Self-Employment, Industrial Diversity, and Growth in Appalachia

September 27, 2021

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1. Overview

The Appalachian Region is a region designated for federal support through the Appalachian Regional Commission (ARC) due to historic high levels of poverty and economic distress. Since its formation in 1965, ARC has made some strides in addressing poverty. At the same time, while some portions of the region have thrived, others continue to lag the nation in terms of economic outcomes.

Despite these challenges, there is some evidence from previous research that places in the Appalachian Region with more entrepreneurs or self-employed have better outcomes, including higher employment growth. This is in spite of other factors, including lower levels of educational attainment, that would otherwise suggest lower levels of growth. However, this does not mean that all entrepreneurs are created equally. Some people may become self-employed due to a lack of other opportunities, while others may be more innovative, exploiting new opportunities and contributing to growth. Additionally, entrepreneurship in certain industries may be more beneficial to growth than those in other industries.

If having more entrepreneurs or self-employed does contribute to growth, there is also the question of how the business mix in a community may contribute to or hinder the emergence of new entrepreneurs. Another line of research suggests that having more industrial diversity (i.e., a diverse set of business types) can contribute to higher levels of economic growth and may also help create a culture that supports entrepreneurship and the associated regional growth. However, in small or rural regions, such as many of the communities in Appalachia, the relationship between industrial diversity and entrepreneurship may not hold. In small, more rural areas, there

simply may not be much industrial diversity. Or, if there is a lot of diversity (many types of businesses), then there may be fewer gaps for new entrepreneurs to fill than in urban areas.

This report delves into the role of self-employment and industrial diversity on regional growth in Appalachia. We use employment change as our proxy for economic growth, as positive employment change is the net outcome of increases in labor demand by businesses and increases in labor supply by workers, which together contribute to growth. We consider the role generally of the self-employed, as well as that of the self-employed in specific industries, in impacting this growth. We also examine the role of industrial diversity and how it may affect employment growth. Finally, we look at the factors that are associated with higher levels of self-employment, both overall and in key industries, that our analysis suggests are important to regional growth.

Given the COVID-19 pandemic, we extend the base analysis to examine the importance of hard-hit industries to the economic outcomes in the region. This provides some idea of the impact after the scope of our analysis and may provide insights that will help with the economic recovery.

To conduct our analysis, we obtained detailed county-level and industry-level employment and self-employment data from Economic Modeling LLC (EMSI), which provides unsuppressed county-level employment at the four-digit industry level using the North American Industry Classification System (NAICS). To support our modeling, we also gathered data on various other county-level factors that have been shown to

influence regional economic growth, such as historic economic performance and industrial composition.

The results suggest that having more self-employment overall and in some key industries (such as manufacturing, information, and travel and leisure) contributes to more employment growth in counties in the Appalachian Region. We also find some evidence that more economic diversity leads to higher levels of overall growth. However, in the Appalachian Region, *lower* economic diversity plays a key role in increasing entrepreneurship, at least in some industries. This suggests that entrepreneurs in the region may be exploiting gaps in starting new businesses. Our results also indicate that both overall employment and self-employment in industries that were negatively affected by the COVID-19 pandemic had been contributing to growth, which suggests that efforts to help these businesses through the economic transition induced by the crisis may be one way to support future growth.

2. Previous Research

In this section, we discuss previous research related to the current project.

2.1 - Entrepreneurship in the Appalachian Region

ARC has long been interested in the potential for entrepreneurship in the region. From 1997 through 2005, ARC invested nearly $43 million in the Entrepreneurship Initiative (EI), a program to stimulate and support entrepreneurship across Appalachia. Several years after the initiative, the Rural Policy Research Institute (RUPRI), RUPRI Center for Rural Entrepreneurship, EntreWorks Consulting, and Research Triangle

Institute (RTI), conducted an evaluation of the EI (RUPRI et al., 2008).[1] They identified

three main goals of the EI: "to increase the number of entrepreneurs establishing

businesses in the region, to increase the survival rate of such ventures, and to increase

the proportion that develop into high growth businesses that create jobs and wealth in

Appalachia" (RUPRI et al., 2008, ii). The report found that as a result of EI investments

12,000 jobs were created or retained and over 1,700 new businesses were formed.

Additionally, EI investments were instrumental in attracting almost $73 million in private

investment to support entrepreneurship in the region. Overall, the report concluded that

the program made entrepreneurship an effective economic development strategy in

local communities in the region.

ARC has also funded several other studies to examine the linkages between

entrepreneurship and economic growth in the Appalachian Region. A 2013 report,

prepared by Rural Support Partners, discusses seven successful entrepreneurial efforts

throughout Appalachia (Rural Support Partners, 2013).[2] Overall, they found that the

energy, health, manufacturing, and local food sectors demonstrate promising

entrepreneurial opportunities, particularly for rural and/or underserved areas.

A 2018 report by EntreWorks Consulting, in partnership with the Center for

Regional Economic Competitiveness and the Center for Rural Entrepreneurship,

assessed how best to support entrepreneurship in the Appalachia Region going forward

(EntreWorks Consulting et al., 2018).[3] That report first details the characteristics of

entrepreneurial ecosystems, based on market access, capital, talent, business

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[1] https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=72
[2] https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=106
[3] https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=147

assistance, infrastructure, culture, and regulatory support. They then present case studies of eight entrepreneurial ecosystems throughout the region and find that more successful entrepreneurial communities are those with a supportive local culture that embraces entrepreneurship, and communities that "think big." The report also compares the performance of Appalachian counties on various measures of entrepreneurial activity to counties outside the region and concludes that entrepreneurial activity in ARC is on par with the rest of the nation. Based on these findings, they present recommendations on the best ways to initiate and support entrepreneurial development throughout the region. These recommendations are targeted at four key stakeholder groups: (1) ARC, (2) state partners, (3) local partners, and (4) entrepreneurs themselves. Some suggestions include targeting ecosystem gaps, funding and promoting state/regional gateways, "thinking big" in terms of regional partners and service areas, and engaging in local, regional or statewide ecosystem services and networks, among others.

Beyond the work by ARC, several academic studies have analyzed the impact of entrepreneurship on economic growth in the Appalachian Region. For example, Stephens and Partridge (2011) and Stephens et al. (2013) both find that self-employment is positively associated with employment and income growth in the Appalachian Region and in similar regions throughout the US.

2.2 - Literature Review - Other Studies

2.2.1 - Entrepreneurship and Economic Growth

While the studies discussed above, which focused on the Appalachian Region, appear to suggest that economic development strategies aimed at fostering regional

growth through entrepreneurship can be effective, the broader literature is more mixed. Komarek and Loveridge (2014; 2015) find that small businesses contribute to more job growth in some U.S. regions, but not in others. Thus, the relationship between entrepreneurship and economic growth is not always clear (see Urbano et al. (2019), which contains a survey of the literature on entrepreneurship and economic growth).

One reason for these mixed results may be due to the fact that not all entrepreneurs are created equally. Some people may be "necessity entrepreneurs" due to a lack of other opportunities, such as after losing a job (Acs et al., 2009; Low, Henderson, and Weiler, 2005), while others may be more innovative, exploiting new opportunities and contributing to growth. Low and Isserman (2015) create a measure of innovative entrepreneurship using non-employer businesses in specific industries and find a positive relationship between innovative entrepreneurship and future growth in population and employment. However, the work by Stephens et al. (2013) found that, even if we cannot distinguish between innovative and necessity entrepreneurs, the self-employed appear to be leading to job creation beyond just their own jobs, especially in the Appalachian Region.

Additionally, there is some evidence that entrepreneurship in certain industries may be more beneficial to growth than in other industries. For example, Deller (2010) and Deller and McConnen (2009) examine the impact of small businesses on county-level growth and find that the effects vary by industry. However, very little empirical work has been done to examine the impact of entrepreneurship by industry, especially in the Appalachian Region, and to determine which industries may be most beneficial to growth.

2.2.2 - Economic Diversity

Another strain of research has linked economic diversity to regional growth with studies generally finding that more industry diversity can promote increases in economic output, employment, income, local knowledge spillovers and innovation (Davies & Tonts, 2010; Feldman & Audretsch, 1999; Frenken, van Oort, & Verburg, 2007; Hammond and Thompson, 2004; Izraeli & Murphy, 2003; Simon, 1988; van Stel & Nieuwenhuijsen, 2004). Likewise, more diversified labor markets have been shown to have lower unemployment rates (Neumann and Topel, 1991; Partridge and Rickman, 1995). Additionally, more diversified economies usually display greater stability and less volatility from external downturns (Conroy, 1975).

Places that are more diverse are also expected to promote cross-fertilization of ideas which may offer more opportunities for entrepreneurship and growth (Feldman & Audretsch, 1999; Frenken et al., 2007; Van Stel & Nieuwenhuijsen, 2004). However, while many previous papers have found evidence of these so-called agglomeration effects from businesses co-locating with other businesses, most of this has been in urban areas (i.e. Glaeser & Gottlieb, 2009). In rural areas, some industries may benefit from having related businesses nearby (clustering, as defined by Porter, 1998), while others may do better if they fill a niche in that community. In fact, Goetz and Rupasingha (2014) found that the drivers of self-employment vary across counties. Beyond this, perhaps due to data limitations, little previous research has considered the role that the presence of businesses in specific industries and employment diversity play in supporting new entrepreneurs.

To measure diversity, the previous literature has used various metrics, such as the Herfindhal-Hirschman Index (HHI), the entropy index, and others (Wagner, 2000; Dissart, 2003; Jackson, 2015). The HHI is a measure of market concentration and can be used to measure how diverse (specialized) an economy is in terms of employment or industrial composition (Chen, 2018).[4]

A previous study funded by ARC considered economic diversity trends in Appalachian counties and sub-regions defining four types of diversity: (1) industrial, (2) functional, (3) occupational, and (4) knowledge (Feser et al, 2014).[5] The study focuses on ten Appalachian counties and their economic development practices and diversification strategies. It then summarizes the lessons that emerge about what diversity means for economic development in the region. These lessons suggest that the role of diversity in the region's economic outcomes is complex. For example, one lesson suggests that regions should support diversification and specialization at the same time. Overall, the report concludes that it is important to have a well-balanced economic development strategy to promote economic growth.

3. Data and Analysis

3.1 - Measure of Local Areas

Consistent with most recent U.S. regional and urban economic analysis, we use counties as our measure of local areas. While there are tradeoffs when choosing any geographic unit for this type of research (Partridge and Rickman, 2006), counties are

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[4] The HHI is further discussed in the Data and Analysis section and the formula is provided in Appendix A1.
[5] https://www.arc.gov/research/researchreportdetails.asp?REPORT_ID=108

the smallest geographical area for which we can get sufficient data, especially for many rural areas.

We adjust our county-level data to account for the fact that the definition of counties may be different between sources of data, thus we create county measures that are consistent across sources. In the rare cases where counties split, merge, or change, we also consolidate the counties to account for the change.

3.2 - Descriptive Analysis of Employment Growth, Self-Employment, and Industrial Diversity

In order to examine the interplay between economic growth, self-employment (our measure of entrepreneurship), and industrial diversity, we use unsuppressed county-level employment data through a license from Economic Modeling, LLC (EMSI).[6] We then calculate county-level measures of the percent change in employment, the share of overall employment that is self-employed, and shares of employment in specific industries that are self-employed. As shown in Figure 1, there is tremendous variation in how employment changed from 2011 to 2019 across the Appalachian Region. Figure 2 shows the variation in how much counties rely on self-employment as a share of total employment, using data from 2019.

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[6] These data include total employment and self-employment by 6-digit NAICS industry by county. The publicly-available data are suppressed in many counties due to small numbers of firms.

Figure 1: Percent Change in County-level Employment (Employment Growth), 2011 to 2019, Appalachian Region
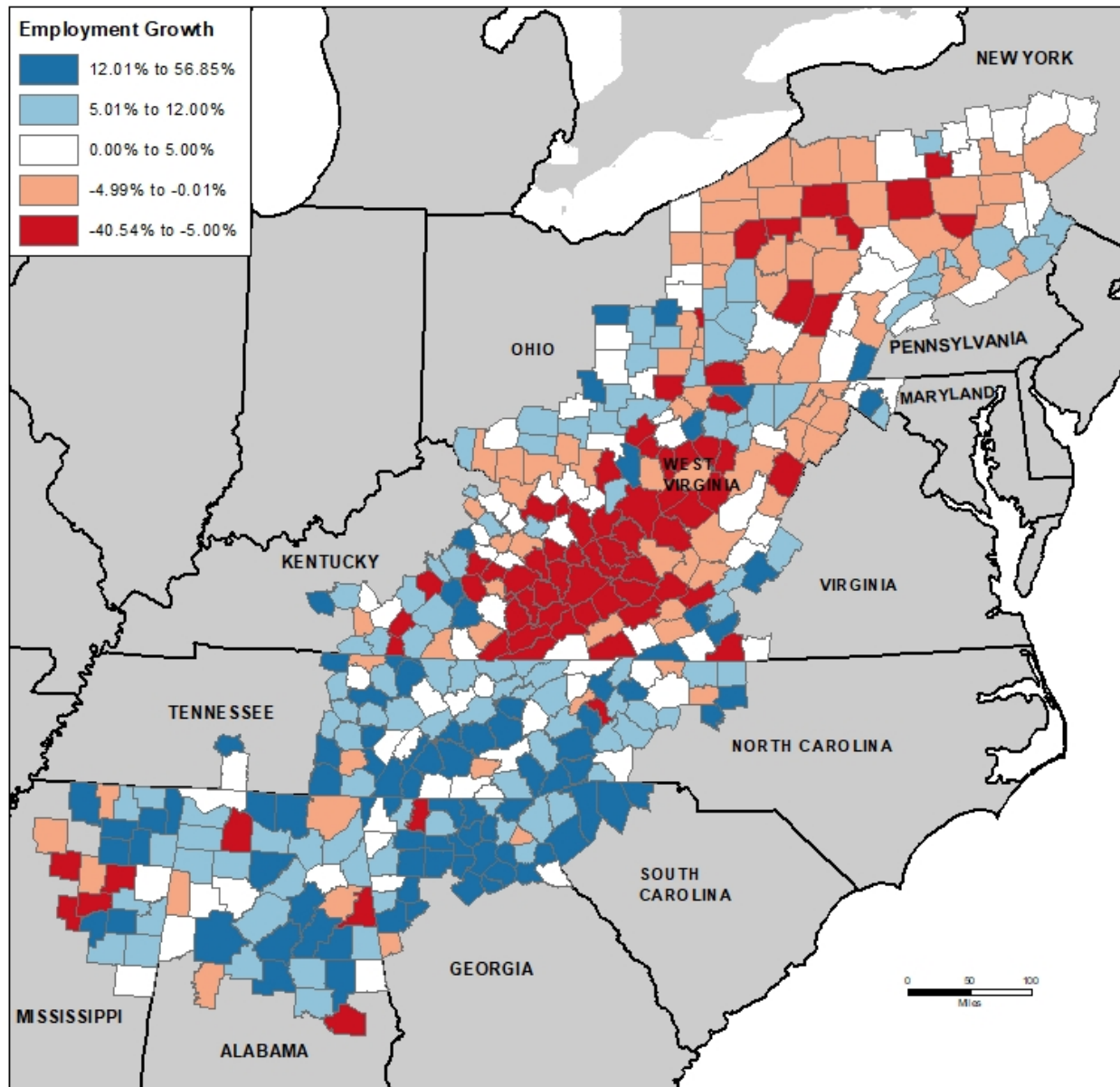
Figure 2: Self-Employment Share of County-Level Employment, 2019, Appalachian Region

Self-Employment Share
- 3.1% to 5.93%
- 5.94% to 8.5%
- 8.51% to 11.91%
- 11.92% to 17.41%
- 17.42% to 38.04%
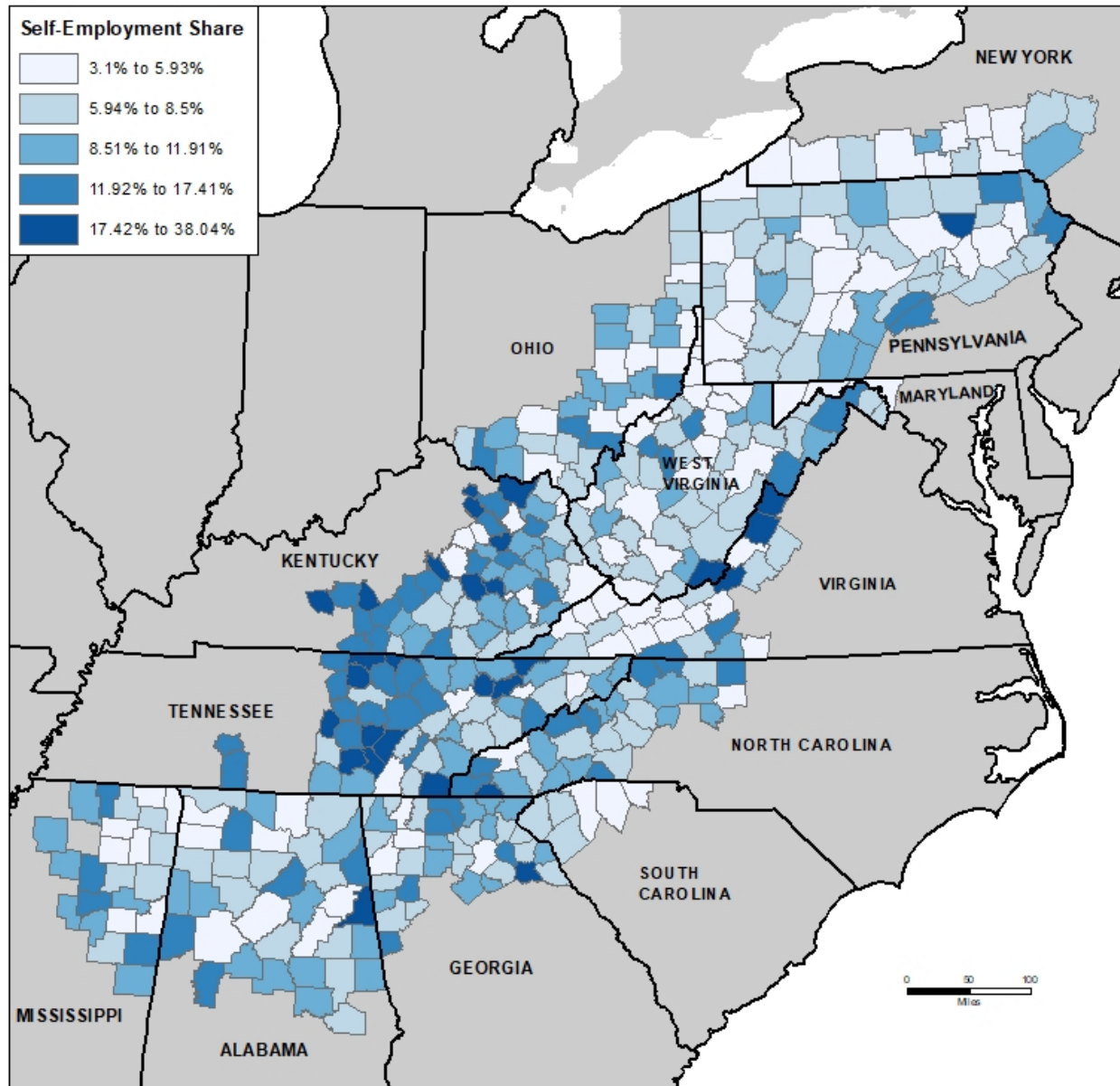
Beyond the overall impact of self-employment on growth, we are also interested in whether self-employment in specific industries may be driving growth. To address this, we create industry-specific self-employment shares (amount of county-level employment in those industries that is self-employed), using two-digit North American Industry Classification System (NAICS) industries, as small, rural counties may not have enough employment in more disaggregated industries. Since certain two-digit NAICS industries are similar, we also combine these industries so that our data are reflective of entire industries as a whole. For example, two-digit NAICS codes 31, 32, and 33, are all considered to be within the manufacturing sector. After combining similar industries and removing the industry considered "Unclassified", there are a total of 13 different industries. Table 1 provides a summary of the industries used in our analysis, and the share of county-level self-employed workers in those industries in 2010 and 2018.[7] As shown, we can see that the agriculture, construction, professional and business services, and other services industries have the highest county-level shares of self-employed workers.

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[7] Due to data availability we only have industry-level data through 2018.

Table 1: County-Level Industry Self-Employment (SE) Shares in Appalachian Region (2010 and 2018)*

NAICS Code	Industry Description	2010		2018	
		Average SE Share (%) of County-Level Industry Employment	Average # of County-Level Industry SE Jobs	Average SE Share (%) of County-Level Industry Employment	Average # of County-Level Industry SE Jobs
11	Agriculture	46.07	83	39.12	68
21	Mining	5.06	3	5.25	3
22	Utilities	0.00	0	4.06	1
23	Construction	43.01	417	39.50	375
31, 32, and 33	Manufacturing	3.86	46	4.64	48
42	Wholesale Trade	9.34	29	7.76	23
44 and 45	Retail Trade	7.55	135	6.29	121
48 and 49	Transportation and Warehousing	19.66	67	17.73	70
51	Information	7.81	15	10.53	18
52 and 53	Finance, Insurance, and Real Estate	12.01	98	11.69	94
54, 55, and 56	Professional and Business Services	28.76	306	26.26	324
61 and 62	Educational Services	5.36	137	5.05	139
71 and 72	Travel and Leisure	5.80	80	5.34	84
81	Other Services	32.37	256	32.35	269

* Self-employment shares are calculated as the percent of employment in that industry that is self-employed. We use 2018, as we did not have industry-level self-employment data for 2019.

We also create a measure of economic diversity at the county level using the Herfindahl-Hirschman Index (HHI), a widely used metric for determining economic diversity (Chen, 2020). The HHI measures market concentration and a lower HHI represents a more diverse economy.[8] We calculate the HHI based using employment in the 4-digit NAICS industry which allows us to see if there is a concentration of employment in the same industry or whether employment in a county is highly diverse

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[8] A formula for the HHI used in this analysis can be found in Appendix A1.

across different industries. Figure 3 show the variation in how concentrated or diverse counties were in 2018 across the region.[9] The area in Western Pennsylvania which appears highly diverse is the Greater Pittsburgh Region.

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[9] Detailed industry-level employment data are only available through 2018.

Figure 3: Industrial Diversity in Appalachian Region (2018) using the Herfindahl-Hirschman Index (HHI)
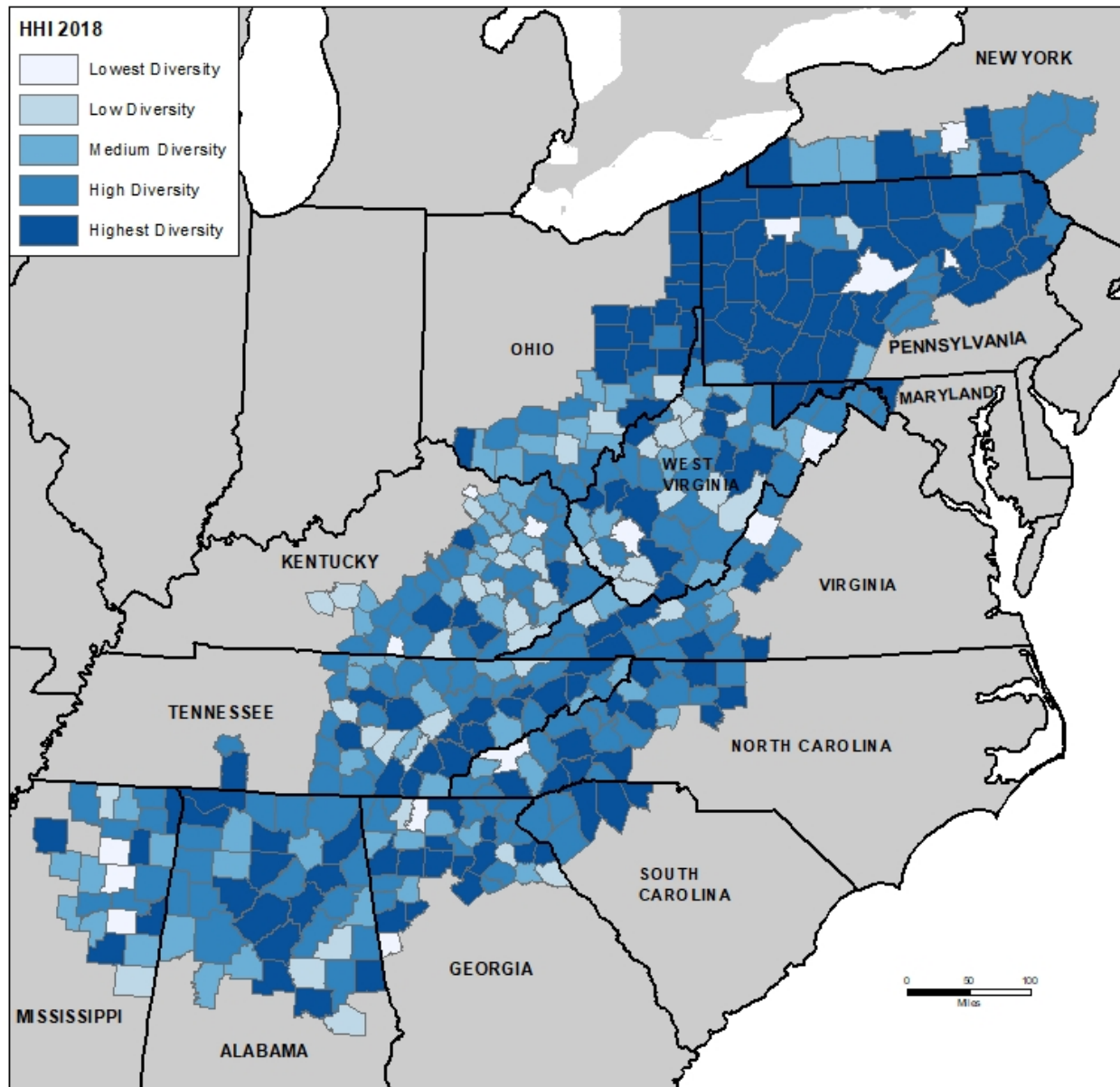
Since the previous research has found that there are differences in economic growth across urban and rural regions as well as differences in entrepreneurship, we further examine these differences in Tables 2 and 3, which rank the top and bottom Appalachian counties, both overall, and separated into rural and urban counties, in terms of employment changes from 2011 to 2019. This highlights the tremendous variation in the economic outcomes and levels of self-employment across the Appalachian Region.

Table 2: Appalachian Counties ranked on Employment Growth (2011 to 2019)

			Total		
Rank	County	State	Employment Growth (%) (2011 - 2019)	Self-Employment Share (%) (2010)	Self-Employment Share (%) (2019)
1	Jackson	GA	56.85	8.72	6.3
2	Paulding	GA	51.48	15.22	14.12
3	Forsyth	GA	48.33	8.59	8.09
4	Cherokee	GA	40.51	12.78	10.76
5	White	GA	36.48	15.11	9.12
416	Lincoln	WV	-25.76	9.55	8.18
417	Clay	WV	-26.86	9.25	10.62
418	McDowell	WV	-27.96	3.86	5.6
419	Mingo	WV	-33.67	3.97	6.52
420	Boone	WV	-40.54	4.12	6

Table 3: Urban and Rural Appalachian Counties ranked on Employment Growth (2011 to 2019)

			Urban		
Rank	County	State	Employment Growth (%) (2011 - 2019)	Self-Employment Share (%) (2010)	Self-Employment Share (%) (2019)
1	Paulding	GA	51.48	15.22	14.12
2	Forsyth	GA	48.33	8.59	8.09
3	Cherokee	GA	40.51	12.78	10.76
4	Sequatchie	TN	34.01	18.07	17.93
5	Barrow	GA	32.09	10.80	10.23
148	Wirt	WV	-12.24	16.57	14.02
149	Fayette	WV	-13.33	6.08	6.31
150	Lincoln	WV	-25.75	9.55	8.18
151	Clay	WV	-26.86	9.25	10.62
152	Boone	WV	-40.54	4.15	6

			Rural		
Rank	County	State	Employment Growth (%) (2011 - 2019)	Self-Employment Share (%) (2010)	Self-Employment Share (%) (2019)
1	Jackson	GA	56.84	8.72	6.3
2	White	GA	36.48	15.11	9.12
3	Doddridge	WV	29.53	9.97	12.66
4	Fannin	GA	28.51	16.25	12.86
5	Banks	GA	26.87	13.63	12.9
264	Martin	KY	-21.80	4.98	8.02
265	Harlan	KY	-22.94	5.63	7.56
266	Knott	KY	-23.24	9.44	12.7
267	McDowell	WV	-27.96	3.86	5.6
268	Mingo	WV	-33.67	3.97	6.52

3.3 – Empirical Approach

Using the data for Appalachian counties, we then estimate equation (1) using ordinary least squares (OLS) regression:

$$y_i = \beta_0 + \beta_1\, Ent_i + \beta_2\, ED_i + \beta_3\, X_i + \varepsilon_i \tag{1}$$

We use equation (1) to estimate a variety of models, where y_i includes measures of:

1) Percent change in Total Employment, 2011 to 2019

2) Self-Employment Share, 2019

3) (Industry) Self-Employment Shares in Key Industries, 2018[10]

Our key variables of interest and other control variables (as described below) are from the year 2010 or earlier in order to avoid reverse causation. In other words, we want to be able to measure whether or not these factors led to higher employment growth or more self-employment.

First, we assess the economic path of counties using the percent change in total employment (including both self-employment and wage and salary employment) from 2011 to 2019. We are particularly interested in whether self-employment affects economic growth and whether self-employment in specific industries may matter more. We separately look at two groups of potential measures of self-employment in order to examine how having more self-employed affects overall employment outcomes. These include the total self-employment share and the (industry) self-employment share in

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[10] Our detailed industry-level self-employment data are only available through 2018.

each two-digit NAICS industry (as explained above). We also consider the role of industrial or economic diversity in supporting overall growth.

We also examine the county-level self-employment shares in 2019 as we are interested not only in overall economic outcomes, but also in what factors are driving self-employment and entrepreneurship. To consider industry-level entrepreneurship, we assess the shares of self-employment for the industries with the highest levels of self-employment in 2018.[11] As shown in Table 1, these include: agriculture, construction, professional and business services, and other services.[12]

In the models where the (overall) self-employment share and (industry) self-employment shares in key industries are the outcome measures, our key variables of interest are our measures of industrial composition and diversification. We are particularly interested in whether entrepreneurship is affected by the industrial and employment mix of a county, which may explain why some regions have more self-employment (or more self-employment in industries that support growth) than others.

We examine the role of industrial composition and economic diversity (ED_i) on employment changes and self-employment using two different measures. First, we use the HHI to measure industrial diversity, as described above. Second, we use the shares of total employment in each two-digit industry, which assesses the impact of industrial composition and also controls for county-level employment concentration. Table 4 presents the summary statistics for the county-level industry shares of total employment using data from 2018.

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[11] Again, as noted above, we only have industry-level self-employment data through 2018.
[12] The NAICS codes for the industries with the highest levels of self-employment are as follows: agriculture (11), construction (23), professional and business services (54, 55, and 56), and other services (81).

Table 4: Industry Employment Shares in the Appalachian Region (2018)*

NAICS Code	Industry Description	Average Share (%) of County-Level Employment
11	Agriculture	1.19
21	Mining	1.09
22	Utilities	0.45
23	Construction	4.60
31, 32, and 33	Manufacturing	10.56
42	Wholesale Trade	1.69
44 and 45	Retail Trade	8.65
48 and 49	Transportation and Warehousing	2.44
51	Information	0.62
52 and 53	Finance, Insurance, and Real Estate	2.40
54, 55, and 56	Professional and Business Services	5.48
61 and 62	Educational Services	10.88
71 and 72	Travel and Leisure	6.81
81	Other Services	3.60
90	Government	14.85

* Employment shares are calculated as the percent of total county-level employment in that industry. We use 2018, as we did not have industry-level employment data for 2019.

3.4 - Other Factors Affecting Economic Outcomes

We also control for other factors that have been shown to influence regional economic outcomes. By including these other controls, we can isolate the relationship between our key factors and economic growth and entrepreneurship. Table 5 provides an overview of the data used in our analysis, including the sources of the data.

Table 5: Data and Sources

Outcome Variables (y)	Source of Data
Percent change in total employment, 2011 to 2019	U.S. Bureau of Economic Analysis (BEA)
Self-employment share, 2019	Economic Modeling, LLC (EMSI)
(Industry) self-employment share in key industries, 2018	Economic Modeling, LLC (EMSI)

Explanatory Variables

Key Variables

Self-employment share, 2010	Economic Modeling, LLC (EMSI)
(Industry) self-employment shares in 2-digit NAICS industries, 2010	Economic Modeling, LLC (EMSI)
Herfindahl-Hirschman Index (Economic Diversity) using 4-digit NAICS industries, 2010	Economic Modeling, LLC (EMSI)
(Industry) total employment share in each 2-digit NAICS industry, 2010	Economic Modeling, LLC (EMSI)

Historic Variables

Percent of total employment that is in manufacturing, agriculture, and mining, 1970	U.S. Bureau of Economic Analysis (BEA)
Historical poverty rate, 1960	U.S. Census

Other Controls

Labor Force Participation Rate, ages 16-65, 2010	U.S. Bureau of Labor Statistics (BLS) and U.S. Census
Percent of the population that is white, 2010	U.S. Census
Median Age of the population, 2010	U.S. Census
Share of population with various education levels, 2010	U.S. Census
Percent of people in creative class occupations, 2007 to 2011	USDA Economic Research Service (ERS)
Natural amenities score, 1999	USDA Economic Research Service (ERS)
Topography score, 1999	USDA Economic Research Service (ERS)
Social capital index, 2009	Northeast Regional Center for Rural Development
Percent of households with broadband access, 2010	U.S. Census
Urban indicator, 2013	U.S. Office of Management and Budget (OMB)
Distance and incremental distances to closest urban center, 2013 definition	Author creation in ArcGIS
Population Density, 2010	U.S. Census
State fixed effects	U.S. Census

Persistently high poverty rates in many Appalachian counties were a key driver in the formation of ARC and the designation of the counties within the region. Additionally, industries such as manufacturing, mining, and agriculture have faced significant labor-

saving mechanization which has reduced employment and affected the economic prospects of regions. Places with historic high concentrations of manufacturing and mining employment may also not have a tradition of self-employment. To control for all of these factors, we include the 1960 poverty rate from the U.S. Census, as well as the percent of total employment that is in manufacturing, agriculture, and mining in 1970 from the BEA.

Since education and human capital have been linked to economic growth and innovative entrepreneurship, we include data on education levels form the U.S. Census and the percent of people in creative class occupations using the USDA Economic Research Service (ERS) data. Creative occupations are those that require thinking creatively, including engineers, architects, artists, and others. People in these knowledge- and idea-based occupations may be drawn to areas that provide a high quality of life (Florida, 2002). These factors may be especially important to include, since rural areas tend to lose much of their talent when young adults move out.

Infrastructure is also a critical component of economic development and a lack of supporting infrastructure (such as high-speed broadband internet access) may make it difficult to attract new employers or start a new business. Additionally, broadband can help facilitate regional entrepreneurship and foster startup activities in desired industries (Audretsch et al., 2015). Therefore, we control for the percent of households with broadband access using data from the US Census American Community Survey (ACS). While we realize that this data may not be truly representative of the areas that have broadband access (as the collection of accurate broadband data is challenging), we include this variable as a proxy for high-speed internet access.

Urban areas are home to diverse economies that have supported higher levels of economic growth. Additionally, proximity to urban economies have been shown to have positive spillovers to nearby regions. Thus, we include a variable to indicate whether the county is located within an urban area using the 2013 definition of urban from the U.S. Office of Management and Budget (OMB), where "urban" is a county located in a core-based statistical area (CBSA) also known as a Metropolitan Statistical Area (MSA). We also include measures of the distance in miles from the population-weighted center of each county to the population center of the nearest metropolitan area (MSA) and three measures of incremental distance to a) an MSA with a population over 250,000, b) an MSA with a population over 500,000, and c) an MSA with a population over 1.5 million. All of these measures have been found to be an important determinant to growth in both urban and rural areas (Partridge et al., 2008; Stephens et al., 2013).

Since natural amenities have been found to be positively related to rural economic growth (McGranahan and Wojan, 2007; McGranahan et al., 2010; Partridge et al., 2008; Stephens et al., 2013), we include the value for each county of the natural amenities scale from ERS. The natural amenities scale is a measure of the physical characteristics of a county that make it more desirable to live in.[13] We also include the county-level topography score, which is a measure of land variation (i.e., plains, hills, mountains). In general, the higher the topography score, the more appealing the setting. We separately control for topography because Appalachian counties tend to have higher scores, for example, the average standardized topography score in the

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[13] The scale combines six measures, including warm winter, winter sun, temperate summer, low summer humidity, topography, and water area (USDA ERS).

Appalachian Region is nearly one standard deviation higher from the mean than the national average, and topography may provide some advantages in terms of tourism and quality of life, but may also be a barrier to growth if it makes it more difficult to access those locations or build infrastructure.

The social capital index, which measures the level of engagement in a community, is also included in our model as places with higher levels of social capital, all else equal, are expected to have higher levels of growth (Rupasingha et al., 2006). The index combines information on a) the number of establishments in industries such as fitness and recreational sports centers, golf courses and country clubs, etc., b) the voter turnout in 2012, c) the 2010 Census response rate, and d) the number of non-profit organizations without including those with an international approach.

Our models also include other information on the people and workforce in each county which can affect employment changes, including the labor force participation rate (the share of the population ages 16-64 that is working or looking for work), the percent of the population that is white, the median age of the population, and the population density (people per square mile). Previous research has found that the labor force participation rate is linked to higher employment growth and that counties in the Appalachian Region have lower labor force participation rates (Stephens and Deskins, 2018).

Finally, all models include an indicator variable for the state the county is located in. The state indicator controls for state-specific policies and other factors (including tax policies, education policies, etc.) that may be affect economic outcomes.

3.5 – Estimation Strategy

We estimate our models for all Appalachian counties and then separate out the counties into rural and urban samples. As noted above, as much as possible, we draw our control variables or variables of interest from 2010 (or earlier) in order to avoid reverse causation, where the outcome may be affecting the control variable, instead of the other way around.

4. Results of Main Statistical Analysis

We first examine the results for the models where we consider the factors that affect employment changes between 2011 and 2019. The results are shown in Table 6. As noted above, we are especially interested in how self-employment may be affecting employment growth.

Table 6: Self-Employment, Industry Diversity and Percent Employment Change, 2011 to 2019

	(1) Total	(2) Total	(3) Urban	(4) Urban	(5) Rural	(6) Rural
Self-Employment Share, 2010	0.647***	0.429***	1.046***	0.904***	0.430	0.166
	(0.212)	(0.151)	(0.388)	(0.258)	(0.295)	(0.199)
Agriculture Total Employment Share, 2010	-0.305		0.0914		-0.337	
	(0.211)		(0.486)		(0.264)	
Mining Total Employment Share, 2010	-0.627***		-0.267		-0.640***	
	(0.169)		(0.340)		(0.207)	
Utilities Total Employment Share, 2010	-0.263		-0.203		-0.342	
	(0.381)		(0.856)		(0.450)	
Construction Total Employment Share, 2010	0.0291		0.245		0.0859	
	(0.185)		(0.350)		(0.278)	
Manufacturing Total Employment Share, 2010	-0.0164		-0.193		0.0605	
	(0.0891)		(0.193)		(0.109)	

	(1)	(2)	(3)	(4)	(5)	(6)
Wholesale Trade Total Employment Share, 2010	0.582**		1.094**		0.404	
	(0.272)		(0.483)		(0.343)	
Retail Trade Total Employment Share, 2010	-0.192		0.294		-0.312	
	(0.169)		(0.333)		(0.216)	
Transportation and Warehousing Total Employment Share, 2010	0.171		-0.0162		0.259	
	(0.212)		(0.404)		(0.299)	
Information Total Employment Share, 2010	-0.297		-0.301		-0.251	
	(0.453)		(0.922)		(0.558)	
Finance, Insurance, and Real Estate Total Employment Share, 2010	-0.0452		-1.053*		0.0109	
	(0.378)		(0.617)		(0.528)	
Professional and Business Services Total Employment Share, 2010	-0.00397		0.00304		0.0538	
	(0.146)		(0.273)		(0.210)	
Educational Services Total Employment Share, 2010	0.0764		0.254		0.186	
	(0.102)		(0.183)		(0.134)	
Travel and Leisure Total Employment Share, 2010	0.221		-0.223		0.456***	
	(0.144)		(0.339)		(0.174)	
Other Services Total Employment Share, 2010	-0.467		-0.516		-0.106	
	(0.414)		(0.761)		(0.555)	
HHI, 2010		-20.01		-93.16***		2.930
		(18.79)		(35.01)		(24.68)
Constant	-47.78***	-44.39***	-95.65***	-82.36***	-30.32*	-28.65*
	(12.85)	(12.99)	(29.69)	(24.49)	(16.05)	(17.30)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	420	420	152	152	268	268
R-squared	0.649	0.619	0.782	0.761	0.623	0.569
Adjusted R-squared	0.604	0.584	0.684	0.691	0.542	0.506

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Other controls include: Demographic controls (education, race, median age), share of creative class employment, historic employment and poverty controls, the labor force participation rate, controls for natural amenities and topography, the social capital index, broadband access, and controls for urbanization and population density.

The results in Table 6 show that having higher levels of self-employment is important to employment growth in Appalachian counties. Specifically, as shown in columns 1 and 2, a 1% increase in the share of self-employment increases employment growth from 2011 to 2019 by .429% to .647%. When we examine rural and urban areas separately, we see that this increase is being driven by increases in urban areas; there seems to be no effect in rural areas in our sample. This makes sense since the urban counties in our sample grew on average by about 12% during this time period, while rural counties only grew by about 3%.

In Table 6, we also examine how the industrial composition of counties and industrial diversity affect employment growth. Overall, very few industries appear to be affecting overall employment growth in the region. However, a few key industries stand out – notably, the lower employment growth (not surprisingly) associated with higher levels of both overall and rural mining employment, and the higher employment growth associated with higher levels of rural travel and leisure employment. In columns 2, 4, and 6, we use the HHI as our measure of diversity. While the HHI result is statistically insignificant overall and in rural counties, a more diverse economy (a lower HHI) appears to be helping urban counties in the region (column 4).

Since self-employment appears to be driving higher employment growth, at least in the urban areas in our sample, in Table 7, we consider the self-employment shares of industries in order to see what types of self-employment may be especially important to growth in Appalachian counties. While more overall self-employment in urban counties in the region was shown to be beneficial to growth in Table 6, this does not appear to be dominated by self-employment in any specific industry. At the same time, while overall

self-employment (Table 6) did not appear to help rural counties in the region, the results in Table 7 suggest that more self-employment in specific industries may be conducive to rural employment growth (such as manufacturing, information, and travel and leisure), while others are not.

Table 7: Industry Self-Employment and Percent Employment Change, 2011 to 2019

	(1) Total	(2) Total	(3) Urban	(4) Urban	(5) Rural	(6) Rural
Agriculture Self-Employment Share, 2010	-0.00748	-0.00256	-0.0815	-0.0210	-0.00948	-0.00880
	(0.0298)	(0.0294)	(0.0701)	(0.0659)	(0.0361)	(0.0364)
Mining Self-Employment Share, 2010	-0.00512	0.00888	-0.0964	-0.0524	-0.0155	0.00940
	(0.0261)	(0.0265)	(0.0697)	(0.0652)	(0.0305)	(0.0320)
Construction Self-Employment Share, 2010	0.0229	0.00397	0.0289	-0.0557	0.0528	0.00493
	(0.0455)	(0.0342)	(0.132)	(0.0734)	(0.0547)	(0.0432)
Manufacturing Self-Employment Share, 2010	0.0986	0.0793	-0.554**	-0.199	0.173***	0.122*
	(0.0602)	(0.0580)	(0.263)	(0.189)	(0.0641)	(0.0633)
Wholesale Trade Self-Employment Share, 2010	0.0197	0.0139	-0.177*	-0.187**	-0.00749	0.0133
	(0.0348)	(0.0325)	(0.102)	(0.0843)	(0.0447)	(0.0403)
Retail Trade Self-Employment Share, 2010	-0.0614	-0.0125	0.0962	0.237	-0.189	-0.0998
	(0.198)	(0.162)	(0.639)	(0.418)	(0.233)	(0.187)
Transportation and Warehousing Self-Employment Share, 2010	-0.00632	-0.0108	0.141	0.140*	0.0109	-0.00807
	(0.0437)	(0.0347)	(0.122)	(0.0816)	(0.0515)	(0.0420)
Information Self-Employment Share, 2010	0.0752*	0.0760*	0.117	0.103	0.132***	0.115**
	(0.0421)	(0.0388)	(0.124)	(0.107)	(0.0489)	(0.0467)
Finance, Insurance, and Real Estate Self-Employment Share, 2010	0.163*	0.125	0.253	0.396**	0.0638	0.0807
	(0.0982)	(0.0769)	(0.228)	(0.164)	(0.113)	(0.0904)
Professional and Business Services Self-Employment Share, 2010	0.0860*	0.0754**	-0.0436	0.0167	0.0593	0.0366
	(0.0480)	(0.0368)	(0.172)	(0.104)	(0.0590)	(0.0438)
Educational Services Self-Employment Share, 2010	-0.188	-0.191	1.084**	0.448	-0.257	-0.326

	(0.216)	(0.166)	(0.474)	(0.355)	(0.272)	(0.202)
Travel and Leisure Self-Employment Share, 2010	-0.0620	-0.0680	-0.693***	-0.430**	0.284**	0.0573
	(0.0829)	(0.0787)	(0.240)	(0.194)	(0.141)	(0.129)
Other Services Self-Employment Share, 2010	0.0586	0.108*	0.0730	0.130	0.0158	0.0952
	(0.0612)	(0.0563)	(0.152)	(0.123)	(0.0730)	(0.0679)
HHI, 2010		-50.19**		-96.36**		-27.69
		(20.49)		(39.29)		(26.86)
Constant	-56.60***	-48.97***	-90.78***	-81.92***	-51.58***	-36.45**
	(13.50)	(13.36)	(31.51)	(26.71)	(17.16)	(18.11)
Industry Total Employment Shares	Yes		Yes		Yes	
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	420	420	152	152	268	268
R-squared	0.659	0.634	0.807	0.780	0.656	0.598
Adjusted R-squared	0.602	0.588	0.684	0.684	0.558	0.514

Standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Other controls include: Demographic controls (education, race, median age), share of creative class employment, historic employment and poverty controls, the labor force participation rate, controls for natural amenities and topography, the social capital index, broadband access, and controls for urbanization and population density.

We now turn to our analysis of the factors that support more self-employment in 2019. In each model, we also include the self-employment share in 2010 to account for the recent prevalence of self-employment in each county and because previous research suggests the persistence of an entrepreneurial culture where places with a history of self-employment are more likely to have high levels of self-employment today. In fact, as shown in Table 8, our results support this hypothesis as the coefficient on the self-employment in 2010 is positive and statistically significant in all models.

Table 8: Share of Total Employment that is Self-Employed, 2019

	(1) Total	(2) Total	(3) Urban	(4) Urban	(5) Rural	(6) Rural
Self-Employment Share, 2010	0.783***	0.845***	0.945***	0.856***	0.647***	0.832***
	(0.0575)	(0.0406)	(0.0579)	(0.0414)	(0.0933)	(0.0627)
Agriculture Total Employment Share, 2010	-0.193***		-0.223***		-0.139*	
	(0.0572)		(0.0725)		(0.0837)	
Mining Total Employment Share, 2010	-0.0476		0.0266		-0.0863	
	(0.0459)		(0.0507)		(0.0656)	
Utilities Total Employment Share, 2010	-0.0267		0.148		-0.0511	
	(0.103)		(0.128)		(0.143)	
Construction Total Employment Share, 2010	0.00203		-0.00621		0.110	
	(0.0502)		(0.0521)		(0.0880)	
Manufacturing Total Employment Share, 2010	-0.112***		-0.0455		-0.144***	
	(0.0242)		(0.0288)		(0.0346)	
Wholesale Trade Total Employment Share, 2010	-0.122		0.0125		-0.247**	
	(0.0738)		(0.0720)		(0.109)	
Retail Trade Total Employment Share, 2010	-0.219***		-0.0992**		-0.257***	
	(0.0459)		(0.0496)		(0.0685)	
Transportation and Warehousing Total Employment Share, 2010	-0.107*		0.00596		-0.207**	
	(0.0577)		(0.0602)		(0.0948)	
Information Total Employment Share, 2010	-0.193		-0.105		-0.266	
	(0.123)		(0.137)		(0.177)	
Finance, Insurance, and Real Estate Total Employment Share, 2010	-0.0694		0.0426		-0.229	
	(0.103)		(0.0920)		(0.167)	
Professional and Business Services Total Employment Share, 2010	-0.0772*		-0.0504		-0.0726	
	(0.0398)		(0.0408)		(0.0665)	
Educational Services Total Employment Share, 2010	-0.0779***		-0.0455*		-0.0871**	
	(0.0277)		(0.0272)		(0.0423)	
Travel and Leisure Total Employment Share, 2010	-0.0174		0.0325		-0.0277	
	(0.0390)		(0.0505)		(0.0551)	
Other Services Total Employment Share, 2010	-0.143		-0.329***		-0.0503	
	(0.112)		(0.114)		(0.176)	

	(1)	(2)	(3)	(4)	(5)	(6)
HHI, 2010		31.61***		14.36**		34.36***
		(5.047)		(5.611)		(7.761)
Constant	10.21***	1.536	9.734**	2.349	11.78**	1.747
	(3.490)	(3.489)	(4.426)	(3.925)	(5.087)	(5.440)
Other Controls						
State Fixed Effects						
Observations	420	420	152	152	268	268
R-squared	0.844	0.834	0.956	0.944	0.825	0.803
Adjusted R-squared	0.824	0.819	0.936	0.928	0.787	0.774

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Other controls include: Demographic controls (education, race, median age), share of creative class employment, historic employment and poverty controls, the labor force participation rate, controls for natural amenities and topography, the social capital index, broadband access, and controls for urbanization and population density.

In this analysis, we are primarily interested in the industrial composition, measured by the industry employment shares (columns 1, 3, and 5), and industrial diversity, using the HHI (columns 2, 4, and 6), impact self-employment levels. As shown in Table 8, the presence of more employment in certain sectors (such as agriculture, manufacturing, retail, and educational services) leads to less overall self-employment in Appalachian counties, suggesting that having higher concentrations of employment in certain industries may crowd out self-employment. In other words, if there is a large employer with ample job opportunities then there may not be a need to start a business. We also find a positive and statistically significant relationship between HHI and self-employment overall, and in both urban and rural counties in the Appalachian Region. This suggests that a *less* diverse economy leads to more self-employment. This may be due to residents recognizing 'holes in the market' and starting businesses to fill the gaps. For example, if there is no convenience store in the nearby area because jobs are concentrated in only a few industries, a resident may open a convenience store. In other words, residents may be more inclined to start a business to take advantage of an

opportunity or gap in the marketplace. Or, it may be due to the lack of opportunities in other industries in places where employment is highly concentrated and residents starting businesses out of necessity.

To further examine this, we examine the share of self-employment in 2018 in specific industries. As shown in Table 1, the industries in the Appalachian Region with the highest shares of self-employment are agriculture, construction, professional and business services, and other (miscellaneous) services. In Table 9, we present an abbreviated set of results focusing on the overall Appalachian Region (combining rural and urban counties together). It appears that having more overall self-employment increases the share of self-employed in all of these industries, again suggesting that some places have a culture of entrepreneurship that supports higher levels of self-employment.

Table 9: Share of Self-Employed in Specific Industries, 2018

	Agriculture		Construction		Professional and Business Services		Other Services	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Self-Employment Share, 2010	1.120***	0.463	2.849***	1.504***	1.118***	1.733***	1.168***	0.831***
	(0.404)	(0.283)	(0.289)	(0.234)	(0.266)	(0.210)	(0.187)	(0.137)
Agriculture Total Employment Share, 2010	-0.182		-0.885***		-0.963***		-0.830***	
	(0.402)		(0.288)		(0.265)		(0.186)	
Mining Total Employment Share, 2010	-0.0123		-0.473**		-0.379*		-0.214	
	(0.322)		(0.230)		(0.212)		(0.149)	
Utilities Total Employment Share, 2010	0.332		0.783		-0.283		0.111	
	(0.727)		(0.520)		(0.479)		(0.336)	
Construction Total Employment Share, 2010	-0.979***		-3.115***		-0.621***		-0.0444	
	(0.353)		(0.252)		(0.232)		(0.163)	
Manufacturing Total Employment Share, 2010	-0.0246		-0.167		-0.762***		-0.212***	
	(0.170)		(0.122)		(0.112)		(0.0786)	
Wholesale Trade Total Employment Share, 2010	0.996*		-0.734**		-1.195***		-0.469*	
	(0.518)		(0.371)		(0.341)		(0.240)	
Retail Trade Total Employment Share, 2010	-0.567*		-0.634***		-0.869***		-0.367**	
	(0.323)		(0.231)		(0.212)		(0.149)	
Transportation and Warehousing Total Employment Share, 2010	-0.325		-0.473		-1.052***		-0.0457	
	(0.405)		(0.290)		(0.267)		(0.187)	
Information Total Employment Share, 2010	-0.732		-0.688		-1.553***		-0.512	
	(0.864)		(0.618)		(0.569)		(0.400)	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Finance, Insurance, and Real Estate Total Employment Share, 2010	-0.514		-0.460		-1.378***		0.0697	
	(0.722)		(0.516)		(0.475)		(0.334)	
Professional and Business Services Total Employment Share, 2010	-0.158		-0.159		-1.975***		-0.209	
	(0.279)		(0.200)		(0.184)		(0.129)	
Educational Services Total Employment Share, 2010	-0.0230		-0.328**		-0.491***		-0.163*	
	(0.195)		(0.139)		(0.128)		(0.0900)	
Travel and Leisure Total Employment Share, 2010	-0.0236		-0.306		-0.702***		-0.159	
	(0.274)		(0.196)		(0.180)		(0.127)	
Other Services Total Employment Share, 2010	-1.136		-1.269**		-0.386		-2.249***	
	(0.790)		(0.565)		(0.520)		(0.365)	
HHI, 2010		40.87		148.1***		140.4***		62.17***
		(35.26)		(29.09)		(26.18)		(17.11)
Constant	22.99	17.23	47.29***	32.26	54.11***	26.25	50.60***	26.90**
	(24.53)	(24.38)	(17.54)	(20.11)	(16.15)	(18.10)	(11.34)	(11.83)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	420	420	420	420	420	420	420	420
R-squared	0.383	0.352	0.724	0.614	0.723	0.630	0.803	0.773
Adjusted R-squared	0.303	0.293	0.688	0.579	0.687	0.597	0.778	0.752

Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Other controls include: Demographic controls (education, race, median age), share of creative class employment, historic employment and poverty controls, the labor force participation rate, controls for natural amenities and topography, the social capital index, broadband access, and controls for urbanization and population density.

Focusing on the results for the construction, professional and business services, and other services industries in columns 3-8 of Table 9, some clear patterns emerge. First, we find that having more overall employment in the same industry results in lower rates of self-employment in that industry. This is consistent with the discussion above – if that industry already is present in that region, people do not need to start a business and/or there is no gap to fill. This is further highlighted by the results in columns 2, 4, and 6, where higher HHI (or lower economic diversity) is associated with higher levels of self-employment in these industries.

The results for agriculture self-employment are a bit different, with no crowding out effect from overall agriculture employment or industrial diversity (or lack of it). This may be due to the fact that agriculture self-employment requires land and other resources that make the factors that affect the decision to become self-employment in this industry different.

5. COVID-19 and the Appalachian Region

The COVID-19 pandemic induced an economic crisis that had widespread impacts across the U.S. economy, including in the Appalachian Region. Government shutdowns and fear of the virus reduced the foot traffic into small, local businesses, and despite government programs such as the Paycheck Protection Program (PPP), there is evidence that small businesses and the self-employed were hard hit by the pandemic.[14] This is especially true for the self-employed in industries that were most vulnerable and at-risk from the COVID-19 induced economic crisis.

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[14] https://www.score.org/resource/infographic/megaphone-main-street-impact-covid-small-businesses

While the data we use in this analysis do not allow us to examine directly the impact of the COVID-19 induced crisis on the Appalachian Region or the self-employed in the region, we separately examine the contribution of hard-hit industries and self-employment in those industries to employment growth from 2011 to 2019. In other words, were these industries contributing to growth before the COVID-19 crisis?

To determine which industries were hardest hit, we examine overall industry employment changes in the Appalachian Region between April 2019 and April 2020 as well as between June 2019 and June 2020, to account for seasonality in employment. We then define COVID-19 affected industries based on those that experienced the largest overall employment losses. These industries include the following (NAICS codes are in parentheses): Mining (21), Heavy Manufacturing (33), Arts, Administrative and Support and Waste Management and Remediation Services (56), Entertainment and Recreation (71), Accommodation and Food Services (72), Child Care (6244), Specific Retail (furniture, home furnishings, clothing, shoes, jewelry, and sporting goods store, department stores, florists, office supply stores, used merchandise stores, and miscellaneous retail) (4421, 4422, 4481, 4482, 4483, 4511, 4522, 4531, 4532, 4533, 4539).

Using this definition, we calculate the share of overall employment and share of self-employment in these COVID-19 Affected Industries. Table 10 provides averages of these shares and the corresponding numbers of jobs for counties in the Appalachian Region for both 2010 and 2018. The overall employment in the Affected industries represents over 20% of the overall employment, on average, in Appalachian counties, with self-employment in the Affected industries represents about 20% of overall self-

employment. Overall, there has been an increase in employment in the Affected

industries since 2010, but a slight decline in the share of self-employment and the

number of self-employed. Figure 4 illustrates how the share of overall self-employment

in the Affected industries varies across the region (using data from 2018).

Table 10: COVID-19 Affected Industries in the Appalachian Region

Year	Average Share (%) of County-Level Employment in Affected Industries	Average # of County-Level Jobs in Affected Industries	Average Share (%) of County-Level Self-Employment in Affected Industries	Average # of County-Level Self-Employed Jobs in Affected Industries
2010	22.79	6034	21.98	368
2018	24	6741	21.6	358

COVID-19 affected industries are defined as the following (NAICS codes are in parentheses): Mining (21), Heavy Manufacturing (33), Arts, Administrative and Support and Waste Management and Remediation Services (56), Entertainment and Recreation (71) Accommodation and Food Services (72), Child Care (6244), Specific Retail (furniture, home furnishings, clothing, shoes, jewelry, and sporting goods store, department stores, florists, office supply stores, used merchandise stores, and miscellaneous retail) (4421, 4422, 4481, 4482, 4483, 4511, 4522, 4531, 4532, 4533, 4539).

Figure 4: COVID-19 Affected Share of Self-Employment in Appalachian Region (2018)
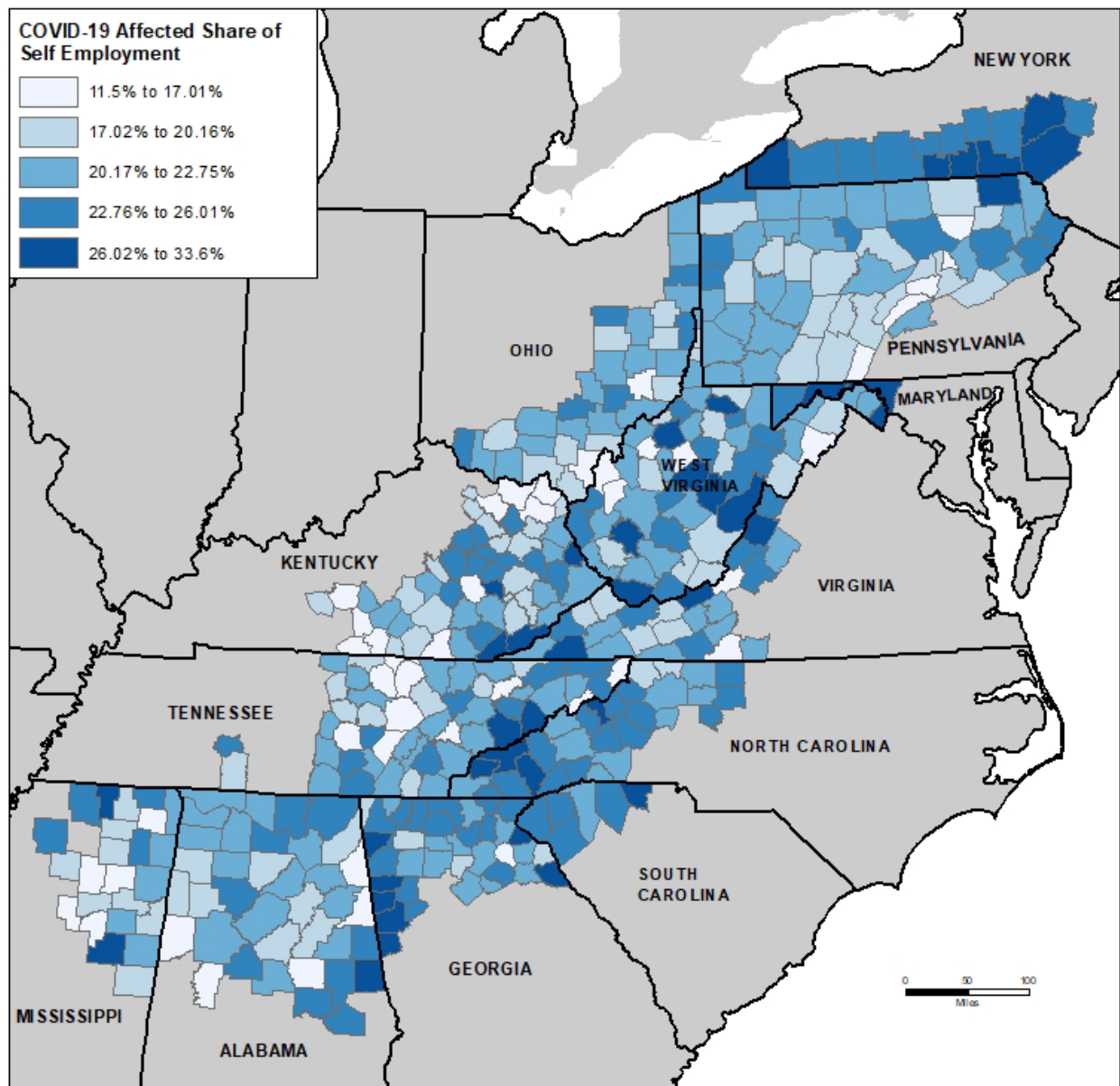
While there have been changes in the share of employment in these industries over time, to avoid reverse causation, we use the shares of employment and self-employment in 2010 in the COVID-19 Affected Industries and estimate their impact on employment changes from 2011 to 2019. The results are shown in Table 11. For the overall Appalachian Region and rural counties in the region, having more overall

employment and more self-employment in 2010 in Affected industries was associated

with higher employment growth in recent years. This suggests that future employment

growth, especially in rural Appalachian counties, may be negatively impacted by the

COVID-19 crisis if these businesses do not recover.

Table 6: COVID-19 Affected Industries and Percent Employment Change, 2011 to 2019

	(1) Total	(2) Urban	(3) Rural
Affected Self-Employment Share, 2010	0.696**	-0.0724	0.728**
	(0.287)	(0.670)	(0.355)
Affected Total Employment Share, 2010	0.668**	0.130	0.682**
	(0.271)	(0.682)	(0.328)
Non-Affected Self-Employment Share, 2010	0.467***	0.783***	0.219
	(0.156)	(0.275)	(0.202)
Affected Self-Employment Share, 2010 * Affected Total Employment Share, 2010	-0.0330***	-0.0139	-0.0319**
	(0.0118)	(0.0284)	(0.0147)
Constant	-62.71***	-101.5***	-43.02**
	(14.09)	(26.70)	(18.22)
Other Controls	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
Observations	420	152	268
R-squared	0.627	0.756	0.578
Adjusted R-squared	0.590	0.679	0.512

Standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Dependent Variable is percent change in county-level employment from 2011 to 2019.

Other controls include: Demographic controls (education, race, median age), share of creative class employment, historic employment and poverty controls, the labor force participation rate, controls for natural amenities and topography, the social capital index, broadband access, and controls for urbanization and population density.

Affected industries are defined as the following (NAICS codes are in parentheses): Mining (21), Heavy Manufacturing (33), Arts, Administrative and Support and Waste Management and Remediation Services (56), Entertainment and Recreation (71) Accommodation and Food Services (72), Child Care (6244), Specific Retail (furniture, home furnishings, clothing, shoes, jewelry, and sporting goods store, department stores, florists, office supply stores, used merchandise stores, and miscellaneous retail) (4421, 4422, 4481, 4482, 4483, 4511, 4522, 4531, 4532, 4533, 4539).

Affected Self-Employment Share is the share of total county-level self-employment that is in the affected industries. Affected Total Employment Share is the share of total county-level employment that is in the affected industries.

6. Conclusion and Implications

Overall, our analysis suggests that promoting self-employment and entrepreneurship may be one way that communities in the Appalachian Region can generate economic growth. While self-employment is linked with overall growth in communities in the Appalachian Region, it is especially important for growth in urban counties in the region. However, self-employment in specific industries also seems to be important to growth in rural counties in the region who lag their urban counterparts in terms of overall employment growth. Since these places also lack other advantages in terms of their labor force and infrastructure, supporting the development of small businesses and entrepreneurs may be one of the best ways to help these areas thrive economically.

The findings from this report also further emphasize the point made in the 2014 ARC report by Feser et al. about the need to balance economic diversification and specialization. We find that, while economic diversification does appear to generate higher levels of economic growth in the Appalachian, it is most important for urban counties in the region. However, less economic diversification in all types of counties in the region supports more self-employment, perhaps due to the opportunities to exploit holes in the market. Consistent with this, our results show that more employment in a specific industry results in less self-employment in that same industry. Thus, local leaders and policymakers who are interested in supporting employment growth need to consider how an economy diversifies. Perhaps economic diversification will be achieved by supporting new businesses and entrepreneurs who can fill holes in the market and help grow the economy.

We also find evidence that past experience with self-employment is associated with more overall self-employment and more self-employment in specific industries in the region. Thus, places with low levels of previous self-employment may need to create an entrepreneurial culture to overcome this.

Data limitations mean we are unable to assess the impact of the COVID-19 induced economic crisis on self-employment in the Appalachian Region. However, we do provide evidence that having more employment and more self-employment in those industries (at least initially) most negatively affected by the COVID-19 were associated with higher levels of county-level employment growth in the region since the last recession. This suggests that efforts to help business owners and workers in these industries deal with the fallout from the crisis may help counties in the region rebound over the coming years.

Among those who have been affected by the COVID-induced economic crisis are those who are self-employed in travel and leisure businesses. Our analysis suggests that the self-employed in that industry helped drive regional employment growth, at least in rural counties, from 2011 to 2019. Given the relative rural nature and the natural resources of the Appalachian Region, and the proximity of the region to a large portion of the U.S. population, the travel and leisure sector in the Appalachian Region may be well-positioned to capture the emerging post-COVID travel boom. This sector in the Appalachian Region is also likely protected from the declines in business travel, which is not expected to rebound anytime soon. Promoting the travel industry in the region, and supporting new travel-related entrepreneurs, may thus be a strategy that parts of the region should consider.

Finally, while our report suggests that promoting self-employment and entrepreneurship can help generate economic growth in the region, other factors still matter. Investments in infrastructure, including broadband (wired and wireless), roads, and schools, will make communities more attractive to current and potential residents, support self-employment and entrepreneurship, and help the self-employed promote their businesses and attract new customers.

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Appendix A1

The HHI is calculated as:

$$HHI_i = \sum_{j=1}^{N} (e_{ij}/E_i)^2$$

where e_{ij} is the employment for industry j in the ith county, E_i is the total employment in the ith county, and N is the total number of industries in the ith county. The index reaches its maximum of 1 if all the employment in a county is in one sector and approaches its minimum of 1/N if all industries are evenly distributed in terms of employment. Therefore, a lower HHI represents a more diverse economy in terms of industry employment.