

The Economic Impact of Coal Mine Closures in Appalachian Ohio: Comparing Administrative Boundaries and Functional Economies

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Abstract

This study models the economic impact of 2019 coal mine closures in Appalachian Ohio, emphasizing best practices in regional economic analysis. Using multi-regional input-output (MRIO) modeling across three geographic scales, it demonstrates how defining “functional economies” improves accuracy while also addressing the practical demands of stakeholders who require analysis aligned with political and organizational boundaries. Results show total job losses between 422 and 452, with multipliers from 2.07 to 2.21. By presenting multiple models, the study exemplifies rigorous, context-sensitive modeling that supports data-driven decision-making in facilitating economic transitions.

1 Introduction

In the fall of 2019, CCU Coal and Construction, LLC submitted a WARN Notice to the State of Ohio, announcing plans to lay off 205 workers across the Appalachian Ohio region (Ohio Department of Job and Family Services, 2019). These job losses were linked to declining coal demand following the closure of American Electric Power’s coal-fired power plant in Coshocton, Ohio (Williams and Burger, 2019). The federal Economic Development Agency provided support for regional partnerships to facilitate the necessary economic transition catalyzed by the series of coal mine closures in the region. This cross-sector partnership support included university collaboration with local development districts to investigate the economic impact of job loss, to conduct skillshed analysis, and to strategize around opportunities for long-term economic resilience and workforce engagement.

Although the original WARN Notice is no longer available on the state’s website, it outlined the anticipated job reductions by county. The layoffs included 115 positions in Athens and Perry Counties, 42 in Belmont County, 29 in Harrison County, 18 across Coshocton, Muskingum, Stark, and Tuscarawas Counties, and one in Jackson County. These counties span eastern and southeastern Ohio, with several non-contiguous areas affected.

To estimate the impact of the job losses, this report employs three distinct, yet related, geographic modeling methods. Approaching economic analysis with multiple models reflects both best practices, as well as practical, political, and organizational constraints and motivations for modeling the impacts of economic shocks.

2 Literature Review

2.1 Coal Economy

The decline of the coal economy, including coal mining, is well documented in the academic literature (Appalachian Regional Commission, 2016; Betz et al., 2015; Blonz et al., 2023; McIlmoil et al., 2023). Our aim is not to revisit this extensive body of work, but rather to situate the current closure within its broader context, particularly in Appalachia. As Betz et al. (2015) observe, Appalachia's share of coal production has fallen since the 1990s, driven by several factors—including the Clean Air Act of 1990, which favored low-sulfur coal from the Western U.S., and the subsequent rise of natural gas as a dominant source of electricity.

While this economic shift poses serious local and regional challenges, a parallel body of research has examined the broader negative impacts of coal mining on health and well-being. Living near coal mining operations has been linked to lower in-migration rates due to coal dust (Cebula and Duquette, 2023), elevated mortality rates (Ghosh and Cebula, 2021), and a range of diseases (Cortes-Ramirez et al., 2018).

Both nationally and regionally, the federal government and private foundations alike have taken an interest in facilitating cross-sector partnerships to address the externalities of the coal economy and its decline (e.g., Appalachian Regional Commission, 2016; Ford Foundation, 2025). Nationally, the retirement of coal-fired power plants and the resulting decline in coal demand have spurred numerous studies on employment and wage impacts (Pham et al., 2025). This study illustrates the university partner in role as an economic analyst seeking to support community and government partnerships with data for decision making via short-term employment-focused models.

2.2 Economic Impact Analysis

Input-output analysis, especially IMPLAN, is commonly used to assess the economic impact of exogenous shocks on an economy, such as the closure of a major employment facility (Dallaire-Fortier, 2024; Dudensing et al., 2019; Ro, 1982). In the academic literature, IMPLAN has been used to estimate the economic impact of coal mining (Considine, 2024), coal-fired power plants (Jolley et al., 2019), and clean coal energy generation (Altman and Hunter, 2015).

To capture the economic impact of coal mine closures on directly affected regions and the ripple effects across surrounding counties, trade flow data at the county level is essential. However, there is no publicly available dataset that provides observed comprehensive trade flow data between U.S. counties. IMPLAN is a platform that provides estimated inter-county trade flows, generated using a calibrated gravity model, which allows for a multi-regional input-output analysis at the county level (IMPLAN, 2025; Lindall et al., 2006).

3 Data and Methodology

This analysis follows the best practice guidelines outlined by Clouse et al. (2023), which recommend using the lowest level of a “functional economy” and employing multi-regional input-output (MRIO) analysis to minimize aggregation bias (p.6). A functional economy is one that could continue to exist without the broader region it resides in or near. Therefore, a zip code, county, city, or any other geographic area that is highly dependent on the interconnectedness of a larger region in terms of imports and exports of goods, services, and labor is not considered “functional economies” (Clouse et al., 2023). In the case of rural Appalachian Ohio, a single county is not a “functional economy” on its own and could not be considered at a regional level for any input-output analysis. Therefore, in this study, we include multiple MRIO models to estimate the direct economic impacts of job loss and the ripple effects throughout the larger Appalachian and Ohio region.

3.1 Data Collection

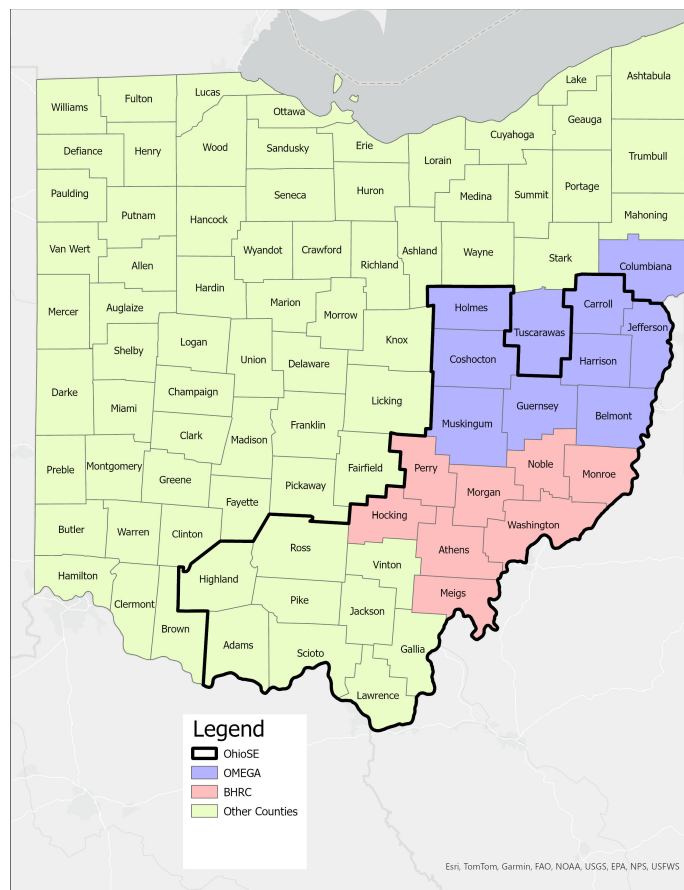
Data was collected from the WARN Notice submitted by CCU Coal and Construction, LLC. Each model uses the reported job loss in the coal mining industry in either 4 or 5 county regions as reported in the WARN Notice.

3.2 Analysis

Three economic impact models were constructed to reflect different geographic boundaries aligned with methodological rigor and political and organizational structures. Each of the models utilized MRIO analysis to better understand the connectedness of the counties where the direct impact of job loss occurred and the broader regional economy. MRIO analysis allows researchers to contribute the direct impacts to a specific area rather than using an average measure of the larger region, which would be weighted to the proportion of industrial activity and skew the impacts accordingly (Clouse et al., 2023). Additionally, MRIO allows for feedback in terms of commuting and trade between the areas of direct impact and the broader region, and vice versa. Because of this, the results of an MRIO analysis will not be the same as simply summing together separately run impacts in the region.

The base model (1) focused on a rigorous data-driven definition of the lowest level of a multi-regional “functional economy”: the eight counties affected by mine closures (minus Jackson County). Model 2 expanded this impact model based on two federally designated Economic Development Districts: Buckeye Hills Regional Council (BHRC) and Ohio Mid-Eastern Governments Association (OMEGA). Model 3, the broadest model, included the statewide economic development organization JobsOhio, designated OhioSE region, along with Stark and Tuscarawas Counties. Figure 1 shows these geographies.

Figure 1: BHRC, OMEGA, and OhioSE regions



4 Results

Model 1 estimates that the loss of 204 direct mining jobs leads to a total loss of 422 jobs (multiplier: 2.07). Model 2, which includes additional counties tied to federal economic development regions, estimates a slightly higher total job loss of 444 (multiplier: 2.18). Model 3, covering the largest area and including 205 direct job losses, results in 452 total job losses (multiplier: 2.21). Multipliers for labor income, value-added, and output were relatively consistent across models. Table 1 provides details associated with each model.

Table 1: CCU Coal and Construction Closure (2019 data and dollar year)

Impact Type	Employment	Labor Income	Value Added	Output
<i>Model 1: MRIO 8 Counties (Athens, Perry, Belmont, Harrison, Coshocton, Muskingum, Stark, and Tuscarawas)</i>				
Direct	-204	-\$34,385,648	-\$32,725,111	-\$69,674,895
Indirect	-69	-\$4,237,788	-\$8,623,807	-\$17,121,777
Induced	-149	-\$5,616,772	-\$11,450,167	-\$20,377,351
Total	-422	-\$44,240,208	-\$52,799,085	-\$107,174,023
Multiplier	2.07	1.29	1.61	1.54
<i>Model 2: MRIO using the BHRC and OMEGA, plus Stark County</i>				
Direct	-204	-\$34,385,648	-\$32,725,111	-\$69,674,895
Indirect	-77	-\$4,782,884	-\$9,855,831	-\$19,826,763
Induced	-163	-\$6,101,308	-\$12,430,276	-\$22,154,175
Total	-444	-\$45,269,840	-\$55,011,218	-\$111,655,833
Multiplier	2.18	1.32	1.68	1.60
<i>Model 3: MRIO using the OhioSE plus Tuscarawas and Stark Counties</i>				
Direct	-205	-\$34,584,645	-\$32,932,826	-\$70,063,738
Indirect	-81	-\$5,119,656	-\$10,405,509	-\$21,060,690
Induced	-166	-\$6,264,837	-\$12,722,787	-\$22,646,787
Total	-452	-\$45,969,139	-\$56,061,122	-\$113,771,215
Multiplier	2.21	1.33	1.70	1.62

5 Discussion

Best practices in economic impact modeling, as reflected in Model 1, recommend defining the smallest possible “functional economy” to ensure analytical precision (Clouse et al., 2023). Especially for rural regions such as Appalachian Ohio, understanding local economic patterns is best practice for defining this functional unit. In creating the MRIO region for Model 1, the counties chosen represent the geographic spread of the CCU Coal and Construction job loss, commuter patterns, and economic context of the geographically isolated, mostly rural region. In defining the MRIO region, it was critical to capture the patterns typical of the regional context to ensure the precision of the movement of goods and services. Choosing too small a region would yield data too imprecise to garner reliable results, but choosing too large a region over-estimates multiplier effects.

However, federal agencies and regional economic development organizations prefer (and might require) impact estimates aligned with designated administrative boundaries. Model 2 responds to this need by expanding the analysis to include two federally designated Economic Development Districts. Model 3 further

broadens the scope to reflect how state-level stakeholders, such as JobsOhio, might assess impacts across the entire OhioSE region.

5.1 Best Practices and Policy Implications

Model variations highlight the importance of balancing methodological rigor with the practical and political realities of funding, governance, and regional planning. Establishing the MRIO region in all three models keeps the direct impacts situated in the county in which they occur and thus allows the modeling to capture ripple effects of the induced and indirect impacts in the larger geographical regions more accurately. Furthermore, presenting stakeholders and policymakers with multiple models affords clarity on both localized impact and more broad-reaching implications that touch overlapping development districts. Multiple models allow policymakers to strategize both locally and on a state or regional level.

Organizations use economic analyses like the one presented here to inform policy interventions and resource allocation in the event of exogenous shocks. In the example of coal mine closures in Appalachia, the direct labor loss indicates a need for upskilling or reskilling workforce efforts, which can be provided by Economic Development Districts and workforce partners (Appalachian Regional Commission, 2021). Indirect and induced labor losses give policymakers insight into the broader ripple effects on the regional workforce, helping to inform next steps, such as attracting new employers or pursuing alternative economic development strategies, to absorb or redirect workers who may be displaced by the coal mine's closure (Ricket et al., 2023).

5.2 Limitations

There are several limitations to this study and input-output modeling in general. The input-output model is a static framework that relies on economic data from a single year (Dorfman, 1954; Leontief, 1936). The model assumes that industries use inputs in fixed proportions and do not account for changes in technology, productivity, prices, or relationships between industries over time (Clouse et al., 2023). The model also assumes a fixed regional labor market, where workers do not migrate, retrain, or switch jobs after economic shocks. While assumptions make the input-output model less suitable for long-term economic analysis, the model is still useful for analyzing short-term economic impacts, where major structural changes are not expected right away.

Another limitation of this study is the absence of observed county-to-county trade flow data in the United States. To address this gap, IMPLAN employs a calibrated, doubly constrained gravity model that estimates inter-county commodity flows based on regional output, demand, and geographic distance (Lindall et al., 2006). The estimated trade flows enable MRIO analysis at the county level, making it possible to analyze the cross-regional economic impact of coal mine closure in the absence of observed trade data.

5.3 Conclusion

University partners play a critical role in conducting economic analysis and communicating to cross-sector partners. Using best practices such as leveraging local expertise to define impact areas, providing multiple models, and clear communication to stakeholders, economic analyses can help facilitate economic transitions and policy decisions that support regional economies.

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