Destined to Fail

Why the Appalachian Natural Gas Boom Failed to Deliver Jobs & Prosperity and What It Teaches Us

July 2021

Ohio River Valley Institute

Authors

Sean O'Leary, Lead Author
Ohio River Valley Institute
sean@ohiorivervalleyinstitute.org

Greta Shum
University of Washington

Logan Arnold
University of Washington

Tyler Cox
University of Washington

Ben Hunkler
Ohio River Valley Institute

Ohio River Valley Institute
216 Franklin Street, Suite 400
Johnstown, PA 15901
www.ohiorivervalleyinstitute.org

Cover photo: Ted Auch/FracTracker Alliance, 2019

Released July 2021 by the Ohio River Valley Institute.

The Ohio River Valley Institute is an independent, nonprofit research and communications center founded in 2020. We equip the region's residents and decision-makers with the policy research and practical tools they need to advance long-term solutions to some of Appalachia's most significant challenges. Our work includes in-depth research, commentary, and analysis, delivered online, by email, and in-person to policy champions, emerging leaders, and a range of community partners.

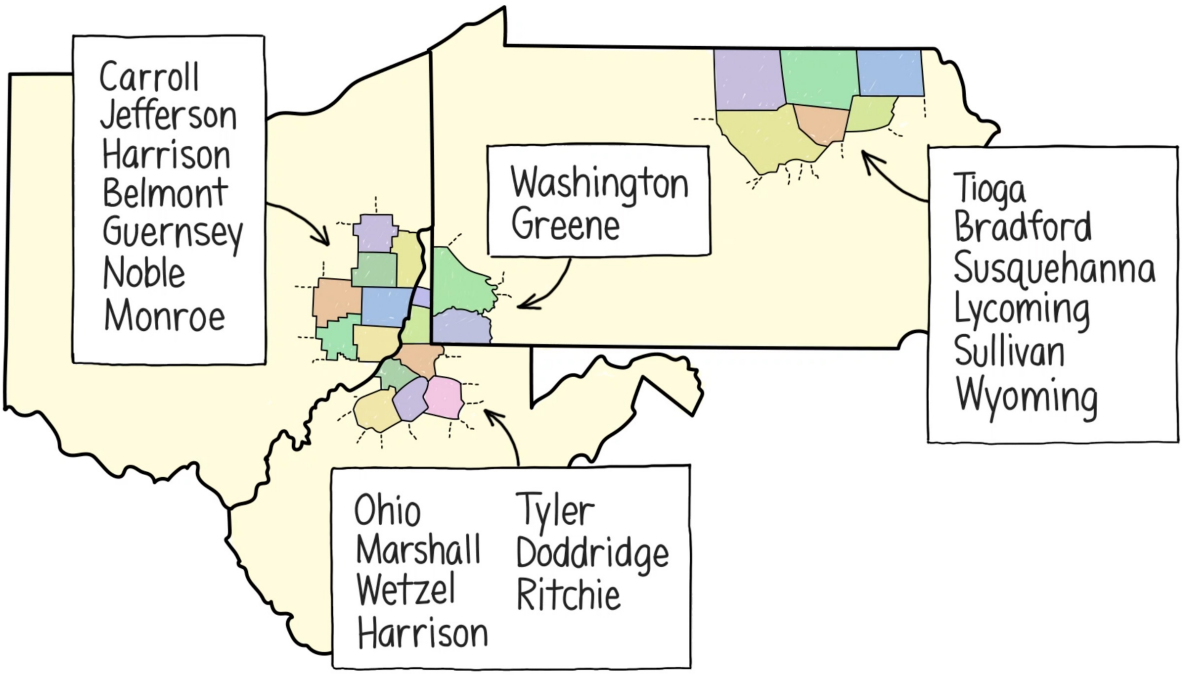
Contents

Ted Auch/FracTracker Alliance

List of Figures

The Bad Deal: Introduction and Executive Summary

Between 2008 and 2019, twenty-two counties in Ohio, Pennsylvania, and West Virginia that produce 90% of Appalachian natural gas badly trailed the nation in key measures of economic prosperity, including growth in jobs, personal income, and population. That's despite the fact that, during this period, economic output grew at a rate three times faster than that of the nation.

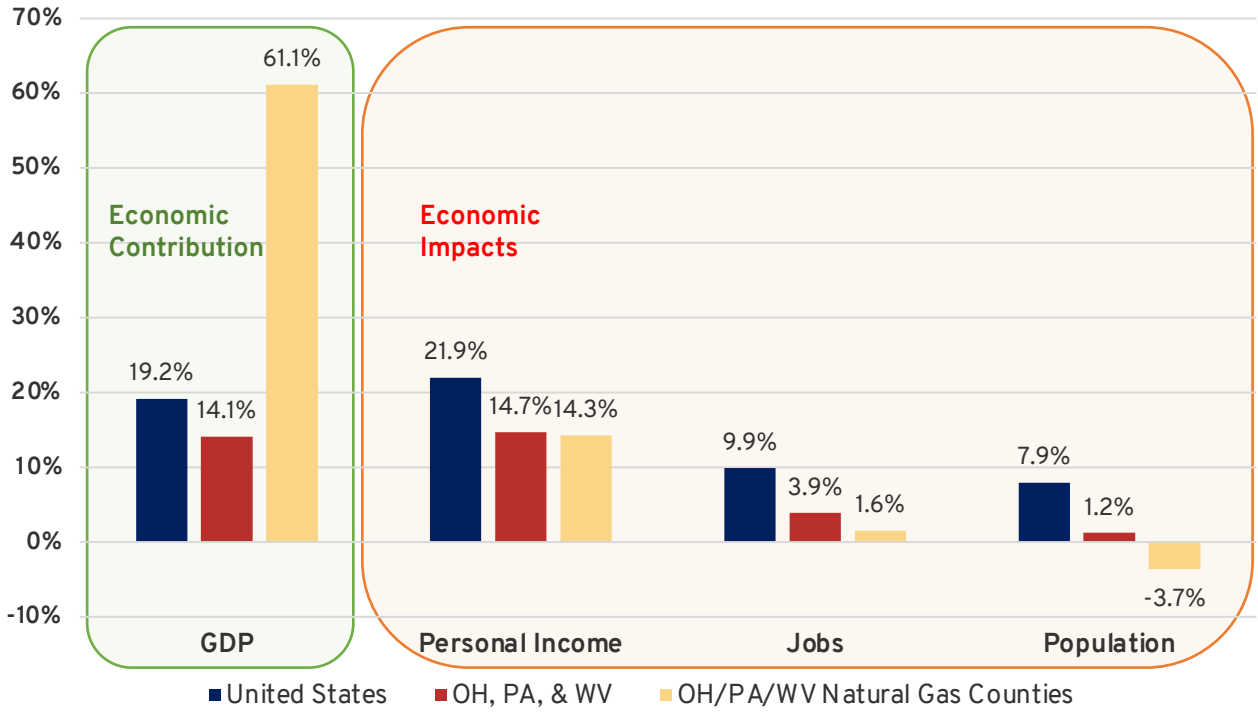


The immense growth in gross domestic product (GDP) in the twenty-two counties we'll call "Frackalachia" was driven by a natural gas production boom, which caused the Mining, quarrying, and oil and gas sector to grow from 4% of Frackalachia's economy in 2008 to 35% in 2019. (As defined by the Bureau of Economic Analysis, the Mining, quarrying, and oil and gas sector encompasses the extraction of mineral solids, liquid minerals, and gases, such as natural gas.)[1]

But, for the counties of Frackalachia, the boom, which reshaped the region's landscape as well pads, pipelines, processing facilities and other gas-related infrastructure proliferated, turned out to be an economic bust and a bad deal that imposed significant burdens on people and communities while giving back little in return.

As the prevalence of the Mining sector increased and output as measured by gross domestic product (GDP) skyrocketed, jobs in Frackalachia increased by just 1.6%—more than eight percentage points below the national average. Personal income growth was a third below the national average, and Frackalachia lost over 37,000 people even as the nation's population was growing by nearly 8% (Fig. 1).

Fig. 1: Change in GDP, Personal Income, Jobs, and Population, 2008—2019 (2019 dollars)



Source: Author's calculation using Quarterly Census of Employment and Wages data

Ohio River Valley Institute

Learning From the Experience

The question is, why did this disconnect between economic growth and key measures of prosperity happen? Can the problems that prevented job and income growth in Frackalachia be fixed, or at least mitigated? And what can the Frackalachian counties and the rest of us learn from the experience to help us come up with better economic development strategies?

This report will answer these questions in detail, but in summary.

- **Very little of the billions of dollars ostensibly invested in Frackalachia and little of the revenue generated by the resulting sales of the natural gas actually entered local economies.** This is demonstrated not just by the failure of personal income to grow at a level commensurate with output growth, but also in analyses of compensation and wage data, which show that, while the Mining, quarrying, and oil and

Ted Auch/FracTracker Alliance

gas extraction sector comprised 35% of Frackalachia's GDP in 2019, it provided less than 10% of the compensation received by workers.

- **Growth in the Mining, quarrying, and oil and gas extraction sector has little effect on other sectors of Frackalachia's economy.** The bulk of the job creation predicted by industry-sponsored economic impact studies was expected to come from indirect and induced employment in other economic sectors. However, after controlling for the immense GDP growth in the mining sector, the rest of the Frackalachian economy grew by just 17% between 2008 and 2019, two percentage points less than the U.S. economy, although slightly better than the economies of Ohio, Pennsylvania, and West Virginia. So, while the fracking boom sent some ripples through the region's economy, those ripples were small and not sufficient to overcome chronically anemic growth

rates in Appalachia and the eastern industrial states of Ohio and Pennsylvania.

- **The factors that depressed job and income multipliers in Frackalachia are largely structural and not easily altered.** Because the natural gas industry is highly capital-intensive and not very labor-intensive, relatively few jobs are created for each dollar invested and earned. Also, with large numbers of trained workers and service providers able to remotely serve the Marcellus and Utica gas plays from outside the region, the demand for indigenous resources is not high. Finally, natural gas prices sank to a lower point and remained lower than most observers expected at the beginning of the decade. Consequently, royalties and other revenues earned by property owners are less than anticipated.

- **While these problems can't be solved, they can be mitigated in ways that could improve the natural gas industry's economic contribution to the region.** States and, to some degree, local governments can take steps to (a) retain more natural gas investment and revenue in their local economies and (b) minimize the negative impacts, including air, soil, water, and noise pollution, that fracking imposes. These steps could include severance taxes and impact fees as well as added regulation of well drilling and operations.

- **The key economic development lesson to take away from the Frackalachian experience is that the region needs to invest in economic development strategies that succeed in the areas where natural gas-based development failed.** Such strategies would focus on development of industries that are labor-intensive rather than capital-intensive, they would leverage the existing business community and institutions, and the industries that are developed would provide annuity benefits in the form of savings and improved quality of life that would serve to compound economic impacts and contribute to an improved atmosphere that is more attractive to prospective businesses and families.

Ted Auch/FracTracker Alliance

The Anatomy of the Bad Deal: Why Frackalachia's Economy Grew but Prosperity Didn't

"What in the hell went wrong?"

—former Belmont County, OH commissioner Mike Bianconi

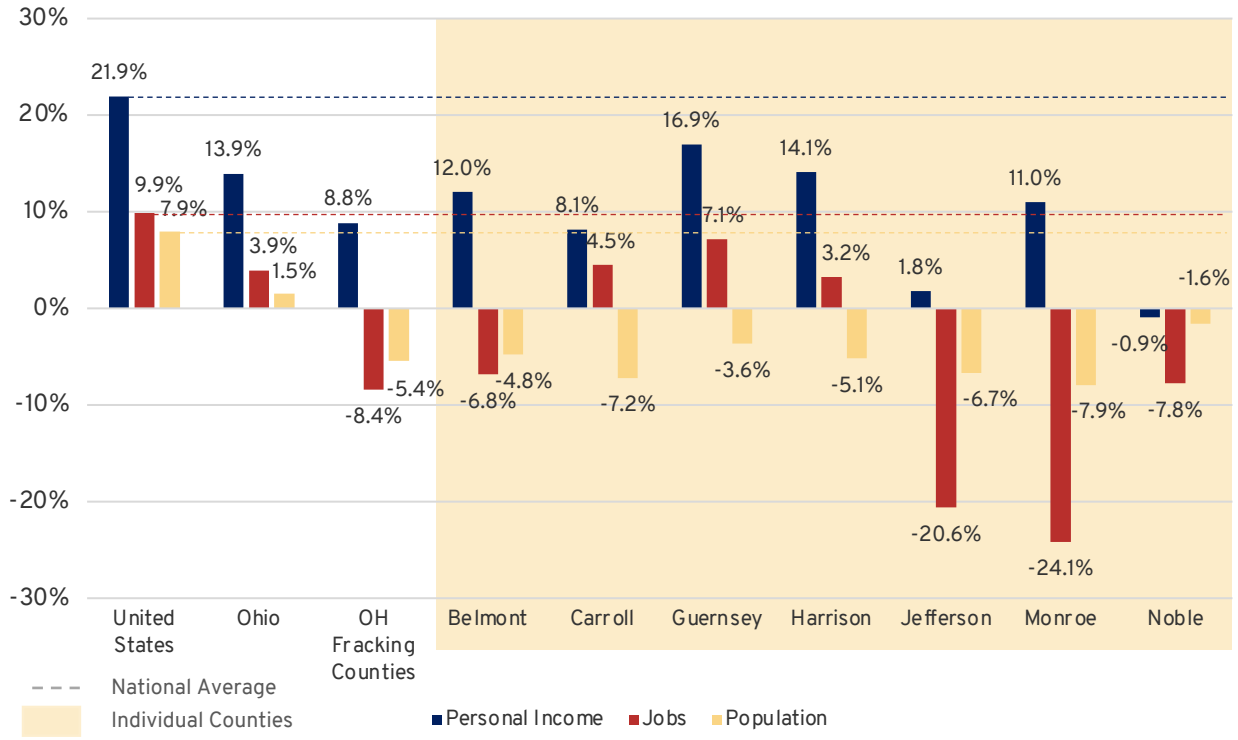
The early 2010s were a time of economic misery for most Americans. The housing market had crashed, millions of mortgages were underwater, unemployment was spiking, and the banking system, the car industry, and other sectors of the economy had to be bailed out by the federal government. But, in the greater Ohio Valley and northern Appalachia, it was a time of optimism and even giddiness because, after decades of decline due to the collapse of the steel industry and the accelerating descent of coal, the region found itself sitting on a world-scale motherlode of natural gas.

Industry-sponsored economic impact analyses were predicting that natural gas development would create more than 450,000 jobs in Ohio, Pennsylvania, and West Virginia. Strangers from traditional oil and gas states, such as Aubrey McClendon, CEO of Chesapeake Energy, were showing up at county commission offices and city council meetings talking of investments of hundreds of millions and sometimes billions of dollars in local counties and communities.

And they followed through! Between 2008 and 2019, the natural gas industry made over $80 billion in upstream, midstream, and downstream investments[2] in Ohio to extract, process, and transport natural gas and its byproducts. And that figure doesn't include the additional billions of revenue generated from the sales of gas.

The combined investment and sales revenue caused economic output in the eastern Ohio counties to grow by an inflation-adjusted 88% during that period, more than four times the national average. Yet, personal income growth during the period, while positive, was less than half the national average, the number of jobs in the seven counties declined by 6,777 and the population dropped twice as much, by 13,795 (Fig. 2).

Fig. 2: Ohio Percent Change in Personal Income, Jobs, and Population, 2008–2019

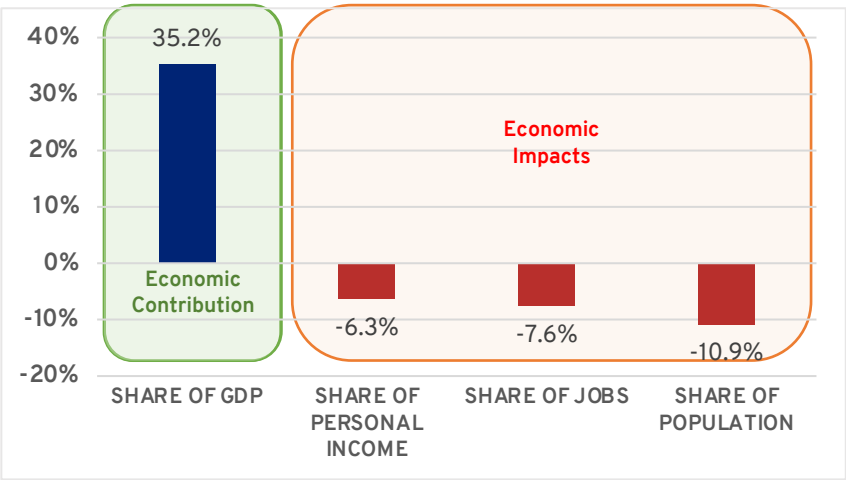


Source: Author's calculation using Quarterly Census of Employment and Wages data

Ohio River Valley Institute

Eastern Ohio is where the disconnect between natural gas-driven GDP growth and measures of prosperity is at its worst, but to one degree or another the disconnect played out across Frackalachia, where GDP soared while shares of the nation's jobs, personal income, and population all shrank (Fig. 3).

Fig. 3: Frackalachia Change in Shares of U.S. Economy, 2008–2019



Source: Author's calculation using Bureau of Economic Analysis data

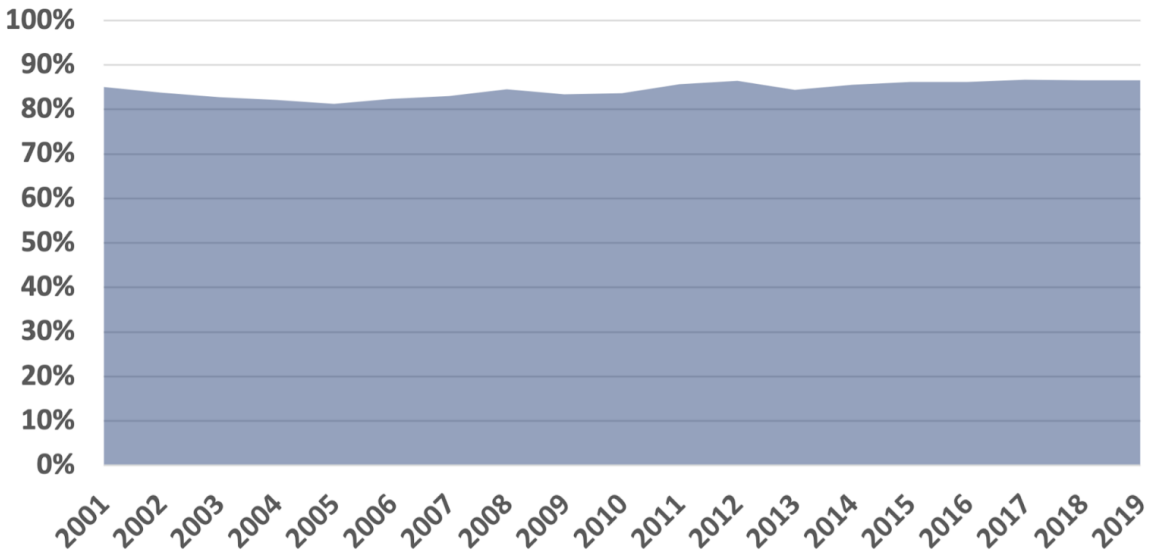
Ohio River Valley Institute

So, what went wrong and where did all that money go?

The Great Disconnect Between Output and Income

In the American economy, personal income—the aggregate amount of everyone's earnings, dividends, and other sources of income—has maintained a highly stable relationship with gross domestic product for decades. Going back more than 50 years, through stock market rallies and recessions, the ratio of personal income to GDP has changed only slightly, creeping up from 80% and 87% of the value produced by the economy is realized as income by the public (Fig. 4).

Fig. 4: U.S. Personal Income-to-Gross Domestic Product (PI:GDP) Ratio, 2001—2019



Source: Bureau of Economic Analysis

While there is some local and regional variation in the relationship between personal income and GDP, it's usually isolated and not very great. That is why, when you look at lists of the top 15 states for per capita GDP and per capita personal income, with just two exceptions, the names are the same.

But, if Frackalachia with its nearly 1 million residents were a state, its relationship between personal income and GDP would be an extreme outlier.

Fig. 5: Per Capita GDP and Personal Income by State, 2019

Per Capita GDP in 2019: Top 15 States		
1	District of Columbia	$ 203,173
2	New York	$ 91,102
3	Massachusetts	$ 86,557
4	Connecticut	$ 80,729
5	Washington	$ 80,500
6	California	$ 79,287
7	Delaware	$ 79,159
8	North Dakota	$ 75,034
	Frackalachia	**$ 74,828**
9	Alaska	$ 74,343
10	New Jersey	$ 71,467
11	Maryland	$ 70,587
12	Illinois	$ 69,886
13	Wyoming	$ 69,839
14	Colorado	$ 68,242
15	Minnesota	$ 68,050
	United States	$ 65,298

Per Capita Personal Income in 2019: Top 15 States		
1	District of Columbia	$ 83,406
2	Connecticut	$ 77,289
3	Massachusetts	$ 74,187
4	New York	$ 71,717
5	New Jersey	$ 70,471
6	California	$ 66,619
7	Washington	$ 64,758
8	Maryland	$ 64,640
9	New Hampshire	$ 63,502
10	Alaska	$ 62,806
11	Wyoming	$ 62,189
12	Colorado	$ 61,157
13	Virginia	$ 59,657
14	Minnesota	$ 58,834
15	Illinois	$ 58,764
	United States	$ 56,490
41	**Frackalachia**	**$ 49,820**

Source: Author's calculation using Bureau of Economic Analysis data

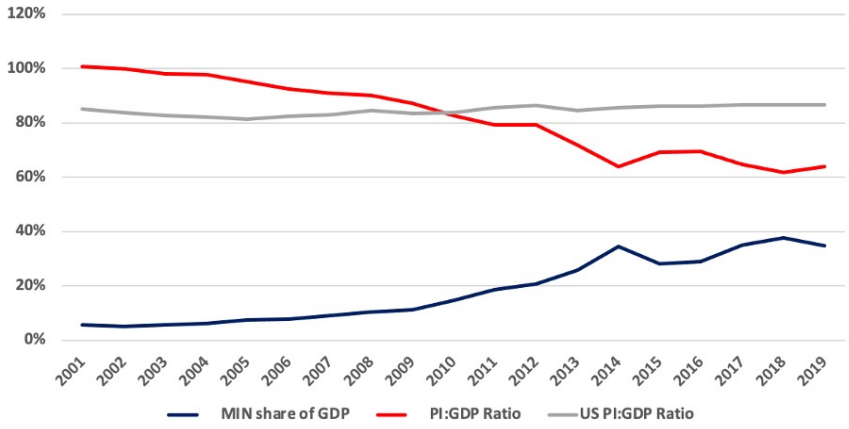
Ohio River Valley Institute

Frackalachia as a state would rank 9th in per capita GDP, putting it in the top quintile for economic output, and 41st in personal income, putting it in the bottom quintile as one of the least prosperous places in the nation (Fig. 5). But Frackalachia's situation wasn't always this way.

The Disconnect Was Caused by the Natural Gas Boom

Back in 2001, Frackalachia's personal income-to-GDP (PI:GDP) ratio actually exceeded the national average. Then, starting in the middle of the decade and accelerating after 2008, Frackalachia's PI:GDP ratio plunged below the national average and eventually reached a level of just 63.9% in 2019. And it did so largely in lock step with the rise of the Mining, quarrying, oil and natural gas extraction sector's share of the region's economy (Fig. 6).

Fig. 6: Frackalachia Mining Share of GDP and PI:GDP, 2001-2019



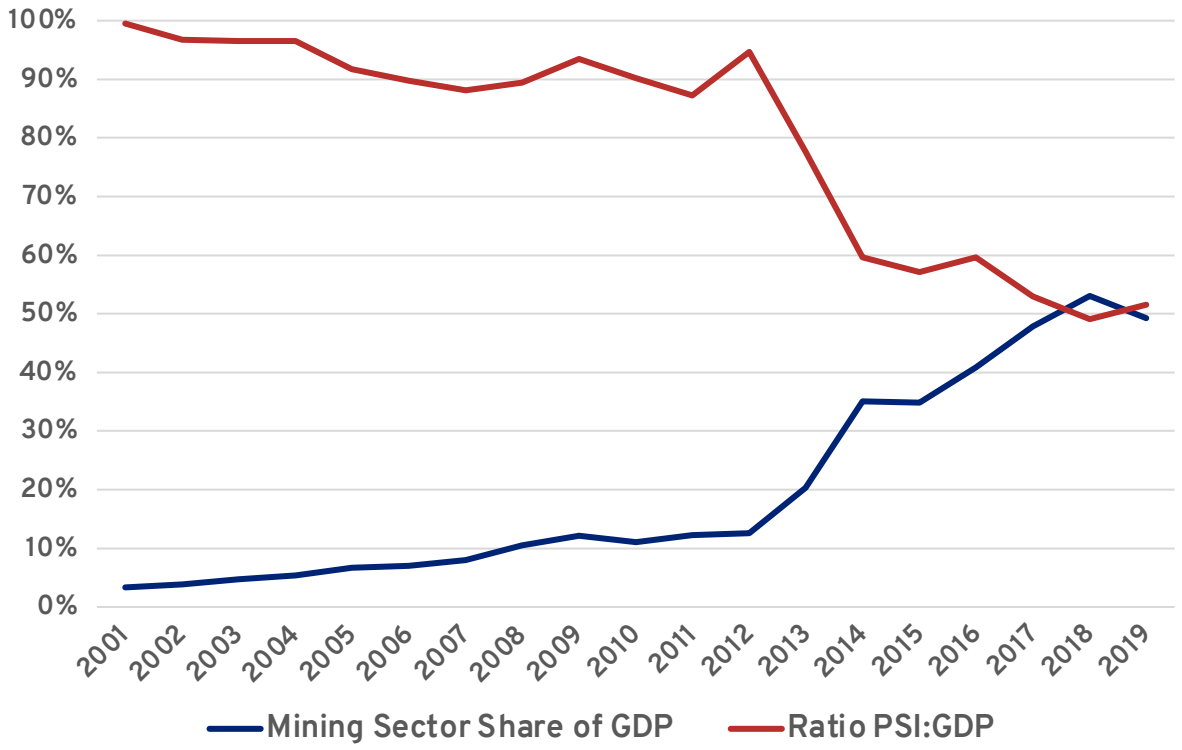
Source: Author's calculation using Bureau of Economic Analysis data

Ohio River Valley Institute

A comparison of Frackalachia's gross domestic product by sector in 2008 and 2019 shows that Mining, quarrying, and oil and gas exploration was responsible for only 4% of output in 2008 before soaring to 34.9% in 2019. In some counties, the sector grew to the point that it constituted more than two-thirds of all economic output. And, in many cases, those are the counties where PI:GDP ratios suffered the most.

This is especially evident in the case of the seven Ohio Frackalachian counties. Significant development of natural gas from Ohio's Utica Shale did not begin until 2013, five years after production from the Marcellus Shale began in Pennsylvania and West Virginia. But, in the Utica play, development ramped up more quickly and occupied a greater share of the economy than it did in Pennsylvania and West Virginia…and the PI:GDP ratio deteriorated proportionately (Fig. 7).

Fig. 7: Ohio Frackalachia Counties Mining Share of GDP and PI:GDP, 2001-2019

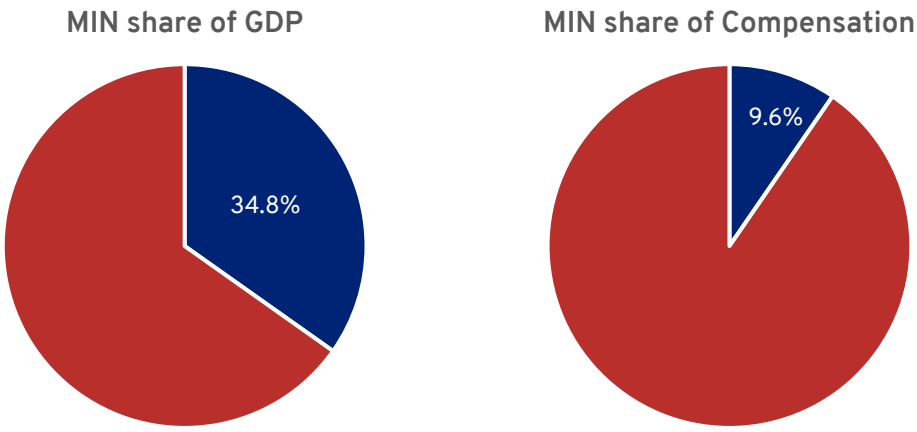


Source: Author's calculation using Bureau of Economic Analysis data

Ohio River Valley Institute

The principal reason why the natural gas boom drove down the PI:GDP ratio is apparent in employee compensation data.

Fig. 8: Frackalachia Mining Share of GDP and Compensation, 2019



Source: Author's calculation using Bureau of Economic Analysis data

Ohio River Valley Institute

In Frackalachia as a whole, the Mining sector, led by natural gas, made up more than one-third of GDP in 2019. Yet the sector provided less than 10% of employee compensation (Fig. 8).

In Belmont and Guernsey Counties in Ohio, the discrepancy between share of GDP and share of compensation was even more extreme. There the Mining sector made up 50.5% of GDP in 2019—more than all other economic sectors combined. Yet, the sector provided just 12.6% of employee compensation in the two counties and it provided just 6.4% of jobs. Both the Health Care and Government sectors provided more compensation and more jobs than Mining despite making up just 4% and 6% of GDP, respectively.

Ted Auch/FracTracker Alliance

This dynamic played out in less extreme form across all of Frackalachia. Mining is by far the largest economic sector in Frackalachia—more than twice the size of Finance, the second ranked sector, and about the same size as the next three sectors combined (Fig. 9). Yet, Mining ranked only fourth among major sectors for employee compensation, trailing Government, Health Care, and Manufacturing (Fig. 10). And its share of jobs was even smaller, being surpassed by eight other sectors (Fig. 11).

Fig. 9: Frackalachia Mining Sector GDP Ranking, 2019 (thousands of dollars)

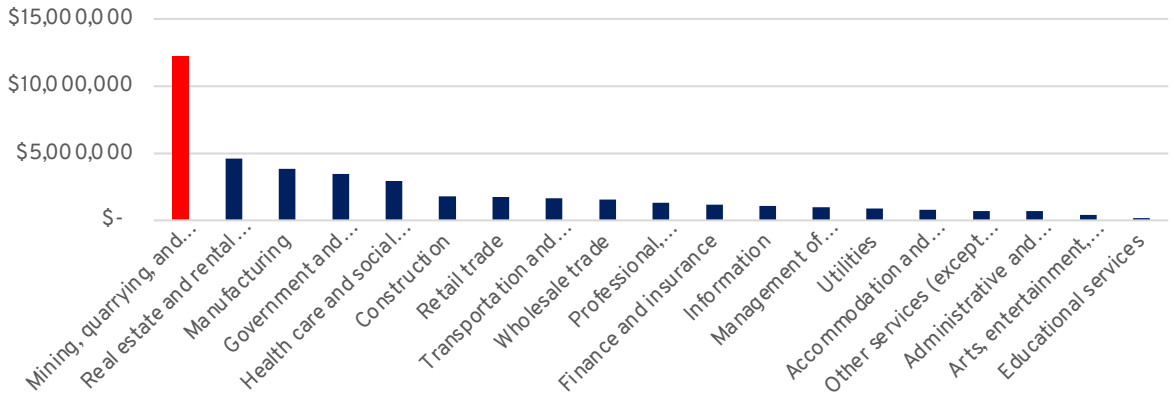


Fig. 10: Frackalachia Mining Sector Compensation Ranking, 2019 (thousands of dollars)

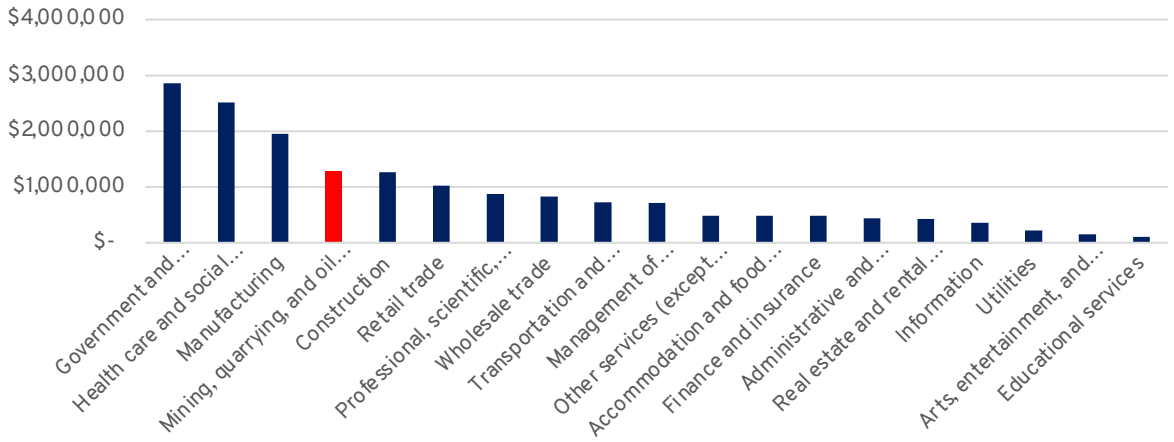
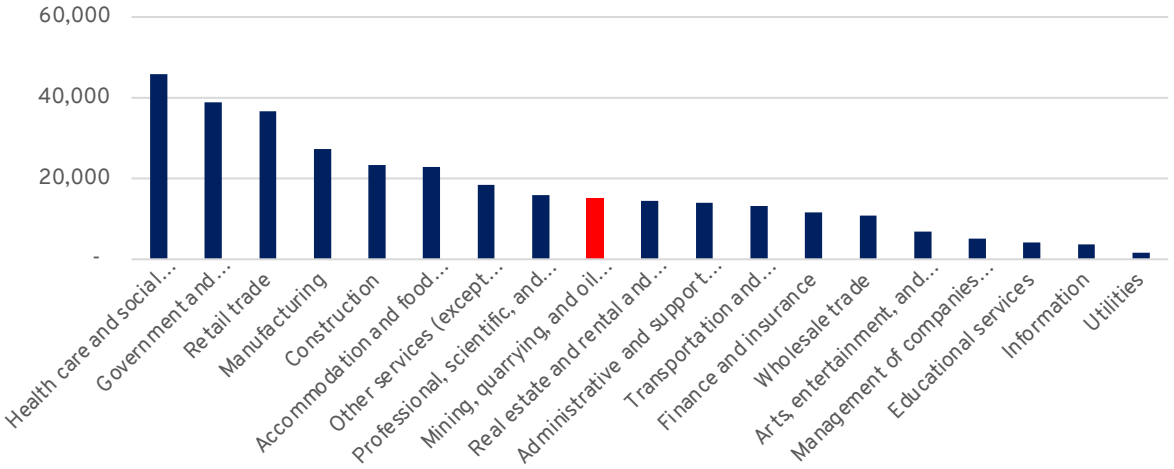


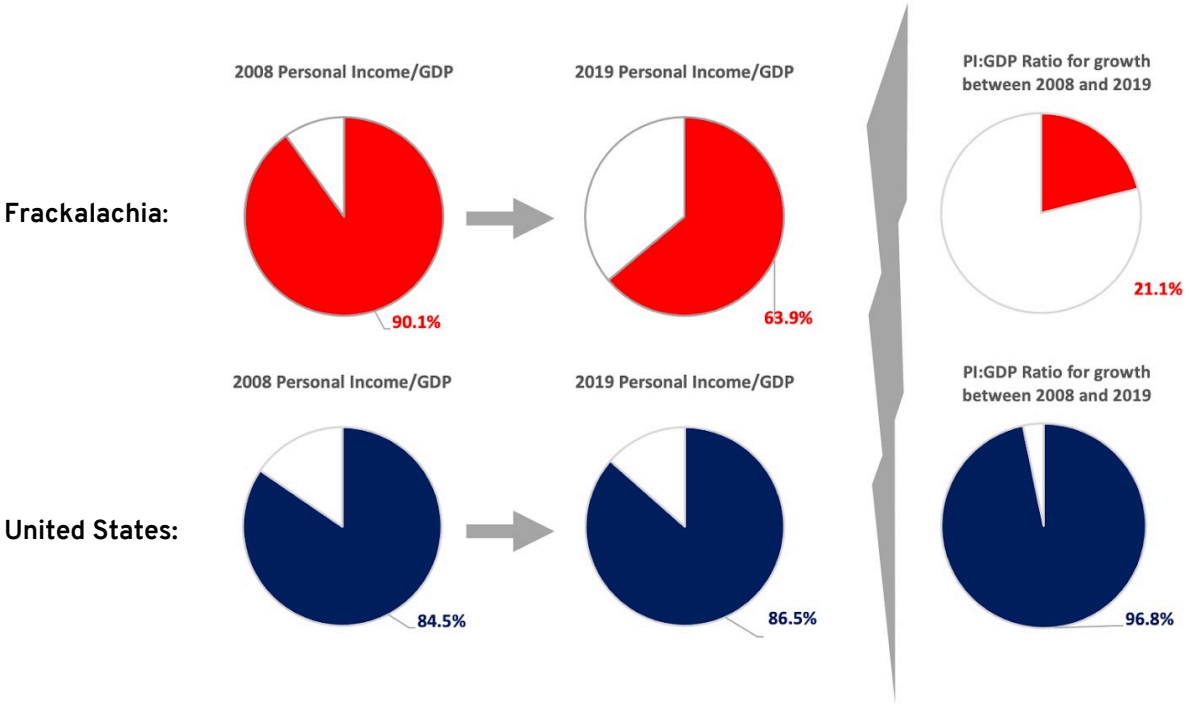
Fig. 11: Frackalachia Mining Sector Employment Ranking, 2019 (number of jobs)



Source for all three charts: Author's calculation using Bureau of Economic Analysis data

Ohio River Valley Institute

Fig. 12: Frackalachia vs. U.S. PI:GDP for Growth, 2008—2019



Source: Author's calculation using Bureau of Economic Analysis data

Ohio River Valley Institute

In all, during a period when 97% of GDP growth nationally was realized as personal income, in Frackalachia the figure was only 21%, and that's because three-quarters of Frackalachian growth arose in the jobs and compensation-poor Mining, Quarrying, and Oil & Natural Gas Extraction sector (Fig. 12).

The Boom's Impact on Other Economic Sectors and on the Unemployment Rate Was Minimal

The region was also not helped by the fact that the natural gas boom's economic coattails were quite short. Looking just at the 25% of economic growth between 2008 and 2019 that was not attributable to the Mining sector, we see that the rest of Frackalachia's economy grew by just 17.4% during the period. That is slightly better than the rate of growth of 14.1% for the combined states of Ohio, Pennsylvania, and West Virginia, but it's less than the average growth of the nation as a whole despite the immense amount of investment that ostensibly entered Frackalachian counties.

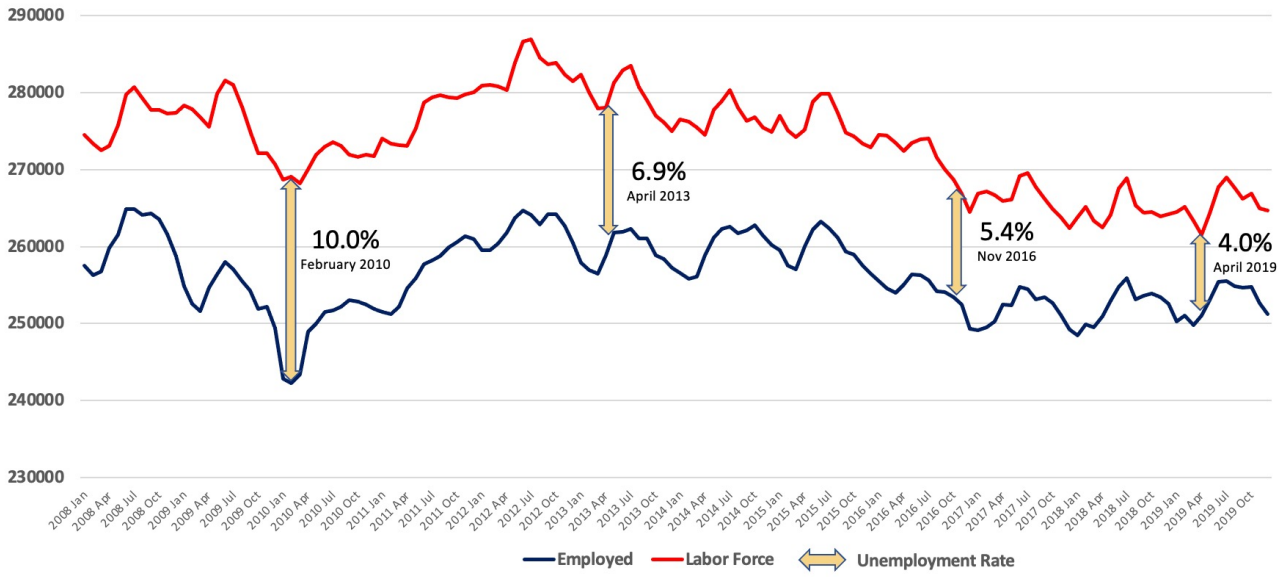
The small advantage that Frackalachia holds over the three states in non-Mining economic growth suggests that the explosion in the Mining sector helped lift some other sectors of the economy, but only modestly.

The same is true with respect to declines in Frackalachia's unemployment rate. When the first ORVI report on the natural gas boom's failure to produce significant growth in jobs was released, one of the arguments most frequently advanced by defenders of the industry's jobs performance was that unemployment rates fell in the principal natural gas counties during the boom period.

However, even that apparently positive economic outcome was a case of "addition by subtraction". The improved unemployment rate was generally attributable not to an increase in the number of people with jobs, but rather to a decline in the region's labor force.

Of the Frackalachian counties, those in Pennsylvania experienced the best outcome for job growth with a rate of 4.6%. That's less than half the national rate, but better than the overall Frackalachian rate of 1.6%. At the same time, the unemployment rate in Pennsylvania's eight Frackalachian counties declined from a high of 10% in February 2010 to a low of 4% in April 2019 (Fig. 13).

Fig. 13: Employment, Labor Force, and Unemployment in Pennsylvania Frackalachian Counties, 2008—2019



Source: Author's calculation using Bureau of Economic Analysis data, Land Area Unemployment Statistics

Ohio River Valley Institute

The anomaly is that the number of employed people peaked in early 2013 at just under 265,000 and then declined by 15,000 to about 250,000 by the end of 2019. Despite that tumble, the unemployment rate went down because the size of the labor force—the number of people either with jobs or looking for work, which serves as the denominator in calculating the unemployment rate—declined even faster: by 20,000, from a high of 286,000 in 2012 to about 266,000 in 2019.

From an economic prosperity perspective, a declining unemployment rate driven by a decline in the labor force is in important ways even worse than having a rising unemployment rate. That's because, in addition to fewer people holding jobs, the talent pool is being eroded as people who don't have jobs either give up looking for work or move out of the region altogether. The loss of talented workers diminishes a region's appeal for prospective employers.

Ted Auch/FracTracker Alliance

Why the Deal with Natural Gas Went Bad

> *"It is possible, then, that the potential economic impact of gas extraction to the Pennsylvania economy could be quite small if (1) well drilling utilizes out-of-state economic resources, and (2) landowners save or spend their lease and royalty payments in other states or countries. The possibility of these two occurrences may not be remote."*
>
> *—economist Thomas C. Kinnaman, Ph.D.*

Those are the prophetic closing words of a 2010 paper, titled "The Economic Impacts of Shale Gas Extraction: A Review of Existing Studies" by Bucknell University economics professor Thomas C. Kinnaman[3]. Although Dr. Kinnaman did not predict that these conditions he cites would prove to be the case, they became so and with the consequence of which he warned, not just for Pennsylvania, but for Ohio and West Virginia as well.

Dr. Kinnaman was writing[4] primarily in response to two recently published papers that were sponsored by the Marcellus Coalition, an organization made up of representatives of the natural gas industry. The papers were, "An Emerging Giant: Prospects and Economic Impacts of Developing the Marcellus Shale Natural Gas Play" (Considine et al., 2009) and another titled "The Economic Impacts of the Pennsylvania Marcellus Shale Gas Play: An Update" (Considine et al., 2010). The second of these was later expanded upon by the same authors in a study for the American Petroleum Institute titled, "The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia".[5]

These and other papers were regularly cited both by industry representatives and state and local policymakers as evidence of the job creation and prosperity building potential of the Appalachian natural gas boom. These expectations were summarized in the following chart from the third of these reports, which projects that Pennsylvania and West Virginia could, under a high development scenario, expect to see the creation of 211,909 and 43,746 new jobs, respectively (Fig. 14).

Fig. 14: Estimated Future Economic Impacts under Three Development Scenarios

Assumptions	***Low Development**** (E = 0.5, R/W = 1.5 bcf)			***Medium Development*** (E = 1.0, R/W = 2.0 bcf)			***High Development***** (E = 2.7, R/W = 2.8 bcf)		
	2011	**2015**	**2020**	**2011**	**2015**	**2020**	**2011**	**2015**	**2020**
Employment	*Number of Jobs*								
NY	0	0	0	1,419	15,727	18,027	1,598	20,803	27,060
PA	60,755	77,788	87,119	98,222	121,816	140,169	111,413	160,205	211,909
WVA	11,405	12,332	14,856	18,437	20,864	25,810	22,928	30,675	43,746
Total	72,160	90,120	101,975	118,078	158,408	184,007	135,939	211,683	282,716

Source: *The Economic Impacts of Shale Gas Extraction: A Review of Existing Studies*

But, as Dr. Kinnaman suggested might be the case, some key assumptions underlying the projections turned out to be mistaken. And these mistaken assumptions became leakage points that caused large portions of natural gas investments and revenue from sales to be realized as income in places other than Frackalachia, thus producing the disconnect between the region's personal income and GDP.

At first glance, it seems inconceivable that nearly 80% of Frackalachia's incremental economic output between 2008 and 2019 could have evaporated from the region, but when we look at the number and variety of leakage points, the disconnect between growth and prosperity seems not only conceivable but preordained.

Leakage Point #1: The Appalachian natural gas boom relied heavily on out-of-state workers and suppliers of services

Dr. Kinnaman's first concern was that well-drilling and other activities might rely on out-of-state resources to a greater degree than was assumed in the economic impact studies. Kinnaman reported that the Considine analyses assumed that 95% of the resources required to produce shale gas in Pennsylvania—labor, services, equipment, and materials—would come from within the state. Kinnaman contrasted this assumption with a contemporaneous finding by the Allegheny Conference that "70% of workers originate from other areas of the country".[6] Another contemporaneous survey of industry employers by Kelsey, et. al[7] found that 37.3% of industry workers were from out-of-state.

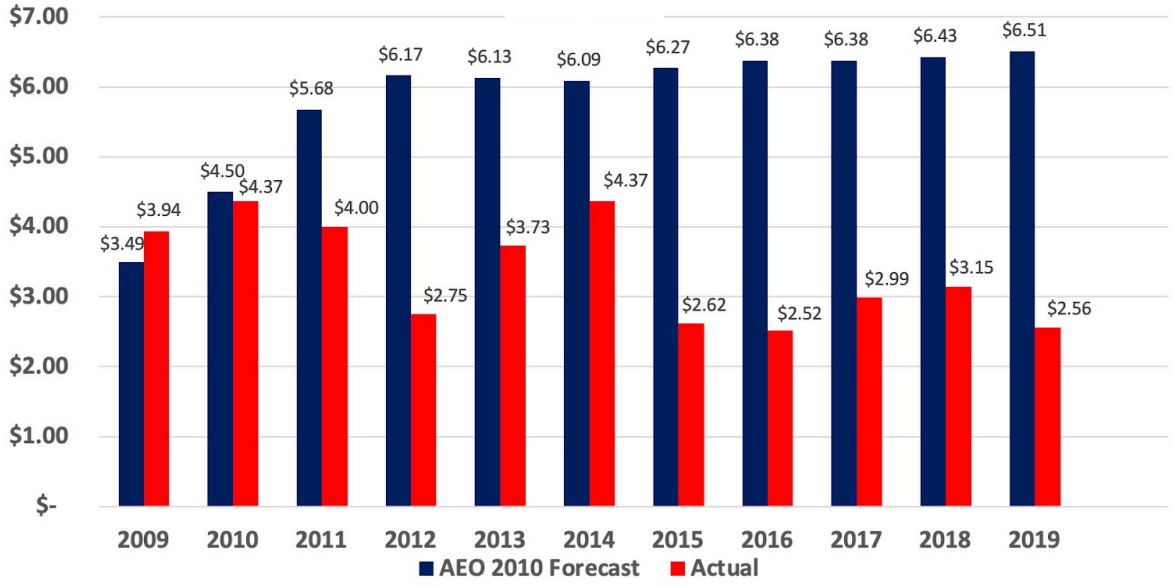
The conclusion that Considine's assumption that 95% of resources would come from within the state was a serious exaggeration is supported by other data points and anecdotal evidence, including the previously cited job and compensation data, skyrocketing hotel occupancy rates, upward pressure on rents, the ubiquity of license plates and commercial vehicles from the Gulf Coast region, and, at one time, the proliferation in the region of man camps populated by out-of-state workers, most of whom worked for out-of-state service providers.[8]

Leakage Point #2: Leasing and royalty income turned out to be less than was assumed

The industry-sponsored economic impact studies of a decade ago imagined that royalty payments to Frackalachian property owners would be spent in local economies and, along with natural gas worker wages, drive as much as two-thirds of overall jobs growth. We've seen how the value of worker wages to local economies was diluted because substantial portions were exported elsewhere. But the data suggest that the expected amount of revenue from royalties was diluted even more.

The studies Kinnaman reviewed based anticipated royalties on U.S. Energy Information Administration long-term price forecasts for natural gas. At the time the studies were done, U.S. Energy Information Administration 2010 Annual Energy Outlook[9] was current. As figure XX illustrates, prices fell far below the forecasted figures almost from the beginning and eventually settled in at levels that are half or less than what was expected. And, in many cases, regional market prices were significantly lower than the Henry Hub price, reducing royalty payments even further (Fig 15).

Fig. 15: Forecasted and Actual Henry Hub Spot Price for Natural Gas, 2008-2019



Source: Author's calculation using Energy Information Administration Energy Outlook data

Ohio River Valley Institute

Even though natural gas production in Pennsylvania exceeded even the "High Development" scenario contained in the Considine study, actual royalty revenues were a fraction of what was assumed.[10]

Ted Auch/FracTracker Alliance

Leakage Point #3: Far less than 100% of lease and royalty payments enter local economies.

Other factors diluted the value of royalties to local economies even more. Dr. Kinnaman's analysis found that the Considine studies assumed that 100% of royalty income realized by property owners would be spent within Pennsylvania and that the spending would take place within one year of the arrival of payments.

There are no definitive data regarding the disposition of leasing and royalty income; however, Kelsey et. al. explored the issue of how royalty funds were consumed by recipients and found that "landowners save or invest about 55 percent of the total leasing dollars in the year they receive such payments, rather than spending them immediately. They also save or invest about 66 perent of all the royalty dollars they receive. This means a significant portion of leasing and royalty dollars are not spent in Pennsylvania in the year those dollars are received, reducing their potential economic impact in the year the companies pay mineral right owners for leases and royalties."[7]

Also, of the portion of production-related revenues that recipients do spend, we have no idea of how much is spent outside of the region on everything from major purchases of second homes to small purchases such as transactions with Amazon.

Finally, these aren't the only reasons leasing fees and royalty payments failed to enter local economies to the degree or at the speed assumed in the economic impact studies. It appears from Kelsey's research that about 17% of leased property is publicly-owned, mostly by the state, and another 7.7% is owned by out-of-state residents, which means that portion of production-related revenues didn't show up in local economies.

Taken together, the three factors just discussed—lower than expected natural gas prices, a greater-than-expected tendency for royalty and lease fee recipients to save and invest rather than spend their proceeds, and nearly a quarter of proceeds going to the state or non-residents—it is quite likely that the amount of production-related revenues entering local economies is less than 20% of the amount assumed in Considine's economic impact studies.

Leakage Point #4: Relatively little of the income generated by natural gas extraction and processing goes to labor

Even if local workers had received a larger share of the jobs provided by the natural gas industry, the effect would still be muted because, by its nature, the industry creates few jobs relative to its level of output.

In 2017, the U.S. Bureau of Labor Statistics issued a report showing that the Mining sector, which includes natural gas extraction, allocated the smallest share of income to labor of any major economic sector. Just 22 cents of every dollar was realized as employee compensation in 2014 (Fig. 16), and by some measures the oil and gas production sub-sectors appeared to perform even more poorly. So, it's probably not coincidental that only 21% of incremental GDP generated by Frackalachian GDP counties between 2008 and 2019 was realized as personal income.

Fig. 16: Employee-Only Labor Share, Nonfarm Business Subsectors, 1997-2014

Sector	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Change, 1997 to 2014
Mining	0.37	0.44	0.41	0.33	0.31	0.31	0.26	0.25	0.21	0.21	0.20	0.18	0.22	0.21	0.20	0.22	0.21	0.22	-0.15
Utilities	.24	.26	.26	.28	.29	.30	.28	.27	.28	.26	.27	.28	.27	.25	.26	.27	.27	.26	.02
Construction	.67	.66	.66	.67	.67	.66	.64	.61	.59	.60	.62	.66	.64	.64	.64	.63	.63	.64	-.04
Durable goods	.62	.64	.66	.66	.70	.66	.64	.63	.62	.61	.61	.62	.62	.57	.58	.57	.57	.57	-.06
Nondurable goods	.49	.49	.48	.48	.46	.46	.45	.42	.41	.39	.38	.39	.35	.34	.34	.34	.34	.34	-.15
Wholesale trade	.50	.51	.52	.52	.53	.53	.52	.51	.50	.50	.50	.50	.49	.47	.48	.48	.47	.47	-.03
Retail trade	.58	.57	.58	.58	.58	.58	.57	.57	.56	.56	.58	.58	.56	.55	.56	.55	.55	.55	-.03
Transportation and warehousing	.65	.65	.66	.67	.68	.68	.65	.63	.62	.59	.62	.60	.61	.58	.58	.59	.58	.58	-.07
Information	.43	.44	.45	.52	.49	.42	.41	.38	.38	.38	.37	.35	.36	.34	.36	.37	.36	.37	-.06
Finance, insurance, real estate, rental and leasing	.23	.24	.24	.25	.24	.24	.23	.24	.24	.25	.25	.26	.23	.23	.23	.23	.23	.23	.00
Educational services, health care, and social assistance	.41	.40	.39	.38	.34	.34	.36	.39	.38	.38	.39	.39	.38	.38	.40	.42	.41	.42	.01
Professional and business services	.70	.72	.72	.75	.73	.71	.70	.70	.70	.71	.71	.70	.70	.70	.71	.72	.73	.74	.04
Arts, entertainment, recreation, accommodation, and food services	.56	.58	.58	.57	.59	.58	.58	.58	.58	.57	.58	.59	.58	.58	.58	.59	.58	.59	.03
Other services (except government)	.39	.39	.38	.38	.41	.39	.44	.43	.41	.39	.42	.43	.44	.40	.44	.42	.44	.44	.05

Source: Bureau of Labor Statistics

An analysis of natural gas industry revenue allocation in Belmont County, Ohio conducted by ORVI Senior Researcher Ted Boettner found that, in the year 2017, only 8.9% of income went to labor.[11] It's also the case that Mining's reign as the least labor-intensive of industries began in 2005, before the start of the Appalachian natural gas boom.

Direct costs and destruction of quality of life

With the exception of the discrepancy between the expected and actual prices of natural gas, all the factors mentioned above contributed to the disconnect between GDP and personal income that was noted earlier in this paper and which is fundamentally responsible for the failure of the Appalachian natural gas boom to deliver significant job and income growth. But the natural gas industry is also burdened by additional drawbacks which dilute its ability to generate local economic prosperity.

The natural gas industry's "Boom/Bust" character creates risk and discourages development in other sectors

First, because it is susceptible to major fluctuations in commodity prices, natural gas is subject to boom and bust cycles. Those fluctuations can produce sudden increases and decreases in employment and demand for services. They can also produce unusually high rates of bankruptcy such as those that have afflicted many exploration and development companies in the natural gas industry.[12]

Consequently, businesses in other economic sectors that would usually expand in response to a growing economy hesitate to do so in light of the risk that the growth may be short-lived and quickly reversed, in which case they may not be able to recover investments they would have to make in order to expand.

The natural gas industry damages quality of life

In a recent paper, University of Akron economist Amanda Weinstein and her colleagues, Michael Hicks and Emily Wornell of Ball State University, examined factors that are most effective in enabling micropolitan areas—small cities and towns and their surrounding areas—to achieve and sustain economic growth and its accompanying benefits.[13] The study's premise was that, while the vast majority of research into economic development has focused on larger cities and metropolitan areas, "micropolitan areas are not simply scaled-back versions of metropolitans; we cannot assume that either research findings about or successful policy prescriptions in major metropolitan areas like San Francisco are accurate or appropriate in small cities like Wooster, Ohio."

The study's key finding was that "micropolitan area counties with higher quality of life experience higher population growth and higher employment growth, but we find no statistically significant relationship between quality of the business environment and growth in micropolitan areas."

This finding should come as no surprise to policymakers in many micropolitan and rural regions and states that have premised economic development strategies on providing the best possible business environment -- low taxes and minimal regulation -- for the natural gas industry only to be disappointed with the results. In fact, by sacrificing tax revenue and relaxing regulations that would otherwise protect soil, water, air, and other critical components of quality of life, they may have diminished rather than enhanced job growth and economic development prospects.

Two recent studies assessed costs that the Appalachian fracking boom has imposed that are not typically captured in economic impact studies.

"Cumulative environmental and employment impacts of the shale gas boom," a 2019 study by Erin N. Mayfield, Jared L. Cohon, and Nicholas Z. Muller of Carnegie-Mellon University, Inês M. L. Azevedo of Princeton University, and Allen L. Robinson of Stanford

University, examined economic, health, and climate impacts of the Appalachian natural gas boom between 2004 and 2016 and determined that, while the boom can be credited with generating approximately 94,000 new jobs and adding $20 billion to wages and income, its effects on air quality resulted in between 1,200 and 4,600 premature deaths whose cost it calculated at $23 billion using standard valuation techniques.[14] The study also found an additional $34 billion in costs from greenhouse gas emissions caused by the boom.

Put another way, the study found that the monetary trade-off between wage and income benefits on the one hand and the health of people in the region as measured by early mortality on the other is about one-to-one. But the malign impact on climate change is about 50% greater than either the economic benefits or the health costs, and when the climate costs of natural gas development are combined with the health costs, they are nearly three times the size of the economic benefits.

But, human health and climate are not the only quality of life components that suffered as a result of the natural gas boom in Appalachia. Additional costs are imposed on communities' infrastructure, including roads and bridges, local justice, health care, and waste disposal systems, as well as on residents who may experience increases in noise, light, and groundwater pollution. All of these can contribute to reputational harm and perceived reductions in quality of life, which in turn can influence life choices and business choices.

No studies have been done to assess all of these factors and to determine their impact on Frackalachia's economy and whether it has made the area more or less attractive as a place to live, locate, or expand a business. But we can get an indication by looking at population change and growth in the non-Mining sectors of the Frackalachian economy.

Since the natural gas boom began in 2008, Frackalachia's population has declined by nearly 3.8% even as the nation's population grew, as did the populations of Ohio and Pennsylvania. West Virginia's population fell, but not as fast as the plunge in population in the state's Frackalachian counties. And, as was noted earlier in this paper, non-Mining sector GDP in the Frackalachian counties grew at a rate of 17.1%, which is two percentage points worse than the national average, but three percentage points better than overall GDP growth in Ohio, Pennsylvania, and West Virginia. However, much of the non-Mining growth is confined to just a few economic sectors that are closely related to the natural gas boom. They include Accommodation (hotels and motels), Transportation, and the Leasing and Rental sector of Real Estate. In sectors other than those, the natural gas boom seems to have had little if any impact.

In summary, the available evidence suggests that (a) quality of life is an important factor in the pursuit of economic prosperity for non-metropolitan communities, (b) the fracking boom has generally diminished the quality of life in Frackalachian counties, and (c) that diminution can be measured by population loss and by the failure of non-Mining sectors of local economies to grow and prosper in concert with the expansion of the natural gas industry.

How Frackalachia Can Improve Upon the Bad Deal

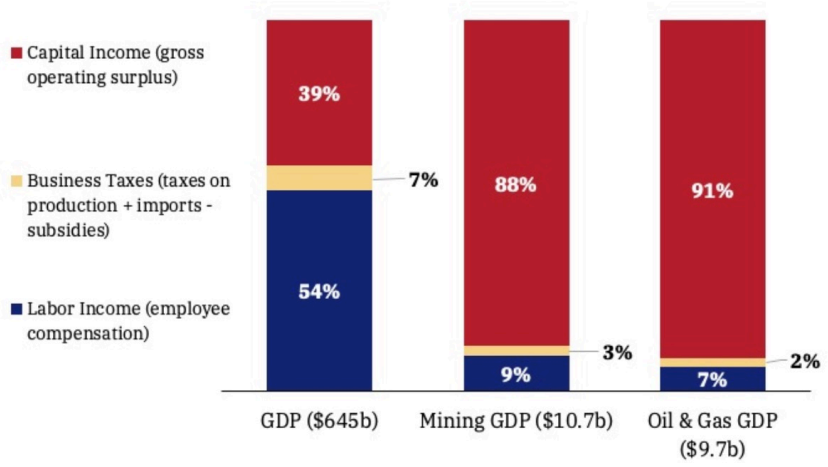
Many of the factors that contributed to the natural gas boom's failure to deliver economic prosperity are structural in nature, meaning that there is little that policymakers can do to correct them and also that they are unlikely to be overcome by additional growth in output. Consequently, policymakers in the states of Ohio, Pennsylvania, and West Virginia and in their Frackalachian counties face two challenges if they are to succeed in improving economic outcomes associated with the natural gas industry:

- A greater share of natural gas development funding and revenues must be retained and enter local economies.
- The industry's negative impacts on health, the business environment, and quality of life must be mitigated.

A greater share for local economies

Taxation is the principal means available to states and local jurisdictions for the retention of a greater share of funds resulting from commerce. At present, instead of using taxes to compensate for the natural gas industry's shortcomings in employment and income growth, some Frackalachian jurisdictions actually reward those shortcomings.

Fig. 17: Components of State GDP in Ohio, 2017



Source: Bureau of Economic Analysis, Regional Accounts

Ohio River Valley Institute

An analysis from September 2020 by Ohio River Valley Institute Senior Researcher Ted Boettner illustrates this point.[11] Statewide, business taxes in Ohio constitute 7% of GDP. However, business taxes make up just 2% of GDP generated by the oil and gas industry (Fig. 17).

According to a comparison of effective tax rates on natural gas production performed by the Independent Fiscal Office of the Commonwealth of Pennsylvania[15] in 2014, the industry's tax burden in Pennsylvania is the lowest among major gas-producing states included in the analysis (Fig. 18).

Fig. 18: Effective Tax Rates by State, Production Level, and Price Scenario

	High Production					
	Low Price			High Price		
State	State	Local	Total	State	Local	Total
Pennsylvania	0.8%	n.a.	0.8%	0.6%	n.a.	0.6%
Arkansas	3.3	1.0%	4.3	3.6	0.9%	4.5
Colorado[1]	4.8	0.9	5.7	4.8	0.9	5.7
Louisiana	3.2	n.a.	3.2	3.3	n.a.	3.3
Michigan	5.9	n.a.	5.9	5.9	n.a.	5.9
North Dakota	2.5	n.a.	2.5	2.3	n.a.	2.3
Ohio	0.8	1.0	1.8	0.6	0.8	1.4
Oklahoma	3.9	n.a.	3.9	3.9	n.a.	3.9
Texas	3.7	0.9	4.6	3.7	0.9	4.6
Virginia	n.a.	3.0	3.0	n.a.	3.0	3.0
West Virginia	5.8	1.7	7.5	5.7	1.8	7.5

[1] Local effective tax rates exclude property tax liability used as a credit against state severance tax.

Source: Independent Fiscal Office of the Commonwealth of Pennsylvania

Particularly noteworthy is Pennsylvania's exemption of natural gas from property taxes, which do apply to minerals such as coal and gravel. The exemption resulted from a 2002 Pennsylvania Supreme Court ruling[16] and subsequent efforts to revise the law to include natural gas failed in the state legislature. The effect is to greatly reduce the amount of tax revenue received by counties from production that takes place within their borders.

Reforms to property taxes, severance taxes, and the possible revocation of some industry-specific tax credits are all available means by which the problem can be addressed without negatively impacting other business sectors.

Mitigating the harm to quality of life

The natural gas industry has proven to be highly intrusive, not very labor intensive, it imposes significant costs, and does not highly leverage the local economy or businesses. Not the ideal foundation upon which to try to build a prosperous economy. But, from those shortcomings, we can imagine qualities that would contribute to effective economic development.

Ted Auch/FracTracker Alliance

Oil and gas development is regulated primarily at the state level, posing challenges for local jurisdictions seeking to mitigate quality of life harms associated with shale gas activity. Even so, a variety of regulatory, non-regulatory, and fiscal tools at the disposal of municipal and county officials can be employed to reduce the impacts of fracking on public health and the environment.

In townships and micropolitan areas with home rule, local governments can establish ordinances to curtail the impunity with which shale gas development has swept through Frackalachia. Expanding setback requirements would be a critical first step toward mitigating fracking's harms to health and quality of life, effectively distancing residents and businesses from the harmful impacts of air and water pollution.[17] In Pennsylvania, for example, shale gas well pads and compressor stations can operate as near as 500 feet and 750 feet, respectively, from the nearest occupied building. To minimize exposure to air and noise pollution, a 2020 Pennsylvania Attorney General Report recommends a minimum setback of 2,500 feet from residences and 5,000 feet from sensitive sites like schools and hospitals.[18] Some experts have advised even greater setback distances.[19]

Establishing and maintaining comprehensive, common-sense nuisance and environmental regulations would further safeguard Frackalachian communities from the ecological and health-related costs of shale gas development. Measures to require site upkeep, establish safety and emergency response procedures, enforce ambient noise standards, and assign haul routes can drastically reduce quality of life risks and impacts. Where feasible, local land use planning and zoning ordinances can designate shale gas development as a special or conditional use activity, empowering local governments to ensure that industry operations comply with health, safety, and environmental regulations.

In communities where local regulatory action is preempted by state regulations, non-regulatory approaches, such as taxation, community engagement, monitoring and data collection, and establishing transparent channels for public communication can help ensure the oil and gas industry is held accountable for negative quality of life impacts.[20]

Barb Jarmoska/FracTracker Alliance

Economic Development Alternatives for Fossil Fuel Communities and for Appalachia Generally: What Frackalachia's Experience Teaches Us

The natural gas industry may be structurally incapable of becoming a foundation for job growth and economic prosperity in Appalachia. But the weaknesses that make the industry incapable may at least provide direction for alternative development strategies and industries that can be effective. There are four criteria for the kinds of industries that may be more effective at stimulating job growth and prosperity:

1. **High labor intensity:** Economic development strategies should focus on or at least incorporate to a high degree industries that are highly labor-intensive not just in order to generate job growth, but also to maximize the economic multipliers that derive from job growth.

2. **Significant leverage of local resources, including businesses, institutions, and workers:** One of the natural gas industry's greatest weaknesses as an economic development platform in Appalachia is that much of the expertise, experience, and capabilities that power the industry are found outside the region, resulting in a large-scale exportation of compensation and capital. Industries that rely more heavily on local suppliers, institutions, and workers will keep more money and more of the multiplier effect in local economies.

3. **More annuity-producing than cost-producing:** When an old house or building is retrofitted with high-efficiency doors and windows and improved insulation, the work is usually done by local companies and workers who, in turn, spend much of their compensation in the community, which keeps the economic multiplier effect local. But these enhancements produce an additional stream of disposable income for local residents in the form of ongoing savings on utility bills. A large portion of these savings also enter local economies; they continue to do so for years or even decades, and their cumulative value often ends up exceeding the value of the original investment.

4. **Quality of life enhancing:** Buildings and homes that receive upgrades such as those described above become more comfortable for workers and residents, thereby improving their quality of life. Many businesses and industries produce outcomes that

improve quality of life not just for individuals but for the community as a whole. And, as Weinstein's research suggests, quality of life amenities may be the single most important factor in producing growth and prosperity.

When these criteria are met, the scale of the economic outcomes may far exceed the value of the inputs. That is what seems to be taking place in Centralia, Washington, a Pacific Northwest coal town whose economic situation looked for decades like the plight of many communities in Appalachia, which now face the risk of steeper decline as the world transitions to clean energy.

But, in 2011, faced with the recent closure of a coal mine—the town's largest employer—and the impending closure of a coal-fired power plant, the mine and power plant's owner, environmental organizations, and the governor of Washington hammered out an agreement that provided funds for worker and community transition. Focusing heavily on investments in energy efficiency, education, and new energy technologies—industries which meet all four criteria—Centralia experienced a boom.

- Centralia's economic output as measured by gross domestic product grew at twice the rate of U.S. GDP
- The rate of job growth exceeded the nation's for four straight years
- And the town's and the surrounding area's populations grew faster than the national average as well

The question of whether the experience of this old coal town can serve as a model of successful economic transition, not just for other coal towns facing the loss of mines and power plants, but for communities nationally that have seen their fortunes wane as the U.S. economy has transitioned away from manufacturing and other heavy industries is explored in a companion report.

Jason Kozak/FracTracker Alliance

References

1. United States Bureau of Economic Analysis. "Regional Economic Accounts: Regional Definitions." *United States Bureau of Economic Analysis.* Accessed 2021. https://apps.bea.gov/regional/definitions/
2. Thomas, Andrew R., Mark Henning, Oluwatosin Oladipo and Samuel Owusu-Agyemang. "Shale Investment Dashboard in Ohio Q1 and Q2 2020." Prepared for *JobsOhio*, 2021. https://www.jobsohio.com/wp-content/uploads/2021/04/Shale-Dashboard-Q1Q2-2020-Final.pdf
3. Kinnaman, Thomas C., "The Economic Impacts of Shale Gas Extraction: A Review of Existing Studies." 2010. https://digitalcommons.bucknell.edu/cgi/viewcontent.cgi?article=1004&context=fac_pubs
4. Kinnaman, Thomas C., "The Economic Impacts of Shale Gas Extraction: Moving Beyond Jobs" and Tax Revenues https://digitalcommons.bucknell.edu/cgi/viewcontent.cgi?article=1712&context=fac_journ
5. Considine, Timothy J., "The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia: A Report to The American Petroleum Institute" https://www.api.org/~/media/Files/News/2011/API%20Economic%20Impacts%20Marcellus%20Shale.pdf
6. Allegheny Conference. "70 Percent Of Marcellus Shale Workers From Out-Of-State." 2010. http://www.northcentralpa.com/feeditem/2010-07-26_allegheny-conference-70-percentmarcellus-shale-workers-out-state
7. Kelsey, Timothy W., Martin Shields, James R. Ladlee, and Melissa Ward. "Economic Impacts of Marcellus Shale in Pennsylvania: Employment and Income in 2009," *Marcellus Shale Education & Training Center*, 2011. https://www.pct.edu/files/imported/business/shaletec/docs/EconomicImpactFINALAugust28.pdf
8. Hunt, Spencer. "Fracking: So where's the economic boom that was promised?" *Columbus Dispatch*, 2014. https://www.dispatch.com/article/20140128/NEWS/301289852
9. United States Energy Information Administration. "Annual Energy Outlook 2010 with Projections to 2035." *United States Energy Information Administration.* 2010. https://www.eia.gov/outlooks/archive/aeo10/gas.html
10. Legere, Laura. "Pennsylvania landowners share the pain of low natural gas prices," *Pittsburgh Post-Gazette*, 2019. https://www.post-gazette.com/business/powersource/2019/09/08/Pennsylvania-Marcellus-Utica-Shale-royalty-owners-low-natural-gas-prices/stories/201909080048
11. Boettner, Ted. "The Fracking Boom in Appalachia: Big GDP Growth, Small Amount of Jobs and Local Income," *Ohio River Valley Institute*, 2020. https://ohiorivervalleyinstitute.org/the-fracking-boom-in-appalachia-big-gdp-growth-small-amount-of-jobs-and-local-income/
12. Hipple, Kathy. "Bankruptcies in Financial Sector Mount in 2019: E&P Companies' Debt of $26 Billion Doubled over Previous Year," *Institute for Energy Economics and Financial Analysis*, 2020. https://ieefa.org/wp-content/uploads/2020/01/Bankruptcies-in-Fracking-Sector-Mount-in-2019_January-2020.pdf

References

13. Weinstein, Amanda, Michael Hicks, and Emily Wornell. Working Paper: "An Aggregate Approach to Estimating Quality of Life in Micropolitan Areas." *University of Akron College of Business Administration*, 2021. https://ohiorivervalleyinstitute.org/wp-content/uploads/2021/07/Manuscript-Quality-of-Life-in-Micropolitan-Areas-3-2-21-with-title-page.pdf
14. Mayfield, Erin N et al. "Cumulative environmental and employment impacts of the shale gas boom." *Nature sustainability*. 2019. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6914251/
15. Pennsylvania Independent Fiscal Office. "Natural Gas Extraction: An Interstate Tax Comparison," 2014. http://www.ifo.state.pa.us/download.cfm?file=Resources/Documents/NG-Interstate-Comparison-2014-03.pdf
16. Supreme Court of Pennsylvania. *Independent Oil & Gas Association v. Board of Assessment Appeals*, 814 A.2d 180, Harvard Law School's *Caselaw Access Project*, 2002. https://cite.case.law/a2d/814/180/9336482/
17. Persico, Emily, and Rob Altenburg. "Buried Out of Sight: Uncovering Pennsylvania's Hidden Fossil Fuel Subsidies," *PennFuture*, 2021. https://www.pennfuture.org/Files/Admin/PF_FossilFuel_Report_final_2.12.21.pdf
18. Office of the Attorney General, "Report 1 of the Forty-Third Statewide Investigating Grand Jury," *Commonwealth of Pennsylvania*, 2020. https://www.attorneygeneral.gov/wp-content/uploads/2020/06/FINAL-fracking-report-w.responses-with-page-number-V2.pdf
19. Lewis, Celia, Lydia Greiner, and David Brown. "Setback distances for unconventional oil and gas development: Delphi study results," *PLoS ONE*, 2018. https://doi.org/10.1371/journal.pone.0202462
20. Center for Science and Democracy, "Managing the Risks of Unconventional Oil and Gas Development: What Local Communities Can Learn from Others' Experiences," *Union of Concerned Scientists and Consensus Building Institute*, 2015. https://www.ucsusa.org/sites/default/files/attach/2015/06/ucs-managing-risks-unconventional-oil-gas-development-2015.pdf
21. Kleinhenz and Associates, "Ohio's Natural Gas and Crude Oil Exploration and Production Industry and the Emerging Utica Gas Formation Economic Impact Study" https://www.heartland.org/_template assets/documents/publications/Ohio%20Natural%20Gas%20and%20Crude%20Oil%20Industry%20Economic%20Impact%20Study%20September%202011.pdf

Ohio River Valley Institute

Ted Auch/FracTracker Alliance