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Employment and Income Effects of Investments Made Using the Act 13 Unconventional Natural Gas Impact Fee in Pennsylvania

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Abstract: Unconventional natural gas extraction presents numerous opportunities and risks for communities across the United States. To capture a portion of the revenue generated by the resource states tax unconventional natural gas development. While most states collect revenue via severance taxes, Pennsylvania took a novel approach and established an impact fee on the industry instead. Unlike severance taxes in other states, the fee is collected annually and distributed directly to municipalities. While reports show that municipalities use the funds to pay for critical infrastructure, no best practices on how to allocate the funds exist. Citing the literature on mineral resource extraction and infrastructure-led development in American communities, this study examined impact fee payments made to counties with unconventional natural gas wells. The study evaluated whether counties that used the funds to invest in infrastructure were better off in terms of employment and income than other shale-producing counties that did not. Panel fixed- and random-effects regressions suggested that no statistically significant employment or income effects existed. The results suggest that local infrastructural investments are not a successful way to overcome the resource curse issues identified in the literature.

Keywords: energy; mineral resource extraction; resource curse; severance tax; shale gas

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Citation: Young, C. Employment and Income Effects of Investments Made Using the Act 13 Unconventional Natural Gas Impact Fee in Pennsylvania. *Energies* **2023**, *16*, 4437. https://doi.org/10.3390/en16114437

Academic Editor: Alan Brent

Received: 22 March 2023
Revised: 15 May 2023
Accepted: 29 May 2023
Published: 31 May 2023

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1. Introduction

Pennsylvania sits atop vast reserves of natural gas. In the early 2000s, firms enhanced the recovery of the resource in Pennsylvania and other states around the country using a process known as unconventional natural gas development or hydraulic fracturing. Since that time, communities with hydraulic fracturing experienced a boom in development directly and indirectly tied to the industry. Communities claimed that the flurry of activity led to rent increases, higher sales tax receipts, and gains in employment and wages [1]. At the same time, however, communities also reported negative impacts such as higher demands on local goods and services and stress on local infrastructure [2,3].

To mitigate negative aspects of the industry and capture a portion of the revenue generated by hydraulic fracturing, Pennsylvania passed legislation in 2012, known as Act 13, that established an impact fee on unconventional natural gas extraction. Under the law, a fee is assessed on every unconventional natural gas well, and most proceeds are distributed to the municipalities where extraction occurs. Pennsylvania is the only state to assess a fee rather than a severance tax on unconventional natural gas development and allocate the funds primarily to municipalities [4,5].

Given the distribution of Act 13 funds to municipalities rather than the state, as with most severance taxes, Pennsylvania provides the unique opportunity to examine the local effects of revenue generated from hydraulic fracturing. Research suggests that local authorities' strategic use of the funds from Act 13 could not only ameliorate some of the industry's negative impacts but also help municipalities diversify their economies and positively influence employment and wages. One area of particular focus in the literature is

infrastructural investments. Numerous studies suggest that investments in infrastructure projects positively affect employment and wages at the county level [6–8].

Drawing from two distinct bodies of literature—one regarding the economic impacts of mineral resource extraction, and another concerning infrastructure-led development in American communities—this study sought to understand whether Act 13 dollars invested in infrastructure increased county-level employment and wages in Pennsylvania. Both bodies of literature are vast. However, they exist separately and have little overlap. While the mineral resource extraction literature argues that funds from extractive industries should be saved, few works explore which investments are advantageous or how much revenue should be saved rather than spent. Likewise, the literature on infrastructure-led development addresses the impacts of large projects on communities but not in the context of resource extraction, where demands on local goods and services increase dramatically amidst resource booms [1,9,10].

This study addresses the gap in the existing bodies of literature by working to understand if public funds generated by extractive activities that are invested in infrastructure such as roads, bridges, and sewers affect levels of employment and per capita personal income. The study uses Pennsylvania's Act 13 unconventional natural gas impact fee because of its distribution at the local level. The results of the study are useful for Pennsylvania's county leaders as they attempt to understand how or if the funds impact local economic and community development efforts.

2. Literature Review

The following sections present the literature on mineral resource extraction and infrastructure-led development. This study combines both bodies to provide valuable insights for Pennsylvania's leaders as they seek to understand the potential effects of infrastructural investments on local economic and community development efforts.

2.1. Mineral Resource Extraction

Mineral resource extraction can be both a blessing and a curse for local economies. The research suggests that extraction may lead to short-term economic benefits for jurisdictions, such as capital injections into local economies, population growth, increased rents, employment gains, higher wages, greater profits among firms, and income from royalties collected on land leases [9,11–13]. However, a reliance on extraction at the local level can also stymy long-term economic growth. Communities that rely on extraction may have an overly specialized labor force and be prone to economic shocks [14]. Furthermore, the positive economic effects of the industry can be negated by externalities, such as environmental degradation and public health concerns [2,15,16].

Given these risks, researchers coined the term *resource curse* to explain the negative aspects of mineral resource extraction on local, state, and national economies. Findings from these studies suggest that policymakers should use public revenue generated by extraction to reinvest in communities or establish a legacy or permanent fund that can be used to overcome the *curse* and ensure long-term economic growth [17–20]. In doing so, public officials can stabilize their economies and provide for future generations.

Unfortunately, little work has been carried out to understand how much of the revenue generated by extraction should be spent, how much should be invested, or which investments prove most beneficial. The literature reveals a consensus that saving or investing the funds in such a way as to create permanent income from the exhaustible resource is desirable [21]. However, no specific best practices have been examined (e.g., proportions, types of investments, or institutions). Furthermore, much of the literature concerning these strategies has an international focus, with few works examining resource curse solutions in the United States [22,23]. Consequently, much of the literature addresses fraud, abuse, and waste issues and does not evaluate institutions that may impact such decisions domestically [18,24,25].

What is available on decision-making in the United States tends to examine state-level spending and saving of public revenue generated by mineral resource extraction. Several studies, for example, examine the structure and form of legacy or permanent funds established by states with extraction. Others situate the permanent and legacy funds within states' economic, environmental, political, and social contexts [26–28]. Few, however, address revenue generated at the local or county levels. Thus, a gap in the literature explaining local decision-making processes exists.

By examining the impacts of Act 13 funds at the county level, this study will enhance the literature on mineral resource extraction. Specifically, the research will address how revenue generated by resource extraction can be leveraged to impact local economies. Gaining these insights will help researchers understand how mineral resource extraction impacts communities and why such payments should be examined in addition to income, employment, and royalties generated by extraction. Furthermore, the results provide insights to local policymakers who must allocate the funds generated by Act 13.

2.2. Infrastructure-Led Development

While the mineral resource extraction literature does not address how communities with extraction should spend the revenue generated by the activity, a broader body of literature concerning investments in public infrastructure offers some suggestions. According to numerous research studies, investments in public infrastructure tend to be associated with localized improvements in employment and wages [7,29–32]. The researcher argues that because infrastructure facilitates basic economic activity (e.g., roads help deliver goods and services, utility power businesses, etc.) and the construction of infrastructure often employs the local labor force, large capital projects tend to support local economies [32]. In teasing out this trend, the research shows that the observed effects vary based on the type of project undertaken and the project's location [32–34].

Many economic studies on infrastructure-led development examine the impacts of transportation infrastructure on local economies. Employing linear regressions and other methods, such as input-output modeling, a multitude of studies show that significant expansions of roadways and railroads are associated with increases in local employment, wages, and economic output [35,36]. Thus, scholars argued that investments made in transportation can lead to localized economic boosts that might not otherwise occur. However, additional work must be performed to understand the impacts of other major infrastructure projects unrelated to transportation in the United States.

An emerging thread within the literature questions the applicability of the transportation findings to other types of infrastructure and suggests that more robust and diverse analyses must be conducted [37]. Consequently, recent works have focused on other projects, such as telecommunications and water infrastructure, to determine how project type influences economic outcomes. Those studies suggest that the type of project matters and that economic outcomes vary based on which projects are undertaken [29].

In addition to project type, the scale and location of an infrastructure project impact economic development outcomes. Research shows a range of impacts when geography is considered. Some studies, for example, indicate that as the distance from the project increases, economic impacts (changes to employment and wages) decrease [32]. Others show that the project's positive results can spill over across communities and counties [29,36]. Given the wide range of outcomes, it is essential to consider both the location of the project and the scale of measurement (city, town, and state, for example) in determining economic effects [37].

Despite the vast research on mineral resource extraction and infrastructure-led development, few works combine the streams to understand if such investments can facilitate economic growth during mineral resource extraction [38,39]. Adopting approaches utilized in other studies, this work builds on the two streams to examine the impacts of infrastructural investments at the county level. Understanding the effects of these local payments is critical to the success of mineral resource extraction communities. With no guidance or best

practices available from the state government (at least in the case of Pennsylvania), counties have only their experiences with other resources to guide them. This study sheds light on the near-term impacts of shale gas dollars and helps local officials understand whether Act 13 funds leveraged for local infrastructure influence wages and employment.

3. Materials and Methods

This study aimed to examine the impact of infrastructural investments on employment and income among counties receiving monies from the Unconventional Natural Gas Well Fund (UNGWF) in Pennsylvania to understand if revenue from shale gas development can be leveraged to promote economic development. The study employed both fixed-effects and random-effects regression models to examine the relationship using data made available by the Bureau of Economic Analysis (BEA), Bureau of Labor Statistics (BLS), Pennsylvania Department of Environmental Protection (DEP), Pennsylvania Public Utilities Commission (PUC), and U.S. Census Bureau from 2001 to 2019. The model included control variables for prevailing economic conditions, policy intervention, and population.

3.1. Data

The population of interest for the study included all counties in Pennsylvania with shale gas development. Under Act 13, 60 percent of the monies collected are directly distributed to local governments annually. According to records from the DEP, 40 counties with active wells in the Commonwealth have received payments from Act 13. Records from the DEP were cross-checked against forms from the PUC, which collects and disburses funds from Act 13.

The fee uses a formula that takes the age of each unconventional natural gas well, the amount of natural gas produced at the well, the consumer price index, and several other variables into account to determine the amount charged for each well annually. Revenue generated by the fee is collected by the PUC and distributed to counties and municipalities. Sixty percent of the revenue collected is distributed to counties and municipalities with wells through the UNGWF. The remaining 40 percent is dedicated to the Marcellus Legacy Fund. Payments to the counties, boroughs, and townships through the UNGWF range from only a few dollars to several million dollars, depending on the level of extraction in each locale and the other variables included in the formula [40]. Officials may allocate the funds for various uses, including investing in local infrastructure but must report their expenditures to the PUC.

Under the law, every municipality (borough, township, and county) that receives payments from Act 13 must report its allocations to the Commonwealth. Those allocations are reported to the PUC on a worksheet with thirteen spending categories. The spending categories are shown in Table 1 below. Completed allocation worksheets are returned to the PUC and reported online. Currently, data for the years 2011 through 2019 are available.

This study used only data for the first and second categories, which best reflect infrastructural investments according to the literature on infrastructure-led development [8,36,41,42]. The values for both categories in any given year were summed to create a general infrastructure variable (Infrastructure), which served as the independent variable in the model. No data for boroughs and townships were included since the scale of focus was the county. All reporting years (2011–2019) were included in the study for counties with shale gas development that received Act 13 funds.

The first dependent variable, county unemployment, is a rate made available by the Local Area Unemployment Statistics of the BLS. The BLS collects estimates of total unemployment at the county level. The second dependent variable, Per Capita Personal Income, uses data made available by the BEA. Both metrics collected by the BLS and BEA, respectively, are well-accepted and widely used in the literature [43–45]. All dollars were adjusted to reflect constant-dollar values.

Table 1. Act 13 Permitted Uses.

	Permitted Uses
Use 1	Construction, reconstruction, maintenance, and repair of roadways, bridges, and public infrastructure
Use 2	Water, stormwater, and sewer systems, including construction, reconstruction, maintenance, and repair
Use 3	Emergency preparedness and public safety, including law enforcement and fire services, hazardous material response, 911, equipment acquisition, and other services
Use 4	Environmental programs, including trails, parks and recreation, open space, flood plain management, conservation districts, and agricultural preservation
Use 5	Preservation and reclamation of surface and subsurface waters and water supplies
Use 6	Tax reductions, including homestead exclusions
Use 7	Projects to increase the availability of safe and affordable housing to residents
Use 8	Records management, geographic information systems, and information technology
Use 9	The delivery of social services
Use 10	Judicial services
Use 11	Deposit into the municipality's capital reserve fund if the funds are used solely for a purpose outlined in Act 13 of 2012
Use 12	Career and technical centers for training of workers in the oil and gas industry
Use 13	Local or regional planning initiatives under the act of 31 July 1968 (P.L. 805, No. 247), known as the Pennsylvania Municipalities Planning Code

The research included control variables in the model to account for possible differences associated with endogenous and exogenous factors. The model controlled for the county population (Population) using decennial census figures and intercensal estimates from the U.S. Census Bureau from 2001 to 2019. Ouedraogo (2016) provides an excellent overview of mineral resource extraction's impacts on population growth and decline and the relationship between extraction, population changes, employment, and wages. Given these relationships, controlling for the population at the county level proved necessary [1]. In addition, the model controlled for educational attainment at the county level (the percentage of the population with a bachelor's degree or higher) given the relationship between education and wages (Education) [46].

The model also accounted for the number of wells in each county annually (WellCount). Controlling for the level of activity allowed the researcher to tease out differences that may be attributed to industrial activity rather than infrastructural investments alone. Annual well counts are made available by the DEP. The well counts are representative of unconventional natural gas wells only and do not include conventional natural gas wells, as conventional wells do not factor into Act 13 assessments or distributions [10,44,47].

In the quasi-experimental model, the researcher included a dummy variable for infrastructural investments since the enactment of Act 13 (InvestmentTreatment). The dummy variable demarcates the policy treatment group in the regression to identify those counties that invested in infrastructure. The treatment group dummy variable is similar to the assigned value used in a difference-in-difference estimation. Counties that invested in infrastructure at any point since 2011 were assigned the value of '1', and counties that never invested in infrastructure were assigned the value of '0'.

Finally, a dummy variable to control for years before and after the passage of Act 13 was included in the model (PrePost). The data spans from 2001 to 2019 to establish county baselines before the passage of Act 13. Establishing a baseline before Act 13 was critical for two reasons. First, in the years leading up to the passage of Act 13, Pennsylvania, as with most of the United States, experienced the economic problems associated with the

Great Recession. These recessionary issues could impact the results [48]. Second, shale gas development had begun in earnest before Act 13 was passed, meaning there were several years in which Pennsylvania's extractive industry was untaxed. Those early years of extraction could also impact the results of the model.

3.2. Panel Estimation

The study sought to determine whether counties receiving funds from Act 13 in Pennsylvania that invested in infrastructure fared better in terms of wages and employment than their peers that saved the revenue or spent it in other categories.. The panel data from 2001 to 2019 were used to estimate the effects of investments in construction, reconstruction, maintenance, and repair of roadways, bridges, and public infrastructure and investments in water, stormwater, and sewer systems on county-level employment and income. The following two models were used in the estimation, with variables shown in county c at time t:

$$\begin{aligned} Employment = \quad & \alpha_t + \beta_1 Infrastructure_{c,t} + \beta_2 Population_{c,t} + \beta_3 Education_{c,t} + \beta_4 InvestmentTreatment_{c,t} \\ & + \beta_5 WellCount_{c,t} + \beta_6 PrePost_{c,t} + \delta_c + u_t + \varepsilon_{c,t} \end{aligned} \quad (1)$$

$$\begin{aligned} Income \quad = \alpha + \beta_1 Infrastructure_{c,t} + \beta_2 Population_{c,t} + \beta_3 Education_{c,t} + \beta_4 InvestmentTreatment_{c,t} \\ + \beta_5 WellCount_{c,t} + \beta_6 PrePost_{c,t} + \theta_{c,t} + \varepsilon_{c,t} \end{aligned} \quad (2)$$

The first model utilized time and entity fixed-effects while the second model used random-effects. The Durbin-Wu-Hausman test was used to determine the suitability of the models based on the correlation between individual characteristics and regressors [49]. When using the Hausman test, the null hypothesis states that the random-effects model is preferred. Therefore, if the p-value is less than 0.05, the null hypothesis should be rejected. The values of p were $p < 0.001$ while $p > 0.1$, for the first and second models, respectively. Given the results of the test, the estimate for employment utilized a fixed-effects model while the estimate for income used a random-effects model.

The estimated values of β_1 represent the change in employment and income per dollar invested in infrastructure. The fixed effects allowed for the control of factors that may also influence employment and income at the county level over time. The study used unweighted ordinary least squares regression in equation 1 and generalized least squares estimation in equation 2. Similar approaches have been adopted in the infrastructure and mineral resource extraction literature [44,45].

There was a total of 40 counties receiving payments from Act 13 included in the study. Baseline data from 2001 to 2011 were analyzed, with data from Act 13 between 2011 and 2019 used to measure the potential impacts of infrastructural investments. Thus, the panel included data from 2001 to 2019 for 40 counties, yielding 760 observations. Descriptive statistics for the study are shown in the table below (Table 2).

Table 2. Descriptive Statistics (n = 760).

	Mean	**St. Dev.**
Per Capita Personal Income	$74,046	7,860.67
Unemployment Rate	6.50%	1.59
Infrastructural Investment	$51,783.62	294,355.45
Well Count	14.16	38.90
Population	125,111.79	196,064.47

Analysis of the counties suggests that the Act 13 recipients over the study period were largely rural, except for Allegheny County, which includes the City of Pittsburgh. Allegheny County is an outlier in the data set, with over one million residents. The most significant infrastructural investment made by any county was $3,601,105, and the smallest investment was $0.

4. Results

The results suggest that the first model has explanatory value in terms of employment at the county level ($F = 28.22$, $p < 0.001$), $r^2 = 0.18$); with the number of wells, time before and after the passage of Act 13, and educational attainment proving significant (see Table 3). There was no statistically significant association between investments in infrastructure on employment in Pennsylvania. The dummy variable for investment was omitted due to collinearity.

Table 3. Income and Employment Effects.

	Standardized Coefficients Beta	**Robust Std. Errors**	**t**	**Sig.**
Population (Unemployment, %)	0.000	0.000	−4.545	0.845
Education (Unemployment, %)	−0.205 ***	0.025	−8.27	<0.001
Well Count (Unemployment, %)	0.006 ***	0.001	1.284	<0.001
Infrastructure (Unemployment)	0.000	0.000	−1.467	0.841
PrePost (Unemployment)	0.578 ***	0.185	−0.271	0.003
Invested (Unemployment)	(omitted)			
Constant (Unemployment)		2.05	5.49	<0.001
	Standardized Coefficients Beta	**Robust Std. Errors**	**z**	**Sig.**
Population (Income, Dollars)	0.003 ***	0.000	5.50	<0.001
Education (Income, Dollars)	182.28 ***	19.987	9.12	<0.001
Well Count (Income, Dollars)	5.45 **	2.346	2.32	0.020
Infrastructure (Income)	0.000	0.000	0.33	0.740
PrePost (Income)	1220.75 ***	205.32	5.95	<0.001
Invested (Income)	434.06	444.156	0.98	0.328
Constant (Income)		403.726	28.55	<0.001

*** $p < 0.01$, ** $p < 0.05$.

The model for income shows no association between investments in infrastructure on per capita personal income, despite the model explaining a considerable amount of variance in the dependent variable (Wald Chi-squared = 465.85, $p < 0.001$, $r^2 = 0.46$). Such as with the fixed-effects model for employment, multiple control variables proved statistically significant in the random-effects model for income, including education, well count, and the control for the period before and after the passage of Act 13. Unlike with employment, population proved significant in the random-effects model.

5. Discussion

Counties that used revenue from Act 13 to invest in roadways, bridges, water, sewers, and other major infrastructure were no better off in terms of employment and per capita personal income than counties that allocated the funds in any of the other approved spending categories identified in Act 13. The inclusion and significance of multiple variables controlling for county size/population, well counts, period before/after Act 13, and policy treatment suggest that other factors influenced employment and income more than infrastructural investments. Overall, the study indicated that the patterns observed in other studies concerning infrastructure-led development are not apparent in Pennsylvania and that alternative investments may prove more advantageous for communities interested in leveraging shale gas revenue dollars for economic development opportunities.

5.1. Employment

The control variables included in the panel estimation suggest that several other factors were more important in explaining the variation in unemployment between 2001 and 2019 than infrastructural investments. For example, the percentage of the population with a bachelor's degree, the number of wells, and the dummy variable controlling for the passage of Act 13 all impacted levels of employment during the study period. Interestingly, the well count showed that the unemployment rate increased with each additional well, a finding that adds to the literature on the economic impacts of unconventional natural gas development more broadly.

5.2. Income

Unlike employment, per capita, personal income was impacted by population. Rural counties had lower income levels than their more suburban and urban counterparts. The well count and the dummy variable controlling for the period before and after the passage of Act 13 also proved statistically significant in this model. In terms of the well count, the results showed an increase of $5.45 in income with each additional well, indicating an overall economic benefit of extraction regardless of how local authorities allocated funds from Act 13. This finding suggests a very modest increase in income for county residents, with a slight economic impact from shale gas activity overall.

The pre- and post-Act 13 variables also suggested that the legislation affected county income. In the years after the passage of Act 13, incomes increased by $1220.75 in the recipient counties. A counterargument to the law's impact on income is that the wage increase can be attributed to shale gas development in general, and not Act 13 specifically. However, unconventional natural gas wells were drilled several years before Act 13 was passed, and the increase in income was not captured in the earlier period.

Finding that Act 13 as a policy measure positively affected income is significant because the statute has been debated since its establishment. Pennsylvania Governor Tom Wolf attempted to undo the fee multiple times and install a more traditional severance tax. However, he never met success as local governments lobbied the legislature to oppose any changes to the impact fee. This study lends support to the local governments that argued that the fee would serve local communities better than a state severance tax.

5.3. Allocations from Act 13

Aside from the mandatory reporting guidelines provided by the Pennsylvania legislature; little guidance exists for Pennsylvania's municipalities on utilizing the funding received through Act 13. Acknowledging the literature on infrastructure-led development, this study sought to determine whether counties that used the funds for infrastructure experienced lower unemployment and incomes. The results show that investing in infrastructure using funds generated by shale gas development does not affect county-level employment or income. Had such a pattern materialized, it would have offered best practice for local officials who wanted to leverage revenue from the industry to promote economic development. The econometric models bore no such pattern. Consequently, local officials are just as well to use the funds as they see fit, as there was no association between investments in infrastructure, low unemployment, and high wages.

Understanding the potential benefits of such an investment is essential because the literature on resource extraction suggests that strategic investment of severance taxes and other such revenues can help communities, states, and nations ameliorate negative growth patterns associated with extractive industries. Numerous studies suggest that legacy or permanent funds that reinvest revenue generated by extraction are helpful, but details on how such funds should function are scant [26,27,50].

5.4. Findings in Context

Leveraging natural gas dollars for public infrastructure leads to neither decreases in unemployment nor income increases. The findings from this study suggest that in-

vestments made in infrastructure funded by Act 13 revenue may not facilitate economic development in the way it has in other studies. Such a conclusion lends support to the work of Deng (2013), who posited that research findings on infrastructural-led development are inconclusive and that the economic impacts of infrastructure projects are primarily contingent on different contexts, periods, and geographies [37].

Since tax policies have historically focused on severance taxes, this study supports an alternative regime that could benefit local governments and communities that directly host extraction [4]. While the results show no support for infrastructure-led development to impact employment or income in mineral resource extraction communities, they indicate that revenue streams benefiting local communities directly, such as in Act 13, can have a positive effect at the municipal level. Such findings bolster support for detractors of Act 13 in Pennsylvania, specifically, and offer alternative revenue schemes for states with mineral resource extraction, broadly.

Furthermore, the study offers additional evidence in the debate on the economic impacts of shale gas development. The economic impacts of gas development are more frequently explored in terms of income to gas output (of millions of cubic feet), jobs to output, income to known gas reserves, and others [1,5,22,45]. The model here relates income and employment in terms of the annual well count, an approach that does not appear as often in the literature.

6. Conclusions

Using fixed- and random-effects regressions, this study examined the impact of infrastructural investments from Act 13, the unconventional natural gas impact fee in Pennsylvania, on county-level employment and income between 2001 and 2019. While the two models explained some of the variation in employment and income, the variable of interest, infrastructural investment, proved statistically insignificant. Control variables included in the model, such as educational attainment and the number of natural gas wells, proved more predictive in the estimations of employment and income.

Despite the efforts of the study to collect the best data available and control for confounding variables, several shortcomings exist. First, the data made available by the Public Utilities Commission (PUC) are self-reported by the counties. As such, there is no way to ensure that the reported allocations come to fruition. That is, the researcher could not discern if the allocations in the PUC database were spent in the areas reported by the counties. Second, the data did not specify the type of projects funded or the time horizons of the projects. Thus, the data does not indicate precisely what was funded by the counties or when the projects were completed. Finally, the study does not account for spillovers between counties. Given the rural nature of much of Pennsylvania, significant projects or investments in one county may spill over into other counties, creating a regional growth effect. Unfortunately, the control variables included could not fully account for the potential regional nature of growth in the given time horizon.

Future studies should consider evaluating other spending categories reported to the PUC to identify potential impacts on employment, income, and other economic indicators. Furthermore, additional work should be completed to identify if deposits into capital reserve funds have an impact on county economies. Identifying the impacts of savings would enhance and augment the literature on permanent funds, which primarily focuses on state-level impacts [4,26,27,50].

While the findings reported here show an insignificant relationship, additional work could provide insights and further bridge the divide between the mineral resource extraction and infrastructure-led development bodies of literature by giving decision-makers better guidance as to how to effectively invest revenue generated by extractive industries. Such guidance is needed as leaders in Pennsylvania, other states, and even other nations contemplate how best to utilize revenue from mineral resource extraction to leverage additional economic benefits. Despite these shortcomings, the study provides additional insights into the economic value of shale gas development, supports Act 13 as an alterna-

tive tax scheme for extractive industries, and delves into the potential impact of spending patterns from shale gas revenue.

Funding: This research received no external funding.

Data Availability Statement: All data for this study are publicly available. Act 13 funds are reported and available here: https://www.act13-reporting.puc.pa.gov/Modules/Reports/ReportViewer.aspx?rptPath=/Act%2013/GovernmentSpendingLocalityDetails (accessed on 4 April 2023).

Conflicts of Interest: The author declares no conflict of interest.

References

1. Ouedraogo, A. Local economic impact of boom and bust in mineral resource extraction in the united states: A spatial econometrics analysis. *Resour. Policy* **2016**, *50*, 292–305. [CrossRef]
2. Haefele, M.A.; Morton, P. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains: Western Economics Forum. 2009. Available online: https://ageconsearch.umn.edu/record/92810 (accessed on 7 December 2019).
3. Newell, R.G.; Raimi, D. The fiscal impacts of increased U.S. oil and gas development on local governments. *Energy Policy* **2018**, *117*, 14–24. [CrossRef]
4. Rabe, B.G.; Hampton, R.L. Taxing Fracking: The Politics of State Severance Taxes in the Shale Era: Taxing Fracking. *Rev. Policy Res.* **2015**, *32*, 389–412. [CrossRef]
5. Black, K.J.; McCoy, S.J.; Weber, J.G. When Externalities Are Taxed: The Effects and Incidence of Pennsylvania's Impact Fee on Shale Gas Wells. *J. Assoc. Environ. Resour. Econ.* **2018**, *5*, 107. [CrossRef]
6. Backer, L.C. Sovereign Wealth Funds, Capacity Building, Development and Governance. *Wake For. Law Rev.* **2017**, *52*, 735.
7. Cohen, J.P. The broader effects of transportation infrastructure: Spatial econometrics and productivity approaches. *Transp. Res. Part E Logist. Transp. Rev.* **2010**, *46*, 317–326. [CrossRef]
8. Melo, P.C.; Graham, D.J.; Brage-Ardao, R. The productivity of transport infrastructure investment: A meta-analysis of empirical evidence. *Reg. Sci. Urban Econ.* **2013**, *43*, 695–706. [CrossRef]
9. Gittings, R.K.; Roach, T. Who Really Benefits from a Resource Boom? Evidence from the Marcellus and Utica Shale Plays. *Energy Econ.* **2019**, *87*, 104489. [CrossRef]
10. Tsvetkova, A.; Partridge, M.D. Economics of modern energy boomtowns: Do oil and gas shocks differ from shocks in the rest of the economy? *Energy Econ.* **2016**, *59*, 81–95. [CrossRef]
11. Hoy, K.A.; Kelsey, T.W.; Shields, M. An Economic Impact Report of Shale Gas Extraction in Pennsylvania with Stricter Assumptions. *Ecol. Econ.* **2017**, *138*, 178–185. [CrossRef]
12. Kinnaman, T.C. The economic impact of shale gas extraction: A review of existing studies. *Ecol. Econ.* **2011**, *70*, 1243–1249. [CrossRef]
13. Tunstall, T. Recent Economic and Community Impact of Unconventional Oil and Gas Exploration and Production on South Texas Counties in the Eagle Ford Shale Area. *J. Reg. Anal. Policy* **2015**, *45*, 82–92. [CrossRef]
14. Corden, W.M. Booming Sector and Dutch Disease Economics: Survey and Consolidation. *Oxf. Econ. Pap.* **1984**, *36*, 359. [CrossRef]
15. Castelli, M. Fracking and the Rural Poor: Negative Externalities, Failing Remedies, and Federal Legislation. *Ind. J. Law Soc. Equal.* **2015**, *3*, xii.
16. Zuo, N.; Schieffer, J.; Buck, S. The effect of the oil and gas boom on schooling decisions in the U.S. *Resour. Energy Econ.* **2019**, *55*, 1–23. [CrossRef]
17. Boutilier, R.G. Raiding the honey pot: The resource curse and weak institutions at the project level. *Extr. Ind. Soc.* **2017**, *4*, 310–320. [CrossRef]
18. Dubé, J.; Polèse, M. Resource Curse and Regional Development: Does Dutch Disease Apply to Local Economies? Evidence from Canada. *Growth Chang.* **2015**, *46*, 38. [CrossRef]
19. Gilberthorpe, E.; Papyrakis, E. The extractive industries and development: The resource curse at the micro, meso and macro levels. *Extr. Ind. Soc.* **2015**, *2*, 381–390. [CrossRef]
20. Gilberthorpe, E.; Rajak, D. The Anthropology of Extraction: Critical Perspectives on the Resource Curse. *J. Dev. Stud.* **2017**, *53*, 186–204. [CrossRef]
21. Papyrakis, E. The Resource Curse—What Have We Learned from Two Decades of Intensive Research: Introduction to the Special Issue. *J. Dev. Stud.* **2017**, *53*, 175–185. [CrossRef]
22. Graves, P.E.; Weiler, S.; Tynon, E.E. The Economics of Ghost Towns. *J. Reg. Anal. Policy* **2009**, *39*, 10. [CrossRef]
23. Venables, A.J. Using Natural Resources for Development: Why Has It Proven So Difficult? *J. Econ. Perspect.* **2016**, *30*, 161–184. [CrossRef]
24. Ross, M.L. The Political Economy of the Resource Curse. *World Polit.* **1999**, *51*, 297–322. [CrossRef]
25. Smith, B. The resource curse exorcised: Evidence from a panel of countries. *J. Dev. Econ.* **2015**, *116*, 57–73. [CrossRef]
26. Anderson, J. The Alaska Permanent Fund: Politics and Trust. *Public Budg. Financ.* **2002**, *22*, 57. [CrossRef]

27. Bishop, T.R. Looking 'North to the Future': Modeling Pennsylvania's Development of Natural Gas on Alaska's Permanent Fund Dividend. *Widener Law J.* **2014**, *23*, 813–842.
28. Thomas, C.S.; Savatgy, L.C.; Klimovich, K. *Alaska Politics and Public Policy: The Dynamics of Beliefs, Institutions, Personalities and Power*; University of Alaska Press: Fairbanks, AK, USA, 2016; Available online: https://libproxy.washjeff.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1261340&site=eds-live (accessed on 7 December 2019).
29. Elburz, Z.; Nijkamp, P.; Pels, E. Public infrastructure and regional growth: Lessons from meta-analysis. *J. Transp. Geogr.* **2017**, *58*, 1–8. [CrossRef]
30. Garin, A. Putting America to work, where? Evidence on the effectiveness of infrastructure construction as a locally targeted employment policy. *J. Urban Econ.* **2019**, *111*, 108–131. [CrossRef]
31. Leigh, A.; Neill, C. Can national infrastructure spending reduce local unemployment? Evidence from an Australian roads program. *Econ. Lett.* **2011**, *113*, 150–153. [CrossRef]
32. Ozbay, K.; Ozmen-Ertekin, D.; Berechman, J. Contribution of transportation investments to county output. *Transp. Policy* **2007**, *14*, 317–329. [CrossRef]
33. Bogart, D. Infrastructure and institutions: Lessons from history. *Reg. Sci. Urban Econ.* **2020**, *94*, 103626. [CrossRef]
34. Duffy-Deno, K.T.; Eberts, R.W. Public infrastructure and regional economic development: A simultaneous equations approach. *J. Urban Econ.* **1991**, *30*, 329–343. [CrossRef]
35. McCarthy, P.; Zhai, Z. Economic impact analysis of GDOT short line railroad infrastructure investment in Georgia. *Res. Transp. Econ.* **2019**, *77*, 100728. [CrossRef]
36. Sobieralski, J.B. Transportation infrastructure and employment: Are all investments created equal? *Res. Transp. Econ.* **2020**, *77*, 100927. [CrossRef]
37. Deng, T. Impacts of Transport Infrastructure on Productivity and Economic Growth: Recent Advances and Research Challenges. *Transp. Rev.* **2013**, *33*, 686–699. [CrossRef]
38. Manzano, O.; Gutiérrez, J.D. The subnational resource curse: Theory and evidence. *Extr. Ind. Soc.* **2019**, *6*, 261–266. [CrossRef]
39. Papyrakis, E.; Gerlagh, R. Resource abundance and economic growth in the United States. *Eur. Econ. Rev.* **2007**, *51*, 1011–1039. [CrossRef]
40. Bushman, J. *Pennsylvania Impact Fee and Natural Gas Trends*; IFO: Munich, Germany, 2020; p. 15.
41. Leduc, S.; Wilson, D. Roads to Prosperity or Bridges to Nowhere? Theory and Evidence on the Impact of Public Infrastructure Investment. *NBER Macroecon. Annu.* **2013**, *27*, 89–142. [CrossRef]
42. Hopkins, K.G.; Grimm, N.B.; York, A.M. Influence of governance structure on green stormwater infrastructure investment. *Environ. Sci. Policy* **2018**, *84*, 124–133. [CrossRef]
43. Kenyon, P. Infrastructure Spending and Unemployment: Government Responsibility for Growth and Jobs. *Aust. Econ. Rev.* **1997**, *30*, 421–432. [CrossRef]
44. Paredes, D.; Komarek, T.; Loveridge, S. Income and employment effects of shale gas extraction windfalls: Evidence from the Marcellus region. *Energy Econ.* **2015**, *47*, 112–120. [CrossRef]
45. Weber, J.G. The effects of a natural gas boom on employment and income in Colorado, Texas and Wyoming. *Energy Econ.* **2012**, *34*, 1580–1588. [CrossRef]
46. Gottlieb, P.D.; Fogarty, M. Educational Attainment and Metropolitan Growth. *Econ. Dev. Q.* **2003**, *17*, 325. [CrossRef]
47. Haggerty, J.; Gude, P.H.; Delorey, M.; Rasker, R. Long-term effects of income specialization in oil and gas extraction: The U.S. West, 1980–2011. *Energy Econ.* **2014**, *45*, 186–195. [CrossRef]
48. Deller, S.C.; Schreiber, A. *Frac Sand Mining and Community Economic Development*; Series 565; University of Wisconsin, Agricultural and Applied Economics: Madison, WI, USA, 2012; Available online: https://ideas.repec.org/p/ecl/wisagr/565.html (accessed on 25 October 2019).
49. Greene, W.H. *Econometric Analysis*; Pearson: London, UK, 2012.
50. Kozminski, K.; Baek, J. Can an oil-rich economy reduce its income inequality? Empirical evidence from Alaska's Permanent Fund Dividend. *Energy Econ.* **2017**, *65*, 98–104. [CrossRef]

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