennsylvania, had experienced substantial levels of natural gas activity two to three years previously. Still other local governments, such as those in North Dakota and South Texas, were in the middle of heavy activity.

Government capacity and rurality of region also play an important role in managing impacts. For example, an oil and gas boom leading to an influx of hundreds or thousands of workers will be felt very strongly in a rural region with limited housing stock, unpaved roads, and limited government services (N.C. Department of Environment and Natural Resources 2012). That same growth may also be felt, though to a lesser extent, in a more densely populated region with ample housing stock, sturdy roads, and substantial existing government infrastructure. Our interviews took us to regions that varied from a densely populated city such as Fort Worth, Texas, to some of the most sparsely populated parts of the United States in eastern Montana and southeastern Wyoming (for population density details, see Appendix A).

The scale of oil and gas development in a region can be measured in a variety of ways. Two helpful metrics that we consider indicate the number of oil and gas well completions per year in a given county divided by (1) the county population; or (2) the square miles of land area within that county. Well completions may be a more accurate measure of activity than number of wells drilled or rig count, since the heaviest volume of truck traffic tends to be associated with completion activities. We refer to these metrics as "completions per hundred persons" and "completions per hundred square miles," respectively, and report those metrics for each county we visited in Appendix A.

While visiting each jurisdiction, we collected available budget and financial documents, allowing us to access data from small local governments that do not publish detailed financial information on a website. Where possible, we gathered audited financial statements, which provide succinct and reliable financial data. When audited financial data were not available, we gathered data from budgets, which often reflect planned (rather than actual) revenues and expenditures. Numerous local officials supplied us with data directly from their budget report systems, or through email. Additionally, we gathered a variety of other data from state and local governments in each region, including data on severance taxes, property values, property taxes, sales taxes, and oil and gas production on federal or state lands.

Structured interviews were a key component of this research. While data on revenues and expenditures help us measure local fiscal effects associated with oil and gas development, some cannot be measured with financial data alone. First, interviews were necessary to help us understand how much of a given financial impact was related to oil and gas activity, rather than some other factor. Second, governments facing increased demands for services such as traffic control or road repair may not have the revenue to provide those services. Such a situation would not be reflected in government financial statements, and interviews were necessary to determine whether such situations had occurred. Finally, data on government costs do not tell a causal story. For example, a city that spends an additional $5 million on road repair in the years following heavy oil and gas

activity may be either repairing roads damaged by oil and gas operations, upgrading roads that had long been in disrepair, building new roads because new revenues were available, or any combination. Interviews with officials were essential to understand the driving forces behind a given revenue source or expenditure.

While the wide geographic scope of our research has made it impossible to visit every local government or gather every piece of relevant financial information, we believe our approach to choosing cases and data collection has been sufficient to answer our major research questions. Although this is not a comprehensive review of local governments in each of our sample states, we believe our findings provide a representative view of how local government finances have been affected by oil and gas development in each region.

Importantly, this report does not address the longer-term effects of an oil and gas boom on local governments or the communities they serve. Instead, it can serve as a foundation for more detailed understanding of how local governments can best anticipate and manage the effects of an oil and gas boom if it occurs. For details on our calculations of determining the top oil- and gas-producing counties, along with a list of counties visited, please see Appendix A.

3. Revenues and costs in eight states

Experience with revenues, service demands, and costs varied substantially in the regions we examined. Revenue sources varied according to state policies: in Colorado, Montana, North Dakota, and Pennsylvania, state-collected severance taxes or impact fees provided large amounts of revenue for local governments. In Arkansas, Colorado, Louisiana, North Dakota, Texas, and Wyoming, locally levied property and sales taxes related either directly or indirectly to oil and gas activity provided substantial new revenue. For some local governments, leasing bonuses and royalties from oil and gas production on government-owned land provided large revenue streams, while a smaller group derived revenue from selling water to oil and gas operators for hydraulic fracturing.

In addition to these easily measurable revenues, in-kind contributions from operators played a vital role in limiting costs for some local governments. Local agreements to maintain and repair roads played a large role across Arkansas and Pennsylvania, as well as in certain parts of Colorado, Louisiana, and Texas.

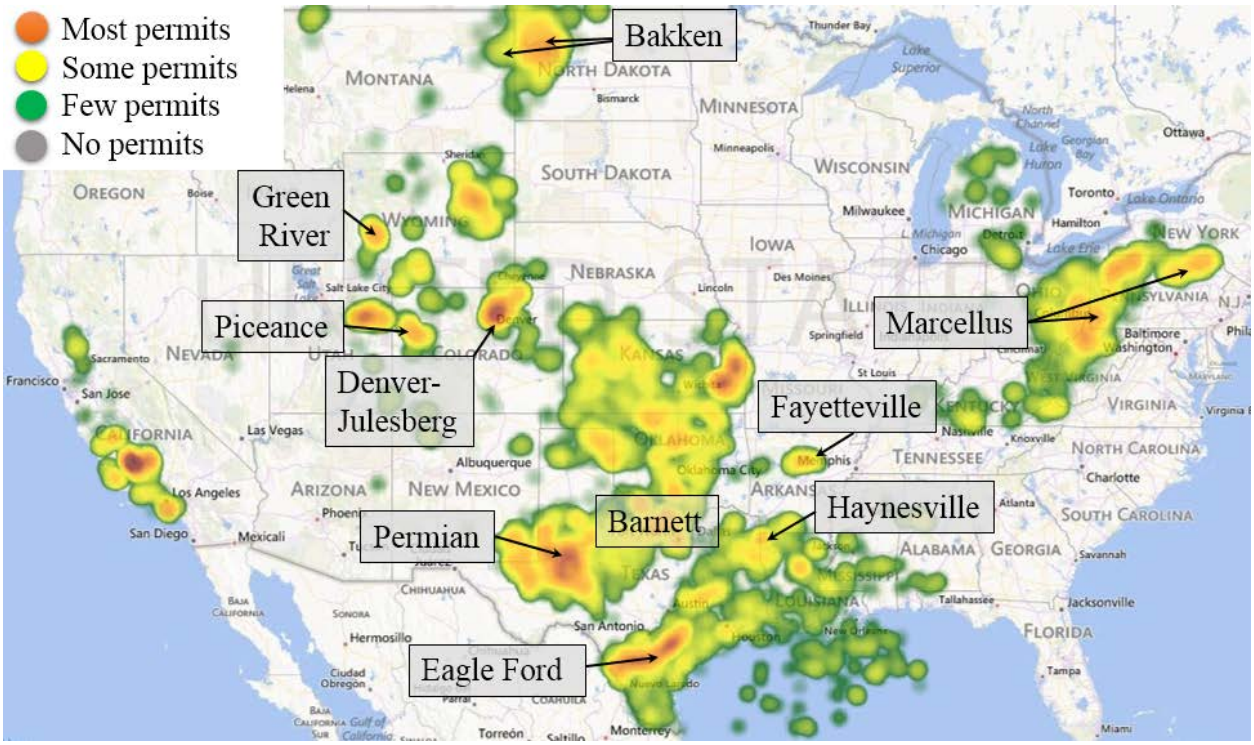
Local government costs generally followed a more consistent pattern than revenues in the states we visited. For local governments that maintain many miles of roadways (typically counties), road repairs were a leading cost. For those where a boom generated rapid population growth, sewer and water infrastructure tended to be a leading cost, primarily for municipalities. This was especially the case rural parts of western Colorado, North Dakota, Montana, south Texas, and Wyoming.

Staff costs, some direct and some indirect, existed to varying degrees in every region we visited. Workforce retention was a common issue, as some government employees were attracted to high-wage opportunities in the oil and gas industry (though many returned to government work after a short time). In turn, many local governments raised wages and other compensation to attract or retain employees, while local governments in North Dakota have spent millions of dollars subsidizing housing for staff. Some local governments have added positions, ranging from small increases in Arkansas, Pennsylvania, and Louisiana to a doubling or even tripling of staff in parts of North Dakota and south Texas. Many of these new positions have included substantial equipment costs, especially in law enforcement and emergency services.

Most, but not all, local governments that we visited reported a net positive impact on their finances from oil and gas development. Most local governments experienced positive net effects in Arkansas, Colorado, Louisiana, Texas, and Pennsylvania. Results were mixed in Montana and Wyoming, and local governments we visited in North Dakota have mostly experienced net negative financial effects. Additionally, these results may vary over time. For example, some municipalities in western Colorado and Wyoming described substantial fiscal challenges at the height of the drilling and hydraulic fracturing phase, but noted that these challenges have faded as drilling has slowed and public infrastructure has caught up with population.

We describe experience in each of these states, beginning with Texas and Louisiana, longtime hubs of the domestic oil and gas industry. We then describe our findings from the Bakken region in North Dakota and Montana. Next, we discuss findings in the mountain west states of Colorado and Wyoming. Finally, we describe findings from Pennsylvania and Arkansas.

Figure 1. Regions visited



Map source: Drilling Info 2.0, with annotations by the authors.
Note: Heat map indicates permits issued for oil and gas drilling in 90 days prior to 1/14/2014.

3.1 Texas

Table 6. Texas County Summary

Major revenue source(s)	Property taxes
Major cost(s)	Roads Staff costs
Net fiscal impact	Neutral to large net positive

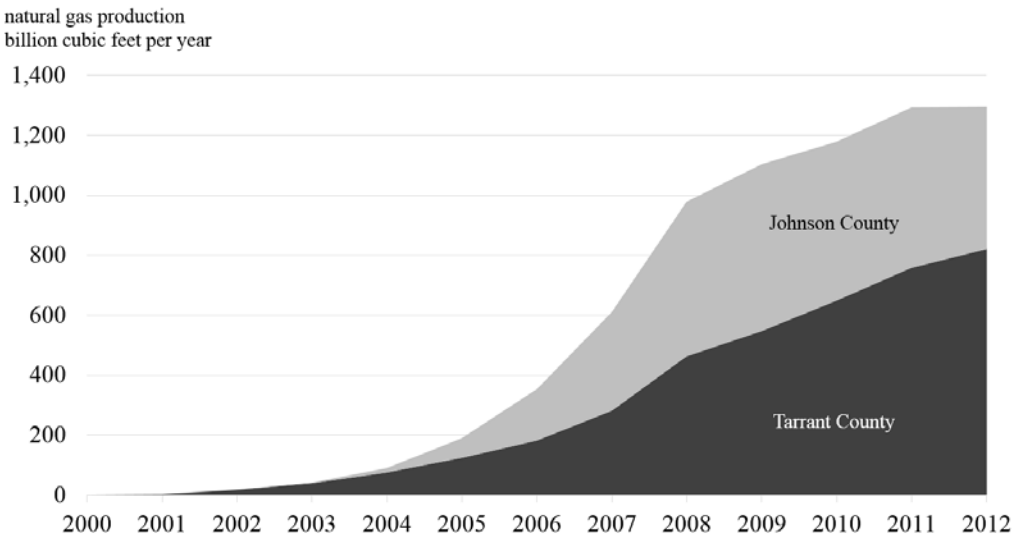
Table 7. Texas Municipality Summary

Major revenue source(s)	Sales taxes Lease revenues
Major cost(s)	Sewer and water Staff costs
Net fiscal impact	Neutral to large net positive

3.1.1 Barnett shale region, TX

The Barnett shale region, which is centered in and around Forth Worth, Texas, was the testing ground for the "slick water" hydraulic fracturing and horizontal drilling technologies that enabled much of the new oil and gas production described in this report (Zuckerman 2013). Production has surged throughout much of the region, but nowhere more so than in Tarrant and Johnson counties (see Figure 2), where the density of wells completed per square mile has been higher than any other county in this report (see Appendix Table A4). We examined both counties, as well the cities of Cleburne, Fort Worth, and Flower Mound.

Figure 2. Natural gas production in Tarrant and Johnson Counties, TX



Data source: TX Railroad Commission (2013).

3.1.1.1 County-level experience in Barnett shale region, TX

3.1.1.1.1 Tarrant County, TX

Tarrant County, which contains much of the city of Fort Worth, has seen new revenues and costs that would make a large impact in many other counties. But due to the region's large and diverse economy, Barnett shale development has had a limited impact on county government finances. To date, Barnett activity appears to have been a net financial positive for county finances due to increased revenue from property taxes and lease revenue from production on county-owned lands. In 2007, mineral properties added approximately $3.7 million, or 1.3 percent, to the county's property tax revenue. From 2009 through 2011, that figure was closer to $11 million per year (roughly 3.5 percent), and has fallen back to $8 million in 2012 (roughly 2.5 percent) as natural gas prices have fallen.[1] Leases on county-owned land have generated roughly $3 million per year since 2009, and the county also saw an uptick of a "couple million dollars" from fees for the clerk-recorder's office, though these revenues have faded as leasing activity has slowed.[2] In the context of annual revenues of $504 million in 2012, these new sources have a noticeable, but limited impact on overall county revenues.

[1] Valuation data from Tarrant Appraisal District, annual reports. Revenue data from Tarrant County Auditor's Office, comprehensive annual financial reports, 2005-2012.
[2] Based on interview with Tarrant County administrator G.K. Maenius, 12/9/2013.

In addition, a bill passed by the Texas state legislature in 2013[3] will allocate some $2.5 million to Tarrant County (and roughly $225 million to counties throughout the state) to help cover the costs of repairing roads affected by surging statewide oil and gas activity. While this sum is not particularly large relative to other revenue sources or relative to the impact to roads caused by the industry, it represents the first instance of the Texas state government allocating substantial monies from its severance tax revenue to local governments to help manage the local impact of the oil and gas industry.

Tarrant County experienced notable new costs, primarily from increased demand for road maintenance from heavy truck traffic. Local officials have not quantified the effect of traffic from oil and gas operations and, although they estimate that it is significant, they report that the new revenues described above have easily outweighed any new costs.

3.1.1.1.2 Johnson County, TX

In more rural neighboring Johnson County, property tax revenues also increased substantially due to Barnett activity, but local officials describe the net fiscal impact to date as roughly neutral. Property tax revenues from mineral properties grew from virtually zero in 2002 to $5 million in 2007 and $12 million in 2009, before falling back to roughly $7 million in 2012. In 2009, mineral properties represented 31 percent of the county's property tax base, falling to 19 percent in 2012.[4] Johnson County leased roughly 40 acres for natural gas production, which generated some $2 million in 2010,[5] though this revenue has substantially decreased as production and prices have fallen. The county government also raised revenue by carefully enforcing road weight restrictions for oversize trucks and by imposing a $300 annual permit fee per well pad. In addition, the county has entered into road maintenance agreements (RMAs) with several local operators, and a substantial share of road repairs have been paid for by natural gas and wastewater disposal companies, though precise numbers were not available.[6]

An important element of Texas property tax law has limited the amount of revenue Johnson County and other Texas local governments can raise from property taxes. If annual property tax revenues for a municipality or county grow by more than 8 percent in any given year (regardless of the property tax rate), voters are entitled to hold an election to "rollback" the property tax rate so

[3] Texas 2013 Senate Bill 1747. Signed 6/14/2013.

[4] Based on mineral property data from Capital One Appraisal Group, provided via email; and general property valuation data and tax rates from Johnson County Appraisal District, available online at: http://www.johnsoncad.com/property.php.

[5] Based on data from Johnson County Auditor's Office.

[6] Based on interview with Johnson County Judge Roger Harmon, 12/10/13.

that the total increase in property tax revenue is limited to 8 percent. While such rollback elections are uncommon, many local officials are reluctant, for political and budget planning purposes, to subject budget plans to the risk of a rollback petition. As a result, officials in many of the counties we visited have reduced their property tax rates as mineral values have increased, seeking to stay within the "rollback" limit of an 8 percent annual increase in property tax revenues. This policy limits revenues in the years when mineral values are high, and it also raises the possibility that when mineral values decrease (as they recently have for counties such as Johnson), property tax rates may need to rise to maintain government services.

Johnson County has experienced substantial new costs, and local officials reported a wider range than in neighboring Tarrant County. Johnson County's road repair expenditures increased from $8 million in 2007 to $10 million during 2008 and 2009 largely due to Barnett shale activity. Local population also surged during the peak of drilling activity, which increased demand for a variety of services. Notable effects occurred in the county EMS department and law enforcement, which added four officers to manage increased traffic and some increase in local crimes such as DUIs. Law enforcement spending grew from $16 to $19 million from 2007 to 2009. The county also had some workforce retention challenges, though officials did not describe this problem as severe.

Finally, local officials expressed concern over a long-term cost which has not yet materialized: that the thousands of gas wells and associated pipelines in Johnson County would increase the cost of future development. The county expects its population to grow substantially in the coming decades, and new commercial or residential building projects may need to reroute natural gas pipelines or move away from well sites to build in their desired locations, potentially increasing development costs, slowing growth, and reducing property tax revenue. This issue may be especially acute in Johnson County, where the number of well completions per square mile has been very high. In 2008, 127 wells were completed for every 100 square miles of county land — the highest in our 8-state sample (see Appendix A, Table A4).

3.1.1.2 Municipal-level experience in Barnett shale region, TX

3.1.1.2.1 Fort Worth, TX

In Fort Worth (pop. ~780,000), where thousands of Barnett wells have been drilled within city limits, new sources of revenue — led by leases on city-owned property — have generated substantial net financial benefits for the city government. Since 2005, when the city created a division to manage natural gas drilling issues, Fort Worth has leased roughly 11,000 acres and generated over $200 million in revenues for city coffers. Property tax revenue from natural gas properties has also surged, with annual revenues growing from $1.5 million in 2009 to $8.5 million

in 2013.[7] In the context of the city's $1.2 billion in annual revenues, these sums are substantial, though not overwhelming. The city has also generated "a few million dollars" (precise numbers were not available) from permitting fees for well sites and water sales to operators for hydraulic fracturing.[8] Sales tax revenue was also substantially higher due to Barnett shale development. In 2002, retail sales from mining/quarrying/oil and gas extraction represented 0.29 percent of all sales in Fort Worth. In 2008, that figure had reached nearly 12 percent, representing roughly $13 million in sales tax revenues in that year alone. By 2012, sales from the mining/quarrying/oil and gas extraction category had fallen to roughly 7 percent of total retail sales, representing roughly $11 million in sales tax revenues for Fort Worth.[9]

Since Fort Worth maintains hundreds of miles of roads, the city has experienced some substantial effects from heavy truck traffic. However, precise numbers were not available as the city government has not estimated costs specifically attributable to Barnett shale traffic. Another cost has been from the establishment of a new division to monitor gas activities for environmental and engineering issues, as well as to administer the city's gas leases. These costs are in the range of $1 million per year, and are paid for entirely by receipts from a permit fee levied on gas wells within city limits. A final cost is similar to the concern described by officials in Johnson County — namely, that the thousands of natural gas wells and their associated pipelines within city limits could slow or increase the cost of future development.

3.1.1.2.2 Cleburne, TX

In Cleburne (pop. ~30,000), the seat of Johnson County, the net financial effects to date have been positive, but local officials express a similar concern regarding natural gas wells and pipelines potentially constraining future growth. Overall revenues for the city increased from $45 million in 2005 to $70 million in 2008 before leveling out around $65 million in subsequent years. The main drivers of this growth have been property tax and sales tax revenues, as the city contains hundreds of Barnett wells and experienced a substantial increase in sales activity during the peak drilling years of 2007 and 2008. The city has also gathered $33 million in lease revenue from publicly owned lands from 2006 through 2012, though these revenues have slowed in recent years as production and prices have fallen.[10]

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[7] Based on data provided by Fort Worth Gas Lease Program, though December 2013.

[8] Based on interview with Fort Worth Director of Development and Planning Randle Hardwood, and Gas Drilling Program officers Jean Petr and Rick Trice, 12/10/2013.

[9] Sales tax percentage data from TX Comptroller of Public Accounts, Quarterly Sales Tax Data. Available online at: https://mycpa.cpa.state.tx.us/allocation/HistSales.jsp. Fort Worth total sales tax revenues from Comprehensive Annual Financial Reports, available at http://fortworthtexas.gov/government/info/default.aspx?id=54664.

[10] Based on City of Cleburne Comprehensive Annual Finances Reports, Cleburne Financial Transparency website, available at: http://www.ci.cleburne.tx.us/index.aspx?nid=237.

The leading expense for Cleburne has been the impact on roads, though local officials are unsure how to quantify the effects of Barnett activity. Still, they estimate that the costs have been small relative to the revenues. The primary concern among Cleburne officials, as in Fort Worth and Johnson County, is that large numbers of gas wells and extensive pipeline networks will constrain or raise the cost of future development, potentially reducing the city's economic health and tax base. To date, however, this has not been a major issue.[11]

3.1.1.2.3 Flower Mound, TX

Flower Mound (pop. ~68,000), an affluent community northeast of Fort Worth, has been an exception to the general rule that Texas municipalities have experienced roughly neutral or positive net fiscal impacts due to oil and gas development. Approximately 70 wells have been drilled within Flower Mound, and a debate has developed among residents as to whether natural gas drilling should be allowed within the community. Because of these concerns, city officials have spent substantial time and money on legal reviews, studies on potential effects on property values, and public hearings.[12] While increased tax revenues have come from new mineral properties, new well permitting fees, and gas leases on city-owned land, local officials estimate that the overall financial impact has "probably" been a small net negative. Although road repair costs have been minimal due to RMAs between the city and operators, the cost for legal and administrative issues has likely outweighed new tax revenues.[13]

3.1.2 Permian basin region, TX

The Permian basin in western Texas and eastern New Mexico has long been a leading region in the United States for the production of oil and gas. Production declined through most of the past 20 to 30 years, but has turned around due to the application of new technologies on formations such as the Cline, Spraberry, and Wolfcamp (see Figure 3). We visited the region and interviewed officials from Gaines County and the cities of Andrews (in Andrews County) and Midland (in Midland County). We also examined financial data from Andrews County.[14]

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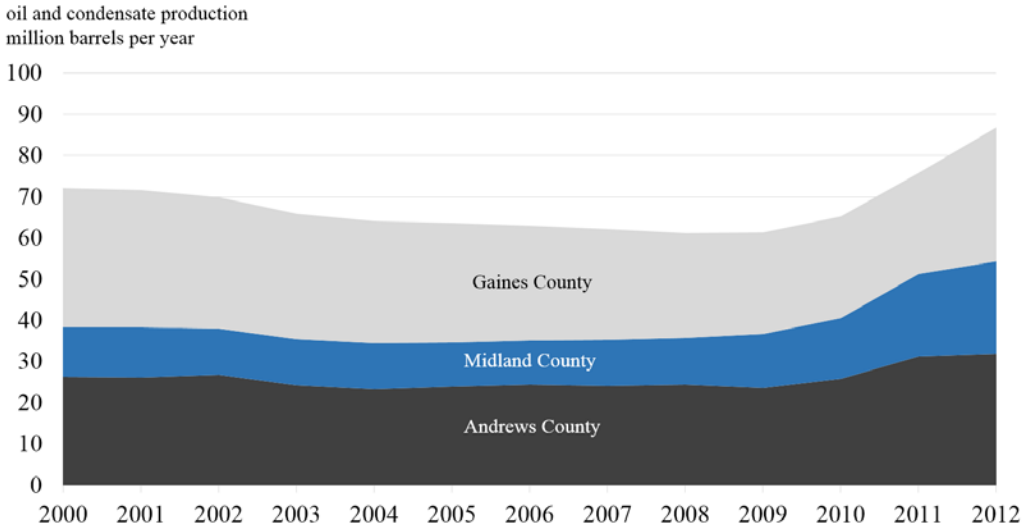
[11] Based on interview with Cleburne city manager Rick Holden, 12/10/2013.

[12] An overview of concerns related to natural gas development in Flower Mound can be found on the city's website, available at: http://www.flower-mound.com/index.aspx?NID=929.

[13] Based on interview with Flower Mound city attorney Terrence Welch, 12/9/2013.

[14] We were not able to arrange interviews with more county officials in the region.

Figure 3. Oil and condensate production in Andrews, Ector, Gaines, and Midland counties, TX



Data source: TX Railroad Commission (2013).

3.1.2.1 County-level experience in Permian basin region, TX

3.1.2.1.1 Gaines County, TX

Gaines County has seen 261 oil and gas well completions from 2008 through 2012, not out of line with its historical norm. By comparison, neighboring Andrews County has seen 651 well completions during that period.[15] As a result, Gaines County officials report that they have seen little net financial impact from new oil and gas operations. Their impressions are borne out by the data: Property taxes, which make up the largest potential oil- and gas-related revenue stream for Texas county governments, remained essentially flat at $18 million to $20 million per year from 2009 through 2012. Similarly, overall revenues hovered between $20 million and $22 million per year during those years.

Gaines County has experienced some new costs as pass-through traffic increased due to more drilling in neighboring counties, and has struggled with workforce retention issues. Expenditures for road and bridge maintenance and repair increased from $5 million to $6 million per year from 2009 to 2012, largely due to salary increases to retain the county road and bridge workforce. Additionally, the county has added seven or eight new positions, primarily in the sheriff's office to handle the increase in traffic. Finally, local officials described a recent increase in the severity of local crime, as the number of capital murder trials has grown from a pre-boom rate of zero or one per year up to eight in 2013. However, it is difficult to know how much of this increase is attributable to the regional increase in oil and gas activity.[16]

[15] Data source: DI Desktop.

[16] Based on interview with Gaines County Judge Lance Celandar; Gaines County Auditor Rick Dollahan, 12/19/13.

Overall county revenues have ranged from $21 million to $23 million per year between 2009 and 2012, while expenditures grew steadily from $16 million to $19 million per year. Local officials describe their county as being in "good fiscal health."[17]

3.1.2.1.2 Andrews County, TX

In neighboring Andrews County, where oil and gas development has seen a larger increase in recent years, tax revenues have grown by roughly 8 percent per year (the maximum annual increase before the property tax rate is subject to voter "rollback"), increasing from $15 million in 2009 to $19 million in 2012, even as county property tax rates have fallen a cumulative 25 percent over those four years. Other revenues from fees, fines, and charges for services have increased by roughly $1 million per year over the same time period.

Expenditures have also increased, although annual revenues have easily outstripped annual expenditures.[18] We were unable to arrange an interview with Andrews County officials, and are not able to assess the net financial effect of recent oil and gas activity.

3.1.2.2 Municipal-level experience in Permian basin region, TX

3.1.2.2.1 Midland, TX

The cities of Midland (pop. ~120,000) and Andrews (pop. ~12,000) have experienced substantially different effects from the recent increase in oil and gas development. Midland is the largest city in the region and, along with neighboring Odessa, makes up what many call the "Petroplex." Midland is historically reliant on the oil and gas industry as its economic base, and city officials are well aware of the challenges associated with unpredictable economic cycles driven by volatile oil and gas prices. To date, municipal officials in Midland describe the recent surge in oil and gas activity as having a neutral net financial impact.

Population in the Permian basin has grown substantially in recent years and Midland has absorbed much of this growth. This has led to a large uptick in sales tax revenues, which grew from $24 million in 2009 to $35 million in 2012, with sales taxes from the mining/quarrying/oil and gas extraction sector accounting for 8 percent of overall sales in 2009 and 17 percent in 2012.[19] Property

[17] Financial data based on Gaines County annual audited financial reports, 2008-2012, available at http://www.co.gaines.tx.us/default.aspx?Gaines_County/Financial.CAFR.

[18] Financial data based on Andrews County annual audited financial reports, 2008-2012, available at http://www.co.andrews.tx.us/departemnts/financial_transparency.php#revize_document_center_rz81.

[19] Sales tax percentage data from TX Comptroller of Public Accounts, Quarterly Sales Tax Data. Available online at: https://mycpa.cpa.state.tx.us/allocation/HistSales.jsp.

tax revenues also grew from $30 million to $34 million per year over the same period as both new construction and new oil and gas mineral properties pushed up property values within city limits, though property tax rates also increased by roughly 3 percent during these years. Other revenues such as hotel taxes and charges for services helped drive the city's overall revenues from $162 million in 2009 to $183 million in 2012.[20]

To date, new revenues have far outstripped new expenditures in Midland. However, local officials note that not all city costs and service demands have been captured by costs that appear on financial documents. Instead, they describe a variety of infrastructure improvements — primarily roads and bridges — that are required to meet growing demand, and which they expect to largely negate rising revenues. For example, the city approved $51 million in infrastructure projects in 2012, many of which would not have been necessary for many years had oil and gas activity not substantially increased. The city has also seen major new staff costs, as roughly 35 new city employees have been added, largely in the police and fire departments, and large salary increases have been necessary to retain staff. The city has also built a new fire station (~$4 million) and a municipal courthouse (~$9 million), and expects to soon expand its office space (~$10 million).

Since the oil and gas industry is the driving force behind the regional economy and has been for decades, local officials attribute virtually all of these new revenues and costs to the recent surge in oil and gas development in the Permian basin.[21]

3.1.2.2.2 Andrews, TX

In Andrews, a small city roughly an hour's drive north of Midland, the story is different, as new revenues have grown quickly while new demand for services has been limited. Although Andrews has seen some increase in population in recent years and an expansion of hotels and businesses, new workers in the region have primarily chosen to locate in the larger cities of Midland or Odessa. As a result, business activity has increased substantially in Andrews, but demand for services has grown at a slower pace. The primary new revenue source for the city has been sales taxes, which grew from $2.7 million in 2009 to $4.3 million in 2012, driving overall revenues from $9.5 million to $11.5 million over the same period.[22]

Expenses have increased more slowly, rising from $7.9 million in 2009 to $8.8 million in 2012. These new expenses have primarily been due to wear and tear on city roads, although the

[20] Based on data from Midland Comprehensive Annual Financial Reports, 2010-2012, available at http://www.midlandtexas.gov/Archive.aspx?AMID=54.

[21] Based on interview with Midland city manager Courtney Sharp, 12/19/2013.

[22] Based on Andrews Comprehensive Annual Financial Reports, 2006-2012, provided by Andrews Department of Finance.

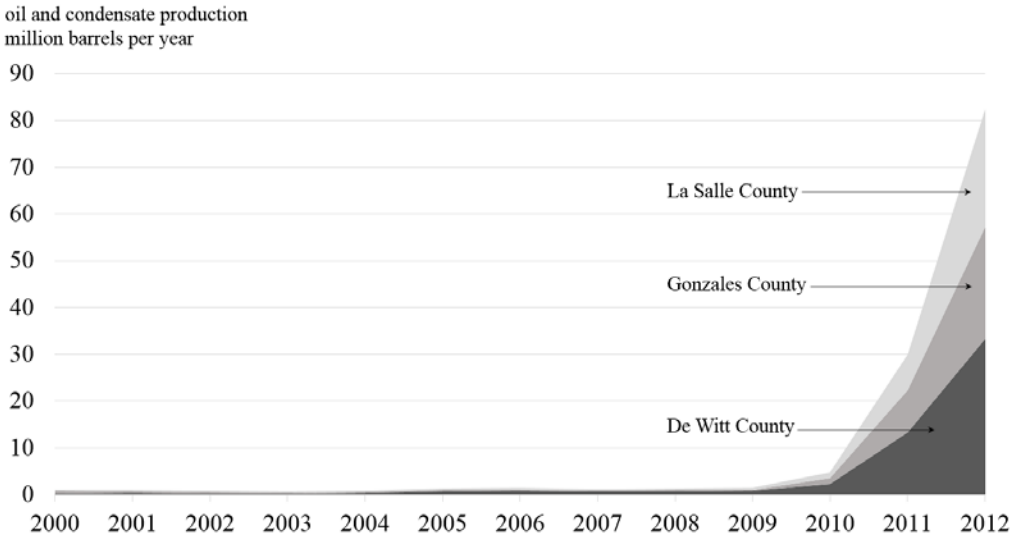
heaviest truck traffic passing through city limits travels mainly on state-maintained roads, limiting the city's costs. Andrews also recently expanded its staff by roughly 15 percent, which will raise expenditures in 2013.

The single largest project taken on by the city is described by local officials not as a cost, but instead an opportunity: Andrews had long planned to build a loop road that would ring the city, and construction was to be financed through a bond issuance. However, the recent increase in revenues allowed Andrews to begin construction earlier than planned and pay for half of the $13 million project with cash, reducing the debt it would have otherwise incurred and reducing future interest payments.[23]

3.1.3 Eagle Ford shale region, TX

Unlike the Permian basin, where oil and gas production has long driven the local economy, the Eagle Ford shale region in southern Texas has only recently become a major producer of hydrocarbons. Beginning with gas production in the late 2000s, operators in the Eagle Ford have increasingly targeted liquids-rich areas of the play, and production has grown dramatically since 2010 (see Figure 4). We examined three top-producing counties: De Witt, Gonzales, and La Salle, along with the cities of Cuero, Gonzales, and Cotulla, the respective seats of each county. We also examined San Antonio, the regional economic hub.

Figure 4. Oil and condensate production in De Witt, Gonzales, and La Salle Counties, TX



Data source: TX Railroad Commission (2013).

[23] Based on interview with Andrews city manager Glen Hackler, director of finance Steve Eggleston, and director of economic development Wesley R. Burnett, 12/19/13.

3.1.3.1 County-level experience in Eagle Ford shale region, TX

Fiscal effects for these three counties varied, with De Witt County reporting a roughly neutral net fiscal impact, Gonzales County a large net positive impact, and La Salle County a small net positive fiscal impact from Eagle Ford development.

3.1.3.1.1 De Witt County, TX

In De Witt County, where 583 oil and gas well completions took place from 2008 through 2012,[24] property tax revenues have grown from $7 million in 2011 to a projected $26 million in 2014, almost entirely due to new oil and gas properties. Taxable property value in the county grew from $1.2 billion to $5.4 billion over the same period, and the county has substantially lowered its property tax rate in response, from 47.3 mills in 2007 to 26 in 2011 and 14.6 in 2013. This reduction in the county's tax rate was in part due to the desire stay below the "rollback" revenue increase of 8 percent per year. The county has also experienced increased revenues in other areas, primarily a $2 million annual increase in charges for services such as the clerk-recorder's office, where land records are available to operators for a fee.[25] Finally, in-kind contributions from operators, primarily of materials for road repair, have totaled an estimated $3 million since Eagle Ford development began in earnest.[26]

De Witt County, more than any other county we visited in Texas, has struggled to keep up with increased costs associated with oil and gas development. The primary cost has been roads, some of which have deteriorated to the point where previously paved roads have turned almost entirely to sand and gravel. County spending on roads and bridges grew from $3 million in 2011 (21 percent of the county budget) to $15 million budgeted in 2014 (57 percent of the county budget). A county-commissioned study to estimate the road-related costs from the expected volume of Eagle Ford traffic forecast a road repair impact of $432 million over the lifetime of the play, or roughly $133,000 per well (Naismith Engineering 2012).

In part due to the advocacy of local officials in south Texas and multiple state-led reports on oil- and gas-related costs in the Eagle Ford and other regions of Texas (TX Dept. of Transportation 2012; Porter 2013), the Texas legislature passed a bill in 2013 to allocate roughly $225 million per year to counties affected by oil and gas development (see section 3.1.1.1.1). These funds will be allocated based on grant applications prepared by the counties and evaluated by the state. De Witt

[24] Data source: DI Desktop.

[25] Data source: De Witt County annual budgets and Comprehensive Annual Financial Reports, 2009-2013. Provided by De Witt County Auditor's Office.

[26] Based on interview with De Witt County Judge Daryl Fowler, 12/16/2013.

County expects roughly $4.5 million in additional funds, though this will not alleviate all the road repair costs faced by the county.

Other notable costs for De Witt County have primarily related to staff, as the county added roughly 10 new employees in the road and bridge department and raised salaries by roughly 30 percent to attract and retain its workforce. Additionally, local officials have devoted substantial time to Eagle Ford-related issues (again, primarily related to roads), with the county judge estimating that he spends roughly 30 percent of his time on the issue.

3.1.3.1.2 Gonzales County, TX

In Gonzales County, which neighbors De Witt County to the north, 230 oil and gas well completions occurred from 2008 through 2012,[27] costs have been less substantial, and the net fiscal impact has been a large positive.[28] Overall tax revenue for the county has roughly doubled, from $3.6 million in 2008 to $7.1 million budgeted in 2013,[29] substantially faster than the annual 8 percent "rollback" trigger that could allow voters to reduce the tax rate. However, the county has lowered its property tax rate from 64.5 mills in 2012 to 27 mills in 2014, and voters have not organized to reduce it further. The county has also seen increased revenues of roughly $300,000 per year from the clerk-recorder's office, along with cumulative in-kind donations of roughly $1 million in from oil and gas operators, mostly in road construction materials. Finally, the county expects to receive $3.7 million in revenue from the state to manage the impact of oil and gas development due to the 2013 legislation described above.

Gonzales County has seen a large increase in road costs, though not as large as in neighboring De Witt County. Local officials estimate that road material costs have increased by "a couple million dollars" over the past several years, attributable almost entirely to Eagle Ford shale activity. Expenditures on roads and bridges grew from roughly $2 million in 2007 to $3 million in 2012, then to a budgeted level of $6.3 million in 2014. However, the county has not experienced the type of road damage found in De Witt County, largely due to the fact that far fewer wells have been drilled in gas-rich (but not liquids-rich) Gonzales County.

The county has added seven new staff positions attributable to Eagle Ford activity, and has had some workforce retention challenges, leading to a $3.50/hour wage increase for most employees. These new costs have helped drive overall county expenditures from $7.7 million in 2007

[27] Data source: DI Desktop.

[28] Based on interview with Gonzales County Judge David Bird, 12/17/13.

[29] Data source: Gonzales County annual budgets, provided by the Gonzales County Auditor's Office.

to $10.4 million in 2012. However, revenues have increased at a substantially faster rate [30] and local officials report that they have not struggled to meet any new service demands.

3.1.3.1.3 La Salle County, TX

In La Salle County, where 712 oil and gas wells have been completed from 2008 to 2012,[31] the surge in oil and gas activity has created challenges, but resulted in a net benefit for the county's fiscal health. As in other Texas counties, property taxes have led the increase, rising from $3.1 million in 2008 to a budgeted level of $15 million in 2014. As in Gonzales County, this increase far surpasses the 8 percent "rollback" level, though voters have not petitioned to reduce property tax rates. Revenues in the clerk-recorder's office have also grown by over $200,000 per year, and most of these funds have been reinvested to digitize the county's records systems. Another major benefit has been in-kind donations, which have totaled some $8 million, primarily for road repair materials and some new fire and EMS equipment.[32] Overall county revenues have grown from $7.1 million in 2008 to $18.7 million in 2012, and the county has budgeted overall revenues to grow further.[33]

Costs in La Salle County have been substantial and have increased in a variety of areas. First and foremost, road costs have roughly doubled from $1.3 million in 2008 to $2.7 million in 2012, which local officials attribute almost entirely to oil and gas activity. Additionally, salaries have risen across the board in response to workforce retention challenges, in some cases growing by 40 percent to 60 percent. The county has added a fire department for the first time, with 14 staff members and a $2 million fire station; the sheriff's office has grown from eight to 24 employees; and other county departments have cumulatively added 17 positions. Additionally, the increased cost of living for local residents — especially increased rental housing prices — has put a strain on the local food bank, to which the county responded by increasing its annual donation from $10,000 to $80,000. Overall county expenditures have grown from $6.6 million in 2008 to $12.6 million in 2012, and are budgeted at $17.4 million in 2014.[34]

Finally, county officials have spent substantial time managing oil- and gas-related issues. For the judge in La Salle County, roughly 50 percent of the workday is spent on issues driven by Eagle Ford development. While the judge notes that this amount of time has crowded out some other

[30] Based on data from Gonzales County Comprehensive Annual Financial Reports, Gonzales County Auditor.

[31] Data source: DI Desktop.

[32] Based on interview with La Salle County Judge Joel Rodriguez, 12/17/13.

[33] Based on data from La Salle County Comprehensive Annual Financial Reports, La Salle County Treasurer.

[34] Based on data from 2014 La Salle County Budget. Available online at http://www.co.la-salle.tx.us/files/lasalle_budget2014.pdf.

activities (notably long-term planning), he believes that the increased oil- and gas-activity has been a substantial net benefit for county finances.

3.1.3.2 Municipal-level experience in Eagle Ford shale region, TX

3.1.3.2.1 Cuero and Gonzales, TX

The cities of Cuero and Gonzales, the county seats of De Witt and Gonzales counties, respectively, are of similar size (each around 7,000 in population) and have experienced similarly positive financial effects from Eagle Ford development. Officials in both cities report large net fiscal benefits, largely due to increased sales tax revenues. Sales tax revenues increased for Gonzales from $950,000 in 2009 to $1.6 million in 2013,[35] and in Cuero from $1.2 million to $3.6 million per year over the same period.[36] Both cities have also experienced large additional revenues from hotel taxes, as hundreds of new hotel rooms have been built to accommodate oil and gas workers in both cities.

Unlike the counties in which they are located, road repair costs for Cuero and Gonzales related to Eagle Ford activity have been modest. This is largely due to the fact that the main arteries are state-owned and maintained, and little oilfield traffic has affected city-owned roads. While spending on roads has increased in both cities, local officials describe this increased spending as an opportunity to improve road conditions city-wide, rather than an effort to repair roads damaged by oilfield traffic.[37] Both cities have, however, added substantial staff and faced challenges with workforce retention. Gonzales added 13 staff to an existing workforce of 100, and Cuero added eight new positions, largely to enforce traffic laws on busier roads. In addition, both cities have raised salaries by roughly 15 percent over the past two years.

3.1.3.2.2 Cotulla, TX

Cotulla, which lies roughly two hours southwest of Cuero and Gonzales and is the seat of La Salle County, has experienced the most rapid growth of any Texas city we examined, but also reported that net financial impacts have been a large positive. Population has grown from 3,600 in 2010 to an estimated 12,000 in 2013, and city staffing has grown from 15 to 40 over the same period. Local officials say that demand for virtually all city services has doubled or tripled, and they attribute this growth entirely to the Eagle Ford shale.[38]

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[35] Data source: Gonzales City Comprehensive Annual Financial Reports. Available at http://www.cityofgonzales.org/financialtransparency.html.

[36] Based on interview with Cuero city manager Raymie Zella, 12/16/2013.

[37] Based on interview with Gonzales city manager Allen Barnes, 12/17/2013.

[38] Based on interview with Cotulla city manager Larry Dovalina, 12/17/2013.

Sales tax revenues grew from $450,000 in 2008 to $3 million in 2012, and hotel tax revenues quintupled from $250,000 to $1.25 million over the same period. Other substantial revenue sources have been lease revenue from city property (roughly $110,000 to date), as well as in-kind donations of emergency services equipment from oil and gas operators (worth roughly $75,000).

Costs for the city have risen sharply, led by the need to expand sewer and water infrastructure to accommodate rapid population growth. These projects will likely cost some $15 million to $18 million over five years, and will primarily be paid for through user fees. The staffing increases noted above have been compounded by workforce retention challenges, as Cotulla's city government has lost a number of its most experienced employees. To try to retain its staff, the city raised wages by $3 per hour per employee, which at 45 employees working 2,080 hours per year adds an additional $281,000 to annual expenditures. Six of the new staff positions went to create a police department which did not previously exist and costs the city an additional $500,000 per year. To accommodate the new staff, Cotulla is spending an estimated $3.5 million to $4 million to construct new office space. Despite these large new costs, local officials are confident that new revenues have outpaced new service demands.

3.1.3.2.3 San Antonio, TX

San Antonio, which is ringed to its south and east by Eagle Ford activity, has experienced some financial impact, but local officials note that the size and breadth of their economy makes it difficult to identify the direct impact of Eagle Ford-related activity. Several oilfield services firms have constructed industrial facilities and staging areas on the city's periphery, which local officials suspect has increased both tax revenues and road maintenance costs.[39] However, they were uncertain of the magnitude of these effects. While our examination of city financial reports revealed no clear linkages between Eagle Ford activity and city finances, state sales tax data indicates that sales from the mining/quarrying/oil and gas extraction sector grew from 0.3 percent of total taxable sales in 2007 to 1.1 percent in 2012.[40] While these figures are small in percentage terms, they represent sales tax revenues of $600,000 in 2007 and $2.4 million in 2012,[41] an increase of $1.8 million per year.

3.2 Louisiana

[39] Based on interview with San Antonio budget director Maria Villagomez, economic development officers James Henderson and Adrian Perez, 12/16/2013.

[40] Sales tax percentage data from TX Comptroller of Public Accounts, Quarterly Sales Tax Data. Available online at: https://mycpa.cpa.state.tx.us/allocation/HistSales.jsp.

[41] Cumulative annual sales tax revenues provided by San Antonio budget director.

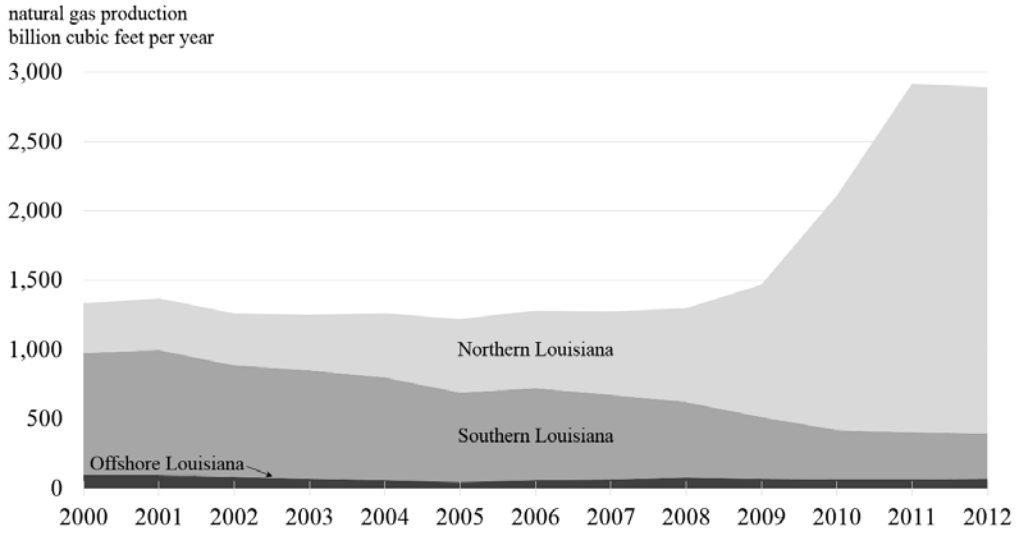
Table 8. Louisiana Parish Summary

Major revenue source(s)	Lease revenue Sales taxes
Major cost(s)	Roads Staff costs
Net fiscal impact	Medium to large net positive

3.2.1 Haynesville shale region, LA

The Haynesville shale underlies parishes in northwest Louisiana and counties in east Texas. While most of Louisiana's natural gas production has historically come from the southern and offshore regions of the state, northern Louisiana has become the dominant producing region operations began in the Haynesville (see Figure 5). Drilling activity peaked between 2008 and 2010, and has slowed substantially since. Most Haynesville production has taken place in three parishes: Bossier (pronounced BO-zure), Caddo, and De Soto. We examined all three parishes (Louisiana does not have counties; parishes provide many of the same functions such as maintaining roads and property records), as well the town of Stonewall.

Figure 5. Louisiana natural gas production



Data source: Louisiana Department of Natural Resources (2013).

3.2.1.1 Parish-level experience in Haynesville shale region, LA

3.2.1.1.1 Caddo and De Soto parishes, LA

Caddo and De Soto parishes have experienced large net fiscal benefits from Haynesville development, and Bossier has seen a more modest net benefit. These benefits occurred despite the fact that Louisiana allocates only a small amount of revenue to parish governments from its oil and

gas severance tax. The major new revenues for Caddo and De Soto parishes came from two primary sources: leases on parish-owned lands and sales taxes.

In the case of Caddo Parish, sales tax revenues doubled from $7.3 million in 2007 to $14.5 million in 2009. De Soto Parish saw even more dramatic growth: from $5.3 million in 2007 to $16 million in 2009, then $26 million per year in 2010 and 2011. Despite the fact that drilling activity has slowed, sales tax revenue continues to be much higher than before the boom began: 2012 sales tax revenues in Caddo and De Soto Parishes were 40 percent and 100 percent higher than 2007, respectively.[42]

An even larger revenue source for these parishes has been from leasing bonuses and royalties. Caddo Parish leased roughly 1,500 acres for extremely high rates: $20,000 to $30,000 per acre, plus up to a 30 percent royalty share.[43] De Soto Parish leased roughly 1,000 acres for $28.7 million, or $28,700 per acre.[44] Royalties for Caddo Parish averaged around $1 million per *month* in 2009 and 2010, though they have decreased significantly in recent years as production has slowed and gas prices have fallen. Royalties for De Soto Parish were roughly $3 million in 2010 and 2011 and roughly $1 million in 2012. Property taxes were one more major source of oil- and gas-related revenue for De Soto Parish, growing from $4 million in 2007 to $11 million in 2012, much of which was attributable to oil and gas surface property located within the parish. (Louisiana state law allows for property taxes to be levied on surface equipment such as rigs and wellheads, but not on the value of oil and gas production or the underground minerals.) (Louisiana Tax Commission 2005-2012).

Caddo and De Soto parishes also experienced some costs due to Haynesville shale development, though they have been small relative to the revenues described above. The largest cost for both parishes was road maintenance, as some parish-owned roads were damaged by heavy truck traffic. However, some of these costs were offset by agreements with operators who in some cases repaired roads after they had completed a well. Local officials in both parishes reported that increased revenues allowed them to not only repair, but upgrade damaged roads once operations were complete.[45] Other costs for both parishes included additional staff in several departments such as law enforcement, administration, and road and bridge crews. Additionally, workforce retention was a challenge during the peak drilling years, especially the road and bridge crews, whose skills

[42] Based on Caddo Police Parish Jury Comprehensive Annual Financial Reports and Audits, 2006-2012, and De Soto Police Parish Jury Annual Financial Reports, 2007-2012.

[43] Based on interview with Robert Glass, Caddo Parish director of public works, 11/26/2013, and Caddo Police Parish Jury Comprehensive Annual Financial Reports and Audits, 2006-2012.

[44] Based on interview with De Soto Parish Assistant Treasurer, Melissa Laffitte, 12/11/2013, and De Soto Police Parish Jury Annual Financial Reports, 2007-2012.

[45] Based on interviews with Robert Glass, Caddo Parish director of public works, 11/26/2013; and De Soto Parish Assistant Treasurer, Melissa Laffitte, 12/11/2013.

operating heavy equipment made them well-qualified to earn higher salaries with natural gas companies and related contractors.

3.2.1.1.2 Bossier Parish, LA

In Bossier Parish, where less Haynesville development has occurred, the parish government experienced a smaller impact and a small net financial benefit. Just like Caddo and De Soto parishes, Bossier Parish experienced increased road and bridge costs, with cumulative repair costs attributable to the Haynesville shale estimated by local officials at roughly $13 million to $15 million. However, a substantial share — between $3 million and $4 million — of those costs were paid by operators. The parish government also added new staff to monitor operators' compliance with traffic rules such as weight restrictions on certain roads. This division costs roughly $250,000 per year, but is entirely supported by fees levied on natural gas operators within the parish. Local officials believe this division has saved the parish government hundreds of thousands, if not millions, of dollars in repair costs by discouraging heavy truck operators from driving on weight-restricted roads and bridges.[46]

Revenues for Bossier Parish grew substantially during this period, though local officials are uncertain of the portion attributable to Haynesville activity. Total government revenues grew from roughly $30 million per year from 2004 through 2006 to between $50 million and $60 million per year from 2009 through 2012, with sales tax revenues growing from roughly $20 million per year to $33 million per year over the same period. Although parish officials do not know exactly how much of these revenues are due to Haynesville shale development, they suspect that the effects have been substantial.

3.2.1.2 Municipal-level experience in Haynesville shale region, LA

3.2.1.2.1 Stonewall, LA

Despite numerous attempts, we were not able to arrange meetings with officials from any cities in northern Louisiana. We did, however, examine the town of Stonewall (pop. ~2,000) in De Soto Parish, where substantial Haynesville development has occured.

Despite its location near the center of Haynesville production, the town government has experienced little net financial impact from natural gas development. The town did not experience significant effects on roads, as the major arteries that traverse Stonewall are maintained by the state. The heavy truck traffic that did use town-owned roads created some damage, but it was almost

[46] Based on interview with Bossier Police Parish Jury Admninistrator Bill Altimus, Parish Treasurer Cheryl Thomas, 12/12/13.

entirely repaired by the operating companies. The other substantial cost for the local government was time. The mayor spent significant time during the peak years of 2007 and 2008 talking with local landowners about their options for leasing property and interacting with gas companies, though his most common advice was, "Talk to a lawyer."

The town also experienced some new revenues, such as a $250,000 grant from the De Soto Parish government and a $15,000 donation from a natural gas operator to build a new community center. Increased natural gas development also may have encouraged the state government to improve an important road between the freeway and town, which allowed gas companies to more easily access local well sites but also provided a better route for local residents. Overall, the mayor describes the net financial impact of gas activity to government finances as roughly neutral.[47]

3.3 North Dakota

Table 9. North Dakota County Summary

Major revenue source(s)	Severance tax distributions Sales taxes
Major cost(s)	Roads Staff costs
Net fiscal impact	Small to medium net negative

Table 10. North Dakota Municipality Summary

Major revenue source(s)	Sales taxes Severance tax distributions
Major cost(s)	Sewer and water Roads Staff costs
Net fiscal impact	Medium to large net negative

3.3.1 Bakken shale region, ND

Western North Dakota local governments have perhaps experienced the greatest fiscal effects from oil and gas development of any region we visited. Not only has oil production in the region skyrocketed from roughly 30 million barrels per year in the early 2000s to nearly 250 million in 2012,[48] the extremely rural nature of the area has magnified effects on local governments. In terms of oil and gas well completions per person, North Dakota counties were at the top of our sample in recent years (see Appendix A, Table A3). Across the states we examined, fiscal challenges

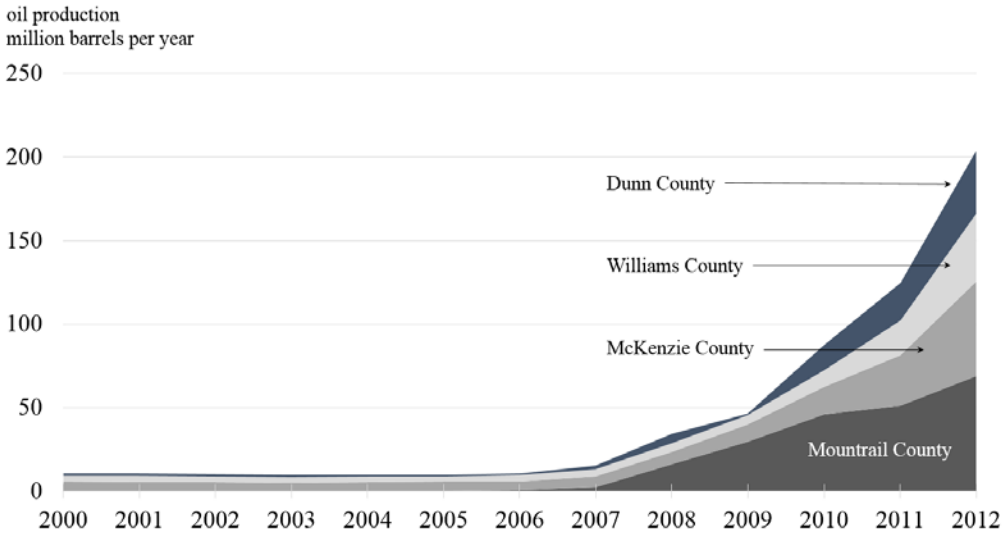
[47] Based on interview with Stonewall mayor Charles Walden, 12/12/2013.

[48] Source: North Dakota Industrial Commission Annual Production Reports.

tended to be most acute during heavy periods of drilling and hydraulic fracturing, which the region was clearly experiencing during our research. The net financial flows to date have been negative for these local governments, but it is possible that the resulting stock of infrastructure could lead to a stronger fiscal foundation.

The four top-producing counties in North Dakota produced roughly 200 million barrels of oil in 2012 (see Figure 6), more than the entire nation of Ecuador, a member of the Organization of the Petroleum Exporting Countries (OPEC) (U.S. Energy Information Administration 2014a). We interviewed officials from the periphery of the boom, in Dickinson, and officials at the heart of the boom in Dunn, McKenzie, and Williams counties, as well as the cities of Watford City and Williston.

Figure 6. Oil production in Dunn, McKenzie, Mountrail, and Williams counties, ND



Data source: North Dakota Industrial Commission (2013).

The population density of the four top oil-producing counties — Dunn, Williams, McKenzie, and Mountrail — is a combined 5.1 persons per square mile, twice as sparsely populated as North Dakota as a whole (10.2 persons per square mile), and roughly three times more sparsely populated than the rapidly growing Eagle Ford counties we visited in Texas (13.8 persons per square mile).[49] As a result, a rapidly growing population has gravitated towards the few cities that occupy the region, magnifying the effects for local governments. While North Dakota has a history of oil and gas production, the scale of the recent boom has resulted in population growth far beyond previous experience and is presenting a variety of challenges for all levels of local government. Recent reports have detailed some of the population effects and associated challenges of Bakken-

[49] Based on 2012 U.S. Census population estimates.

related growth (Center for Social Research at ND State Univ. 2012; Macke & Gardner 2012; Bangsund & Hodur 2013b; Headwaters Economics 2013a; Hodur *et al.* 2013).

3.3.1.1 County-level experience in Bakken shale region, ND

Our examination of Dunn, McKenzie, and Williams counties indicated that, while revenues have grown tremendously in recent years, the costs of managing new service demands resulting from the Bakken boom have grown at an even more rapid rate. As a result, the net fiscal impact to these county governments has been negative. North Dakota levies two major severance-type taxes: the oil and gas production tax, which the state collects before allocating a substantial share to local governments, and the oil extraction tax, which primarily generates revenue for state trust funds. [50] Revenues from these two taxes have grown from roughly $200 million in 2007 to roughly $1.6 billion in 2012 (North Dakota State Tax Commissioner 2012).

After a 2011 revision to the state's allocation formula, allocations from the oil and gas production tax for the counties of Dunn, McKenzie, and Williams have together grown from $9 million in 2007 to more than $50 million in 2012, and will grow further in subsequent years.[51] Local governments in North Dakota cannot collect property taxes on oil and gas production, and distributions from state severance-type taxes helps provide the revenue that does not arise from those property taxes. Other revenue sources, primarily sales taxes and fees for services, have increased dramatically for each county.

3.3.1.1.1 Dunn County, ND

In Dunn County, overall tax receipts grew from $2.4 million in 2005 to $12 million in 2012. Annual revenues from charges for services grew over the same period from $200,000 to $2.4 million. Overall revenues grew from $3.6 million to over $30 million.[52]

However, the service demands associated with increased population and heavy truck traffic have generally outweighed these revenue gains. Dunn County is the most sparsely populated of the three we examined, and officials estimate that the county was unable to provide 30 percent to 40 percent of the services needed to keep up with demand from the Bakken boom. The largest source of this demand was from road repairs, as an estimated 450 of the county's 1,240 road miles have been heavily affected by Bakken traffic. The county's road budget grew from $1.5 million in 2005 to more than $25 million in 2013.

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[50] See N.D. Century Code §57-51-01 and §57-51.1-01

[51] Data from N.D. Office of the State Treasurer. Accessed via web: http://web.apps.state.nd.us/stn/inquiry/taxdistributionsearch.aspx?searchtype=county

[52] Data source: Dunn County Annual Audits, provided by Dunn County Auditor's Office.

Demand for other services in Dunn County has also grown rapidly. Requests for support from county human services has grown by an estimated 60 percent to 70 percent since 2006, as a growing population of job-seekers move to the region and are unable to immediately find work. County staffing levels have roughly doubled from 47 to 93 employees from 2010 to 2013, even as the county struggled to maintain its current workforce due to high housing costs and attractive job opportunities in the private sector. The county's population grew an estimated 30 percent from 2010 to 2013, and criminal activity increased by an estimated 60 percent.[53]

3.3.1.1.2 Williams County, ND

In Williams County, which encompasses the city of Williston, the story is much the same. The county maintains roughly 1,000 miles of road and county commissioners estimate that all of these roads have been affected by Bakken development. The cost of remaking these roads would be roughly $1 million per mile, leading the commissioners to estimate their costs at roughly $1 billion. This is likely an overestimate (according to a 2012 report by the Upper Great Plains Transportation Institute, the entire Western Dakota region requires roughly $520 million in local road repair), but it indicates the magnitude of the challenge.

Other costs for Williams County have included an increase from roughly 130 to 200 staff, a 60 percent to 70 percent increase in demand for human services, a large increase in demands for policing and emergency services, and a high turnover rate for county staff. A housing shortage in Williston, where county offices are located, has affected Williams County so severely that it has purchased one building and built another to provide county employees with affordable housing and to expand office space. These projects were largely funded from the state's oil and gas impact grant fund (which is allocated from the oil and gas production tax), though the county will incur ongoing costs of $700 to $1,100 per month per apartment for roughly 25 apartments, adding roughly $250,000 per year to the budget.[54]

Revenues for Williams County have been led by distributions from the state and by sales taxes. State oil and gas production tax distributions grew from $2 million in 2007 to $17 million in 2012, and sales tax revenues grew from $2.2 million in 2007 to $10.6 million in 2011 (the most recent available year). Overall revenues for the county grew from $11 million in 2004 to $16 million

[53] Based on interview with Dunn County Commissioner Daryl Dukart, 10/14/2013.

[54] Based on interviews with Williams County Commissioners Wayne Aberle, 10/15/2013, and Martin Hanson, 10/15/2013.

in 2007 and to $46 million in 2011.[55] These revenues have certainly grown further in 2012 and 2013, as population, drilling activity, and production have continued to increase.

3.3.1.1.3 McKenzie County, ND

In McKenzie County, costs have grown at a similarly rapid rate and new revenues have not kept pace. Revenues at the time of this writing were only available through 2011, and show total revenues quadrupling from $12 million to $47 million per year from 2006 to 2011. This growth was led by revenues from state impact grants, state oil and gas production tax revenue, and royalties from production on county-owned land.[56]

As in Dunn and Williams counties, roads have been the largest cost, with an estimated $170 million needed to bring the roads up to ideal condition. Local officials acknowledge that prior to Bakken development, roads were not in ideal condition, meaning the full $170 million is not attributable to Bakken activity. Expenditures on roads in the county grew from $3.5 million in 2006 to a budgeted level of $72 million in 2013.[57]

Other service demands have grown rapidly. For example, before Bakken development began in earnest, county EMS providers responded to roughly five or six traffic accidents per month. In 2013, that rate was two to five per day and accidents tended to be more severe, with a higher rate of fatalities. The sheriff's office increased its staff from six to 22 officers, and salaries have risen by roughly 30 percent in recent years. Overall, county staff has grown by roughly 40 percent, and McKenzie County has partnered with Watford City, the county seat, to build employee housing, which has cost the county government an estimated $1.5 million to date.[58] Non-road spending has grown in the county from $3.5 million in 2006 to $24 million in 2013.

Although industry contributions to manage road repairs and dust control have been substantial in the case of Dunn County (roughly $2 million), these contributions have not approached the levels that would cover new road costs. For Williams County, direct contributions from operators have been minimal. However, Williams County officials described several instances where oil and gas operators helped first responders manage prairie fires by supplying equipment which, according to one official, "saved our bacon" on multiple occasions. In McKenzie County, local operators have made substantial donations to help build affordable housing, enabling those

[55] Based on annual audited financial reports provided by the Williams County Auditors Office, 2005-2011.

[56] Based on annual audited financial reports provided by the McKenzie County Auditors Office, 2006-2011.

[57] 2013 figure based on budgeted amount reported in McKenzie County Budget Book, 2013. Available online at: http://county.mckenziecounty.net/DepartmentsDisplay/County-Auditor

[58] Based on interview with McKenzie County director of economic development Gene Veeder, 10/16/2013.

operators to claim a state tax credit[59] and increasing local housing stock, which in turn helps lessen county government-provided housing costs.

3.3.1.2 Municipal-level experience in Bakken shale region, ND

North Dakota's oil and gas production tax revenue-sharing formula labels certain cities as "hub cities" and earmarks revenue for them based on the estimated number of oil and gas workers residing in each.[60] Dickinson and Williston are "hub cities," while Watford City is not. The larger populations of Dickinson and Williston mean that they have grown more due to the Bakken boom in absolute terms, but Watford City has seen larger growth by percentage. Based on our interviews and reviews of municipal financial data, new revenues for all three cities have not kept pace with new costs and service demands.

3.3.1.2.1 Watford City, ND

The population of Watford City, which sits at the crossroads of two major oilfield traffic arteries, has more than quintupled in three years, growing roughly 1,500 residents in 2010 to an estimated 8,000 in 2013. With this growth has come a rapid expansion of local government services. Due to revisions in the state's allocation formula (noted above) city government revenue from the state's oil and gas production tax has grown from roughly $1 million per year from 2008 through 2010 to $5.5 million in 2013 (N.D. State Treasurer 2013). McKenzie County has supplemented this revenue with additional allocations from the county's share of oil and gas production tax revenue. The state has also supplemented Watford City's revenues by awarding it grants from the state oil impact grant program, totaling nearly $30 million from 2011 through 2013 (N.D. Energy Infrastructure and Impact Grant Program 2013). The city's other major revenue source has been sales taxes. Although figures on city sales tax revenue were not available, total taxable sales and purchases in the city grew from $42 million in 2008 to $186 million in 2012, a more than four-fold increase.[61] City revenues from those taxes have likely followed a similar path.

These large revenue increases have nevertheless been outstripped by costs associated with growing demand for services. A 2012 assessment estimated that Watford City required nearly $200 million in infrastructure upgrades to cope with existing and expected population growth resulting from Bakken development (Vision West ND 2012). One way to observe the impact on city finances is to note that prior to large-scale Bakken development, Watford City had no outstanding debt.

[59] The North Dakota Housing Incentive Fund, authorized by the state legislature in 2011, Senate Bill 2210.

[60] See North Dakota 2013-2014 biennium, House Bill 1358.

[61] Based on data from North Dakota Sales and Use Tax Statistical Reports. Available at https://www.nd.gov/tax/salesanduse/pubs/.

Today, due to the necessary expansion of city services, the city has roughly $12.5 million in outstanding loans. The mere existence of debt is not necessarily a bad thing, but local officials describe it as a last-resort measure to manage service demands. The largest cost has been for expansion of sewer and water infrastructure, and although the city has raised its sewer and water connection fee from $300 to roughly $2,000 per household, city officials report that new revenues from these fees are not paying for the costs of expansion.

Staff costs have been the other major issue for Watford City. Professional and administrative staff has grown from 4 to 12 full-time employees, and the city's police force has grown from 3.5 to 13 employees. Watford City has also needed to provide subsidized housing and invested with McKenzie County to build housing units to attract and retain government employees.[62]

3.3.1.2.2 Williston, ND

Rapid population growth has also occurred in Williston, and new costs have outpaced large increases in revenue. Allocations from the state's oil and gas production tax revenue grew from $750,000 in 2007 to over $12 million in 2013 (N.D. State Treasurer 2013), and grants from the state oil impact fund have totaled $24 million from 2011 through 2013 (N.D. Energy Infrastructure and Impact Grant Program 2013). Sales taxes have been a major source growth, increasing from $4.6 million in 2007 to $23 million in 2012, and property tax revenues grew from $3.5 million in 2007 to $12 million in 2011 as the city annexed new land and new buildings sprang up.[63] Fee-for-service revenues have also grown, with charges for city services increasing from $6.5 million in 2007 to $15.5 million in 2011, though these revenues generally only cover a portion of the cost to provide services such as sewer and water connections.

Despite these increases in revenue, demand for services has outstripped Williston's ability to cover new expenses as the population grew from a Census-estimated 14,000 in 2010 to more than 40,000 temporary and permanent residents in 2012 (Bangsund & Hodur 2013b). The city estimates that roughly $370 million in capital upgrades were needed as of 2013, including extensions of sewer and water lines, widening of roads, and expansion of water and wastewater treatment facilities. City staff increased from 102 employees in 2008 to 189 in 2013, and salaries grew by an estimated 40 percent across the board. In addition, the high cost of housing in Williston forced the city to invest in three new apartment buildings, subsidize rents for employees residing in those buildings, and pay

[62] Based on interview with Watford City director of finance Aaron Mitchell and assistant city planner Seth Sampson, 10/16/2013.

[63] Based on Annual Financial Statement from City of Williston Auditor's Office and interview with Williston city auditor John Kautzman, 10/15/2013.

a $1,050 quarterly retention bonus for each employee. The city in 2013 took out a $100 million bond to help pay for these new costs.

3.3.1.2.3 Dickinson, ND

In Dickinson, just south of the most active drilling regions, population roughly tripled from a Census-estimated 18,000 in 2010 to some 50,000 permanent and temporary residents in 2012 (Bangsund & Hodur 2013b). Major revenues have included allocations from the oil and gas production tax, which grew from roughly $300,000 in 2007 to $6.2 million in 2013 (N.D. State Treasurer 2013), along with grants from the state impact fund totaling almost $20 million from 2011 through 2013 (N.D. Energy Infrastructure and Impact Grant Program 2013). Sales taxes have been the second-leading source of revenue growth, increasing from $4 million in 2007 to an estimated $10.6 million in 2012.[64]

Like Watford City, Dickinson has had to assume debt to pay for a variety of new services. In 2010, the city had no debt, but has since issued some $100 million in bonds and identified roughly $230 million in capital projects that will be needed over the next 3-4 years. These projects predominantly involve upgrades to sewer and water infrastructure, as well as improvement of local roads. Staff grew from 110 in 2009 to 180 in 2014, and workforce retention has been a challenge, though Dickinson has not had to subsidize housing like some neighboring cities to the north.[65]

Although the net fiscal effects to date have been negative for Dickinson, local officials anticipate that investments made today could result in a positive fiscal outcome in future years. The challenges of managing recent growth has been substantial, but if and when population growth slows and eventually levels out, the city will have a more robust infrastructure stock, potentially laying the groundwork for a future with fewer fiscal challenges.

3.4 Montana

Table 11. Montana County Summary

Major revenue source(s)	Severance tax revenue
Major cost(s)	Roads Staff costs
Net fiscal impact	[insufficient data]

64 Based on data from Dickinson Auditor's Office, Audited Financial Statements, 2008-2012.

65 Based on interview with Dickinson city manager Shawn Kessel, 10/14/13.

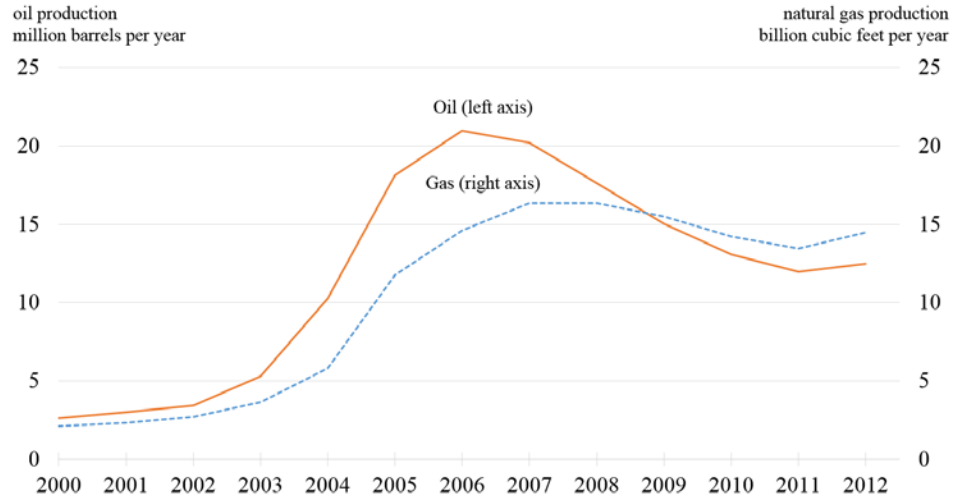
Table 12. Montana Municipality Summary

Major revenue source(s)	None
Major cost(s)	Sewer and water Staff costs
Net fiscal impact	Neutral to large net negative

3.4.1 Bakken shale region, MT

Although most attention related to Bakken development has focused on North Dakota, the first major development of the Bakken occurred in eastern Montana's Elm Coulee field in Richland County. Oil production in the county surged from roughly 3 million barrels in 2000 to more than 20 million in 2006, then fell to roughly 12 million barrels in 2012 (see Figure 7). Although development has slowed, 104 Bakken wells were completed in Richland County in 2012.[66] Perhaps more importantly for local governments, the region has experienced substantial spillovers in population, economic activity, and vehicle traffic from Bakken development across the border in North Dakota. We examined experience in Richland County and Sidney, the county seat, as well as the cities of Glendive and Culbertson.

Figure 7. Richland County, MT oil (left axis) and natural gas (right axis) production



Data Source: Montana Board of Oil and Gas (2013).

3.4.1.1 County-level experience in Bakken shale region, MT

3.4.1.1.1 Richland County, MT

Richland County, where most of Montana's Bakken development has occurred, has seen a substantial rise in revenues associated with oil and gas development. Since the state has no sales tax

[66] Data source: DI Desktop.

and local governments cannot levy property taxes on oil and gas production, the main source of oil- and gas-related revenue for Richland County has been allocations from the state's severance tax, which since 2009 have been in the range of $15 million to $20 million per year.

New costs for Richland County have come from road and bridge capital upgrades, road and bridge maintenance, and staff costs. The county invested more than $20 million in capital projects between 2009 and 2012, and road and bridge repair and maintenance costs grew from $2.5 million in 2009 to $5.5 million in 2012. Costs for staff, primarily due to additional staff and salary increases, grew by 100 percent to 300 percent for some departments, such as the clerk/recorder, judicial/jail, legal services, facilities management, and planning.[67]

We arranged a meeting with the Richland County planner and learned much about growth in that division of the county government. We were unable to meet with county finance officials or commissioners and therefore do not have a conclusion as to the net fiscal impact of Bakken development on the county government.

3.4.1.2 Municipal-level experience in Bakken shale region, MT

Much like western North Dakota, eastern Montana is extremely rural, with population densities in Richland, Roosevelt, and Dawson counties averaging 4.5 people per square mile (see Appendix A). This means that the region's few cities have absorbed virtually all population growth, as little housing stock — especially rental housing — exists beyond municipal bounds.

These Montana cities have generally not been able to keep up with the population growth and costs associated with Bakken development. Part of the challenge is that Montana allocates little severance tax revenue to municipalities in regions affected by oil and gas development. Instead, the state allocates most of this revenue to schools, counties, and state government. A 2013 bill to adjust the state's severance tax distribution formula passed the Montana legislature but was vetoed by the governor.[68] Additionally, the state does not allow Montana cities to levy a sales tax, though it does allow some municipalities in resort areas to do so.

3.4.1.2.1 Glendive and Sidney, MT

Severance tax allocations for Glendive (pop. ~6,500) and Sidney (pop. ~8,000) in 2012 were $95,000 and $800,000 respectively. These revenues have been helpful for the cities, but small relative to the new service demands we describe below. Revenues from property taxes have increased in

[67] Based on authors' review of Richland County budget documents provided at the Richland County courthouse, clerk/recorder's office.

[68] 2013 House Bill 218. For details, see http://openstates.org/mt/bills/2013/HB218/.

Glendive and Sidney thanks to a growing population and new construction, and revenues have risen from fees for building permits, sewer and water connections, and other fee-for-service activities. Sidney has also leased some city-owned land for drilling, which has brought in roughly $15,000 per year over the last several years.

However, these revenues have not kept pace with new costs related to Bakken development. The largest cost for both cities is from water and sewer infrastructure projects, which officials estimate at roughly $20 million for each city. Additionally, these cities have expanded their staffs for law enforcement, public works, and planning, and struggle to retain their existing workforce. In Sidney, city salaries increased 30 percent in each of the past two years, costing the local government roughly $750,000 per year. In the context of an annual budget of $13 million for Sidney and $5 million to $6 million for Glendive, these new costs have severely strained local governments' ability to provide services for residents.[69]

3.4.1.2.2 Culbertson, MT

In the smaller town of Culbertson (pop. ~750), the effects have been less pronounced. While a large number of heavy trucks pass through town, most travel on state-owned roads. And while the city has expanded its staff and raised wages, it has not faced the same retention problems as Glendive and Sidney. These new staff costs have been offset by increased revenue from new property in the city, specifically a facility to distribute sand for hydraulic fracturing and a grain elevator (the opening of which was unrelated to Bakken development). These two facilities boosted property tax revenues by roughly $90,000 per year, which essentially doubled the city's tax revenues.[70] Local officials describe the net fiscal impact as roughly neutral.

3.5 Colorado

Table 13. Colorado County Summary

Major revenue source(s)	Property taxes Severance tax revenue In-kind contributions (road repair)
Major cost(s)	Roads Staff costs
Net fiscal impact	Small net negative to large net positive

[69] Based on interviews with Glendive mayor Jerry Jimison and director of finance Kevin Dorwart, 10/18/2013; and Sidney mayor Bret Smelser, 10/17/2013.

[70] Based on interview with Culbertson mayor Gordon Oelkers, 10/17/2013.

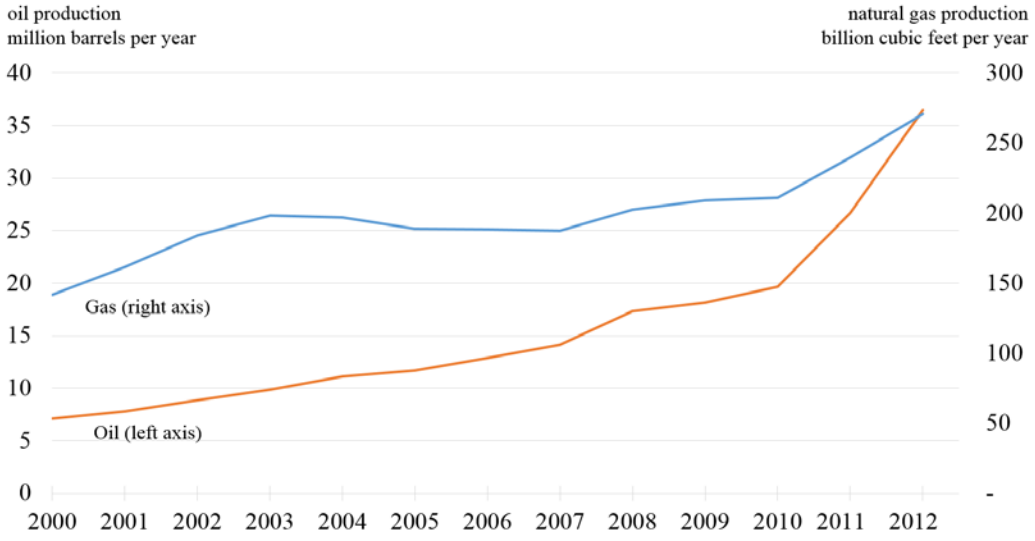
Table 14. Colorado Municipality Summary

Major revenue source(s)	Sales taxes Severance tax revenue Fee-for-service (water sales)
Major cost(s)	Sewer and water Staff costs
Net fiscal impact	Small to medium net positive

3.5.1 Denver-Julseberg basin region, CO

We examined three local governments in the Denver-Julesberg basin, where oil and gas production have recently grown from the Niobrara shale: Weld County, the town of Eaton, and the city of Greeley (see figure 8). More than 3,000 oil and gas wells were completed in Weld County in 2013,[71] making it one of the most densely drilled counties in our sample (see Appendix A Table A4).

Figure 8. Weld County, CO, oil (left axis) and gas (right axis) production



Data Source: Colorado Oil and Gas Conservation Commission (2013).

3.5.1.1 County-level experience in Denver-Julseberg basin region, CO

3.5.1.1.1 Weld County, CO

The Weld County government has seen large financial benefits along with smaller new costs from this increase in drilling activity. The largest increase in revenue has come from property taxes on oil and gas property. Between 2003 and 2012, oil and gas property grew from 22 percent to 52

[71] Source: DI Desktop

percent of the county's total property valuation and, although county-levied tax rates fell by 14 percent over that period, overall property tax revenue grew from roughly $50 million to $110 million per year (Colorado Department of Local Affairs 2003-2012). Oil and gas property generated roughly $50 million in county government revenue in 2012 alone.

Weld County also received between $1.3 million and $3.4 million per year in allocations from the state's severance tax and state-allocated royalties from production on federal lands (Colorado Department of Local Affairs 2010-2012). This figure is small relative to the amount of severance tax revenue generated by oil and gas production in Weld County. Colorado awards roughly 70 percent of its severance tax revenues based on a grant system, and Weld County has not been awarded any grants in recent years.

The county also generated large revenues from production on county-owned land, in-kind contributions, and fees. Oil and gas leases on county-owned land generated $7 million in 2011 and $9 million in 2012. In-kind contributions from local operators were also substantial. In one case, an oil company rebuilt an unused, 12-mile farming road to access a well site. This road now serves local residents as well as oilfield traffic.[72] Other new revenues have come from the clerk-recorder's office, where revenues from fees have increased from $3 million to $6 million per year since 2000 (partly attributable to oil and gas records requests) and from a county "rig fee," which issues a $1,000 permit for drilling rigs to travel on county roads.[73]

The largest costs for Weld County have been from two major road projects. The first, known as the HARP (haul route program), involves maintaining gravel roads that are heavily trafficked by oil and gas operators and has cost the county $4 million to $5 million per year in recent years. The second project involves widening a county road from two to four lanes, which will cost an estimated $160 million over the next several years and would not have been necessary without increased activity in the oil and gas industry. Smaller costs include roughly $400,000 for EMS equipment designed to handle emergencies involving oil and gas facilities, and a small increase in demand on law enforcement, mostly due to theft at oilfield equipment storage sites and well sites.[74]

Overall, new revenues for Weld County's government have outweighed new costs, and local officials report that they are not struggling to address any new service demands related to the oil and gas industry.

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[72] Based on interview with Weld County Commissioners Sean Conway, Mike Freeman, Bill Garcia, and Douglas Rademacher, 11/7/2013.

[73] Data provided by Weld County Financial Consultant, Don Warden. County fund codes 4221 (rig fee) and 4730 (clerk-recorder's office).

[74] Based on interviews with Weld County Commissioners Sean Conway, Mike Freeman, Bill Garcia, and Douglas Rademacher, 11/7/2013; and Weld County Financial Consultant Don Warden, 11/20/2013.

3.5.1.2 Municipal-level experience in Denver-Julseberg basin region, CO

3.5.1.2.1 Eaton, CO

The town of Eaton (pop. ~4,500) has experienced small net fiscal benefits from increased oil and gas activity. For Eaton, the main sources of revenue have been allocations of the state's severance tax and federal mineral royalty revenues, which have totaled roughly $100,000 per year over each of the past five years. The town also received grants funded by state severance tax revenue totaling $375,000, which has helped expand a community center and upgrade a town road (Colorado Department of Local Affairs 2010-2012). Sales tax receipts have also grown from roughly $750,000 to $1.1 million per year, though local officials are uncertain how much of this increase is attributable to population growth related to oil and gas activity. Finally, the town has sold roughly $75,000 worth of unused water for each of the past several years to oil and gas operators for hydraulic fracturing operations.[75]

As for costs, the town has had to shift funds to cover roughly $100,000 in additional road repair costs due to heavy truck traffic, some of which comes from the oil and gas industry and some of which comes from heavy farm equipment. Although hundreds of heavy trucks pass through Eaton's city limits each day, most travel on state-owned roads, limiting costs for the municipal government.

3.5.1.2.2 Greeley, CO

In Greeley, the largest city in Weld County (pop. ~95,000), the largest source of oil- and gas-related revenue is from allocations of Colorado's severance taxes and federal mineral royalties, totaling roughly $2 million per year over each of the past five years (Colorado Department of Local Affairs 2010-2012). The second largest revenue stream in 2012 came from water sales to oil and gas operators, totaling roughly 500 million gallons and $4.3 million, though local officials expect this revenue to decline as operators identify other water sources. The city has also leased property for oil and gas production, generating $234,000 in 2012. Based on surveys of local business owners and estimates of oil and gas workers in the city, Greeley officials estimate that local sales, hotel, and property tax receipts were roughly $1 million higher in 2012 than they would have been without the oil and gas industry.[76]

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[75] Based on interview with Eaton town administrator Gary Carsten and assistant town administrator Donald Cadwallader, 11/7/2013.

[76] Based on data provided by Greeley city officials Roy Otto (city manager), Victoria Runkle (assistant city manager), and Erik Dial (budget analyst, water and sewer department).

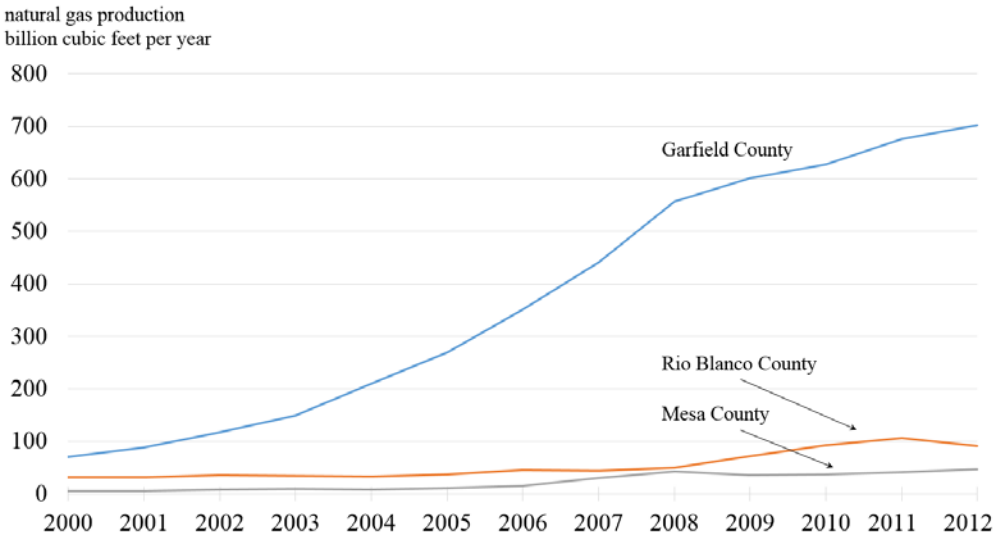
Greeley has also experienced costs due to oil and gas operations, mostly due to heavy trucks on city streets and bridges. As of this writing, the city was conducting a study to estimate the magnitude of these costs and did not have estimates to provide. City officials did not report any other major costs, though they did note that a substantial amount of their time was now devoted to oil- and gas-related issues such as community concerns over drilling near homes, schools, and other potentially sensitive areas. The city manager estimated that up to 20 percent of his time now went to these issues.[77]

In the context of a $206 million city budget, neither the costs nor the revenues related to oil and gas development have played a very large role in city finances. Overall, local officials estimate that the industry has provided a small net financial benefit, though the effects will be easier to quantify once Greeley's assessment of road and bridge costs is complete.

3.5.2 Piceance basin region, CO

Across the Rocky Mountains from Weld County, a major surge in natural gas production occurred in the Piceance (pronounced PEA-awnts) basin in the mid-late 2000s. Over 2,000 wells were completed in Garfield County alone at the peak of drilling activity in 2008, but as natural gas prices declined, drilling and production growth have slowed (see Figure 9).[78] We met with officials from two counties and four municipalities in the region: Garfield and Rio Blanco counties; the town of Carbondale; and the cities of Glenwood Springs, Grand Junction, and Rifle.

Figure 9. Piceance Basin, CO natural gas production



Data source: Colorado Oil and Gas Conservation Commission (2013).

[77] Based on interview with Greeley city manager Roy Otto, 11/7/2013.

[78] Source: DI Desktop

3.5.2.1 County-level experience in Piceance basin region, CO

3.5.2.1.1 Garfield County, CO

In Garfield County, where natural gas production has increased most dramatically, revenues for the county government have increased rapidly and costs have been relatively modest, resulting in a large net fiscal benefit for the county government. The largest oil- and gas-related revenue source has been from property taxes, followed by allocations of state severance taxes and federal mineral royalties. In 2002, total property tax revenue was $12.5 million, roughly 30 percent of which came from oil and gas properties. In 2012, total property tax revenue was $53.7 million, over 70 percent of which came from oil and gas properties.[79] Distributions from severance taxes and federal mineral royalties rose as high as $11.6 million in 2009 before falling to roughly $5 million per year in recent years (Colorado Department of Local Affairs 2010-2012). Sales tax revenues also spiked for the county, peaking near $15 million in 2008 before falling gradually to $8 million in 2012.

To put these numbers in context, Garfield County's total revenue from all sources excluding one-time grants was roughly $61 million in 2005. By 2009, near the peak of drilling activity, that figure had more than doubled to $129 million and in 2012 was $115 million.[80]

Garfield County also experienced large new costs associated with increased demand for services. Population grew rapidly from 2007 through 2009 and the county added roughly 50 staff positions in departments such as law enforcement, road and bridge, and administration. Local officials attribute a substantial share, though not all, of this growth to natural gas activity, as the county also experienced population growth from retirees and second-home purchasers moving to the area. Spending on public safety grew from $8.4 million in 2003 to roughly $22 million per year from 2009 through 2012, and spending on public works (mostly roads and bridges) grew from $5.8 million in 2003 to $26 million in 2012 (Garfield County Department of Finance 2004-2012). The county government also experienced substantial workforce retention challenges during this period, especially in the sheriff's department and among the road and bridge crew.

However, local officials report that the county was able to keep up with demand for the services it was responsible for providing, and increased revenue has allowed it to upgrade county facilities and services. The net fiscal benefits in Garfield County were also partly due to collaboration between local officials and oil and gas operators. For example, the county government worked with operators to establish a haul route so that heavy trucks did not travel on inadequate roads or disrupt

[79] Source: Garfield County Assessor's Office. Annual property tax reports, 2003-2013.

[80] Data provided by Garfield County Director of Finance, Ann Driggers.

school traffic. In some cases, oil and gas companies upgraded roads where well sites were located, such as a $22 million investment from one operator to improve 15 miles of roadway.[81]

3.5.2.1.2 Rio Blanco County, CO

In Rio Blanco County, Garfield County's northern neighbor, the story is different. Natural gas and oil production have surged and more than 1,000 wells have been completed since 2010, [82] and most new production has occurred on land owned by the federal government (roughly 75 percent of Rio Blanco County is federally-owned land). County property tax revenues grew from $4 million to $12 million per year from 2006 to 2012, and sales tax revenue surged from $5 million to $11 million per year during the ramp-up in drilling from 2006 to 2008 (Rio Blanco County Finance Department 2006-2012). Allocations from the state's share of federal mineral royalties have been in the $2 million to $3 million range for the past several years (Colorado Department of Local Affairs 2010-2012). The county also receives payments in lieu of taxes (PILTs) from the federal government, which were $509,000 in 2012.[83] Despite these revenues, local officials report that increased demand for services associated with the oil and gas industry have increased more quickly than revenues.

Unlike Garfield County, which has worked closely with oil and gas operators to repair roads, Rio Blanco County imposes an impact fee assessed on each new well drilled in the county.[84] The level of the fee varies based on factors such as depth and the estimated number of truck trips required. The fee raised $3.6 million in 2012, though not all of this revenue was oil- and gas-related, as the county assesses an impact fee on all new development including residential, commercial, and industrial construction.

The largest single cost for the county is a needed $100 million rebuild of a county road where about 80 percent of traffic is oil- and gas-related. The county spent $6.7 million in 2012 from its impact fee fund on road repairs related to oil and gas activity, though this spending has not been sufficient to make all the necessary upgrades. Other costs for the county have tracked the scale of drilling activity and created smaller financial challenges. For instance, the county nearly doubled its law enforcement staff to cope with increased demands during this period, and expenses grew from $2.2 million in 2006 to $3.8 million in 2010. Now that drilling has slowed and the population is

[81] Based on interviews with Garfield County officials Kirby Wynn (oil and gas liaison), Ann Driggers (county finance director), and Jim Yellico (county assessor).

[82] Data source: DI Desktop.

[83] Data source: Economic Profile System-Human Dimensions Toolkit (EPS-HDT). Available online at: http://headwaterseconomics.org/tools/eps-hdt.

[84] For details on Rio Blanco County's impact fee, see http://www.co.rio-blanco.co.us/departments/development.html#RBCImpactFees.

down, the county is unable to quickly shed those expenses and local officials say they are overstaffed law enforcement,[85] with annual expenditures remaining at $3.7 million in 2012 (Rio Blanco County Finance Department 2006-2012).

Overall, local officials report that increased costs from roads and other services has resulted in a net negative for county government finances.

3.5.2.2 Municipal-level experience in Piceance basin region, CO

The municipalities we visited in the Piceance basin generally reported small net positive impacts due to the increase in natural gas activity. We visited local officials in Grand Junction (pop. ~60,000, Mesa County), Glenwood Springs (pop. ~10,000, Garfield County), Rifle (pop. ~9,000, Garfield County), and Carbondale (pop. ~6,000, Garfield County), which have seen varying levels of effects from natural gas development.

3.5.2.2.1 Grand Junction, CO

A number of oilfield services firms opened facilities in Grand Junction in the mid-2000s, and local officials report that these facilities increased the city's tax base from property, sales, and use tax revenues. As drilling activity slowed in 2009 and 2010, these revenues decreased substantially. Although the city does not have data on oil- and gas-related sales, state data on sales tax revenue from the mining industry in Grand Junction shows revenue from state sales taxes growing from roughly $500,000 in 2004 (1 percent of the total) to $4.3 million in 2008 (7 percent) and falling to $2 million in 2012 (4 percent) (Colorado Department of Revenue 2002-2012). Local sales tax revenues likely followed a similar trajectory. Overall city revenues excluding one-time capital grants peaked at $118 million in 2008, with sales and use taxes providing $59 million, and state severance tax and federal mineral royalty distributions totaling roughly $3 million.[86]

Service demands also increased due to the oil and gas industry, but because a variety of industries in Grand Junction grew rapidly during 2007-2009, local officials are not able to estimate the relative magnitude of the oil and gas sector's impact. They estimate an impact in the millions of dollars to the city's roads from heavy truck traffic, but believe these increased costs were small enough to be paid for with allocations of state severance taxes and federal mineral royalties. At the same time drilling activity slowed in the region, the national economy entered a severe recession, and activity in Grand Junction's leading sector, construction, declined sharply. Local officials are not

[85] Based on interview with the chair of the Rio Blanco County Commissioners, Shawn Bolton, 11/11/13.

[86] Based on data from Grand Junction Comprehensive Annual Financial Reports, 2007-2012. Available at: http://www.gjcity.org/Comprehensive_Annual_Financial_Report.aspx

certain how to disentangle the effects of a bust in the natural gas industry with a bust in the housing market.

Overall, Grand Junction's government appears to have experienced modest net financial benefits during the most active years, primarily due to revenues from local sales taxes and state distributions of severance tax and federal mineral royalties. Now that drilling activity has slowed, the effects are smaller, but local officials still describe the impact of the oil and gas industry as a net positive for city finances.[87]

3.5.2.2.2 Glenwood Springs and Carbondale, CO

The cities of Glenwood Springs and Carbondale, which are located at the periphery of major drilling activity, have experienced small effects from the increase in natural gas activity. The largest cost for both has been time devoted to community concerns over perceived threats to local air and water quality due to drilling and hydraulic fracturing in the region. Because little heavy truck traffic runs along city streets and relatively few oil and gas workers settled in these cities during heavy drilling years, costs have been small.[88] The main revenue source has been allocations of state severance taxes and federal mineral royalties, with Glenwood Springs receiving $500,000 to $1.3 million per year between 2009 and 2012, and Carbondale receiving $300,000 to $850,000 per year during that same period (Colorado Department of Local Affairs 2010-2012).

3.5.2.2.3 Rifle, CO

The city of Rifle experienced the most significant population growth relating to oil and gas development of any municipality we examined in Colorado. Although Rifle struggled to manage growth during the most active drilling years, today the net fiscal impact appears to have been a small positive. Situated in the heart of the natural gas-producing region, Rifle saw its population grow from 6,500 to 9,500 in the late 2000s, accompanied by a building boom of new residential neighborhoods, restaurants, grocery stores, and other businesses. This growth was due in part to natural gas development, along with an influx of retirees and second home buyers (BBC Research and Consulting 2008).

The city experienced large costs associated with this growth, led by expansions of wastewater and water treatment plants. As the city grew, local officials based their estimates of future demand for these services on projections by the state government, which showed Rifle's population roughly

[87] Based on interview with Grand Junction officials Sam Sasuras (mayor), Rich Englehart (city manager), Tim Moore (deputy city manager), and Jodi Romero (financial operations director), 11/12/13.

[88] Based on interviews with Glenwood Springs city manager Jeff Hecksel, 11/11/13; and Carbondale city manager Jay Harrington, 11/11/13.

tripling to 30,000 by 2025. To meet these projected demands, the city built water and wastewater facilities at a cost of roughly $30 million. However, the national recession, housing bust, and slowdown in natural gas development meant that new development in the city essentially stopped in 2009. As a result, the city has raised wastewater fees for customers by over 100 percent and water fees by over 50 percent to cover the costs of these investments.[89] There have been other substantial costs, such as roughly $5 million for road and bridge projects, about $10 million for new city buildings, and an increase in annual general expenditures from $5 million in 2003 to $10 million in 2009 (projected 2013 expenditures are $8 million).

Despite these costs, revenues have grown to accommodate most demands for services and associated expenses. Thanks to large increases in sales tax revenue and allocations from the state's severance tax and federal mineral royalties, total revenues grew from $5 million in 2003 to $10 million in 2009, and are projected at $8 million in 2013. To help fund capital projects such as sewer and water expansions, road and bridge, and new buildings, the Colorado Department of Local Affairs has awarded roughly $13 million in grants to Rifle from the state's severance tax revenues in recent years (Colorado Department of Local Affairs 2010-2012).

Overall, local officials say the net fiscal impact of the surge in natural gas activity has been positive. This is due to the increased population (which has remained roughly flat since 2009), an increased tax base from new businesses, and continuing revenues from the state severance tax. Although city residents have had to pay substantially more for water and sewer services, local officials believe that new amenities such as better grocery stores, restaurants, parks, and infrastructure have resulted in a net benefit for city residents.

Rifle in some ways exemplifies how the local government fiscal impact of oil and gas development can vary over the phase of activity. During phases of rapid population growth, as sales tax revenues and service demands fluctuated in unexpected ways, local officials describe times when the net impact appeared to be negative and times when it appeared to be positive. Now that oil and gas activity (along with other causes of population growth) has slowed and financial flows have become more predictable, the fiscal impact appears to have been a net positive.

3.6 Wyoming

Table 15. Wyoming County Summary

Major revenue source(s)	Property taxes Sales taxes

[89] Based on interview with Matt Sturgeon, Rifle city manager, 1/23/2014.

Major cost(s)	Roads Staff
Net fiscal impact	Large net positive

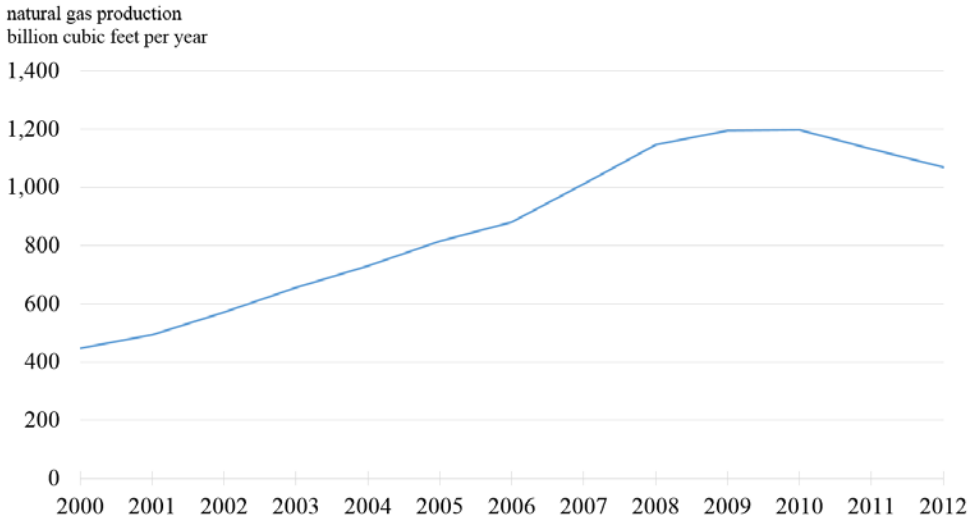
Table 16. Wyoming Municipality Summary

Major revenue source(s)	Sales taxes
Major cost(s)	Sewer and water Staff
Net fiscal impact	Neutral to small net positive

3.6.1 Green River basin region, WY

Sublette County produces more natural gas than any other county in the United States (see Figure 10). However, it is also one of the most sparsely populated counties in our survey (3.6 persons per square mile)[90] and its southern neighbor, Sweetwater County, absorbed much of the population growth that occurred during the surge in natural gas drilling in 2007 and 2008. We examined Sublette County and Pinedale, the county seat, along with the cities of Rock Springs and Green River, both in Sweetwater County.

Figure 10. Sublette County natural gas production



Data Source: Wyoming Oil and Gas Conservation Commission Wyoming (2013).

[90] Data from U.S. Census Bureau based on 2012 population estimate.

3.6.1.1 County-level experience in Green River basin region, WY

3.6.1.1.1 Sublette County, WY

In Sublette County, tax revenues have increased dramatically due to natural gas production and, although the county has experienced new costs, the net result has been a large positive for government finances. Property taxes grew from roughly $55 million in 2003 to $377 million in 2009, at the peak of drilling activity, and have since fallen to $257 million in 2012. This increase was driven almost exclusively by mineral property values (primarily natural gas), which accounted for 97 percent of the county's assessed property valuation in 2012. [91] Sales tax revenues also grew rapidly, from budgeted levels of $2.3 million in 2002 to $13.4 million in 2008, falling to a budgeted level of $9 million in 2013.[92] Local officials attribute virtually all of these new revenues to population growth associated with natural gas development.[93] Severance tax revenues have increased, but Wyoming allocates a relatively small share of severance taxes back to local governments, and this source grew from $70,000 in 2002 to $624,000 in 2013.

New costs have been led by road maintenance and repairs, as the road/bridge budget grew from $3.5 million in 2002 to $31 million in 2008, falling to $23 million in 2013. Virtually all other costs have doubled or tripled, with total spending growing from $11 million in 2002 to $65 million in 2008 and $59 million in 2013. However, much of this new spending was not to mitigate impacts of increased gas development. Rather, many new costs were from projects to improve or expand county services, projects that would not have been possible without the increased revenues described above. A notable example was the construction of a $20 million recreational aquatic center. Tellingly, the county's cumulative cash balance has grown from $11 million in 2002 to $143 million in 2013.

Workforce retention was a challenge for the county government and officials describe a "mass exodus" from certain departments such as law enforcement. The county raised salaries to try to retain workers, but continued to struggle with retention until recently, when natural gas drilling and its associated employment opportunities decreased substantially.

3.6.1.2 Municipal-level experience in Green River basin region, WY

Although most drilling activity has occurred in Sublette County, much of the associated population growth has occurred in the cities of Rock Springs and, to a lesser extent, Green River,

[91] Based on data provided by Sublette County Assessor's Office.

[92] Based on review of Sublette County annual budgets, provided by Sublette County Clerk's Office.

[93] Based on interview with Sublette County Commissioners Andy Nelson and Jim Latta, 11/14/13.

which lie roughly one hour south in Sweetwater County. Like some other municipalities we examined in sparsely populated areas, these cities struggled to manage the financial impacts of natural gas development during the most active drilling years, but many of these challenges have faded as drilling activity and population growth slowed.

3.6.1.2.1 Rock Springs, WY

Rock Springs (pop. ~24,000) experienced the larger impact of the two Sweetwater County cities, and after substantial fiscal challenges during rapid population growth from 2007 through 2009, local officials now report a roughly neutral financial impact.[94] The dominant new revenue source for the city has been sales and use taxes, which grew from $13 million in 2004 to $24 million during the peak years of 2008 and 2009. These revenues fell below $20 million in 2010 and 2011, but were back up to $24 million in 2012, in part due to a voter-approved increase in the sales tax rate from 5 to 6 percent.[95] Local officials attribute the earlier increase primarily to the surge in population associated with natural gas development. Revenues from property taxes also grew during this period by about $1 million per year. Severance tax allocations from the state remained roughly unchanged, ranging from $1.5 million to $1.8 million per year from 2006 through 2013.[96]

New costs for the city have been significant, primarily from infrastructure projects required by a growing population. The largest cost was an upgrade to the city's wastewater treatment plant, which cost roughly $18 million, two-thirds of which was passed through to customers and one-third of which was paid for with revenues from the additional one percent sales tax noted above. The second major cost was related to workforce retention. Cost of living adjustments of 2 percent to 7 percent per year were given to employees from 2004 through 2010, resulting in a cumulative increase of roughly 35 percent per employee.[97] General government expenditures, which include salaries and other operating costs (but not capital projects such as water or road infrastructure), grew from $3.4 million in 2006 to $5.6 million in 2013.

3.6.1.2.2 Green River, WY

In the neighboring city of Green River (pop. ~13,000), the effects have been less pronounced and resulted in a net positive financial impact, as population growth has not been as substantial as in Rock Springs. The city experienced large growth in sales and use tax revenue, which

[94] Based on interview with Rock Springs mayor Carl Demshar and finance director Lisa Tarufelli, 11/13/13.

[95] Based on data provided by Rock Springs Finance Director's Office.

[96] Based on data from Rock Springs annual financial and compliance reports. Available at: http://www.rswy.net/egov/docs/1248963706205.htm.

[97] Based on data provided by the Rock Springs Finance Director's Office.

accounts for roughly 70 percent of total city revenues. Sales and use tax revenue grew from $12.5 million in 2006 to over $18 million in 2008 before returning to previous levels by 2010.[98]

Along with new revenues, the increase in gas activity and population growth added substantial new costs, particularly in policing and, to a lesser extent, salary increases to retain city employees.[99] Public safety expenditures grew from $4.3 million in 2006 to $6.5 million in 2009, at the peak of drilling activity. Despite these new costs, local officials report a net positive financial impact, as the city has been able to keep up with increased costs as well as expand services such as new afterschool and youth sports programs.

3.6.1.2.3 Pinedale, WY

In Sublette County, the town of Pinedale (pop. ~2,000) experienced a rapid surge in population during the peak drilling years of 2007 through 2009. Overall, local officials report a small net financial benefit, though managing through the peak years of drilling activity presented substantial challenges.[100] Like Rock Springs and Green River, the largest new revenue source for Pinedale was from sales and use taxes, which grew from $1.4 million in 2002 to roughly $4 million in 2006 and 2010 before falling to $2.5 million in 2013.[101] Because of changes to Wyoming's severance tax allocation formula, Pinedale actually saw its severance tax allocation from the state *decrease,* even as gas production grew in the region. Allocations from state severance taxes and federal mineral royalties fell from roughly $500,000 in 2002 to between $200,000 and $275,000 from 2006 through 2013. However, the Sublette County government has helped Pinedale manage growth with between $4 million and $5 million in grants, and providing law enforcement for the town at virtually no cost.

The city's major new costs were primarily from infrastructure upgrades, which were accelerated due rapid population growth. The largest single project was a $22 million sewer system upgrade, for which the city paid $6 million to $8 million (the remainder was covered by federal grants). Road and bridge costs also increased during this period by about $3 million cumulatively, largely due a state policy that stipulated that once the city passed 2,000 residents, the state no longer paid for certain road repair costs. The city has also built a new $3.5 million public works building to house road equipment and materials, and raised salaries by 40 percent to 50 percent to retain

98 Based on data from Green River audited financial reports, available at: http://www.cityofgreenriver.org/Archive.aspx?AMID=47.

99 Based on interview with Green River finance director Jeff Neiters, 11/13/13.

100 Based on interview with Pinedale mayor Steve Smith, 11/15/13.

101 Based on data from Pinedale town budgets, 2002, 2006, 2010, and 2013. Provided by Pinedale mayor's office.

workers. Local officials attribute these new costs primarily to population growth associated with increased natural gas development.

3.7 Pennsylvania

Table 17. Pennsylvania County Summary

Major revenue source(s)	Act 13 distributions
Major cost(s)	Staff costs
Net fiscal impact	Small to large net positive

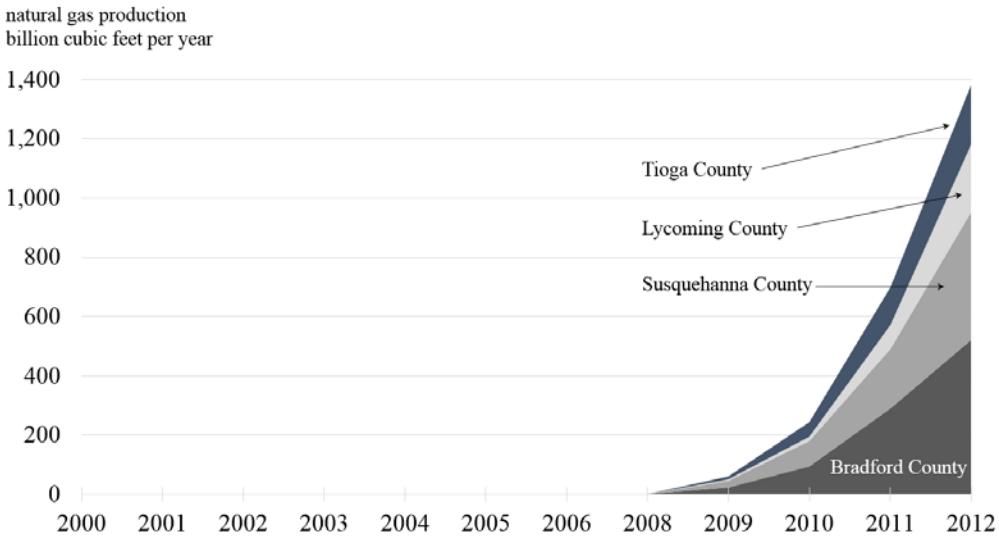
Table 18. Pennsylvania Township Summary

Major revenue source(s)	Act 13 distributions In-kind contributions (road repairs)
Major cost(s)	Staff costs
Net fiscal impact	Small to large net positive

3.7.1 Northeastern Marcellus shale region, PA

Natural gas production from the Marcellus shale has led Pennsylvania to become the third-largest producer of natural gas to the United States (U.S. Energy Information Administration 2014b). Much of this production has taken place in the northeastern corner of the state, sometimes called the "Northern Tier." Pennsylvania has produced relatively small quantities of natural gas for decades, but Marcellus shale development has brought a much larger scale of activity and production (see Figure 11). We examined three of the top-producing counties in the region – Bradford, Lycoming, and Tioga – as well as five townships within Bradford, Tioga, and Susquehanna counties. Townships maintain much of the rural road network in Pennsylvania, while counties provide most law enforcement and emergency services, human services, and maintain county property records. Although we attempted to meet with city and borough officials in the region, we were not able to arrange any interviews.

Figure 11. Marcellus shale gas production in Bradford, Susquehanna, Lycoming, & Tioga Counties, PA



Data source: DI Desktop (2014).

In 2012, Pennsylvania enacted legislation, often referred to as Act 13,[102] which imposes an "impact fee" on each new unconventional gas well drilled in the state. The level of this fee varies depending on the annual average price of natural gas, and operators pay an annually declining fee on each well that produces above a minimal threshold. Revenues from this impact fee are largely distributed back to counties, townships, cities, and boroughs based on the number of wells within or close to their jurisdictional boundaries (PA Public Utility Commission 2014). The fee is in part intended to provide revenue to manage Marcellus-related impacts, as local governments cannot levy property taxes on natural gas production property.

3.7.1.1 County-level experience in Northeastern Marcellus shale region, PA

The three county governments we examined in northeast Pennsylvania have experienced net positive financial impacts from Marcellus shale development. Since Pennsylvania counties do not, by and large, maintain road networks, costs for these counties have been limited and revenues from Act 13 distributions have resulted in a substantial net positive for county government finances.

3.7.1.1.1 Bradford County, PA

Bradford County, a rural county (55 persons per square mile) relative to much of Pennsylvania (284 persons per square mile),[103] has seen the largest amount of Act 13 disbursements of any Pennsylvania local government, providing roughly $15 million total from 2011 through

[102] PA House Bill 1950, 2011 legislative session.

[103] Based on data from 2012 U.S. Census population estimate.

2012.[104] These revenues allowed the county to pay off all of its outstanding debt, which stood at $6.2 million in 2011.[105] The county also received roughly $2 million in leasing bonuses and drew royalties of roughly $10,000 per month in 2013.[106] These revenues are large relative to the county's total 2011 tax revenue of $11.5 million.

Although the county government does not maintain many miles of roads, it has seen some increased costs. Additional staff time has been particularly needed in law enforcement as DUI arrests increased, though how much of the increase was attributable to Marcellus activity is unclear. Additional temporary staff was added to the clerk/recorder's office to manage records requests, though these costs were largely offset by fees charged for those services. Small cost increases also occurred in human services, which experienced additional demand for housing services as local rental rates rose due to an influx of Marcellus workers (Kelsey *et al.* 2012b).

3.7.1.1.2 Lycoming County, PA

In the more urbanized county of Lycoming (95 persons per square mile), new revenues have also been substantial, but had less of an overall impact due to the county's relatively large budget. In the context of a nearly $100 million annual budget, Act 13 disbursements totaled roughly $8 million over two years. Lycoming County has distributed much of these revenues to its townships, cities and boroughs, where they have a larger relative effect. Tax revenues for the county increased by roughly $1.5 million per year from 2007 through 2012,[107] and local officials attribute this in large part to Marcellus activity.[108]

The largest new costs for Lycoming County have come from demand for social services, especially housing, and staff. The county invested $600,000 of its Act 13 distributions in affordable housing projects which became necessary as population growth drove up rental rates (Lycoming County 2012). Two new staff positions were added due to Marcellus development, totaling roughly $100,000 per year, and the county government has lost three to five employees due to competition from the gas industry, though it has not had trouble filling those positions. The overall impact for county finances has been a net positive.

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104 Data on Act 13 disbursements gathered from PA Public Utility Commission. Available online at: https://www.act13-reporting.puc.pa.gov/Modules/Reports/Reports.aspx.

105 Data from Bradford County Auditor's Office, 2011 Audit.

106 Based on interview with Bradford County Commissioner Daryl Miller, 10/2/2013.

107 Data source: Lycoming County Controller's Office, Comprehensive Annual Financial Reports.

108 Based on interview with Lycoming County director of planning Kurt Hausamann, 9/30/2013.

3.7.1.1.3 Tioga County, PA

In Tioga County, substantially more rural than Lycoming County (52 persons per square mile), roughly $9 million in cumulative revenue from Act 13 disbursements over 2011 and 2012 allowed the county to make capital upgrades that it would not have otherwise been able to afford, such as improving EMS facilities and renovating government buildings. The county also received roughly $400,000 from a lease on county-owned land, but has not yet seen royalties from gas production. With total government expenditures of roughly $30 million in 2011, these new revenues are substantial.[109] In-kind contributions from oil and gas operators have also been of note, with companies upgrading the county's scanning equipment to allow easier access to land records and other public documents.

Tioga County did experience some increases in demand for services, which modestly increased staff costs. These increased service demands were especially apparent in social services, and the county is investing roughly $400,000 from Act 13 disbursements to address a shortage in affordable housing largely attributable to Marcellus activity. The county did not add many new staff positions, but did invest some $500,000 to train new staff as it struggled with workforce retention at the height of drilling activity in 2010 and 2011.[110]

3.7.1.2 Township-level experience in Northeastern Marcellus shale region, PA

Townships maintain the bulk of rural roads in Pennsylvania, and Act 13 disbursements to them are largely intended to defray maintenance costs due to Marcellus gas operations. We examined five townships in the Northern Tier, where heavy drilling activity has occurred within their borders or nearby.[111] Local officials in four of the townships reported substantial net benefits to their government's finances, and one township reported net negative fiscal impacts. For those townships reporting net financial benefits, local road repair costs were limited due to road maintenance agreements (RMAs) with local operators, and new revenues from Act 13 disbursements were substantial. The township that reported a net negative impact saw substantial drilling nearby but not within its borders, and was not satisfied with its RMA with the local operator. Publicly available financial data for townships are limited, but local officials shared with us a variety of information via their internal accounting systems.

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109 Data source: Tioga County Clerk's Office.

110 Based on interview with Tioga County commissioner Eric Coolidge and director of planning Jim Weaver, 10/1/2013.

111 In Bradford County: Columbia and Ward townships. In Susquehanna County, Dimock and Springville townships. In Tioga County, Sullivan township. Interviews conducted from 10/1/2013 through 10/3/2013.

3.7.1.2.1 Columbia, Dimock, Springville, and Sullivan townships, PA

In the four townships that reported net positive fiscal impacts, early experience with Marcellus development was not all positive. When drilling began in some areas, truck traffic damaged roads and township leaders spent substantial time and resources on repairs. However, operating companies and township officials soon began collaborating to manage the effects of heavy truck traffic. Many gas companies entered into RMAs with local officials stipulating that they would pay for any damages caused to local roads and fully repair heavily trafficked roads once they had completed a well. Officials in those townships reported that these agreements were central to their ability to manage costs and maintain roads.

Since these RMAs obviated most road maintenance costs for townships, distributions from Act 13 revenue allowed them to purchase or upgrade equipment. The townships of Columbia, Dimock, Springville, and Sullivan each received Act 13 distributions in 2011 and 2012 of roughly $500,000 per year, essentially doubling the annual budget for each township. Some also saw increased revenue from permits required when natural gas gathering lines cross township roadways, along with leasing bonuses and royalties on township-owned land.

Other in-kind contributions have been substantial for some townships. Donations from operators helped pay for new fire trucks and other emergency service vehicles, along with donations of park equipment and signage. One noteworthy contribution came during a severe flood in 2010, when a specialized water pipe was washed away underneath a road in Dimock. Local officials described how a gas operator found the replacement part that the township was unable to locate, drove several hours to retrieve it, and repaired the damage within 24 hours. The affected road, which was an important artery for local schools, quickly reopened.

New costs for these townships have primarily been limited to increased staff time and some challenges with workforce retention. Some larger townships added one or two police officers to manage additional traffic, and occasional heavy truck accidents have required additional time from road crews. However, the RMAs have kept overall costs low.

3.7.1.2.2 Ward Township, PA

The story may be different in Ward Township, a very small community (pop. 128) in Bradford County. Although the township received roughly $500,000 in both 2011 and 2012 from Act 13 disbursements, local officials report that road maintenance costs outstripped new revenues. Because most drilling within or around the township occurs on state-owned forest land, local officials believe that the RMA they secured with the locally operating gas company has not been effective. Instead, they believe the company has focused on maintaining the state-owned park roads rather than township roads. Additionally, they report that materials costs for road maintenance have

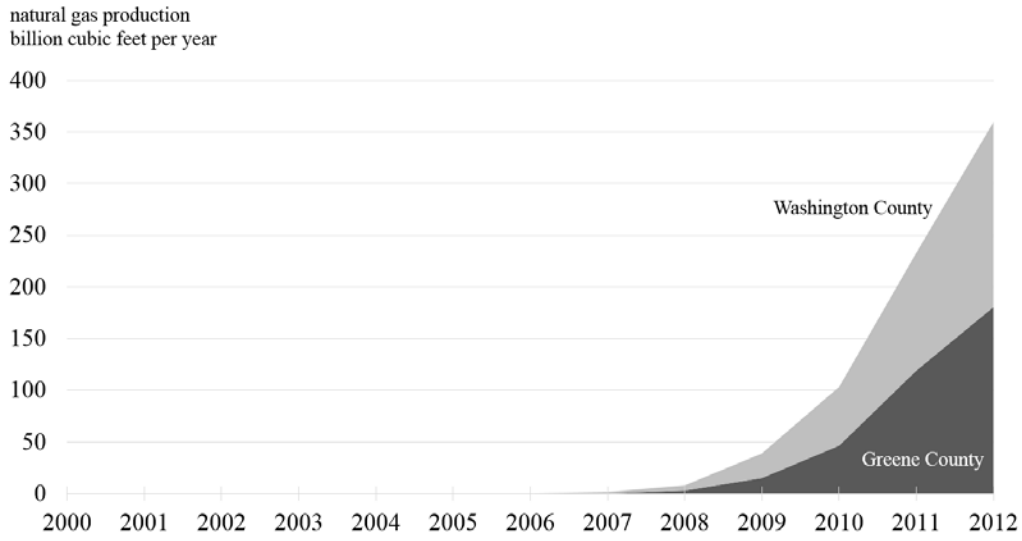
risen substantially since gas operators came to the area, an observation that was repeated in other townships.

However, the township supervisors stated that they had not spent any of the roughly $1 million in Act 13 disbursements, as they were concerned that upgrades to existing roadways would require additional maintenance costs in the future.[112] This was somewhat surprising, as we did not hear this as a major concern in other townships. Additionally, it is unclear whether the $1 million allocated to the township would be sufficient to make all gas-related road repairs should local officials decide to do so.

3.7.2 Southwestern Marcellus shale region, PA

Although a greater volume of gas production comes from the Northern Tier, the first Marcellus shale wells were drilled in southwestern Pennsylvania, near the borders of Ohio and West Virginia. The two counties that have seen the most development, Greene and Washington (see Figure 12), have a long history of coal production, and truck traffic from coal mining has affected local roads for decades. We interviewed officials from both counties and six townships within the two counties. Although we attempted to meet with city and borough officials in the region, we were not able to arrange any interviews. Officials in all the local governments we visited in this region reported net positive financial impact from Marcellus development.

Figure 12. Marcellus shale gas production in Greene and Washington Counties, PA



Data source: DI Desktop (2014).

[112] Based on interview with Ward Township supervisors Ed Sheaffer, Leon Nouse, and Lloyd Ayres, 10/1/2013.

3.7.2.1 County-level experience in Southwestern Marcellus shale region, PA

Greene and Washington counties have a long history of coal mining and some natural gas production, but Marcellus development has far eclipsed the scale of past natural gas operations. A substantial number of gas wells were drilled in the mid-2000s, but these wells generally did not target the Marcellus shale, did not employ hydraulic fracturing, and were relatively shallow, requiring fewer truck trips and less industrial-scale activity. Greene County is largely rural (66 persons per square mile), while Washington County has some medium-sized cities and is more densely populated (244 persons per square mile).[113]

3.7.2.1.1 Greene County, PA

In Greene County, distributions from Act 13 totaled roughly $3 million per year in 2011 and 2012, representing 10 percent of the county's annual revenues of roughly $30 million.[114] Property tax revenues have grown steadily but modestly since 2006, limited by the fact that Pennsylvania counties cannot tax oil and gas production property. However, the county has seen substantial revenue from natural gas production on county-owned property, with leasing bonuses and royalties totaling roughly $1.2 million through late 2013.[115]

Though these revenues are modest relative to the gains seen from property taxes and severance tax distributions in some other states, they have outweighed additional county government costs. Costs have come from increased staff time for the clerk-recorder's office and the geographic information systems (GIS) department, but are largely offset by fees charged for each service. Local officials also reported some increased demands on law enforcement, namely associated with DUI violations, but they have not added additional staff and the overall impact has been small. It is unclear how much of the increase in DUI violations is attributable to population growth associated with Marcellus activity.

3.7.2.1.2 Washington County, PA

In Washington County, which borders Greene County to the north, the story has been similar. With 2012 revenues of $172 million, Washington County's Act 13 disbursements of roughly $4.5 million per year in 2011 and 2012 make a smaller impact on the county's overall financial position. However, the county has leased substantial acreage for Marcellus shale development and netted roughly $8 million in revenue from lease payments through June 2013. A smaller benefit

[113] Based on data from 2012 U.S. Census population estimates.

[114] Based on Greene County annual audits, provided by Greene County Finance and Budget Office. Available at: http://www.co.greene.pa.us/secured/gc2/depts/adm/cc/budget.htm.

[115] Based on interview with Greene County budget director Scott Kelley, 10/19/2013.

came in the form of an upgrade in the county's bond rating, which local officials attribute in large part to these new revenue streams and which they estimate saved the county government $150,000 on a recent $9 million bond issuance. The county has also received some in-kind donations from operators, such as a new running trail in a county-owned park estimated to be worth $750,000.[116]

The county government has also seen new costs, though they are substantially less than the new revenues described above. The primary cost has been in workforce retention, as a number of employees in the Soil and Water Conservation District, which manages erosion control and other environmental effects associated with property development, left to work with Marcellus operators. This led to an increase in costs for training new staff, though officials describe the overall impact as small. The county has also experienced some small, but noticeable increases in demand for human services such as housing, mental health services, and law enforcement, which they attribute partially to increased population and rising housing costs associated with Marcellus development.[117] Finally, the county has experienced some increase in costs for maintaining several county-owned bridges, though local officials only attribute a small share of these costs to Marcellus activity.[118]

3.7.2.2 Township-level experience in Southwestern Marcellus shale region, PA

3.7.2.2.1 Cecil, Chartiers, Cumberland, Franklin, Morgan, and Smith townships, PA

As noted above, Act 13 disbursements to townships are largely intended to help defray road and bridge maintenance costs associated with Marcellus shale operations. We examined six townships in Greene and Washington counties,[119] which uniformly reported net positive financial impacts from Marcellus development. Just as in the Northern Tier, the primary reason for these net benefits were twofold: First, natural gas operators maintained and repaired the roadways that they affected and second, Act 13 disbursements allowed the townships to purchase new equipment and improve services.

Most township officials described the early days of Marcellus development as challenging, as operators began using township roads without first communicating with local officials. This led to a short-term increase in road maintenance costs, as well as significant amounts of overtime from supervisors and other township staff. However, these costs decreased substantially as local officials crafted RMAs with companies. Local officials were generally pleased with the outcome of such

116 Based on interview and information provided by Washington County budget director Roger Metcalfe, 9/17/2013.

117 Based on interview with Washington County Commissioner Harlan Shober, 9/18/2013.

118 Based on interview with Washington County Planning Commission executiver director Lisa Cessna, 9/17/2013.

119 In Greene County, Cumberland, Franklin, and Morgan townships. In Washington County, Cecil, Chartiers, and Smith townships. Interviews conducted 10/17/13-10/25/13 with township supervisors and secretarys.

agreements, and noted in multiple cases a variation on the theme: "I wish I had a gas well on every road," since repairs made after wells were completed often left roads in better shape than before drilling began.

Act 13 disbursements provided large new revenues to many of these townships. The six townships we visited received between $80,000 and $1 million per year in 2011 and 2012, allowing them to purchase new road maintenance equipment. For small townships with annual budgets sometimes in the range of $500,000 per year, this has been a major new revenue stream. Another source of revenue for some townships has been from leasing bonuses and royalties, along with some increases in property tax revenue from new industrial facilities such as gas processing plants locating within township borders. Finally, some townships where natural gas-related industrial facilities have located have seen new revenues from a locally-levied earned income tax, which is assessed on every worker in a given township.

Costs for these local governments have been limited primarily to road maintenance and repair which, as noted above, has generally been offset by in-kind agreements with operators. Some townships reported small challenges with workforce retention, though none had substantial problems filling open positions.

3.8 Arkansas

Table 19: Arkansas County summary

Major revenue source(s)	Property taxes In-kind contributions (road repairs)
Major cost(s)	Roads
Net fiscal impact	Medium to large net positive

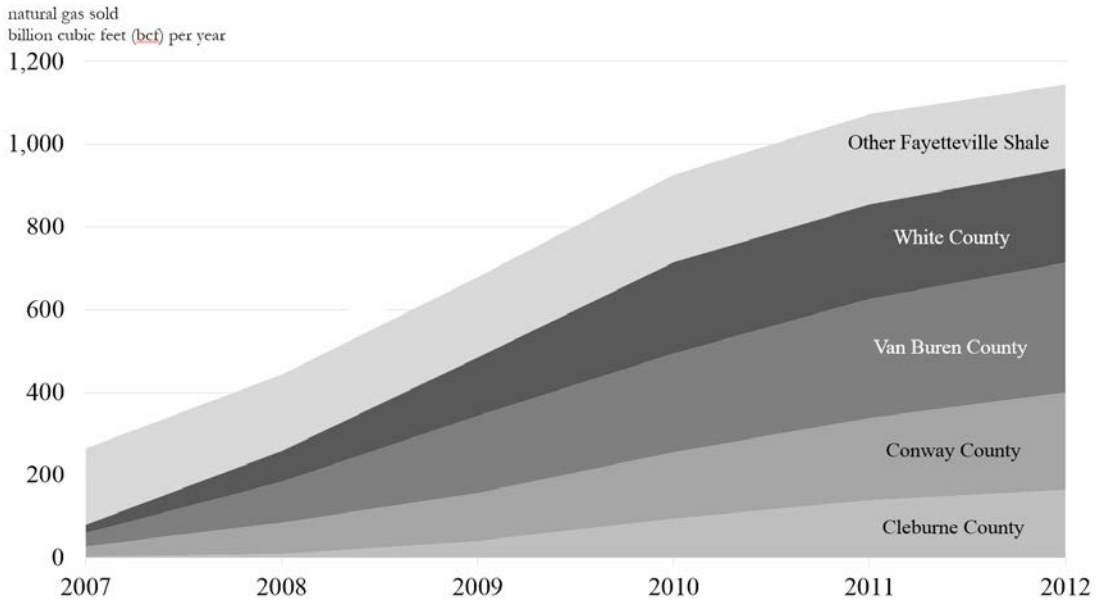
Table 20: Arkansas Municipality Summary

Major revenue source(s)	Lease revenue Sales taxes
Major cost(s)	None
Net fiscal impact	Small to large net positive

3.8.1 Fayetteville shale region, AR

We examined the four counties in Arkansas that have experienced the most significant Fayetteville shale development: Cleburne, Conway, Van Buren, and White counties, as well as neighboring Faulkner County, which has experienced less substantial development (see Figure 13). We also examined the cities of Clinton and Morrilton, both of which were affected by gas development in the region.

Figure 13. Natural gas sales from the Fayetteville Shale



Data source: Arkansas Oil and Gas Commission (2013).

3.8.1.1 County-level experience in Fayetteville shale region, AR

3.8.1.1.1 Cleburne, Conway, Faulkner, Van Buren, and White counties, AR

The five county governments we examined have experienced medium to large net financial benefits from Fayetteville shale development. The most substantial revenue source was from property taxes, as many oil and gas properties came onto county assessment rolls for the first time. Assessed mineral values in the five counties grew from $17.5 million in 2007 to $777 million in 2011. While property tax rates in these counties are low, ranging from 4.1 to 8.6 mills (0.41 to 0.86 percent), this increase in assessed value from mineral properties implies an increase in annual revenues for county governments ranging from a low of $300,000 per year in Faulkner County to a high of $1.7 million per year in Van Buren County.[120] For context, total revenues in 2011 in these five counties ranged from a low of $12.6 million to a high of $24.4 million.

Fayetteville shale development has also boosted sales tax revenues for these counties. As the peak of drilling activity roughly coincided with the financial crisis and recession of 2007-2009, local officials believe that natural gas development helped insulate their economies from the worst effects of the recession. Indeed, sales tax revenues increased in each of these counties from 2005 through 2010 by an average of 52 percent. For each county, sales tax revenues in 2012, several years after the peak of drilling activity, ranged from roughly 25 to 50 percent higher than in 2005, when Fayetteville

[120] Data source: Arkansas Assessment Coordination Division.

shale development began in earnest.[121] Local officials attribute most of this growth to Fayetteville shale activity.

RMAs with gas companies have provided an important in-kind revenue source for all five counties. Generally speaking, local operators agree to pay for materials to repair any roads they damage, while county crews provide labor to make the necessary repairs. These agreements are often informal and materials costs can be substantial. For example, Southwestern Energy — the most active company in the region in recent years — has provided an estimated $17 million in materials since 2007 to repair roads and manage dust in the counties where it operates.[122] All five counties cited these agreements as very important in limiting their costs.[123]

Severance tax allocations have also provided a new source of revenue for these counties, though they have not been as substantial as property or sales tax revenues.

Because of the RMAs described above, county governments experienced relatively small costs associated with Fayetteville shale development. While counties generally provided the labor necessary to make road repairs, they did not add substantial new staff, nor did they report that time spent repairing roads prevented them from accomplishing other priorities. Indeed, several county officials welcomed the new road repair projects and said a number of roads in affected areas were in better condition after oil- and gas-related repairs than they were prior to drilling. Still, most counties reported an increase in costs associated with Fayetteville shale development, and noted that some residents were unhappy with road conditions in areas where heavy truck traffic was ongoing and repairs had not yet occurred.

Expenditures for roads and bridges increased in each county. For example, road and bridge expenditures in Van Buren County roughly doubled from $1.5 million to $3 million per year from 2005 to 2010. However, local officials generally viewed these expenditures as opportunities to upgrade infrastructure rather than costs that they were saddled with due to increased heavy truck traffic.

The second common cost described by a variety of local officials related to workforce retention. All county officials we interviewed reported that at least some of their staff, especially in the road and bridge or sheriff's departments, left to work for natural gas operators. However, none had trouble filling the vacant positions and none increased compensation to retain workers. As such,

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121 Data source: Arkansas Division of Legislative Audit. Annual county financial audits. Available at http://arklegaudit.gov/#search.

122 Data source: Southwestern Energy, Conway, AR.

123 Based on interviews with Cleburne County Judge Jerry Holmes, 2/11/14; Conway County Judge Jimmy Hart, 2/3/14; Faulkner County Judge Allen Dodson, 2/3/14; Van Buren County Judge Roger Hooper, 2/3/14; and White County Judge Michael Lincoln, 2/6/14.

these counties experienced some increased training costs, but little in the way of large recurring costs.

3.8.1.2 Municipal-level experience in Fayetteville shale region, AR

3.8.1.2.1 Clinton and Morrilton, AR

The city governments of Clinton (pop. ~2,500) and Morrilton (pop. ~6,700) have also experienced net positive financial impacts due to Fayetteville shale activity. A major source of revenue has been leasing and royalty payments from natural gas development on city-owned land. In Clinton and Morrilton, leases have cumulatively generated some $1.2 million and $600,000 for city governments, respectively. For Clinton, where total government revenue was $2 million in 2005, this represents a substantial infusion of cash. In Morrilton, where annual revenues were $5 million in 2005, the revenue is less substantial.

Sales taxes surged during the peak drilling years in both cities though, again, the effects were more pronounced in the smaller city of Clinton. Sales tax revenue grew from $1 million in 2005 to $2 million in 2008, and fell back to $1.3 million in 2011 and 2012. In Morrilton, sales tax revenue grew from $2 million in 2005 to $2.75 million in 2008 and has hovered around $2.5 million in recent years.[124] Local officials in both cities attribute most of this increase to growth in economic activity associated with Fayetteville shale activity.

In Clinton, where a number of wells have been drilled within city limits, local officials entered into RMAs similar to those arranged by county governments. This agreement has substantially reduced the burden for repairing city-owned roads, which would have otherwise been substantial.[125]

Overall costs for both cities have been small, with workforce retention challenges appearing as the leading issue. In Morrilton, roughly 10 city employees left to work with natural gas operators during the peak years of drilling, although the city did not have to raise salaries to attract new employees and had little trouble filling the positions.[126] In Clinton, local officials reported that only a few employees left to work with natural gas operators or related contractors, and they had no trouble filling the positions, nor did they have to raise wages.

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[124] Data source: Arkansas Division of Legislative Audit. Annual city financial audits. Available at http://arklegaudit.gov/#search.

[125] Based on interview with Clinton mayor Roger Rorie, 2/5/14.

[126] Based on interview with Morrilton mayor Stewart Nelson, 2/5/14.

These cities experienced some population growth during the most active years of drilling, but the proximity of urban centers such as Little Rock and its northern suburbs meant that Clinton and Morrilton did not absorb the majority of this temporary population increase. While hotel rooms were booked solidly in the two cities, neither substantially expanded services or infrastructure.

4. Conclusion

After examining a wide variety of regions implementing a substantial range of policies and experiencing a wide range of effects, it appears that most local governments have experienced net financial benefits from the recent increase in oil and gas development. However, some local governments, notably in western North Dakota and municipalities in eastern Montana, have so far experienced net negative financial impacts due to new demands brought on by rapid population growth associated with oil and gas development. Additionally, some municipalities in rural Colorado and Wyoming that eventually experienced a net positive impact struggled to manage the fiscal effects of rapid population growth during the peak of drilling activity.

We offer below some hypotheses as to the key drivers of these net fiscal impacts:

A variety of revenue-raising mechanisms have the potential to generate financial benefits for local governments. Some local governments have experienced net financial benefits due primarily to allocations of severance tax revenue or impact fees (as in Pennsylvania), while others have experienced net benefits primarily due to property and sales tax revenues (as in Arkansas, Louisiana, Texas, and Wyoming). Other local governments have benefitted from a combination of these revenue sources (as in Colorado).

Collaboration with oil and gas operators can play a large role in mitigating potential costs for local governments. For example, the road maintenance agreements in place in Arkansas and Pennsylvania have allowed local governments to benefit from new revenues while limiting new costs to maintain and repair roads damaged by heavy truck traffic. In areas where such agreements are less prominent, such as Montana, North Dakota, and Texas, local governments that maintain many miles of road have in some cases struggled to keep up with new costs. It is unclear why this type of collaboration between local government and industry is more common in some regions. The relatively low severance tax rates in Arkansas and impact fee in Pennsylvania may be one factor, though we note that in Colorado, which employs a severance tax and property taxes on oil and gas properties, collaboration on road maintenance between local governments and operators was present in some regions.

The relative scale and speed of an oil and gas boom does not by itself appear to predict the net financial impacts to local governments, though a large-scale surge in activity accompanied by rapid population growth clearly creates more fiscal challenges than a smaller increase in oil and gas activity. Local governments in the Bakken and Eagle Ford regions are both currently experiencing rapid oil and gas development and population growth, though the net financial impacts have been different, with Bakken local governments experiencing net negative financial effects and Eagle Ford local governments experiencing net positive financial effects. In other regions experiencing relatively

large-scale and rapid growth in oil and gas activity (such as the Barnett, Fayetteville, Haynesville, and Marcellus regions), most evidence indicates net positive fiscal effects for local governments.

The phase of development of an oil and gas boom does appear to influence the fiscal effects that local governments experience, as major costs are more likely during the peak of drilling and hydraulic fracturing activity. Major new revenues are sometimes slow to catch up with increased demand for services associated with heavy truck traffic and population growth. Some local governments in very rural regions have struggled with fiscal issues during this phase, though the longer-term fiscal effects generally turned to a roughly neutral or a net positive effect as development slowed. However, a number of local governments we examined were experiencing or had experienced large fiscal benefits even at the peak of drilling and hydraulic fracturing activities.

We observed net financial benefits in regions that experienced a peak of drilling activity in 2007-2008 (e.g., the Barnett, Fayetteville, Green River, Haynesville, and Piceance regions), 2009-2010 (the Marcellus region), and regions experiencing a high volume of activity during our research (the Eagle Ford and Permian regions). Only in the Bakken region, where drilling and hydraulic fracturing activity was high during our research, did we observe consistently net negative financial impacts on local governments. Additionally, some rural municipalities in Colorado and Wyoming struggled to manage the financial impact during the peak of activity, and the lasting effects have ranged from roughly neutral to a small net positive.

The rurality of a given region appears to have played a role in the challenges faced by local governments in the North Dakota Bakken region, as well as for municipalities in sparsely populated parts of Colorado, Montana, and Wyoming. However, we observed net financial benefits for counties in rural Colorado and Wyoming that are allowed to levy property taxes on oil and gas production.

A combination of factors such as the scale and speed of development and the rurality of the region appear to have come together to create fiscal challenges for local governments in the Bakken. The region has experienced a very rapid increase in oil and gas development and population growth and is located in an extremely rural region. When growth eventually slows, the fiscal effects for local governments may become more positive, as we observed in parts of western Colorado and Wyoming. Continued research and observation of the Bakken region will be helpful in determining the extent to which each of these factors has contributed to the experience of local governments in that region.

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6. Appendix A

6.1 Interviews and other information

Table A1. Table of plays visited and other information

Play visited	Experts interviewed	Predominant Type	New wells in 2013	Population density (persons per sq. mile)
Fayetteville Shale (AR)	11	Dry gas	435	50
Green River Basin (WY)	7	Dry gas	466	4
Haynesville Shale (LA/TX)	6	Dry gas	529	157
Piceance Basin (CO)	10	Dry gas, NGLs	539	22
Marcellus Shale (PA)	29	Dry gas, NGLs	668	89
Barnett Shale (TX)	7	Dry gas	830	1,280
Niobrara Shale (CO)	8	Oil	1,123	66
Bakken Shale (ND/MT)	20	Oil	1,562	6
Permian Basin (TX)	7	Oil and gas	2,262	5
Eagle Ford Shale (TX)	11	Oil and gas	2,911	14

Data sources: DI Desktop for new wells in 2013, based on number of wells with first production between 1/1/2013 and 12/31/2013. U.S. Census Bureau for population density. Population densities are based on county populations and land areas in the counties where we interviewed local officials and/or other experts.

6.2 Identifying top oil- and gas-producing counties

To identify the parts of the country that have experienced the largest growth in oil and gas production in recent years, we gathered oil and gas production data at the county level from all major oil- and gas-producing states. We then narrowed this dataset to all counties from the top 10 oil- and/or gas-producing states that have experienced major new production from shale or other "tight" formations. Next, we sorted the data to identify counties that, for any year between 2007 and 2012, were among the top 5 percent in total oil or gas production. We also identified the counties that, for any year between 2007 and 2012, were among the top 5 percent in total oil or gas production per square mile of county land area.

The table below presents the 91 counties that we identified through this process, along with a note as to whether or not we interviewed experts in this county. We visited 28 of these counties and every state identified except Oklahoma, which we did not visit due to resource and time limitations.

Table A2. Table of top oil- and gas-producing counties between 2007 and 2012

State	County	Region	Visited?
CO	Weld	Niobrara	Yes
	La Plata	Other	No
	Montezuma	Other	No
	Garfield	Piceance	Yes
MT	Richland	Bakken	Yes
ND	Bowman	Bakken	No
	Divide	Bakken	No
	Dunn	Bakken	Yes
	McKenzie	Bakken	Yes
	Mountrail	Bakken	Yes
	Williams	Bakken	Yes
OK	Beckham	Oklahoma	No
	Carter	Oklahoma	No
	Coal	Oklahoma	No
	Hughes	Oklahoma	No
	Latimer	Oklahoma	No
	Pittsburg	Oklahoma	No
	Roger Mills	Oklahoma	No
	Stephens	Oklahoma	No
PA	Bradford	Marcellus	Yes
	Greene	Marcellus	Yes
	Lycoming	Marcellus	Yes
	Susquehanna	Marcellus	Yes
	Tioga	Marcellus	Yes
	Washington	Marcellus	Yes
	Wyoming	Marcellus	No
TX	Denton	Barnett	No
	Hood	Barnett	No
	Johnson	Barnett	Yes
	Montague	Barnett	No
	Parker	Barnett	Yes
	Tarrant	Barnett	Yes
	Atascosa	E Ford	No
	Caldwell	E Ford	No
	De Witt	E Ford	Yes
	Dimmit	E Ford	No
	Gonzales	E Ford	Yes
	Karnes	E Ford	Yes
	LaSalle	E Ford	Yes
	Live Oak	E Ford	No
	McMullen	E Ford	No
	Webb	E Ford	No
	Wise	E Ford	No
	Zapata	E Ford	No
	Harrison	Haynesville	No
	Nacogdoches	Haynesville	No
	Panola	Haynesville	Yes
	Rusk	Haynesville	No
	San Augustine	Haynesville	No
	Shelby	Haynesville	No
	Wood	Haynesville	No
	Andrews	Permian	Yes

	Cochran	Permian	No
	Crane	Permian	No
	Ector	Permian	Yes
	Gaines	Permian	Yes
	Glasscock	Permian	No
	Hockley	Permian	No
	Howard	Permian	No
	Irion	Permian	No
	Loving	Permian	No
	Martin	Permian	No
	Midland	Permian	Yes
	Pecos	Permian	No
	Reagan	Permian	Yes
	Scurry	Permian	No
	Terry	Permian	No
	Upton	Permian	No
	Ward	Permian	No
	Winkler	Permian	No
	Yoakum	Permian	No
	Cooke	Texas	No
	Freestone	Texas	No
	Gregg	Texas	No
	Hemphill	Texas	No
	Hidalgo	Texas	No
	Jefferson	Texas	No
	Leon	Texas	No
	Limestone	Texas	No
	Madison	Texas	No
	Ochiltree	Texas	No
	Refugio	Texas	No
	Robertson	Texas	No
	Starr	Texas	No
	Wheeler	Texas	No
WY	Sublette	Green River	Yes
	Sweetwater	Green River	Yes
	Campbell	Niobrara	No
	Fremont	Niobrara	No
	Johnson	Other	No
	Park	Other	No

6.3 Identifying counties with the largest relative increase in oil and gas activity

The following two series of tables show two different ways of evaluating the scale of oil and gas activity in a given county. First, table A3 shows the number of oil or gas wells completed for every 100 persons living within each county for the years 2002 through 2012. This metric helps understand the scale of oil and gas activity relative to the rurality of a region. The counties with the highest numbers in this category include counties in rural Colorado, North Dakota, and Wyoming, where drilling activity has been extensive and the local population is small. The counties with the lower numbers in this category include counties where little or no drilling occurred in certain years (i.e., Arkansas counties in 2005), or in counties with large populations (i.e., Texas' Tarrant County).

Second, table A4 shows the number of oil or gas wells completed for every 100 square miles of county area for the years 2002 through 2012. This metric helps understand the density of oil and gas activity in a given region. The counties with the highest numbers in this category include Weld County, Colorado, and Tarrant and Johnson counties in Texas, where thousands of oil and gas wells have been drilled in certain years. The counties with the lower numbers in this category include counties where little or no drilling occurred in certain years (i.e., Arkansas counties in the early 2000s), or in counties that cover large areas (i.e., counties in Montana or Wyoming).

Table A3. Number of new oil and gas well completions for every 100 persons

AR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cleburne County	0.00	0.00	0.00	0.00	0.02	0.06	0.15	0.45	0.70	0.57	0.64
Conway County	0.00	0.00	0.02	0.12	0.19	0.50	0.69	0.68	0.81	0.84	0.65
Van Buren County	0.00	0.00	0.02	0.08	0.23	0.89	1.65	1.39	1.43	1.20	1.44
White County	0.00	0.00	0.00	0.00	0.02	0.23	0.26	0.35	0.27	0.25	0.18
CO	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Garfield County	0.59	0.59	0.86	1.59	2.19	2.73	3.73	1.75	1.93	1.65	1.28
Mesa County	0.01	0.00	0.03	0.13	0.20	0.29	0.26	0.06	0.05	0.02	0.01
Rio Blanco County	1.24	1.59	1.66	2.01	3.35	3.16	4.76	3.73	5.18	3.64	1.84
Weld County	0.39	0.37	0.39	0.38	0.47	0.55	0.64	0.44	0.76	0.87	0.49
LA	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bossier Parish	0.07	0.10	0.16	0.18	0.21	0.27	0.21	0.12	0.04	0.05	0.03
Caddo Parish	0.02	0.02	0.03	0.08	0.09	0.08	0.10	0.06	0.06	0.07	0.07
De Soto Parish	0.35	0.38	0.58	0.58	0.64	0.97	1.08	0.95	1.52	1.96	0.69
MT	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Richland County	0.26	0.54	1.27	1.64	1.80	1.47	0.82	0.14	0.44	0.29	0.96
Roosevelt County	0.06	0.07	0.06	0.06	0.08	0.12	0.06	0.03	0.09	0.27	0.39
ND	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dunn County	0.03	0.06	0.00	0.15	0.30	1.55	3.71	3.18	3.75	5.55	7.18
McKenzie County	0.18	0.35	0.73	0.78	1.15	0.90	1.44	1.31	2.36	4.49	6.13
Williams County	0.05	0.06	0.06	0.08	0.13	0.31	0.20	0.16	0.55	1.16	1.57
PA	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bradford County	0.00	0.01	0.00	0.01	0.00	0.01	0.04	0.12	0.46	0.49	0.19
Greene County	0.11	0.06	0.12	0.11	0.27	0.80	0.64	0.25	0.22	0.11	0.11
Lycoming County	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.06	0.15	0.13
Susquehanna County	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.18	0.23	0.38	0.28
Tioga County	0.01	0.01	0.00	0.00	0.01	0.01	0.05	0.12	0.56	0.47	0.17
Washington County	0.00	0.00	0.01	0.02	0.05	0.11	0.11	0.06	0.07	0.05	0.01
TX	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Andrews County	0.66	0.69	0.70	0.65	0.63	0.35	0.72	0.64	1.09	1.07	0.84
DeWitt County	0.06	0.10	0.18	0.33	0.24	0.31	0.39	0.17	0.31	0.90	1.12
Gaines County	0.29	0.55	0.46	0.57	0.52	0.41	0.38	0.20	0.40	0.36	0.20
Gonzales County	0.00	0.00	0.00	0.01	0.02	0.00	0.03	0.02	0.18	0.33	0.59
Johnson County	0.00	0.02	0.06	0.17	0.32	0.50	0.60	0.29	0.30	0.20	0.11
La Salle County	0.57	0.84	0.98	1.02	1.10	1.01	1.44	0.69	1.38	1.95	5.02
Midland County	0.06	0.08	0.09	0.06	0.04	0.03	0.04	0.02	0.05	0.06	0.03
Tarrant County	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.03	0.03	0.03	0.02
WY	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sublette County	3.65	3.34	4.67	4.60	6.59	5.41	6.62	5.39	4.40	4.52	2.36
Sweetwater County	0.56	0.71	0.64	0.74	0.77	0.66	0.76	0.34	0.69	0.50	0.62

Data sources: DI Desktop for number of well completions per year. U.S. Census Bureau for annual estimated population. Data for Arkansas shows number of wells entering into production per year, as completion data were not available.

Table A4. Number of oil and gas well completions for every 100 square miles

AR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cleburne County	0.0	0.0	0.0	0.2	0.7	2.5	6.7	20.6	32.7	26.5	30.0
Conway County	0.0	0.0	0.9	4.5	7.1	18.7	25.9	25.5	31.1	32.1	25.2
Van Buren County	0.0	0.0	0.4	1.8	5.2	20.6	38.4	32.2	34.9	29.1	34.7
White County	0.0	0.0	0.0	0.0	1.4	16.2	18.9	25.9	20.4	19.2	14.0
CO	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Garfield County	9.3	9.5	14.0	26.6	38.0	49.1	69.4	33.4	36.7	31.3	24.7
Mesa County	0.5	0.2	1.3	5.1	7.9	12.2	11.0	2.8	2.3	1.1	0.4
Rio Blanco County	2.3	2.9	3.0	3.6	6.3	6.1	9.3	7.6	10.7	7.7	3.9
Weld County	19.7	19.4	21.3	21.3	27.5	33.5	40.0	28.2	48.7	56.6	32.1
LA	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bossier Parish	8.9	12.6	19.4	23.1	26.9	35.2	27.4	15.6	5.1	6.7	4.4
Caddo Parish	6.7	6.8	9.0	22.5	26.4	22.0	28.2	17.4	18.4	20.6	20.7
De Soto Parish	10.3	11.1	17.0	17.1	19.0	29.1	32.7	28.6	46.5	60.1	21.4
MT	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Richland County	1.2	2.4	5.5	7.1	7.8	6.4	3.6	0.6	2.1	1.4	5.0
Roosevelt County	0.3	0.3	0.3	0.3	0.3	0.5	0.3	0.1	0.4	1.2	1.8
ND	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Dunn County	0.0	0.1	0.0	0.2	0.5	2.5	6.1	5.3	6.6	10.4	14.2
McKenzie County	0.4	0.7	1.4	1.6	2.3	1.8	2.9	2.8	5.5	11.4	17.8
Williams County	0.5	0.6	0.5	0.8	1.3	2.9	1.9	1.6	6.0	13.6	20.2
PA	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bradford County	0.2	0.5	0.2	0.4	0.3	0.8	2.1	6.5	24.9	27.1	10.5
Greene County	7.5	4.0	8.0	7.5	18.4	54.7	43.9	17.2	14.6	7.3	7.1
Lycoming County	0.0	0.0	0.0	0.0	0.0	0.5	0.9	1.5	5.6	14.3	12.0
Susquehanna Co.	0.0	0.0	0.0	0.0	0.1	0.2	3.2	8.7	12.3	20.0	14.6
Tioga County	0.3	0.5	0.1	0.1	0.3	0.3	1.9	4.3	20.7	17.6	6.5
Washington County	0.6	1.1	2.0	4.4	11.2	26.7	27.1	14.8	17.3	11.9	3.6
TX	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Andrews County	5.7	5.9	6.0	5.5	5.4	3.1	6.6	6.0	10.8	11.0	9.0
DeWitt County	1.3	2.1	4.0	7.4	5.3	6.7	8.4	3.6	6.8	20.1	25.2
Gaines County	2.7	5.2	4.4	5.5	5.0	4.1	3.9	2.0	4.7	4.3	2.5
Gonzales County	0.0	0.0	0.0	0.2	0.3	0.0	0.6	0.3	3.4	6.2	11.2
Johnson County	0.6	3.3	11.7	34.4	65.3	103.4	127.1	62.8	63.5	41.1	23.5
La Salle County	2.2	3.3	3.9	4.1	4.4	4.0	5.7	2.7	6.4	9.1	24.0
Midland County	7.9	10.9	12.6	8.2	5.6	4.0	5.9	3.4	7.6	8.7	5.2
Tarrant County	13.9	19.7	25.9	27.2	33.0	64.8	77.8	57.3	71.3	70.2	48.1
WY	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Sublette County	4.6	4.3	6.3	6.5	9.7	8.7	11.3	9.7	9.2	9.4	5.0
Sweetwater County	2.0	2.5	2.3	2.6	2.8	2.5	2.9	1.4	2.9	2.1	2.7

Data sources: DI Desktop for number of well completions per year. U.S. Census Bureau for land area. Data for Arkansas shows number of wells entering into production per year, as completion data were not available.