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Ohio Utica Shale Gas Monitor

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Maxine Goodman Levin College of Urban Affairs

Ohio Utica Shale Gas Monitor

January 2014

Maxine Goodman Levin College of Urban Affairs

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EXECUTIVE SUMMARY

This report analyzes aggregate indicators of economic activity related to the early stages of Utica and Marcellus shale development in the State of Ohio from January through August 2013, reviewing sales receipts as a leading indicator of economic activity, total employment based upon where people live rather than work, well activity, and gas prices.

This issue of the Ohio Utica Shale Monitor is supplemented with state permitting data through December 2013. The study groups Ohio's counties into four levels of shale activity – strong, moderate, weak and non-shale -- based on their geology, the likelihood that either natural gas liquids (NGLs) or oil are present in their shale formations, and well activity. (See the Methodology section for further explanation.)

Among the study's findings:

- The driver of investment and drilling activity across all of the oil and gas fields in the United States is the price levels of the three main products: oil, natural gas liquids, and methane, or dry gas. Investment and exploratory drilling activity has picked up in Ohio as drillers take advantage of higher returns from natural gas liquids [NGLs] in the southern portion of the Utica formation.
- Permitting of horizontal natural gas wells continued at a rapid pace but midstream infrastructure challenges remain. An additional 164 wells were permitted during the second quarter of 2013 alone, an increase of 321% compared to the same quarter of 2012. However, the number of *new* wells producing oil and gas through the second quarter of 2013 (2) dropped off compared to the first half of 2012 (46).
- Growth in sales receipts correlates with the rapid increase in the number of wells permitted, drilled and the increased production in the counties with strong shale activity. Year-over-year sales tax receipts enjoyed double digit percentage growth in April through August 2013, reflecting increased wealth creation.
- Employment in counties with strong shale activity remains a challenge, with relatively flat employment rates through the second quarter of 2013. As these numbers reflect where a person lives rather than where they work, commuting patterns likely play a role in the

data. Hiring is taking place in the metropolitan areas in the moderate shale counties where field service firms have established operations. In addition, non-shale-related sectors have absorbed a number of restructurings, potentially impacting the data.

- As of December 18, 2013, Ohio's Utica formation had 39 active drilling rigs. In comparison, Ohio's Marcellus formation had 2 rigs active.

- Larger economic benefits will be reaped if ethane is "cracked" into its commercially valuable components in or close to Ohio. Potential benefits will be reduced if the NGLs are either barged or piped to Louisiana or Texas. Interest, intent and investments are being announced:
 - In September 2013, U.K. based Velosys announced its intent to build a plant to convert natural gas to diesel fuel and other liquids in Ashtabula, Ohio.
 - In November 2013, Brazil's Odebrecht announced Project ASCENT (Appalachian Shale Cracker Enterprise) to build an ethane cracker and three polyethylene plants in West Virginia.
 - *Plastic's News* reported that Canada's NOVA Chemicals Corp was able to convert ethane from the Marcellus shale basin to ethylene. As a result, the company intends to increase the amount of ethane it uses in its Corunna, Ontario, ethylene plant and to expand the capacity of its Coruna cracker at the same location by 20 percent by 2018.
 - In December 2013, Shell rolled over its option on land near Pittsburgh for the third time. Shell committed to begin clearing the site in the first quarter of 2014, however, the company has not publicly announced a decision on building an ethylene cracker. The length of this option was reported by the *Pittsburgh Post-Gazette* to be confidential.

COUNTY CLASSIFICATIONS AND TRENDS

- Drilling and permitting have shifted in recent months, indicating the industry is migrating activity south and east, focusing its areas of investment. The number of counties with strong shale activity has gone to eight from 15, and moderate activity has gone to five from 30.

- Strong shale counties have the highest potential for producing commercial amounts of NGLs. There strong shale counties are along Ohio's eastern border in the Northern Appalachian portion of the state: Belmont, Carroll, Columbiana, Guernsey, Harrison, Jefferson, Monroe, and Noble.
- Moderate shale counties are to the north and immediate west of the strong counties. Mahoning, Portage, Stark, Trumbull, and Tuscarawas are the five moderate counties.
- Weak shale counties are part of the Utica formation and have deposits of natural gas but have not proven to hold NGLs. There are 30 such counties that range north to Lake Erie, west of the city of Columbus, and south to Hocking and Washington counties.
- Forty-five counties are considered to be "non-shale" because of their geology.

There were marked increases in sales receipts during 2012 and the first two quarters of 2013 in the strong shale counties. Through August 2013, sales receipts in strong shale counties continued their steady growth. Second-quarter sales receipts increased by 12.2% (\$1.3 billion) over Q2 2012 (\$1.16 billion) (Chart 1). Moderate shale counties also saw solid growth, with estimated sales increasing by 10.7% in Q2. Sales in both the strong and moderate shale counties continued to outperform sales in weak shale and non-shale counties, continuing a trend that goes back to 2009 (Appendix Chart 1).

Increased sales reflect spending by land and mineral rights owners as well as spending of out-of-state workers because hotel and lodging bills are subject to the sales and use tax in Ohio, as are restaurant meals. Robust increases in sales in the moderate shale counties reflect their locations: the Canton and Youngstown-Warren metropolitan areas border the group of strong shale counties and are located in moderately strong shale counties. Akron and Summit County have easy access to shale country and benefits from spending, as it is a major retail destination for northern Appalachian Ohio. These metropolitan areas have larger populations and stronger retailing presence than do the much more rural strong shale counties.

Employment among the residents of these counties has yet to show substantial gains. The moderate shale counties performed the best as employment increased by .5% in Q1 and .4% in Q2. Surprisingly, employment growth was the weakest in the strong shale counties,

dipping by -0.5% in Q1 and -0.8% Q2. Employment in the weak and non-shale counties remained relatively stable.

Chart 1

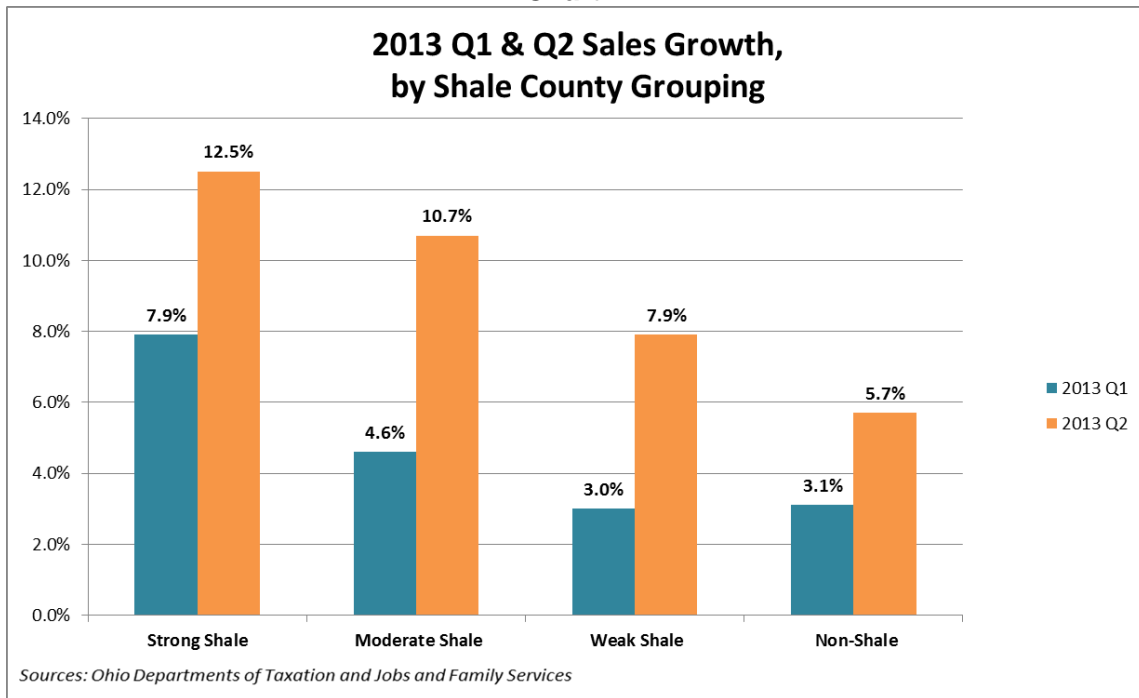


Chart 2

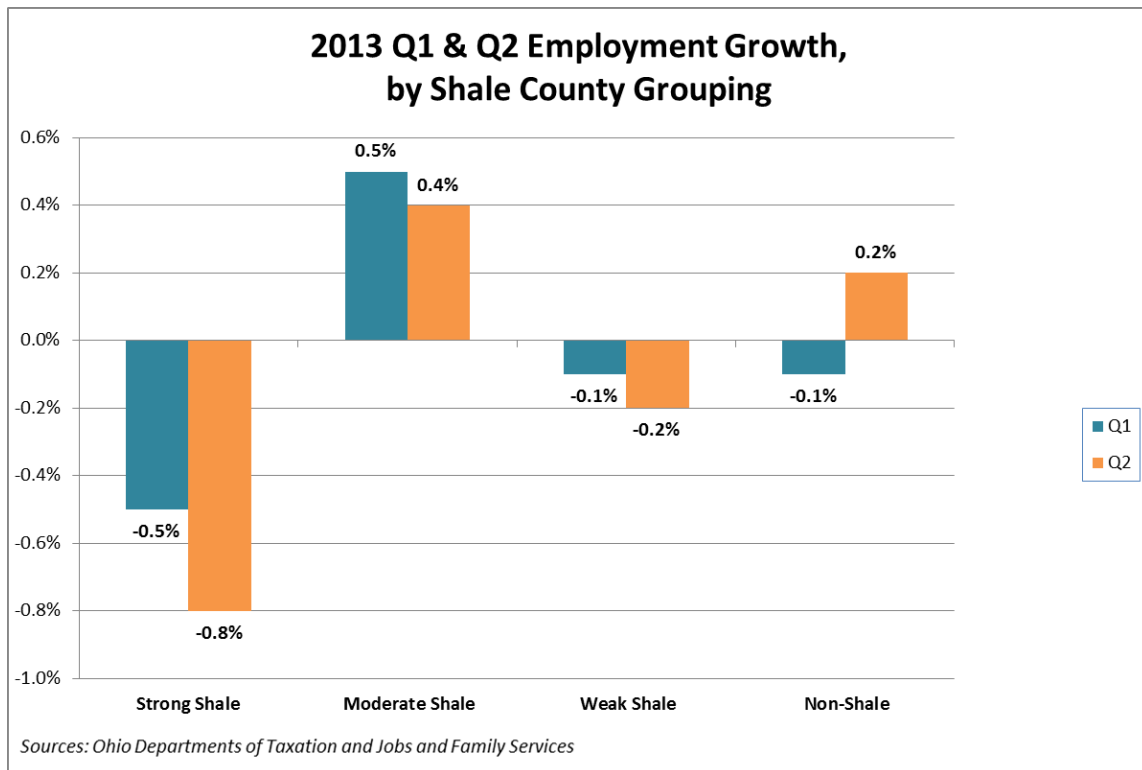


Chart 3

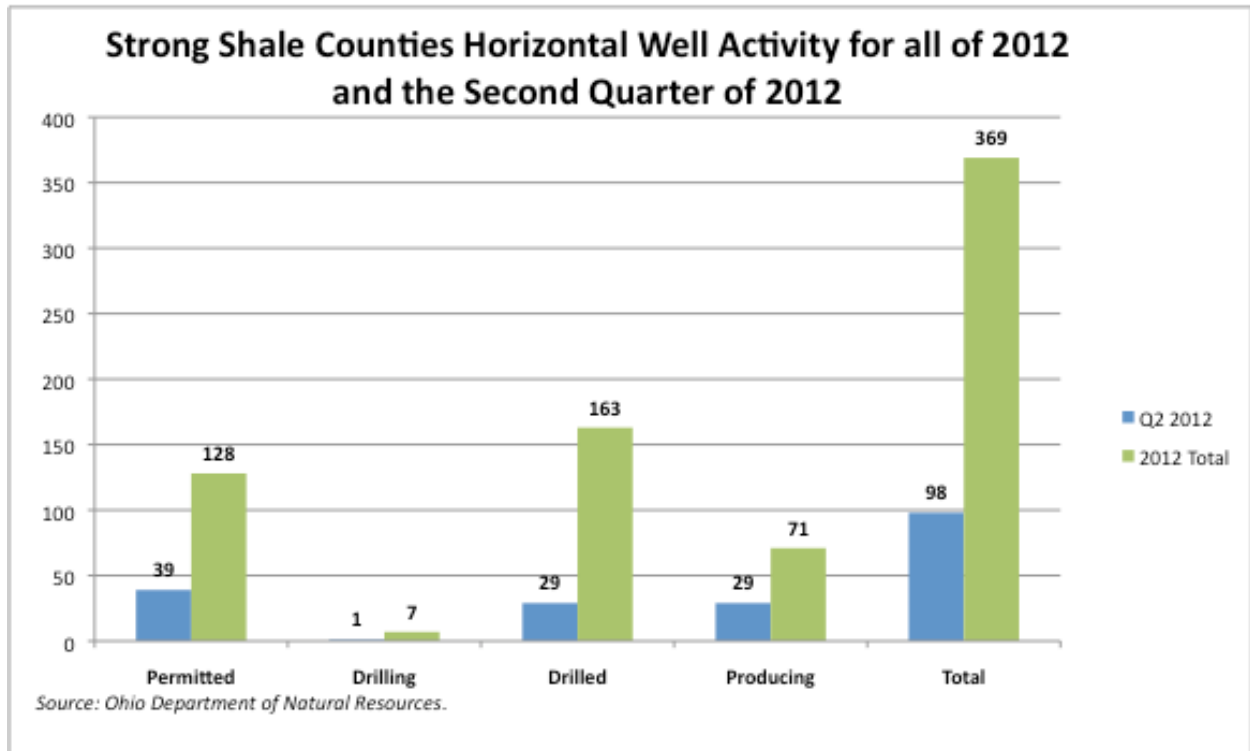
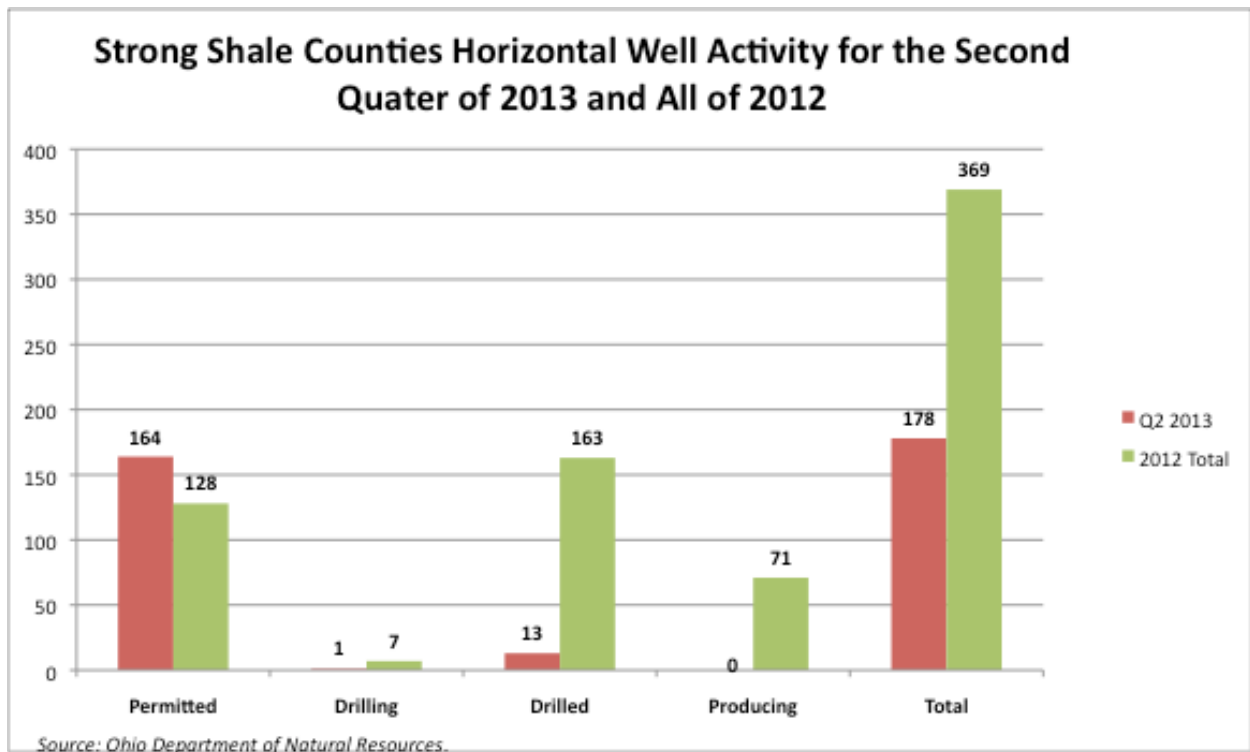


Chart 4



INTRODUCTION

In 2011, drilling for oil and gas recommenced in the state of Ohio after a century of near dormancy due to recently developed horizontal drilling technologies that enabled the extraction of hydrocarbons from shale reservoirs that previously could not be economically tapped.¹ The purpose of this report is to monitor the development of Ohio's natural gas fields and the growth of the oil and gas industries in both the Utica and Marcellus shale formations by tracking four early stage indicators of activity: sales activity, total employment, well development, and natural prices.

It is beyond the scope of this report to analyze the complete economic impact of shale exploration. Rather, this report addresses four questions: *Has sales activity in the shale counties been growing faster than elsewhere in Ohio? Has employment growth in the shale counties been faster than elsewhere in Ohio? What is the status of horizontal well drilling activity? How is shale exploration and development affecting prices for the natural gas and natural gas liquids?*

Where is 'Shale Country'?

To facilitate the assessment of estimated sales activity, employment growth, and well development and to better understand how shale oil and gas development is affecting different areas, each of Ohio's 88 counties is grouped into one of four categories: strong shale counties, moderate shale counties, weak shale counties, and non-shale counties. We classified counties based on geological data and well activity data obtained through the Ohio Department of Natural Resources (ODNR), Division of Oil and Gas Resources.² Figure 1 and Table 1 display each of the counties and their current classification. Based on the most current geological information and horizontal well permitting and drilling activity, several counties have been reclassified from the March 2013 version of this report, decreasing the number of strong shale counties and increasing the number of moderate shale counties.³ Furthermore, since shale exploration and production remains in its early stages throughout Ohio, there is potential for these classifications to change as new geological data are released.

Figure 1

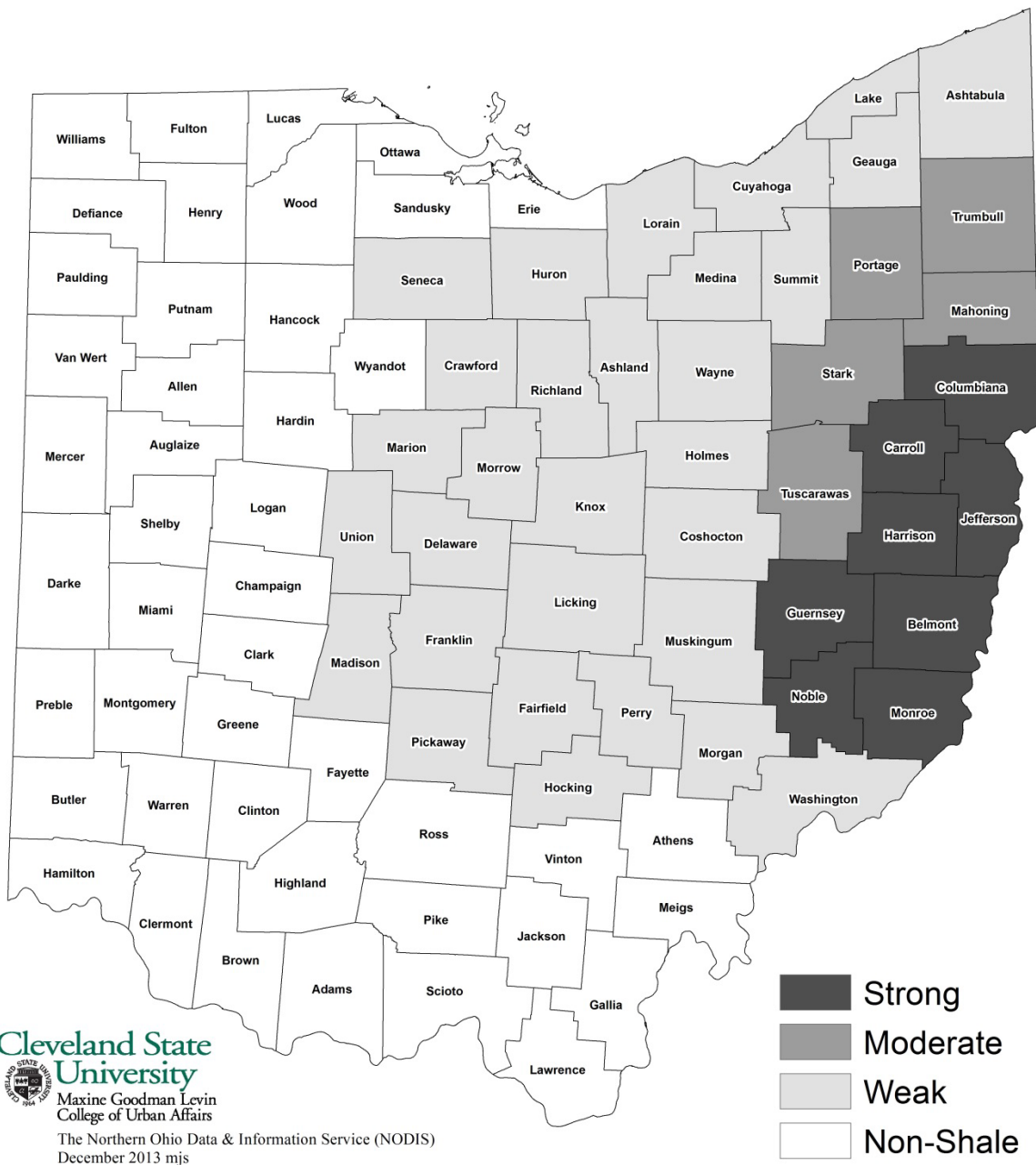


Table 1: County Classifications (n=88)			
Strong (n=8)	Moderate (n= 5)	Weak (n=30)	Non-shale (n= 45)
Belmont	Mahoning	Ashland	Adams
Carroll	Portage	Ashtabula	Allen
Columbiana	Stark	Coshocton	Athens
Guernsey	Trumbull	Crawford	Auglaize
Harrison	Tuscarawas	Cuyahoga	Brown
Jefferson		Delaware	Butler
Monroe		Fairfield	Champaign
Noble		Franklin	Clark
		Geauga	Clermont
		Hocking	Clinton
		Holmes	Darke
		Huron	Defiance
		Knox	Erie
		Lake	Fayette
		Licking	Fulton
		Lorain	Gallia
		Madison	Greene
		Marion	Hamilton
		Medina	Hancock
		Morgan	Hardin
		Morrow	Henry
		Muskingum	Highland
		Perry	Jackson
		Pickaway	Lawrence
		Richland	Logan
		Seneca	Lucas
		Summitt	Meigs
		Union	Mercer
		Washington	Miami
		Wayne	Montgomery
			Ottawa
			Paulding
			Pike
			Preble
			Putnam
			Ross
			Sandusky
			Scioto
			Shelby
			Van Wert
			Vinton
			Warren
			Williams
			Wood
			Wyandot

Table 2: Quarterly and Annual Change, Sales Receipts					
Year	Quarter	Strong	Moderate	Weak	Non-shale
2009	1	-3.8%	-3.8%	-9.7%	-9.3%
	2	-9.7%	-18.4%	-10.7%	-10.9%
	3	-8.5%	-7.5%	-9.0%	-9.3%
	4	1.2%	-4.5%	-1.3%	-2.1%
<i>Annual Change</i>		<i>-5.3%</i>	<i>-8.7%</i>	<i>-7.8%</i>	<i>-8.0%</i>
2010	1	0.2%	-0.8%	0.7%	-0.8%
	2	7.2%	17.2%	7.4%	5.9%
	3	8.1%	0.0%	6.2%	6.7%
	4	3.9%	-7.9%	6.0%	5.5%
<i>Annual Change</i>		<i>4.8%</i>	<i>1.8%</i>	<i>5.0%</i>	<i>4.3%</i>
2011	1	5.9%	0.6%	4.6%	6.4%
	2	7.8%	-6.6%	5.5%	5.2%
	3	5.2%	4.3%	6.3%	4.1%
	4	9.0%	10.8%	3.9%	4.7%
<i>Annual Change</i>		<i>7.0%</i>	<i>2.0%</i>	<i>5.1%</i>	<i>5.1%</i>
2012	1	11.9%	13.5%	7.9%	5.4%
	2	11.3%	18.3%	5.7%	5.7%
	3	8.6%	15.0%	5.9%	4.9%
	4	6.3%	15.0%	4.8%	2.4%
<i>Annual Change</i>		<i>9.5%</i>	<i>15.5%</i>	<i>6.1%</i>	<i>4.6%</i>
2013	1	7.9%	4.6%	3.0%	3.1%
2013	2	12.5%	10.7%	7.9%	5.7%
<i>Source:</i> Ohio Department of Taxation. Estimation by Levin College of Urban Affairs, Cleveland State University. <i>Note:</i> Quarterly change is percent change from the same quarter of the previous year.					

RESULTS

Sales Receipts:

Table 2 displays the annual and quarterly change in sales receipts for each group of counties from 2009 through August of 2013.⁴ **The reported quarterly change is the 12-month percent change in estimated sales.** The reason for calculating the change from the same quarter of the previous year is to account for seasonal fluctuations in sales activity.

In 2009, each of the four groups of counties experienced annual declines in sales tax receipts, compared to 2008, reflecting the impact of the Great Recession.⁵ While the moderate, weak, and non-shale counties saw their annual sales tax receipts rebound starting in 2010, the strong shale counties did not experience strong positive annual growth until 2011 and even then

the change was very small. By the first quarter of 2012, however, this relationship among the counties turned around. The strong and moderate shale counties experienced double-digit growth in sales receipts, reaching a peak of 18.3% growth rate in the third quarter in moderate shale counties, and growing at an annual rate of 15.5%. Sales receipts increased 9.5% over 2012. This growth far outpaced the growth in sales receipts in the weak and non-shale counties during 2012.⁶ Rapid growth in sales receipts in strong and moderate shale counties has continued through the second quarter of 2013 and remains faster than sales growth elsewhere in the state.

Total Employment:

Table 3 reflects the annual and quarterly changes in total employment for each group of counties between 2009 and the third quarter of 2013. **The reported quarterly change is the 12-month percent change from the same quarter of the previous year based on a person's place of residence, not place of work.**

The employment trends in 2009 mirrored the declines in sales receipts noted above. However, unlike rapid growth in sales receipts that were observed in subsequent years, growth in employment was small in 2011 across all four groups of Ohio's counties, but the non-shale counties experienced the least growth.

Employment gains in 2012 were again modest, with the strong shale counties not experiencing any employment growth. During 2012, state employment increased 0.6% and the weak shale counties experienced the most growth at 0.8%.

Through the second quarter of 2013, employment growth among the residents of shale country has again stagnated and even declined a bit. Employment among residents in the strong shale counties has decreased by 0.8% or by about 4,300 persons employed. Employment in moderate counties has increased slightly, by 0.5% in Q1 and 0.4% in Q2. Employment in weak counties decreased slightly in 2013, and in non-shale counties it has increased.

Table 3: Quarterly and Annual Change, Employment						
Year	Quarter	Strong	Moderate	Weak	Non-shale	State
2009	1	-3.4%	-4.0%	-3.1%	-4.1%	-3.6%
	2	-3.6%	-4.9%	-3.6%	-4.8%	-4.2%
	3	-4.2%	-5.3%	-4.0%	-4.7%	-4.4%
	4	-4.3%	-5.0%	-4.1%	-4.5%	-4.3%
Annual Change		-3.9%	-4.8%	-3.7%	-4.5%	-4.1%
2010	1	-2.4%	-2.3%	-2.5%	-3.0%	-2.7%
	2	-1.0%	-0.7%	-1.2%	-1.2%	-1.2%
	3	-0.3%	0.5%	-0.2%	-0.7%	-0.3%
	4	0.7%	1.4%	0.7%	0.0%	0.5%
Annual Change		-0.7%	-0.3%	-0.8%	-1.2%	-0.9%
2011	1	0.8%	1.1%	1.1%	0.5%	0.8%
	2	0.1%	0.8%	0.6%	-0.3%	0.3%
	3	0.2%	0.4%	0.7%	-0.1%	0.3%
	4	1.0%	0.9%	1.5%	0.5%	1.0%
Annual Change		0.5%	0.8%	1.0%	0.1%	0.6%
2012	1	0.1%	0.8%	1.0%	0.4%	0.7%
	2	0.7%	0.9%	1.2%	0.5%	0.8%
	3	0.0%	0.5%	0.7%	0.3%	0.5%
	4	-0.5%	0.5%	0.4%	0.1%	0.3%
Annual Change		0.0%	0.5%	0.8%	0.3%	0.6%
2013	1	-0.5%	0.5%	-0.1%	-0.1%	0.0%
2013	2	-0.8%	0.4%	-0.2%	0.2%	0.0%

Source: Ohio Department of Jobs and Family Services. *Note:* Quarterly change is percent change from the same quarter of the previous year.

How can these results be reconciled with shale-related construction activity and employers reporting job openings for truck drivers, welders, and construction labor? There are several reasons:

- Skilled and specialized workers employed by global oil field services firms are shifted from play to play. Crews have been moved from Pennsylvania's Marcellus play into Ohio's Utica play. Workers come from the Gulf States and other parts of the traditional oil patch to work the rigs.
- The data used in this report are based on where people live, not work. Hiring is taking place in the metropolitan areas in the moderate shale counties where field service firms have set their operations in moderately strong shale counties that are affiliated.

- Growth in shale jobs is being offset by employment losses in other industries. For example, the closure of Ormet's aluminum smelter complex in the strong shale Monroe County will ultimately result in the loss of 1,200 jobs. When the closing was announced in February of 2013 the complex employed nearly 1,200 and at the time of its closing in October 2013 700 were still at the plant. The state of Ohio estimates that about half of the workers at Ormet live in Ohio; the remainder are residents of West Virginia. Another example is employment in coal mining. Statewide the number of coal mining jobs decreased by 265 from the first quarter of 2012 to the first quarter of 2013. Much of Ohio's coal mines are located in the strong shale counties.

Monthly Sales Growth in Strong Shale Counties:

Chart 1 and Table 4 display the 12-month percent change in estimated sales receipts between 2010 and 2013 for the strong shale counties.⁷ The positive trend in sales receipts begins in May 2011 and continues through the first quarter of 2013. This turnaround and subsequent growth in sales receipts correlates with the rapid increase in the number of wells permitted, drilled, and the increase in production in strong shale counties (see Table 5). These counties experienced a 20.4% increase in total sales activity in 2012 (\$15.5 billion), compared to 2011 (\$12.8 billion). Sales receipt growth was robust in strong shale counties through the first quarter of 2013, with growth at or above 10% during each of the first three months. This continues to be the fastest growth in the state.

Chart 5:

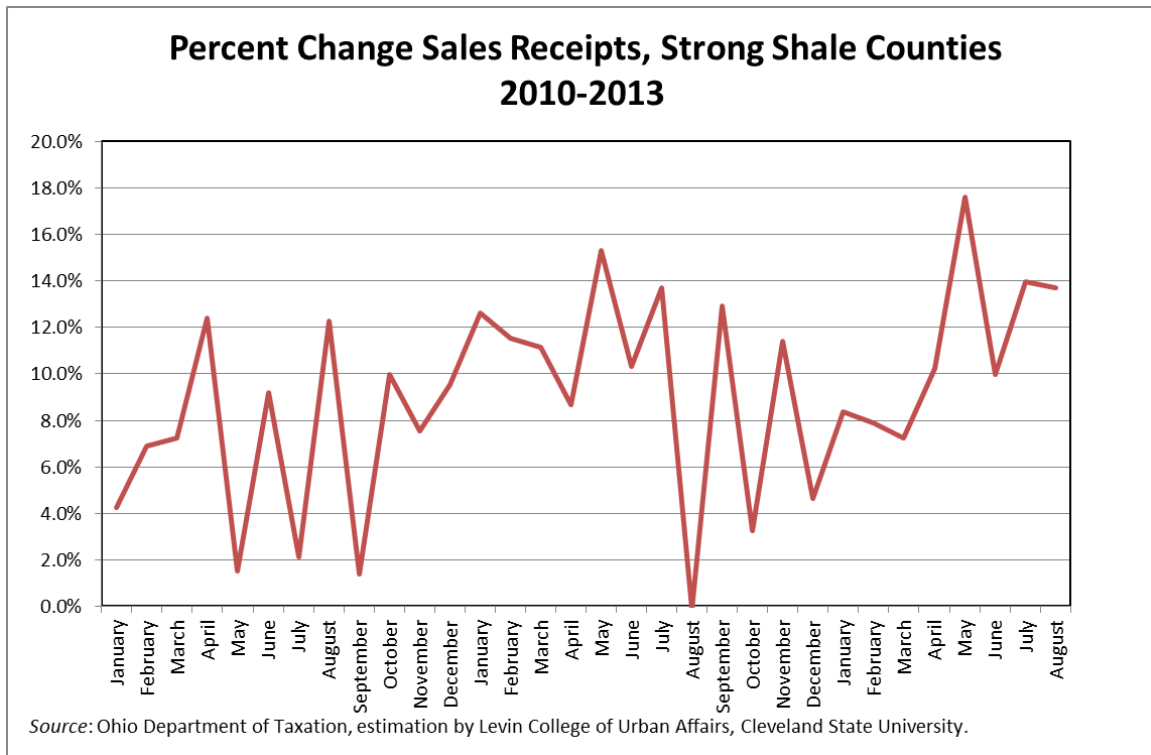


Table 4: Estimated Monthly Sales Receipts, Strong Shale Counties							
					<u>12 month Percent Change</u>		
	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2010-2011</u>	<u>2011-2012</u>	<u>2012-2013</u>
January	\$396,752,178	\$413,652,775	\$465,889,541	\$504,855,572	4.3%	12.6%	8.4%
February	\$271,404,037	\$290,136,307	\$323,567,838	\$349,157,434	6.9%	11.5%	7.9%
March	\$290,007,835	\$310,994,193	\$345,612,733	\$370,710,548	7.2%	11.1%	7.3%
April	\$325,605,706	\$365,990,169	\$397,807,985	\$438,570,453	12.4%	8.7%	10.2%
May	\$309,365,214	\$314,044,723	\$362,173,093	\$425,951,208	1.5%	15.3%	17.6%
June	\$328,904,617	\$359,111,081	\$396,132,708	\$435,675,200	9.2%	10.3%	10.0%
July	\$372,150,488	\$380,102,838	\$432,208,005	\$492,510,640	2.1%	13.7%	14.0%
August	\$340,668,935	\$382,483,774	\$381,888,532	\$434,246,835	12.3%	-0.2%	13.7%
September	\$329,200,277	\$333,740,203	\$376,935,845		1.4%	12.9%	
October	\$327,212,182	\$359,844,099	\$371,473,117		10.0%	3.2%	
November	\$322,977,527	\$347,376,290	\$387,042,874		7.6%	11.4%	
December	\$338,659,583	\$370,913,791	\$388,048,385		9.5%	4.6%	
Totals:	\$3,952,908,579	\$4,228,390,244	\$4,628,780,655	\$3,451,677,891	7.0%	9.5%	11.2%*

Source: Ohio Department of Taxation, estimation by Levin College of Urban Affairs, Cleveland State University. See Appendix B for explanation of estimation techniques. * January through August

Well Activity:

Table 5 summarizes horizontal well activity in strong and moderate counties between 2009 and the second quarter of 2013. Activity is divided into four categories:⁸

- *Permitted*: the well has been permitted but drilling activity has not begun
- *Drilling*: the well is being drilled
- *Drilled*: the well has been drilled but is not in the production phase
- *Producing*: the well is/has been stimulated and is producing gas, natural gas liquids, and/or oil

Permitting and producing activity began to take off during the third quarter of 2011 and all types of well activity grew steadily through 2012 in the strong shale counties. By the end of 2012, the number of horizontal wells drilled in the strong shale counties had increased by 758% from the previous year, while the number of wells permitted had climbed by 482%. During 2013, well permitting continued at a rampant pace, with an additional 164 wells permitted during the second quarter of 2013 alone, an increase of 321% compared to the same quarter of 2012. However, the number of new wells producing oil and gas through the second quarter of 2013 (2) has dropped off compared to the first half of 2012 (46). This reflects the fact that the midstream infrastructure was not yet fully built out.

Table 5: Total Horizontal Wells (Utica and Marcellus)												
Year	Quarter	Strong Counties					Moderate Counties					State Total
		Permitted	Drilling	Drilled	Producing	Total	Permitted	Drilling	Drilled	Producing	Total	
2009	1	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	1	1	0	0	0	0	0	2
	3	2	0	0	0	2	0	0	0	0	0	4
	4	0	0	0	0	0	0	0	0	0	0	0
	Total		2	0	0	1	3	0	0	0	0	0
2010	1	1	0	0	0	1	0	0	0	0	0	2
	2	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	1	1	0	0	0	0	0	2
	4	0	0	2	2	4	0	0	0	0	0	8
	Total		1	0	2	3	6	0	0	0	0	0
Annual Change		-50%	n/a	n/a	200%	100%	n/a	n/a	n/a	n/a	n/a	100%
2011	1	2	0	0	3	5	0	0	0	0	0	10
	2	3	0	3	3	9	0	0	0	0	0	18
	3	7	1	1	16	25	1	0	0	0	1	52
	4	10	0	15	21	46	2	0	2	0	4	100
	Total		22	1	19	43	85	3	0	2	0	5
Annual Change		2100%	n/a	850%	1333%	1317%	n/a	n/a	n/a	n/a	n/a	1400%
2012	1	27	1	23	17	68	2	0	1	1	4	144
	2	39	1	29	29	98	1	0	0	1	2	200
	3	30	2	56	17	105	2	0	0	0	2	214
	4	32	3	55	8	98	0	0	0	0	0	196
	Total		128	7	163	71	369	5	0	1	2	8
Annual Change		482%	600%	758%	65%	334%	67%	n/a	-50%	n/a	60%	319%
2013	1	40	2	66	2	110	0	0	0	0	0	220
	2	164	1	13	0	178	6	0	0	0	6	368
	Annual Change*	209%	50%	52%	-96%	73%	500%	n/a	n/a	-100%	200%	84%

Source: ODNR, Weekly and Cumulative Permitting Activity, <http://oilandgas.ohiodnr.gov/shale#SHALE>; accessed 7.25.13.

* Change between Q1 and Q2 2013 and Q1 and Q2 2012.

Permitted: the well has been permitted the application to drill, but has not begun any drilling activity
Drilling: the well is being drilled
Drilled: the well has been drilled but is not in the production phase yet
Producing: the well is/has been stimulated and is producing oil and/or gas

Natural Gas Prices and Production:

Changes in the monthly Citygate price of natural gas and the price paid by commercial consumers are charted from 2008 through August 2013 using data from the Energy Information Administration (EIA).⁹ Natural gas price trends in Ohio mirror those at the national level, as depicted in Charts 4 and 5. Starting in 2011, both the Citygate and commercial gas prices in Ohio began to dip below the average national prices, although this trend is a bit stronger in commercial gas prices.¹⁰

In both Ohio and the U.S., the average Citygate price of natural gas (-58%, OH; -49%, U.S) and the average price for commercial consumers (-47%, OH; -37%, U.S.) fell precipitously between 2008 and 2011 reflecting the surge in supply of this product. Since shale production took off in Ohio during the third quarter of 2011, average prices for natural gas have remained below the national average. Between 2011 and 2012 the average Citygate price in Ohio fell from \$5.46 to \$4.62. In 2013, this pricing trend accelerated and the gap in prices widened; Ohio's Citygate prices were 85 cents lower than the national average and \$1.12 lower for commercial consumers.

The EIA's data on gross natural gas withdrawals of shale gas between 2008 and 2011 is graphed for Ohio and United States.¹¹ Chart 6 shows the overall increase in shale gas production across the U.S., with gross withdrawals increasing from an average of approximately 240,000 million cubic feet in 2008 to over 700,000 million cubic feet in 2011 (an increase of 196%). By contrast, Ohio's growth in shale gas production did not begin until 2011 and takes off in the third quarter of that year (see Chart 7 and Table 5) with gross gas withdrawals from shale gas reaching 480 million cubic feet in December 2011.¹²

Finally, Chart 8 displays the U.S. Natural Gas Liquid Composite Price (Dollars per Million BTUs) between 2009 and August 2013.¹³ Average prices peaked in 2011 at just over \$15 per million BTUs, fell by 27% in 2012 (\$10.98) and by another 13% through August 2013 (\$9.66).

Chart 6:

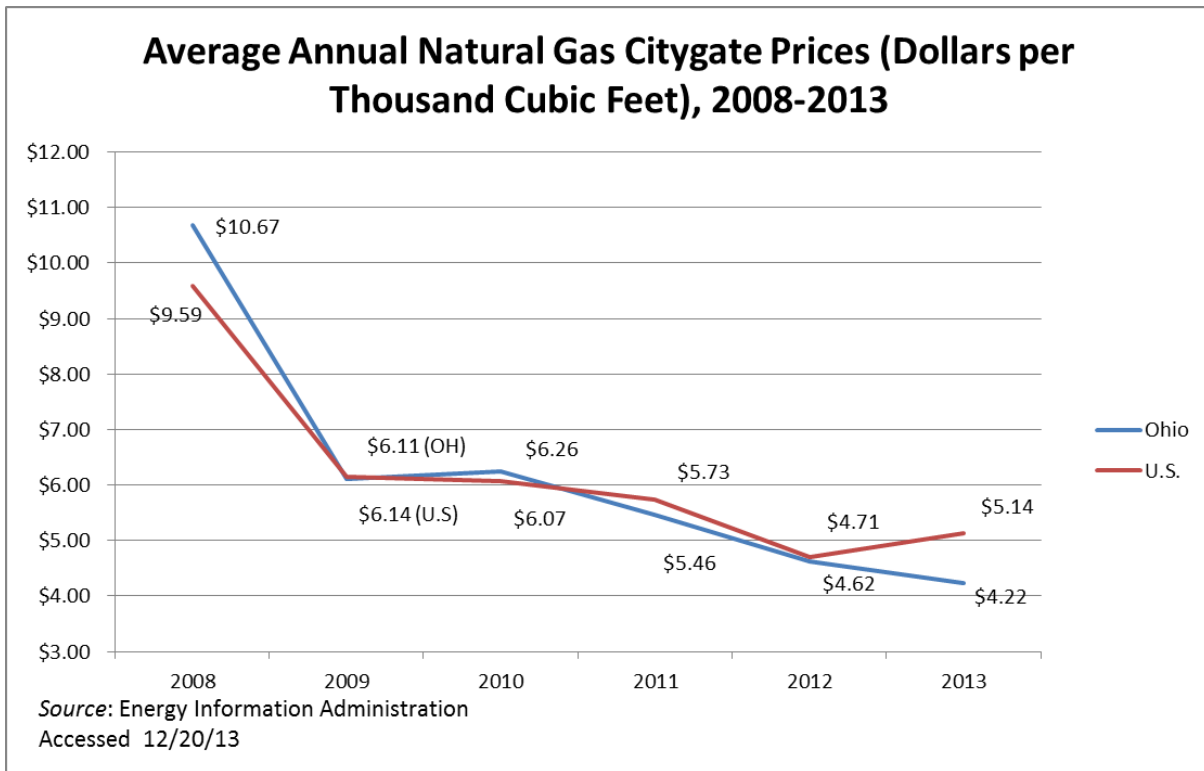


Chart 7:

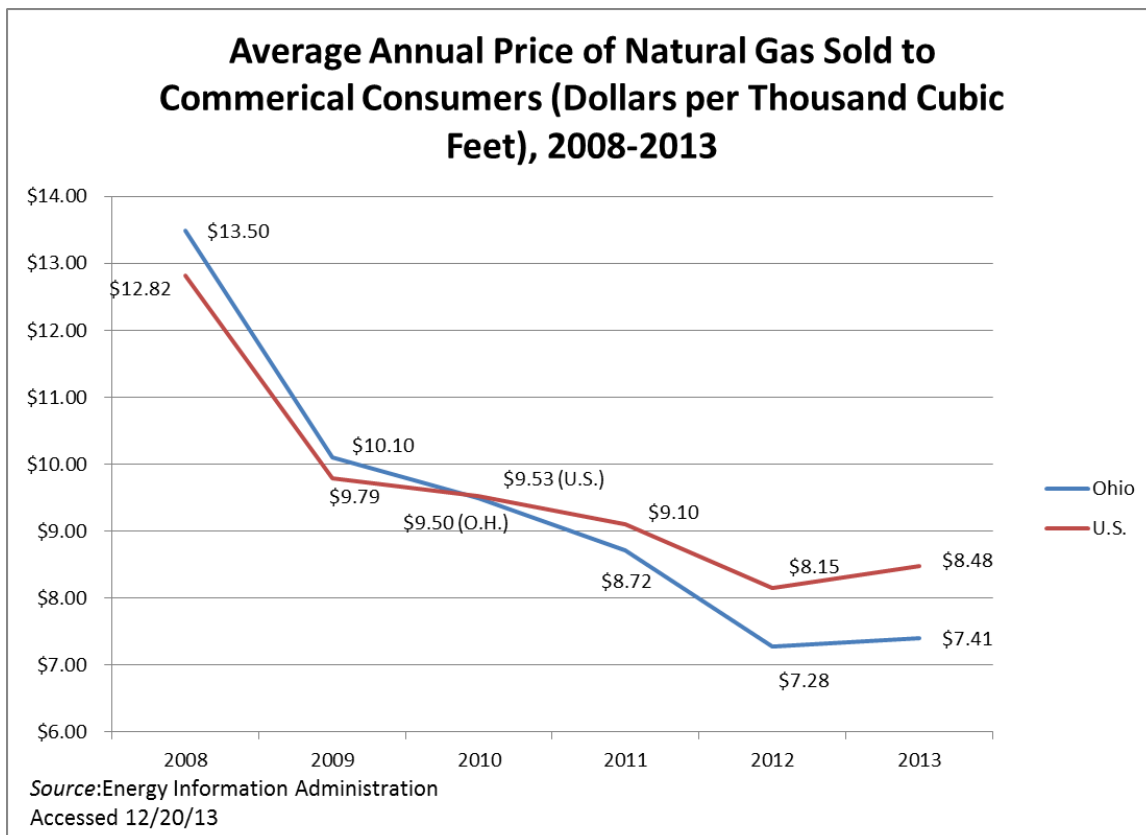


Chart 8:

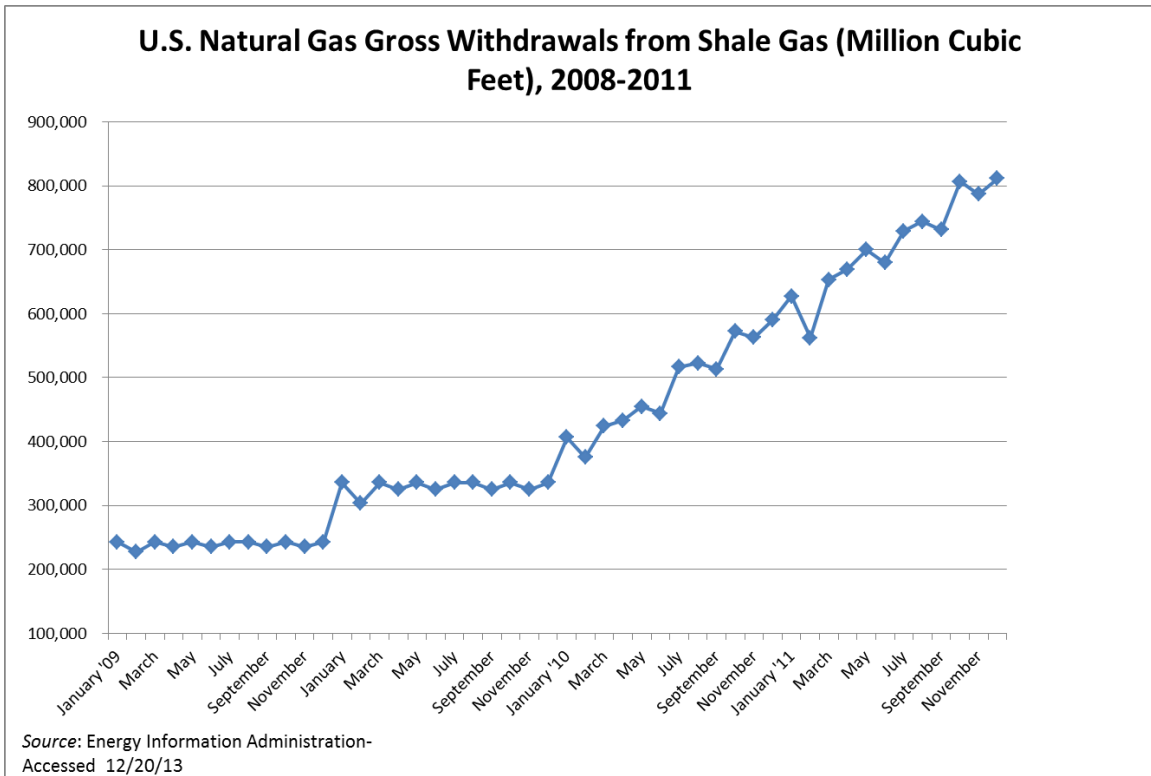


Chart 9:

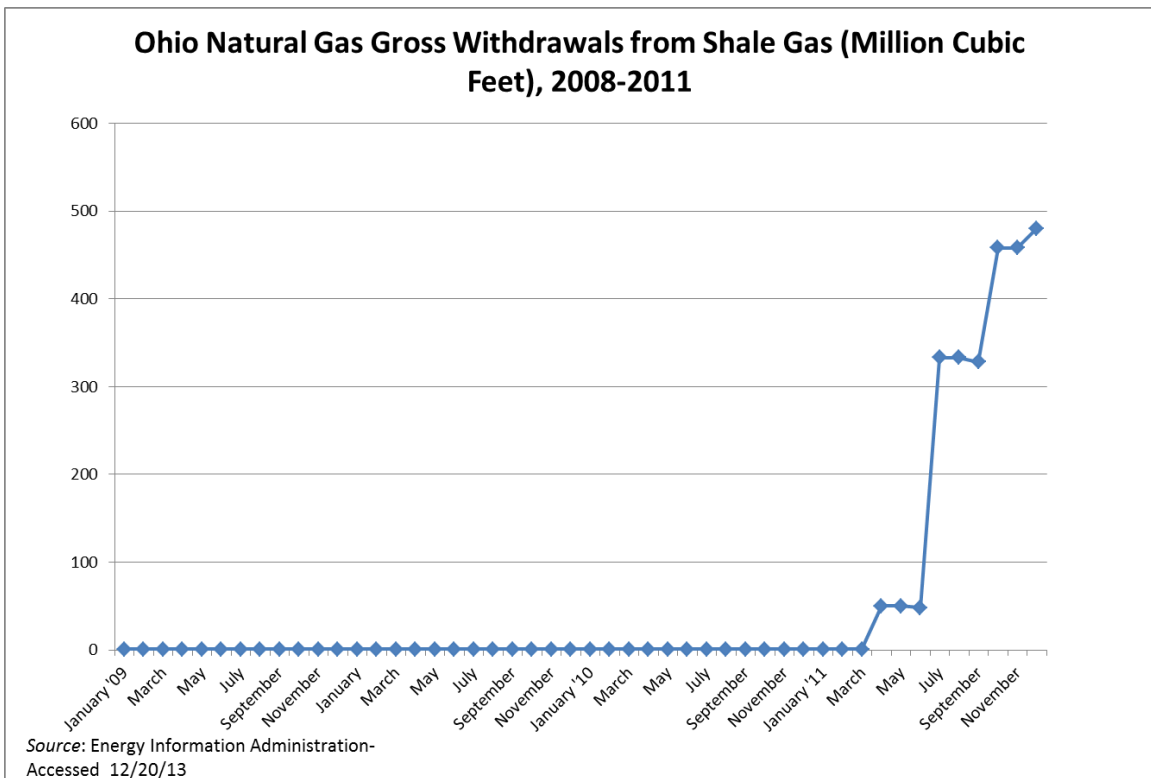
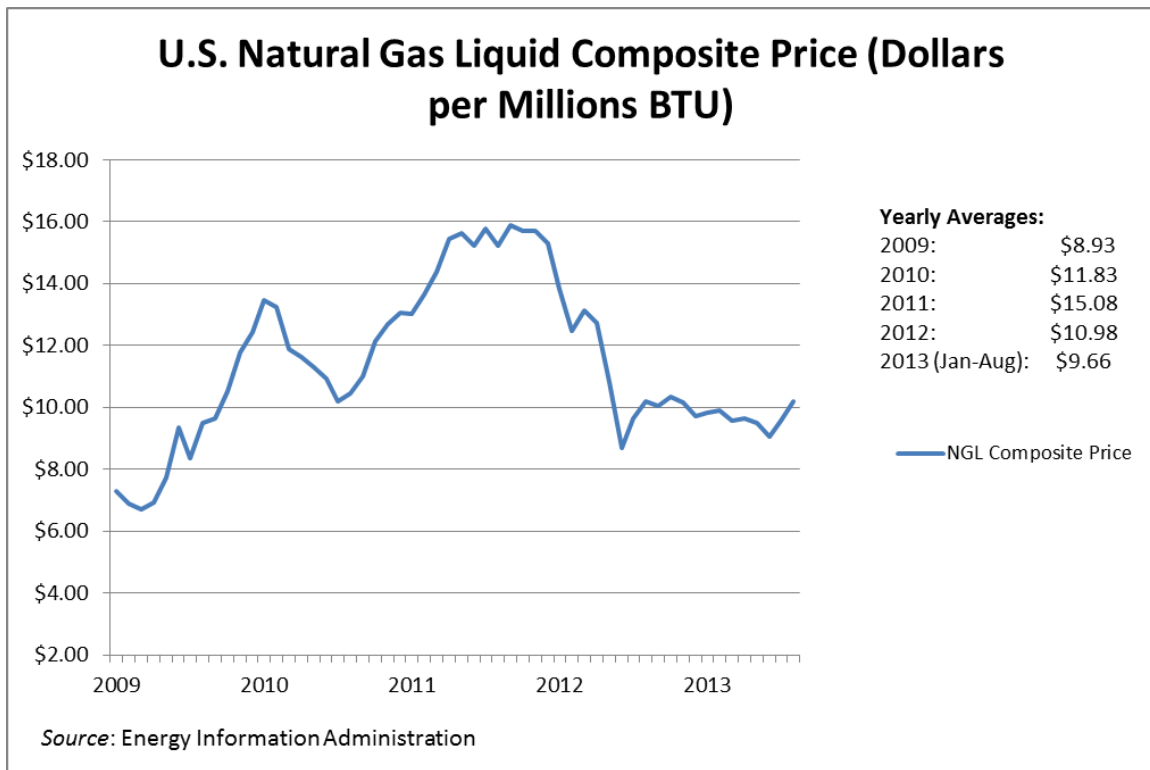


Chart 10:



DISCUSSION AND CONCLUSIONS

Shale oil and gas activity continues to be in the science and data gathering stage of exploration in the State of Ohio, and the midstream-gathering infrastructure is still being built out. The data presented and analyzed within this report offer an initial assessment of how shale oil and gas development is affecting Ohio counties, based on groupings formed by their projected geological formations and current horizontal well activity.

Sales receipts have risen in conjunction with shale activity, with strong shale counties growing the fastest and non-shale counties growing the slowest. It is likely this robust sales growth in the strong and moderate shale counties is being driven by “shaleionaires,” the landowners profiting from leasing their former agricultural land for drilling purposes.

The growth in sales activity during 2012 and Q1 & Q2 of 2013 in strong and moderate shale counties mirrors the uptick in horizontal well activity experienced in these counties during the same time period (Table 3). Total horizontal well activity (including permitting, drilling, and production) in strong shale counties increased by 334% in 2012 and by 82% during the second quarter of 2013, with much of the 2013 growth driven by a flurry of permitting activity (164 in Q2

2013 alone). While this analysis cannot specify the direct impact of shale development on sales activity, there is a relationship between the two variables.

Total employment growth has been much less robust than sales activity in Ohio's shale country. However, strong (0.1%) and moderate (0.2%) shale counties did experience very modest growth in total employment growth during the second quarter of 2013, while all other county groups experienced small declines in total employment- weak (-0.1%) and non-shale (-1.6%). This muted employment growth can be attributed to several factors. First, as others within the shale arena have noted, Ohio's workforce is still being trained and prepared to work within the oil and gas industry.¹⁴ Second, as the midstream development -- "the system of pipelines and processing plants that will take the hydrocarbons from the well pad to the end-user, whether it's a chemical company, a refinery or your BBQ grill"-- continues and improves market access over the next several years, production numbers are predicted to continue rising and associated job growth will accompany these developments.¹⁵ Lastly, the employment data analyzed here reflects total employment in Ohio counties and does not specifically focus on sectors or industries (i.e. manufacturing, construction, transportation) that are more likely to be more directly impacted by shale development.

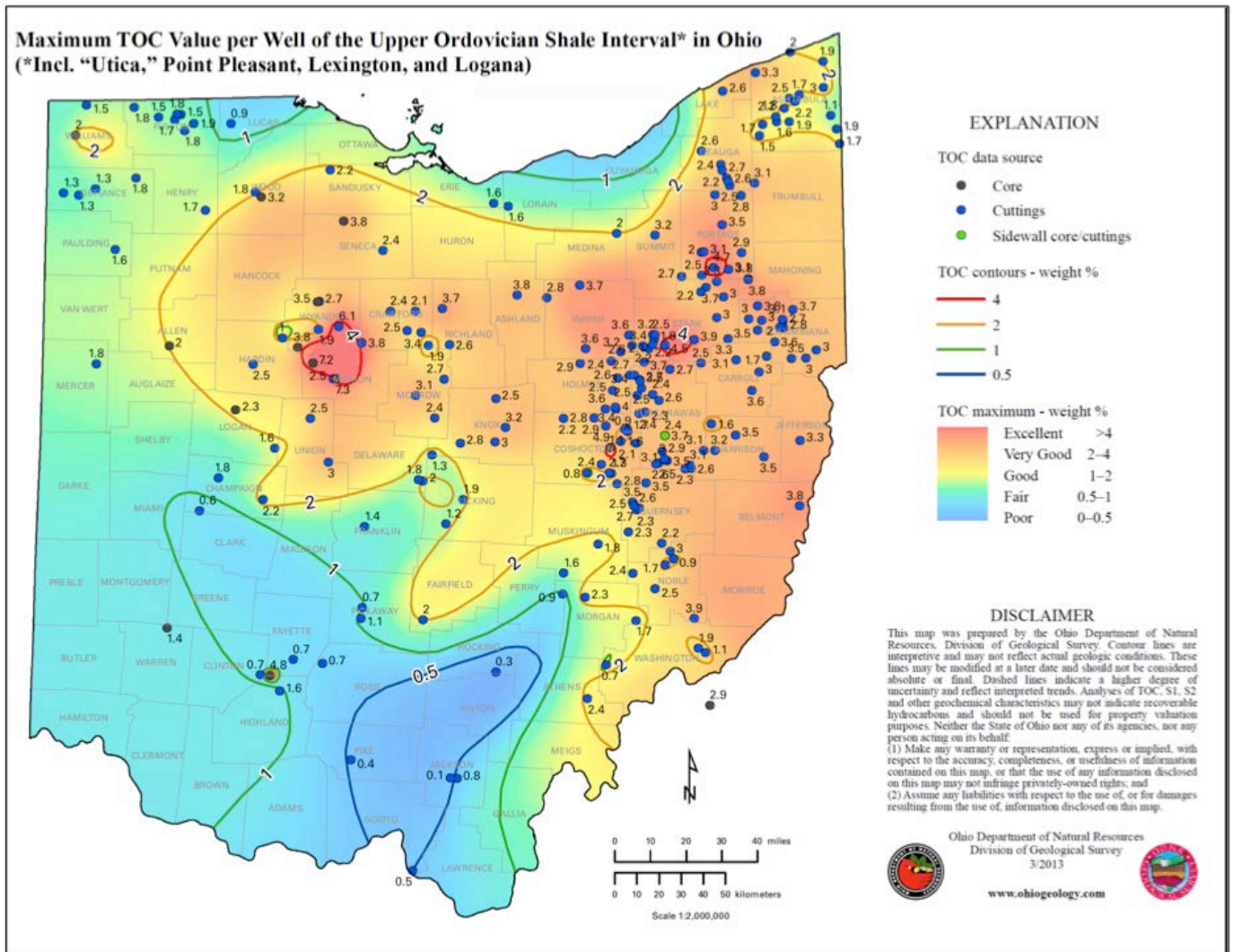
Critical to the development of the natural gas resources in Ohio is the price of natural gas liquids (NGLs) and dry gas or methane. With the advent of horizontal drilling and hydraulic fracking technologies, large volumes of dry natural gas can be extracted from a number of shale formations throughout the country. Despite the fact that the price of dry gas has increased from \$3 to about \$5 per thousand cubic feet (nationally), it is unlikely to rise until the conversion of the U.S. economy from a predominantly oil and coal powered economy to natural gas power is further along.

The various shale gas fields, or plays, will be developed based on the value of their component resources—oil, NGLs, and dry gas. The excitement over the Utica Shale in Ohio is based on the limited presence of oil in the formation and the much more extensive presence of NGLs. However, the degree to which the presence of NGLs changes the mid-term economic landscape of Ohio depends in no small part on where the NGLs are processed. This is especially so for ethane, a critical building block of industrial plastics. Large benefits will be reaped if ethane is "cracked" into its commercially valuable components in or close to Ohio. Potential benefits will be reduced if it is barged or piped to Louisiana or Texas.

In September 2013, U.K.-based Velosys announced its intent to build a plant to convert natural gas to diesel fuel and other liquids in Ashtabula, Ohio. In November 2013, Brazil's Odebrecht announced Project ASCENT (Appalachian Shale Cracker Enterprise) to build an ethane cracker and three polyethylene plants in West Virginia. *Plastic's News* reported that Canada's NOVA Chemicals Corp was able to convert ethane from the Marcellus shale basin to ethylene. As a result, the company intends to increase the amount of ethane it uses in its Corunna, Ontario, ethylene plant and to expand the capacity of its Corruna cracker at the same location by 20 percent by 2018. Finally, in December 2013, Shell rolled over its option on land near Pittsburgh for the third time. Shell committed to begin clearing the site in the first quarter of 2014, however, the company has not publicly announced a decision on an ethylene cracker. Its announcement came weeks after Shell said it was pulling out of a similar investment in Louisiana. The length of this option was reported by the *Pittsburgh Post-Gazette* to be confidential.

Since 2011, Ohio natural gas production has been increasing, but remains a small fraction of the national supply. As the market for Ohio's natural gas grows with production, so will the economic benefits. Through Q2 of 2013, shale's impact on sales receipts is highly encouraging if employment is able to catch up.

Appendix A: Figures, Charts, and Tables
 Appendix Figure 1¹⁶



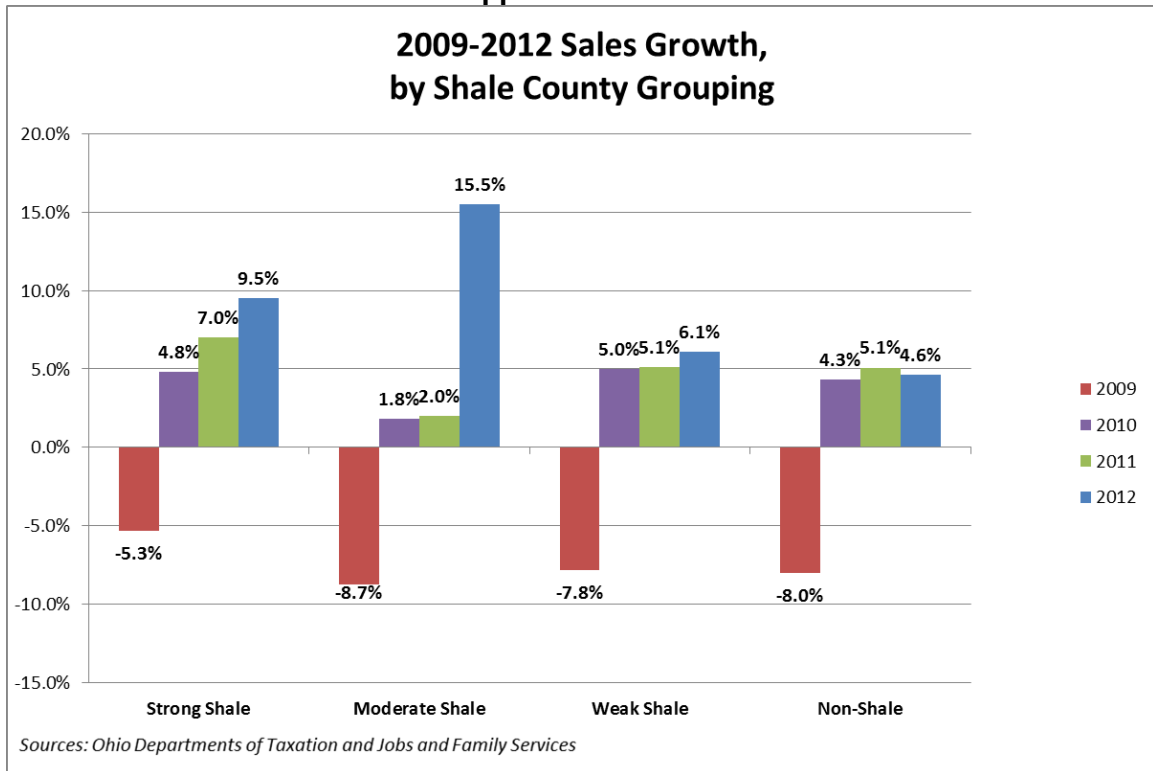
Department of Natural Resources
 Note: TOC is Total Organic Carbon

Changes in County Classification from August 2013 to January 2014		
<u>County</u>	<u>August 2013 Classification</u>	<u>New Classification</u>
Noble	Weak	Strong
Jefferson	Moderate	Strong
Monroe	Moderate	Strong
Mahoning	Strong	Moderate
Portage	Strong	Moderate
Stark	Strong	Moderate
Trumbull	Strong	Moderate
Tuscarawas	Strong	Moderate
Ashtabula	Strong	Weak
Coshocton	Strong	Weak
Geauga	Strong	Weak
Holmes	Moderate	Weak
Knox	Moderate	Weak
Licking	Moderate	Weak
Muskingum	Moderate	Weak
Summit	Moderate	Weak
Washington	Moderate	Weak
Allen	Moderate	Non-Shale
Athens	Moderate	Non-Shale
Hancock	Moderate	Non-Shale
Hardin	Moderate	Non-Shale
Logan	Moderate	Non-Shale
Meigs	Moderate	Non-Shale
Putnam	Moderate	Non-Shale
Sandusky	Moderate	Non-Shale
Williams	Moderate	Non-Shale
Wyandot	Moderate	Non-Shale
Adams	Weak	Non-Shale
Auglaize	Weak	Non-Shale
Brown	Weak	Non-Shale
Butler	Weak	Non-Shale
Champaign	Weak	Non-Shale
Clark	Weak	Non-Shale
Clermont	Weak	Non-Shale
Clinton	Weak	Non-Shale
Darke	Weak	Non-Shale

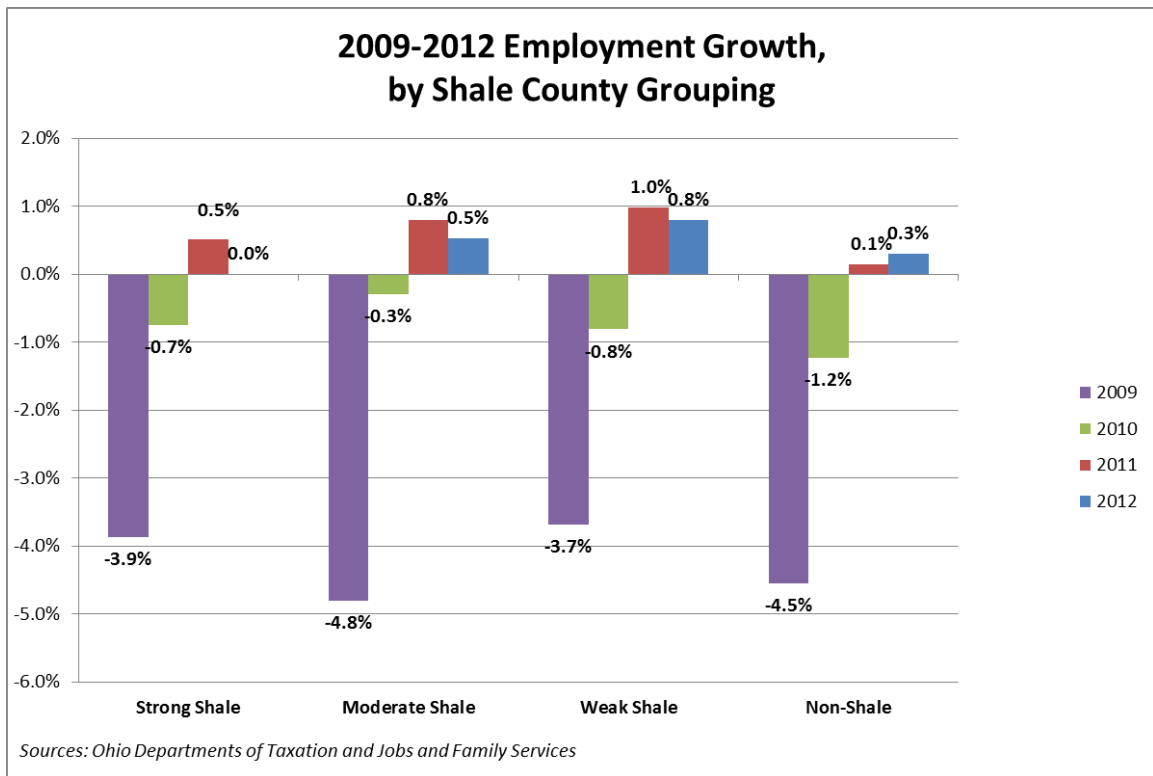
Ohio Utica Shale Gas Monitor: January 2014

Defiance	Weak	Non-Shale
Erie	Weak	Non-Shale
Fayette	Weak	Non-Shale
Fulton	Weak	Non-Shale
Gallia	Weak	Non-Shale
Greene	Weak	Non-Shale
Hamilton	Weak	Non-Shale
Henry	Weak	Non-Shale
Highland	Weak	Non-Shale
Lucas	Weak	Non-Shale
Mercer	Weak	Non-Shale
Miami	Weak	Non-Shale
Montgomery	Weak	Non-Shale
Ottawa	Weak	Non-Shale
Paulding	Weak	Non-Shale
Preble	Weak	Non-Shale
Shelby	Weak	Non-Shale
Van Wert	Weak	Non-Shale
Warren	Weak	Non-Shale
Wood	Weak	Non-Shale
<i>Note: Counties not listed did not change groups</i>		

Appendix Chart 1



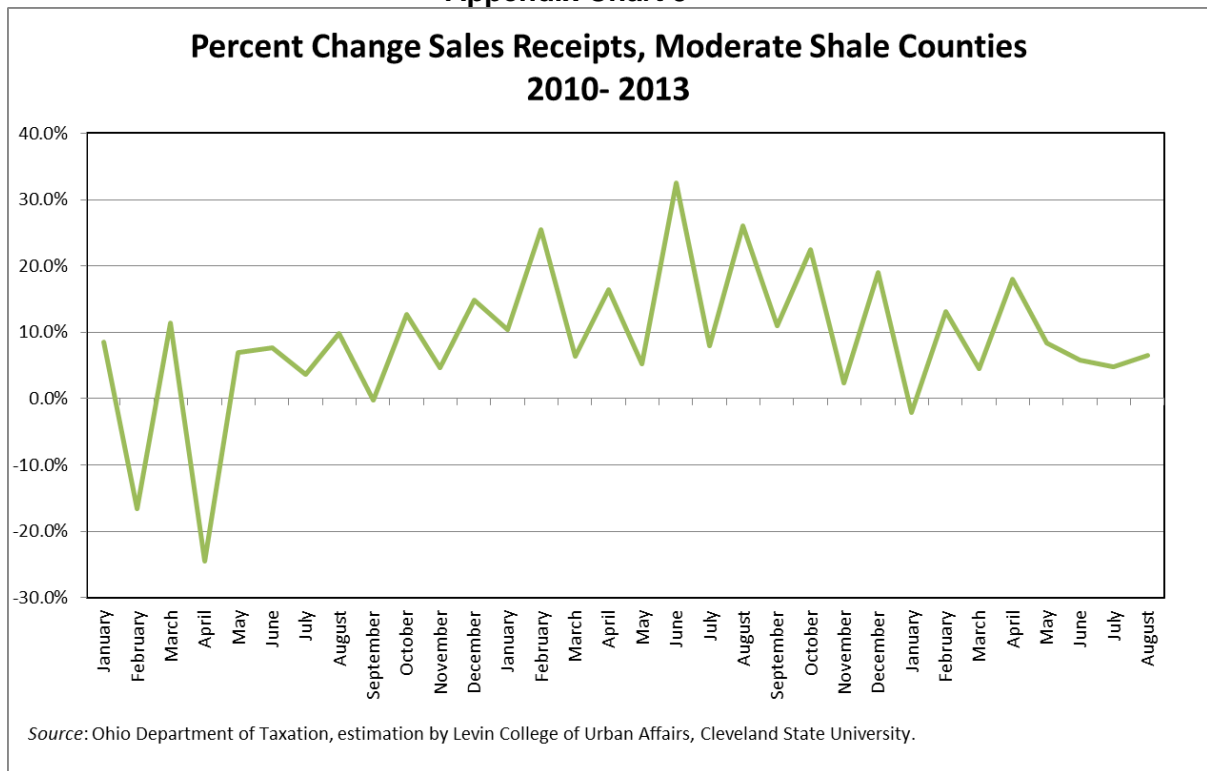
Appendix Chart 2



Appendix Table 2: Total Monthly Sales Receipts, Moderate Shale Counties							
					12 month Percent Change		
	2010	2011	2012	2013	2010-2011	2011-2012	2012-2013
January	\$831,275,628	\$901,886,698	\$995,851,265	\$975,386,216	8.5%	10.4%	-2.1%
February	\$732,381,843	\$610,410,246	\$766,215,808	\$867,330,240	-16.7%	25.5%	13.2%
March	\$571,884,280	\$636,743,333	\$677,147,930	\$708,011,789	11.3%	6.3%	4.6%
April	\$1,026,610,654	\$774,638,863	\$901,717,292	\$1,063,542,236	-24.5%	16.4%	17.9%
May	\$647,943,966	\$693,148,631	\$729,793,251	\$791,511,853	7.0%	5.3%	8.5%
June	\$684,486,924	\$736,717,375	\$976,220,898	\$1,032,840,860	7.6%	32.5%	5.8%
July	\$768,760,662	\$796,388,048	\$859,506,729	\$900,436,885	3.6%	7.9%	4.8%
August	\$695,389,502	\$763,429,787	\$962,430,842	\$1,025,278,671	9.8%	26.1%	6.5%
September	\$689,870,975	\$687,844,714	\$763,762,465		-0.3%	11.0%	
October	\$678,242,157	\$764,830,659	\$936,344,980		12.8%	22.4%	
November	\$673,001,358	\$704,175,361	\$720,997,769		4.6%	2.4%	
December	\$694,399,872	\$797,491,969	\$949,692,080		14.8%	19.1%	
Totals:	\$8,694,247,821	\$8,867,705,684	\$10,239,681,309	\$7,364,338,751	2.0%	15.5%	7.2%*

Source : Ohio Department of Taxation. * January through August

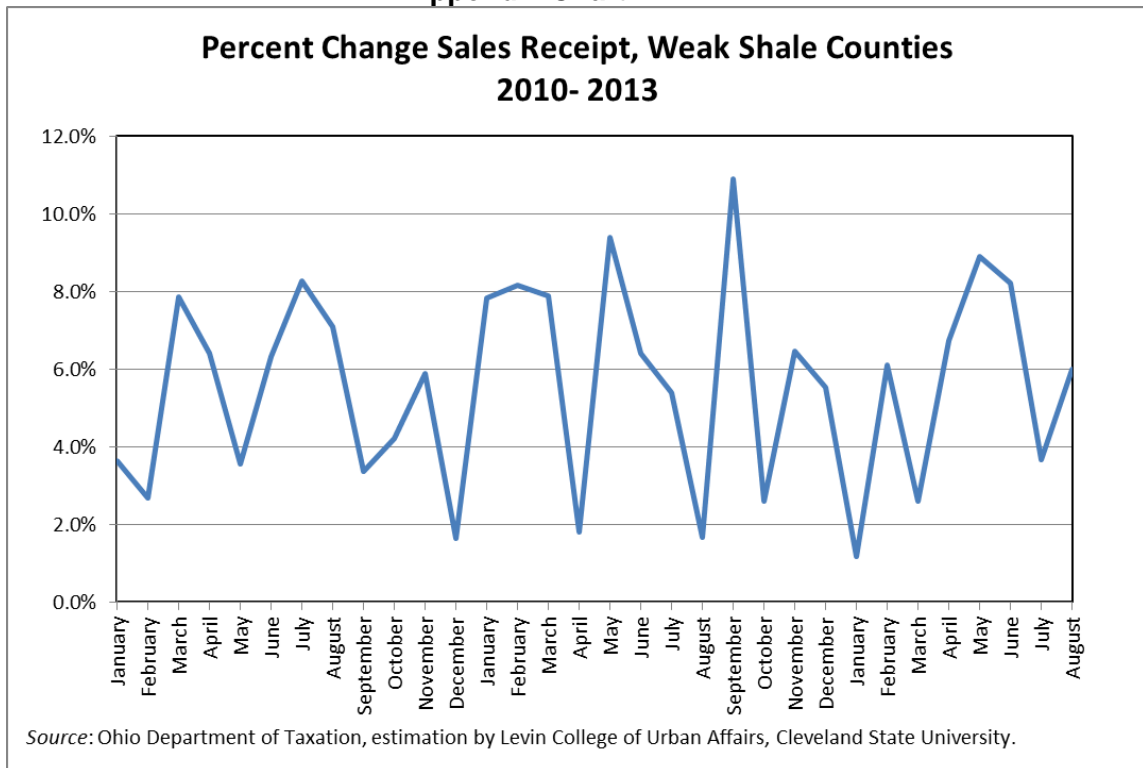
Appendix Chart 3



Appendix Table 3: Total Monthly Sales Receipts, Weak Shale Counties							
					12 month Percent Change		
	2010	2011	2012	2013	2010-2011	2011-2012	2012-2013
January	\$5,924,223,335	\$6,139,733,922	\$6,620,949,001	\$6,698,071,591	3.6%	7.8%	1.2%
February	\$4,195,196,954	\$4,307,765,778	\$4,659,324,122	\$4,944,355,798	2.7%	8.2%	6.1%
March	\$4,149,962,236	\$4,476,350,117	\$4,829,292,797	\$4,955,543,457	7.9%	7.9%	2.6%
April	\$5,030,797,324	\$5,352,439,588	\$5,449,150,424	\$5,815,487,120	6.4%	1.8%	6.7%
May	\$4,490,568,917	\$4,649,854,086	\$5,086,157,413	\$5,538,902,338	3.5%	9.4%	8.9%
June	\$4,737,564,837	\$5,037,475,909	\$5,360,761,835	\$5,801,443,691	6.3%	6.4%	8.2%
July	\$5,223,021,083	\$5,654,311,688	\$5,959,433,078	\$6,177,416,963	8.3%	5.4%	3.7%
August	\$4,789,316,765	\$5,128,411,936	\$5,214,323,745	\$5,526,762,896	7.1%	1.7%	6.0%
September	\$4,651,089,945	\$4,807,253,150	\$5,331,690,641		3.4%	10.9%	
October	\$4,911,816,689	\$5,118,838,551	\$5,251,495,709		4.2%	2.6%	
November	\$4,647,049,664	\$4,920,501,019	\$5,238,544,330		5.9%	6.5%	
December	\$4,914,190,141	\$4,995,348,363	\$5,271,968,945		1.7%	5.5%	
Totals:	\$57,664,797,890	\$60,588,284,107	\$64,273,092,038	\$45,457,983,855	5.1%	6.1%	5.3%*

Source: Ohio Department of Taxation. * January through August

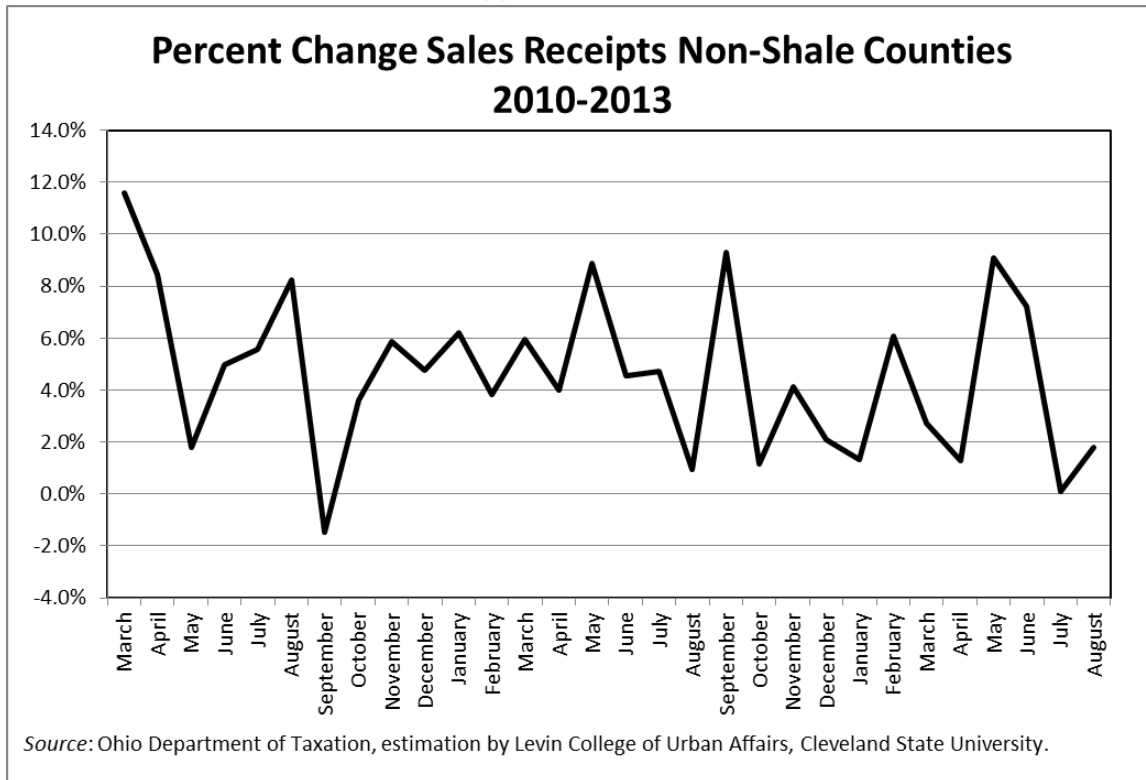
Appendix Chart 4



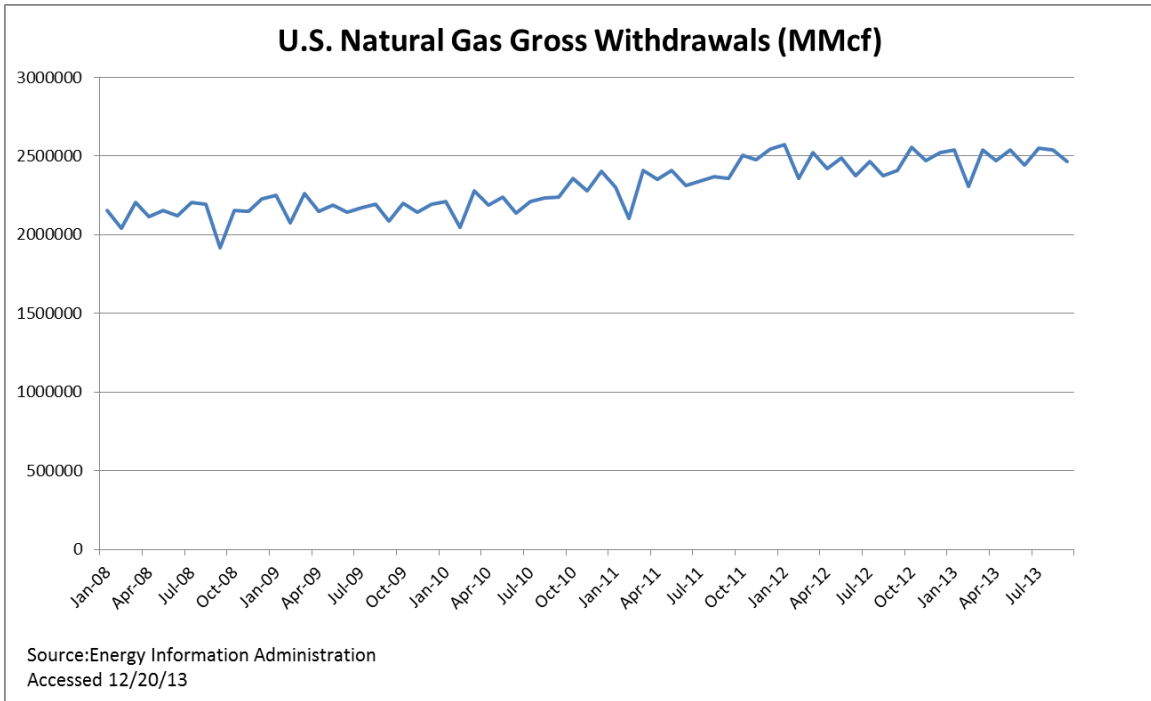
Appendix Table 4: Estimated Monthly Sales Receipts, Non-Shale Counties							
					12 month Percent Change		
	2010	2011	2012	2013	2010-2011	2011-2012	2012-2013
January	\$4,221,778,467	\$4,357,480,311	\$4,628,238,925	\$4,688,758,636	3.2%	6.2%	1.3%
February	\$2,912,036,083	\$3,080,280,866	\$3,198,055,960	\$3,392,337,548	5.8%	3.8%	6.1%
March	\$2,918,493,227	\$3,257,134,278	\$3,450,634,507	\$3,545,319,429	11.6%	5.9%	2.7%
April	\$3,529,299,348	\$3,826,943,616	\$3,980,455,377	\$4,031,831,373	8.4%	4.0%	1.3%
May	\$3,213,947,005	\$3,272,123,561	\$3,562,246,776	\$3,886,267,673	1.8%	8.9%	9.1%
June	\$3,404,347,737	\$3,574,091,212	\$3,736,762,776	\$4,005,782,077	5.0%	4.6%	7.2%
July	\$3,851,090,991	\$4,065,934,808	\$4,257,613,474	\$4,261,399,003	5.6%	4.7%	0.1%
August	\$3,444,468,022	\$3,727,668,885	\$3,762,651,628	\$3,829,745,542	8.2%	0.9%	1.8%
September	\$3,529,056,612	\$3,476,794,382	\$3,800,773,486		-1.5%	9.3%	
October	\$3,521,143,014	\$3,648,771,929	\$3,691,591,559		3.6%	1.2%	
November	\$3,293,158,870	\$3,486,545,835	\$3,630,956,443		5.9%	4.1%	
December	\$3,472,360,111	\$3,638,207,578	\$3,714,486,197		4.8%	2.1%	
Totals:	\$41,311,179,487	\$43,411,977,260	\$45,414,467,107	\$31,641,441,280	5.1%	4.6%	3.48%*

Source: Ohio Department of Taxation, estimation by Levin College of Urban Affairs, Cleveland State University. See Appendix B for explanation of estimation techniques * January through August

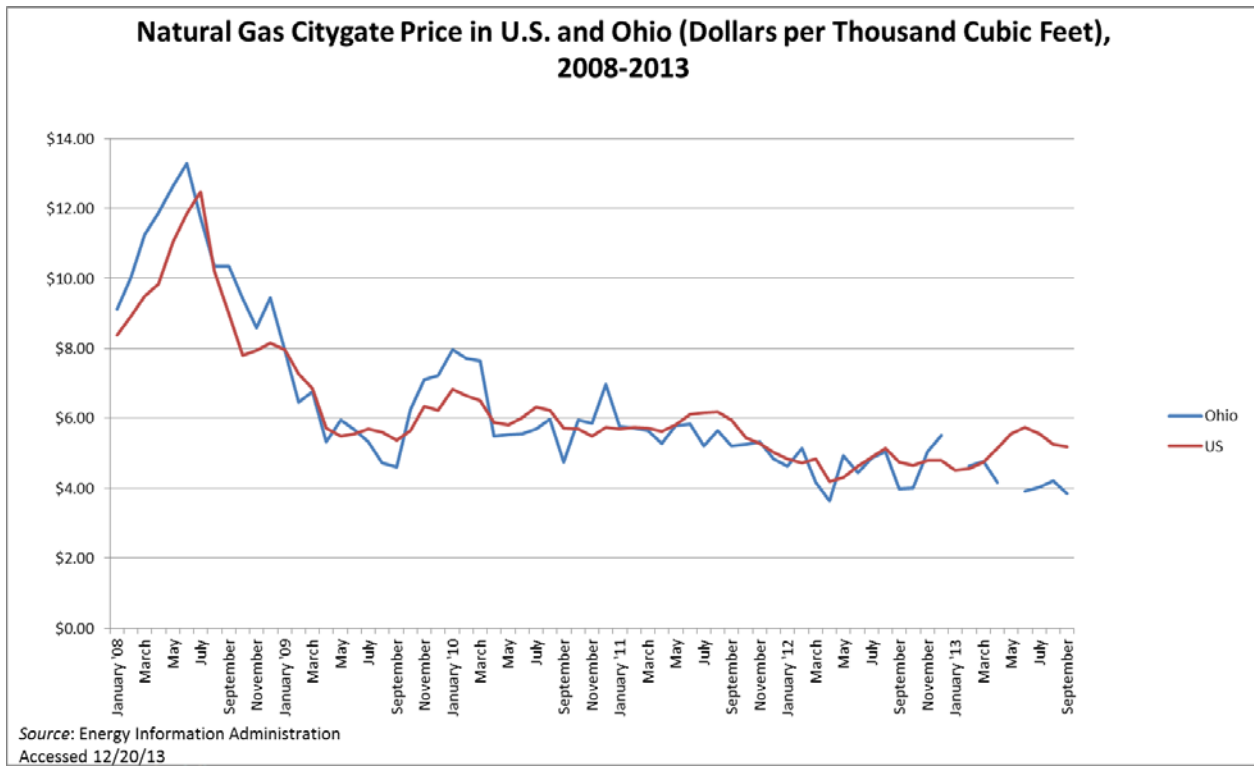
Appendix Chart 5



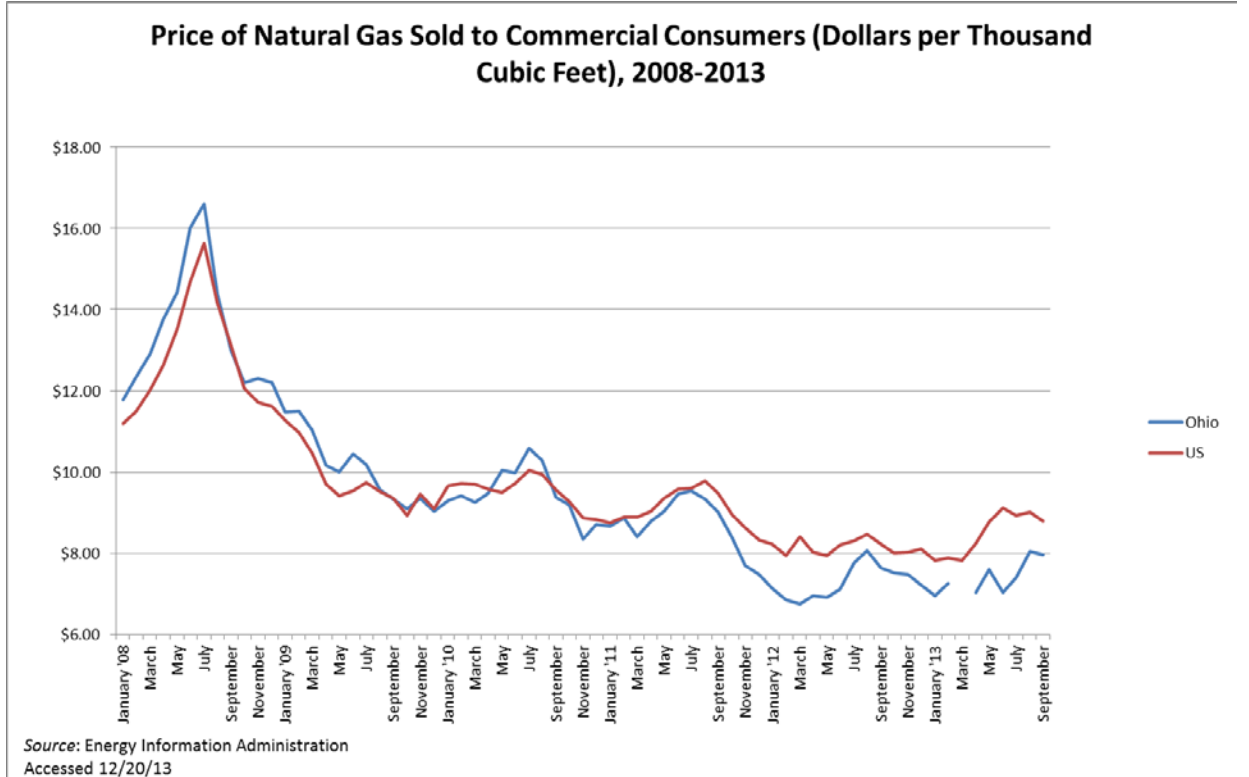
Appendix Chart 6



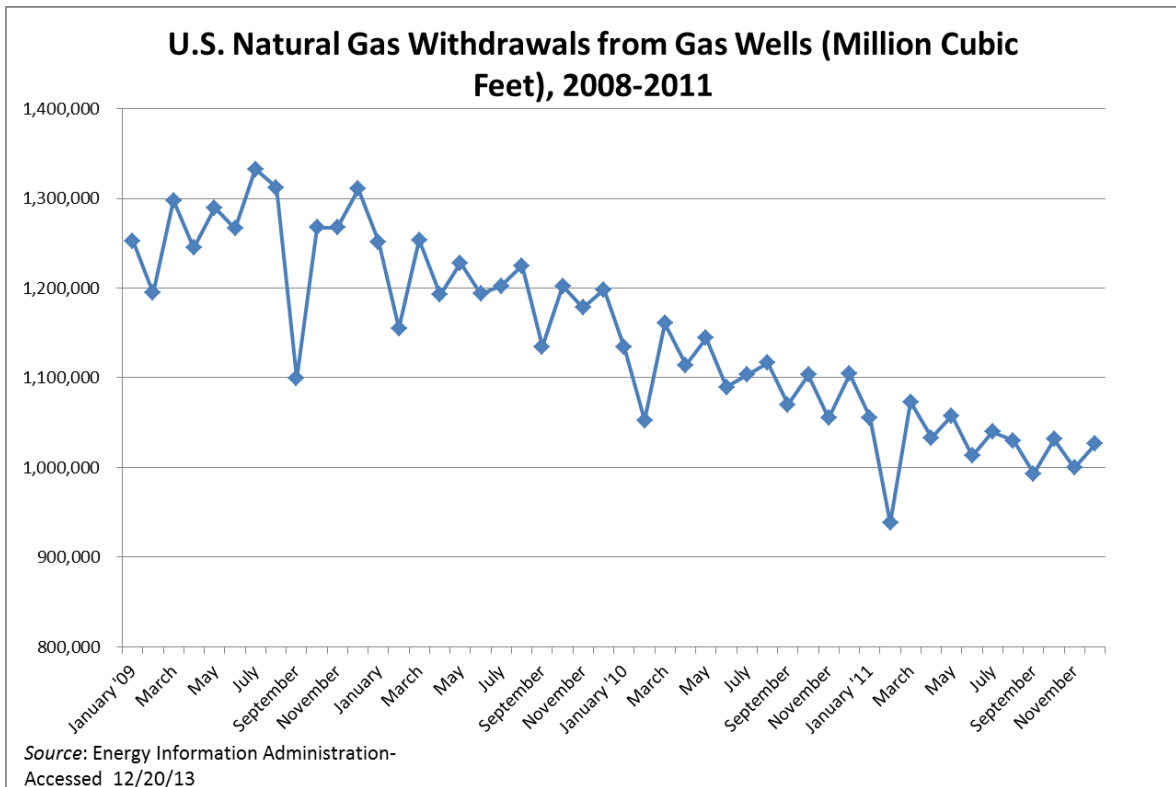
Appendix Chart 7



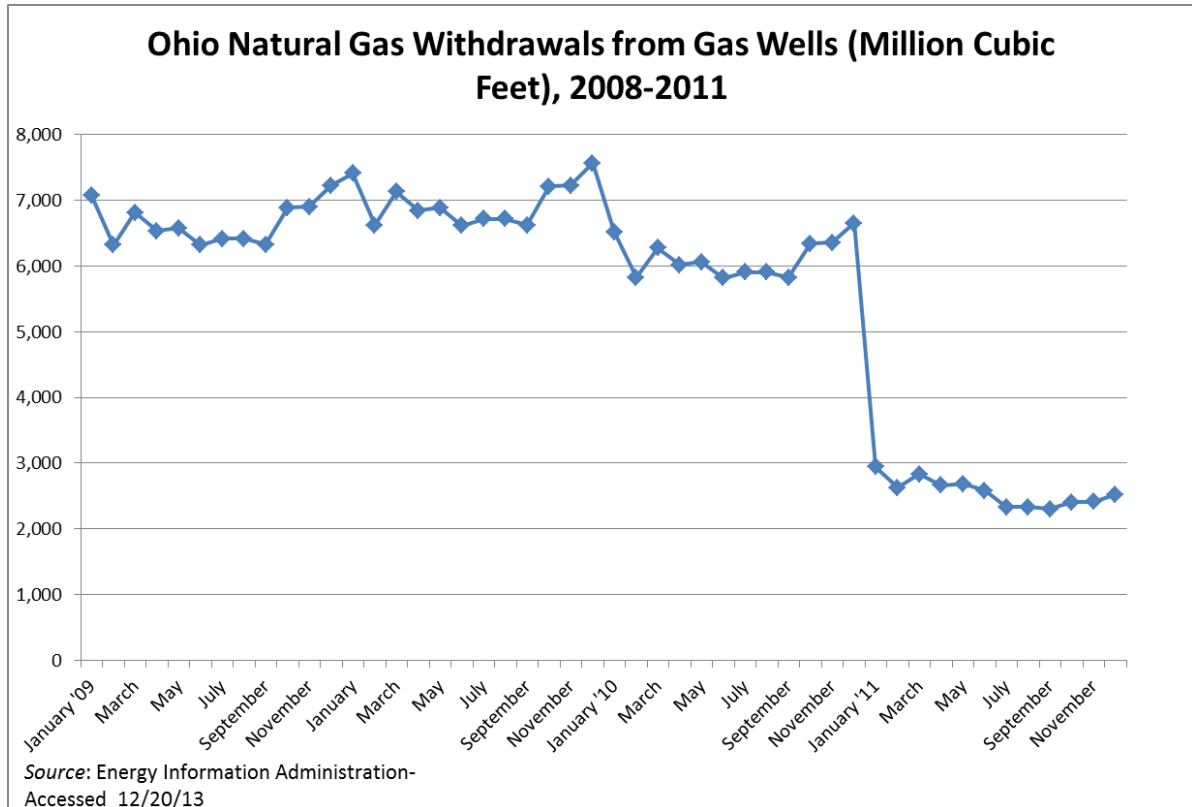
Appendix Chart 8



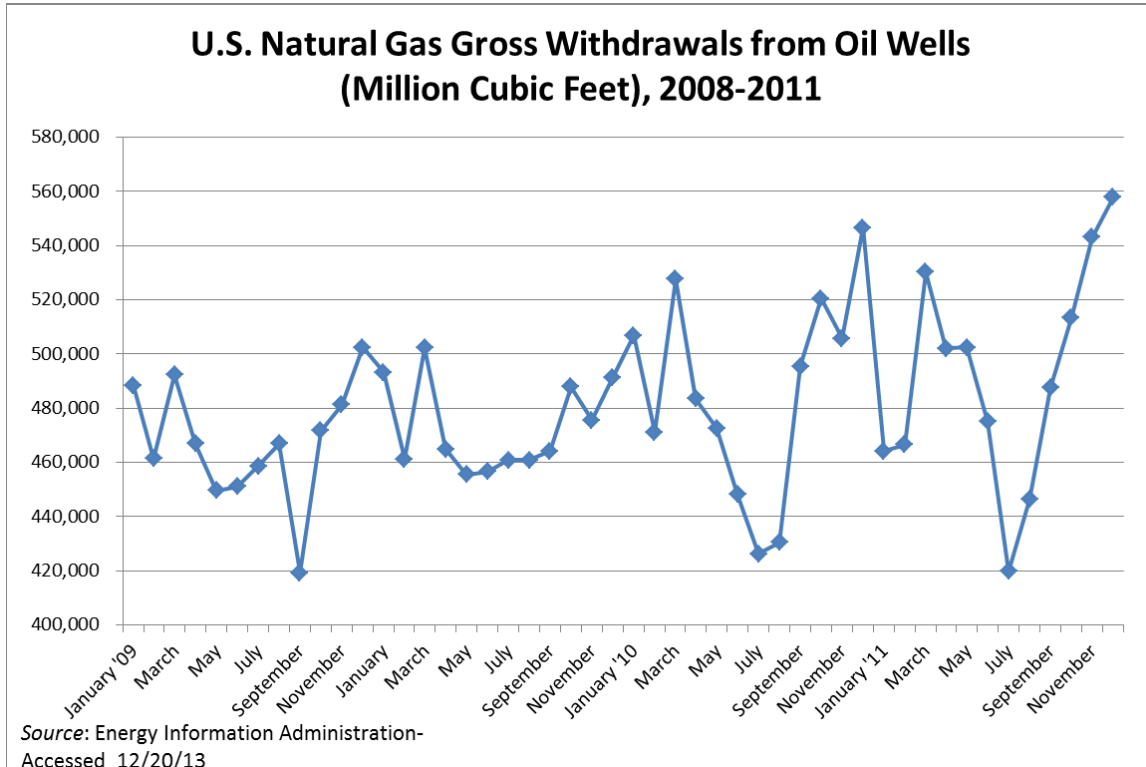
Appendix Chart 9



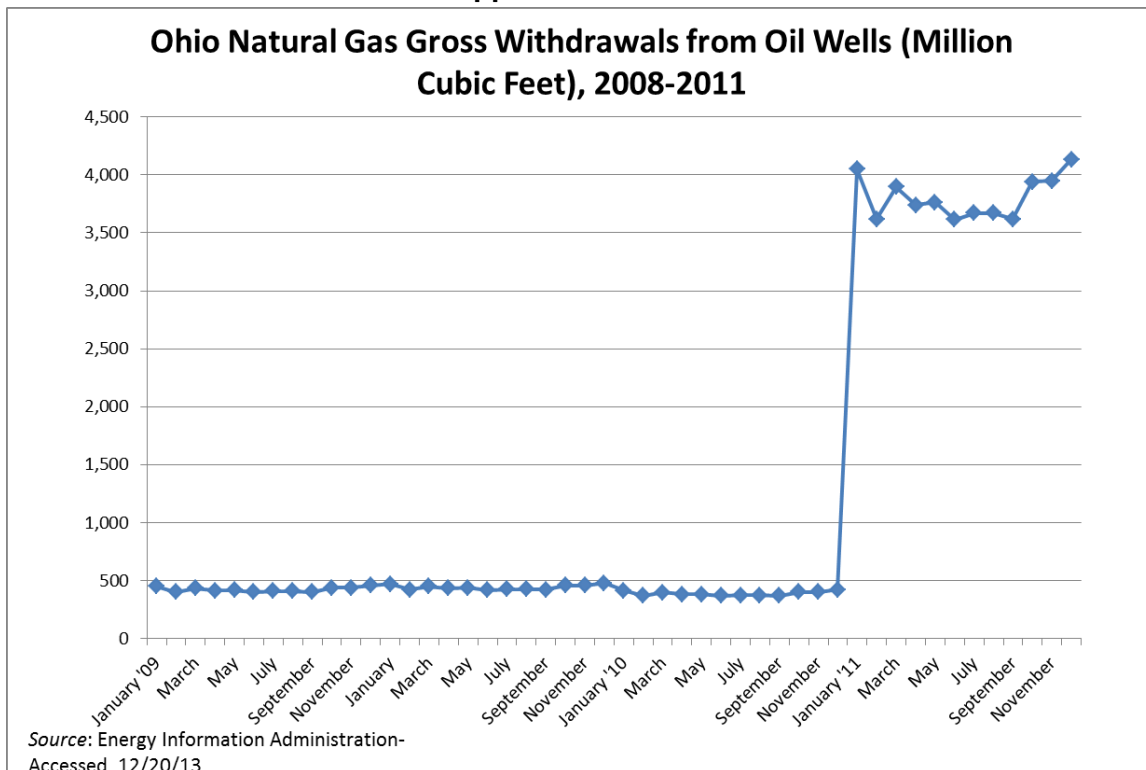
Appendix Chart 10



Appendix Chart 11



Appendix Chart 12



Appendix B: Methodology

The following section outlines the methodology used to group Ohio's counties and to analyze the sales tax and total employment data throughout this report.

Counties were scored based on total well activity and geological formation:

- Counties with 1-5 wells were given a score of 1
- Counties with 6-24 wells were given a score of 2
- Counties with 25 or more wells were given a score of 3
- Counties with very good to excellent geology were given a score of 4.0-4.5
- Counties with fair/good to very good geology were given a score of 3.0-3.75
- Counties with fair to good geology were given a score of 2.0-2.5
- Counties with poor to good geology were given a score of 0.75

The scores were then added together, and counties were grouped based on natural breaks within the distribution. Strong counties are those with a score of 5 or greater, moderate counties between 3 and 5, weak counties between 0.5 and 2.5, and non-shale counties less than 0.5. Well activity (<http://oilandgas.ohiodnr.gov/shale#SHALE>) and geological formation data (http://www.dnr.state.oh.us/Portals/10/Energy/Utica/Ordov-Shale_TOC-Max_03-2013.pdf) were obtained from the Ohio Department of Natural Resources.

Employment data were sourced from the Ohio Department of Jobs and Family Services, Civilian Labor Force Estimate.¹⁷ The employment data are an estimate of the numbers of people who live in the county and are employed, not the number of jobs in the county. In other words, these data are estimated by place of residence instead of place of work.

Sales tax data were gathered from the Ohio Department of Taxation, Sales Tax Distributions.¹⁸ The estimated sales receipts data were derived from the apportionment amounts within the Current and Prior Years' Sales Tax Distribution reports. Sales tax rates are sourced from the County and Regional Transit Authority Permissive Sales and Use Tax Collections and Tax Rates, by Month (S1). Both documents are available from the Ohio Department of Taxation. These reports are inclusive of retail sales activity; business-to-business transactions are generally exempt under the current Ohio legislative code.

In order to estimate **sales receipts** from the **sales tax data**, the sales tax distribution apportionment amounts were divided by the local sales tax rates.¹⁹ This process was performed for each of Ohio's 88 counties for each month between January 2008 and October 2013. Although most shale activity did not commence until 2011, data were collected from the previous three years to allow for comparisons with previous time periods and to be able to identify trends.

Annual calculations: The annual growth rate was determined by summing the twelve months of sales receipts/employment for each of the county groupings and calculating the year-to-year change.

Quarterly calculations: The quarterly growth rate was determined by summing the three months of sales receipts/employment for each of the county groupings and calculating the year-to-year change. In other words, the quarterly growth rates for sales receipts and employment are based on the change from the same quarter in the previous year. For example, the Q1 2013 growth rate is based on the increase/decrease from Q1 2012.

Monthly calculations: The 12-month percent change for sales receipts and employment are based on the change from the same month in the previous year.

Endnotes

¹ Thomas, A.R. et al. (2011). "An Analysis of the Economic Potential for Shale Formations in Ohio." Ohio Shale Coalition.

http://urban.csuohio.edu/publications/center/center_for_economic_development/Ec_Impact_Ohio_Utica_Shale_2012.pdf

² Ohio Department of Natural Resources, "Shale Well Drilling and Permitting." Retrieved July 20, 2013, <http://oilandgas.ohiodnr.gov/shale#SHALE>; Ohio Department of Natural Resources, "Maximum TOC Value per Well of the Upper Ordovician Shale Interval in Ohio." Retrieved July 20, 2013, http://www.dnr.state.oh.us/Portals/10/Energy/Utica/Ordov-Shale_TOC-Max_03-2013.pdf.

³ Please refer to Appendix Table 1 for a list of reclassified counties and Appendix B for more information on how counties were reclassified.

⁴ Refer to Appendix B for an explanation of how estimated sales receipts were calculated.

⁵ The National Bureau of Economic Research, "US Business Cycle Expansions and Contractions," <http://www.nber.org/cycles.html>.

⁶ The exception to this is non-shale counties during the third quarter of 2012. A closer examination of the data revealed this growth was driven by a drastic increase of sales receipts (242%) in Pike County during July 2012. According to the Ohio Department of Taxation, this increase was due to taxpayers taking advantage of the Use Tax Amnesty Program, which was in effect between October 1, 2011 and May 1, 2013, and allowed taxpayers to satisfy their past consumer's use tax liability without additional penalty (J. Heckert, personal communication, August 1, 2013).

⁷ Similar charts and tables for the other county groups can be found in Appendix A. Refer to Appendix B for an explanation of how estimated sales receipts were calculated.

⁸ These categories reflect designations made by ODNR in their weekly and cumulative data of shale permitting activity, <http://oilandgas.ohiodnr.gov/shale#SHALE>.

⁹ Energy Information Administration, "Natural Gas Summary," Retrieved August 9, 2013, http://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_soh_m.htm. The Citygate price refers to "[A] point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system" (http://www.eia.gov/dnav/ng/tbldefs/ng_pri_sum_tbldef2.asp). The commercial price refers to "[T]he price of gas used by nonmanufacturing establishments or agencies primarily engaged in the sale of goods or services such as hotels, restaurants, wholesale and retail stores and other service enterprises; and gas used by local, State and Federal agencies engaged in nonmanufacturing activities" (http://www.eia.gov/dnav/ng/tbldefs/ng_pri_sum_tbldef2.asp).

¹⁰ For charts displaying the monthly changes in natural gas prices for both residential and commercial consumers, please refer to Appendix A.

¹¹ EIA data on shale gas production in 2012 was not yet available at the time of this report's publication.

¹² For charts displaying Ohio and U.S. gross withdrawals from gas and oils well, see Appendix A.

¹³ Natural gas liquids (NGLs) include hydrocarbons such as ethane, propane, butane, isobutene, and pentane. According to the EIA, "[T]he natural gas liquids (NGL) composite price is derived from daily Bloomberg spot price data for natural gas liquids at Mont Belvieu, Texas, weighted by gas processing plant production volumes of each product as reported on Form EIA-816, "Monthly Natural Gas Liquids Report" (EIA, Definitions, Sources and Explanatory Notes http://www.eia.gov/dnav/ng/TblDefs/ng_pri_fut_tbldef2.asp). The prices reported are spot prices, or

“[T]he price for a one-time open market transaction for immediate delivery of a specific quantity of product at a specific location where the commodity is purchased "on the spot" at current market rates” (EIA, Definitions, Sources and Explanatory Notes http://www.eia.gov/dnav/ng/TblDefs/ng_pri_fut_tbldef2.asp). Natural gas liquids (NGLs) include hydrocarbons such as ethane, propane, butane, isobutene, and pentane.

¹⁴ Lendel, I. (2013, May 24). “Look for long-term successes from the Utica shale,” <http://www.crainscleveland.com/article/20130524/BLOGS05/130529882/1241/newsletter04>

¹⁵ Samuel, J. (2013, August 2). “What happened to the shale boom?” <http://www.crainscleveland.com/article/20130802/BLOGS05/130739971>; Samuel, J. (2013, June 7). “Don't let those early Utica shale production numbers fool you,” <http://www.crainscleveland.com/article/20130607/BLOGS05/130609880/-1/blogs05>

¹⁶ Ohio Department of Natural Resources, “Maximum TOC Value per Well of the Upper Ordovician Shale Interval in Ohio.” Retrieved July 20, 2013, http://www.dnr.state.oh.us/Portals/10/Energy/Utica/Ordov-Shale_TOC-Max_03-2013.pdf.

¹⁷ Ohio Department of Jobs and Family Services, “Civilian Labor Force Estimates,” <http://ohiolmi.com/asp/laus/vbLaus.htm>.

¹⁸ Ohio Department of Taxation, “Distributions-Sales Tax,” http://www.tax.ohio.gov/government/distributions_sales_.aspx.

¹⁹ The sales tax amounts from the Department of Taxation have two months associated with them: the **month allocated**, which reflects the month the tax was collected, and the **month paid**, which reflects the month the revenue is distributed to the counties. The Department’s website explains that “[B]ecause of the time required to process tax returns and to identify the proper permissive tax amounts for each county and transit authority, the revenue from the monthly collections is distributed to the counties and regional transit authorities in the second month following the collection month. For example, this means that sales made in January are primarily reflected in February collections, which are distributed as revenue to the counties and transit authorities in April.” The months/years displayed in the tables throughout this report reflect the month allocated, or when the tax was collected. Note that this is a change from how the data were reported in the March 2013 version of this report. Additionally, the local sales tax in Stark County expired in July 2011 and was reinstated in April 2012. In order to maintain an unskewed dataset, sales data for Stark County data from October 2011 to June 2012 were estimated using the average growth rate of the five previous months (5.4%).