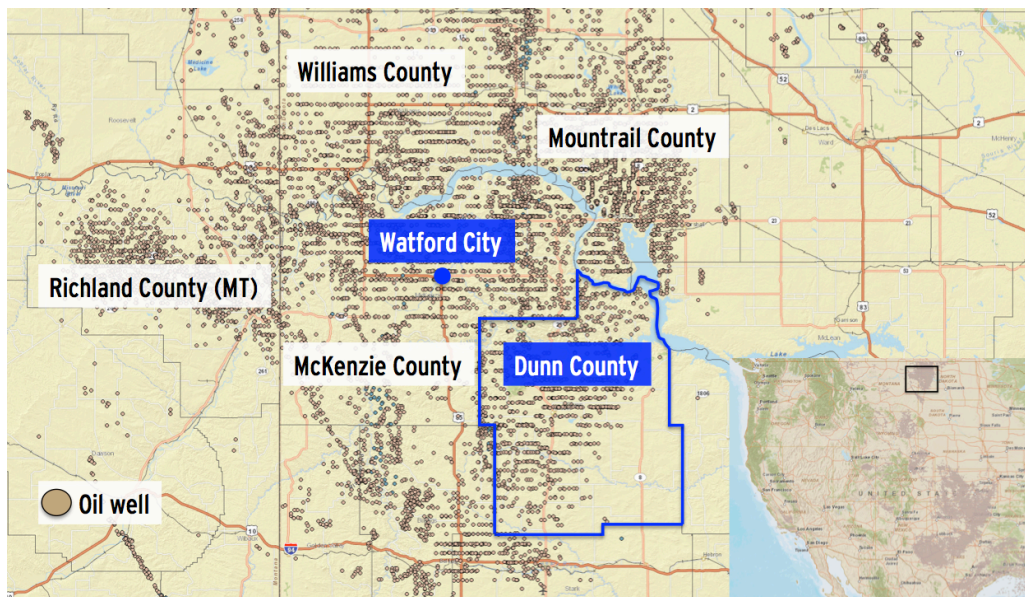


May 2016

Dunn County and Watford City, North Dakota: A case study of the fiscal effects of Bakken shale development



Daniel Raimi

Richard G. Newell



Duke University Energy Initiative
Box 90467
Durham, NC 27708
www.energy.duke.edu

About the authors

Daniel Raimi is an Associate in Research with the Duke University Energy Initiative (daniel.raimi@duke.edu). He is also a Lecturer at the University of Michigan's Ford School of Public Policy and a Research Specialist at the University of Michigan Energy Institute. Richard G. Newell is the Gendell Professor of Energy and Environmental Economics at Duke University's Nicholas School of the Environment and Director of Duke's Energy Data Analytics lab (richard.newell@duke.edu). He is also a Research Associate at the National Bureau of Economic Research, Cambridge, MA.

About this report

This report is one in a series to be produced by the authors 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. Other reports focus on the net fiscal impacts of increased oil and gas production for local governments, and the collection and allocation of revenue from oil and gas production for local governments. 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>.

We thank the local officials and experts who provided their time and expertise through on-site interviews and communication over phone and e-mail. In particular, we thank Daryl Dukart of Dunn County and the North Dakota Association of Oil and Gas Producing Counties, Brent Sanford of Watford City, Shirley Brentrup of Vision West North Dakota, and Ben Gibson and Margaret Lillard at the Duke University Energy Initiative for reviewing and commenting on earlier drafts of this paper.

Contents

| | |
|---|-----------|
| Abstract..... | 1 |
| 1. Report summary | 2 |
| 2. Background | 3 |
| 2.1 Related research | 5 |
| 3. Background on the Bakken region..... | 5 |
| 3.1 Major economic sectors | 5 |
| 3.2 The boom | 6 |
| 3.3 State policy changes | 8 |
| 3.4 The slowdown..... | 8 |
| 4. Dunn County and Watford City..... | 9 |
| 4.1 Background | 10 |
| 4.2 Dunn County, ND | 11 |
| 4.3 Watford City, ND..... | 15 |
| 5. Conclusion | 18 |
| 6. Appendix A | 19 |
| 6.1 Oil and gas revenue allocation to local governments | 19 |
| 7. References..... | 21 |

This page is intentionally blank.

Dunn County and Watford City, N. Dakota: A case study of the fiscal effects of Bakken shale development

Daniel Raimi and Richard G. Newell

Abstract

The Bakken region of North Dakota and Montana has experienced perhaps the greatest effects of increased oil and gas development in the United States, with major implications for local governments. Though development of the Bakken began in the early 2000s, large-scale drilling and population growth dramatically affected the region from roughly 2008 through today. This case study examines the local government fiscal benefits and challenges experienced by Dunn County and Watford City, which lie near the heart of the producing region. For both local governments, the initial growth phase presented major fiscal challenges due to rapidly expanding service demands and insufficient revenue. In the following years, these challenges eased as demand for services slowed due to declining industry activity and state tax policies redirected more funds to localities. Looking forward, both local governments describe their fiscal health as stronger because of the Bakken boom, though higher debt loads and an economy heavily dependent on the volatile oil and gas industry each pose challenges for future fiscal stability.

Key Words: Shale gas, tight oil, severance tax, property tax, resource taxation, local public finance, revenue sharing, hydraulic fracturing

*Daniel Raimi is an Associate in Research with the Duke University Energy Initiative (daniel.raimi@duke.edu). He is also a Lecturer at the University of Michigan Ford School of Public Policy and a Research Specialist at the University of Michigan Energy Institute. Richard G. Newell is the Gendell Professor of Energy and Environmental Economics at Duke University's Nicholas School of the Environment and Director of Duke's Energy Data Analytics Lab (richard.newell@duke.edu). He is also a Research Associate at the National Bureau of Economic Research, Cambridge, MA. This report is part of a series produced by the authors on shale public finance, supported by the Alfred P. Sloan Foundation. For more information, to view previous publications, view interactive maps showing some of our key findings, or to be notified when new publications are released, visit <http://energy.duke.edu/shalepublicfinance>.

1. Report summary

Increased oil and natural gas production from shale formations has had major effects on local governments in a variety of regions across the United States, and the fiscal impacts for governments in North Dakota and Montana's Bakken shale region have been particularly acute. Although Bakken development began in the early 2000s in eastern Montana, the bulk of development has occurred since roughly 2008 in western North Dakota.

These major fiscal impacts in the Bakken region have been driven by two key factors. First, the scale of industry activity was enormous, with production rivaling that of any other region of the United States. As a result, population in some cities and counties doubled, tripled, or quadrupled, leading to rapid growth in government revenues and demand for services. Second, the region is substantially more rural than any other U.S. shale region and, despite a history of oil production over several decades, western North Dakota did not have a pre-existing workforce or other infrastructure capable of supporting large-scale industry investment.

During our first visit in fall 2013, public infrastructure needs were acute and revenues had generally been insufficient to allow local governments to meet growing demand for services such as repairing roads; expanding water and wastewater infrastructure; and ramping up emergency, fire, police, and other services. Each local government we examined stated in structured interviews that demand for services was substantially outstripping revenues, and financial data supported those assertions. When we returned roughly two years later, a second round of structured interviews and a review of the most recent financial data indicated a shift in fiscal health: While a number of long-term challenges remained, many of the most immediate needs had eased.

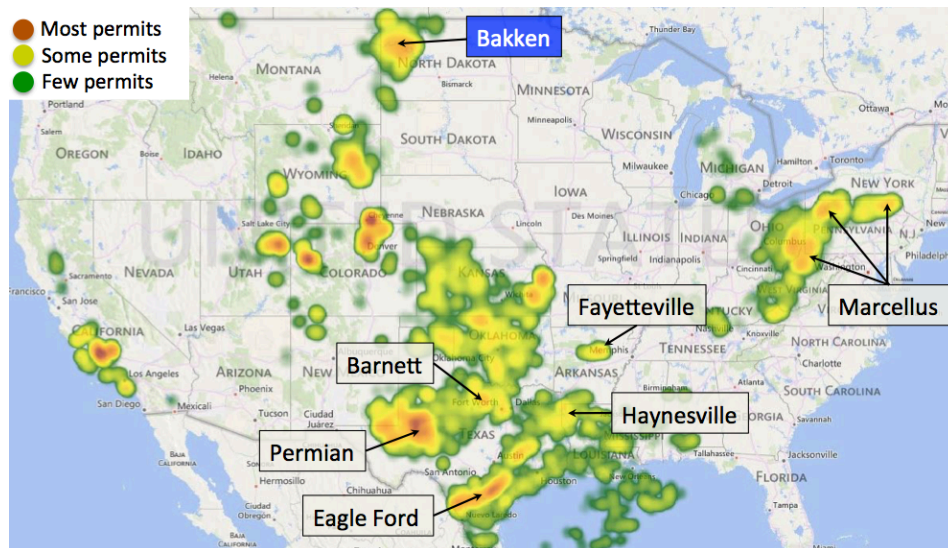
This change was driven by two leading factors. First, low oil prices in late 2014 and 2015 slowed investment substantially, halting population growth and lessening demand for a wide range of local government services. Second, the North Dakota state legislature in 2015 passed a series of bills that provided additional revenue to local governments, allowing them to better meet the needs of the larger economy and population.

In a change from our previous findings, most local governments reported that their fiscal health was stronger overall because of Bakken shale development, and that revenues had largely "caught up" with demand for services. However, there is also cause for concern over future fiscal stability. First, Watford City and other municipalities in the region have taken on large new debt obligations, with government revenues tied closely to economic activity driven by volatile oil prices. Second, all local governments in the region have become heavily dependent on oil-driven revenues and, while local leaders are currently working to mitigate the risks of future fiscal volatility, the rural nature of the region may make it difficult to diversify economically.

2. Background

Beginning around 2005, the Barnett shale in north Texas became the first major shale formation in the United States to produce natural gas at large scale. In the following years, shale gas development spread to other formations including the Haynesville in Texas and Louisiana, the Fayetteville in Arkansas, and the Marcellus in Pennsylvania and West Virginia. Beginning around 2008, and accelerating after 2010, companies began producing large quantities of oil from shale formations in west Texas' Permian basin region, the Eagle Ford shale in south Texas, and the Bakken in Montana and North Dakota (Figure 2.1).

Figure 2.1 Heat map of oil and gas drilling permit activity



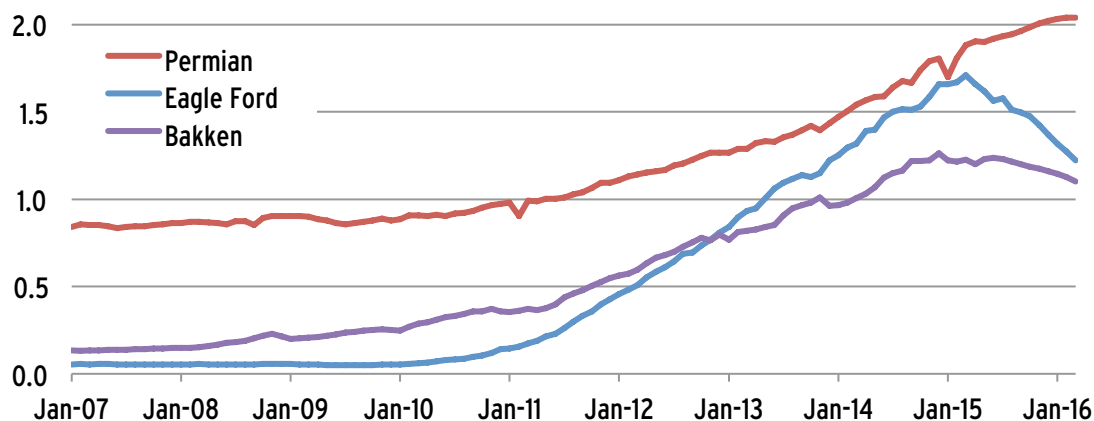
Map source: DI Desktop. Annotations by the authors. Heat map based on number of oil and gas drilling permits issued in the 90 days leading up to 5/1/2015.

As a result, United States natural gas production grew from 19 trillion cubic feet (Tcf) in 2005 to more than 27 Tcf in 2014, and domestic crude oil production grew from five million barrels per day (mb/d) in 2008 to 8.7 mb/d in 2014. This surge brought with it major new investment and population growth in producing regions, with substantial fiscal effects for local governments.

Between 2013 and 2015, we examined local government fiscal issues associated with oil and gas production in every major producing region of the United States. Of the 16 states and two-dozen oil and gas plays we examined, none experienced a more substantial impact than the Bakken region of western North Dakota and eastern Montana. For this reason, the local government fiscal issues we describe in this report are not indicative of the experience for most other parts of the United States where substantial oil and gas production occurs. However, the scale of the boom does offer an example of the opportunities and challenges for local governments associated with large-scale natural resource development, and insight into relevant policy approaches to managing the inevitable impacts of such activity.

Two other major plays, the Permian basin in west Texas/eastern New Mexico and the Eagle Ford shale in south Texas, have experienced similar growth in oil production over roughly the past five years (Figure 2.2). This growth in production has been accompanied by substantial growth in government revenue and demand for services for all three regions, as we describe in a previous report (Newell & Raimi 2015b).

Figure 2.2 Oil production in select regions (mb/d)



Note: Regional definitions based on U.S. EIA definitions of producing regions as defined in their monthly Drilling Productivity Reports (see Appendix A, Table 6.1).

The Bakken region differs from the Permian and Eagle Ford regions in one key dimension: its remoteness. While all three are relatively sparsely populated, the Bakken region is far more rural, with just 5.6 residents per square mile compared with 20 and 40.7 residents in the Permian and Eagle Ford regions, respectively. According to the U.S. Department of Agriculture's rural-urban continuum codes, where the number nine designates the most rural regions of the United States, Bakken counties average a score of 8.2, compared with respective scores of 6.4 and 5.2 for Permian and Eagle Ford counties (Table 2.1).

Table 2.1 Population density and rurality in select regions

| Region | Residents per square mile (2010) | Rural-urban continuum code (2013, 9=most rural, 1=most urban) |
|------------|----------------------------------|---|
| Bakken | 5.6 | 8.2 |
| Permian | 20.0 | 6.4 |
| Eagle Ford | 40.7 | 5.2 |

Note: Regional definitions based on U.S. EIA definitions of producing regions as defined in their monthly Drilling Productivity Reports (see Table 6.1). Population density estimates from the U.S. Census Bureau. Rural-urban continuum codes from the U.S. Department of Agriculture (U.S. Department of Agriculture 2013).

The high rural-urban continuum score for the Bakken accounts for not only its low population density, but also for the fact that there is no large city in the area to absorb rapid

population growth. The largest cities in western North Dakota are Dickinson and Williston, with respective 2005 populations of roughly 16,000 and 12,000. In contrast, most of the Eagle Ford region can be reached from San Antonio (pop. ~1.4 million) within one hour, while the Permian basin centers around the “petroplex” of Midland (pop. ~124,000) and Odessa (pop. ~111,000). These cities, with their relatively ample supply of housing stock (temporary and permanent) and municipal infrastructure, can much more easily absorb an influx of thousands of temporary workers and new residents.

2.1 Related research

Academic and independent researchers have assessed a variety of economic and fiscal issues associated with shale development, including economic impacts and potential future economic challenges for shale regions (Macke & Gardner 2012; Bangsund & Hodur 2013b, a; Allcott & Keniston 2014; Brown 2014; Haggerty & McBride 2014; Weber 2014; Christopherson 2015), state-level oil and gas tax policy (Headwaters Economics 2013, 2014; Newell & Raimi 2015a; Weber *et al.* 2015), demographic and socioeconomic analyses (Lycoming County 2012; Hodur *et al.* 2013; Gopalakrishnan & Klaiber 2014; Jacquet & Kay 2014; Muehlenbachs *et al.* 2014; Weber *et al.* 2014), infrastructure needs (Upper Great Plains Transportation Institute 2012; Vision West ND 2012; Abramzon *et al.* 2014), and other issues specific to local governments (Anderson & Theodori 2009; Christopherson & Rightor 2012; Headwaters Economics 2014; Newell & Raimi 2015b).

A smaller number of reports have examined specific localities (Costanzo & Kelsey 2012; Haggerty & McBride 2014; Jacquet 2014), but generally do not focus on local government fiscal issues in the relevant regions. Another strain of relevant research examines local public finances, seeking to identify quantitative measures that can help officials and analysts better assess the fiscal health of local government entities (Peterson 1977; State of Washington 2010; DiNapoli 2014; Marlowe 2014; McFarland & Pagano 2014; Marlowe 2015), though this work does not focus on issues related to natural resource development.

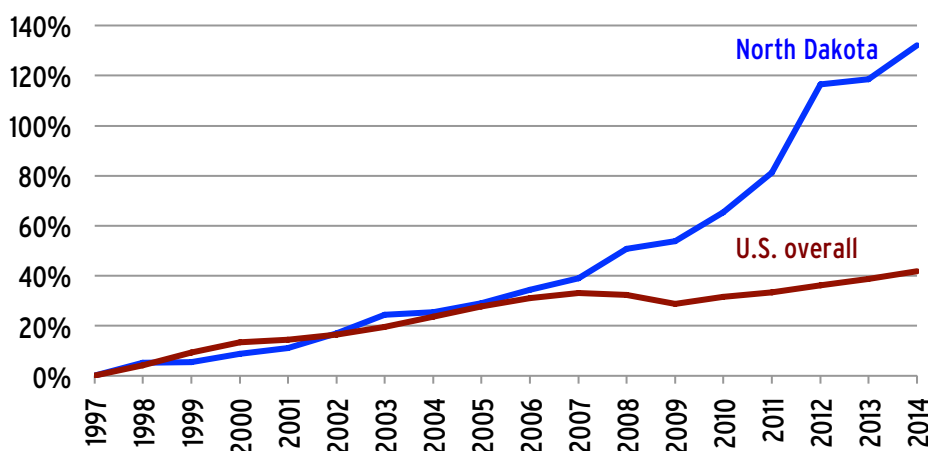
3. Background on the Bakken region

3.1 Major economic sectors

North Dakota’s largest economic sector prior to the Bakken boom was the public sector, followed by real estate, manufacturing, health care, and a range of other industries. Generally speaking, the state’s demographic health was stable but not growing. After rapid population growth in the early part of the 20th century, the population reached a peak of roughly 681,000 in 1930. From 1990 through 2000, the population remained stable at roughly 640,000 residents, even while nationwide population grew by more than 13 percent.

Economically, the decade 1997-2007 saw North Dakota growing at a similar pace to the United States average until Bakken development began in earnest. Since 1997, the US economy has grown by roughly 40 percent, whereas North Dakota's has grown by more than 120 percent in real terms, faster than any other state (Figure 3.1). North Dakota continued growing through the 2008-2009 financial crisis and recession, a factor contributing to the large influx of economic migrants from other parts of the United States.

Figure 3.1 Real GDP growth in North Dakota and the United States, 1997=0



Data source: U.S. Bureau of Economic Analysis. Note: Base year of 1997 is used because previous years employ a different methodology to calculate GDP. Earlier data are not directly comparable with post-1997 data.

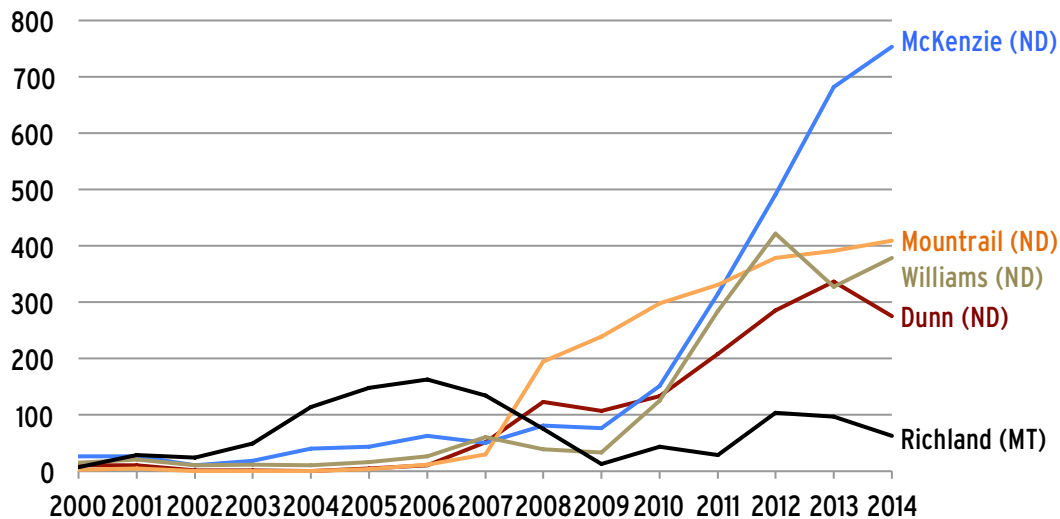
North Dakota's rapid economic growth has been led by oil and gas development. In 2005, mining, which includes oil and gas activities, accounted for less than 2 percent of the state's gross domestic product (GDP). By the first quarter of 2015, mining would account for 15 percent of GDP, becoming the largest sector of the economy. Bakken development drove the state economy to roughly double in real terms, from \$26.5 billion in the first quarter of 2005 to \$49.5 billion in the same period of 2015 (U.S. Bureau of Economic Analysis 2015). This growth is all the more dramatic when placed in geographic context: Bakken shale development was occurring only in the western part of the state, concentrated in Dunn, McKenzie, Mountrail, and Williams counties, which accounted for 87 percent of statewide oil production in 2014 (North Dakota Industrial Commission 2014).

3.2 The boom

Although the most substantial population growth and fiscal impacts for local governments occurred in western North Dakota, horizontal drilling and hydraulic fracturing were first applied at large scale to the Bakken on the Montana side of the border. In particular, Richland County,

Montana saw hundreds of well completions in an area known as the Elm Coulee field during the early 2000s. Production in eastern Montana grew substantially during this time, but slowed as producers moved east toward North Dakota over the next 10 years (Figure 3.2).

Figure 3.2 Oil and gas well completions in leading Bakken counties



Data source: DI Desktop

The year 2008 was pivotal for Bakken development in North Dakota, as drilling activity in Dunn and Mountrail counties surpassed the levels in Richland County, MT. Although oil prices fell more than 75 percent in 2008 due to the Great Recession, drilling activity remained robust, even growing slightly from 482 well completions statewide in 2008 to 489 in 2009. As oil prices recovered and stabilized over roughly the next five years, drilling activity soared, and completions grew from roughly 800 statewide in 2010 to more than 2,000 in 2013 and 2014.

With this new economic activity came rapid population growth, which in turn generated new demand for services as well as state and local government revenues. As we documented in our 2014 report (Newell & Raimi 2015b), populations in cities such as Dickinson and Williston grew faster than the local housing stock could accommodate, and governments struggled to hire staff to keep up with demand for all types of services. County governments also expanded their staffs rapidly in the face of widespread damage to local roads and rapid growth in demand for social services.

By late 2013, local governments across the region were struggling to manage this growth, and reported that, while revenues had grown rapidly, they generally had not kept pace with demand for services. Cities such as Dickinson and Williston borrowed tens of millions of dollars for new infrastructure projects, while county officials reported that they lacked the funds, equipment, and people to make the hundreds of millions of dollars worth of needed road upgrades.

3.3 State policy changes

During this period, state government revenues were soaring. From FY 2004 to FY 2014, total state tax collections grew from roughly \$1 billion to roughly \$6 billion. In FY 2013 and FY 2014, North Dakota collected more tax revenue per capita than any other state. This growth was driven primarily by the state's two taxes on oil and gas production: the Oil Extraction Tax and the Gross Production Tax. These two sources together grew from generating \$73 million in FY 2004 to more than \$3.2 *billion* in 2014 (North Dakota State Tax Commissioner 2014).

Observing this growth, local government officials from the Bakken region lobbied state legislators to send additional revenues to the regions producing the bulk of this new wealth. Regional groups including the North Dakota Association of Oil and Gas Producing Counties worked with the state legislature to pass several key pieces of legislation to address the fiscal challenges in the Bakken region.

In early 2015, four bills became law, each addressing different aspects of the fiscal challenge. The first bill (Senate Bill 2103) issued one-time “surge” funding of \$1.1 billion to address local and state infrastructure needs. Two bills (House Bill 1176 and House Bill 1377) adjusted the state's revenue allocation formulas to direct a larger proportion of Gross Production Tax revenues to local governments. The fourth (House Bill 1476) removed a clause that would have reduced tax rates when the oil price fell below a certain threshold, helping to stabilize revenues in a low oil price environment.

Together, these policy changes assured an increased share of oil and gas revenue for local governments in the Bakken region. Local officials expected that these new revenues would be necessary to manage continued growth in demand for services, as stable oil prices through 2013 and most of 2014 led many to believe that drilling activity would continue to grow.

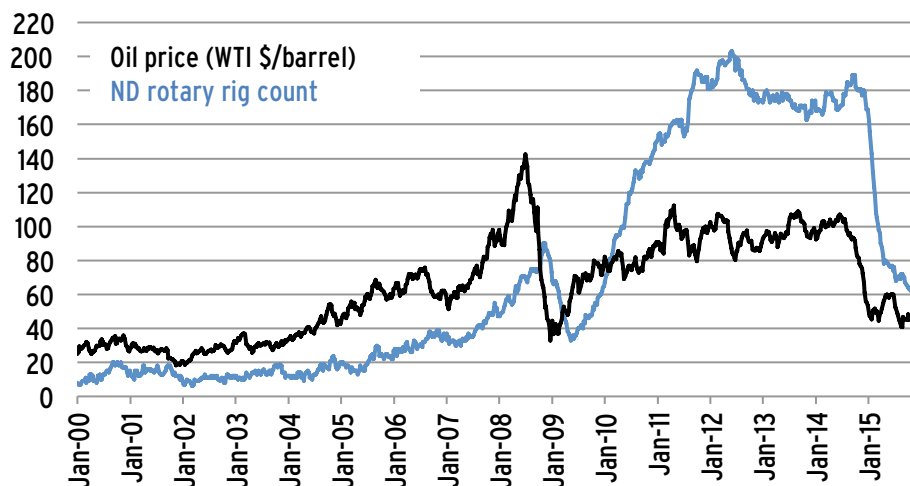
For details of how these legislative changes changed revenue allocation for local governments, see Appendix A, Section 6.1.

3.4 The slowdown

As state policymakers were making changes to address rapid population growth and strained local services, however, the conditions on the ground were changing again. Global oil prices fell by more than 50 percent in late 2014 and stayed low through the end of 2015 due to a variety of factors including increased production in the United States, slower economic growth in Asia, and a decision by members of the Organization of Petroleum Exporting Countries (OPEC) not to restrain production. As a result of this drop in prices, drilling activity in the Bakken (and in most other domestic shale plays) declined dramatically. The number of drilling rigs operating in North Dakota

fell from roughly 180 in December 2014 to just 60 a year later (Figure 3.3), with similar cutbacks in other major shale plays.

Figure 3.3 Oil prices and drilling rigs operating in North Dakota



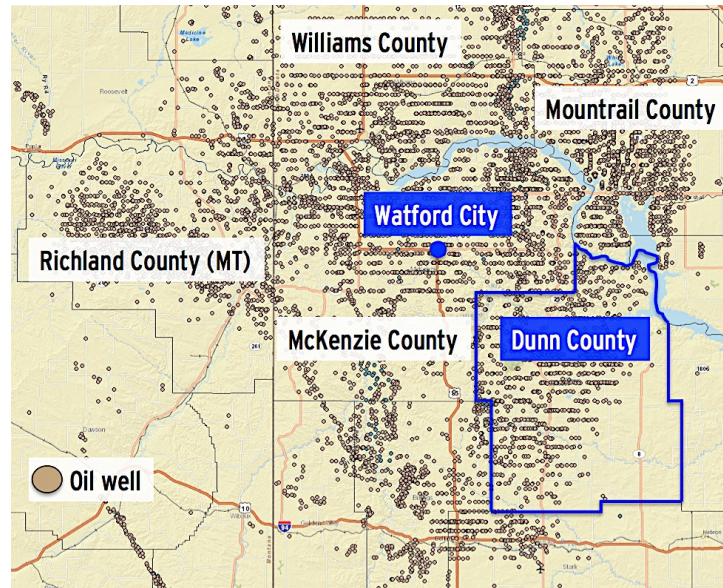
Data sources: BakerHughes for rig count, U.S. EIA for West Texas Intermediate spot price (nominal dollars)

In turn, oil production from the Bakken began to slow in 2015, and by the end of the year had decreased for the first time in over a decade. After a high of 1.26 mb/d in December 2014, oil production was 1.11 mb/d in December 2015, a decline of roughly 12 percent (U.S. Energy Information Administration 2015).

With this background in place, we turn now to the fiscal effects of Bakken shale development for two local governments in western North Dakota: Dunn County and Watford City.

4. Dunn County and Watford City

While many local governments in the Bakken region have been heavily affected by oil development, we focus here on a single county and a single city. We choose these localities for several reasons. First, they are situated in some of the most productive regions of the Bakken region. Second, the fiscal issues they have experienced reflect the experiences of other cities and counties in the region. Third, while we examined local governments across the region, we were able to spend more time with local government officials in Dunn County and Watford City than in most other jurisdictions. Through interviews and research in county and city archives, we accessed more detailed information (including financial and government operational data) for these two local governments than for others in the region.

Figure 4.1 Map of key Bakken counties

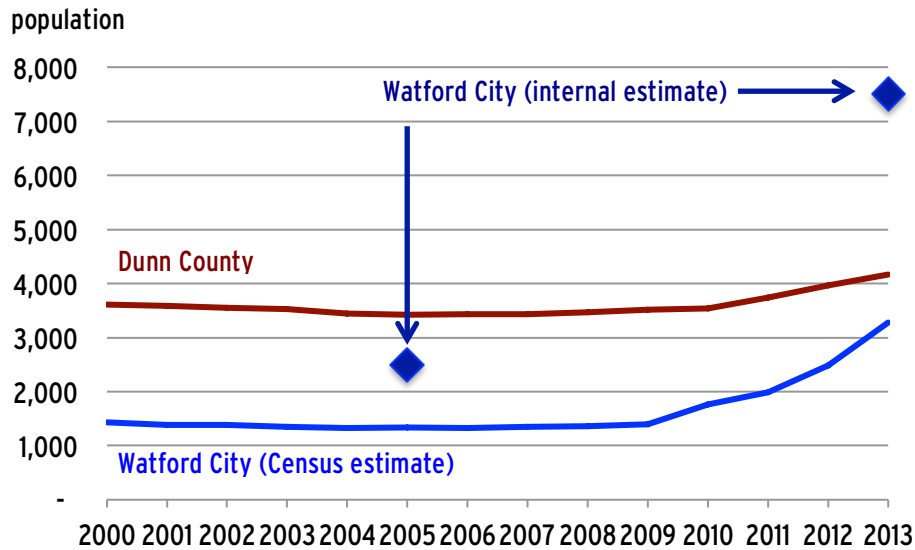
Map source: U.S. EIA energy mapping system. Annotations by the authors.

4.1 Background

Dunn County sits at the southeastern edge of the Bakken producing region. It is less densely populated than the Bakken region as a whole, with just 1.8 residents per square mile compared with the regional average of 5.6. Killdeer, the largest city, is home to just 751, and Manning, the county seat, is unincorporated and home to just 74 people. Dunn County covers roughly 2,000 square miles (nearly as large as the state of Delaware), and although its population has grown since the beginning of Bakken development, it is home to just 4,100 residents.

Watford City, the seat of neighboring McKenzie County, lies at the heart of the producing region and has experienced rapid population growth. A city of less than 1,500 before Bakken development began in earnest, its population has more than doubled according to Census estimates and more than tripled according to internal city estimates (which are based on the number of sewer and water connections provided by the city).

Figure 4.2 Population growth in Dunn County and Watford City



Data sources: U.S. Census Bureau. Watford City mayor based on number of water and wastewater connections.

4.2 Dunn County, ND

Because Dunn County is not home to any large cities, local fiscal impacts have been felt primarily at the county government level. Demand for services has been driven by two major factors. First, nearly 1,500 wells were completed in the county from 2008 through 2014, resulting in a major influx of industry activity. Second, vehicles and workers associated with Bakken development often commute through Dunn County, traveling from the city of Dickinson (just south of the county border) to the even more heavily drilled counties of McKenzie and Mountrail.

4.2.1 Fiscal challenges in 2013

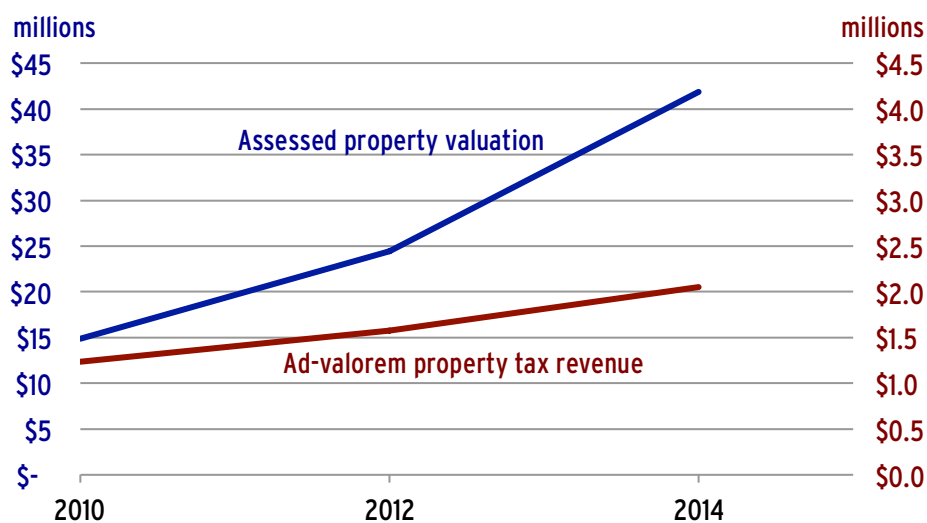
Beginning around 2010, Dunn County started to feel acute effects of Bakken development. Due to the hundreds of wells drilled in and around the county, the volume of heavy and light-duty vehicle traffic dramatically increased. Of the 1,240 miles of roads maintained by the county, local officials estimated that roughly 450 had been heavily impacted by Bakken development. In an effort to manage these demands, annual spending on roads grew from roughly \$1.5 million in 2005 to roughly \$31 million in 2014 (Dunn County ND Auditor's Office 2005 - 2014).

Other services were heavily affected as well. The human services department, which provides services such as affordable housing support, substance abuse treatment, mental health care, and child foster care, saw demand grow by roughly half over the same period. A variety of other services grew at a similarly rapid rate, with the overall staff level growing from 47 in 2010 to 93 by late 2013.

While service demands grew, public revenues also increased rapidly, led by state allocations of the Gross Production Tax, which grew from less than \$1 million in 2005 to nearly \$28 million in 2014. Local governments in North Dakota cannot levy property taxes on oil and gas production property, and these allocations are provided by the state in lieu of those local levies. The state also awarded roughly \$3 million in Impact Grants to Dunn County for emergency services, law enforcement, road construction, and other purposes through 2014 (North Dakota Energy Infrastructure and Impact Office 2016). The Impact Grant program distributes revenue generated by the Oil and Gas Production Tax to communities experiencing acute impacts.

One factor constrained revenue growth from county property taxes. From 2010 to 2014, countywide assessed values grew by 180 percent, from roughly \$15 million to roughly \$42 million, driven by new pipelines and other infrastructure associated with transporting oil and gas. However, ad-valorem tax revenue grew by just 66 percent, from \$1.2 million to \$2.1 million over the same period, as the county mill levy fell from 83.10 to 49.06 mills (Figure 4.3). Under North Dakota law, the absolute level of revenue from property taxes may not grow beyond a certain rate, forcing counties to reduce tax rates if property values rise rapidly (see ND Century Code §57-15).

Figure 4.3 Dunn County property valuations and ad-valorem property tax revenue



Data source: Dunn County auditor's office

Local officials in 2013 stated that the county was unable to provide a variety of needed services, with roughly one quarter of overall demand going unmet.¹ Along with the sheer scale of public sector needs, high-paying opportunities in the oil and gas sector made it difficult for Dunn

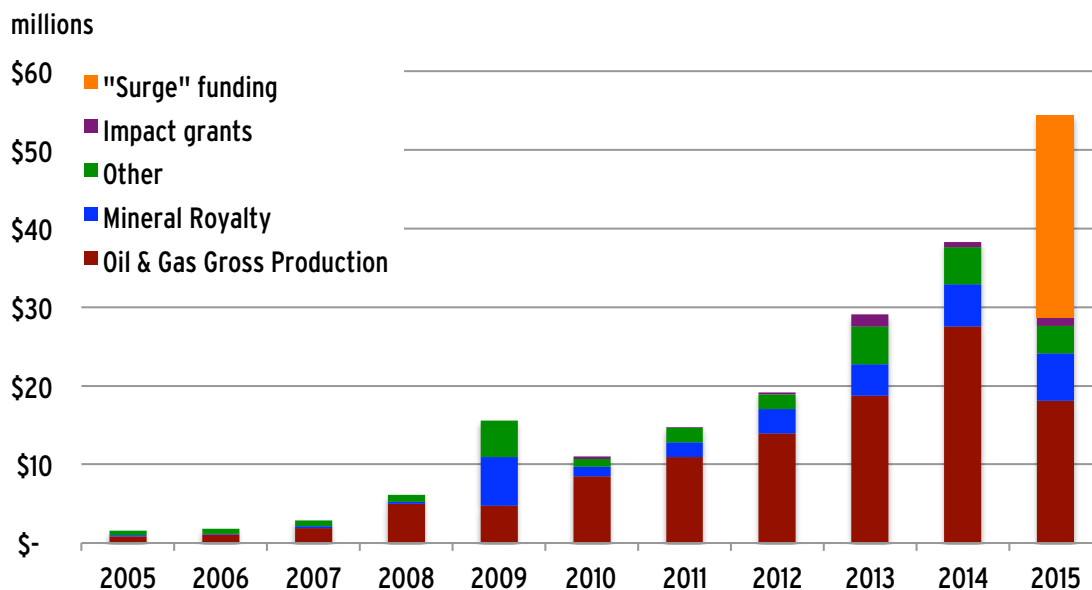
¹ Based on interview with Dunn County commissioner Daryl Dukart, October 14, 2013 in Dickinson, ND.

County to attract and retain employees, leading the county to substantially increase salaries. In addition, the cost of hiring contractors for road repairs or other services increased rapidly due to new competition for labor and materials across the Bakken region.

4.2.2 Re-assessing in 2015

When we returned to Dunn County in late 2015, demands related to Bakken development continued to be substantial. However, the overall fiscal situation had improved markedly, and a variety of local officials unanimously agreed that the county was in stronger fiscal condition than before Bakken development began, and far stronger than during our 2013 interviews.² First, revenue had roughly doubled from 2013 to 2015. Although lower oil prices led to declining receipts from the Gross Production Tax, \$25.7 million in one-time “surge” funding pushed overall transfers from the state to roughly \$53 million (Figure 4.4).

Figure 4.4 State revenue distributions to Dunn County



Data source: North Dakota Treasurer’s Office (2016).

Second, the slowdown in drilling activity eased demand in a variety of sectors. Road traffic decreased markedly, allowing county crews to catch up on millions of dollars worth of improvements. In addition, weakening demand in the oil sector helped drive down contractor costs by roughly one quarter, substantially lowering the overall cost of labor and materials.

² Based on interview on October 22, 2015, in Manning, ND, with Dunn County commissioner Daryl Dukart, sheriff Clay Coker, planning and zoning administrator Sandy Rhode, director of social services Tom Picken, clerk of court/recorder Lisa Guenther, auditor Tracey Dolezal, and Vision West ND consultant Deb Nelson.

With higher funding levels in 2015, the county has been more equipped to manage these higher levels of activity, though some challenges remain. Demand for local EMS systems and the county clerk of court have continued to grow, straining existing staff. Calls to the sheriff's office roughly doubled from 2012 to 2013, doubled again from 2013 to 2014, and were up roughly 75 percent through October 2015. Calls for drug-related issues had increased substantially, along with cases of domestic violence and DUIs. Local officials report that these increases primarily reflect population growth, and that increased staffing from two deputies in 2010 to 17 in 2015 has made it possible to manage this growth in enforcement activity.

Local officials also describe challenges related to social services. Despite the decrease in drilling activity, calls related to drug abuse, foster care, and domestic violence all grew substantially through the time of our visit. Meeting rising demand for mental health services has also been a challenge, as there are no medical facilities in Dunn County that offer mental health treatment. As a result, sheriffs and deputies have had to transport clients several hours away to Bismarck or Fargo on a fairly regular basis.

The challenge of workforce retention has largely eased and, after several years of rapidly increasing wages, local officials expected salaries to remain flat in the coming years.

4.2.3 Prospects for the future

Service demands for Dunn County have changed dramatically as a result of Bakken development. During our visit in 2015, it appeared that revenues had largely caught up with demand for services. Local officials stated that the county was in stronger fiscal health than during our 2013 visit, and stronger than it was prior to Bakken development. Considering the years ahead, a number of fiscal opportunities and risks emerge.

Unlike most municipalities in the Bakken region, Dunn County did not need to take out substantial debt to manage infrastructure growth. As of 2014, long-term public debt was less than \$500,000, and interest payments were \$0 (Dunn County ND Auditor's Office 2005 - 2014). Economic activity in the county was robust during our 2015 visit, with pipeline construction continuing to provide substantial employment even as drilling work had slowed. The county holds net assets of roughly \$43 million, more than 10 times the 2005 level, and \$22.5 million of those assets were unrestricted, meaning they could be used for any future or current needs.

However, because growth has been fueled entirely by oil and gas development, the long-term fiscal health of the county (and region more broadly) may be tied closely to continued oil and gas production. In October 2015, WTI spot crude was trading at roughly \$45 per barrel (bbl) and local officials expressed hope that prices and activity would soon pick up. However, crude has continued to fall, and in January 2016 fell into the \$30/bbl range. During follow-up conversations in

January 2016, local officials stated that they were concerned about funding current service and staffing levels, due to a combination of low prices for oil and agricultural commodities, another important sector of the county's economy.³

Understanding the risks of an economy dependent on volatile commodity prices, Dunn County and other regional officials are working to diversify their economic base into other sectors under the broad umbrella of Vision West ND, which convenes local leaders from government and the private sector to address these—and other—challenges. However, given the remote and sparsely populated nature of the region, the long-term success of these efforts is uncertain.

4.3 *Watford City, ND*

Watford City is located near the center of McKenzie County, which saw roughly 3,000 well completions between 2008 and 2014, by far the most of any county in the Bakken. Watford City also lies at the crossing of State Route 23 and U.S. Highway 85, two of the major arteries used to transport oil and gas workers and equipment across the region. As a result, Watford City has experienced rapid growth in population, economic activity, and associated fiscal impacts.

4.3.1 *Rapid growth through 2013*

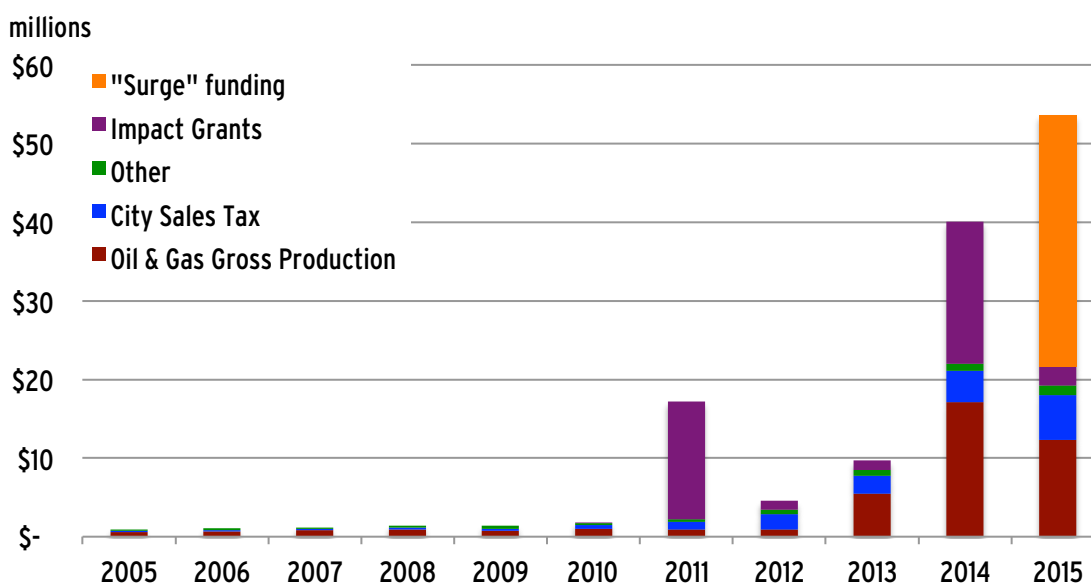
At the time of our 2013 visit, Watford City was facing a range of fiscal challenges and was struggling to manage the pace of population growth. As we described in a 2014 report (Newell & Raimi 2015b), rapidly rising demand for services drove the city to increase full-time staff from four to 12, and the police force from 3.5 to 13 full-time equivalent employees. After years of budgeting without any debt, the city had taken out roughly \$12.5 million in loans for water, wastewater, and road infrastructure, which they described as a measure of last resort to manage growth. Clearly, existing revenue streams were not sufficient to manage growth in demand for services.

Like Dunn County, most revenues for Watford City come through distributions from the state. These distributions were relatively slow to respond to the rapid population growth. As Watford City took out millions of dollars in new loans to upgrade infrastructure, distributions from the state grew from \$1.4 million in 2008 to \$3.4 million in 2012. While this growth represented a more than doubling of annual transfers, local officials reported that they were not sufficient to manage growth in demand for the services and infrastructure described above. To make up for some of the shortfall, the state allocated roughly \$15 million worth of Impact Grants in 2011. Over \$1 million was awarded to Watford City through this program in 2012 and 2013, followed by \$18 million in 2014.

³ Based on email communication with Dunn County commissioner Daryl Dukart, Jan. 28, 2016.

Along with these grants, the state crafted a longer-term solution through a reformulation of the distribution of the state’s Oil and Gas Production Tax, which was changed to send more revenue to Watford City and other local governments struggling to manage new demands (see Section 3.3). Additionally, “surge” funding authorized in 2015, which sent hundreds of millions of dollars of oil and gas tax revenues to the four largest cities in the Bakken region, pushed revenues far beyond their previous levels. In 2015, despite declining revenue from the production tax driven by lower oil prices, surge funds pushed total distributions to \$51 million (Figure 4.5).

Figure 4.5 State revenue distributions to Watford City



Data source: North Dakota Treasurer’s Office (North Dakota Treasurer’s Office 2016) and North Dakota State Impact Grant Office (North Dakota Energy Infrastructure and Impact Office 2016).

4.3.2 Activity stabilizes in 2015, infrastructure needs remain

Watford City continues to be the geographical epicenter of Bakken development. Drilling activity in McKenzie County slowed from 754 well completions in 2014 to 455 in 2015, but this figure is still nearly 200 completions greater than Williams County, the second most heavily drilled county in 2014.

In turn, economic activity and tax revenue has slowed in Watford City alongside the rest of the region. As one economic indicator, the statewide taxable value of sales fell by 25 percent in the third quarter of 2015 compared with the same period of 2014, while the taxable value of sales in Watford City fell by 37 percent (North Dakota State Tax Commissioner 2015). Despite these declines, total revenue has grown enormously thanks to the “surge” funding depicted in Figure 4.5. This injection of capital coupled with a slowdown in vehicle traffic and population growth has enabled the city to “catch up” to some degree on its backlog of infrastructure projects.

Increased staffing and revenue has allowed the city to provide more services for its larger population, and local officials report that they are generally well-equipped to meet day-to-day demand. In 2015, total city staffing was 52, compared with 10 before Bakken development began. Police staff has grown from four to 20, and the city's budget has grown from roughly \$1.5 million in 2005 to over \$100 million in 2015.

However, infrastructure upgrades remain a work-in-progress. Watford City's capital improvement plan totals \$344 million, led by \$200 million in road construction projects, and the city has taken out roughly \$150 million in loans to pay for these upgrades.⁴ Although these loans are provided at low interest rates, the city's annual debt payments are roughly \$7 million.

4.3.3 *Future opportunities and concerns*

Perhaps more than any other city in the Bakken region, Watford City's fiscal future faces substantial uncertainty. With its \$150 million debt load, newly expanded staff, and ongoing infrastructure projects, the city's fiscal health will largely hinge on future economic activity and associated population, which will in turn be driven by the level of oil and gas activity in the Bakken.

Put simply, a stable (or growing) population and economy is likely to support the types of investments made by the city and state to upgrade Watford City. However, a protracted slump in drilling activity has the potential to slow investment across the region, and in a worst-case scenario, could lead to a declining population in the city. In turn, a shrinking population could reduce the city's revenue base and make it difficult to finance the current level of services and the \$150 million in debt.

As noted above, the bulk of Watford City's growth has been funded by revenues from state-collected oil and gas production taxes, allocated through a variety of mechanisms. Monthly allocations of Gross Production Tax revenue has declined from a peak of more than \$2 million in September 2014 to less than \$1 million during most of 2015. These allocations may decline further in 2016 if oil continues to trade in the \$30 to \$40/bbl range.

During our 2015 visit, local officials were optimistic about the current and future prospects for Watford City's fiscal health. However, the large accumulation of debt coupled with an economy heavily tied to volatile commodity prices may—if industry activity continues to ebb—combine to present substantial challenges in the coming years and decades.

⁴ Based on interview with mayor Brent Sanford, September 23, 2015, in Watford City.

5. Conclusion

North Dakota and Montana's Bakken shale region has experienced rapid economic and population growth since 2008, with major implications for local government finances. The large scale of impacts is primarily the result of two key factors. First, the scale of industry activity was enormous, with production rivaling any other region of the United States. As a result, population in some cities doubled, tripled, or quadrupled, leading to rapid growth in government revenues and demand for services. Second, the Bakken region is substantially more rural than any other U.S. shale region, and western North Dakota did not have a pre-existing workforce or other infrastructure capable of supporting large-scale industry investment.

During our first visit in fall 2013, public infrastructure needs were acute, and revenues were generally insufficient to allow local governments to keep up with demand for services such as repairing roads, expanding water and wastewater infrastructure, ramping up emergency, fire, police, and other services. Local government officials in each jurisdiction we examined, including Dunn County and Watford City, reported that demand for services was substantially outstripping revenues, and financial data supported those assertions. When we returned two years later, a second round of structured interviews and a review of the most recent financial data indicated a shift in fiscal health: while a number of long-term challenges remained, many of the most immediate needs were being met.

This change was also attributable to two major factors. First, low oil prices in late 2014 and 2015 slowed investment substantially, halting population growth and lessening demand for a wide range of local government services. Second, the North Dakota state legislature in 2014 passed a series of bills that provided additional revenue to local governments, allowing them to better meet the needs of their expanded cities and counties.

This case study focuses on the fiscal experiences of Dunn County and Watford City. In a change from our previous findings, these local governments reported that their fiscal health was stronger overall because of Bakken shale development, and that revenues had largely "caught up" with demand for services. However, there is cause for concern over future fiscal stability. For Watford City, government revenue is tied closely to economic activity driven by volatile oil prices, which could create challenges for financing expanded services and \$150 million in debt over the coming years and decades. Dunn County, like most other local governments in the region, has become heavily dependent on oil-driven revenues, and while local leaders are currently working to mitigate the risks of future fiscal volatility, the rural nature of the region may make it difficult to develop a more diverse economic base.

6. Appendix A

Table 6.1 Counties included in regional definitions

| State | County | Region |
|-------|--|------------------|
| MT | Dawson, McCone, Richland, Roosevelt, Sheridan | Bakken shale |
| ND | Billings, Bottineau, Burke, Divide, Dunn, Golden Valley, McHenry, McKenzie, McLean, Mercer, Mountrail, Renville, Stark, Ward, Williams | Bakken shale |
| TX | Atascosa, Bastrop, Bee, Brazos, Burleson, DeWitt, Dimmit, Fayette, Frio, Gonzales, Karnes, La Salle, Lavaca, Lee, Leon, Live Oak, Madison, Maverick, McMullen, Milam, Webb, Wilson, Zavala | Eagle Ford shale |
| NM | Chaves, Eddy, Lee, Roosevelt | Permian basin |
| TX | Andrews, Bailey, Borden, Cochran, Coke, Concho, Crane, Crockett, Crosby, Culberson, Dawson, Dickens, Ector, Edwards, Fisher, Floyd, Gaines, Garza, Glasscock, Hale, Hockley, Howard, Irion, Kent, Kimble, Lamb, Loving, Lubbock, Lynn, Martin, Menard, Midland, Mitchell, Motley, Nolan, Pecos, Reagan, Real, Reeves, Schleicher, Scurry, Sterling, Sutton, Terrell, Terry, Tom Green, Upton, Val Verde, Ward, Winkler, Yoakum | Permian basin |

Source: U.S. EIA Drilling Productivity Reports. Available at: <http://www.eia.gov/petroleum/drilling/>

6.1 Oil and gas revenue allocation to local governments

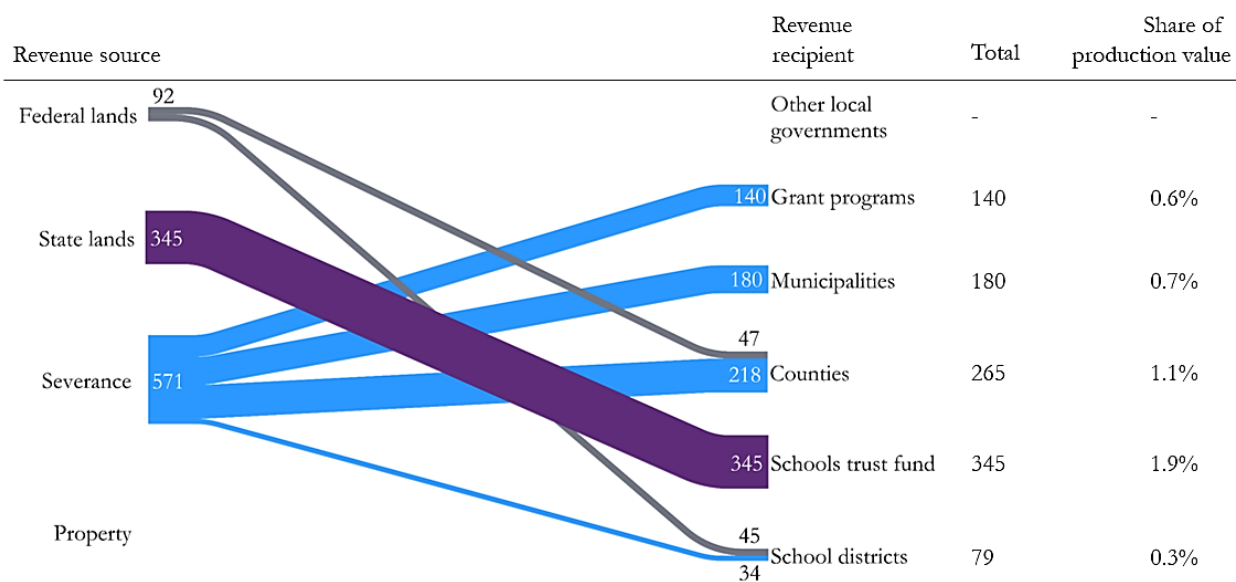
Revenue from the Gross Production Tax (one of two severance taxes levied by the state) is shared between local governments in the Bakken region, with county and municipal governments seeing the largest share, along with the state Impact Grant program. State leases endow a school trust fund, and revenue from federal leases flows directly to counties and school districts.

Table 6.2 North Dakota FY 2013 oil and gas production and production value

| Oil production (Mbbbl) | Oil price (\$/bbl) | Natural gas production (bcf) | Natural gas price (\$/mcf) | Total production value (\$billion) |
|------------------------|--------------------|------------------------------|----------------------------|------------------------------------|
| 276.7 | \$86.28 | 204.3 | \$3.31 | \$24.6 |

Note: Oil price based on U.S. EIA first purchase price. Natural gas price based on White River Hub via Bloomberg.

Figure 6.1 North Dakota FY 2013 local government revenue from oil and gas production (\$million)



Note: Figures at left show local government revenue from four major sources. Figures at right show allocation of those revenues to local governments. Sums may not total due to rounding.

Due to the legislation described in Section 3.3, allocations to local governments grew in the most recent fiscal year. Table 6.3 shows how those changes would have affected oil and gas revenues in fiscal years (FY) 2012 and 2013. In reality, these formula changes took effect in FY 2016, but because detailed data are not yet available for that year, we present below estimates of how the formula changes would have affected allocations in FY 2013.

Allocations to the local government grant program increased from \$120 million to \$140 million per year (though, as a share of production value, allocations decreased due to the rapid growth in production). Allocations to municipalities more than doubled in absolute terms, and grew from 0.5 percent to 0.7 percent of production value. Similarly, county governments saw an increase of roughly \$120 million, growing from 0.8 percent to 1.1 percent of production value. Revenues to the state’s school trust fund fell slightly, but remained substantial at 1.9 percent of production value, and direct revenues to school districts grew by \$30 million, remaining at 0.3 percent of production value.

Table 6.3 FY 2012 and FY 2013 local government revenue allocations in ND

| Fiscal Year | Grant program | Municipalities | Counties | Schools trust fund | School districts |
|---------------------------|---------------|----------------|----------|--------------------|------------------|
| 2012 Amount (\$M) | 120 | 79 | 144 | 411 | 49 |
| Share of production value | 0.7% | 0.5% | 0.8% | 2.4% | 0.3% |
| 2013 amount (\$M) | 140 | 180 | 265 | 345 | 79 |
| Share of production value | 0.6% | 0.7% | 1.1% | 1.9% | 0.3% |

Note: FY 2013 allocations to local governments shown here differ from actual FY 2013 values because we apply the most recent (2015) allocation formulas to revenue collected in FY 2013.

7. References

- Abramzon, S., Samaras, C., Curtright, A., Litovitz, A., Burger, N., 2014. Estimating the Consumptive Use Costs of Shale Natural Gas Extraction on Pennsylvania Roadways. *Journal of Infrastructure Systems* 0, 06014001.
- Allcott, H., Keniston, D., 2014. Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America. National Bureau of Economic Research, Working Paper 20508.
- Anderson, B.J., Theodori, G.L., 2009. Local leaders' perceptions of energy development in the Barnett Shale. *Southern Rural Sociology* 24, 113-129.
- Bangsund, D., Hodur, N.M., 2013a. Petroleum industry's economic contribution to North Dakota in 2011. ND State University Center for Agribusiness and Applied Economics, Report No. 710, Fargo, ND.
- Bangsund, D., Hodur, N.M., 2013b. Williston Basin 2012: Projections of future employment and population, North Dakota Summary. North Dakota State Univ. Agribusiness and Applied Economics Report No. 704, Fargo, ND.
- Brown, J., 2014. Production of natural gas from shale in local economies: a resource blessing or curse? , Federal Reserve Bank of Kansas City.
- Christopherson, S., 2015. Risks Beyond the Well Pad. In: Finkel ML (ed.) *The Human and Environmental Impact of Fracking: How Fracturing Shale for Gas Affects Us and Our World*. Praeger, Santa Barbara, CA.
- Christopherson, S., Rightor, N., 2012. How shale gas extraction affects drilling localities: Lessons for regional and city policy makers. *Journal of City and Town Management* 2.
- Costanzo, C., Kelsey, T.W., 2012. Marcellus Shale and Local Collection of State Taxes: What the 2011 Pennsylvania Tax Data Say. Penn State Center for Economic and Community Development, University Park, PA.
- DiNapoli, T.P., 2014. Fiscal Stress Monitoring System. Office of the New York State Comptroller, Albany, NY.
- Dunn County ND Auditor's Office, 2005 - 2014. Annual Financial Audits. Provided via email on Jan. 18, 2016.
- Gopalakrishnan, S., Klaiber, H.A., 2014. Is the shale energy boom a bust for nearby residents? Evidence from housing values in Pennsylvania. *American Journal of Agricultural Economics* 96, 43-66.
- Haggerty, J.H., McBride, K., 2014. Navigating beyond the resource curse: Do local monitoring programs empower fracking host communities? . Headwaters Economics, Bozeman Montana.
- Headwaters Economics, 2013. North Dakota not returning adequate oil revenue to local governments. Bozeman, MT.
- Headwaters Economics, 2014. How state return revenue to local governments from unconventional oil extraction: windfall or missed opportunity? Headwaters Economics, Bozeman, MT.

-
- Hodur, N.M., Bangsund, D., Rathge, R., Olson, K., 2013. Estimates of enrollment projections: Ray, Stanley, Williston and Dickinson. North Dakota State University Center for Agribusiness and Applied Economics, Report No. 708-S, Fargo, ND.
- Jacquet, J., Kay, D., 2014. The Unconventional Boomtown: Updating the impact model to fit new spatial and temporal scales. *Journal of Rural and Community Development* 9.
- Jacquet, J.B., 2014. The Battlement Mesa Health Impact Assessment: A case study and oral history of process and lessons learned. *Headwaters Economics*, Bozeman, MT.
- Lycoming County, 2012. The impacts of the Marcellus Shale industry on housing in Lycoming County. Williamsport, PA.
- Macke, D., Gardner, D., 2012. Policy education white paper-Western North Dakota Energy Project. Center for Rural Entrepreneurship, commissioned by the Bush Foundation through the Western ND Energy Project, Lincoln, NE.
- Marlowe, J., 2014. Guide to Financial Literacy: Connecting Money, Policy, and Priorities. *Governing Magazine*.
- Marlowe, J., 2015. Guide to Financial Literacy, vol. 2: Managing Your Jurisdiction's Financial Health. *Governing Magazine*.
- McFarland, C., Pagano, M.A., 2014. City Fiscal Conditions 2014. National League of Cities, Center for City Solutions and Applied Research.
- Muehlenbachs, L., Spiller, E., Timmins, C., 2014. The housing market impacts of shale gas development. Resources for the Future Discussion Paper 13-39-REV, Washington, D.C.
- Newell, R.G., Raimi, D., 2015a. Oil and Gas Revenue Allocation to Local Governments in Eight States. National Bureau of Economic Research Working Paper w21615.
- Newell, R.G., Raimi, D., 2015b. Shale Public Finance: Local Government Revenues and Costs Associated with Oil and Gas Development. National Bureau of Economic Research Working Paper w21542.
- North Dakota Energy Infrastructure and Impact Office, 2016. Grant Round Results. URL <https://www.nd.gov/energyimpact/HistoricResults.aspx>.
- North Dakota Industrial Commission, 2014. North Dakota Drilling and Production Statistics. URL <https://www.dmr.nd.gov/oilgas/stats/AnnualProduction/2014AnnualProductionReport.pdf>.
- North Dakota State Tax Commissioner, 2014. State and Local Taxes: An Overview and Comparative Guide (aka, "The Redbook").
- North Dakota State Tax Commissioner, 2015. Sales and Use Tax Statistical Reports. URL <http://www.nd.gov/tax/salesanduse/pubs/index.html>.
- North Dakota Treasurer's Office, 2016. Revenue Distribution webpage. URL <http://www.nd.gov/treasurer/revenue-distribution/>.
- Peterson, J.E., 1977. Simplification and standardization of state and local government fiscal indicators. *National Tax Journal* 30.

- State of Washington, 2010. Washington State local government financial health indicators. Office of the State Treasurer.
- U.S. Bureau of Economic Analysis, 2015. Regional Economic Accounts, Quarterly GDP by State. URL <http://www.bea.gov/regional/index.htm>.
- U.S. Department of Agriculture, 2013. 2013 Rural-Urban Continuum Codes.
- U.S. Energy Information Administration, 2015. Drilling Productivity Report. URL <http://www.eia.gov/petroleum/drilling/>.
- Upper Great Plains Transportation Institute, 2012. An assessment of county and local road infrastructure needs in North Dakota. North Dakota State University, Report submitted to the 63rd North Dakota Legislative Assembly, Bismarck, ND.
- Vision West ND, 2012. City of Watford City, ND: Municipal Infrastructure Needs Assessment.
- Weber, J.G., 2014. A decade of natural gas development: The makings of a resource curse? *Resource and Energy Economics* 37, 168-183.
- Weber, J.G., Burnett, J., Xiarchos, I.M., 2014. Shale Gas Development and Housing Values over a Decade: Evidence from the Barnett Shale.
- Weber, J.G., Chomas, M., Wang, Y., 2015. How Much Do US State Governments Really Tax Oil and Gas Extraction? Retrieved from SSRN.