Shift-Share Analysis, Appalachian Counties

Prepared for the Appalachian Regional Commission

by

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Introduction

In *County-level CIE Supply Chain Analysis*, the second of five parts of *An Economic Analysis of the Appalachian Coal Industry Ecosystem* posted to the Commission's website in January of 2018, we developed a set of metrics that were used to provide insights on the past and future supply chain implications of long-term coal industry decline in Appalachia.[1] These metrics were used to identify counties that have been heavily impacted by the decline of the coal industry, those that remain dependent on the coal industry ecosystem (CIE), and among the dependent counties, those that are at greatest risk of further impact. This document reports the results of further exploratory analysis aimed at more detailed descriptions of employment trends and conditions in the 420 counties that form the Appalachian Region (the Region) that might prove useful in devising regional economic development strategies.

The primary tool for this research is shift-share analysis (SSA). SSA has a long and storied history in regional analysis.[2] It is a straightforward method that can be used to decompose growth into three readily interpreted and easily understood components. While its simplicity has been the source of episodic criticism, its ease of implementation and transparency have allowed it to remain among the most useful and widely applied of all regional economic analytical tools.[3] In their historical reconnaissance of SSA, Lahr and Ferreira conclude that, as a "practicable accounting identity," SSA "remains an excellent starting point for analyzing growth change and differences at the regional level." It is in this spirit that we launch this descriptive investigation.

In the next section, we review the foundations of SSA and the ways we use it to classify and categorize study regions. In section three, we present the empirical results of our analysis in map and tabular form.

Shift-Share Analysis

In this section, we provide a largely textual description of the SSA method. Because the method is so intuitive and readily accessible, we are able to describe the SSA component derivations and their interpretations without the need for extensive equation sets and variable definitions that are common in presentations of similar economic analysis methods. Those interested in mathematical formulations may consult Appendix I, or numerous sources in the literature, such as Jackson and Haynes (2009), or Lahr and Ferreira (2020).

Employment, wages, and related regional characteristics can be associated with industries, industries compose regional economic systems, and regional economic systems can be grouped into larger regions, which can ultimately define nations and even the global economy. When our interest lies in regional economic performance, it is meaningful to compare industries' performance relative to one another, relative to the regional economic system, and relative to a larger referent region of which the study-region is a part. Likewise, regional industrial systems

[1] https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=141. Accessed October 21, 2019.
[2] ML Lahr and JP Ferreira. "A Reconnaissance through the History of Shift-Share Analysis". Handbook of Regional Science, Vol 1: History of Regional Science 2019.
[3] Criticism of SSA is most often leveled at its use as a theoretical tool or in forecasting. Other issues involve typical analytical considerations such as those pertaining to the choice of analytical period, levels of aggregation, appropriate referent region.

can be summarized and compared to other regions. SSA supports precisely these kinds of analytical comparisons.

Foundations

The fundamental questions that are addressed by SSA are focused on industry performance. Specifically, we ask (1) How much an industry in a study region would have grown had it grown at the overall rate for the referent region (2) How much an industry would have grown had it grown at the difference between the overall rate and that industry's rate in the referent region, and (3) what are the changes in study region industries that cannot be attributed to overall average growth nor to industry performance in the referent region. The most common measure of performance is employment growth, and the most commonly used study regions are counties or multi-county metropolitan areas, but any smaller region can be compared to a larger geographical region in which it is located. The national economy is the most commonly used referent region, and for this reason, the growth in a study region's industry that would have occurred had it grown at the referent region's overall average growth rate is by convention called the National Share, or NS component of change.[4] The growth in a study-region industry that would have occurred had its industry grown at the referent region's industry-specific growth rate is called the Industry Mix, or IM component of change. The growth that is not attributable to the National Share or Industry Mix component is most often called the Regional Shift, or RS component of change. The Regional Shift variable is often taken to reflect some kind of local comparative advantage for the industry in question.

To clarify, consider the example of an analysis of county growth relative to the nation. Assume that over the course of a study period the national economy grew by 10%, and that national Industry A grew by 11%. If county Industry A began the study period with 200 employees, then its NS change component for Industry A would be 200 X 10% = 20. Its IM component would be 200 X (11% - 10%) = 2. If Industry A in the county actually grew by 30 employees, then its RS component of change would be 30 - NS - IM = 30 - 20 - 2 = 8. The positive IM identifies Industry A as an industry that is growing faster than the national average. The positive RS identifies the region as a better than average place for Industry A. It indicates that it grew faster than would have been predicted relative to both national and industry-specific growth rates. Restated, some portion of the observed growth, 8 employees in this case, cannot be attributed to the national rate of growth or to the industry-specific rate of growth.

Implementing SSA clearly requires a measure of economic performance, a study region, a designated study period, and a referent region against which to compare the study region's economic sectors. Although the most commonly used referent region is the region's national economy, other comparisons can also provide useful information. For example, we might be interested to discover how an Appalachian county's industries compared to overall average and industry-specific growth in the Appalachian Region. A third referent region of interest might be more localized, such as a county and its neighboring counties. The research in this report makes use of all of these referent regions. Each of the 420 counties in the Appalachian Region will be used as study regions. The economies of these counties will be assessed, individually, relative to the national economy, to the economy of the Region, and to referent regions formed from each

[4] For simplicity, we use the NS abbreviation even when the referent region is not the nation.

county and its neighboring counties. Additionally, we will conduct SSA on the entire Appalachian Region relative to the national economy.

The time period selected for SSA can have an impact on the results. The most critical consideration when it comes to selecting a time period is the need to avoid choosing beginning- and end-points that are in dramatically different positions on the business cycle. The national growth rate computed from a business cycle peak to a business cycle trough, for example, would be quite different from the same rate computed from trough to peak. The recent CIE analysis was conducted using employment data from the 2005 to 2015 period. At the time of that analysis, 2015 data were the most recent available, and both of these years were post-recession years, with no signs of either marking the peak or decline in a national business cycle. As of this writing, the 2018 data are the most recent available, and given the relatively stable growth trends since 2015, we will focus the results from the SSA on the 2005–2018 period. We also will use employment data drawn from the Bureau of Labor Statistics and processed further and supplied by IMPLAN, a third-party commercial vendor.[5] Our analysis uses a level of industry detail based on the 71-sector classification system used in the Bureau of Economic Analysis' annual input-output accounts.[6] The final 68-sector industry classification scheme is included as Appendix II.

SSA also makes it possible to characterize the entirety of the industrial economy of each study region. The sums of each of the three components for all industries in a county provide measures of the relationships of the local economy to national and industry trends, and the deviations from these trends, which are often taken to reflect *overall* regional comparative advantage.

Interpreting SSA Results

One of the advantages of SSA is the ease of interpretation of results. We focus on the industry mix (or simply, mix) and regional shift (or simply, shift) components because the NS component, which simply reflects average expected growth, will have the same sign for all constituent study areas. The mix component is of somewhat greater interest, because it provides not only industry-specific performance expectations, but when summed over all of a region's industries, it reveals whether the region is composed of well- or poorly-performing industries, and by doing so it reflects the health of the regional industrial structure. A positive mix value for a region indicates a healthy and desirable industry structure. The shift value is often the most informative, because for a single industry a positive shift indicates better than expected performance, and a positive sum across all of a region's industries suggests that this is a region that is favorable for economic activity in general.

Jackson and Haynes (2009) summarize the interpretations for the four possible combinations of industry-specific mix and shift variable values relative to the nation as shown in Table 1, below.

Table 1. Interpreting the Signs of IM and RS Components

IM	RS	Assessment

[5] https://implan.com/data/ last accessed January 31, 2020.
[6] https://www.bea.gov/industry/input-output-accounts-data last accessed January 31, 2020. Database compatibilities reduced the 71-sectors in the BEA scheme to the 68 sectors that we use in our analyses.

-	-	This industry was a poor performer overall, and even poorer in the study region than elsewhere
-	+	This industry was a poor performer overall, but better in the study region than elsewhere
+	-	This industry was a good performer overall, but poorer in the study region than elsewhere
+	+	This industry was a good performer overall, and even better in the study region than elsewhere

Mitchel, Myers and Juniper (2005) introduced an additional informative variable to SSA, namely the Total Share, or TS, and define it as the sum of the mix and shift values. The TS can be computed for individual industries and can be computed for an entire study region using the sums of its industries' IM and RS component values. Table 2, below, displays the ways in which these three variables can used to define six shift-share categories and their associated interpretations and policy implications. For the interpretations in Table 2, the study regions are counties and the referent region is the national economy.

Table 2. Category Definitions and Interpretations

Group	Total Share	Condition	Interpretation
1	Positive	Positive mix and shift	County growing faster than national average with advantageous industry mix and local factors. No policy indicated.
2	Positive	Positive mix > negative shift	County growing faster than national average due to a favorable industry mix offsetting unfavorable local conditions. Development policy could focus on improving local infrastructure (such as transport systems).
3	Positive	Positive shift > negative mix	County growing faster than national average with local factors offsetting the unfavorable industry mix. Development policy could target growth industries to offset the concentration of static or declining industries.
4	Negative	Positive shift < negative mix	County growing slower than national average, due to unfavorable industry mix but partly offset by advantageous local factors. Development policy could target growth industries to offset the concentration of static or declining industries.
5	Negative	Positive mix < negative shift	County growing slower than national average due to disadvantageous local factors partly offset by favorable industry mix. Development policy could focus on improving local infrastructure (such as transport systems).
6	Negative	Negative mix and shift	County growing slower than national average with local factors and industry mix providing disadvantages. The county lacks growth industries and local infrastructure.

The 420 Appalachian counties can be assigned to these six general categories, and because there are three referent regions, group membership can vary from one analysis to the next. We also have the additional all-counties analysis relative to the national economy. Thus, to distinguish among analyses, we have assigned four different identifiers to the four different analyses:

- Appalachia vs. the United States fall into categories **A – F**[7]
- Counties to the United States referent are labeled **I – VI**
- Counties to the Appalachian Region referent are labeled **a – f**
- Counties to the neighboring counties referent are labeled **i – vi**

These categories are summarized in Table 3, below.

Table 3. Categories Relative to Four SSA Configurations

Appalachia vs. U.S.	County vs. U.S.	County vs. Appalachia	County vs. Neighbors	Condition			Interpretation	Policy Action Target
				TS	IM	RS		
A	**I**	**a**	**i**	**+**	**+**	**+**	Region growing faster than referent with favorable industry mix and local factors.	**No regional policy indicated.**
B	**II**	**b**	**ii**	**+**	**+**	**-**	Region growing faster than referent with industry mix offsetting unfavorable local factors.	Regional policy could **focus on improving local infrastructure (such as transport systems)**.
C	**III**	**c**	**iii**	**+**	**-**	**+**	Region growing faster than referent with local factors offsetting unfavorable industry mix.	Regional policy should **focus on developing growth industries** to offset the concentration of industries that are either static or in decline.
D	**IV**	**d**	**iv**	**-**	**-**	**+**	Region growing slower than referent with unfavorable industry mix partly offsetting favorable local factors.	Regional policy should **focus on developing growth industries** to offset the concentration of industries that are either static or in decline.
E	**V**	**e**	**v**	**-**	**+**	**-**	Region growing slower than referent with industry mix partly offsetting unfavorable local factors	Regional policy could **focus on improving local infrastructure (such as transport systems)**.
F	**VI**	**f**	**vi**	**-**	**-**	**-**	Region growing slower than referent with unfavorable local factors and industry mix.	**Develop growth industries and local infrastructure.**

[7] Prior to this analysis, there were 6 possible outcomes, corresponding to the six conditions A – F. The single Appalachia vs United States analysis placed resulted in the F outcome.

Counties whose all-industry summaries put them in the first category are the healthiest in the region. As such, they would not be priority counties for policies aimed at alleviating economic distress. Counties in the second group have generally favorable industrial structures, but for some reason don't perform as well as would be expected solely on that basis. This might occur in places where public infrastructure is deteriorating or otherwise less than satisfactory. In the third group, the industrial structure is not generally a favorable one, but the county apparently has some characteristics – such as a well-developed transportation system – that allow it to overcome any disadvantageous industry mix. In Group D and E counties, the IM and RS are offsetting, but positive values on one variable are too small to offset the negative trends in the other. Finally, counties in the sixth group are facing the worst of all situations, where mix is disadvantageous relative to the referent region, and the county is generally not a favorable location for economic activity.

Industries also can be differentiated using the same combinations of TS, IM, and RS components. For example, to be in the **I, a, i** category, an industry must have positive values for all three components, and to be in the **II, b, ii** category, an industry must have a positive TS and IM, but a negative RS, and so on. These categories are shown in Table 4, below.

Table 4. Industry Groupings and Interpretations

ARC vs. Nation	County vs. Nation	County vs. Appalachia	County vs. Neighbors	Condition TS	IM	RS	Industry Description
A	**I**	**a**	**i**	**+**	**+**	**+**	Strong referent and regional performance
B	**II**	**b**	**ii**	**+**	**+**	**-**	Strong referent trends outweigh poor regional performance
C	**III**	**c**	**iii**	**+**	**-**	**+**	Strong regional trends outweigh poor referent performance
D	**IV**	**d**	**iv**	**-**	**-**	**+**	Poor referent trends outweigh strong regional performance
E	**V**	**e**	**v**	**-**	**+**	**-**	Poor regional performance outweighs strong referent trends
F	**VI**	**f**	**vi**	**-**	**-**	**-**	Poor referent and regional performance

To assist decision-makers in the identification of high-potential industries (HPI) for development purposes, such as targeting for recruitment or retention programs, these categories can be used as an informative screening tool. To qualify as HPI in the county analyses reported here, industries must meet three criteria. First, they must first belong to groups A, B, or C, or I, II, or III. Second, they must also belong to groups a, b, or c, or i, ii, or iii. Third, the industry must account for at least 1% of county employment.

Of course, HPI status is no guarantee that these industries are good candidates for in-county development; HPI status only identifies a smaller set of candidate industries worthy of *further* consideration as part of development policies. These industries will need to be the subject of further assessment prior to formulating development programs, as there may very well be locational or theoretic reasons as to why an industry identified as HPI might not be a good choice for development, such as a lack of necessary infrastructure (specialized or general), perhaps in the form of high-power electricity, rail access, high-volume water supply, treatment requirements, etc. HPI status is merely intended to assist development professionals by narrowing the focus of their analyses.

In this part of the report, we provide a two-level analysis of the Appalachian Region. The first level presents the analysis of the SSA of the entire Appalachian Region relative to the national economy. The second level focuses on the summary results of the analyses of each county relative to each of the three referent regions.

Results: Appalachia

In this section we present the results for Appalachia in summary, by industry, and by county.

Appalachia Overall

Although the whole of Appalachia is too large and heterogeneous for the development of targeted development policy, we carried out an SSA for Appalachia vs. the United States to provide a point of reference for the subsequent county-based analyses. In this analysis, the entire region and its industries are compared to the United States economy for the 2005 to 2018 time period. Both were relatively stable and comparable years. Had the Region grown at the national average rate of growth, it would have added more than a million employees, but because of its comparative regional disadvantages, total Appalachian employment grew by only 32,956, or 0.34% during the study period. Its Industry Mix and Regional Shift summary measures were both negative, with the IM registering -146,586 and the RS registering -913,159, for a Total Share of -1,059,745, from a starting period employment base of 9,689,610. The relatively small negative IM value suggests that the Region's industrial structure is somewhat less advantageous than its national economic counterparts, but the relatively large negative RS value suggests that the Region must overcome relatively large comparative disadvantages. Comprehensive results for Appalachian industries are found in this report's Supplemental Documents.

Appalachia By Industry

We find that only seventeen of 68 Appalachian industries belong to categories A, B, and C, which exhibit stronger performance than industries in categories D, E, and F, and two of these industries are excluded from analysis.[8] Table 5 below lists the SSA metrics for the remaining fifteen industries in categories A, B, and C. Seven of these industries are in category A, with positive IM and RS components; seven are in category B, where a desirable industry mix outweighed the regional comparative disadvantages; and one is in category C, where the regional comparative advantage compensated for the counterpart national industry's slower than average rate of growth.

Table 5. Appalachian Industries in Groups A, B, and C

Industry	Name	Group Membership	Total Share (TS)	Regional Employment 2018
55	Administrative and …	A	11,701	499,331
54	Management of companies …	A	35,210	132,275
64	Accommodation	A	8,587	110,539
56	Waste management and …	A	4,836	33,494

[8] Of these, two industries provide very little information or guidance. The first of these is Rail Transportation, which is an industry that is not covered comprehensively in the study region database, and the second is the Unclassified industry, which is the catchall for employment that the Bureau of Labor Statistics was unable to allocate to any named industry. Both of these industries will be removed from all subsequent counts, tables and charts.

6	Support activities for …	A	6,408	22,296
46	Securities, commodity …	A	2,612	22,225
3	Oil and gas extraction	A	2,343	7,889
69	*Unclassified*	*A*	*3,850*	*3,850*
34	*Rail transportation*	*A*	*10*	*10*
65	Food services and drinking …	B	62,656	832,480
58	Ambulatory health care …	B	85,072	528,510
53	Miscellaneous profession …	B	5,993	281,912
61	Social assistance	B	39,111	253,021
63	Amusements, gambling, …	B	3,925	102,638
52	Computer systems design …	B	20,374	71,799
62	Performing arts, spectator …	B	2,908	35,054
16	Motor vehicles, bodies …	C	11,614	149,132

Table 6. Top Ten Industries Ranked by Regional Shift (RS)

Industry	Name	Total Share (TS)	Industry Mix (IM)	Regional Shift (RS)	Regional Employment 2018
16	Motor vehicles, bodies …	11,614	-24,968	36,582	149,132
54	Management of companies …	35,210	20,453	14,757	132,275
21	Textile mills and …	-68,543	-75,624	7,081	75,677
64	Accommodation	8,587	2,105	6,482	110,539
23	Paper products	-12,799	-17,004	4,205	40,004
3	Oil and gas extraction	2,343	93	2,250	7,889
55	Administrative and …	11,701	9,493	2,208	499,331
27	Plastics and rubber prod…	-9,426	-11,445	2,019	106,551
56	Waste management and …	4,836	2,865	1,971	33,494
46	Securities, commodity …	2,612	1,324	1,288	22,225

Table 7. Top Ten Industries Ranked by Total Share (TS)

Industry	Name	Total Share (TS)	Industry Mix (IM)	Regional Shift (RS)	Regional Employment 2018
58	Ambulatory health care …	85,072	139,790	-54,718	528,510
65	Food services and drinking …	62,656	131,882	-69,226	832,480
61	Social assistance	39,111	125,994	-86,883	253,021
54	Management of companies …	35,210	20,453	14,757	132,275

52	Computer systems design …	20,374	30,519	-10,145	71,799
55	Administrative and …	11,701	9,493	2,208	499,331
16	Motor vehicles, bodies …	11,614	-24,968	36,582	149,132
64	Accommodation	8,587	2,105	6,482	110,539
6	Support activities for …	6,408	5,884	524	22,296
53	Miscellaneous profession …	5,993	41,903	-35,910	281,912

Appalachia By County

In this section, we present an overview of Appalachian counties in comparison to one another. We make these comparisons by first assessing the group memberships outcomes for the entire Region, and second by assessing the county distributions of SSA component scores, namely RS, TS, and IM.

Group Membership

Because we have three alternative referent regions against which to compare counties, we can assign counties to categories relative to each referent region. In all three cases, counties in the first three categories are performing well, and counties in the last three categories are performing poorly relative to the referent regions. A comprehensive list of counties in the analysis along with group membership identification is included as Appendix III.

Map 1 displays the county categories relative to the United States, Map 2 displays the county categories relative to the Appalachian Region, and Map 3 displays the county categories relative to the more local area, as defined by the county and its neighboring counties.

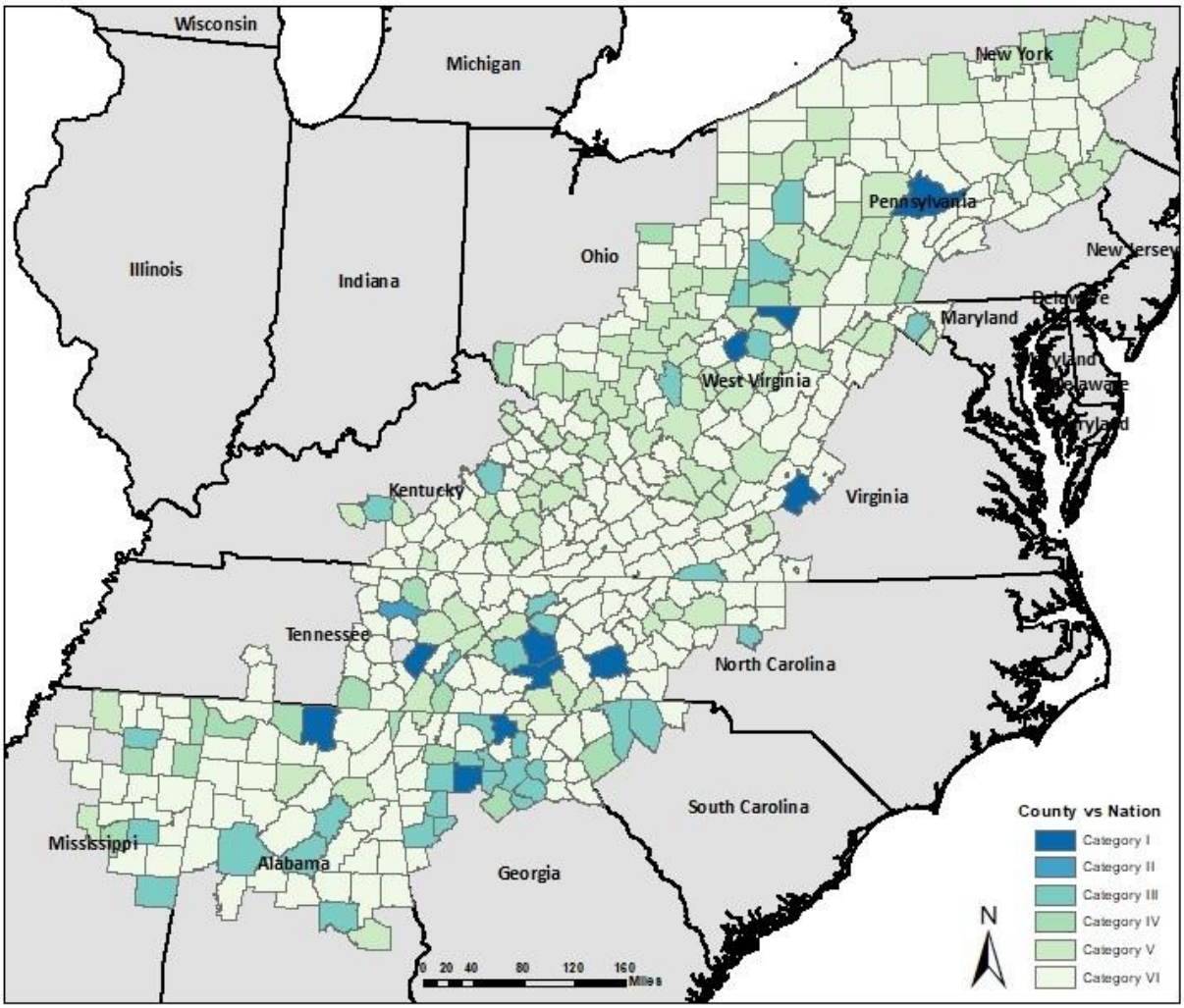
Because Appalachia so broadly underperformed the United States' economy during the study period, Map 1 is also dominated by group membership in the poor-performers categories. Table 8 confirms this relationship, and shows that the numbers of counties that fall into the top three groups increases as the geographical scope of the referent region diminishes.

Table 8. Appalachian County Group Membership by Referent Region

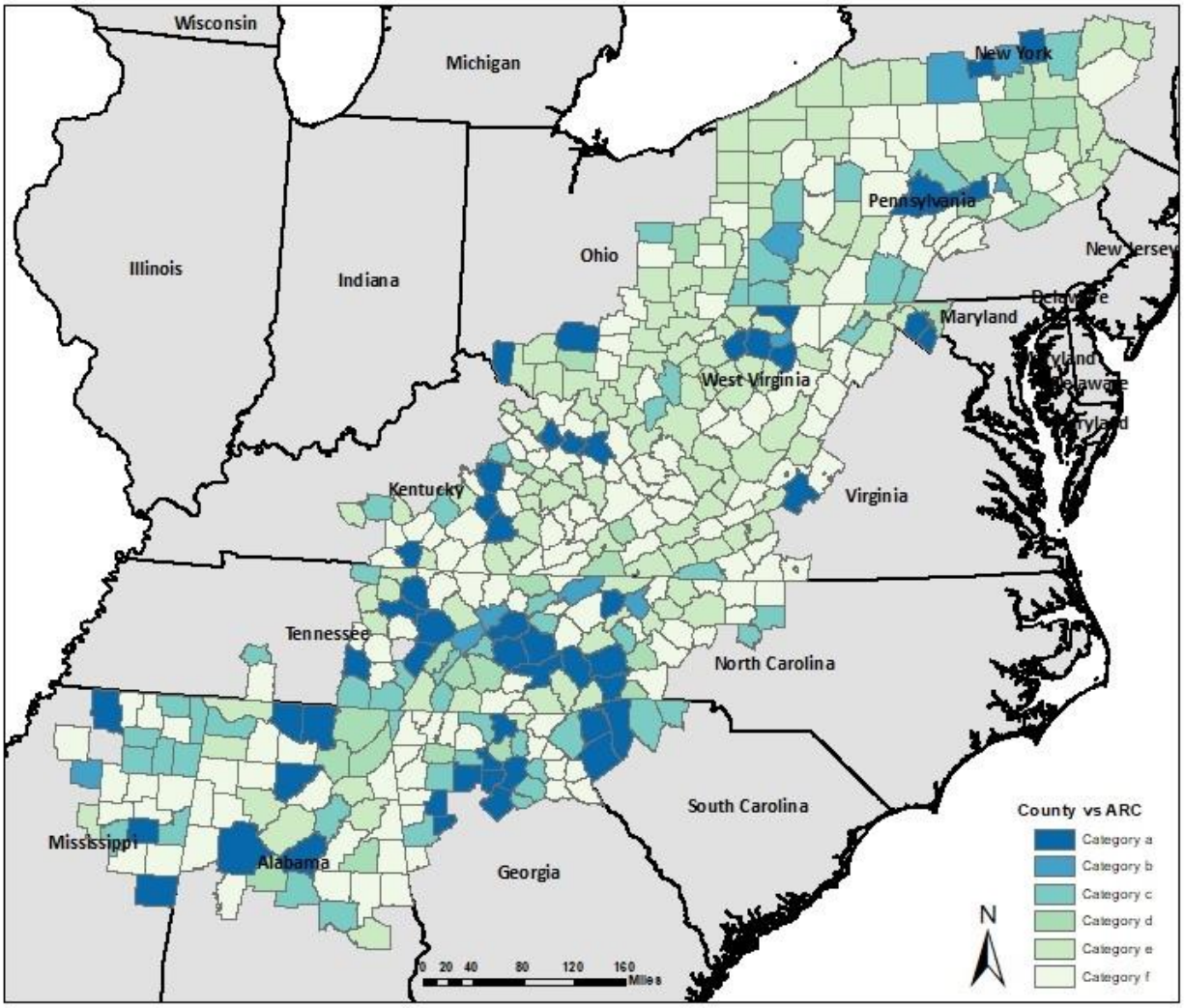
County vs. United States	Count	County vs. Appalachia	Count	County vs. Neighbors	Count	Condition TS	IM	RS
I	11	a	52	i	67	+	+	+
II	1	b	10	ii	29	+	+	-
III	36	c	54	iii	63	+	-	+
Subtotal	48		116		159			
IV	18	d	27	iv	14	-	-	+
V	97	e	119	v	97	-	+	-
VI	257	f	158	vi	150	-	-	-
Subtotal	372		304		261			

On Maps 1 – 3, darker colors correspond to the top three categories. Hence, we see many fewer darkly colored counties on Map 1 than on Map 2, and fewer again on Map 2 than on Map 3. Referring to Table 2, counties in the top groups (I, a, and i) are in least need of focused regional development policies, and those in the second and third groups also have a positive TS value, implying either an advantageous industry structure or regional comparative advantages. Those counties in the fourth groups appear to have some regional comparative advantages, but less favorable industrial structures than the referent regions. Fifth group counties have favorable industrial structures but have regional comparative disadvantages that might be overcome with local infrastructure investments, and sixth-group counties warrant comprehensive assessments with respect to both industry structure and local infrastructure. For more detailed analysis by county, readers may consult the Supplemental Documents for this report.

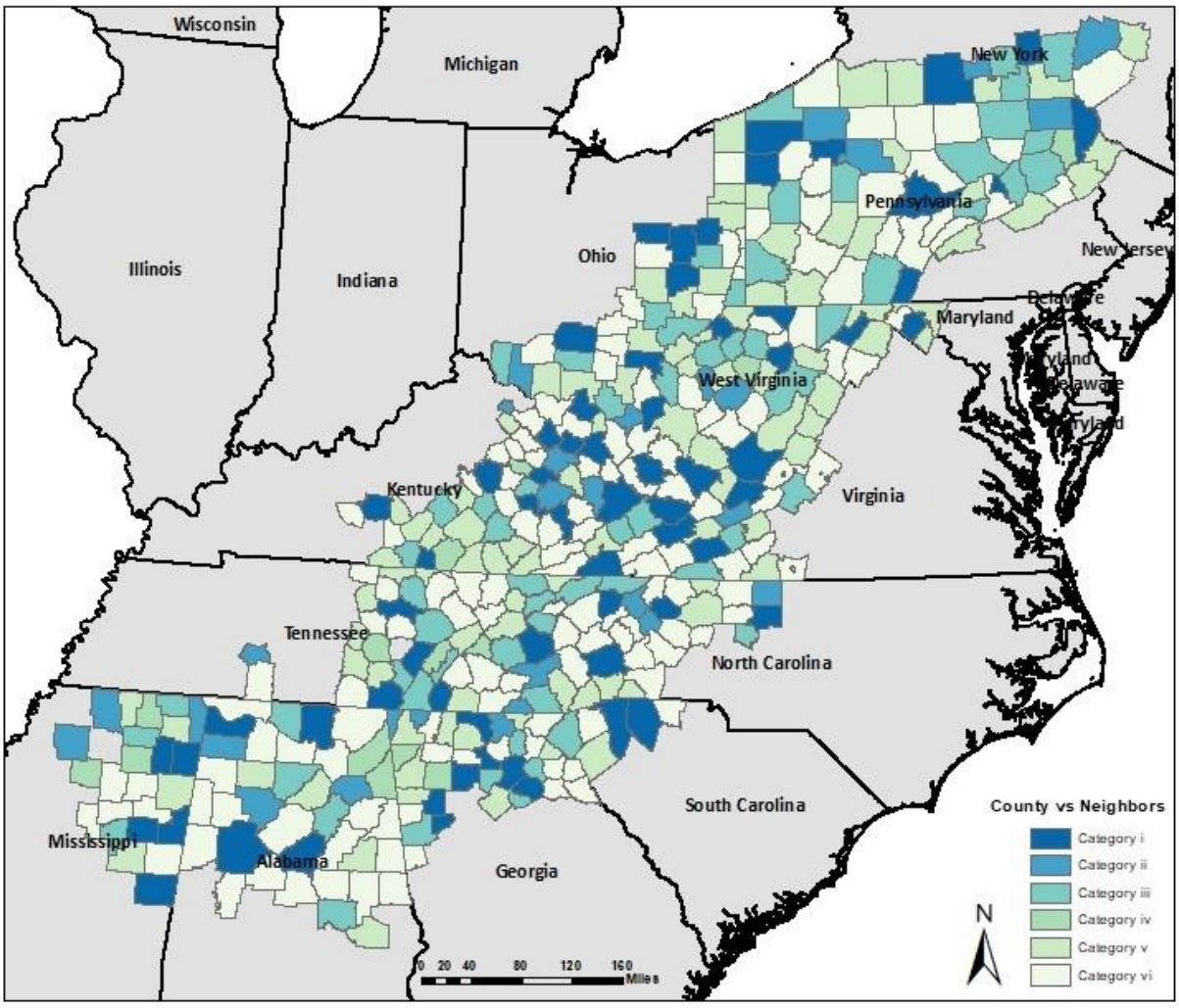
Map 1. Appalachian Counties vs. the United States: Shift Share Analysis 2005 - 2018



Map 2. Appalachian Counties vs. the Appalachian Region: Shift Share Analysis 2005 - 2018



Map 3. Appalachian Counties vs. their Neighbors: Shift Share Analysis 2005 - 2018



County Summary Variables

Having industry-specific results from the analyses relative to three different referent regions also proves quite useful. Although a given industry might not appear to be a good prospect when compared to the national economy, it might still be among the best options for a more restricted geography. Hence, it is useful to identify comparative advantages and disadvantages relative to a range of geographical options and, in in subsequent more detailed industry assessment, also in consideration of industry clustering considerations and market characteristics.

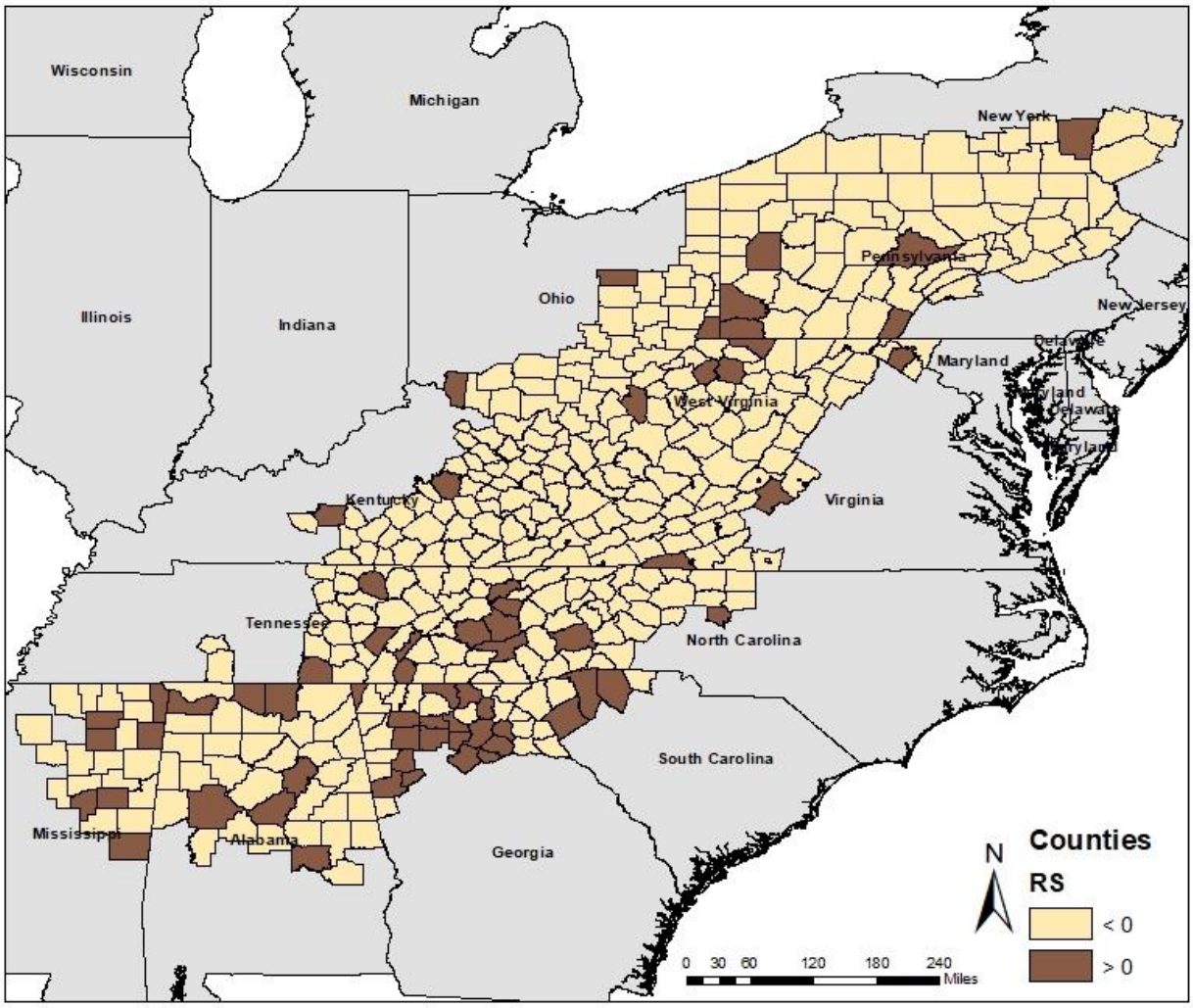
As with group membership, because the Appalachian economy generally underperforms the national economy, the SSA results relative to the nation most often identify generally poor industry-specific performance in terms of employment growth. The additional referent regions give a better sense of what might be viable options relative to Appalachia and to the more local geographic areas.

The remaining subsections are each composed of three referent-region maps for each of three summary variables: Regional Shift, Industry Mix, and Total Share. The maps display whether the values have positive or negative values for the three SSA components. These maps reveal the spatial dispersion or clustering of results. Actual values for each of the summary component variables can be found in the Supplemental Documents to this report.

County Summary Variables: Regional Shift

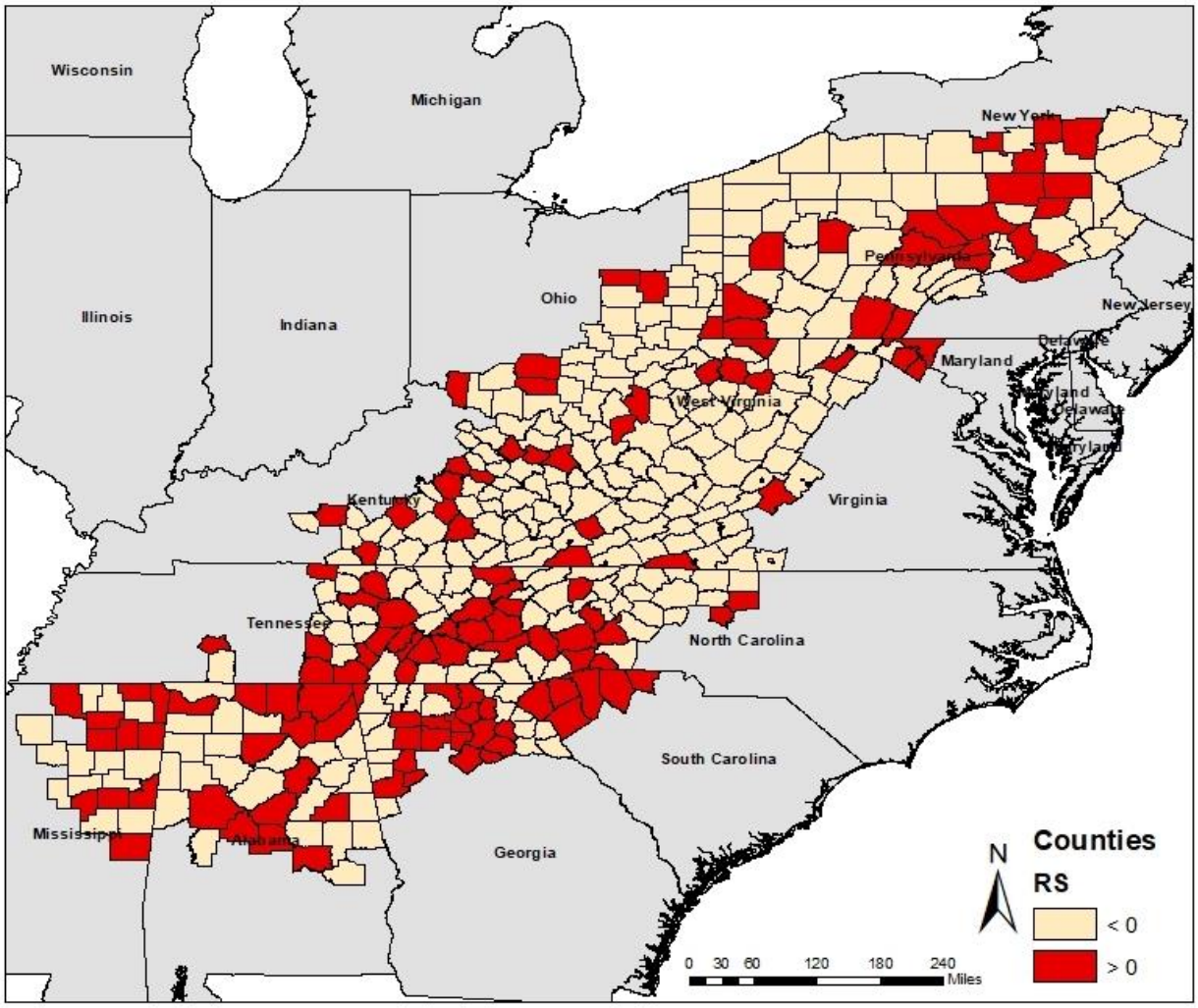
Map 4, below, reveals some spatial clustering of regional comparative advantage. The paucity of positive RS values also confirms the general underperformance of Appalachian counties compared to the whole of the United States.

Map 4. Appalachian Counties vs. the United States: Regional Shift (RS) 2005 - 2018



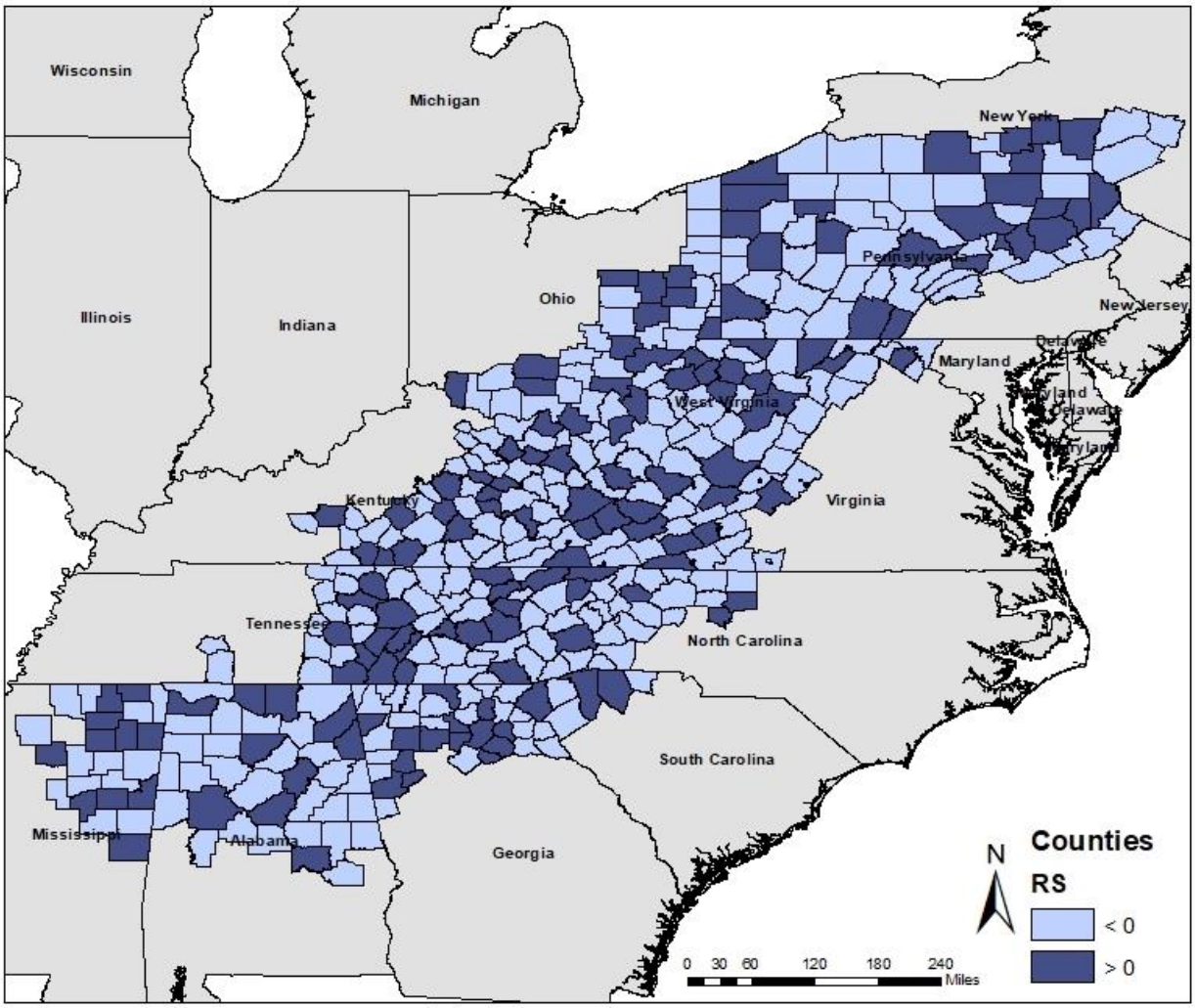
Consistent with the summary-component trends in Table 8, Map 5 reveals a larger number of counties with positive RS summary component values than Map 4, and as would be expected, the map also reveals more and mostly larger clusters.

Map 5. Appalachian Counties vs. Appalachia: Regional Shift (RS) 2005 - 2018



Map 6 likewise reveals a more regular distribution of positive RS values. In part, this arises from the definition of the referent region, which includes the study region county and its neighboring counties. Hence, there will be no large clusters of counties with negative RS values. Note that neighboring counties can lie outside of the formally defined Appalachian Region.

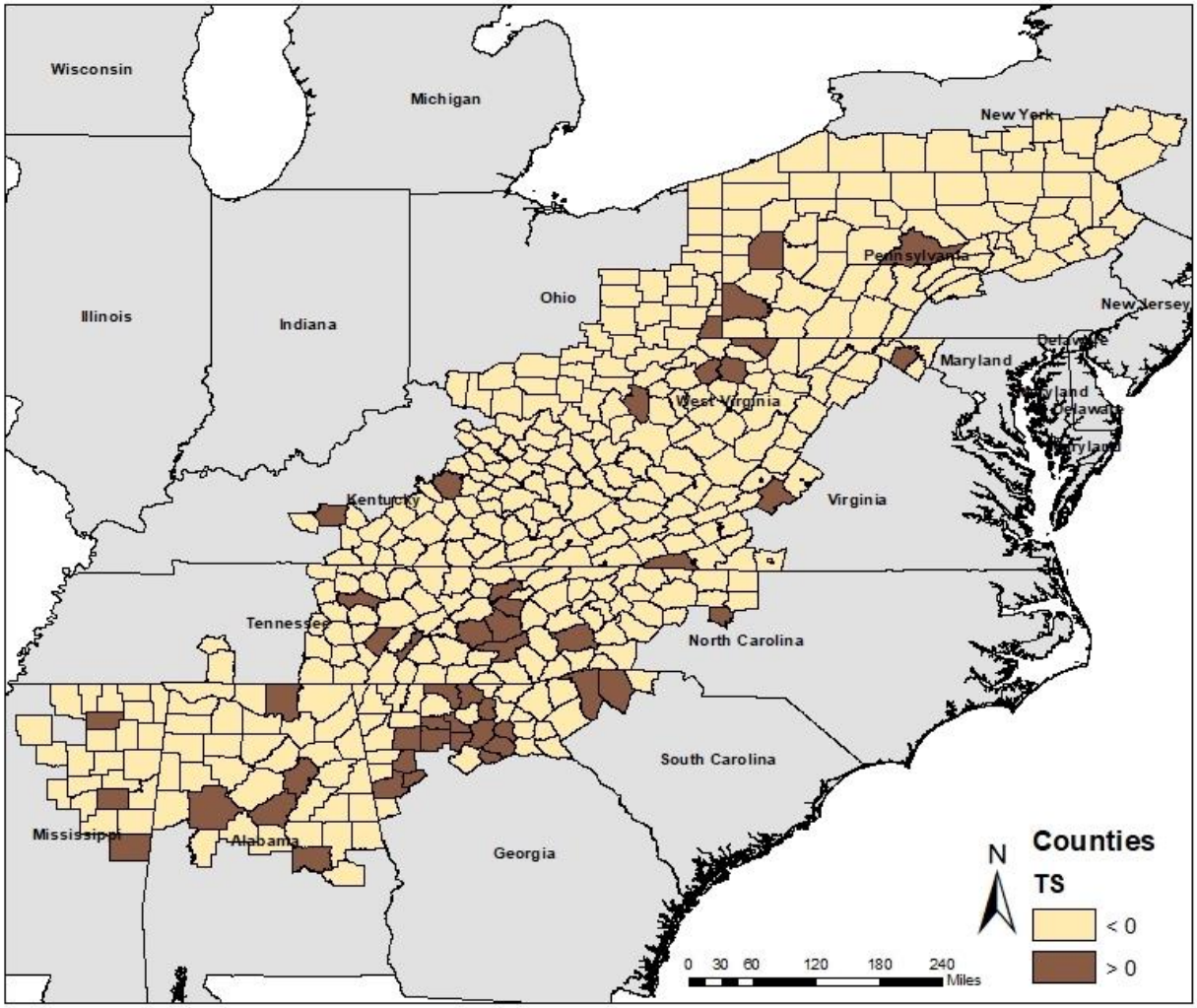
Map 6. Appalachian Counties vs. Neighbors: Regional Shift (RS) 2005 - 2018



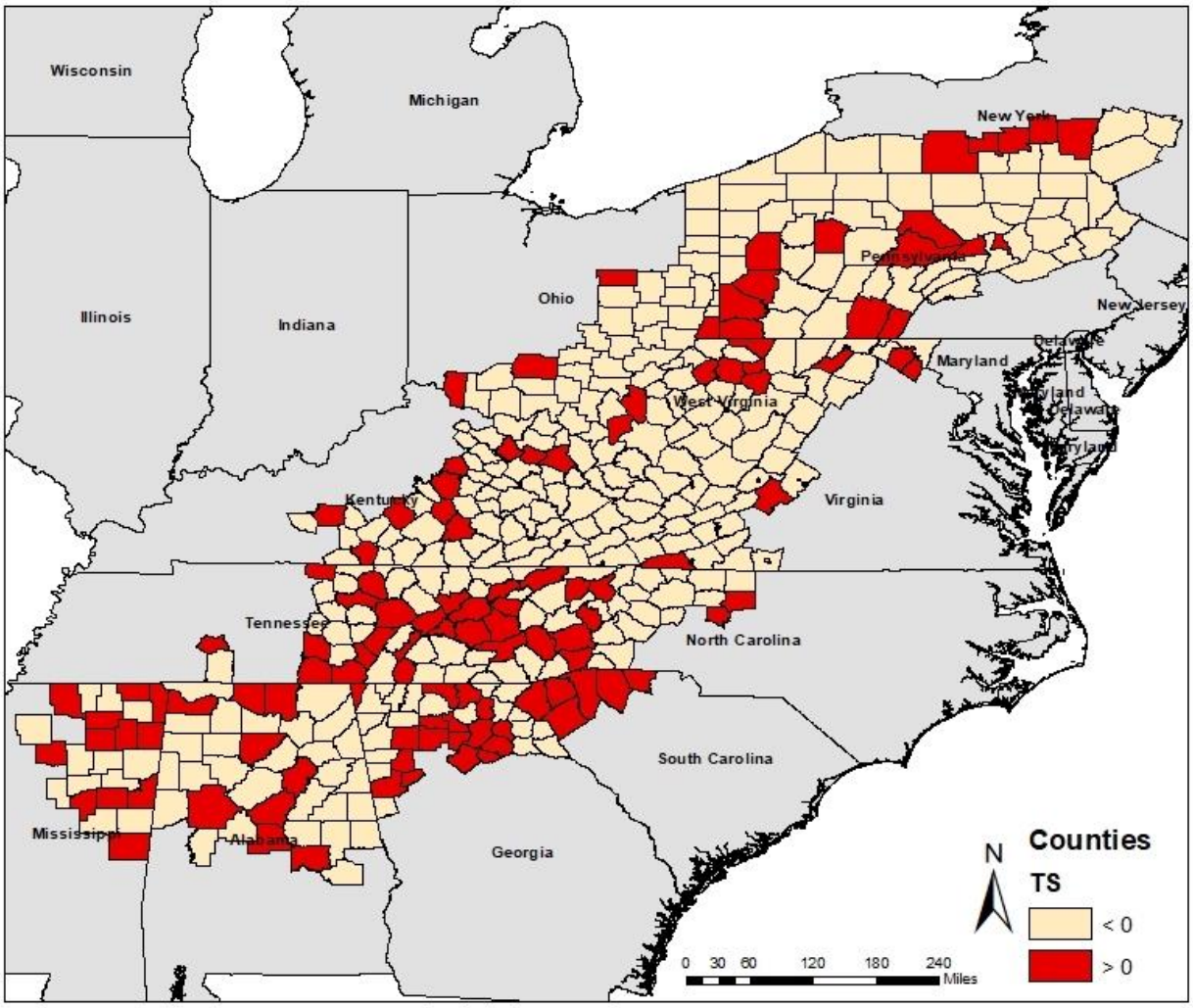
County Summary Variables: Total Share

Maps 7, 8, and 9 show the locations and distributions of Total Share summary component values. Positive TS values indicate counties that outperformed the national economy because of either favorable industry structure or some other favorable county-specific reasons, or both.

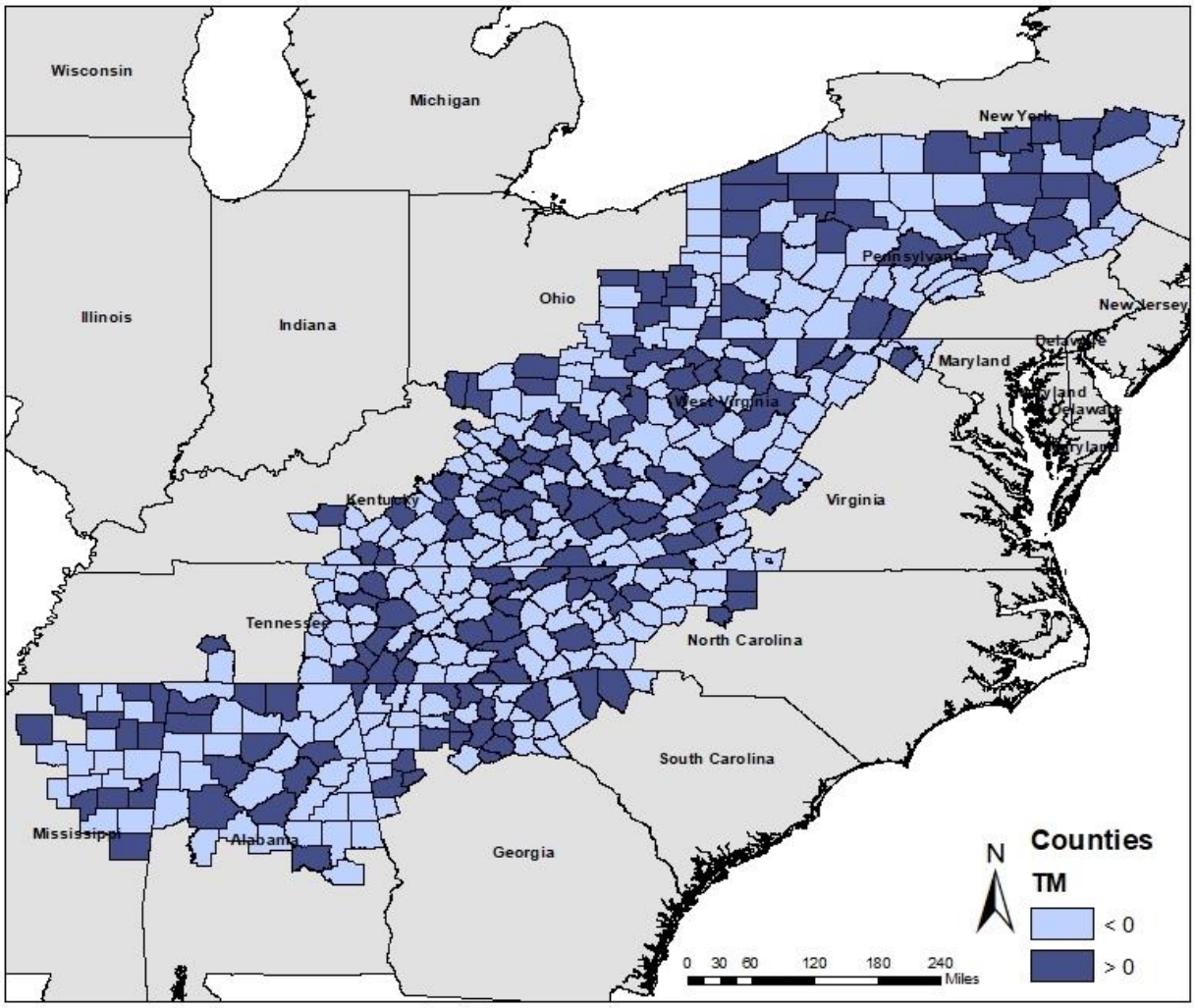
Map 7. Appalachian Counties vs. the United States: Total Share (TS) 2005 - 2018



Map 8. Appalachian Counties vs. Appalachia: Total Share (TS) 2005 - 2018



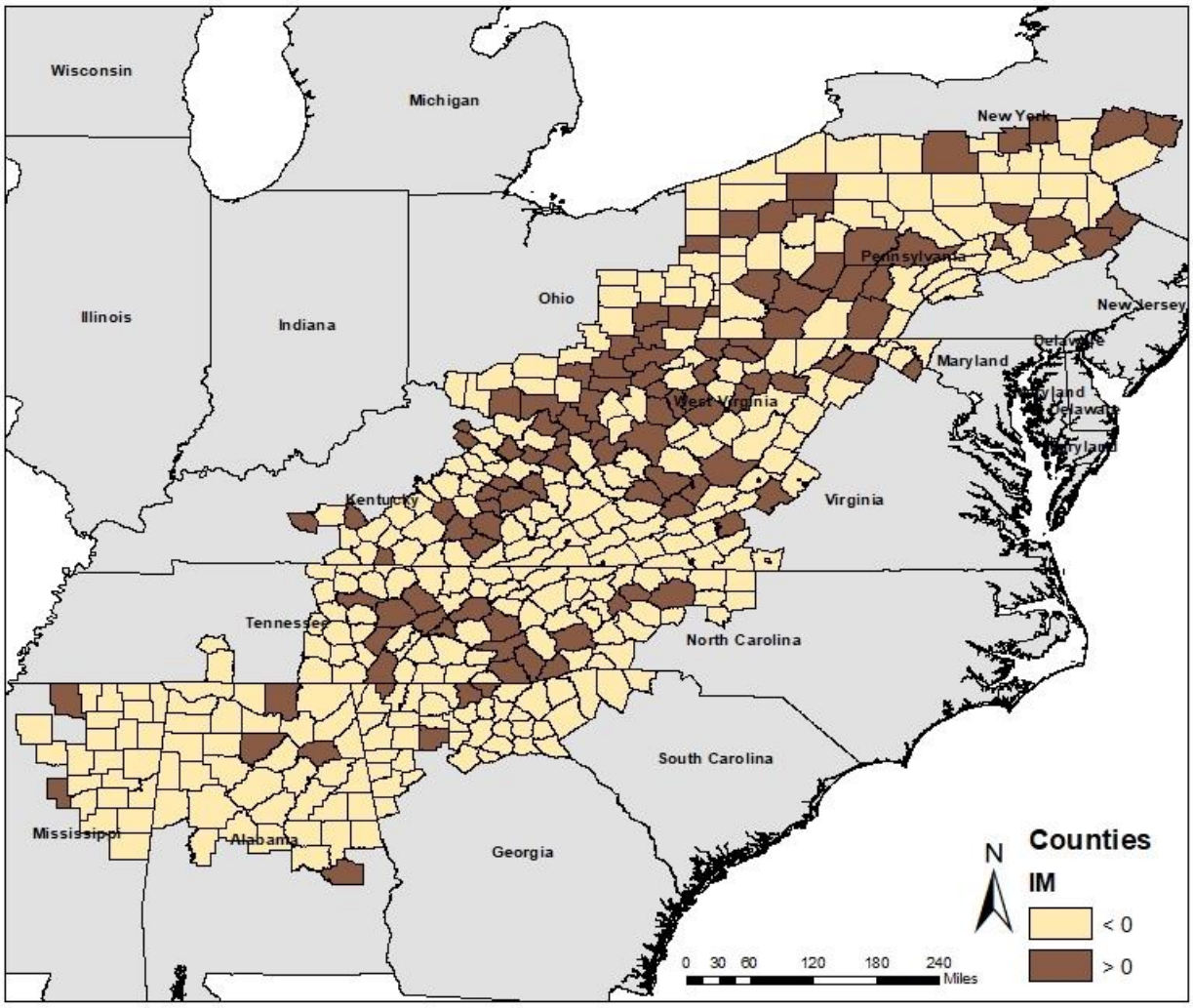
Map 9. Appalachian Counties vs. Neighbors: Total Share (TS) 2005 - 2018



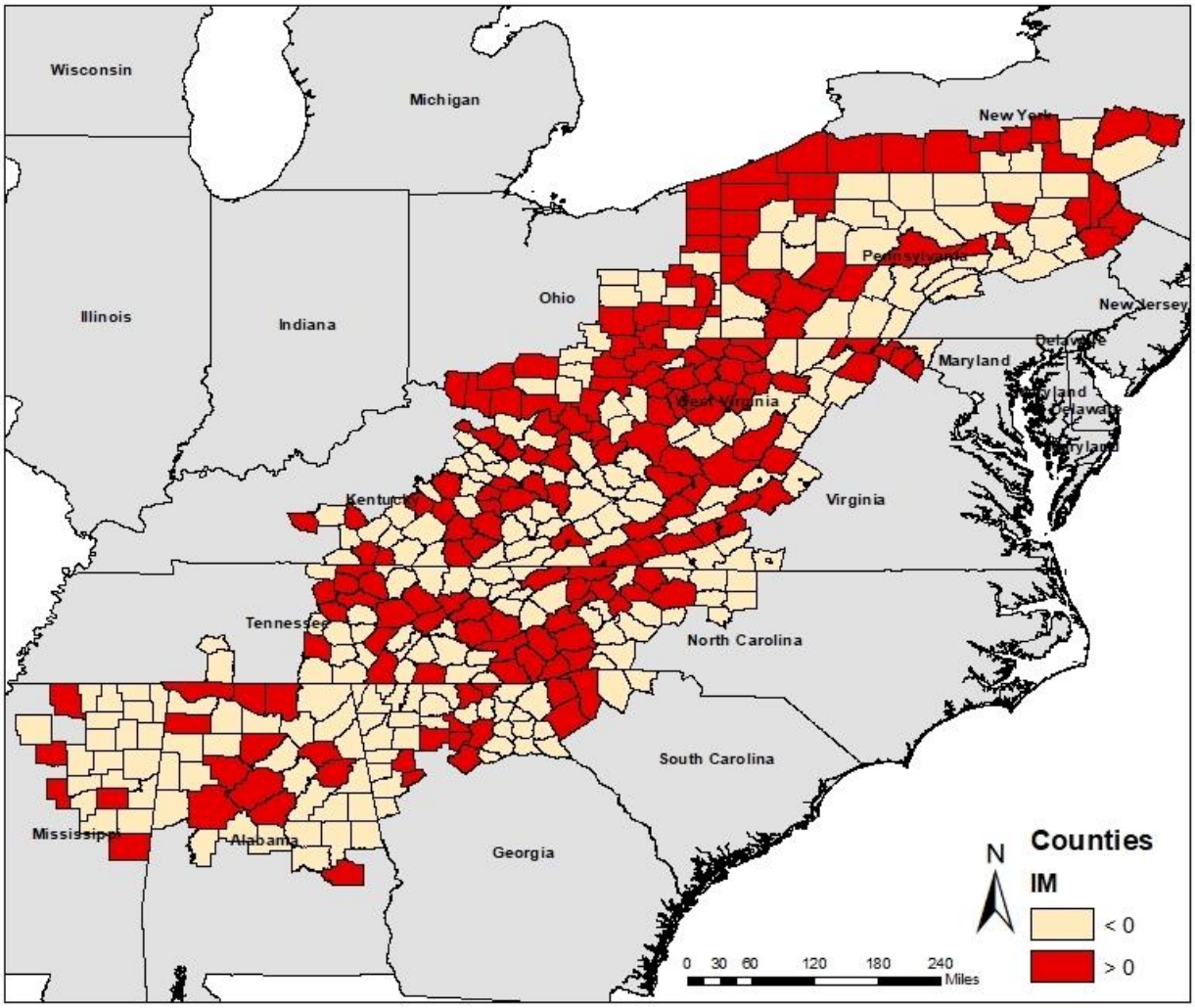
County Summary Variables: Industry Mix

Maps 10, 11, and 12 display the locations and distributions of counties with favorable industrial structures. Trends similar to those for the RS and TS component summaries are observed in these final maps.

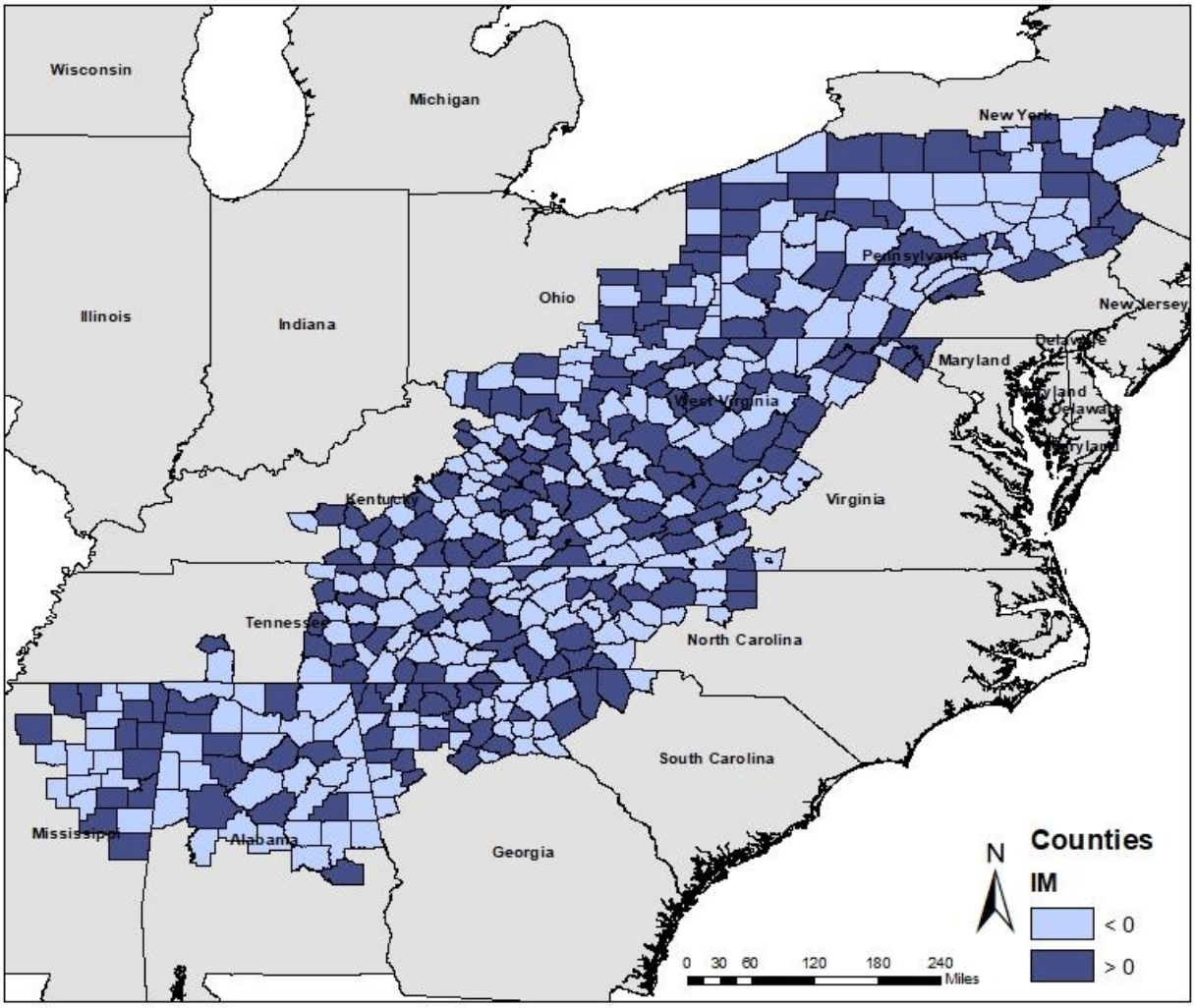
Map 10. Appalachian Counties vs. Nation: Industry Mix (IM) 2005 - 2018



Map 11. Appalachian Counties vs. Appalachia: Industry Mix (IM) 2005 - 2018



Map 12. Appalachian Counties vs. Neighbor: Industry Mix (IM) 2005 - 2018



Description of Supplemental Documents

There is one Supplemental Document for every state in Appalachia. These documents are composed of one Chapter for each of the state's Appalachian counties. Each Chapter begins with a brief summary of overall county growth, along with a table of summary results for the three SSA configurations: county vs. nation, county vs. Appalachia, and county vs. neighbors. County summaries are followed by industry-specific results in terms of group membership, and for high-potential industries, the SSA results are presented graphically. Assuming that readers have access to this document and a general understanding of the fundamentals of SSA, the Chapters are designed to be useful as standalone documents for readers who might wish to extract the relevant pages.

There are two additional Supplemental Documents that present SSA for all micropolitan and metropolitan areas that are wholly contained in the Appalachian Region. These documents contain study area analyses that are similar in structure to the county-level analyses, but they exclude the *area plus neighbor counties* referent regions.

References

Jackson, R, and K Haynes. (2009). "Shift-Share Analysis." 125-131. In Kitchin, R., & Thrift, N. (2009). *International encyclopedia of human geography*. Elsevier.

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Lahr, Michael L. & Ferreira, João Pedro (2020). A reconnaissance through the history of shift-share analysis. *Handbook of Regional Science* Retrieved from https://doi.org/doi:10.7282/t3-0gs3-nw29

Mitchell, W., Myers, J., & Juniper, J. (2005). Extending shift-share analysis to account for spatial effects: a study using Australian census data, Centre of Full Employment and Equity, WP 05-19. CofFEE, Newcastle, Australia.

Appendix I. Shift Share: Mathematical Foundations

This Appendix draws heavily on Jackson and Haynes (2009).

Variables:

e_t^r - total employment in region *r* at time *t*

$e_{i,t}^r$ - employment in region *r* industry *i* at time *t*

e_t^n - total national employment at time *t*

$e_{i,t}^n$ - national employment in industry *i* at time *t*

With these values for beginning and ending periods, we calculate the following three growth rates:

$$r_i = e_{i,t}^r \Big/ e_{i,t-1}^r \quad = \text{growth rate for regional industry } i \tag{1}$$

$$n_i = e_{i,t}^n \Big/ e_{i,t-1}^n \quad = \text{growth rate for national industry } i \tag{2}$$

$$n = e_t^n \Big/ e_{t-1}^n \quad = \text{average national total growth rate} \tag{3}$$

By definition:

$$e_{i,t}^r = e_{i,t-1}^r r_i = e_{i,t-1}^r \left(e_{i,t}^r \Big/ e_{i,t-1}^r \right) \tag{4}$$

If regional industry *i* grew at the average national rate, we could write

$$e_{i,t}^r = e_{i,t-1}^r n, \tag{5}$$

and we would attribute the change in industry *i* in region *r* simply to overall system change. If industry *i* is a particularly fast-growing one nationally, however, there will be a difference between *n* and n_i. Further, if there were no regional variation in industry i's growth rate, we could account for the deviation of specific industry performance from the average by the following:

$$e_{i,t}^r = e_{i,t-1}^r \left[n + \left(n_i - n \right) \right] \tag{6}$$

The order of the rates in the new term in parentheses is not arbitrary, because if the industry is fast-growing (nationally), $e_{i,t}^r$ must be greater than the value obtained from equation 2.

If there is variation in industry *i*'s growth rate across geographical regions, then the difference between r_i and n_i will be non-zero. To reflect this variation in our formal representation, we would then transform the previous equation into the following:

$$e_{i,t}^r = e_{i,t-1}^r \left[n + \left(n_i - n \right) + \left(r_i - n_i \right) \right] \tag{7}$$

The bracketed term in equation (7) clearly reduces to $r_i = \left(e^r_{i,t} / e^r_{i,t-1}\right)$, duplicating and confirming the identity in equation (4).

If we are interested in examining directly the change in employment, we can subtract $e^r_{i,t-1}$ from both sides, yielding

$$e^r_{i,t} - e^r_{i,t-1} = e^r_{i,t-1}\left[n + \left(n_i - n\right) + \left(r_i - n_i\right)\right] - e^r_{i,t-1} \quad (8)$$

or $$\Delta e^r_i = e^r_{i,t-1}\left[n + \left(n_i - n\right) + \left(r_i - n_i\right) - 1\right] \quad (9)$$

and $$\Delta e^r_i = e^r_{i,t-1}\left[\left(n-1\right) + \left(n_i - n\right) + \left(r_i - n_i\right)\right], \quad (10)$$

where Δe^r_i is the change in regional industry *i* employment over the study period.

We can separate the components of the right-hand-side of (10), however, yielding the following values and interpretations:[9]

$N_i = e^r_{i,t-1}(n-1) =$ the national share component, which is the growth in the regional industry that can be attributed to the national average rate of growth,

$M_i = e^r_{i,t-1}(n_i - n) =$ the industry mix component, or the growth in the regional industry that can be attributed to the difference between the specific industry's national growth rate and the national average rate of growth, and

$R_i = e^r_{i,t-1}(r_i - n_i) =$ the regional shift, i.e., growth in the regional industry that cannot be attributed to industry or national effects: often assumed to reflect comparative advantage.

Given these definitions,

$$\Delta e^r_i = N_i + M_i + R_i \quad (8)$$

Finally, we can sum both sides over all industries and show that

$$\sum \Delta e^r_i = \sum \left(N_i + M_i + R_i\right) \quad (9)$$

$$\Delta e^r = N + M + R \quad (10)$$

(10)

[9] By definition, if $e^r_{(i,t)} = 0$, then $R_i = e^r_{i,t}$ and $M_i = N_i = 0$.

Appendix II. Industry Names

01 Farms
02 Forestry fishing and related activities
03 Oil and gas extraction
04 Coal Mining
05 Mining except coal oil and gas
06 Support activities for mining
07 Utilities
08 Construction
09 Wood products
10 Nonmetallic mineral products
11 Primary metals
12 Fabricated metal products
13 Machinery
14 Computer and electronic products
15 Electrical equipment appliances and components
16 Motor vehicles bodies and trailers and parts
17 Other transportation equipment
18 Furniture and related products
19 Miscellaneous manufacturing
20 Food and beverage and tobacco products
21 Textile mills and textile product mills
22 Apparel and leather and allied products
23 Paper products
24 Printing and related support activities
25 Petroleum and coal products
26 Chemical products
27 Plastics and rubber products
28 Wholesale trade
29 Motor vehicle and parts dealers
30 Food and beverage stores
31 General merchandise stores
32 Other retail
33 Air transportation
34 Rail transportation
35 Water transportation
36 Truck transportation
37 Transit and ground passenger transportation
38 Pipeline transportation
39 Other transportation and support activities
40 Warehousing and storage
41 Publishing industries except internet includes software
42 Motion picture and sound recording industries
43 Broadcasting and telecommunications
44 Data processing internet publishing and other information
45 Federal Reserve banks credit intermediation and related a
46 Securities commodity contracts and investments
47 Insurance carriers and related activities
48 Funds trusts and other financial vehicles
49 Real estate
50 Rental and leasing services and lessors of intangible asset
51 Legal services
52 Computer systems design and related services
53 Miscellaneous professional scientific and technical services
54 Management of companies and enterprises
55 Administrative and support services
56 Waste management and remediation services
57 Educational services
58 Ambulatory health care services
59 Hospitals
60 Nursing and residential care facilities
61 Social assistance
62 Performing arts spectator sports museums and related act
63 Amusements gambling and recreation industries
64 Accommodation
65 Food services and drinking places
66 Other services, except government
67 Postal service
68 Government
69 Unclassified

Appendix III. Appalachian County Group Membership

FIPS Code	County Name	County vs. Nation	County vs. Appalachia	County vs. Neighbors
01007	Bibb County, Alabama	VI	d	vi
01009	Blount County, Alabama	VI	f	v
01015	Calhoun County, Alabama	VI	e	vi
01017	Chambers County, Alabama	VI	f	vi
01019	Cherokee County, Alabama	VI	f	iv
01021	Chilton County, Alabama	VI	c	vi
01027	Clay County, Alabama	VI	d	v
01029	Cleburne County, Alabama	VI	f	vi
01033	Colbert County, Alabama	IV	c	i
01037	Coosa County, Alabama	VI	f	vi
01043	Cullman County, Alabama	V	a	iii
01049	DeKalb County, Alabama	VI	d	iv
01051	Elmore County, Alabama	III	c	iii
01055	Etowah County, Alabama	V	e	ii
01057	Fayette County, Alabama	VI	f	vi
01059	Franklin County, Alabama	VI	e	ii
01065	Hale County, Alabama	VI	f	vi
01071	Jackson County, Alabama	VI	d	vi
01073	Jefferson County, Alabama	VI	e	vi
01075	Lamar County, Alabama	VI	f	vi
01077	Lauderdale County, Alabama	VI	e	vi
01079	Lawrence County, Alabama	VI	f	vi
01083	Limestone County, Alabama	IV	a	iii
01087	Macon County, Alabama	V	e	v
01089	Madison County, Alabama	I	a	i
01093	Marion County, Alabama	VI	f	vi
01095	Marshall County, Alabama	VI	d	vi
01103	Morgan County, Alabama	VI	f	vi
01107	Pickens County, Alabama	VI	f	vi
01111	Randolph County, Alabama	VI	f	vi
01115	St. Clair County, Alabama	III	c	iii
01117	Shelby County, Alabama	III	a	i
01121	Talladega County, Alabama	VI	f	vi
01123	Tallapoosa County, Alabama	VI	f	vi
01125	Tuscaloosa County, Alabama	III	a	i
01127	Walker County, Alabama	VI	e	ii
01133	Winston County, Alabama	VI	f	v

13011	Banks County, Georgia	III	c	iii
13013	Barrow County, Georgia	III	c	iii
13015	Bartow County, Georgia	III	c	iv
13045	Carroll County, Georgia	III	c	iii
13047	Catoosa County, Georgia	V	f	ii
13055	Chattooga County, Georgia	VI	f	iv
13057	Cherokee County, Georgia	I	a	i
13083	Dade County, Georgia	IV	c	ii
13085	Dawson County, Georgia	III	a	i
13097	Douglas County, Georgia	III	a	i
13105	Elbert County, Georgia	VI	f	vi
13111	Fannin County, Georgia	III	c	i
13115	Floyd County, Georgia	VI	f	v
13117	Forsyth County, Georgia	III	a	iii
13119	Franklin County, Georgia	VI	f	vi
13123	Gilmer County, Georgia	VI	f	v
13129	Gordon County, Georgia	IV	d	vi
13135	Gwinnett County, Georgia	IV	a	v
13137	Habersham County, Georgia	VI	f	vi
13139	Hall County, Georgia	III	a	i
13143	Haralson County, Georgia	VI	f	vi
13147	Hart County, Georgia	VI	f	vi
13149	Heard County, Georgia	VI	f	vi
13157	Jackson County, Georgia	III	c	i
13187	Lumpkin County, Georgia	VI	d	vi
13195	Madison County, Georgia	VI	f	vi
13213	Murray County, Georgia	VI	f	v
13223	Paulding County, Georgia	III	a	i
13227	Pickens County, Georgia	III	c	vi
13233	Polk County, Georgia	VI	f	v
13241	Rabun County, Georgia	VI	f	vi
13257	Stephens County, Georgia	VI	f	v
13281	Towns County, Georgia	V	e	v
13291	Union County, Georgia	I	a	ii
13295	Walker County, Georgia	VI	f	v
13311	White County, Georgia	III	c	iii
13313	Whitfield County, Georgia	VI	f	vi
21001	Adair County, Kentucky	VI	f	v
21011	Bath County, Kentucky	VI	f	vi
21013	Bell County, Kentucky	VI	f	v
21019	Boyd County, Kentucky	V	e	v

21025	Breathitt County, Kentucky	V	e	ii
21043	Carter County, Kentucky	VI	f	vi
21045	Casey County, Kentucky	VI	c	iii
21049	Clark County, Kentucky	VI	c	vi
21051	Clay County, Kentucky	V	e	vi
21053	Clinton County, Kentucky	V	e	i
21057	Cumberland County, Kentucky	VI	a	iii
21061	Edmonson County, Kentucky	V	e	vi
21063	Elliott County, Kentucky	V	a	i
21065	Estill County, Kentucky	VI	f	vi
21069	Fleming County, Kentucky	VI	e	vi
21071	Floyd County, Kentucky	VI	e	ii
21079	Garrard County, Kentucky	VI	f	vi
21087	Green County, Kentucky	V	e	v
21089	Greenup County, Kentucky	V	e	i
21095	Harlan County, Kentucky	VI	f	vi
21099	Hart County, Kentucky	III	c	i
21109	Jackson County, Kentucky	VI	f	vi
21115	Johnson County, Kentucky	VI	f	vi
21119	Knott County, Kentucky	VI	f	vi
21121	Knox County, Kentucky	V	e	v
21125	Laurel County, Kentucky	V	a	iii
21127	Lawrence County, Kentucky	V	a	i
21129	Lee County, Kentucky	V	e	iii
21131	Leslie County, Kentucky	VI	f	vi
21133	Letcher County, Kentucky	VI	f	vi
21135	Lewis County, Kentucky	VI	f	vi
21137	Lincoln County, Kentucky	VI	e	v
21147	McCreary County, Kentucky	VI	f	v
21151	Madison County, Kentucky	III	a	i
21153	Magoffin County, Kentucky	V	e	v
21159	Martin County, Kentucky	VI	f	vi
21165	Menifee County, Kentucky	VI	f	vi
21169	Metcalfe County, Kentucky	VI	f	vi
21171	Monroe County, Kentucky	VI	f	v
21173	Montgomery County, Kentucky	VI	f	vi
21175	Morgan County, Kentucky	VI	f	ii
21181	Nicholas County, Kentucky	V	f	v
21189	Owsley County, Kentucky	V	e	i
21193	Perry County, Kentucky	VI	f	i
21195	Pike County, Kentucky	VI	f	i

21197	Powell County, Kentucky	VI	d	iv
21199	Pulaski County, Kentucky	VI	f	v
21201	Robertson County, Kentucky	V	e	ii
21203	Rockcastle County, Kentucky	V	a	iii
21205	Rowan County, Kentucky	V	a	i
21207	Russell County, Kentucky	VI	f	v
21231	Wayne County, Kentucky	VI	f	iv
21235	Whitley County, Kentucky	VI	e	v
21237	Wolfe County, Kentucky	V	e	i
24001	Allegany County, Maryland	VI	e	v
24023	Garrett County, Maryland	VI	f	iii
24043	Washington County, Maryland	VI	d	v
28003	Alcorn County, Mississippi	VI	c	iii
28009	Benton County, Mississippi	VI	f	v
28013	Calhoun County, Mississippi	VI	f	vi
28017	Chickasaw County, Mississippi	VI	f	vi
28019	Choctaw County, Mississippi	IV	c	iii
28025	Clay County, Mississippi	VI	f	vi
28057	Itawamba County, Mississippi	IV	c	i
28069	Kemper County, Mississippi	III	a	i
28081	Lee County, Mississippi	VI	c	i
28087	Lowndes County, Mississippi	VI	c	i
28093	Marshall County, Mississippi	V	a	ii
28095	Monroe County, Mississippi	VI	f	v
28097	Montgomery County, Mississippi	V	e	vi
28103	Noxubee County, Mississippi	VI	f	vi
28105	Oktibbeha County, Mississippi	III	a	i
28107	Panola County, Mississippi	VI	f	ii
28115	Pontotoc County, Mississippi	IV	c	iv
28117	Prentiss County, Mississippi	VI	f	v
28139	Tippah County, Mississippi	VI	f	iv
28141	Tishomingo County, Mississippi	IV	c	ii
28145	Union County, Mississippi	III	c	iii
28155	Webster County, Mississippi	VI	f	vi
28159	Winston County, Mississippi	VI	f	v
28161	Yalobusha County, Mississippi	VI	b	iv
36003	Allegany County, New York	VI	e	v
36007	Broome County, New York	VI	e	v
36009	Cattaraugus County, New York	VI	e	v
36013	Chautauqua County, New York	VI	e	vi
36015	Chemung County, New York	VI	f	v

36017	Chenango County, New York	IV	c	iii
36023	Cortland County, New York	V	a	i
36025	Delaware County, New York	VI	f	vi
36077	Otsego County, New York	V	e	ii
36095	Schoharie County, New York	V	e	v
36097	Schuyler County, New York	VI	a	ii
36101	Steuben County, New York	V	b	i
36107	Tioga County, New York	VI	d	iii
36109	Tompkins County, New York	V	b	iii
37003	Alexander County, North Carolina	VI	f	vi
37005	Alleghany County, North Carolina	VI	f	v
37009	Ashe County, North Carolina	VI	e	vi
37011	Avery County, North Carolina	V	e	ii
37021	Buncombe County, North Carolina	I	a	i
37023	Burke County, North Carolina	VI	f	vi
37027	Caldwell County, North Carolina	VI	f	vi
37039	Cherokee County, North Carolina	VI	f	vi
37043	Clay County, North Carolina	VI	f	ii
37059	Davie County, North Carolina	III	c	iii
37067	Forsyth County, North Carolina	VI	c	i
37075	Graham County, North Carolina	VI	f	vi
37087	Haywood County, North Carolina	VI	a	vi
37089	Henderson County, North Carolina	VI	a	v
37099	Jackson County, North Carolina	V	e	v
37111	McDowell County, North Carolina	VI	d	vi
37113	Macon County, North Carolina	V	e	iii
37115	Madison County, North Carolina	VI	e	vi
37121	Mitchell County, North Carolina	VI	f	vi
37149	Polk County, North Carolina	VI	d	v
37161	Rutherford County, North Carolina	VI	f	vi
37169	Stokes County, North Carolina	VI	f	ii
37171	Surry County, North Carolina	VI	f	vi
37173	Swain County, North Carolina	I	a	ii
37175	Transylvania County, North Carolina	V	e	v
37189	Watauga County, North Carolina	V	e	i
37193	Wilkes County, North Carolina	V	e	v
37197	Yadkin County, North Carolina	VI	f	vi
37199	Yancey County, North Carolina	VI	c	vi
39001	Adams County, Ohio	V	e	v
39007	Ashtabula County, Ohio	VI	e	v
39009	Athens County, Ohio	V	e	v

39013	Belmont County, Ohio	V	e	v
39015	Brown County, Ohio	VI	e	ii
39019	Carroll County, Ohio	VI	e	i
39025	Clermont County, Ohio	IV	a	iii
39029	Columbiana County, Ohio	VI	f	v
39031	Coshocton County, Ohio	VI	f	vi
39053	Gallia County, Ohio	V	e	v
39059	Guernsey County, Ohio	V	e	i
39067	Harrison County, Ohio	VI	f	iii
39071	Highland County, Ohio	VI	e	vi
39073	Hocking County, Ohio	VI	f	vi
39075	Holmes County, Ohio	IV	c	i
39079	Jackson County, Ohio	VI	f	vi
39081	Jefferson County, Ohio	VI	e	vi
39087	Lawrence County, Ohio	V	e	iii
39099	Mahoning County, Ohio	V	e	v
39105	Meigs County, Ohio	V	e	i
39111	Monroe County, Ohio	VI	f	vi
39115	Morgan County, Ohio	V	e	iii
39119	Muskingum County, Ohio	VI	e	v
39121	Noble County, Ohio	V	e	v
39127	Perry County, Ohio	VI	f	vi
39131	Pike County, Ohio	VI	d	iii
39141	Ross County, Ohio	VI	a	i
39145	Scioto County, Ohio	V	e	v
39155	Trumbull County, Ohio	VI	e	vi
39157	Tuscarawas County, Ohio	VI	d	i
39163	Vinton County, Ohio	V	f	vi
39167	Washington County, Ohio	V	e	iii
42003	Allegheny County, Pennsylvania	V	b	v
42005	Armstrong County, Pennsylvania	VI	f	vi
42007	Beaver County, Pennsylvania	VI	e	vi
42009	Bedford County, Pennsylvania	V	c	iii
42013	Blair County, Pennsylvania	V	f	vi
42015	Bradford County, Pennsylvania	VI	d	iii
42019	Butler County, Pennsylvania	III	c	iii
42021	Cambria County, Pennsylvania	V	e	v
42023	Cameron County, Pennsylvania	VI	f	v
42025	Carbon County, Pennsylvania	VI	f	vi
42027	Centre County, Pennsylvania	I	a	i
42031	Clarion County, Pennsylvania	VI	f	vi

42033	Clearfield County, Pennsylvania	V	f	vi
42035	Clinton County, Pennsylvania	VI	c	vi
42037	Columbia County, Pennsylvania	VI	d	iii
42039	Crawford County, Pennsylvania	VI	e	i
42047	Elk County, Pennsylvania	VI	f	ii
42049	Erie County, Pennsylvania	VI	e	iii
42051	Fayette County, Pennsylvania	V	e	v
42053	Forest County, Pennsylvania	V	e	i
42057	Fulton County, Pennsylvania	IV	c	i
42059	Greene County, Pennsylvania	IV	c	v
42061	Huntingdon County, Pennsylvania	VI	f	vi
42063	Indiana County, Pennsylvania	V	e	v
42065	Jefferson County, Pennsylvania	VI	c	iii
42067	Juniata County, Pennsylvania	VI	f	vi
42069	Lackawanna County, Pennsylvania	VI	e	iv
42073	Lawrence County, Pennsylvania	VI	e	v
42079	Luzerne County, Pennsylvania	V	f	iii
42081	Lycoming County, Pennsylvania	VI	d	iii
42083	McKean County, Pennsylvania	VI	f	vi
42085	Mercer County, Pennsylvania	V	e	i
42087	Mifflin County, Pennsylvania	VI	f	vi
42089	Monroe County, Pennsylvania	V	e	v
42093	Montour County, Pennsylvania	V	b	i
42097	Northumberland County, Pennsylvania	VI	f	vi
42099	Perry County, Pennsylvania	VI	f	v
42103	Pike County, Pennsylvania	V	e	v
42105	Potter County, Pennsylvania	VI	f	vi
42107	Schuylkill County, Pennsylvania	VI	d	v
42109	Snyder County, Pennsylvania	VI	d	iii
42111	Somerset County, Pennsylvania	VI	f	vi
42113	Sullivan County, Pennsylvania	V	e	vi
42115	Susquehanna County, Pennsylvania	VI	d	ii
42117	Tioga County, Pennsylvania	VI	f	vi
42119	Union County, Pennsylvania	VI	a	v
42121	Venango County, Pennsylvania	V	f	vi
42123	Warren County, Pennsylvania	V	e	ii
42125	Washington County, Pennsylvania	III	c	iii
42127	Wayne County, Pennsylvania	VI	e	i
42129	Westmoreland County, Pennsylvania	V	e	vi
42131	Wyoming County, Pennsylvania	VI	d	iii
45007	Anderson County, South Carolina	IV	a	v

45021	Cherokee County, South Carolina	VI	c	vi
45045	Greenville County, South Carolina	III	a	i
45073	Oconee County, South Carolina	VI	c	iii
45077	Pickens County, South Carolina	VI	a	vi
45083	Spartanburg County, South Carolina	III	c	i
47001	Anderson County, Tennessee	VI	b	vi
47007	Bledsoe County, Tennessee	I	a	i
47009	Blount County, Tennessee	III	a	iii
47011	Bradley County, Tennessee	IV	c	i
47013	Campbell County, Tennessee	VI	f	vi
47015	Cannon County, Tennessee	VI	f	v
47019	Carter County, Tennessee	VI	b	ii
47025	Claiborne County, Tennessee	VI	d	iii
47027	Clay County, Tennessee	VI	e	v
47029	Cocke County, Tennessee	VI	f	vi
47031	Coffee County, Tennessee	VI	a	v
47035	Cumberland County, Tennessee	V	a	iii
47041	DeKalb County, Tennessee	VI	e	vi
47049	Fentress County, Tennessee	VI	f	vi
47051	Franklin County, Tennessee	IV	c	vi
47057	Grainger County, Tennessee	III	c	iii
47059	Greene County, Tennessee	VI	f	vi
47061	Grundy County, Tennessee	VI	f	v
47063	Hamblen County, Tennessee	VI	f	vi
47065	Hamilton County, Tennessee	V	e	iii
47067	Hancock County, Tennessee	VI	f	v
47073	Hawkins County, Tennessee	VI	b	iii
47087	Jackson County, Tennessee	VI	e	vi
47089	Jefferson County, Tennessee	III	c	iii
47091	Johnson County, Tennessee	VI	f	vi
47093	Knox County, Tennessee	V	a	v
47099	Lawrence County, Tennessee	VI	f	vi
47101	Lewis County, Tennessee	VI	c	ii
47105	Loudon County, Tennessee	V	c	iv
47107	McMinn County, Tennessee	VI	d	vi
47111	Macon County, Tennessee	VI	c	vi
47115	Marion County, Tennessee	VI	c	i
47121	Meigs County, Tennessee	III	c	iii
47123	Monroe County, Tennessee	VI	d	vi
47129	Morgan County, Tennessee	V	e	vi
47133	Overton County, Tennessee	IV	a	iii

47137	Pickett County, Tennessee	VI	f	v
47139	Polk County, Tennessee	VI	e	v
47141	Putnam County, Tennessee	II	a	i
47143	Rhea County, Tennessee	VI	d	iv
47145	Roane County, Tennessee	V	b	v
47151	Scott County, Tennessee	VI	f	vi
47153	Sequatchie County, Tennessee	VI	c	iii
47155	Sevier County, Tennessee	I	a	i
47159	Smith County, Tennessee	VI	e	v
47163	Sullivan County, Tennessee	VI	e	iii
47171	Unicoi County, Tennessee	VI	e	vi
47173	Union County, Tennessee	VI	f	v
47175	Van Buren County, Tennessee	VI	f	v
47177	Warren County, Tennessee	VI	f	iv
47179	Washington County, Tennessee	VI	a	i
47185	White County, Tennessee	VI	f	vi
51005	Alleghany County, Virginia	VI	f	vi
51017	Bath County, Virginia	VI	e	v
51021	Bland County, Virginia	VI	f	v
51023	Botetourt County, Virginia	I	a	iii
51027	Buchanan County, Virginia	VI	f	iii
51035	Carroll County, Virginia	VI	f	vi
51045	Craig County, Virginia	VI	e	vi
51051	Dickenson County, Virginia	VI	d	iii
51063	Floyd County, Virginia	VI	f	vi
51071	Giles County, Virginia	VI	f	ii
51077	Grayson County, Virginia	III	c	iii
51089	Henry County, Virginia	VI	f	vi
51091	Highland County, Virginia	VI	f	v
51105	Lee County, Virginia	VI	f	vi
51121	Montgomery County, Virginia	V	e	v
51141	Patrick County, Virginia	VI	f	v
51155	Pulaski County, Virginia	VI	e	iii
51163	Rockbridge County, Virginia	VI	f	vi
51167	Russell County, Virginia	VI	f	vi
51169	Scott County, Virginia	VI	d	i
51173	Smyth County, Virginia	VI	e	vi
51185	Tazewell County, Virginia	VI	e	i
51191	Washington County, Virginia	VI	e	vi
51195	Wise County, Virginia	VI	e	v
51197	Wythe County, Virginia	VI	e	i

54001	Barbour County, West Virginia	V	a	i
54003	Berkeley County, West Virginia	III	a	i
54005	Boone County, West Virginia	VI	f	vi
54007	Braxton County, West Virginia	V	e	ii
54009	Brooke County, West Virginia	VI	f	vi
54011	Cabell County, West Virginia	V	e	ii
54013	Calhoun County, West Virginia	V	e	ii
54015	Clay County, West Virginia	VI	f	vi
54017	Doddridge County, West Virginia	I	a	iii
54019	Fayette County, West Virginia	VI	e	v
54021	Gilmer County, West Virginia	V	e	v
54023	Grant County, West Virginia	VI	f	vi
54025	Greenbrier County, West Virginia	V	e	i
54027	Hampshire County, West Virginia	V	e	v
54029	Hancock County, West Virginia	VI	f	vi
54031	Hardy County, West Virginia	VI	f	vi
54033	Harrison County, West Virginia	III	a	iii
54035	Jackson County, West Virginia	III	c	iii
54037	Jefferson County, West Virginia	V	a	v
54039	Kanawha County, West Virginia	V	e	v
54041	Lewis County, West Virginia	VI	e	iv
54043	Lincoln County, West Virginia	V	e	vi
54045	Logan County, West Virginia	VI	f	i
54047	McDowell County, West Virginia	VI	f	i
54049	Marion County, West Virginia	V	e	vi
54051	Marshall County, West Virginia	III	c	iii
54053	Mason County, West Virginia	VI	f	vi
54055	Mercer County, West Virginia	V	e	vi
54057	Mineral County, West Virginia	V	c	i
54059	Mingo County, West Virginia	VI	f	vi
54061	Monongalia County, West Virginia	I	a	i
54063	Monroe County, West Virginia	VI	f	i
54065	Morgan County, West Virginia	VI	e	vi
54067	Nicholas County, West Virginia	VI	f	vi
54069	Ohio County, West Virginia	V	e	vi
54071	Pendleton County, West Virginia	VI	f	v
54073	Pleasants County, West Virginia	VI	f	v
54075	Pocahontas County, West Virginia	VI	e	v
54077	Preston County, West Virginia	VI	f	vi
54079	Putnam County, West Virginia	VI	c	i
54081	Raleigh County, West Virginia	V	e	i

54083	Randolph County, West Virginia	VI	f	iii
54085	Ritchie County, West Virginia	VI	e	iii
54087	Roane County, West Virginia	V	e	vi
54089	Summers County, West Virginia	V	e	v
54091	Taylor County, West Virginia	VI	b	vi
54093	Tucker County, West Virginia	V	e	v
54095	Tyler County, West Virginia	VI	e	i
54097	Upshur County, West Virginia	V	e	v
54099	Wayne County, West Virginia	VI	f	vi
54101	Webster County, West Virginia	VI	f	vi
54103	Wetzel County, West Virginia	V	e	v
54105	Wirt County, West Virginia	V	e	v
54107	Wood County, West Virginia	V	e	v
54109	Wyoming County, West Virginia	V	f	vi