ECONOMIC STRUCTURE IN APPALACHIA'S URBAN REGIONS: SUPPLEMENT 2

Clustering and Diversification Strategies

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Chapter 1. Cornelia, GA

Study Area Overview

The Cornelia, GA study region occupies 277 square-miles and had a 2018 population of 45,388. The employed share of the regional labor force during the 2014-2018 period averaged 97.3%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Government and Unclassified. These three industries account for a combined 27.25% of the region's economy. The region's 2018 coefficient of specialization (COS) is 43.06, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Cornelia, GA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Food Services and Drinking Places, whose employment grew by 443 followed by Elementary and Secondary Schools and Junior Colleges, Colleges, Universities, and Professional Schools. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 1.37, 12.66, and 2.41.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	443	128	1.37
143	Elementary and Secondary Schools	199	-110	12.66
144	Junior Colleges, Colleges, Universities, and Professional Schools	197	148	2.41
42	Plastics Product Manufacturing	147	147	2.74
80	Motor Vehicle Body and Trailer Manufacturing	133	133	8.92
110	Wired Telecommunications Carriers	116	164	6.97
89	Medical Equipment and Supplies Manufacturing	80	52	24.98
115	Monetary Authorities, Credit Intermediation, and Related Activities	53	68	0.93
94	General Merchandise Stores	45	25	1.57
60	Coating, Engraving, Heat Treating, and Allied Activities	44	44	3.45

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Cornelia, GA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 29.06, followed by Education and Knowledge Creation and Information Technology and Telecommunications. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Cornelia, GA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

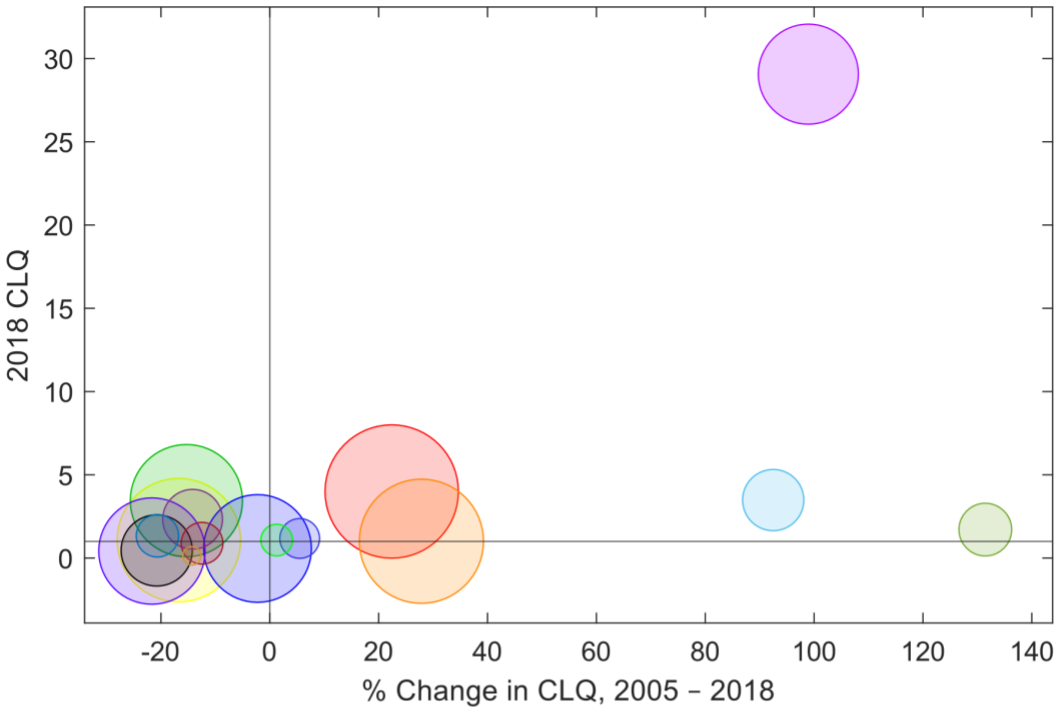
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
9	Education and Knowledge Creation	3.26	4.00	1,919
3	Arts, Entertainment, Recreation and Visitor Industries	0.79	1.01	1,648
4	Biomedical/Biotechnical (Life Sciences)	1.29	1.08	1,629
1	Agribusiness, Food Processing and Technology	4.07	3.45	1,326
8	Defense and Security	0.59	0.58	1,215
5	Business and Financial Services	0.54	0.42	1,181
2	Apparel and Textiles	14.61	29.06	1,036
16	Transportation and Logistics	0.58	0.46	488
12	Information Technology and Telecommunications	1.81	3.48	346
11	Forest and Wood Products	2.72	2.33	327
6	Chemicals and Chemical-Based Products	0.74	1.71	245
17	Transportation Equipment	1.68	1.33	145
15	Primary and Fabricated Metal Products	1.02	0.89	139
10	Energy (Fossil and Renewable)	1.12	1.18	124
14	Mining, Glass and Ceramics	1.07	1.08	69
13	Machinery	0.15	0.13	13
7	Computer, Electronic, and Electrical Products	0.00	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Cornelia, GA



Bubble Size as the Employment for Each Cluster

- Education and Knowledge Creation (1,919)
- Arts, Entertainment, Recreation and Visitor Industries (1,648)
- Biomedical/Biotechnical (Life Sciences) (1,629)
- Agribusiness, Food Processing and Technology (1,326)
- Defense and Security (1,215)
- Business and Financial Services (1,181)
- Apparel and Textiles (1,036)
- Transportation and Logistics (488)
- Information Technology and Telecommunications (346)
- Forest and Wood Products (327)
- Chemicals and Chemical-Based Products (245)
- Transportation Equipment (145)
- Primary and Fabricated Metal Products (139)
- Energy (Fossil and Renewable) (124)
- Mining, Glass and Ceramics (69)
- Machinery (13)
- Computer, Electronic, and Electrical Products (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Cornelia, GA identifies 3 anchor industries in 3 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Textile Mills and Textile Product Mills, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
2	Apparel and Textiles	26	Textile Mills and Textile Product Mills	1,018	973
4	Biomedical/Biotechnical (Life Sciences)	89	Medical Equipment and Supplies Manufacturing	655	735
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	0	147

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
26	Textile Mills and Textile Product Mills	45.00	377	-41.39	-4.40	0.62	0.13
89	Medical Equipment and Supplies Manufacturing	24.98	52	4.20	12.20	0.60	0.11
42	Plastics Product Manufacturing	2.74	147	-6.65	N/A	0.61	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment

column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 26

Textile Mills and Textile Product Mills

Industry #	Industry Name	Employment
1	Crop Production	-42
32	Converted Paper Product Manufacturing	-6
35	Basic Chemical Manufacturing	-17
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-5
72	Semiconductor and Other Electronic Component Manufacturing	-16
133	Management of Companies and Enterprises	-25
139	Investigation and Security Services	-5

Table 6. Phase 2 Deficits Adding Anchor Industry 89

Medical Equipment and Supplies Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-45	-3
32	Converted Paper Product Manufacturing	-11	-5
35	Basic Chemical Manufacturing	-22	-4
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-19	-14
72	Semiconductor and Other Electronic Component Manufacturing	-29	-12
133	Management of Companies and Enterprises	-50	-25
139	Investigation and Security Services	-12	-6

Table 7. Phase 3 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-46	-1
32	Converted Paper Product Manufacturing	-12	-1
35	Basic Chemical Manufacturing	-24	-3

59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-20	-1
72	Semiconductor and Other Electronic Component Manufacturing	-30	-1
133	Management of Companies and Enterprises	-53	-3
139	Investigation and Security Services	-12	-1

Chapter 2. Corning, NY

Study Area Overview

The Corning, NY study region occupies 1,391 square-miles and had a 2018 population of 95,796. The employed share of the regional labor force during the 2014-2018 period averaged 94.8%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Government and Unclassified and Food Services and Drinking Places. These three industries account for a combined 22.21% of the region's economy. The region's 2018 coefficient of specialization (COS) is 38.33, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Corning, NY can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Individual and Family Services, whose employment grew by 739 followed by Computer Systems Design and Related Services and Scientific Research and Development Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 2.39, 1.77, and 9.39.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
155	Individual and Family Services	739	57	2.39
128	Computer Systems Design and Related Services	724	594	1.77
130	Scientific Research and Development Services	370	168	9.39
81	Motor Vehicle Parts Manufacturing	359	399	5.06
149	Outpatient Care Centers	330	315	1.52
45	Glass and Glass Product Manufacturing	282	411	39.79
126	Architectural, Engineering, and Related Services	242	197	2.01
167	Food Services and Drinking Places	242	-348	0.80
165	Other Amusement and Recreation Industries	228	184	1.13
137	Business Support Services	227	222	1.23

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Corning, NY, the cluster with the largest CLQ in 2018 is Mining, Glass and Ceramics with a CLQ of 6.16, followed by Transportation Equipment and Education and Knowledge Creation. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Corning, NY cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

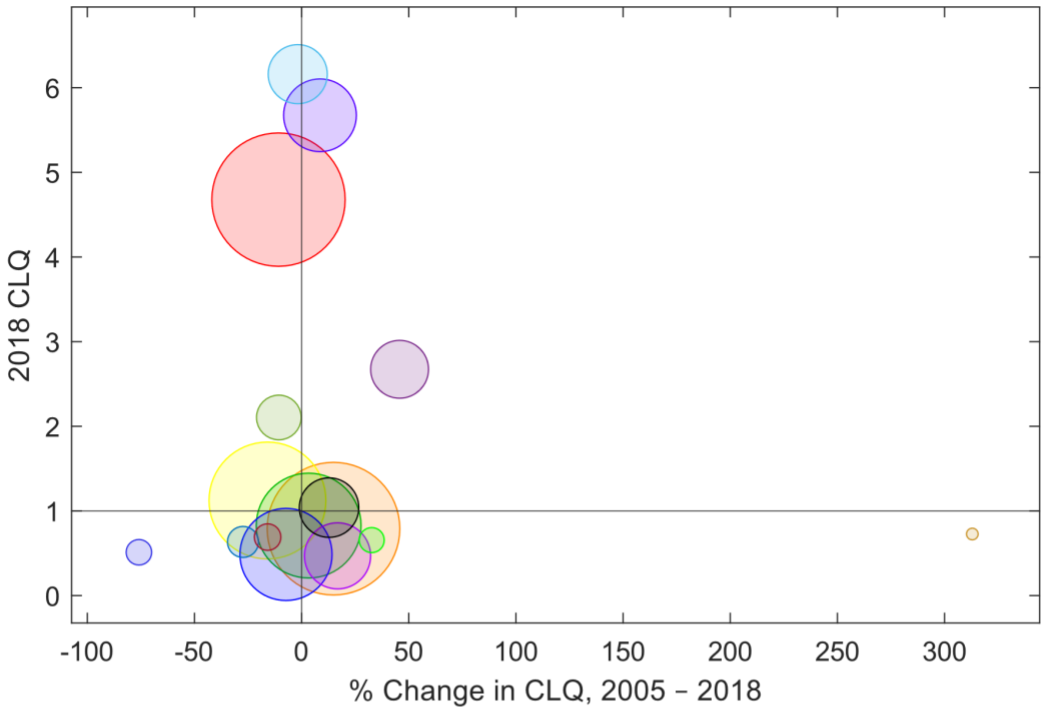
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
9	Education and Knowledge Creation	5.24	4.68	5,725
5	Business and Financial Services	0.69	0.79	5,663
4	Biomedical/Biotechnical (Life Sciences)	1.34	1.12	4,334
3	Arts, Entertainment, Recreation and Visitor Industries	0.80	0.83	3,439
8	Defense and Security	0.52	0.49	2,613
17	Transportation Equipment	5.23	5.67	1,572
16	Transportation and Logistics	0.40	0.47	1,279
1	Agribusiness, Food Processing and Technology	0.92	1.04	1,018
14	Mining, Glass and Ceramics	6.27	6.16	1,002
11	Forest and Wood Products	1.83	2.67	958
13	Machinery	2.35	2.10	546
15	Primary and Fabricated Metal Products	0.87	0.63	253
10	Energy (Fossil and Renewable)	0.82	0.69	186
7	Computer, Electronic, and Electrical Products	2.12	0.51	172
12	Information Technology and Telecommunications	0.49	0.66	166
2	Apparel and Textiles	0.18	0.73	66
6	Chemicals and Chemical-Based Products	0.00	0.17	61

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Corning, NY



Bubble Size as the Employment for Each Cluster
Education and Knowledge Creation (5,725)
Business and Financial Services (5,663)
Biomedical/Biotechnical (Life Sciences) (4,334)
Arts, Entertainment, Recreation and Visitor Industries (3,439)
Defense and Security (2,613)
Transportation Equipment (1,572)
Transportation and Logistics (1,279)
Agribusiness, Food Processing and Technology (1,018)
Mining, Glass and Ceramics (1,002)
Forest and Wood Products (958)
Machinery (546)
Primary and Fabricated Metal Products (253)
Energy (Fossil and Renewable) (186)
Computer, Electronic, and Electrical Products (172)
Information Technology and Telecommunications (166)
Apparel and Textiles (66)
Chemicals and Chemical-Based Products (61)

2. CADS Analysis

The 2018 CADS analysis of the economy of Corning, NY identifies 5 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Scientific Research and Development Services, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
9	Education and Knowledge Creation	130	Scientific Research and Development Services	1,145	1,515
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	341	700
14	Mining, Glass and Ceramics	45	Glass and Glass Product Manufacturing	527	809
11	Forest and Wood Products	87	Office Furniture (Including Fixtures) Manufacturing	809	850
5	Business and Financial Services	128	Computer Systems Design and Related Services	192	916

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
130	Scientific Research and Development Services	9.39	168	17.65	32.34	0.79	0.11
81	Motor Vehicle Parts Manufacturing	5.06	399	-11.56	105.48	0.61	0.09
45	Glass and Glass Product Manufacturing	39.79	411	-24.49	53.53	0.70	0.06
87	Office Furniture (Including Fixtures) Manufacturing	33.60	181	-17.39	5.03	0.66	0.05

128	Computer Systems Design and Related Services	1.77	594	67.55	377.07	0.85	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 130

Scientific Research and Development Services

Industry #	Industry Name	Employment
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-1
35	Basic Chemical Manufacturing	-4
42	Plastics Product Manufacturing	-12
43	Rubber Product Manufacturing	-9
49	Steel Product Manufacturing From Purchased Steel	-1
51	Nonferrous Metal (except Aluminum) Production and Processing	-2
52	Foundries	-2
53	Forging and Stamping	-2
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	N/A
61	Other Fabricated Metal Product Manufacturing	-5
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-4
96	Air Transportation	-5
97	Rail Transportation	-2
104	Warehousing and Storage	N/A
129	Management, Scientific, and Technical Consulting Services	-105
135	Facilities Support Services	-7

Table 6. Phase 2 Deficits Adding Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-6	-6
35	Basic Chemical Manufacturing	-10	-6
42	Plastics Product Manufacturing	-49	-38
43	Rubber Product Manufacturing	-20	-11
49	Steel Product Manufacturing From Purchased Steel	-19	-18
51	Nonferrous Metal (except Aluminum) Production and Processing	-22	-20
52	Foundries	-70	-68
53	Forging and Stamping	-33	-31
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-90	-96
61	Other Fabricated Metal Product Manufacturing	-27	-23
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-6	-2
96	Air Transportation	-8	-2
97	Rail Transportation	-9	-6
104	Warehousing and Storage	-17	-58
129	Management, Scientific, and Technical Consulting Services	-129	-24
135	Facilities Support Services	-9	-2

Table 7. Phase 3 Deficits Adding Anchor Industry 45

Glass and Glass Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-7	-0
35	Basic Chemical Manufacturing	-19	-9
42	Plastics Product Manufacturing	-66	-17
43	Rubber Product Manufacturing	-21	-1
49	Steel Product Manufacturing From Purchased Steel	-20	-1
51	Nonferrous Metal (except Aluminum) Production and Processing	-23	-1
52	Foundries	-70	-1
53	Forging and Stamping	-33	-1
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-102	-12
61	Other Fabricated Metal Product Manufacturing	-30	-3
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-7	-1
96	Air Transportation	-9	-2
97	Rail Transportation	-25	-17
104	Warehousing and Storage	-57	-41
129	Management, Scientific, and Technical Consulting Services	-139	-10
135	Facilities Support Services	-10	-1

Table 8. Phase 4 Deficits Adding Anchor Industry 87

Office Furniture (Including Fixtures) Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-57	-50

35	Basic Chemical Manufacturing	-23	-3
42	Plastics Product Manufacturing	-88	-22
43	Rubber Product Manufacturing	-24	-3
49	Steel Product Manufacturing From Purchased Steel	-28	-8
51	Nonferrous Metal (except Aluminum) Production and Processing	-27	-4
52	Foundries	-72	-2
53	Forging and Stamping	-40	-7
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-117	-15
61	Other Fabricated Metal Product Manufacturing	-33	-3
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-8	-1
96	Air Transportation	-11	-2
97	Rail Transportation	-29	-4
104	Warehousing and Storage	-103	-45
129	Management, Scientific, and Technical Consulting Services	-151	-12
135	Facilities Support Services	-11	-1

Table 9. Phase 5 Deficits Adding Anchor Industry 128

Computer Systems Design and Related Services

Industry #	Industry Name	Employment	Added to Deficit
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-57	-0
35	Basic Chemical Manufacturing	-23	-0
42	Plastics Product Manufacturing	-89	-1
43	Rubber Product Manufacturing	-24	-0
49	Steel Product Manufacturing From Purchased Steel	-28	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-28	-0
52	Foundries	-73	-0
53	Forging and Stamping	-41	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-117	-1
61	Other Fabricated Metal Product Manufacturing	-33	-1
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-11	-2
96	Air Transportation	-13	-2
97	Rail Transportation	-30	-0
104	Warehousing and Storage	-104	-2
129	Management, Scientific, and Technical Consulting Services	-172	-21
135	Facilities Support Services	-14	-3

Chapter 3. Cortland, NY

Study Area Overview

The Cortland, NY study region occupies 499 square-miles and had a 2018 population of 47,823. The employed share of the regional labor force during the 2014-2018 period averaged 96.2%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Government and Unclassified. These three industries account for a combined 26.58% of the region's economy. The region's 2018 coefficient of specialization (COS) is 36.36, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Cortland, NY can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Soap, Cleaning Compound, and Toilet Preparation Manufacturing, whose employment grew by 381 followed by Nursing and Residential Care Facilities and Junior Colleges, Colleges, Universities, and Professional Schools. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 29.49, 2.35, and 4.64.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
40	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	381	381	29.49
154	Nursing and Residential Care Facilities	347	251	2.35
144	Junior Colleges, Colleges, Universities, and Professional Schools	278	114	4.64
167	Food Services and Drinking Places	201	-272	1.32
166	Accommodation	166	151	1.33
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	161	158	7.55
42	Plastics Product Manufacturing	159	161	2.78
177	Grantmaking and Giving Services and Social Advocacy Organizations	118	80	5.08
44	Clay Product and Refractory Manufacturing	106	106	22.28
2	Animal Production	102	116	2.30

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Cortland, NY, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 4.6, followed by Apparel and Textiles and Chemicals and Chemical-Based Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Cortland, NY cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

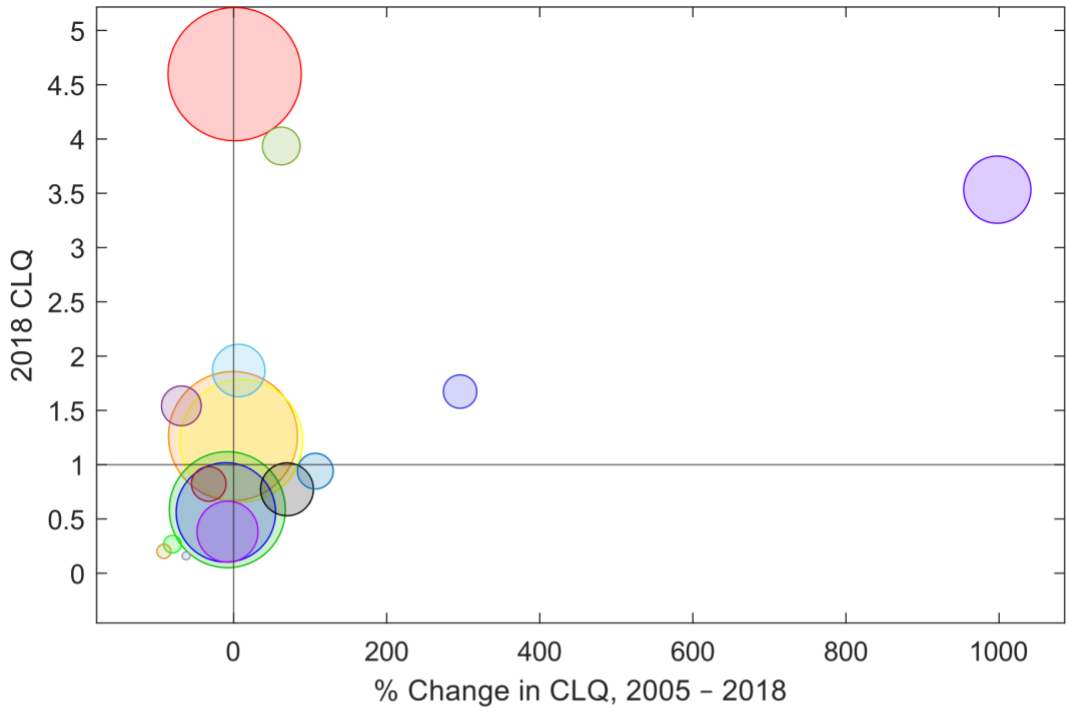
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
9	Education and Knowledge Creation	4.54	4.60	2,736
3	Arts, Entertainment, Recreation and Visitor Industries	1.27	1.26	2,555
4	Biomedical/Biotechnical (Life Sciences)	1.11	1.22	2,288
5	Business and Financial Services	0.64	0.59	2,039
8	Defense and Security	0.62	0.56	1,466
6	Chemicals and Chemical-Based Products	0.32	3.53	626
16	Transportation and Logistics	0.42	0.38	507
1	Agribusiness, Food Processing and Technology	0.46	0.77	368
15	Primary and Fabricated Metal Products	1.75	1.87	362
13	Machinery	4.86	1.54	195
2	Apparel and Textiles	2.43	3.94	174
7	Computer, Electronic, and Electrical Products	0.45	0.94	154
11	Forest and Wood Products	1.22	0.82	143
14	Mining, Glass and Ceramics	0.42	1.67	132
17	Transportation Equipment	1.33	0.27	36
10	Energy (Fossil and Renewable)	2.26	0.20	26
12	Information Technology and Telecommunications	0.42	0.16	20

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Cortland, NY



Bubble Size as the Employment for Each Cluster
Education and Knowledge Creation (2,736)
Arts, Entertainment, Recreation and Visitor Industries (2,555)
Biomedical/Biotechnical (Life Sciences) (2,288)
Business and Financial Services (2,039)
Defense and Security (1,466)
Chemicals and Chemical-Based Products (626)
Transportation and Logistics (507)
Agribusiness, Food Processing and Technology (368)
Primary and Fabricated Metal Products (362)
Machinery (195)
Apparel and Textiles (174)
Computer, Electronic, and Electrical Products (154)
Forest and Wood Products (143)
Mining, Glass and Ceramics (132)
Transportation Equipment (36)
Energy (Fossil and Renewable) (26)
Information Technology and Telecommunications (20)

2. CADS Analysis

The 2018 CADS analysis of the economy of Cortland, NY identifies 7 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Soap, Cleaning Compound, and Toilet Preparation Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
6	Chemicals and Chemical-Based Products	40	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	9	390
9	Education and Knowledge Creation	144	Junior Colleges, Colleges, Universities, and Professional Schools	686	964
5	Business and Financial Services	126	Architectural, Engineering, and Related Services	334	370
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	544	891
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	277	366
1	Agribusiness, Food Processing and Technology	2	Animal Production	103	205
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	26	185

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD

40	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	29.49	381	0.43	4,235.47	0.72	0.15
144	Junior Colleges, Colleges, Universities, and Professional Schools	4.64	114	23.90	40.44	0.85	0.05
126	Architectural, Engineering, and Related Services	2.12	5	9.37	10.89	0.83	0.04
154	Nursing and Residential Care Facilities	2.35	251	17.58	63.77	0.84	0.03
146	Offices of Physicians	1.23	21	24.38	32.13	0.82	0.03
2	Animal Production	2.30	116	-13.46	99.03	0.70	0.03
42	Plastics Product Manufacturing	2.78	161	-6.65	606.33	0.80	0.04

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 40

Soap, Cleaning Compound, and Toilet Preparation Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	-6
32	Converted Paper Product Manufacturing	-27
72	Semiconductor and Other Electronic Component Manufacturing	-19
104	Warehousing and Storage	-27
129	Management, Scientific, and Technical Consulting Services	N/A
131	Advertising and Related Services	-5
137	Business Support Services	N/A
139	Investigation and Security Services	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 144

Junior Colleges, Colleges, Universities, and Professional Schools

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-9	-3
32	Converted Paper Product Manufacturing	-28	-1
72	Semiconductor and Other Electronic Component Manufacturing	-20	-1
104	Warehousing and Storage	-29	-2
129	Management, Scientific, and Technical Consulting Services	N/A	-2
131	Advertising and Related Services	-6	-1
137	Business Support Services	-0	-2
139	Investigation and Security Services	-1	-2

Table 7. Phase 3 Deficits Adding Anchor Industry 126

Architectural, Engineering, and Related Services

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-9	-1
32	Converted Paper Product Manufacturing	-28	-0
72	Semiconductor and Other Electronic Component Manufacturing	-21	-1
104	Warehousing and Storage	-31	-2
129	Management, Scientific, and Technical Consulting Services	-9	-23
131	Advertising and Related Services	-8	-1
137	Business Support Services	-5	-5
139	Investigation and Security Services	-7	-5

Table 8. Phase 4 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-11	-2
32	Converted Paper Product Manufacturing	-29	-1
72	Semiconductor and Other Electronic Component Manufacturing	-21	-1
104	Warehousing and Storage	-33	-2
129	Management, Scientific, and Technical Consulting Services	-17	-9
131	Advertising and Related Services	-9	-1
137	Business Support Services	-8	-3
139	Investigation and Security Services	-9	-3

Table 9. Phase 5 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-12	-0
32	Converted Paper Product Manufacturing	-30	-0
72	Semiconductor and Other Electronic Component Manufacturing	-22	-0
104	Warehousing and Storage	-34	-1
129	Management, Scientific, and Technical Consulting Services	-26	-9
131	Advertising and Related Services	-10	-1
137	Business Support Services	-12	-5
139	Investigation and Security Services	-12	-3

Table 10. Phase 6 Deficits Adding Anchor Industry 2

Animal Production

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-40	-28
32	Converted Paper Product Manufacturing	-30	-1
72	Semiconductor and Other Electronic Component Manufacturing	-22	-1
104	Warehousing and Storage	-36	-2
129	Management, Scientific, and Technical Consulting Services	-28	-1
131	Advertising and Related Services	-10	-1
137	Business Support Services	-14	-1
139	Investigation and Security Services	-13	-1

Table 11. Phase 7 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-41	-1
32	Converted Paper Product Manufacturing	-31	-1
72	Semiconductor and Other Electronic Component Manufacturing	-23	-1
104	Warehousing and Storage	-39	-4
129	Management, Scientific, and Technical Consulting Services	-29	-1
131	Advertising and Related Services	-11	-0
137	Business Support Services	-14	-1
139	Investigation and Security Services	-14	-0

Chapter 4. Coshocton, OH

Study Area Overview

The Coshocton, OH study region occupies 564 square-miles and had a 2018 population of 36,629. The employed share of the regional labor force during the 2014-2018 period averaged 95.6%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Nursing and Residential Care Facilities and Foundries. These three industries account for a combined 21.8% of the region's economy. The region's 2018 coefficient of specialization (COS) is 46.31, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Coshocton, OH can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Foundries, whose employment grew by 211 followed by Individual and Family Services and Animal Slaughtering and Processing. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 93.07, 1.29, and 18.58.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
52	Foundries	211	344	93.07
155	Individual and Family Services	170	130	1.29
20	Animal Slaughtering and Processing	156	141	18.58
151	Home Health Care Services	126	76	1.93
154	Nursing and Residential Care Facilities	81	-29	3.32
19	Dairy Product Manufacturing	78	72	12.69
10	Support Activities for Mining	52	45	2.97
87	Office Furniture (Including Fixtures) Manufacturing	48	48	6.99
156	Community and Vocational Rehabilitation Services	42	44	5.18
22	Bakeries and Tortilla Manufacturing	41	41	1.90

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Coshocton, OH, the cluster with the largest CLQ in 2018 is Primary and Fabricated Metal Products with a CLQ of 9.29, followed by Energy (Fossil and Renewable) and Apparel and Textiles. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Coshocton, OH cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

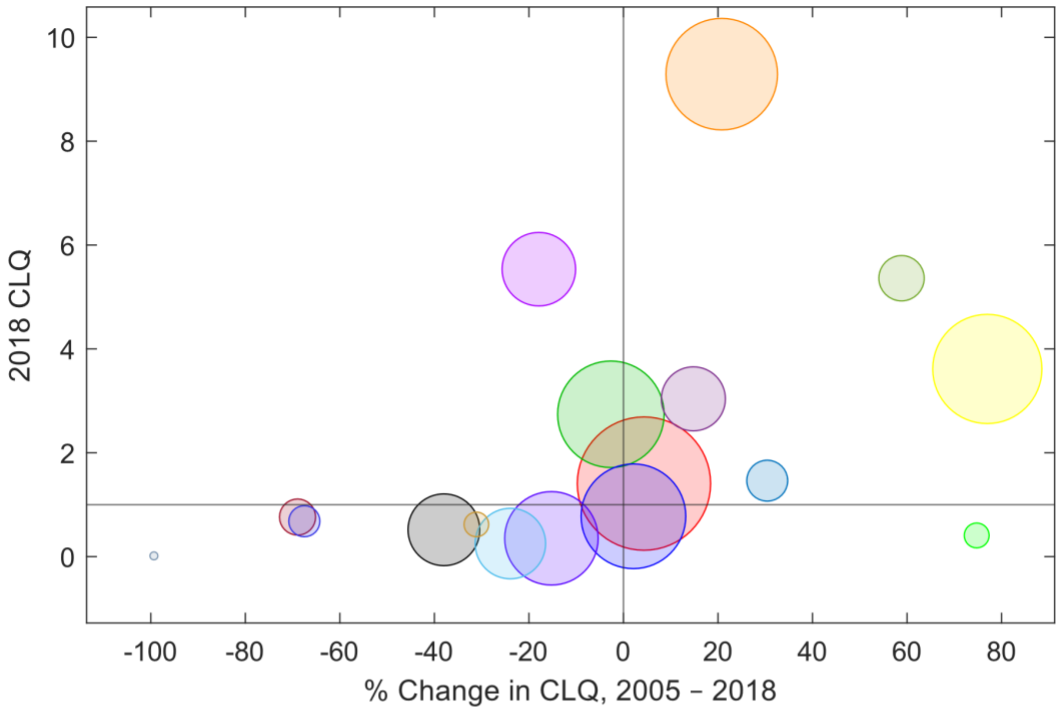
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.35	1.41	1,487
15	Primary and Fabricated Metal Products	7.69	9.29	1,015
1	Agribusiness, Food Processing and Technology	2.04	3.61	970
9	Education and Knowledge Creation	2.82	2.74	919
3	Arts, Entertainment, Recreation and Visitor Industries	0.76	0.78	885
5	Business and Financial Services	0.42	0.35	692
10	Energy (Fossil and Renewable)	6.74	5.54	407
16	Transportation and Logistics	0.83	0.52	386
8	Defense and Security	0.33	0.25	371
11	Forest and Wood Products	2.65	3.04	298
2	Apparel and Textiles	3.38	5.36	133
13	Machinery	1.12	1.46	104
6	Chemicals and Chemical-Based Products	2.45	0.76	76
17	Transportation Equipment	2.10	0.68	52
12	Information Technology and Telecommunications	0.23	0.41	28
14	Mining, Glass and Ceramics	0.90	0.62	28
7	Computer, Electronic, and Electrical Products	2.26	0.01	1

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Coshocton, OH



Bubble Size as the Employment for Each Cluster

- Biomedical/Biotechnical (Life Sciences) (1,487)
- Primary and Fabricated Metal Products (1,015)
- Agribusiness, Food Processing and Technology (970)
- Education and Knowledge Creation (919)
- Arts, Entertainment, Recreation and Visitor Industries (885)
- Business and Financial Services (692)
- Energy (Fossil and Renewable) (407)
- Transportation and Logistics (386)
- Defense and Security (371)
- Forest and Wood Products (298)
- Apparel and Textiles (133)
- Machinery (104)
- Chemicals and Chemical-Based Products (76)
- Transportation Equipment (52)
- Information Technology and Telecommunications (28)
- Mining, Glass and Ceramics (28)
- Computer, Electronic, and Electrical Products (1)

2. CADS Analysis

The 2018 CADS analysis of the economy of Coshocton, OH identifies 1 anchor industry in 1 cluster. Identified anchor and its parent cluster are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industry and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Animal Slaughtering and Processing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
1	Agribusiness, Food Processing and Technology	20	Animal Slaughtering and Processing	461	618

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
20	Animal Slaughtering and Processing	18.58	141	3.38	33.87	0.44	0.16

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 20

Animal Slaughtering and Processing

Industry #	Industry Name	Employment
1	Crop Production	-62
2	Animal Production	-587
5	Support Activities for Agriculture and Forestry	-18
15	Animal Food Manufacturing	-24
32	Converted Paper Product Manufacturing	-11
42	Plastics Product Manufacturing	-11
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-10
103	Couriers and Messengers	-11
104	Warehousing and Storage	-14
136	Employment Services	-15

Chapter 5. Crossville, TN

Study Area Overview

The Crossville, TN study region occupies 681 square-miles and had a 2018 population of 59,673. The employed share of the regional labor force during the 2014-2018 period averaged 95.1%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Elementary and Secondary Schools. These three industries account for a combined 20.46% of the region's economy. The region's 2018 coefficient of specialization (COS) is 38.85, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Crossville, TN can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Scenic and Sightseeing Transportation and Support Activities for Transportation, whose employment grew by 848 followed by Services to Buildings and Dwellings and Elementary and Secondary Schools. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 11.06, 2.3, and 8.31.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	848	810	11.06
140	Services to Buildings and Dwellings	540	494	2.30
143	Elementary and Secondary Schools	405	228	8.31
178	Civic, Social, Professional, and Similar Organizations	385	387	4.56
181	Government and Unclassified	384	361	0.41
93	Food and Beverage Stores	188	163	1.58
2	Animal Production	165	179	3.11
136	Employment Services	143	140	1.48
44	Clay Product and Refractory Manufacturing	136	325	133.51
167	Food Services and Drinking Places	130	-261	1.07

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Crossville, TN, the cluster with the largest CLQ in 2018 is Mining, Glass and Ceramics with a CLQ of 11.61, followed by Education and Knowledge Creation and Forest and Wood Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Crossville, TN cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

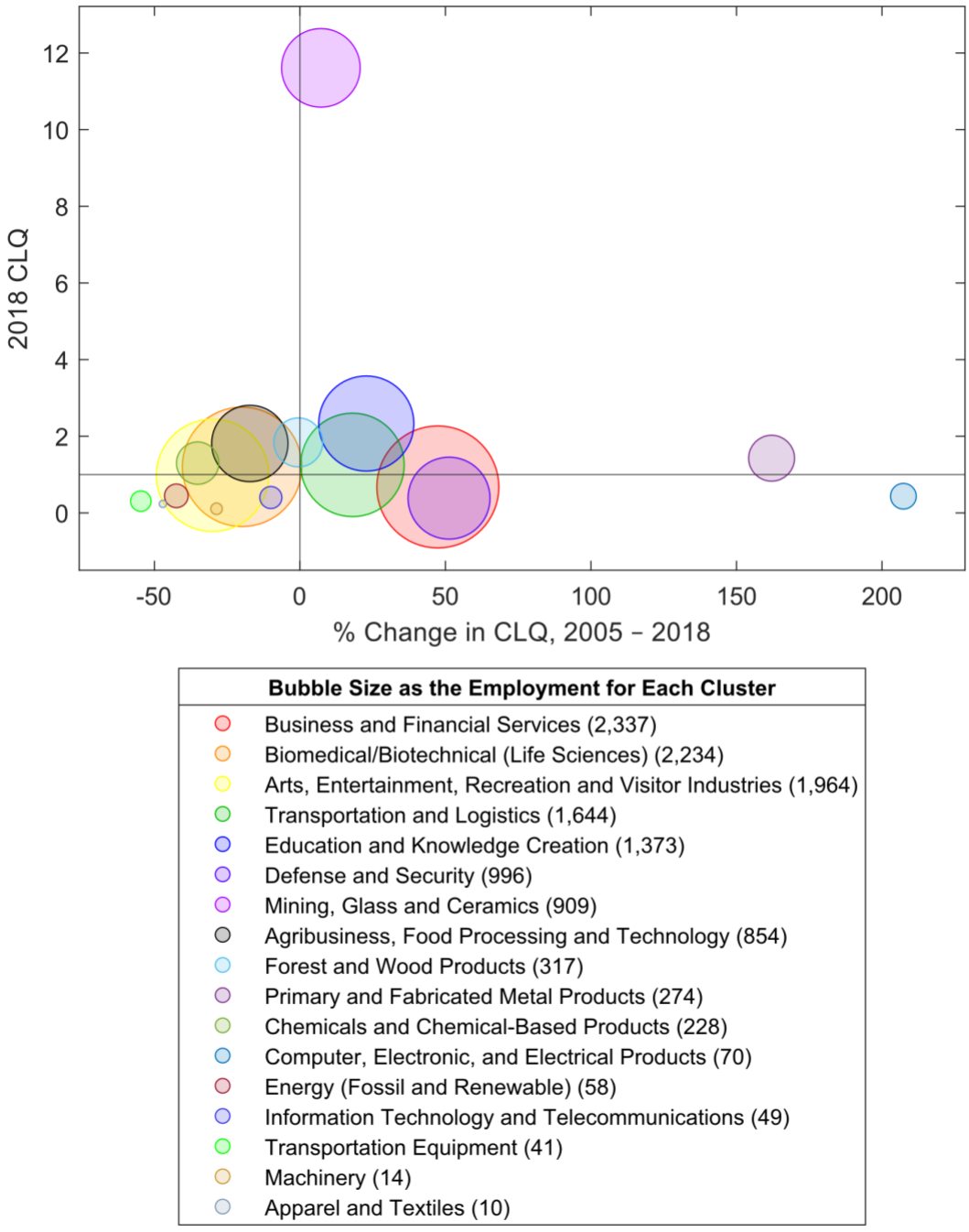
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
5	Business and Financial Services	0.46	0.68	2,337
4	Biomedical/Biotechnical (Life Sciences)	1.50	1.20	2,234
3	Arts, Entertainment, Recreation and Visitor Industries	1.40	0.98	1,964
16	Transportation and Logistics	1.06	1.25	1,644
9	Education and Knowledge Creation	1.90	2.33	1,373
8	Defense and Security	0.25	0.38	996
14	Mining, Glass and Ceramics	10.83	11.61	909
1	Agribusiness, Food Processing and Technology	2.19	1.81	854
11	Forest and Wood Products	1.85	1.84	317
15	Primary and Fabricated Metal Products	0.54	1.43	274
6	Chemicals and Chemical-Based Products	2.00	1.30	228
7	Computer, Electronic, and Electrical Products	0.14	0.44	70
10	Energy (Fossil and Renewable)	0.77	0.45	58
12	Information Technology and Telecommunications	0.45	0.40	49
17	Transportation Equipment	0.68	0.31	41
13	Machinery	0.15	0.11	14
2	Apparel and Textiles	0.45	0.24	10

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Crossville, TN



2. CADS Analysis

The 2018 CADS analysis of the economy of Crossville, TN identifies 4 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Scenic and Sightseeing Transportation and Support Activities for Transportation, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
16	Transportation and Logistics	102	Scenic and Sightseeing Transportation and Support Activities for Transportation	138	986
14	Mining, Glass and Ceramics	44	Clay Product and Refractory Manufacturing	495	631
1	Agribusiness, Food Processing and Technology	2	Animal Production	109	274
11	Forest and Wood Products	30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	217	246

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	11.06	810	27.52	614.33	0.68	0.08
44	Clay Product and Refractory Manufacturing	133.51	325	-38.17	27.44	0.76	0.07

2	Animal Production	3.11	179	-13.46	151.06	0.63	0.03
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	8.91	86	-26.04	13.43	0.72	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 102

Scenic and Sightseeing Transportation and Support Activities for Transportation

Industry #	Industry Name	Employment
1	Crop Production	N/A
3	Forestry and Logging	N/A
15	Animal Food Manufacturing	-0
61	Other Fabricated Metal Product Manufacturing	-1
64	Commercial and Service Industry Machinery Manufacturing, Including Digital Camera Manufacturing	-10
72	Semiconductor and Other Electronic Component Manufacturing	-1
103	Couriers and Messengers	-7
104	Warehousing and Storage	N/A
133	Management of Companies and Enterprises	N/A
137	Business Support Services	-8
139	Investigation and Security Services	-13

Table 6. Phase 2 Deficits Adding Anchor Industry 44

Clay Product and Refractory Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	N/A	-2
3	Forestry and Logging	-1	-2
15	Animal Food Manufacturing	-0	-0
61	Other Fabricated Metal Product Manufacturing	-11	-9
64	Commercial and Service Industry Machinery Manufacturing, Including Digital Camera Manufacturing	-10	-0
72	Semiconductor and Other Electronic Component Manufacturing	-10	-9
103	Couriers and Messengers	-10	-3
104	Warehousing and Storage	N/A	-21
133	Management of Companies and Enterprises	-13	-17
137	Business Support Services	-11	-3
139	Investigation and Security Services	-15	-2

Table 7. Phase 3 Deficits Adding Anchor Industry 2

Animal Production

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-15	-41
3	Forestry and Logging	-1	-0
15	Animal Food Manufacturing	-10	-10
61	Other Fabricated Metal Product Manufacturing	-11	-0
64	Commercial and Service Industry Machinery Manufacturing, Including Digital Camera Manufacturing	-10	-0
72	Semiconductor and Other Electronic Component Manufacturing	-11	-1
103	Couriers and Messengers	-12	-2
104	Warehousing and Storage	N/A	-3
133	Management of Companies and Enterprises	-18	-4
137	Business Support Services	-13	-2
139	Investigation and Security Services	-16	-1

Table 8. Phase 4 Deficits Adding Anchor Industry 30

Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-19	-4
3	Forestry and Logging	-15	-14
15	Animal Food Manufacturing	-10	-0
61	Other Fabricated Metal Product Manufacturing	-12	-1
64	Commercial and Service Industry Machinery Manufacturing, Including Digital Camera Manufacturing	-10	-0
72	Semiconductor and Other Electronic Component Manufacturing	-14	-3
103	Couriers and Messengers	-13	-1
104	Warehousing and Storage	-16	-17
133	Management of Companies and Enterprises	-23	-5
137	Business Support Services	-15	-2
139	Investigation and Security Services	-17	-1

Chapter 6. Cullman, AL

Study Area Overview

The Cullman, AL study region occupies 735 square-miles and had a 2018 population of 83,442. The employed share of the regional labor force during the 2014-2018 period averaged 95.8%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Elementary and Secondary Schools. These three industries account for a combined 21.28% of the region's economy. The region's 2018 coefficient of specialization (COS) is 37.18, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Cullman, AL can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Plastics Product Manufacturing, whose employment grew by 1,136 followed by Food Services and Drinking Places and Employment Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 11.23, 1.16, and 1.11.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
42	Plastics Product Manufacturing	1,136	1,140	11.23
167	Food Services and Drinking Places	637	77	1.16
136	Employment Services	499	497	1.11
95	All Other Retail	385	432	1.29
94	General Merchandise Stores	186	142	1.92
146	Offices of Physicians	184	50	1.54
81	Motor Vehicle Parts Manufacturing	171	274	9.89
181	Government and Unclassified	167	119	0.36
11	Electric Power Generation, Transmission and Distribution	161	164	4.14
144	Junior Colleges, Colleges, Universities, and Professional Schools	149	69	1.46

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Cullman, AL, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 4.94, followed by Chemicals and Chemical-Based Products and Forest and Wood Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Cullman, AL cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

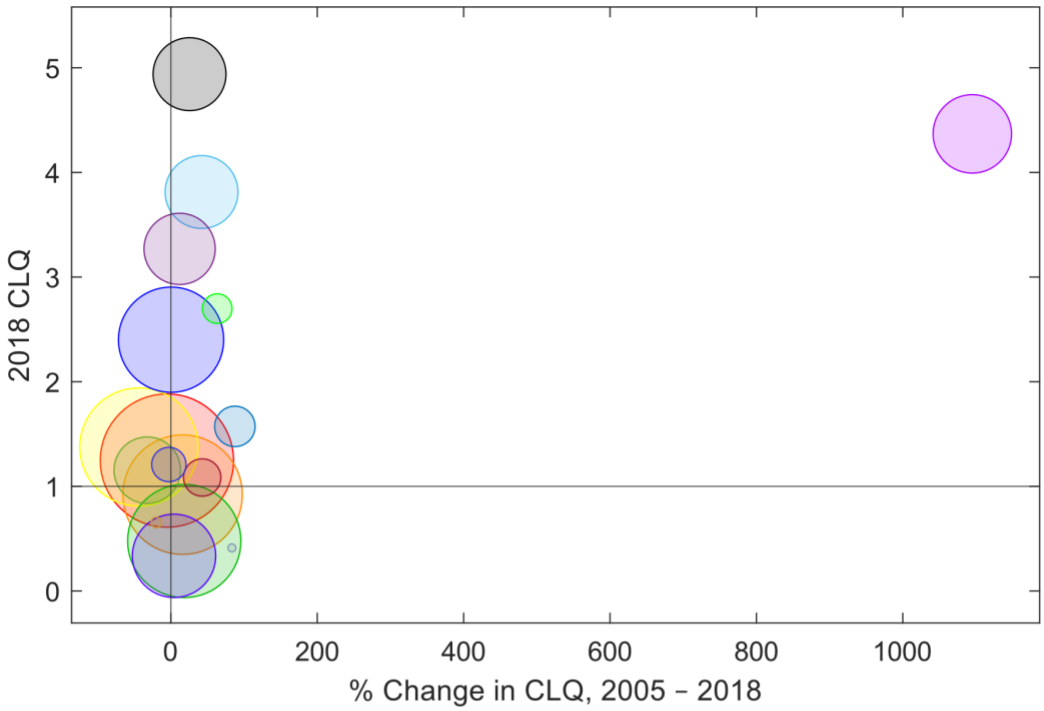
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.32	1.25	3,740
3	Arts, Entertainment, Recreation and Visitor Industries	0.79	0.92	2,978
16	Transportation and Logistics	2.44	1.38	2,916
5	Business and Financial Services	0.40	0.48	2,664
9	Education and Knowledge Creation	2.39	2.40	2,285
8	Defense and Security	0.32	0.34	1,405
6	Chemicals and Chemical-Based Products	0.37	4.37	1,238
17	Transportation Equipment	3.93	4.94	1,064
11	Forest and Wood Products	2.69	3.81	1,062
15	Primary and Fabricated Metal Products	2.92	3.27	1,014
1	Agribusiness, Food Processing and Technology	1.70	1.15	879
10	Energy (Fossil and Renewable)	0.84	1.57	328
7	Computer, Electronic, and Electrical Products	0.76	1.08	284
13	Machinery	1.24	1.21	244
2	Apparel and Textiles	1.65	2.70	191
14	Mining, Glass and Ceramics	0.82	0.65	83
12	Information Technology and Telecommunications	0.22	0.41	81

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Cullman, AL



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (3,740)
Arts, Entertainment, Recreation and Visitor Industries (2,978)
Transportation and Logistics (2,916)
Business and Financial Services (2,664)
Education and Knowledge Creation (2,285)
Defense and Security (1,405)
Chemicals and Chemical-Based Products (1,238)
Transportation Equipment (1,064)
Forest and Wood Products (1,062)
Primary and Fabricated Metal Products (1,014)
Agribusiness, Food Processing and Technology (879)
Energy (Fossil and Renewable) (328)
Computer, Electronic, and Electrical Products (284)
Machinery (244)
Apparel and Textiles (191)
Mining, Glass and Ceramics (83)
Information Technology and Telecommunications (81)

2. CADS Analysis

The 2018 CADS analysis of the economy of Cullman, AL identifies 4 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Motor Vehicle Parts Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	893	1,064
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	60	1,196
10	Energy (Fossil and Renewable)	11	Electric Power Generation, Transmission and Distribution	130	291
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	309	453

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
81	Motor Vehicle Parts Manufacturing	9.89	274	-11.56	19.15	0.64	0.17
42	Plastics Product Manufacturing	11.23	1,140	-6.65	1,900.49	0.52	0.11
11	Electric Power Generation, Transmission and Distribution	4.14	164	-2.47	124.24	0.69	0.07
55	Architectural and Structural Metals Manufacturing	6.38	149	-1.47	46.60	0.62	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment
27	Apparel, Leather and Allied Product Manufacturing	-17
35	Basic Chemical Manufacturing	-10
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-14
48	Iron and Steel Mills and Ferroalloy Manufacturing	-47
49	Steel Product Manufacturing From Purchased Steel	-28
51	Nonferrous Metal (except Aluminum) Production and Processing	-31
52	Foundries	-40
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-32
66	Metalworking Machinery Manufacturing	-14
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-15
68	Other General Purpose Machinery Manufacturing	-15
72	Semiconductor and Other Electronic Component Manufacturing	-71
97	Rail Transportation	-10
139	Investigation and Security Services	-9

Table 6. Phase 2 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-18	-1
35	Basic Chemical Manufacturing	-51	-41

36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-83	-70
48	Iron and Steel Mills and Ferroalloy Manufacturing	-48	-2
49	Steel Product Manufacturing From Purchased Steel	-29	-1
51	Nonferrous Metal (except Aluminum) Production and Processing	-34	-2
52	Foundries	-42	-1
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-53	-21
66	Metalworking Machinery Manufacturing	-17	-2
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-15	-1
68	Other General Purpose Machinery Manufacturing	-17	-3
72	Semiconductor and Other Electronic Component Manufacturing	-89	-19
97	Rail Transportation	-20	-10
139	Investigation and Security Services	-19	-10

Table 7. Phase 3 Deficits Adding Anchor Industry 11

Electric Power Generation, Transmission and Distribution

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-19	-1
35	Basic Chemical Manufacturing	-53	-2
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-84	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-49	-1
49	Steel Product Manufacturing From Purchased Steel	-30	-1
51	Nonferrous Metal (except Aluminum) Production and Processing	-34	-0
52	Foundries	-42	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-55	-2
66	Metalworking Machinery Manufacturing	-18	-1
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-17	-2
68	Other General Purpose Machinery Manufacturing	-18	-1
72	Semiconductor and Other Electronic Component Manufacturing	-91	-1
97	Rail Transportation	-25	-6
139	Investigation and Security Services	-25	-6

Table 8. Phase 4 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-19	-0
35	Basic Chemical Manufacturing	-54	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-84	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-61	-12
49	Steel Product Manufacturing From Purchased Steel	-38	-8
51	Nonferrous Metal (except Aluminum) Production and Processing	-38	-4
52	Foundries	-45	-3
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-73	-18
66	Metalworking Machinery Manufacturing	-22	-4
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-17	-0
68	Other General Purpose Machinery Manufacturing	-19	-1

72	Semiconductor and Other Electronic Component Manufacturing	-96	-5
97	Rail Transportation	-27	-2
139	Investigation and Security Services	-32	-8

Chapter 7. Cumberland, MD-WV

Study Area Overview

The Cumberland, MD-WV study region occupies 752 square-miles and had a 2018 population of 97,915. The employed share of the regional labor force during the 2014-2018 period averaged 93.28%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Government and Unclassified and Hospitals. These three industries account for a combined 22.77% of the region's economy. The region's 2018 coefficient of specialization (COS) is 35.06, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Cumberland, MD-WV can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Aerospace Product and Parts Manufacturing, whose employment grew by 506 followed by Individual and Family Services and Community and Vocational Rehabilitation Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 8.76, 1.4, and 6.74.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
82	Aerospace Product and Parts Manufacturing	506	447	8.76
155	Individual and Family Services	490	156	1.40
156	Community and Vocational Rehabilitation Services	433	437	6.74
144	Junior Colleges, Colleges, Universities, and Professional Schools	366	-7	4.53
167	Food Services and Drinking Places	255	-623	1.15
129	Management, Scientific, and Technical Consulting Services	241	223	0.69
42	Plastics Product Manufacturing	238	254	3.47
152	Other Ambulatory Health Care Services	217	183	3.70
86	Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing	214	289	6.85
113	Data Processing, Hosting, and Related Services	174	121	4.95

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Cumberland, MD-WV, the cluster with the largest CLQ in 2018 is Forest and Wood Products with a CLQ of 6.31, followed by Education and Knowledge Creation and Information Technology and Telecommunications. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Cumberland, MD-WV cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

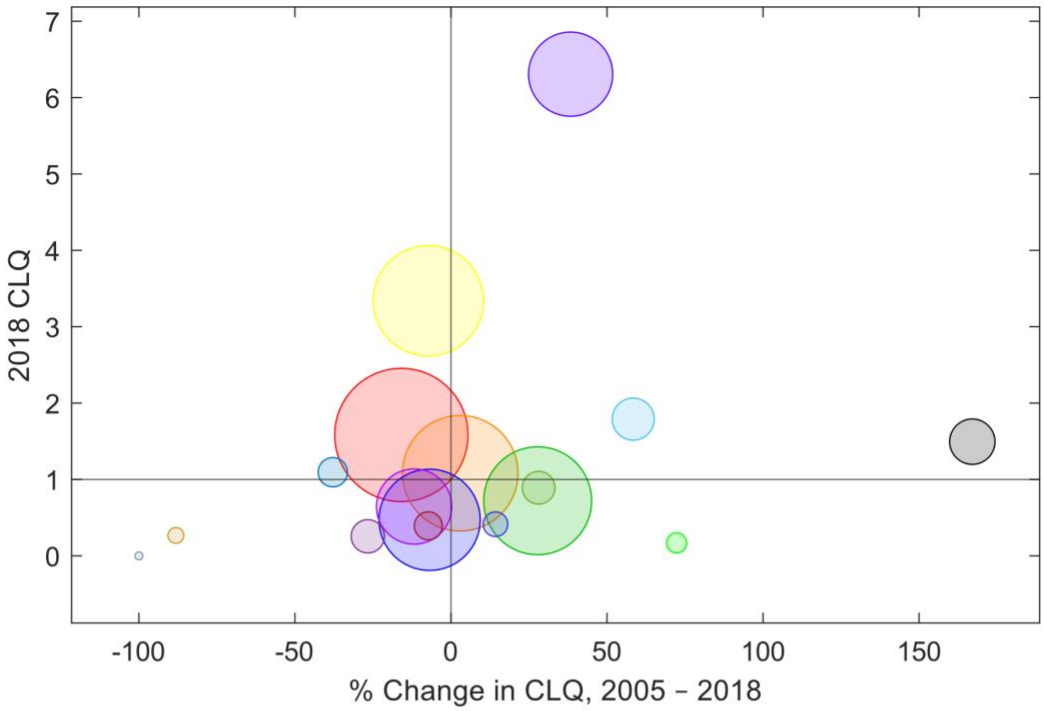
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.88	1.58	6,070
3	Arts, Entertainment, Recreation and Visitor Industries	1.05	1.08	4,472
9	Education and Knowledge Creation	3.60	3.34	4,063
8	Defense and Security	0.56	0.72	3,859
5	Business and Financial Services	0.51	0.47	3,360
11	Forest and Wood Products	4.56	6.31	2,245
16	Transportation and Logistics	0.73	0.65	1,749
6	Chemicals and Chemical-Based Products	0.56	1.50	542
12	Information Technology and Telecommunications	1.13	1.79	451
1	Agribusiness, Food Processing and Technology	0.35	0.26	249
10	Energy (Fossil and Renewable)	0.70	0.89	238
14	Mining, Glass and Ceramics	1.76	1.10	177
15	Primary and Fabricated Metal Products	0.42	0.39	156
13	Machinery	0.36	0.41	107
7	Computer, Electronic, and Electrical Products	0.10	0.17	57
2	Apparel and Textiles	2.26	0.27	24
17	Transportation Equipment	0.72	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Cumberland, MD-WV



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (6,070)
Arts, Entertainment, Recreation and Visitor Industries (4,472)
Education and Knowledge Creation (4,063)
Defense and Security (3,859)
Business and Financial Services (3,360)
Forest and Wood Products (2,245)
Transportation and Logistics (1,749)
Chemicals and Chemical-Based Products (542)
Information Technology and Telecommunications (451)
Agribusiness, Food Processing and Technology (249)
Energy (Fossil and Renewable) (238)
Mining, Glass and Ceramics (177)
Primary and Fabricated Metal Products (156)
Machinery (107)
Computer, Electronic, and Electrical Products (57)
Apparel and Textiles (24)
Transportation Equipment (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Cumberland, MD-WV identifies 6 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Aerospace Product and Parts Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
8	Defense and Security	82	Aerospace Product and Parts Manufacturing	522	1,028
12	Information Technology and Telecommunications	113	Data Processing, Hosting, and Related Services	205	380
11	Forest and Wood Products	88	Other Furniture Related Product Manufacturing	488	493
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	233	472
3	Arts, Entertainment, Recreation and Visitor Industries	166	Accommodation	634	724
11	Forest and Wood Products	86	Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing	218	432

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD

82	Aerospace Product and Parts Manufacturing	8.76	447	11.31	97.02	0.66	0.09
113	Data Processing, Hosting, and Related Services	4.95	121	25.87	84.89	0.84	0.04
88	Other Furniture Related Product Manufacturing	59.97	159	-31.49	1.08	0.72	0.04
42	Plastics Product Manufacturing	3.47	254	-6.65	102.22	0.69	0.04
166	Accommodation	1.53	24	10.44	14.18	0.87	0.02
86	Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing	6.85	289	-34.24	98.42	0.69	0.01

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 82

Aerospace Product and Parts Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	-2
26	Textile Mills and Textile Product Mills	N/A
35	Basic Chemical Manufacturing	-2
43	Rubber Product Manufacturing	-3
48	Iron and Steel Mills and Ferroalloy Manufacturing	-7
53	Forging and Stamping	-8
58	Spring and Wire Product Manufacturing	-9
60	Coating, Engraving, Heat Treating, and Allied Activities	-6
61	Other Fabricated Metal Product Manufacturing	-16
70	Communications Equipment Manufacturing	-18
72	Semiconductor and Other Electronic Component Manufacturing	-59
78	Other Electrical Equipment and Component Manufacturing	-9
81	Motor Vehicle Parts Manufacturing	-8

104	Warehousing and Storage	-0
136	Employment Services	N/A
139	Investigation and Security Services	-7

Table 6. Phase 2 Deficits Adding Anchor Industry 113

Data Processing, Hosting, and Related Services

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-3	-1
26	Textile Mills and Textile Product Mills	N/A	-0
35	Basic Chemical Manufacturing	-2	-0
43	Rubber Product Manufacturing	-3	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-7	-0
53	Forging and Stamping	-8	-1
58	Spring and Wire Product Manufacturing	-10	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-6	-0
61	Other Fabricated Metal Product Manufacturing	-17	-1
70	Communications Equipment Manufacturing	-21	-2
72	Semiconductor and Other Electronic Component Manufacturing	-65	-6
78	Other Electrical Equipment and Component Manufacturing	-10	-1
81	Motor Vehicle Parts Manufacturing	-8	-1
104	Warehousing and Storage	-6	-6
136	Employment Services	-24	-77
139	Investigation and Security Services	-17	-10

Table 7. Phase 3 Deficits Adding Anchor Industry 88

Other Furniture Related Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-8	-6
26	Textile Mills and Textile Product Mills	-37	-54
35	Basic Chemical Manufacturing	-6	-4
43	Rubber Product Manufacturing	-18	-15
48	Iron and Steel Mills and Ferroalloy Manufacturing	-9	-2
53	Forging and Stamping	-10	-1
58	Spring and Wire Product Manufacturing	-52	-43
60	Coating, Engraving, Heat Treating, and Allied Activities	-11	-5
61	Other Fabricated Metal Product Manufacturing	-19	-2
70	Communications Equipment Manufacturing	-21	-0
72	Semiconductor and Other Electronic Component Manufacturing	-76	-11
78	Other Electrical Equipment and Component Manufacturing	-11	-1
81	Motor Vehicle Parts Manufacturing	-11	-3
104	Warehousing and Storage	-37	-31
136	Employment Services	-42	-17
139	Investigation and Security Services	-22	-5

Table 8. Phase 4 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-15	-6
26	Textile Mills and Textile Product Mills	-43	-6

35	Basic Chemical Manufacturing	-19	-12
43	Rubber Product Manufacturing	-19	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-10	-1
53	Forging and Stamping	-10	-1
58	Spring and Wire Product Manufacturing	-52	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-15	-4
61	Other Fabricated Metal Product Manufacturing	-21	-2
70	Communications Equipment Manufacturing	-21	-0
72	Semiconductor and Other Electronic Component Manufacturing	-82	-6
78	Other Electrical Equipment and Component Manufacturing	-11	-1
81	Motor Vehicle Parts Manufacturing	-13	-2
104	Warehousing and Storage	-58	-22
136	Employment Services	-53	-12
139	Investigation and Security Services	-25	-3

Table 9. Phase 5 Deficits Adding Anchor Industry 166

Accommodation

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-18	-3
26	Textile Mills and Textile Product Mills	-46	-3
35	Basic Chemical Manufacturing	-19	-0
43	Rubber Product Manufacturing	-19	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-10	-0
53	Forging and Stamping	-10	-0
58	Spring and Wire Product Manufacturing	-52	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-15	-0
61	Other Fabricated Metal Product Manufacturing	-23	-1
70	Communications Equipment Manufacturing	-21	-0
72	Semiconductor and Other Electronic Component Manufacturing	-82	-1
78	Other Electrical Equipment and Component Manufacturing	-12	-0
81	Motor Vehicle Parts Manufacturing	-14	-1
104	Warehousing and Storage	-62	-3
136	Employment Services	-72	-18
139	Investigation and Security Services	-27	-2

Table 10. Phase 6 Deficits Adding Anchor Industry 86

Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-20	-3
26	Textile Mills and Textile Product Mills	-57	-11
35	Basic Chemical Manufacturing	-20	-1
43	Rubber Product Manufacturing	-20	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-12	-1
53	Forging and Stamping	-11	-1
58	Spring and Wire Product Manufacturing	-53	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-17	-2
61	Other Fabricated Metal Product Manufacturing	-23	-1
70	Communications Equipment Manufacturing	-21	-0

72	Semiconductor and Other Electronic Component Manufacturing	-87	-5
78	Other Electrical Equipment and Component Manufacturing	-12	-0
81	Motor Vehicle Parts Manufacturing	-15	-1
104	Warehousing and Storage	-81	-19
136	Employment Services	-77	-5
139	Investigation and Security Services	-29	-1

Chapter 8. Dalton, GA

Study Area Overview

The Dalton, GA study region occupies 634 square-miles and had a 2018 population of 143,983. The employed share of the regional labor force during the 2014-2018 period averaged 95%. The Textile Mills and Textile Product Mills industry was the region's largest employer in 2018, followed by Wholesale Trade and Food Services and Drinking Places. These three industries account for a combined 41.68% of the region's economy. The region's 2018 coefficient of specialization (COS) is 47.9, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Dalton, GA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Food Services and Drinking Places, whose employment grew by 526 followed by Home Health Care Services and Offices of Dentists. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 0.79, 0.75, and 1.44.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	526	-481	0.79
151	Home Health Care Services	441	416	0.75
147	Offices of Dentists	378	339	1.44
133	Management of Companies and Enterprises	365	303	0.56
91	Wholesale Trade	355	334	1.77
134	Office Administrative Services	338	303	1.96
155	Individual and Family Services	298	74	0.50
38	Pharmaceutical and Medicine Manufacturing	298	298	2.45
41	Other Chemical Product and Preparation Manufacturing	288	288	8.36
146	Offices of Physicians	276	27	1.20

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Dalton, GA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 119.17, followed by Chemicals and Chemical-Based Products and Education and Knowledge Creation. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Dalton, GA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

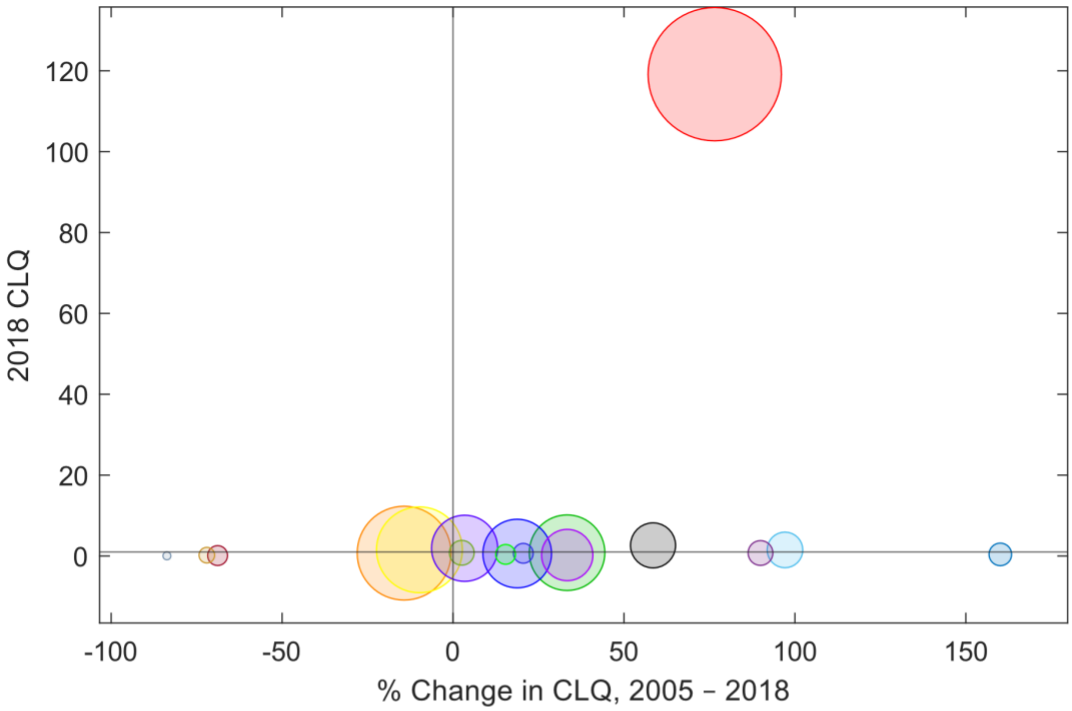
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
2	Apparel and Textiles	67.50	119.17	19,119
5	Business and Financial Services	0.83	0.71	8,984
16	Transportation and Logistics	1.70	1.54	7,392
4	Biomedical/Biotechnical (Life Sciences)	0.61	0.82	5,576
3	Arts, Entertainment, Recreation and Visitor Industries	0.51	0.61	4,487
9	Education and Knowledge Creation	1.85	1.91	4,132
8	Defense and Security	0.18	0.24	2,303
6	Chemicals and Chemical-Based Products	1.66	2.63	1,694
11	Forest and Wood Products	0.76	1.51	953
17	Transportation Equipment	0.39	0.75	366
13	Machinery	0.78	0.80	365
15	Primary and Fabricated Metal Products	0.15	0.40	281
1	Agribusiness, Food Processing and Technology	0.36	0.11	194
14	Mining, Glass and Ceramics	0.56	0.67	192
10	Energy (Fossil and Renewable)	0.35	0.40	192
12	Information Technology and Telecommunications	0.75	0.21	93
7	Computer, Electronic, and Electrical Products	0.23	0.04	22

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Dalton, GA



Bubble Size as the Employment for Each Cluster
Apparel and Textiles (19,119)
Business and Financial Services (8,984)
Transportation and Logistics (7,392)
Biomedical/Biotechnical (Life Sciences) (5,576)
Arts, Entertainment, Recreation and Visitor Industries (4,487)
Education and Knowledge Creation (4,132)
Defense and Security (2,303)
Chemicals and Chemical-Based Products (1,694)
Forest and Wood Products (953)
Transportation Equipment (366)
Machinery (365)
Primary and Fabricated Metal Products (281)
Agribusiness, Food Processing and Technology (194)
Mining, Glass and Ceramics (192)
Energy (Fossil and Renewable) (192)
Information Technology and Telecommunications (93)
Computer, Electronic, and Electrical Products (22)

2. CADS Analysis

The 2018 CADS analysis of the economy of Dalton, GA identifies 2 anchor industries in 2 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Wholesale Trade, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
16	Transportation and Logistics	91	Wholesale Trade	3,934	4,289
5	Business and Financial Services	33	Printing and Related Support Activities	1,676	1,721

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
91	Wholesale Trade	1.77	334	0.53	9.03	0.82	0.16
33	Printing and Related Support Activities	9.45	616	-34.09	2.68	0.79	0.04

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were

reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 91

Wholesale Trade

Industry #	Industry Name	Employment
27	Apparel, Leather and Allied Product Manufacturing	-7
31	Pulp, Paper, and Paperboard Mills	-5
72	Semiconductor and Other Electronic Component Manufacturing	-43
96	Air Transportation	-13
105	Newspaper, Periodical, Book, and Directory Publishers	-12
108	Radio and Television Broadcasting	-15
113	Data Processing, Hosting, and Related Services	-11
117	Insurance Carriers	-35
127	Specialized Design Services	-17
129	Management, Scientific, and Technical Consulting Services	-92
131	Advertising and Related Services	-37
139	Investigation and Security Services	-10
161	Independent Artists, Writers, and Performers	-11

Table 6. Phase 2 Deficits Adding Anchor Industry 33

Printing and Related Support Activities

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-45	-39
31	Pulp, Paper, and Paperboard Mills	-23	-18
72	Semiconductor and Other Electronic Component Manufacturing	-68	-25
96	Air Transportation	-16	-3
105	Newspaper, Periodical, Book, and Directory Publishers	-14	-2
108	Radio and Television Broadcasting	-17	-2
113	Data Processing, Hosting, and Related Services	-15	-3
117	Insurance Carriers	-38	-3
127	Specialized Design Services	-25	-8
129	Management, Scientific, and Technical Consulting Services	-106	-14
131	Advertising and Related Services	-42	-5
139	Investigation and Security Services	-37	-27

161	Independent Artists, Writers, and Performers	-13	-2

Chapter 9. Decatur, AL

Study Area Overview

The Decatur, AL study region occupies 1,270 square-miles and had a 2018 population of 152,046. The employed share of the regional labor force during the 2014-2018 period averaged 95.77%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Construction and Elementary and Secondary Schools. These three industries account for a combined 21.71% of the region's economy. The region's 2018 coefficient of specialization (COS) is 33.81, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Decatur, AL can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Animal Slaughtering and Processing, whose employment grew by 1,325 followed by Nursing and Residential Care Facilities and Food Services and Drinking Places. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 14.69, 1.6, and 1.14.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
20	Animal Slaughtering and Processing	1,325	1,283	14.69
154	Nursing and Residential Care Facilities	704	514	1.60
167	Food Services and Drinking Places	602	-583	1.14
48	Iron and Steel Mills and Ferroalloy Manufacturing	578	578	20.53
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	550	667	50.16
140	Services to Buildings and Dwellings	462	360	0.94
128	Computer Systems Design and Related Services	217	171	0.38
91	Wholesale Trade	199	190	1.00
43	Rubber Product Manufacturing	177	194	5.97
133	Management of Companies and Enterprises	170	21	0.76

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Decatur, AL, the cluster with the largest CLQ in 2018 is Chemicals and Chemical-Based Products with a CLQ of 4.97, followed by Primary and Fabricated Metal Products and Computer, Electronic, and Electrical Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Decatur, AL cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

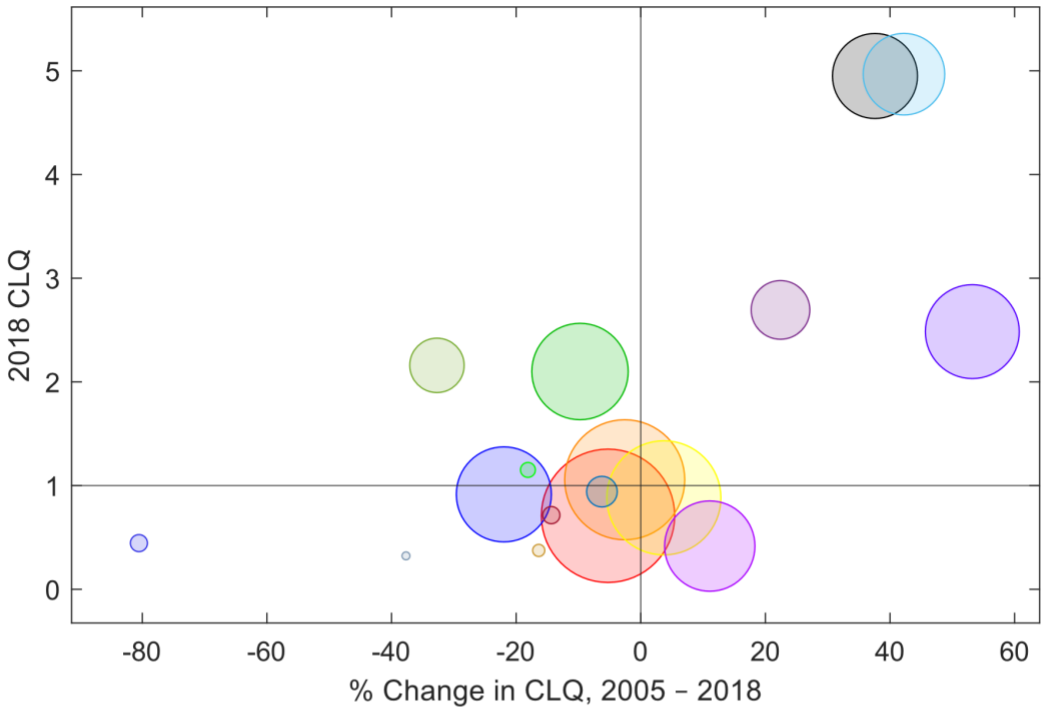
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
5	Business and Financial Services	0.75	0.71	7,296
4	Biomedical/Biotechnical (Life Sciences)	1.08	1.06	5,856
3	Arts, Entertainment, Recreation and Visitor Industries	0.85	0.88	5,269
9	Education and Knowledge Creation	2.33	2.10	3,692
16	Transportation and Logistics	1.17	0.92	3,583
1	Agribusiness, Food Processing and Technology	1.62	2.48	3,495
8	Defense and Security	0.38	0.42	3,221
15	Primary and Fabricated Metal Products	3.60	4.95	2,836
6	Chemicals and Chemical-Based Products	3.49	4.97	2,601
7	Computer, Electronic, and Electrical Products	2.20	2.69	1,301
11	Forest and Wood Products	3.21	2.16	1,111
10	Energy (Fossil and Renewable)	1.00	0.94	363
14	Mining, Glass and Ceramics	0.84	0.72	167
13	Machinery	2.29	0.45	166
2	Apparel and Textiles	1.41	1.15	150
12	Information Technology and Telecommunications	0.45	0.37	136
17	Transportation Equipment	0.52	0.32	128

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Decatur, AL



Bubble Size as the Employment for Each Cluster
Business and Financial Services (7,296)
Biomedical/Biotechnical (Life Sciences) (5,856)
Arts, Entertainment, Recreation and Visitor Industries (5,269)
Education and Knowledge Creation (3,692)
Transportation and Logistics (3,583)
Agribusiness, Food Processing and Technology (3,495)
Defense and Security (3,221)
Primary and Fabricated Metal Products (2,836)
Chemicals and Chemical-Based Products (2,601)
Computer, Electronic, and Electrical Products (1,301)
Forest and Wood Products (1,111)
Energy (Fossil and Renewable) (363)
Mining, Glass and Ceramics (167)
Machinery (166)
Apparel and Textiles (150)
Information Technology and Telecommunications (136)
Transportation Equipment (128)

2. CADS Analysis

The 2018 CADS analysis of the economy of Decatur, AL identifies 5 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
6	Chemicals and Chemical-Based Products	36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	1,038	1,588
1	Agribusiness, Food Processing and Technology	20	Animal Slaughtering and Processing	1,235	2,560
15	Primary and Fabricated Metal Products	48	Iron and Steel Mills and Ferroalloy Manufacturing	0	578
8	Defense and Security	82	Aerospace Product and Parts Manufacturing	588	678
15	Primary and Fabricated Metal Products	59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	577	699

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD

36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	50.16	667	-11.32	52.99	0.78	0.28
20	Animal Slaughtering and Processing	14.69	1,283	3.38	107.30	0.55	0.13
48	Iron and Steel Mills and Ferroalloy Manufacturing	20.53	578	-14.74	N/A	0.84	0.10
82	Aerospace Product and Parts Manufacturing	4.00	23	11.31	15.19	0.89	0.03
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	5.71	109	2.18	21.11	0.91	0.02

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 36

Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	-141
2	Animal Production	N/A
5	Support Activities for Agriculture and Forestry	N/A
6	Oil and Gas Extraction	-45
8	Metal Ore Mining	-1
34	Petroleum and Coal Products Manufacturing	-35
63	Industrial Machinery Manufacturing	-33
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-47
72	Semiconductor and Other Electronic Component Manufacturing	-47
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-32
97	Rail Transportation	-57
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-21

104	Warehousing and Storage	-81
129	Management, Scientific, and Technical Consulting Services	N/A
133	Management of Companies and Enterprises	N/A
137	Business Support Services	-40

Table 6. Phase 2 Deficits Adding Anchor Industry 20

Animal Slaughtering and Processing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-536	-395
2	Animal Production	-2,520	-2,569
5	Support Activities for Agriculture and Forestry	-48	-89
6	Oil and Gas Extraction	-50	-6
8	Metal Ore Mining	-2	-1
34	Petroleum and Coal Products Manufacturing	-39	-5
63	Industrial Machinery Manufacturing	-33	-1
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-48	-2
72	Semiconductor and Other Electronic Component Manufacturing	-61	-14
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-33	-2
97	Rail Transportation	-75	-18
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-79	-58
104	Warehousing and Storage	-169	-89
129	Management, Scientific, and Technical Consulting Services	-37	-41
133	Management of Companies and Enterprises	N/A	-169
137	Business Support Services	-73	-33

Table 7. Phase 3 Deficits Adding Anchor Industry 48

Iron and Steel Mills and Ferroalloy Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-544	-8
2	Animal Production	-2,521	-1
5	Support Activities for Agriculture and Forestry	-49	-2
6	Oil and Gas Extraction	-56	-5
8	Metal Ore Mining	-52	-50
34	Petroleum and Coal Products Manufacturing	-44	-4
63	Industrial Machinery Manufacturing	-34	-1
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-50	-2
72	Semiconductor and Other Electronic Component Manufacturing	-89	-28
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-36	-2
97	Rail Transportation	-112	-36
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-111	-31
104	Warehousing and Storage	-279	-109
129	Management, Scientific, and Technical Consulting Services	-71	-33

133	Management of Companies and Enterprises	-27	-60
137	Business Support Services	-102	-30

Table 8. Phase 4 Deficits Adding Anchor Industry 82

Aerospace Product and Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-545	-1
2	Animal Production	-2,521	-0
5	Support Activities for Agriculture and Forestry	-49	-0
6	Oil and Gas Extraction	-56	-0
8	Metal Ore Mining	-53	-0
34	Petroleum and Coal Products Manufacturing	-44	-0
63	Industrial Machinery Manufacturing	-35	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-51	-0
72	Semiconductor and Other Electronic Component Manufacturing	-127	-38
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-59	-23
97	Rail Transportation	-113	-1
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-114	-3
104	Warehousing and Storage	-295	-16
129	Management, Scientific, and Technical Consulting Services	-94	-24
133	Management of Companies and Enterprises	-61	-35
137	Business Support Services	-112	-10

Table 9. Phase 5 Deficits Adding Anchor Industry 59

Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-545	-0
2	Animal Production	-2,521	-0
5	Support Activities for Agriculture and Forestry	-50	-0
6	Oil and Gas Extraction	-56	-0
8	Metal Ore Mining	-53	-1
34	Petroleum and Coal Products Manufacturing	-44	-0
63	Industrial Machinery Manufacturing	-35	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-51	-0
72	Semiconductor and Other Electronic Component Manufacturing	-133	-6
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-59	-0
97	Rail Transportation	-113	-1
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-116	-2
104	Warehousing and Storage	-324	-30
129	Management, Scientific, and Technical Consulting Services	-97	-3
133	Management of Companies and Enterprises	-77	-16
137	Business Support Services	-117	-4

Chapter 10. DuBois, PA

Study Area Overview

The DuBois, PA study region occupies 1,145 square-miles and had a 2018 population of 79,388. The employed share of the regional labor force during the 2014-2018 period averaged 94.7%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Hospitals. These three industries account for a combined 19.61% of the region's economy. The region's 2018 coefficient of specialization (COS) is 37.81, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in DuBois, PA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Scenic and Sightseeing Transportation and Support Activities for Transportation, whose employment grew by 350 followed by Outpatient Care Centers and Facilities Support Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 2.5, 2.95, and 8.18.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	350	344	2.50
149	Outpatient Care Centers	271	41	2.95
135	Facilities Support Services	237	237	8.18
155	Individual and Family Services	232	-345	1.68
174	Drycleaning and Laundry Services	166	206	7.55
146	Offices of Physicians	161	71	1.07
154	Nursing and Residential Care Facilities	156	-66	2.25
144	Junior Colleges, Colleges, Universities, and Professional Schools	151	64	1.50
178	Civic, Social, Professional, and Similar Organizations	121	138	3.18
181	Government and Unclassified	117	54	0.43

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In DuBois, PA, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 2.75, followed by Primary and Fabricated Metal Products and Forest and Wood Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the DuBois, PA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

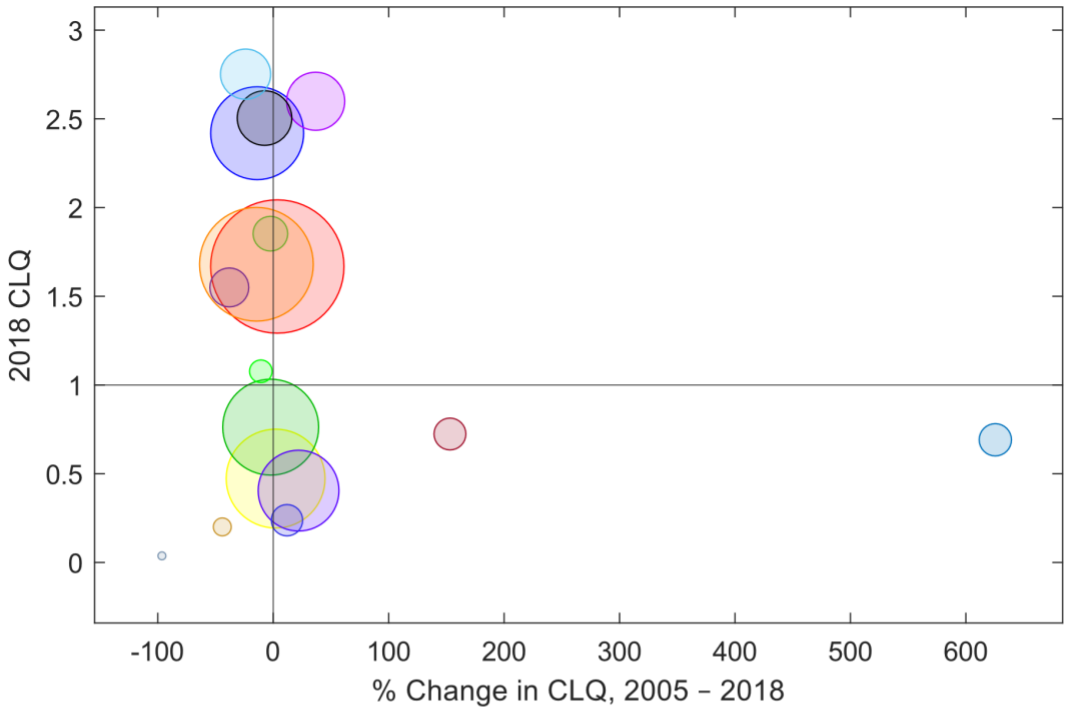
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.61	1.67	5,200
16	Transportation and Logistics	1.97	1.68	3,700
5	Business and Financial Services	0.46	0.47	2,735
3	Arts, Entertainment, Recreation and Visitor Industries	0.78	0.76	2,562
9	Education and Knowledge Creation	2.81	2.42	2,392
8	Defense and Security	0.33	0.40	1,759
15	Primary and Fabricated Metal Products	1.90	2.60	837
11	Forest and Wood Products	2.71	2.50	725
10	Energy (Fossil and Renewable)	3.62	2.75	597
13	Machinery	2.50	1.55	325
14	Mining, Glass and Ceramics	1.90	1.85	244
6	Chemicals and Chemical-Based Products	0.10	0.69	204
7	Computer, Electronic, and Electrical Products	0.29	0.72	197
1	Agribusiness, Food Processing and Technology	0.21	0.24	188
2	Apparel and Textiles	1.21	1.08	79
12	Information Technology and Telecommunications	0.36	0.20	41
17	Transportation Equipment	1.05	0.04	8

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of DuBois, PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (5,200)
Transportation and Logistics (3,700)
Business and Financial Services (2,735)
Arts, Entertainment, Recreation and Visitor Industries (2,562)
Education and Knowledge Creation (2,392)
Defense and Security (1,759)
Primary and Fabricated Metal Products (837)
Forest and Wood Products (725)
Energy (Fossil and Renewable) (597)
Machinery (325)
Mining, Glass and Ceramics (244)
Chemicals and Chemical-Based Products (204)
Computer, Electronic, and Electrical Products (197)
Agribusiness, Food Processing and Technology (188)
Apparel and Textiles (79)
Information Technology and Telecommunications (41)
Transportation Equipment (8)

2. CADS Analysis

The 2018 CADS analysis of the economy of DuBois, PA identifies 4 anchor industries in 3 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Truck Transportation, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
16	Transportation and Logistics	99	Truck Transportation	838	927
4	Biomedical/Biotechnical (Life Sciences)	149	Outpatient Care Centers	273	545
9	Education and Knowledge Creation	144	Junior Colleges, Colleges, Universities, and Professional Schools	366	517
16	Transportation and Logistics	102	Scenic and Sightseeing Transportation and Support Activities for Transportation	24	374

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
99	Truck Transportation	2.92	79	1.19	10.62	0.90	0.07
149	Outpatient Care Centers	2.95	41	84.40	99.22	0.88	0.02
144	Junior Colleges, Colleges, Universities, and Professional Schools	1.50	64	23.90	41.29	0.88	0.02
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	2.50	344	27.52	1,459.08	0.88	0.02

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment

Table 6. Phase 2 Deficits Adding Anchor Industry 149

Outpatient Care Centers

Industry #	Industry Name	Employment	Added to Deficit

Table 7. Phase 3 Deficits Adding Anchor Industry 144

Junior Colleges, Colleges, Universities, and Professional Schools

Industry #	Industry Name	Employment	Added to Deficit

Table 8. Phase 4 Deficits Adding Anchor Industry 102

Scenic and Sightseeing Transportation and Support Activities for Transportation

Industry #	Industry Name	Employment	Added to Deficit

Note: If no industries with deficits greater than 10 employees are identified for a given analysis phase, deficit tables will include only column headings.

Chapter 11. East Liverpool-Salem, OH

Study Area Overview

The East Liverpool-Salem, OH study region occupies 532 square-miles and had a 2018 population of 102,665. The employed share of the regional labor force during the 2014-2018 period averaged 94.7%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Nursing and Residential Care Facilities. These three industries account for a combined 20.74% of the region's economy. The region's 2018 coefficient of specialization (COS) is 37.84, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in East Liverpool-Salem, OH can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Motor Vehicle Body and Trailer Manufacturing, whose employment grew by 463 followed by Individual and Family Services and Animal Slaughtering and Processing. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 15.6, 1.51, and 7.12.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
80	Motor Vehicle Body and Trailer Manufacturing	463	463	15.60
155	Individual and Family Services	311	-95	1.51
20	Animal Slaughtering and Processing	285	271	7.12
50	Alumina and Aluminum Production and Processing	237	237	21.81
145	Other Educational Services	219	211	1.29
42	Plastics Product Manufacturing	188	229	7.46
55	Architectural and Structural Metals Manufacturing	176	180	5.72
156	Community and Vocational Rehabilitation Services	152	153	2.57
68	Other General Purpose Machinery Manufacturing	145	143	6.46
81	Motor Vehicle Parts Manufacturing	136	150	2.35

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In East Liverpool-Salem, OH, the cluster with the largest CLQ in 2018 is Primary and Fabricated Metal Products with a CLQ of 6.38, followed by Mining, Glass and Ceramics and Machinery. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the East Liverpool-Salem, OH cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

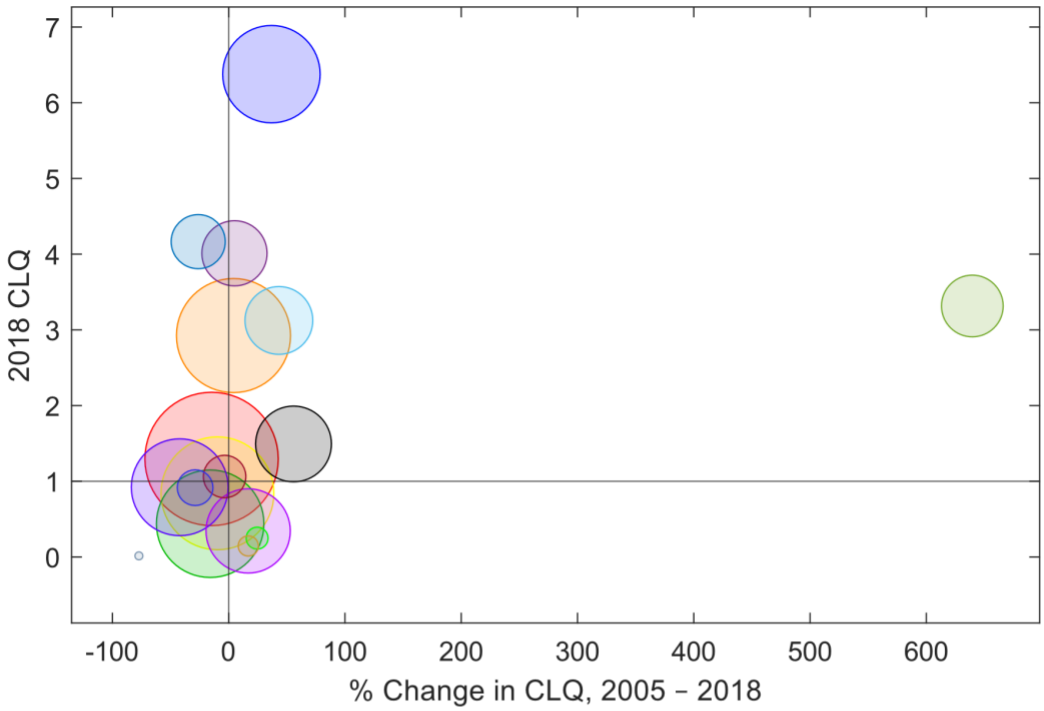
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.52	1.30	3,989
9	Education and Knowledge Creation	2.81	2.92	2,857
3	Arts, Entertainment, Recreation and Visitor Industries	0.93	0.84	2,792
5	Business and Financial Services	0.52	0.44	2,514
15	Primary and Fabricated Metal Products	4.66	6.38	2,030
16	Transportation and Logistics	1.59	0.92	2,004
8	Defense and Security	0.30	0.34	1,479
1	Agribusiness, Food Processing and Technology	0.96	1.49	1,167
6	Chemicals and Chemical-Based Products	2.18	3.12	909
13	Machinery	3.82	4.01	831
17	Transportation Equipment	0.45	3.32	733
14	Mining, Glass and Ceramics	5.65	4.17	541
11	Forest and Wood Products	1.10	1.06	304
10	Energy (Fossil and Renewable)	1.29	0.92	196
12	Information Technology and Telecommunications	0.20	0.25	50
7	Computer, Electronic, and Electrical Products	0.12	0.15	39
2	Apparel and Textiles	0.07	0.02	1

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of East Liverpool-Salem, OH



Bubble Size as the Employment for Each Cluster

- Biomedical/Biotechnical (Life Sciences) (3,989)
- Education and Knowledge Creation (2,857)
- Arts, Entertainment, Recreation and Visitor Industries (2,792)
- Business and Financial Services (2,514)
- Primary and Fabricated Metal Products (2,030)
- Transportation and Logistics (2,004)
- Defense and Security (1,479)
- Agribusiness, Food Processing and Technology (1,167)
- Chemicals and Chemical-Based Products (909)
- Machinery (831)
- Transportation Equipment (733)
- Mining, Glass and Ceramics (541)
- Forest and Wood Products (304)
- Energy (Fossil and Renewable) (196)
- Information Technology and Telecommunications (50)
- Computer, Electronic, and Electrical Products (39)
- Apparel and Textiles (1)

2. CADS Analysis

The 2018 CADS analysis of the economy of East Liverpool-Salem, OH identifies 5 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Animal Slaughtering and Processing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
1	Agribusiness, Food Processing and Technology	20	Animal Slaughtering and Processing	404	689
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	627	815
17	Transportation Equipment	80	Motor Vehicle Body and Trailer Manufacturing	11	474
13	Machinery	68	Other General Purpose Machinery Manufacturing	184	329
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	241	417

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
20	Animal Slaughtering and Processing	7.12	271	3.38	70.55	0.61	0.09
42	Plastics Product Manufacturing	7.46	229	-6.65	29.93	0.74	0.09
80	Motor Vehicle Body and Trailer Manufacturing	15.60	463	-3.45	4,026.20	0.79	0.05
68	Other General Purpose Machinery Manufacturing	6.46	143	1.24	78.80	0.79	0.04

55	Architectural and Structural Metals Manufacturing	5.72	180	-1.47	73.03	0.85	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 20

Animal Slaughtering and Processing

Industry #	Industry Name	Employment
1	Crop Production	-7
2	Animal Production	-635
5	Support Activities for Agriculture and Forestry	-16
26	Textile Mills and Textile Product Mills	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-1
43	Rubber Product Manufacturing	-1
49	Steel Product Manufacturing From Purchased Steel	-1
58	Spring and Wire Product Manufacturing	-4
72	Semiconductor and Other Electronic Component Manufacturing	-4
77	Electrical Equipment Manufacturing	N/A
97	Rail Transportation	-5
103	Couriers and Messengers	-5
104	Warehousing and Storage	N/A
127	Specialized Design Services	-2

Table 6. Phase 2 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-22	-15
2	Animal Production	-635	-1
5	Support Activities for Agriculture and Forestry	-18	-2
26	Textile Mills and Textile Product Mills	-15	-14
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-52	-51
43	Rubber Product Manufacturing	-3	-1
49	Steel Product Manufacturing From Purchased Steel	-2	-1
58	Spring and Wire Product Manufacturing	-5	-1
72	Semiconductor and Other Electronic Component Manufacturing	-18	-14
77	Electrical Equipment Manufacturing	N/A	-4
97	Rail Transportation	-12	-7
103	Couriers and Messengers	-11	-6
104	Warehousing and Storage	N/A	-53
127	Specialized Design Services	-7	-5

Table 7. Phase 3 Deficits Adding Anchor Industry 80

Motor Vehicle Body and Trailer Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-25	-3
2	Animal Production	-635	-0
5	Support Activities for Agriculture and Forestry	-19	-1
26	Textile Mills and Textile Product Mills	-21	-5
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-54	-2
43	Rubber Product Manufacturing	-19	-16
49	Steel Product Manufacturing From Purchased Steel	-7	-5
58	Spring and Wire Product Manufacturing	-9	-4
72	Semiconductor and Other Electronic Component Manufacturing	-30	-12
77	Electrical Equipment Manufacturing	-2	-3
97	Rail Transportation	-15	-2
103	Couriers and Messengers	-15	-4
104	Warehousing and Storage	N/A	-22
127	Specialized Design Services	-11	-4

Table 8. Phase 4 Deficits Adding Anchor Industry 68

Other General Purpose Machinery Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-26	-1
2	Animal Production	-636	-0
5	Support Activities for Agriculture and Forestry	-19	-0
26	Textile Mills and Textile Product Mills	-25	-5
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-56	-1
43	Rubber Product Manufacturing	-21	-2
49	Steel Product Manufacturing From Purchased Steel	-11	-5

58	Spring and Wire Product Manufacturing	-10	-2
72	Semiconductor and Other Electronic Component Manufacturing	-43	-13
77	Electrical Equipment Manufacturing	-23	-21
97	Rail Transportation	-16	-1
103	Couriers and Messengers	-17	-3
104	Warehousing and Storage	-2	-16
127	Specialized Design Services	-13	-2

Table 9. Phase 5 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-27	-1
2	Animal Production	-636	-0
5	Support Activities for Agriculture and Forestry	-19	-0
26	Textile Mills and Textile Product Mills	-26	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-56	-0
43	Rubber Product Manufacturing	-21	-0
49	Steel Product Manufacturing From Purchased Steel	-20	-8
58	Spring and Wire Product Manufacturing	-13	-3
72	Semiconductor and Other Electronic Component Manufacturing	-48	-6
77	Electrical Equipment Manufacturing	-24	-1
97	Rail Transportation	-18	-2
103	Couriers and Messengers	-20	-2
104	Warehousing and Storage	-24	-21
127	Specialized Design Services	-15	-3

Chapter 12. East Stroudsburg, PA

Study Area Overview

The East Stroudsburg, PA study region occupies 608 square-miles and had a 2018 population of 169,507. The employed share of the regional labor force during the 2014-2018 period averaged 93.6%. The Accommodation industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and All Other Retail. These three industries account for a combined 25.69% of the region's economy. The region's 2018 coefficient of specialization (COS) is 35.44, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in East Stroudsburg, PA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Accommodation, whose employment grew by 2,758 followed by Food Services and Drinking Places and Hospitals. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 7.44, 1.15, and 1.09.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
166	Accommodation	2,758	2,485	7.44
167	Food Services and Drinking Places	1,024	-126	1.15
153	Hospitals	996	821	1.09
38	Pharmaceutical and Medicine Manufacturing	594	554	22.06
154	Nursing and Residential Care Facilities	589	416	1.33
149	Outpatient Care Centers	531	289	2.35
164	Gambling Industries (except Casino Hotels)	478	478	10.87
151	Home Health Care Services	388	213	1.12
93	Food and Beverage Stores	357	241	1.84
155	Individual and Family Services	349	-296	1.10

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In East Stroudsburg, PA, the cluster with the largest CLQ in 2018 is Chemicals and Chemical-Based Products with a CLQ of 5.31, followed by Education and Knowledge Creation and Arts, Entertainment, Recreation and Visitor Industries. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the East Stroudsburg, PA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

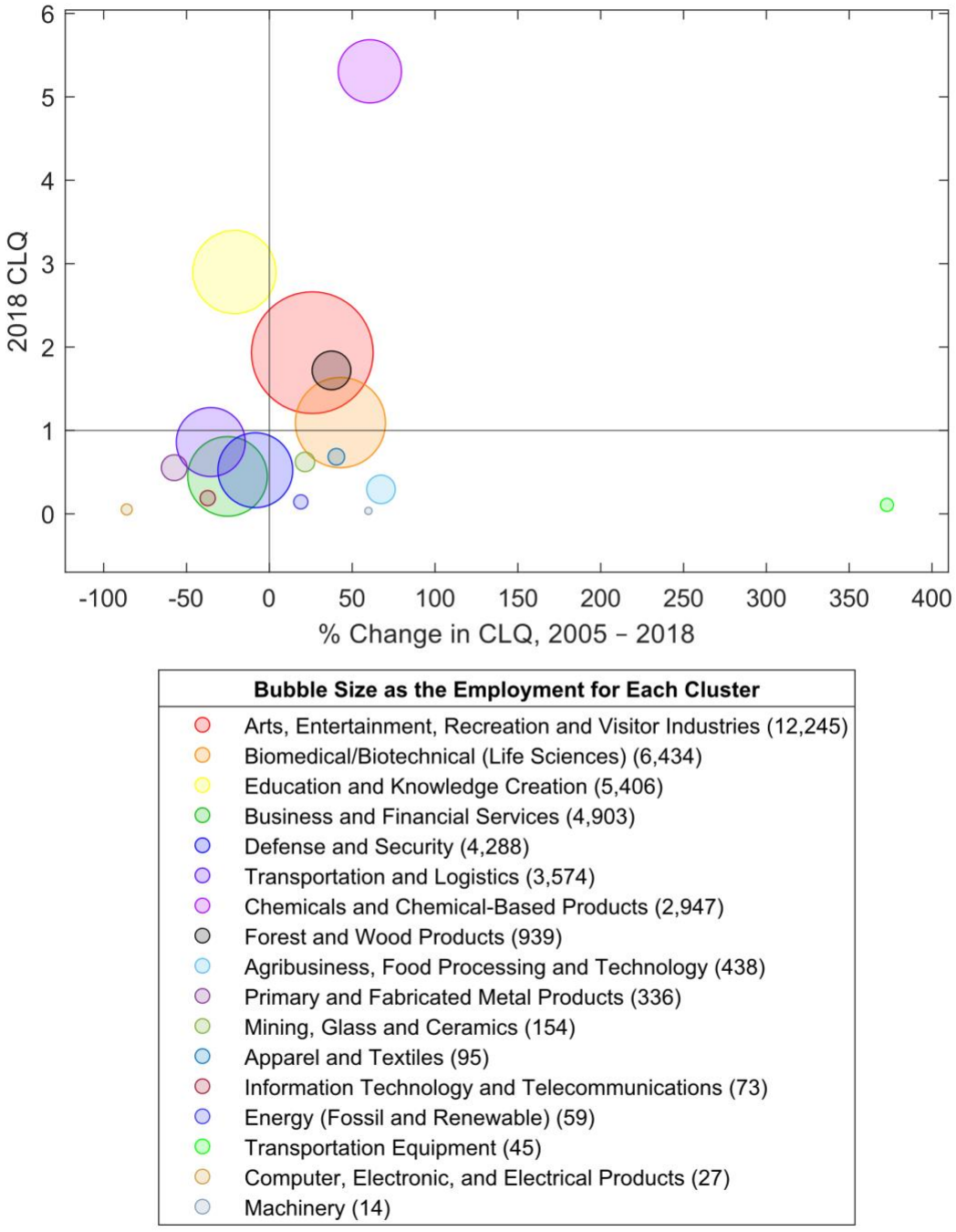
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
3	Arts, Entertainment, Recreation and Visitor Industries	1.53	1.93	12,245
4	Biomedical/Biotechnical (Life Sciences)	0.77	1.09	6,434
9	Education and Knowledge Creation	3.67	2.90	5,406
5	Business and Financial Services	0.60	0.45	4,903
8	Defense and Security	0.57	0.52	4,288
16	Transportation and Logistics	1.33	0.86	3,574
6	Chemicals and Chemical-Based Products	3.30	5.31	2,947
11	Forest and Wood Products	1.25	1.72	939
1	Agribusiness, Food Processing and Technology	0.18	0.29	438
15	Primary and Fabricated Metal Products	1.30	0.55	336
14	Mining, Glass and Ceramics	0.51	0.62	154
2	Apparel and Textiles	0.49	0.68	95
12	Information Technology and Telecommunications	0.30	0.19	73
10	Energy (Fossil and Renewable)	0.12	0.14	59
17	Transportation Equipment	0.02	0.11	45
7	Computer, Electronic, and Electrical Products	0.38	0.05	27
13	Machinery	0.02	0.04	14

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of East Stroudsburg, PA



2. CADS Analysis

The 2018 CADS analysis of the economy of East Stroudsburg, PA identifies 3 anchor industries in 2 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Pharmaceutical and Medicine Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
6	Chemicals and Chemical-Based Products	38	Pharmaceutical and Medicine Manufacturing	1,714	2,309
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	984	1,573
4	Biomedical/Biotechnical (Life Sciences)	149	Outpatient Care Centers	287	817

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
38	Pharmaceutical and Medicine Manufacturing	22.06	554	2.37	34.68	0.80	0.24
154	Nursing and Residential Care Facilities	1.33	416	17.58	59.82	0.91	0.02
149	Outpatient Care Centers	2.35	289	84.40	185.09	0.93	0.02

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has

been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 38

Pharmaceutical and Medicine Manufacturing

Industry #	Industry Name	Employment
72	Semiconductor and Other Electronic Component Manufacturing	-13
108	Radio and Television Broadcasting	-10
129	Management, Scientific, and Technical Consulting Services	-105
131	Advertising and Related Services	-7
133	Management of Companies and Enterprises	-216
134	Office Administrative Services	-11

Table 6. Phase 2 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-14	-1
108	Radio and Television Broadcasting	-11	-1
129	Management, Scientific, and Technical Consulting Services	-121	-16
131	Advertising and Related Services	-9	-2
133	Management of Companies and Enterprises	-228	-12
134	Office Administrative Services	-17	-6

Table 7. Phase 3 Deficits Adding Anchor Industry 149

Outpatient Care Centers

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-14	-1
108	Radio and Television Broadcasting	-11	-1
129	Management, Scientific, and Technical Consulting Services	-132	-11
131	Advertising and Related Services	-10	-2

133	Management of Companies and Enterprises	-238	-10
134	Office Administrative Services	-20	-4

Chapter 13. Elmira, NY

Study Area Overview

The Elmira, NY study region occupies 407 square-miles and had a 2018 population of 84,254. The employed share of the regional labor force during the 2014-2018 period averaged 95.6%. The Government and Unclassified industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Hospitals. These three industries account for a combined 25.38% of the region's economy. The region's 2018 coefficient of specialization (COS) is 31.3, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Elmira, NY can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Air Transportation, whose employment grew by 520 followed by Food Services and Drinking Places and Medical Equipment and Supplies Manufacturing. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 5.42, 1.12, and 5.93.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
96	Air Transportation	520	521	5.42
167	Food Services and Drinking Places	454	-299	1.12
89	Medical Equipment and Supplies Manufacturing	340	336	5.93
153	Hospitals	289	-190	2.60
155	Individual and Family Services	239	-106	1.03
68	Other General Purpose Machinery Manufacturing	204	204	4.17
83	Railroad Rolling Stock Manufacturing	170	197	71.05
17	Sugar and Confectionery Product Manufacturing	149	149	8.58
80	Motor Vehicle Body and Trailer Manufacturing	142	142	3.92
94	General Merchandise Stores	130	77	1.78

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Elmira, NY, the cluster with the largest CLQ in 2018 is Mining, Glass and Ceramics with a CLQ of 4.26, followed by Machinery and Transportation Equipment. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Elmira, NY cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

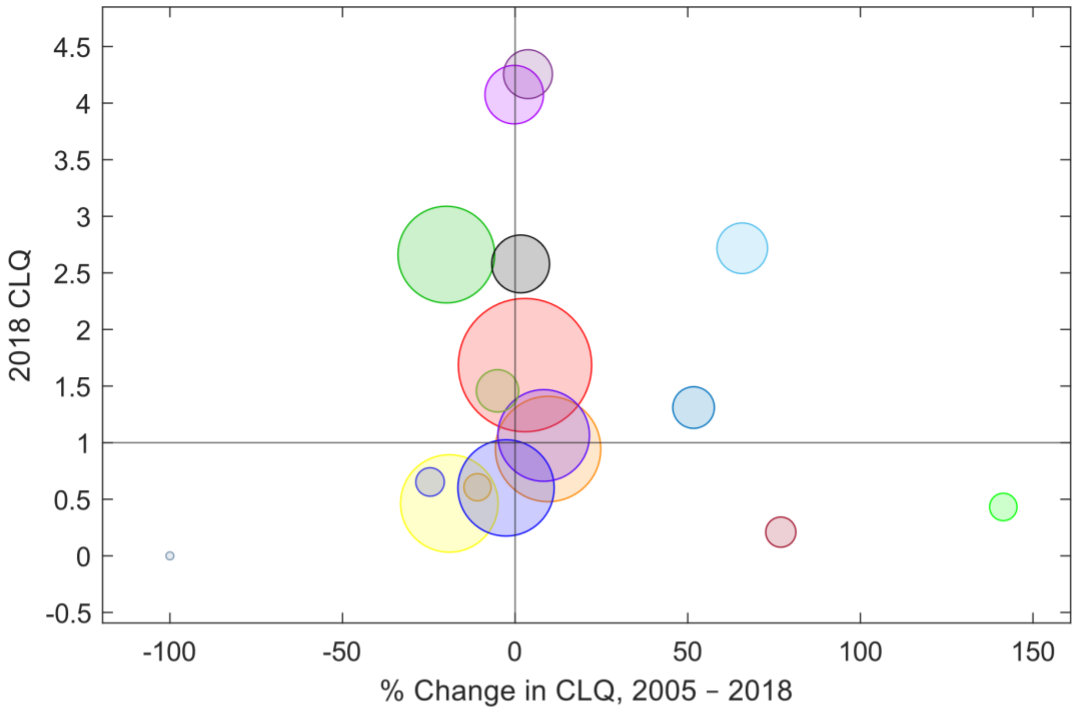
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.64	1.69	6,186
3	Arts, Entertainment, Recreation and Visitor Industries	0.86	0.94	3,735
5	Business and Financial Services	0.57	0.46	3,155
9	Education and Knowledge Creation	3.32	2.66	3,098
8	Defense and Security	0.62	0.60	3,071
16	Transportation and Logistics	0.98	1.06	2,757
13	Machinery	4.09	4.08	1,006
15	Primary and Fabricated Metal Products	2.54	2.58	978
17	Transportation Equipment	1.64	2.72	716
14	Mining, Glass and Ceramics	4.10	4.26	659
7	Computer, Electronic, and Electrical Products	1.54	1.46	466
11	Forest and Wood Products	0.86	1.31	446
1	Agribusiness, Food Processing and Technology	0.12	0.21	195
10	Energy (Fossil and Renewable)	0.87	0.65	167
6	Chemicals and Chemical-Based Products	0.18	0.43	150
12	Information Technology and Telecommunications	0.68	0.61	146
2	Apparel and Textiles	0.07	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Elmira, NY



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (6,186)
Arts, Entertainment, Recreation and Visitor Industries (3,735)
Business and Financial Services (3,155)
Education and Knowledge Creation (3,098)
Defense and Security (3,071)
Transportation and Logistics (2,757)
Machinery (1,006)
Primary and Fabricated Metal Products (978)
Transportation Equipment (716)
Mining, Glass and Ceramics (659)
Computer, Electronic, and Electrical Products (466)
Forest and Wood Products (446)
Agribusiness, Food Processing and Technology (195)
Energy (Fossil and Renewable) (167)
Chemicals and Chemical-Based Products (150)
Information Technology and Telecommunications (146)
Apparel and Textiles (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Elmira, NY identifies 4 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Railroad Rolling Stock Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
17	Transportation Equipment	83	Railroad Rolling Stock Manufacturing	190	360
16	Transportation and Logistics	96	Air Transportation	74	594
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	517	635
4	Biomedical/Biotechnical (Life Sciences)	89	Medical Equipment and Supplies Manufacturing	83	423

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
83	Railroad Rolling Stock Manufacturing	71.05	197	-14.13	89.18	0.70	0.08
96	Air Transportation	5.42	521	-0.73	703.35	0.93	0.06
55	Architectural and Structural Metals Manufacturing	7.31	126	-1.47	22.82	0.62	0.04
89	Medical Equipment and Supplies Manufacturing	5.93	336	4.20	408.36	0.75	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 83

Railroad Rolling Stock Manufacturing

Industry #	Industry Name	Employment
26	Textile Mills and Textile Product Mills	-15
43	Rubber Product Manufacturing	-11
48	Iron and Steel Mills and Ferroalloy Manufacturing	-23
49	Steel Product Manufacturing From Purchased Steel	-15
50	Alumina and Aluminum Production and Processing	-5
51	Nonferrous Metal (except Aluminum) Production and Processing	-15
61	Other Fabricated Metal Product Manufacturing	-17
75	Electric Lighting Equipment Manufacturing	-12
97	Rail Transportation	-7
104	Warehousing and Storage	-26

Table 6. Phase 2 Deficits Adding Anchor Industry 96

Air Transportation

Industry #	Industry Name	Employment	Added to Deficit
26	Textile Mills and Textile Product Mills	-16	-1
43	Rubber Product Manufacturing	-11	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-23	-0
49	Steel Product Manufacturing From Purchased Steel	-15	-0
50	Alumina and Aluminum Production and Processing	-5	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-15	-0
61	Other Fabricated Metal Product Manufacturing	-18	-1
75	Electric Lighting Equipment Manufacturing	-12	-0

97	Rail Transportation	-8	-1
104	Warehousing and Storage	-31	-5

Table 7. Phase 3 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
26	Textile Mills and Textile Product Mills	-16	-1
43	Rubber Product Manufacturing	-12	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-39	-16
49	Steel Product Manufacturing From Purchased Steel	-26	-11
50	Alumina and Aluminum Production and Processing	-12	-7
51	Nonferrous Metal (except Aluminum) Production and Processing	-20	-5
61	Other Fabricated Metal Product Manufacturing	-23	-5
75	Electric Lighting Equipment Manufacturing	-13	-0
97	Rail Transportation	-10	-2
104	Warehousing and Storage	-60	-28

Table 8. Phase 4 Deficits Adding Anchor Industry 89

Medical Equipment and Supplies Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
26	Textile Mills and Textile Product Mills	-24	-8
43	Rubber Product Manufacturing	-13	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-41	-1
49	Steel Product Manufacturing From Purchased Steel	-27	-1
50	Alumina and Aluminum Production and Processing	-13	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-25	-5
61	Other Fabricated Metal Product Manufacturing	-25	-2
75	Electric Lighting Equipment Manufacturing	-13	-0
97	Rail Transportation	-11	-1
104	Warehousing and Storage	-78	-18

Chapter 14. Erie, PA

Study Area Overview

The Erie, PA study region occupies 799 square-miles and had a 2018 population of 272,061. The employed share of the regional labor force during the 2014-2018 period averaged 95.1%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and All Other Retail. These three industries account for a combined 19.6% of the region's economy. The region's 2018 coefficient of specialization (COS) is 32.79, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Erie, PA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Individual and Family Services, whose employment grew by 2,462 followed by Gambling Industries (except Casino Hotels) and Offices of Other Health Practitioners. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 2.32, 9.05, and 1.42.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
155	Individual and Family Services	2,462	391	2.32
164	Gambling Industries (except Casino Hotels)	832	836	9.05
148	Offices of Other Health Practitioners	682	393	1.42
151	Home Health Care Services	681	506	0.77
167	Food Services and Drinking Places	638	-2,227	1.12
146	Offices of Physicians	445	-144	1.42
140	Services to Buildings and Dwellings	441	154	0.76
154	Nursing and Residential Care Facilities	435	-554	2.37
157	Child Day Care Services	337	323	0.77
166	Accommodation	307	208	0.80

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Erie, PA, the cluster with the largest CLQ in 2018 is Chemicals and Chemical-Based Products with a CLQ of 3.92, followed by Transportation Equipment and Primary and Fabricated Metal Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Erie, PA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

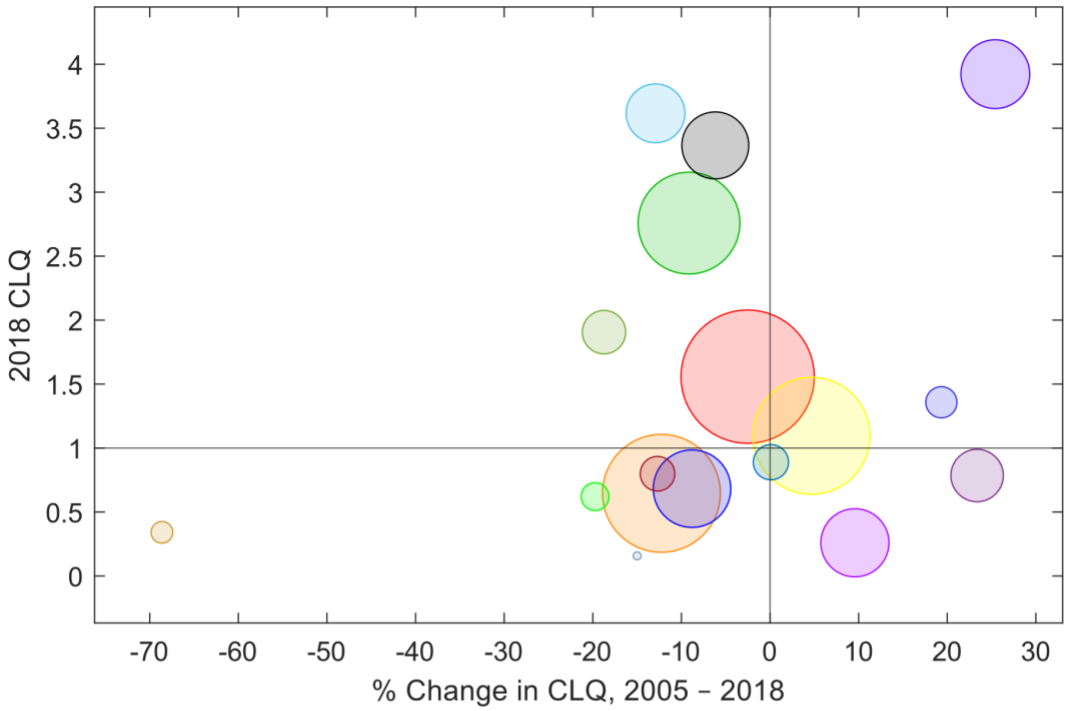
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.60	1.56	19,785
5	Business and Financial Services	0.74	0.65	15,237
3	Arts, Entertainment, Recreation and Visitor Industries	1.05	1.10	14,998
9	Education and Knowledge Creation	3.04	2.76	11,107
16	Transportation and Logistics	0.75	0.68	6,121
6	Chemicals and Chemical-Based Products	3.13	3.92	4,705
8	Defense and Security	0.24	0.26	4,595
15	Primary and Fabricated Metal Products	3.59	3.37	4,417
17	Transportation Equipment	4.15	3.62	3,296
1	Agribusiness, Food Processing and Technology	0.64	0.79	2,531
13	Machinery	2.35	1.91	1,628
7	Computer, Electronic, and Electrical Products	0.89	0.89	984
11	Forest and Wood Products	0.92	0.80	942
14	Mining, Glass and Ceramics	1.14	1.36	727
10	Energy (Fossil and Renewable)	0.77	0.62	548
12	Information Technology and Telecommunications	1.09	0.34	284
2	Apparel and Textiles	0.19	0.16	47

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Erie, PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (19,785)
Business and Financial Services (15,237)
Arts, Entertainment, Recreation and Visitor Industries (14,998)
Education and Knowledge Creation (11,107)
Transportation and Logistics (6,121)
Chemicals and Chemical-Based Products (4,705)
Defense and Security (4,595)
Primary and Fabricated Metal Products (4,417)
Transportation Equipment (3,296)
Agribusiness, Food Processing and Technology (2,531)
Machinery (1,628)
Computer, Electronic, and Electrical Products (984)
Forest and Wood Products (942)
Mining, Glass and Ceramics (727)
Energy (Fossil and Renewable) (548)
Information Technology and Telecommunications (284)
Apparel and Textiles (47)

2. CADS Analysis

The 2018 CADS analysis of the economy of Erie, PA identifies 1 anchor industry in 1 cluster. Identified anchor and its parent cluster are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industry and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Plastics Product Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	3,422	3,541

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
42	Plastics Product Manufacturing	7.86	347	-6.65	3.49	0.80	0.09

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment
3	Forestry and Logging	-13
26	Textile Mills and Textile Product Mills	-17
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-15
31	Pulp, Paper, and Paperboard Mills	-18
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-153
45	Glass and Glass Product Manufacturing	-11
97	Rail Transportation	-33

Chapter 15. Fairmont, WV

Study Area Overview

The Fairmont, WV study region occupies 309 square-miles and had a 2018 population of 56,097. The employed share of the regional labor force during the 2014-2018 period averaged 95.4%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Hospitals and Elementary and Secondary Schools. These three industries account for a combined 21.73% of the region's economy. The region's 2018 coefficient of specialization (COS) is 34.49, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Fairmont, WV can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Gambling Industries (except Casino Hotels), whose employment grew by 113 followed by Water, Sewage and Other Systems and Nursing and Residential Care Facilities. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 10.89, 24.83, and 1.85.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
164	Gambling Industries (except Casino Hotels)	113	118	10.89
13	Water, Sewage and Other Systems	111	106	24.83
154	Nursing and Residential Care Facilities	104	2	1.85
153	Hospitals	93	-122	2.26
155	Individual and Family Services	91	-270	1.58
136	Employment Services	83	82	0.57
60	Coating, Engraving, Heat Treating, and Allied Activities	74	74	4.79
129	Management, Scientific, and Technical Consulting Services	63	23	0.69
80	Motor Vehicle Body and Trailer Manufacturing	63	64	4.58
38	Pharmaceutical and Medicine Manufacturing	61	61	1.86

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Fairmont, WV, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 12.21, followed by Education and Knowledge Creation and Primary and Fabricated Metal Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Fairmont, WV cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

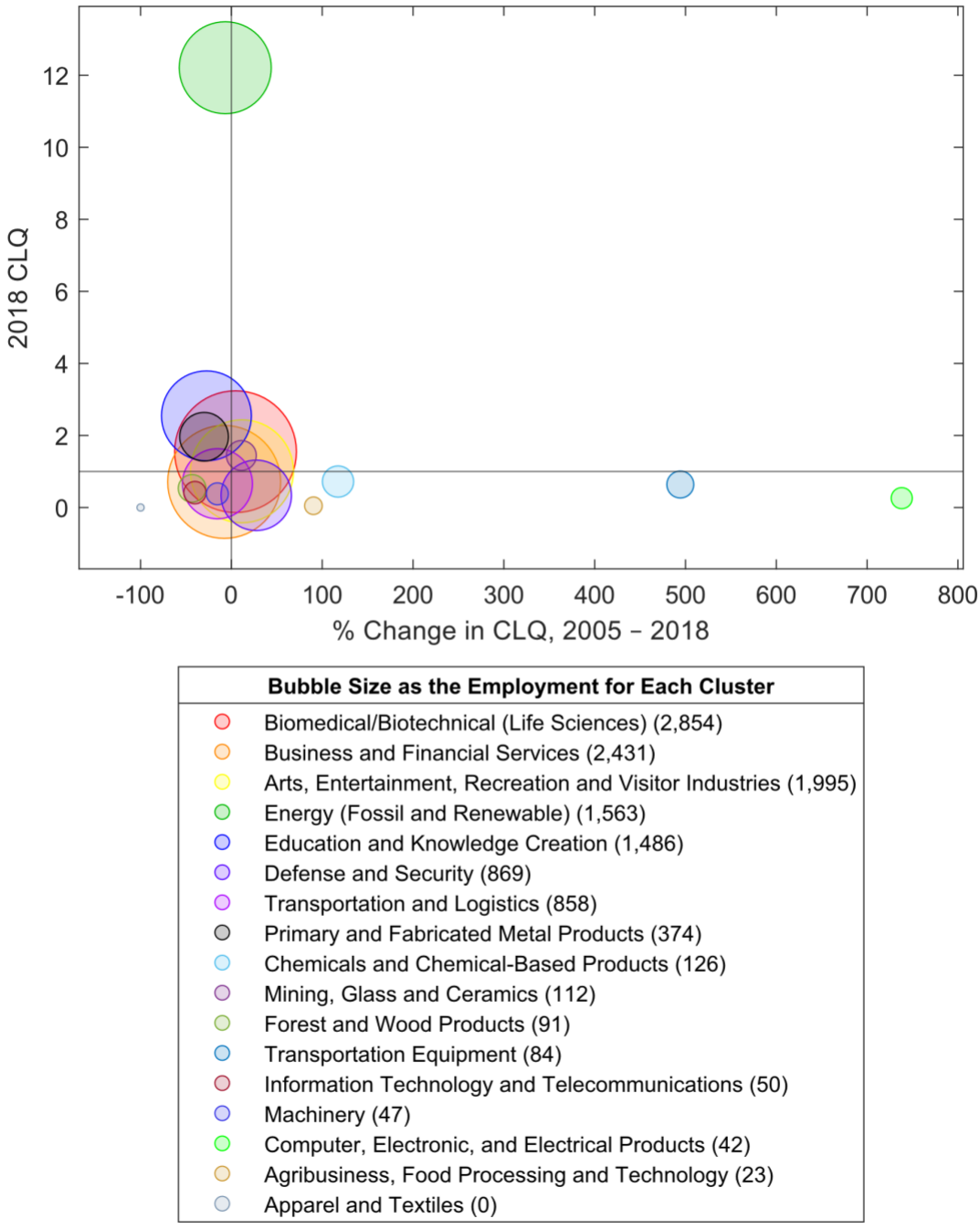
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.48	1.55	2,854
5	Business and Financial Services	0.77	0.71	2,431
3	Arts, Entertainment, Recreation and Visitor Industries	0.90	1.01	1,995
10	Energy (Fossil and Renewable)	13.09	12.21	1,563
9	Education and Knowledge Creation	3.51	2.55	1,486
8	Defense and Security	0.27	0.34	869
16	Transportation and Logistics	0.78	0.66	858
15	Primary and Fabricated Metal Products	2.81	1.96	374
6	Chemicals and Chemical-Based Products	0.33	0.72	126
14	Mining, Glass and Ceramics	1.30	1.44	112
11	Forest and Wood Products	0.94	0.53	91
17	Transportation Equipment	0.11	0.64	84
12	Information Technology and Telecommunications	0.69	0.41	50
13	Machinery	0.45	0.38	47
7	Computer, Electronic, and Electrical Products	0.03	0.26	42
1	Agribusiness, Food Processing and Technology	0.03	0.05	23
2	Apparel and Textiles	0.02	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Fairmont, WV



2. CADS Analysis

The 2018 CADS analysis of the economy of Fairmont, WV identifies 1 anchor industry in 1 cluster. Identified anchor and its parent cluster are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industry and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Nursing and Residential Care Facilities, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	582	686

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
154	Nursing and Residential Care Facilities	1.85	2	17.58	17.87	0.82	0.02

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment

Note: If no industries with deficits greater than 10 employees are identified for a given analysis phase, deficit tables will include only column headings.

Chapter 16. Florence-Muscle Shoals, AL

Study Area Overview

The Florence-Muscle Shoals, AL study region occupies 1,261 square-miles and had a 2018 population of 147,149. The employed share of the regional labor force during the 2014-2018 period averaged 95.55%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Elementary and Secondary Schools. These three industries account for a combined 23.34% of the region's economy. The region's 2018 coefficient of specialization (COS) is 33.09, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Florence-Muscle Shoals, AL can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Motor Vehicle Parts Manufacturing, whose employment grew by 1,538 followed by Food Services and Drinking Places and Railroad Rolling Stock Manufacturing. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 8.54, 1.34, and 98.27.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
81	Motor Vehicle Parts Manufacturing	1,538	1,558	8.54
167	Food Services and Drinking Places	875	-475	1.34
83	Railroad Rolling Stock Manufacturing	756	756	98.27
26	Textile Mills and Textile Product Mills	448	464	6.13
42	Plastics Product Manufacturing	416	464	5.75
95	All Other Retail	254	369	1.45
115	Monetary Authorities, Credit Intermediation, and Related Activities	249	333	1.39
137	Business Support Services	235	200	1.73
144	Junior Colleges, Colleges, Universities, and Professional Schools	220	-1	1.85
148	Offices of Other Health Practitioners	200	96	1.04

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Florence-Muscle Shoals, AL, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 6.4, followed by Apparel and Textiles and Primary and Fabricated Metal Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Florence-Muscle Shoals, AL cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

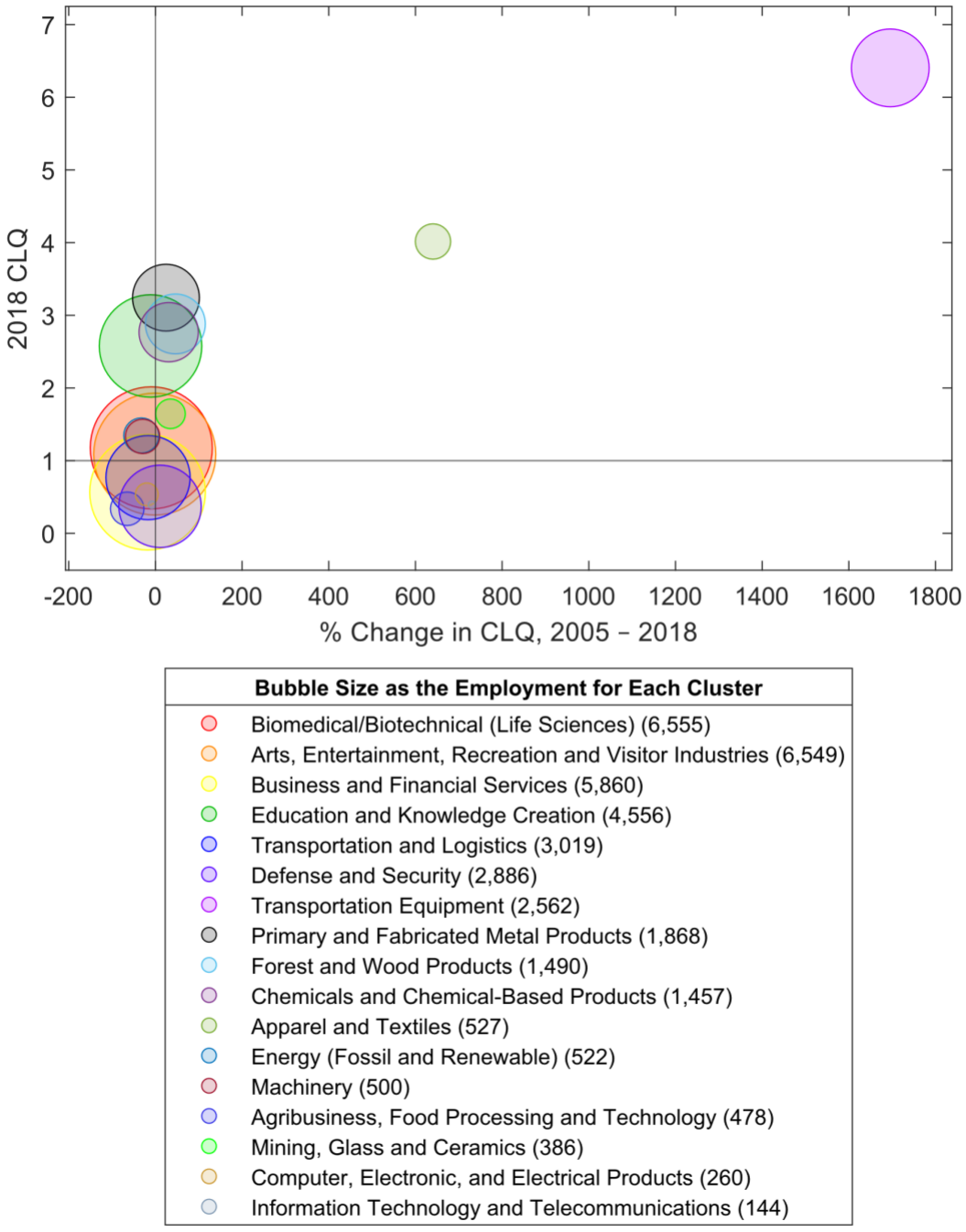
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.30	1.18	6,555
3	Arts, Entertainment, Recreation and Visitor Industries	1.11	1.09	6,549
5	Business and Financial Services	0.69	0.57	5,860
9	Education and Knowledge Creation	2.90	2.58	4,556
16	Transportation and Logistics	0.92	0.77	3,019
8	Defense and Security	0.34	0.37	2,886
17	Transportation Equipment	0.36	6.40	2,562
15	Primary and Fabricated Metal Products	2.61	3.24	1,868
11	Forest and Wood Products	1.97	2.88	1,490
6	Chemicals and Chemical-Based Products	2.12	2.77	1,457
2	Apparel and Textiles	0.54	4.02	527
10	Energy (Fossil and Renewable)	1.99	1.35	522
13	Machinery	1.89	1.33	500
1	Agribusiness, Food Processing and Technology	0.97	0.34	478
14	Mining, Glass and Ceramics	1.22	1.64	386
7	Computer, Electronic, and Electrical Products	0.67	0.54	260
12	Information Technology and Telecommunications	0.43	0.39	144

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Florence-Muscle Shoals, AL



2. CADS Analysis

The 2018 CADS analysis of the economy of Florence-Muscle Shoals, AL identifies 4 anchor industries in 3 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Motor Vehicle Parts Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	167	1,705
17	Transportation Equipment	83	Railroad Rolling Stock Manufacturing	0	756
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	722	1,138
5	Business and Financial Services	115	Monetary Authorities, Credit Intermediation, and Related Activities	1,003	1,252

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
81	Motor Vehicle Parts Manufacturing	8.54	1,558	-11.56	922.45	0.69	0.14
83	Railroad Rolling Stock Manufacturing	98.27	756	-14.13	N/A	0.73	0.09
42	Plastics Product Manufacturing	5.75	464	-6.65	57.60	0.74	0.06
115	Monetary Authorities, Credit Intermediation, and Related Activities	1.39	333	-8.42	24.83	0.92	0.05

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has

been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment
27	Apparel, Leather and Allied Product Manufacturing	-21
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-21
48	Iron and Steel Mills and Ferroalloy Manufacturing	-75
51	Nonferrous Metal (except Aluminum) Production and Processing	-50
52	Foundries	-28
53	Forging and Stamping	-77
58	Spring and Wire Product Manufacturing	N/A
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-113
60	Coating, Engraving, Heat Treating, and Allied Activities	-48
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-24
68	Other General Purpose Machinery Manufacturing	-19
72	Semiconductor and Other Electronic Component Manufacturing	-102
104	Warehousing and Storage	-5
129	Management, Scientific, and Technical Consulting Services	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 83

Railroad Rolling Stock Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-23	-2
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-25	-4
48	Iron and Steel Mills and Ferroalloy Manufacturing	-122	-47
51	Nonferrous Metal (except Aluminum) Production and Processing	-80	-30

52	Foundries	-128	-100
53	Forging and Stamping	-124	-47
58	Spring and Wire Product Manufacturing	-36	-55
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-258	-145
60	Coating, Engraving, Heat Treating, and Allied Activities	-67	-19
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-35	-12
68	Other General Purpose Machinery Manufacturing	-49	-30
72	Semiconductor and Other Electronic Component Manufacturing	-139	-37
104	Warehousing and Storage	-82	-77
129	Management, Scientific, and Technical Consulting Services	-16	-28

Table 7. Phase 3 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-24	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-84	-60
48	Iron and Steel Mills and Ferroalloy Manufacturing	-123	-2
51	Nonferrous Metal (except Aluminum) Production and Processing	-83	-2
52	Foundries	-129	-1
53	Forging and Stamping	-125	-1
58	Spring and Wire Product Manufacturing	-37	-1
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-276	-18
60	Coating, Engraving, Heat Treating, and Allied Activities	-77	-10
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-36	-1
68	Other General Purpose Machinery Manufacturing	-51	-2
72	Semiconductor and Other Electronic Component Manufacturing	-155	-16
104	Warehousing and Storage	-144	-62
129	Management, Scientific, and Technical Consulting Services	-33	-17

Table 8. Phase 4 Deficits Adding Anchor Industry 115

Monetary Authorities, Credit Intermediation, and Related Activities

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-25	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-85	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-124	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-83	-0
52	Foundries	-129	-0
53	Forging and Stamping	-125	-0
58	Spring and Wire Product Manufacturing	-37	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-277	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-78	-0
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-36	-0
68	Other General Purpose Machinery Manufacturing	-51	-0
72	Semiconductor and Other Electronic Component Manufacturing	-156	-2
104	Warehousing and Storage	-147	-3
129	Management, Scientific, and Technical Consulting Services	-99	-66

Chapter 17. Forest City, NC

Study Area Overview

The Forest City, NC study region occupies 564 square-miles and had a 2018 population of 66,826. The employed share of the regional labor force during the 2014-2018 period averaged 93.7%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Government and Unclassified. These three industries account for a combined 23.25% of the region's economy. The region's 2018 coefficient of specialization (COS) is 34.27, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Forest City, NC can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Data Processing, Hosting, and Related Services, whose employment grew by 313 followed by Business Support Services and Government and Unclassified. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 8.4, 2.26, and 0.55.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
113	Data Processing, Hosting, and Related Services	313	311	8.40
137	Business Support Services	232	230	2.26
181	Government and Unclassified	185	140	0.55
93	Food and Beverage Stores	178	151	1.58
166	Accommodation	174	153	1.58
155	Individual and Family Services	164	103	0.77
66	Metalworking Machinery Manufacturing	146	147	7.32
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	117	144	7.73
148	Offices of Other Health Practitioners	104	64	1.38
99	Truck Transportation	94	92	1.42

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Forest City, NC, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 16.11, followed by Education and Knowledge Creation and Forest and Wood Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Forest City, NC cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

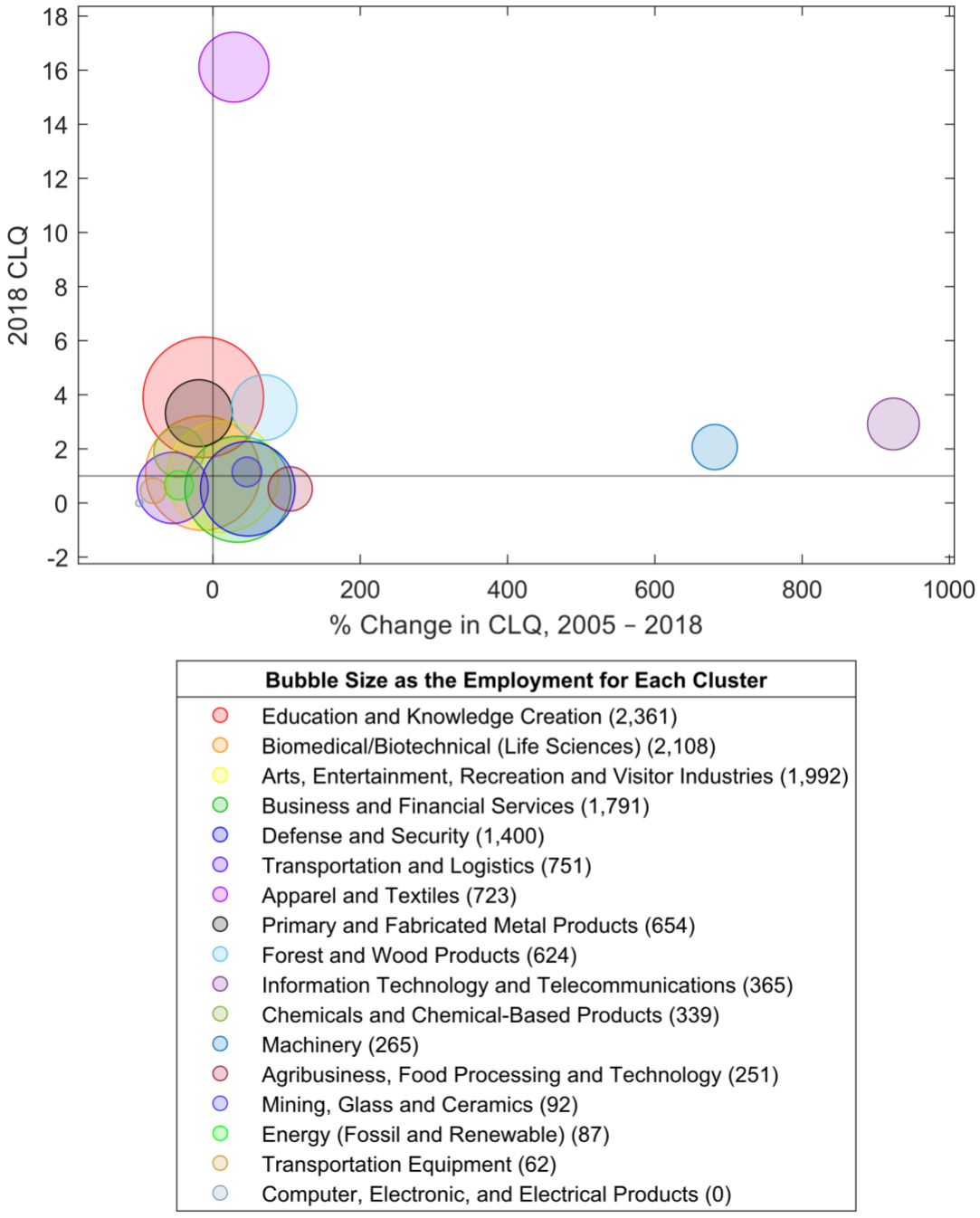
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
9	Education and Knowledge Creation	4.49	3.91	2,361
4	Biomedical/Biotechnical (Life Sciences)	1.28	1.11	2,108
3	Arts, Entertainment, Recreation and Visitor Industries	0.86	0.97	1,992
5	Business and Financial Services	0.38	0.51	1,791
8	Defense and Security	0.36	0.53	1,400
16	Transportation and Logistics	1.23	0.56	751
2	Apparel and Textiles	12.54	16.11	723
15	Primary and Fabricated Metal Products	4.10	3.32	654
11	Forest and Wood Products	2.08	3.53	624
12	Information Technology and Telecommunications	0.29	2.92	365
6	Chemicals and Chemical-Based Products	3.49	1.88	339
13	Machinery	0.26	2.07	265
1	Agribusiness, Food Processing and Technology	0.25	0.52	251
14	Mining, Glass and Ceramics	0.79	1.15	92
10	Energy (Fossil and Renewable)	1.22	0.66	87
17	Transportation Equipment	2.40	0.45	62
7	Computer, Electronic, and Electrical Products	0.46	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Forest City, NC



2. CADS Analysis

The 2018 CADS analysis of the economy of Forest City, NC identifies 6 anchor industries in 6 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Data Processing, Hosting, and Related Services, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
12	Information Technology and Telecommunications	113	Data Processing, Hosting, and Related Services	7	320
11	Forest and Wood Products	28	Sawmills and Wood Preservation	211	216
16	Transportation and Logistics	99	Truck Transportation	182	276
15	Primary and Fabricated Metal Products	52	Foundries	210	200
3	Arts, Entertainment, Recreation and Visitor Industries	166	Accommodation	197	371
5	Business and Financial Services	137	Business Support Services	12	244

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
113	Data Processing, Hosting, and Related Services	8.40	311	25.87	4,525.20	0.80	0.08
28	Sawmills and Wood Preservation	19.02	49	-21.00	2.37	0.70	0.04
99	Truck Transportation	1.42	92	1.19	51.65	0.70	0.03
52	Foundries	14.65	47	-26.93	-4.67	0.60	0.03

166	Accommodation	1.58	153	10.44	88.32	0.87	0.02
137	Business Support Services	2.26	230	11.43	1,930.75	0.88	0.01

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 113

Data Processing, Hosting, and Related Services

Industry #	Industry Name	Employment
3	Forestry and Logging	N/A
5	Support Activities for Agriculture and Forestry	N/A
72	Semiconductor and Other Electronic Component Manufacturing	-5
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-1
104	Warehousing and Storage	-3
128	Computer Systems Design and Related Services	-4

Table 6. Phase 2 Deficits Adding Anchor Industry 28

Sawmills and Wood Preservation

Industry #	Industry Name	Employment	Added to Deficit
3	Forestry and Logging	-38	-77
5	Support Activities for Agriculture and Forestry	-12	-20
72	Semiconductor and Other Electronic Component Manufacturing	-7	-2
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-4	-3
104	Warehousing and Storage	-15	-11
128	Computer Systems Design and Related Services	-6	-2

Table 7. Phase 3 Deficits Adding Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment	Added to Deficit
3	Forestry and Logging	-38	-0
5	Support Activities for Agriculture and Forestry	-12	-0
72	Semiconductor and Other Electronic Component Manufacturing	-8	-1
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-29	-25
104	Warehousing and Storage	-29	-14
128	Computer Systems Design and Related Services	-9	-2

Table 8. Phase 4 Deficits Adding Anchor Industry 52

Foundries

Industry #	Industry Name	Employment	Added to Deficit
3	Forestry and Logging	-38	-0
5	Support Activities for Agriculture and Forestry	-12	-0
72	Semiconductor and Other Electronic Component Manufacturing	-10	-2
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-30	-1
104	Warehousing and Storage	-51	-22
128	Computer Systems Design and Related Services	-11	-2

Table 9. Phase 5 Deficits Adding Anchor Industry 166

Accommodation

Industry #	Industry Name	Employment	Added to Deficit
3	Forestry and Logging	-38	-0
5	Support Activities for Agriculture and Forestry	-12	-0
72	Semiconductor and Other Electronic Component Manufacturing	-10	-0
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-31	-1
104	Warehousing and Storage	-52	-2
128	Computer Systems Design and Related Services	-13	-2

Table 10. Phase 6 Deficits Adding Anchor Industry 137

Business Support Services

Industry #	Industry Name	Employment	Added to Deficit
3	Forestry and Logging	-38	-0
5	Support Activities for Agriculture and Forestry	-12	-0
72	Semiconductor and Other Electronic Component Manufacturing	-10	-0
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-32	-1
104	Warehousing and Storage	-53	-1
128	Computer Systems Design and Related Services	-15	-2

Chapter 18. Fort Payne, AL

Study Area Overview

The Fort Payne, AL study region occupies 777 square-miles and had a 2018 population of 71,385. The employed share of the regional labor force during the 2014-2018 period averaged 96.4%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Apparel, Leather and Allied Product Manufacturing. These three industries account for a combined 20.04% of the region's economy. The region's 2018 coefficient of specialization (COS) is 41.1, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Fort Payne, AL can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Warehousing and Storage, whose employment grew by 615 followed by Motor Vehicle Body and Trailer Manufacturing and Elementary and Secondary Schools. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 4.03, 35.28, and 10.68.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
104	Warehousing and Storage	615	606	4.03
80	Motor Vehicle Body and Trailer Manufacturing	560	567	35.28
143	Elementary and Secondary Schools	457	128	10.68
144	Junior Colleges, Colleges, Universities, and Professional Schools	281	279	1.15
167	Food Services and Drinking Places	261	-149	1.00
68	Other General Purpose Machinery Manufacturing	221	220	7.28
55	Architectural and Structural Metals Manufacturing	214	226	19.56
42	Plastics Product Manufacturing	214	227	5.14
49	Steel Product Manufacturing From Purchased Steel	179	179	23.10
146	Offices of Physicians	152	93	1.09

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Fort Payne, AL, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 23.33, followed by Transportation Equipment and Primary and Fabricated Metal Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Fort Payne, AL cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

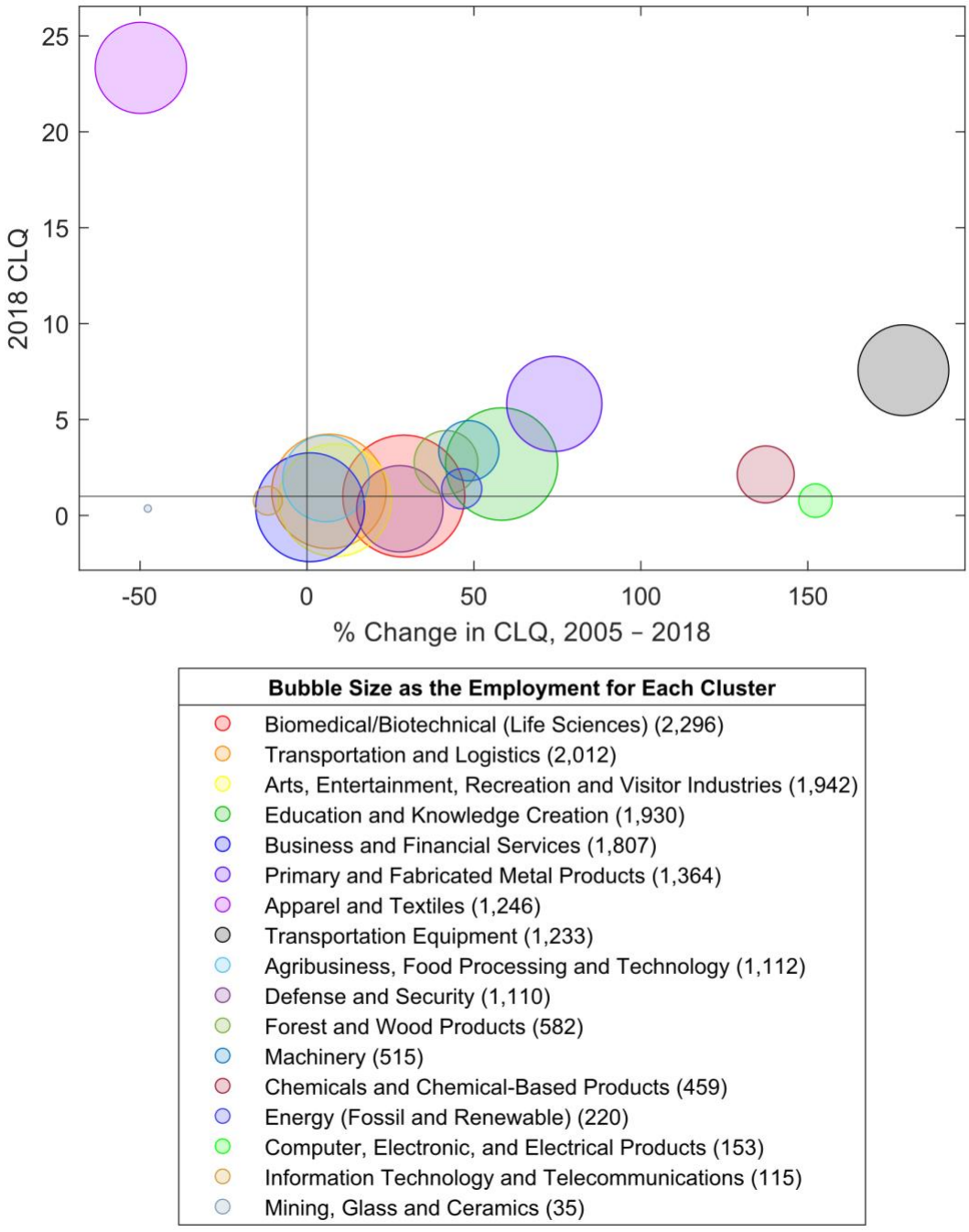
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	0.78	1.01	2,296
16	Transportation and Logistics	1.18	1.26	2,012
3	Arts, Entertainment, Recreation and Visitor Industries	0.73	0.79	1,942
9	Education and Knowledge Creation	1.69	2.68	1,930
5	Business and Financial Services	0.42	0.43	1,807
15	Primary and Fabricated Metal Products	3.34	5.82	1,364
2	Apparel and Textiles	46.45	23.33	1,246
17	Transportation Equipment	2.72	7.57	1,233
1	Agribusiness, Food Processing and Technology	1.83	1.93	1,112
8	Defense and Security	0.27	0.35	1,110
11	Forest and Wood Products	1.95	2.76	582
13	Machinery	2.27	3.37	515
6	Chemicals and Chemical-Based Products	0.90	2.14	459
10	Energy (Fossil and Renewable)	0.95	1.40	220
7	Computer, Electronic, and Electrical Products	0.31	0.77	153
12	Information Technology and Telecommunications	0.87	0.77	115
14	Mining, Glass and Ceramics	0.69	0.36	35

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Fort Payne, AL



2. CADS Analysis

The 2018 CADS analysis of the economy of Fort Payne, AL identifies 6 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Motor Vehicle Body and Trailer Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
17	Transportation Equipment	80	Motor Vehicle Body and Trailer Manufacturing	230	789
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	836	1,050
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	354	444
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	200	414
13	Machinery	68	Other General Purpose Machinery Manufacturing	52	273
16	Transportation and Logistics	104	Warehousing and Storage	10	625

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
80	Motor Vehicle Body and Trailer Manufacturing	35.28	567	-3.45	243.28	0.65	0.10
55	Architectural and Structural Metals Manufacturing	19.56	226	-1.47	25.60	0.59	0.09
81	Motor Vehicle Parts Manufacturing	5.46	131	-11.56	25.35	0.63	0.09

42	Plastics Product Manufacturing	5.14	227	-6.65	106.76	0.52	0.05
68	Other General Purpose Machinery Manufacturing	7.28	220	1.24	421.91	0.71	0.04
104	Warehousing and Storage	4.03	606	88.22	6,146.32	0.86	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 80

Motor Vehicle Body and Trailer Manufacturing

Industry #	Industry Name	Employment
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-4
43	Rubber Product Manufacturing	-27
48	Iron and Steel Mills and Ferroalloy Manufacturing	-13
50	Alumina and Aluminum Production and Processing	-21
51	Nonferrous Metal (except Aluminum) Production and Processing	-8
52	Foundries	-11
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-10
60	Coating, Engraving, Heat Treating, and Allied Activities	-10
66	Metalworking Machinery Manufacturing	-3
76	Household Appliance Manufacturing	-11
78	Other Electrical Equipment and Component Manufacturing	-9
128	Computer Systems Design and Related Services	-5
133	Management of Companies and Enterprises	-13

Table 6. Phase 2 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-6	-1
43	Rubber Product Manufacturing	-28	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-47	-34
50	Alumina and Aluminum Production and Processing	-37	-15
51	Nonferrous Metal (except Aluminum) Production and Processing	-18	-11
52	Foundries	-19	-8
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-63	-53
60	Coating, Engraving, Heat Treating, and Allied Activities	-20	-10
66	Metalworking Machinery Manufacturing	-16	-13
76	Household Appliance Manufacturing	-11	-0
78	Other Electrical Equipment and Component Manufacturing	-11	-2
128	Computer Systems Design and Related Services	-16	-11
133	Management of Companies and Enterprises	-48	-35

Table 7. Phase 3 Deficits Adding Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-9	-3
43	Rubber Product Manufacturing	-32	-4
48	Iron and Steel Mills and Ferroalloy Manufacturing	-58	-11
50	Alumina and Aluminum Production and Processing	-40	-3
51	Nonferrous Metal (except Aluminum) Production and Processing	-26	-8
52	Foundries	-46	-26
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-100	-37
60	Coating, Engraving, Heat Treating, and Allied Activities	-28	-8
66	Metalworking Machinery Manufacturing	-20	-4
76	Household Appliance Manufacturing	-11	-0
78	Other Electrical Equipment and Component Manufacturing	-16	-4
128	Computer Systems Design and Related Services	-21	-5
133	Management of Companies and Enterprises	-73	-26

Table 8. Phase 4 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-31	-22
43	Rubber Product Manufacturing	-32	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-59	-0
50	Alumina and Aluminum Production and Processing	-40	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-27	-1
52	Foundries	-46	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-106	-6
60	Coating, Engraving, Heat Treating, and Allied Activities	-32	-4
66	Metalworking Machinery Manufacturing	-21	-1

76	Household Appliance Manufacturing	-12	-1
78	Other Electrical Equipment and Component Manufacturing	-16	-1
128	Computer Systems Design and Related Services	-25	-4
133	Management of Companies and Enterprises	-88	-15

Table 9. Phase 5 Deficits Adding Anchor Industry 68

Other General Purpose Machinery Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-32	-1
43	Rubber Product Manufacturing	-34	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-64	-6
50	Alumina and Aluminum Production and Processing	-42	-2
51	Nonferrous Metal (except Aluminum) Production and Processing	-30	-3
52	Foundries	-53	-8
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-119	-12
60	Coating, Engraving, Heat Treating, and Allied Activities	-35	-3
66	Metalworking Machinery Manufacturing	-22	-2
76	Household Appliance Manufacturing	-12	-0
78	Other Electrical Equipment and Component Manufacturing	-20	-3
128	Computer Systems Design and Related Services	-31	-6
133	Management of Companies and Enterprises	-107	-19

Table 10. Phase 6 Deficits Adding Anchor Industry 104

Warehousing and Storage

Industry #	Industry Name	Employment	Added to Deficit
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-32	-0
43	Rubber Product Manufacturing	-34	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-64	-0
50	Alumina and Aluminum Production and Processing	-42	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-30	-0
52	Foundries	-54	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-119	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-35	-0
66	Metalworking Machinery Manufacturing	-23	-0
76	Household Appliance Manufacturing	-12	-0
78	Other Electrical Equipment and Component Manufacturing	-20	-0
128	Computer Systems Design and Related Services	-32	-1
133	Management of Companies and Enterprises	-109	-2

Chapter 19. Gadsden, AL

Study Area Overview

The Gadsden, AL study region occupies 535 square-miles and had a 2018 population of 102,501. The employed share of the regional labor force during the 2014-2018 period averaged 94.7%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Employment Services and Hospitals. These three industries account for a combined 23.05% of the region's economy. The region's 2018 coefficient of specialization (COS) is 37.95, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Gadsden, AL can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Employment Services, whose employment grew by 696 followed by Rubber Product Manufacturing and Plastics Product Manufacturing. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 3.14, 48.9, and 3.83.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
136	Employment Services	696	681	3.14
43	Rubber Product Manufacturing	430	620	48.90
42	Plastics Product Manufacturing	262	278	3.83
148	Offices of Other Health Practitioners	242	27	2.47
146	Offices of Physicians	229	-42	2.23
167	Food Services and Drinking Places	211	-768	1.28
81	Motor Vehicle Parts Manufacturing	196	265	5.84
181	Government and Unclassified	167	93	0.42
143	Elementary and Secondary Schools	150	-452	8.97
153	Hospitals	131	-255	1.95

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Gadsden, AL, the cluster with the largest CLQ in 2018 is Chemicals and Chemical-Based Products with a CLQ of 5.8, followed by Transportation Equipment and Education and Knowledge Creation. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Gadsden, AL cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

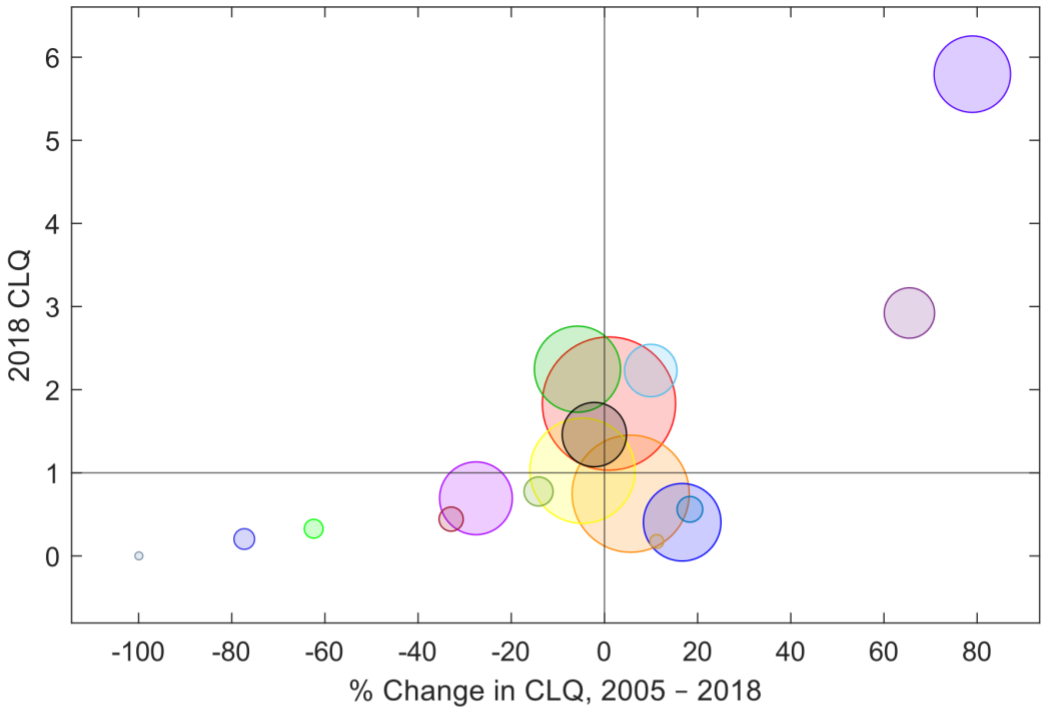
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.82	1.83	6,919
5	Business and Financial Services	0.71	0.75	5,248
3	Arts, Entertainment, Recreation and Visitor Industries	1.08	1.02	4,171
9	Education and Knowledge Creation	2.39	2.25	2,690
8	Defense and Security	0.35	0.41	2,132
6	Chemicals and Chemical-Based Products	3.24	5.80	2,067
16	Transportation and Logistics	0.96	0.69	1,850
1	Agribusiness, Food Processing and Technology	1.49	1.46	1,399
15	Primary and Fabricated Metal Products	2.03	2.23	870
17	Transportation Equipment	1.77	2.92	792
13	Machinery	0.90	0.78	197
12	Information Technology and Telecommunications	0.47	0.56	139
10	Energy (Fossil and Renewable)	0.66	0.44	116
11	Forest and Wood Products	0.90	0.20	71
14	Mining, Glass and Ceramics	0.87	0.33	52
2	Apparel and Textiles	0.16	0.17	16
7	Computer, Electronic, and Electrical Products	1.68	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Gadsden, AL



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (6,919)
Business and Financial Services (5,248)
Arts, Entertainment, Recreation and Visitor Industries (4,171)
Education and Knowledge Creation (2,690)
Defense and Security (2,132)
Chemicals and Chemical-Based Products (2,067)
Transportation and Logistics (1,850)
Agribusiness, Food Processing and Technology (1,399)
Primary and Fabricated Metal Products (870)
Transportation Equipment (792)
Machinery (197)
Information Technology and Telecommunications (139)
Energy (Fossil and Renewable) (116)
Forest and Wood Products (71)
Mining, Glass and Ceramics (52)
Apparel and Textiles (16)
Computer, Electronic, and Electrical Products (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Gadsden, AL identifies 3 anchor industries in 3 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Rubber Product Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
6	Chemicals and Chemical-Based Products	43	Rubber Product Manufacturing	1,105	1,535
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	593	790
4	Biomedical/Biotechnical (Life Sciences)	148	Offices of Other Health Practitioners	361	603

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
43	Rubber Product Manufacturing	48.90	620	-17.19	38.94	0.52	0.13
81	Motor Vehicle Parts Manufacturing	5.84	265	-11.56	33.12	0.64	0.11
148	Offices of Other Health Practitioners	2.47	27	59.61	67.04	0.78	0.01

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has

been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 43

Rubber Product Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	-52
3	Forestry and Logging	-70
5	Support Activities for Agriculture and Forestry	-23
26	Textile Mills and Textile Product Mills	-117
35	Basic Chemical Manufacturing	-48
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-49
48	Iron and Steel Mills and Ferroalloy Manufacturing	-12
52	Foundries	-3
57	Hardware Manufacturing	-12
58	Spring and Wire Product Manufacturing	-12
60	Coating, Engraving, Heat Treating, and Allied Activities	-5
72	Semiconductor and Other Electronic Component Manufacturing	-36
133	Management of Companies and Enterprises	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-58	-6
3	Forestry and Logging	-73	-3
5	Support Activities for Agriculture and Forestry	-24	-1
26	Textile Mills and Textile Product Mills	-130	-12
35	Basic Chemical Manufacturing	-55	-7

36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-58	-10
48	Iron and Steel Mills and Ferroalloy Manufacturing	-46	-34
52	Foundries	-80	-77
57	Hardware Manufacturing	-13	-2
58	Spring and Wire Product Manufacturing	-16	-4
60	Coating, Engraving, Heat Treating, and Allied Activities	-29	-24
72	Semiconductor and Other Electronic Component Manufacturing	-104	-68
133	Management of Companies and Enterprises	-60	-76

Table 7. Phase 3 Deficits Adding Anchor Industry 148

Offices of Other Health Practitioners

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-59	-1
3	Forestry and Logging	-73	-0
5	Support Activities for Agriculture and Forestry	-24	-0
26	Textile Mills and Textile Product Mills	-130	-0
35	Basic Chemical Manufacturing	-57	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-58	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-46	-0
52	Foundries	-80	-0
57	Hardware Manufacturing	-13	-0
58	Spring and Wire Product Manufacturing	-16	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-29	-0
72	Semiconductor and Other Electronic Component Manufacturing	-104	-0
133	Management of Companies and Enterprises	-66	-6

Chapter 20. Gaffney, SC

Study Area Overview

The Gaffney, SC study region occupies 393 square-miles and had a 2018 population of 57,078. The employed share of the regional labor force during the 2014-2018 period averaged 95.5%. The Employment Services industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Textile Mills and Textile Product Mills. These three industries account for a combined 26.22% of the region's economy. The region's 2018 coefficient of specialization (COS) is 48.7, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Gaffney, SC can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Employment Services, whose employment grew by 1,755 followed by All Other Retail and Elementary and Secondary Schools. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 4.5, 1.33, and 10.28.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
136	Employment Services	1,755	1,752	4.50
95	All Other Retail	426	458	1.33
143	Elementary and Secondary Schools	239	-127	10.28
79	Motor Vehicle Manufacturing	188	213	26.00
91	Wholesale Trade	177	175	0.79
104	Warehousing and Storage	176	-239	4.27
33	Printing and Related Support Activities	152	171	3.53
20	Animal Slaughtering and Processing	146	134	7.19
32	Converted Paper Product Manufacturing	120	120	3.35
155	Individual and Family Services	114	52	0.51

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Gaffney, SC, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 32.42, followed by Transportation Equipment and Primary and Fabricated Metal Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Gaffney, SC cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

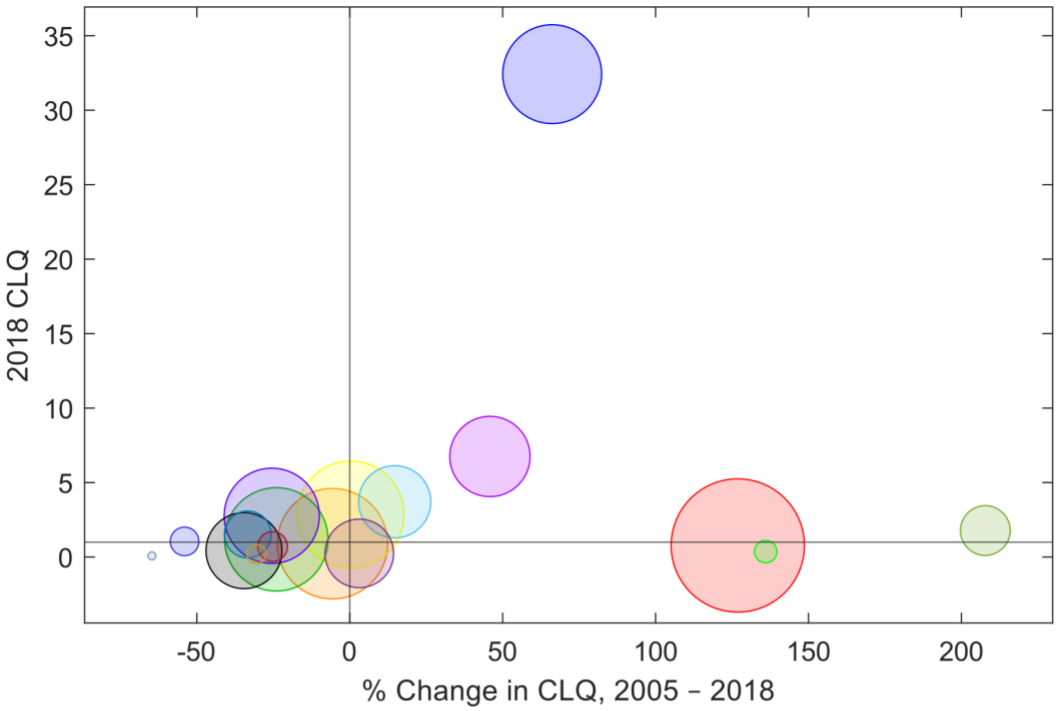
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
5	Business and Financial Services	0.34	0.78	3,203
3	Arts, Entertainment, Recreation and Visitor Industries	0.95	0.90	2,144
9	Education and Knowledge Creation	2.85	2.86	2,007
16	Transportation and Logistics	1.57	1.19	1,862
2	Apparel and Textiles	19.51	32.42	1,691
1	Agribusiness, Food Processing and Technology	3.72	2.77	1,558
17	Transportation Equipment	4.63	6.75	1,074
4	Biomedical/Biotechnical (Life Sciences)	0.66	0.43	950
15	Primary and Fabricated Metal Products	3.24	3.71	850
8	Defense and Security	0.24	0.25	758
11	Forest and Wood Products	0.58	1.78	366
6	Chemicals and Chemical-Based Products	2.28	1.52	318
10	Energy (Fossil and Renewable)	0.95	0.71	109
14	Mining, Glass and Ceramics	2.29	1.05	98
13	Machinery	0.16	0.37	55
7	Computer, Electronic, and Electrical Products	0.28	0.20	38
12	Information Technology and Telecommunications	0.23	0.08	12

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Gaffney, SC



Bubble Size as the Employment for Each Cluster
Business and Financial Services (3,203)
Arts, Entertainment, Recreation and Visitor Industries (2,144)
Education and Knowledge Creation (2,007)
Transportation and Logistics (1,862)
Apparel and Textiles (1,691)
Agribusiness, Food Processing and Technology (1,558)
Transportation Equipment (1,074)
Biomedical/Biotechnical (Life Sciences) (950)
Primary and Fabricated Metal Products (850)
Defense and Security (758)
Forest and Wood Products (366)
Chemicals and Chemical-Based Products (318)
Energy (Fossil and Renewable) (109)
Mining, Glass and Ceramics (98)
Machinery (55)
Computer, Electronic, and Electrical Products (38)
Information Technology and Telecommunications (12)

2. CADS Analysis

The 2018 CADS analysis of the economy of Gaffney, SC identifies 1 anchor industry in 1 cluster. Identified anchor and its parent cluster are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industry and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Motor Vehicle Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
17	Transportation Equipment	79	Motor Vehicle Manufacturing	634	822

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
79	Motor Vehicle Manufacturing	26.00	213	-3.98	29.57	0.36	0.42

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 79

Motor Vehicle Manufacturing

Industry #	Industry Name	Employment
52	Foundries	-154
53	Forging and Stamping	-80
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-249
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-131
71	Audio and Video Equipment Manufacturing	-163
72	Semiconductor and Other Electronic Component Manufacturing	-196
81	Motor Vehicle Parts Manufacturing	-1,226
91	Wholesale Trade	-112
129	Management, Scientific, and Technical Consulting Services	-79
133	Management of Companies and Enterprises	-245

Chapter 21. Gainesville, GA

Study Area Overview

The Gainesville, GA study region occupies 393 square-miles and had a 2018 population of 202,148. The employed share of the regional labor force during the 2014-2018 period averaged 96.8%. The Animal Slaughtering and Processing industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Hospitals. These three industries account for a combined 22.83% of the region's economy. The region's 2018 coefficient of specialization (COS) is 35.51, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Gainesville, GA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Animal Slaughtering and Processing, whose employment grew by 2,801 followed by Food Services and Drinking Places and Employment Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 30.59, 0.94, and 1.63.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
20	Animal Slaughtering and Processing	2,801	2,597	30.59
167	Food Services and Drinking Places	2,319	1,158	0.94
136	Employment Services	1,934	1,923	1.63
153	Hospitals	1,823	1,229	1.81
146	Offices of Physicians	1,563	1,152	2.22
91	Wholesale Trade	1,014	996	1.34
62	Agriculture, Construction, and Mining Machinery Manufacturing	823	783	13.86
80	Motor Vehicle Body and Trailer Manufacturing	706	711	9.34
22	Bakeries and Tortilla Manufacturing	654	652	3.56
133	Management of Companies and Enterprises	649	531	0.76

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Gainesville, GA, the cluster with the largest CLQ in 2018 is Agribusiness, Food Processing and Technology with a CLQ of 4.79, followed by Machinery and Transportation Equipment. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Gainesville, GA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

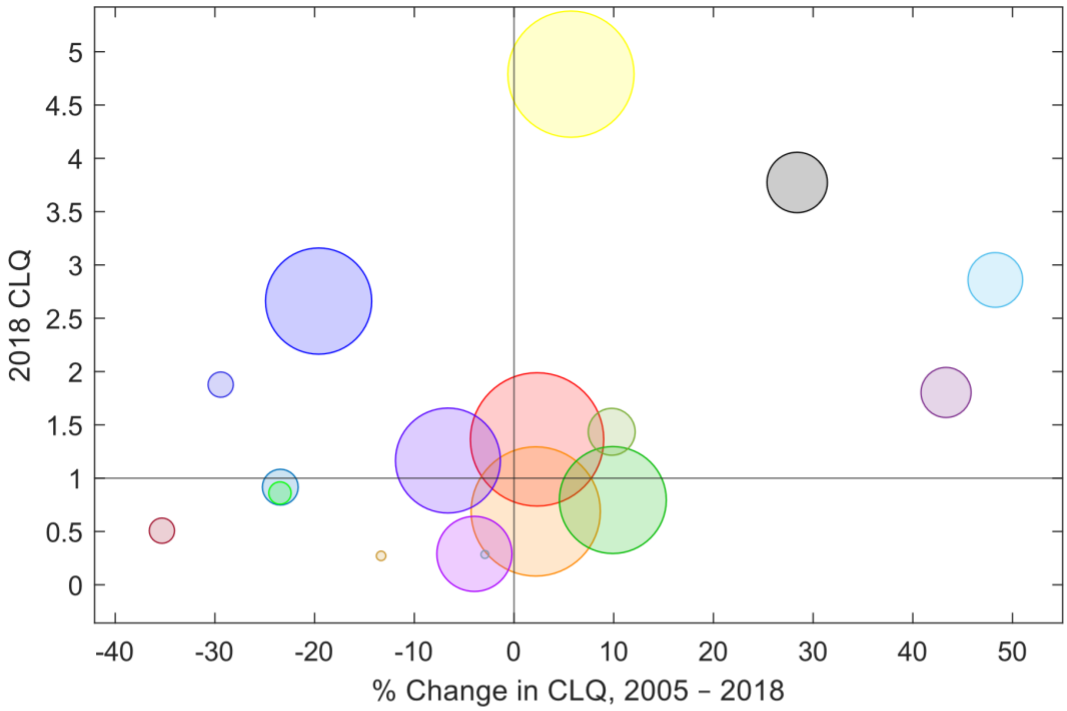
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.33	1.36	12,524
5	Business and Financial Services	0.67	0.69	11,732
1	Agribusiness, Food Processing and Technology	4.53	4.79	11,164
3	Arts, Entertainment, Recreation and Visitor Industries	0.72	0.79	7,868
9	Education and Knowledge Creation	3.31	2.66	7,750
16	Transportation and Logistics	1.25	1.17	7,559
8	Defense and Security	0.30	0.29	3,711
13	Machinery	2.94	3.77	2,331
17	Transportation Equipment	1.93	2.86	1,885
6	Chemicals and Chemical-Based Products	1.26	1.80	1,565
15	Primary and Fabricated Metal Products	1.31	1.44	1,362
11	Forest and Wood Products	1.20	0.92	781
7	Computer, Electronic, and Electrical Products	0.78	0.51	406
2	Apparel and Textiles	2.66	1.88	406
14	Mining, Glass and Ceramics	1.12	0.86	333
10	Energy (Fossil and Renewable)	0.31	0.27	173
12	Information Technology and Telecommunications	0.29	0.28	171

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Gainesville, GA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (12,524)
Business and Financial Services (11,732)
Agribusiness, Food Processing and Technology (11,164)
Arts, Entertainment, Recreation and Visitor Industries (7,868)
Education and Knowledge Creation (7,750)
Transportation and Logistics (7,559)
Defense and Security (3,711)
Machinery (2,331)
Transportation Equipment (1,885)
Chemicals and Chemical-Based Products (1,565)
Primary and Fabricated Metal Products (1,362)
Forest and Wood Products (781)
Computer, Electronic, and Electrical Products (406)
Apparel and Textiles (406)
Mining, Glass and Ceramics (333)
Energy (Fossil and Renewable) (173)
Information Technology and Telecommunications (171)

2. CADS Analysis

The 2018 CADS analysis of the economy of Gainesville, GA identifies 6 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Animal Slaughtering and Processing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
1	Agribusiness, Food Processing and Technology	20	Animal Slaughtering and Processing	6,033	8,834
13	Machinery	62	Agriculture, Construction, and Mining Machinery Manufacturing	838	1,661
4	Biomedical/Biotechnical (Life Sciences)	153	Hospitals	3,285	5,107
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	1,684	3,247
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	750	1,039
9	Education and Knowledge Creation	144	Junior Colleges, Colleges, Universities, and Professional Schools	1,777	2,257

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
20	Animal Slaughtering and Processing	30.59	2,597	3.38	46.43	0.48	0.32
62	Agriculture, Construction, and Mining Machinery Manufacturing	13.86	783	4.70	98.11	0.77	0.09
153	Hospitals	1.81	1,229	18.09	55.49	0.91	0.08

146	Offices of Physicians	2.22	1,152	24.38	92.81	0.95	0.05
81	Motor Vehicle Parts Manufacturing	3.16	376	-11.56	38.55	0.77	0.06
144	Junior Colleges, Colleges, Universities, and Professional Schools	2.22	55	23.90	26.96	0.92	0.02

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 20

Animal Slaughtering and Processing

Industry #	Industry Name	Employment
1	Crop Production	-1,367
2	Animal Production	-8,701
4	Fishing, Hunting and Trapping	-80
5	Support Activities for Agriculture and Forestry	-259
15	Animal Food Manufacturing	-152
16	Grain and Oilseed Milling	-61
32	Converted Paper Product Manufacturing	-126
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-38
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-6
72	Semiconductor and Other Electronic Component Manufacturing	-8
97	Rail Transportation	-64
99	Truck Transportation	-336
104	Warehousing and Storage	N/A
117	Insurance Carriers	N/A
129	Management, Scientific, and Technical Consulting Services	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 62

Agriculture, Construction, and Mining Machinery Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-1,377	-10
2	Animal Production	-8,702	-1
4	Fishing, Hunting and Trapping	-80	-0
5	Support Activities for Agriculture and Forestry	-262	-2
15	Animal Food Manufacturing	-153	-0
16	Grain and Oilseed Milling	-62	-0
32	Converted Paper Product Manufacturing	-140	-14
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-38	-1
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-95	-89
72	Semiconductor and Other Electronic Component Manufacturing	-106	-98
97	Rail Transportation	-75	-12
99	Truck Transportation	-429	-93
104	Warehousing and Storage	-102	-107
117	Insurance Carriers	N/A	-11
129	Management, Scientific, and Technical Consulting Services	-39	-42

Table 7. Phase 3 Deficits Adding Anchor Industry 153

Hospitals

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-1,387	-10
2	Animal Production	-8,706	-5
4	Fishing, Hunting and Trapping	-82	-3
5	Support Activities for Agriculture and Forestry	-263	-1
15	Animal Food Manufacturing	-153	-1
16	Grain and Oilseed Milling	-62	-1
32	Converted Paper Product Manufacturing	-150	-10
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-39	-1
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-96	-1
72	Semiconductor and Other Electronic Component Manufacturing	-114	-8
97	Rail Transportation	-78	-2
99	Truck Transportation	-450	-21
104	Warehousing and Storage	-127	-25
117	Insurance Carriers	-147	-159
129	Management, Scientific, and Technical Consulting Services	-201	-162

Table 8. Phase 4 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-1,391	-4
2	Animal Production	-8,707	-1
4	Fishing, Hunting and Trapping	-83	-0
5	Support Activities for Agriculture and Forestry	-264	-1
15	Animal Food Manufacturing	-153	-0
16	Grain and Oilseed Milling	-62	-0
32	Converted Paper Product Manufacturing	-153	-3
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-40	-0

67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-96	-0
72	Semiconductor and Other Electronic Component Manufacturing	-118	-4
97	Rail Transportation	-79	-1
99	Truck Transportation	-459	-9
104	Warehousing and Storage	-137	-11
117	Insurance Carriers	-163	-16
129	Management, Scientific, and Technical Consulting Services	-283	-81

Table 9. Phase 5 Deficits Adding Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-1,396	-5
2	Animal Production	-8,707	-0
4	Fishing, Hunting and Trapping	-83	-0
5	Support Activities for Agriculture and Forestry	-265	-1
15	Animal Food Manufacturing	-154	-0
16	Grain and Oilseed Milling	-63	-0
32	Converted Paper Product Manufacturing	-160	-7
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-40	-0
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-104	-8
72	Semiconductor and Other Electronic Component Manufacturing	-168	-50
97	Rail Transportation	-84	-5
99	Truck Transportation	-497	-37
104	Warehousing and Storage	-186	-49
117	Insurance Carriers	-167	-4
129	Management, Scientific, and Technical Consulting Services	-302	-20

Table 10. Phase 6 Deficits Adding Anchor Industry 144

Junior Colleges, Colleges, Universities, and Professional Schools

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-1,401	-5
2	Animal Production	-8,710	-2
4	Fishing, Hunting and Trapping	-84	-1
5	Support Activities for Agriculture and Forestry	-265	-1
15	Animal Food Manufacturing	-154	-0
16	Grain and Oilseed Milling	-63	-0
32	Converted Paper Product Manufacturing	-161	-1
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-40	-0
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-104	-0
72	Semiconductor and Other Electronic Component Manufacturing	-169	-1
97	Rail Transportation	-85	-1
99	Truck Transportation	-501	-4
104	Warehousing and Storage	-190	-4
117	Insurance Carriers	-170	-3
129	Management, Scientific, and Technical Consulting Services	-307	-5

Chapter 22. Greeneville, TN

Study Area Overview

The Greeneville, TN study region occupies 622 square-miles and had a 2018 population of 69,087. The employed share of the regional labor force during the 2014-2018 period averaged 93.7%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and All Other Retail. These three industries account for a combined 17.55% of the region's economy. The region's 2018 coefficient of specialization (COS) is 43.4, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Greeneville, TN can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Warehousing and Storage, whose employment grew by 1,212 followed by Hospitals and Community and Vocational Rehabilitation Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 7.66, 1.56, and 5.78.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
104	Warehousing and Storage	1,212	1,070	7.66
153	Hospitals	436	287	1.56
156	Community and Vocational Rehabilitation Services	408	409	5.78
133	Management of Companies and Enterprises	343	343	0.92
137	Business Support Services	325	323	2.30
167	Food Services and Drinking Places	241	-133	0.79
62	Agriculture, Construction, and Mining Machinery Manufacturing	225	196	24.03
80	Motor Vehicle Body and Trailer Manufacturing	216	217	9.49
181	Government and Unclassified	208	174	0.32
95	All Other Retail	185	224	1.12

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Greeneville, TN, the cluster with the largest CLQ in 2018 is Machinery with a CLQ of 8.46, followed by Primary and Fabricated Metal Products and Chemicals and Chemical-Based Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Greeneville, TN cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

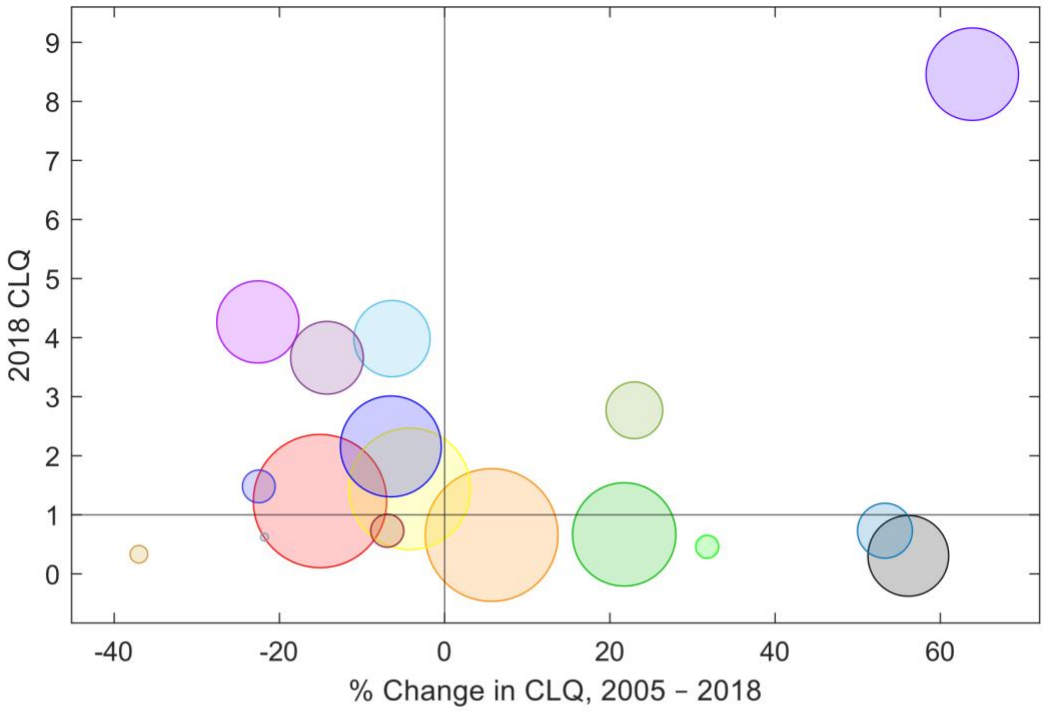
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.45	1.23	3,236
5	Business and Financial Services	0.62	0.66	3,209
16	Transportation and Logistics	1.50	1.44	2,670
3	Arts, Entertainment, Recreation and Visitor Industries	0.55	0.67	1,891
9	Education and Knowledge Creation	2.31	2.16	1,797
13	Machinery	5.16	8.46	1,494
15	Primary and Fabricated Metal Products	5.51	4.27	1,157
8	Defense and Security	0.20	0.31	1,118
6	Chemicals and Chemical-Based Products	4.25	3.98	988
11	Forest and Wood Products	4.27	3.66	892
17	Transportation Equipment	2.25	2.77	522
1	Agribusiness, Food Processing and Technology	0.48	0.73	487
7	Computer, Electronic, and Electrical Products	0.79	0.73	167
14	Mining, Glass and Ceramics	1.91	1.48	164
10	Energy (Fossil and Renewable)	0.35	0.46	84
12	Information Technology and Telecommunications	0.53	0.33	57
2	Apparel and Textiles	0.80	0.62	39

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Greeneville, TN



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (3,236)
Business and Financial Services (3,209)
Transportation and Logistics (2,670)
Arts, Entertainment, Recreation and Visitor Industries (1,891)
Education and Knowledge Creation (1,797)
Machinery (1,494)
Primary and Fabricated Metal Products (1,157)
Defense and Security (1,118)
Chemicals and Chemical-Based Products (988)
Forest and Wood Products (892)
Transportation Equipment (522)
Agribusiness, Food Processing and Technology (487)
Computer, Electronic, and Electrical Products (167)
Mining, Glass and Ceramics (164)
Energy (Fossil and Renewable) (84)
Information Technology and Telecommunications (57)
Apparel and Textiles (39)

2. CADS Analysis

The 2018 CADS analysis of the economy of Greeneville, TN identifies 6 anchor industries in 5 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Agriculture, Construction, and Mining Machinery Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
13	Machinery	62	Agriculture, Construction, and Mining Machinery Manufacturing	599	823
6	Chemicals and Chemical-Based Products	43	Rubber Product Manufacturing	749	886
4	Biomedical/Biotechnical (Life Sciences)	153	Hospitals	827	1,263
16	Transportation and Logistics	104	Warehousing and Storage	161	1,373
13	Machinery	68	Other General Purpose Machinery Manufacturing	283	362
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	280	326

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
62	Agriculture, Construction, and Mining Machinery Manufacturing	24.03	196	4.70	37.51	0.79	0.16
43	Rubber Product Manufacturing	40.56	266	-17.19	18.30	0.69	0.11
153	Hospitals	1.56	287	18.09	52.81	0.78	0.07

104	Warehousing and Storage	7.66	1,070	88.22	752.80	0.88	0.05
68	Other General Purpose Machinery Manufacturing	8.33	75	1.24	27.82	0.78	0.05
55	Architectural and Structural Metals Manufacturing	5.25	50	-1.47	16.40	0.71	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 62

Agriculture, Construction, and Mining Machinery Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	N/A
3	Forestry and Logging	N/A
26	Textile Mills and Textile Product Mills	-6
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-5
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-11
48	Iron and Steel Mills and Ferroalloy Manufacturing	-34
52	Foundries	-34
60	Coating, Engraving, Heat Treating, and Allied Activities	-3
72	Semiconductor and Other Electronic Component Manufacturing	-11
97	Rail Transportation	-6
103	Couriers and Messengers	-11
117	Insurance Carriers	N/A
127	Specialized Design Services	-9
129	Management, Scientific, and Technical Consulting Services	N/A
139	Investigation and Security Services	N/A
140	Services to Buildings and Dwellings	N/A

141	Other Support Services	-9
152	Other Ambulatory Health Care Services	-0

Table 6. Phase 2 Deficits Adding Anchor Industry 43

Rubber Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-16	-28
3	Forestry and Logging	-40	-42
26	Textile Mills and Textile Product Mills	-73	-67
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-31	-26
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-13	-2
48	Iron and Steel Mills and Ferroalloy Manufacturing	-41	-7
52	Foundries	-35	-2
60	Coating, Engraving, Heat Treating, and Allied Activities	-16	-13
72	Semiconductor and Other Electronic Component Manufacturing	-30	-19
97	Rail Transportation	-10	-4
103	Couriers and Messengers	-19	-8
117	Insurance Carriers	N/A	-4
127	Specialized Design Services	-14	-4
129	Management, Scientific, and Technical Consulting Services	-6	-14
139	Investigation and Security Services	N/A	-8
140	Services to Buildings and Dwellings	N/A	-30
141	Other Support Services	-13	-4
152	Other Ambulatory Health Care Services	-0	-0

Table 7. Phase 3 Deficits Adding Anchor Industry 153

Hospitals

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-19	-3
3	Forestry and Logging	-41	-0
26	Textile Mills and Textile Product Mills	-75	-2
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-31	-1
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-13	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-41	-0
52	Foundries	-36	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-17	-1
72	Semiconductor and Other Electronic Component Manufacturing	-32	-2
97	Rail Transportation	-11	-1
103	Couriers and Messengers	-25	-6
117	Insurance Carriers	-20	-39
127	Specialized Design Services	-15	-2
129	Management, Scientific, and Technical Consulting Services	-46	-40
139	Investigation and Security Services	-13	-13
140	Services to Buildings and Dwellings	N/A	-29
141	Other Support Services	-17	-4
152	Other Ambulatory Health Care Services	-21	-21

Table 8. Phase 4 Deficits Adding Anchor Industry 104

Warehousing and Storage

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-20	-1
3	Forestry and Logging	-41	-0
26	Textile Mills and Textile Product Mills	-75	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-32	-0
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-14	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-41	-1
52	Foundries	-37	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-18	-1
72	Semiconductor and Other Electronic Component Manufacturing	-34	-2
97	Rail Transportation	-11	-1
103	Couriers and Messengers	-34	-9
117	Insurance Carriers	-24	-4
127	Specialized Design Services	-16	-1
129	Management, Scientific, and Technical Consulting Services	-54	-8
139	Investigation and Security Services	-19	-6
140	Services to Buildings and Dwellings	-18	-21
141	Other Support Services	-20	-3
152	Other Ambulatory Health Care Services	-21	-0

Table 9. Phase 5 Deficits Adding Anchor Industry 68

Other General Purpose Machinery Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-21	-1
3	Forestry and Logging	-41	-0
26	Textile Mills and Textile Product Mills	-79	-4
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-33	-1
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-16	-2
48	Iron and Steel Mills and Ferroalloy Manufacturing	-48	-7
52	Foundries	-46	-9
60	Coating, Engraving, Heat Treating, and Allied Activities	-21	-3
72	Semiconductor and Other Electronic Component Manufacturing	-46	-12
97	Rail Transportation	-13	-1
103	Couriers and Messengers	-36	-2
117	Insurance Carriers	-26	-1
127	Specialized Design Services	-18	-2
129	Management, Scientific, and Technical Consulting Services	-60	-6
139	Investigation and Security Services	-22	-3
140	Services to Buildings and Dwellings	-26	-8
141	Other Support Services	-21	-2
152	Other Ambulatory Health Care Services	-21	-0

Table 10. Phase 6 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-22	-1
3	Forestry and Logging	-42	-0
26	Textile Mills and Textile Product Mills	-80	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-34	-0
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-17	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-57	-9
52	Foundries	-48	-2
60	Coating, Engraving, Heat Treating, and Allied Activities	-23	-2
72	Semiconductor and Other Electronic Component Manufacturing	-50	-4
97	Rail Transportation	-14	-1
103	Couriers and Messengers	-37	-1
117	Insurance Carriers	-26	-1
127	Specialized Design Services	-20	-2
129	Management, Scientific, and Technical Consulting Services	-63	-3
139	Investigation and Security Services	-27	-6
140	Services to Buildings and Dwellings	-31	-6
141	Other Support Services	-24	-3
152	Other Ambulatory Health Care Services	-21	-0

Chapter 23. Hagerstown-Martinsburg, MD-WV

Study Area Overview

The Hagerstown-Martinsburg, MD-WV study region occupies 1,008 square-miles and had a 2018 population of 285,836. The employed share of the regional labor force during the 2014-2018 period averaged 94.72%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Elementary and Secondary Schools. These three industries account for a combined 21.92% of the region's economy. The region's 2018 coefficient of specialization (COS) is 30.43, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Hagerstown-Martinsburg, MD-WV can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Couriers and Messengers, whose employment grew by 2,148 followed by Hospitals and Warehousing and Storage. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 5.69, 2.01, and 4.45.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
103	Couriers and Messengers	2,148	1,983	5.69
153	Hospitals	1,967	1,118	2.01
104	Warehousing and Storage	1,959	800	4.45
167	Food Services and Drinking Places	1,537	-478	1.06
143	Elementary and Secondary Schools	1,060	-598	9.55
137	Business Support Services	887	841	2.12
155	Individual and Family Services	810	289	0.80
151	Home Health Care Services	715	588	0.88
144	Junior Colleges, Colleges, Universities, and Professional Schools	558	437	0.89
95	All Other Retail	520	745	1.46

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Hagerstown-Martinsburg, MD-WV, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 2.78, followed by Machinery and Chemicals and Chemical-Based Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Hagerstown-Martinsburg, MD-WV cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

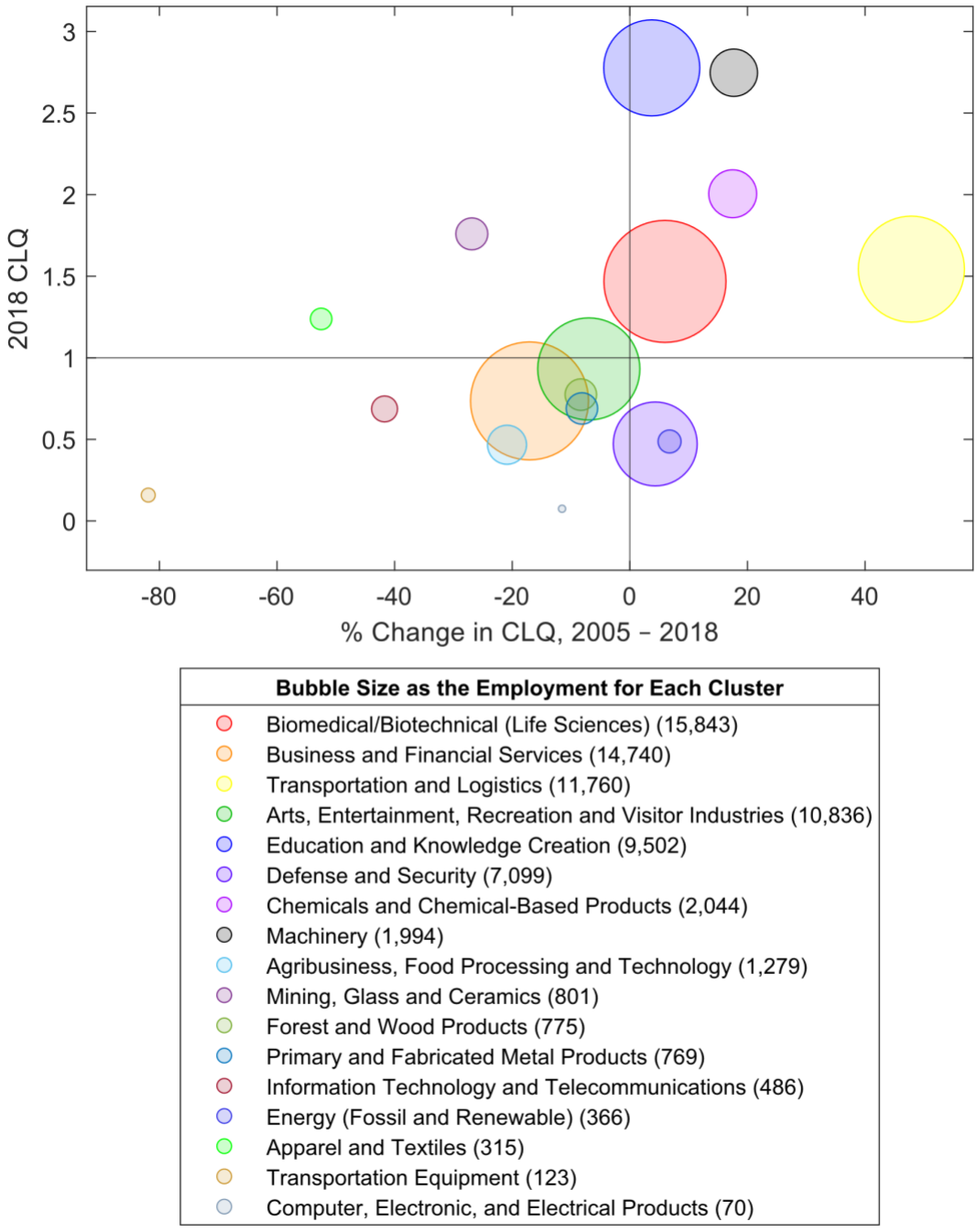
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.39	1.47	15,843
5	Business and Financial Services	0.89	0.74	14,740
16	Transportation and Logistics	1.04	1.54	11,760
3	Arts, Entertainment, Recreation and Visitor Industries	1.00	0.93	10,836
9	Education and Knowledge Creation	2.68	2.78	9,502
8	Defense and Security	0.45	0.47	7,099
6	Chemicals and Chemical-Based Products	1.71	2.01	2,044
13	Machinery	2.33	2.75	1,994
1	Agribusiness, Food Processing and Technology	0.59	0.47	1,279
14	Mining, Glass and Ceramics	2.41	1.76	801
11	Forest and Wood Products	0.84	0.77	775
15	Primary and Fabricated Metal Products	0.75	0.69	769
12	Information Technology and Telecommunications	1.18	0.69	486
10	Energy (Fossil and Renewable)	0.46	0.49	366
2	Apparel and Textiles	2.61	1.24	315
17	Transportation Equipment	0.88	0.16	123
7	Computer, Electronic, and Electrical Products	0.08	0.07	70

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Hagerstown-Martinsburg, MD-WV



2. CADS Analysis

The 2018 CADS analysis of the economy of Hagerstown-Martinsburg, MD-WV identifies 6 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Hospitals, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
4	Biomedical/Biotechnical (Life Sciences)	153	Hospitals	4,690	6,656
9	Education and Knowledge Creation	105	Newspaper, Periodical, Book, and Directory Publishers	1,314	1,259
16	Transportation and Logistics	104	Warehousing and Storage	1,315	3,274
16	Transportation and Logistics	99	Truck Transportation	1,621	1,654
16	Transportation and Logistics	103	Couriers and Messengers	657	2,805
5	Business and Financial Services	137	Business Support Services	407	1,294

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
153	Hospitals	2.01	1,118	18.09	41.94	0.93	0.11
105	Newspaper, Periodical, Book, and Directory Publishers	5.70	617	-51.13	-4.17	0.91	0.04
104	Warehousing and Storage	4.45	800	88.22	149.04	0.94	0.03
99	Truck Transportation	1.51	14	1.19	2.04	0.91	0.03
103	Couriers and Messengers	5.69	1,983	24.98	326.89	0.86	0.03
137	Business Support Services	2.12	841	11.43	218.04	0.95	0.01

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 153

Hospitals

Industry #	Industry Name	Employment
6	Oil and Gas Extraction	-3
31	Pulp, Paper, and Paperboard Mills	-2
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-2
72	Semiconductor and Other Electronic Component Manufacturing	-10
77	Electrical Equipment Manufacturing	-4
89	Medical Equipment and Supplies Manufacturing	-73
97	Rail Transportation	-3
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	N/A
161	Independent Artists, Writers, and Performers	-1
169	Electronic and Precision Equipment Repair and Maintenance	-6

Table 6. Phase 2 Deficits Adding Anchor Industry 105

Newspaper, Periodical, Book, and Directory Publishers

Industry #	Industry Name	Employment	Added to Deficit
6	Oil and Gas Extraction	-3	-1
31	Pulp, Paper, and Paperboard Mills	-8	-6
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-6	-4
72	Semiconductor and Other Electronic Component Manufacturing	-15	-5

77	Electrical Equipment Manufacturing	-4	-1
89	Medical Equipment and Supplies Manufacturing	-73	-0
97	Rail Transportation	-4	-1
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	N/A	-20
161	Independent Artists, Writers, and Performers	-5	-4
169	Electronic and Precision Equipment Repair and Maintenance	-7	-1

Table 7. Phase 3 Deficits Adding Anchor Industry 104

Warehousing and Storage

Industry #	Industry Name	Employment	Added to Deficit
6	Oil and Gas Extraction	-5	-1
31	Pulp, Paper, and Paperboard Mills	-9	-1
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-9	-3
72	Semiconductor and Other Electronic Component Manufacturing	-20	-5
77	Electrical Equipment Manufacturing	-9	-5
89	Medical Equipment and Supplies Manufacturing	-73	-0
97	Rail Transportation	-6	-2
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	N/A	-15
161	Independent Artists, Writers, and Performers	-7	-2
169	Electronic and Precision Equipment Repair and Maintenance	-9	-2

Table 8. Phase 4 Deficits Adding Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment	Added to Deficit
6	Oil and Gas Extraction	-9	-4
31	Pulp, Paper, and Paperboard Mills	-10	-1
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-10	-1
72	Semiconductor and Other Electronic Component Manufacturing	-23	-3
77	Electrical Equipment Manufacturing	-10	-1
89	Medical Equipment and Supplies Manufacturing	-73	-0
97	Rail Transportation	-14	-8
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-6	-157
161	Independent Artists, Writers, and Performers	-10	-3
169	Electronic and Precision Equipment Repair and Maintenance	-10	-2

Table 9. Phase 5 Deficits Adding Anchor Industry 103

Couriers and Messengers

Industry #	Industry Name	Employment	Added to Deficit
6	Oil and Gas Extraction	-16	-8
31	Pulp, Paper, and Paperboard Mills	-13	-3
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-11	-1

72	Semiconductor and Other Electronic Component Manufacturing	-26	-3
77	Electrical Equipment Manufacturing	-11	-1
89	Medical Equipment and Supplies Manufacturing	-73	-0
97	Rail Transportation	-16	-1
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-155	-148
161	Independent Artists, Writers, and Performers	-11	-1
169	Electronic and Precision Equipment Repair and Maintenance	-12	-1

Table 10. Phase 6 Deficits Adding Anchor Industry 137

Business Support Services

Industry #	Industry Name	Employment	Added to Deficit
6	Oil and Gas Extraction	-17	-0
31	Pulp, Paper, and Paperboard Mills	-14	-1
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-12	-1
72	Semiconductor and Other Electronic Component Manufacturing	-27	-1
77	Electrical Equipment Manufacturing	-12	-1
89	Medical Equipment and Supplies Manufacturing	-74	-0
97	Rail Transportation	-16	-0
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-159	-4
161	Independent Artists, Writers, and Performers	-12	-1
169	Electronic and Precision Equipment Repair and Maintenance	-12	-1

Chapter 24. Harriman, TN

Study Area Overview

The Harriman, TN study region occupies 361 square-miles and had a 2018 population of 53,140. The employed share of the regional labor force during the 2014-2018 period averaged 94.1%. The Specialized Design Services industry was the region's largest employer in 2018, followed by Scientific Research and Development Services and Advertising and Related Services. These three industries account for a combined 24.34% of the region's economy. The region's 2018 coefficient of specialization (COS) is 49, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Harriman, TN can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Specialized Design Services, whose employment grew by 1,780 followed by Advertising and Related Services and Architectural, Engineering, and Related Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 54.13, 20.36, and 6.71.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
127	Specialized Design Services	1,780	1,780	54.13
131	Advertising and Related Services	1,263	1,263	20.36
126	Architectural, Engineering, and Related Services	867	837	6.71
136	Employment Services	490	490	1.22
155	Individual and Family Services	450	450	1.55
181	Government and Unclassified	222	198	0.34
139	Investigation and Security Services	206	200	2.09
135	Facilities Support Services	179	179	10.21
143	Elementary and Secondary Schools	177	17	5.88
146	Offices of Physicians	80	48	0.70

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Harriman, TN, the cluster with the largest CLQ in 2018 is Mining, Glass and Ceramics with a CLQ of 5.46, followed by Education and Knowledge Creation and Energy (Fossil and Renewable). The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Harriman, TN cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

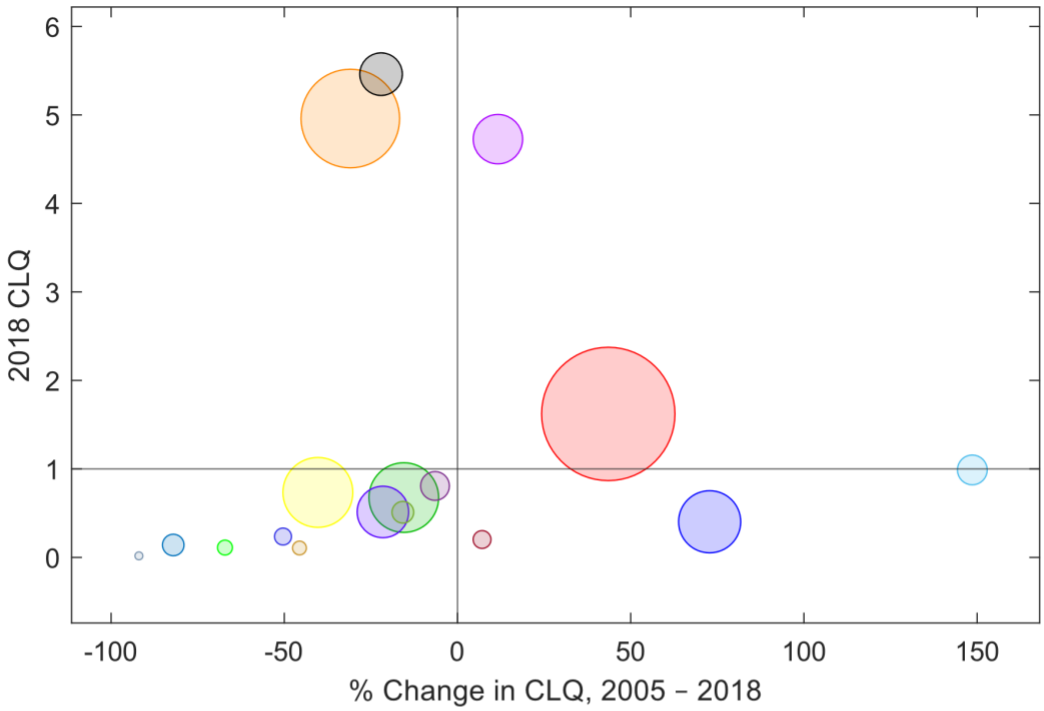
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
5	Business and Financial Services	1.13	1.62	5,689
9	Education and Knowledge Creation	7.18	4.96	2,972
4	Biomedical/Biotechnical (Life Sciences)	1.23	0.73	1,388
3	Arts, Entertainment, Recreation and Visitor Industries	0.80	0.68	1,378
8	Defense and Security	0.23	0.40	1,062
16	Transportation and Logistics	0.65	0.51	686
10	Energy (Fossil and Renewable)	4.23	4.73	621
14	Mining, Glass and Ceramics	7.01	5.46	435
11	Forest and Wood Products	0.40	0.99	173
15	Primary and Fabricated Metal Products	0.86	0.81	158
17	Transportation Equipment	0.61	0.51	69
1	Agribusiness, Food Processing and Technology	0.78	0.14	67
6	Chemicals and Chemical-Based Products	0.19	0.20	36
13	Machinery	0.48	0.24	30
7	Computer, Electronic, and Electrical Products	0.34	0.11	18
12	Information Technology and Telecommunications	0.20	0.11	13
2	Apparel and Textiles	0.22	0.02	1

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Harriman, TN



Bubble Size as the Employment for Each Cluster
Business and Financial Services (5,689)
Education and Knowledge Creation (2,972)
Biomedical/Biotechnical (Life Sciences) (1,388)
Arts, Entertainment, Recreation and Visitor Industries (1,378)
Defense and Security (1,062)
Transportation and Logistics (686)
Energy (Fossil and Renewable) (621)
Mining, Glass and Ceramics (435)
Forest and Wood Products (173)
Primary and Fabricated Metal Products (158)
Transportation Equipment (69)
Agribusiness, Food Processing and Technology (67)
Chemicals and Chemical-Based Products (36)
Machinery (30)
Computer, Electronic, and Electrical Products (18)
Information Technology and Telecommunications (13)
Apparel and Textiles (1)

2. CADS Analysis

The 2018 CADS analysis of the economy of Harriman, TN identifies 1 anchor industry in 1 cluster. Identified anchor and its parent cluster are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industry and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Electric Power Generation, Transmission and Distribution, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
10	Energy (Fossil and Renewable)	11	Electric Power Generation, Transmission and Distribution	521	528

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
11	Electric Power Generation, Transmission and Distribution	11.95	20	-2.47	1.37	0.66	0.19

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 11

Electric Power Generation, Transmission and Distribution

Industry #	Industry Name	Employment
6	Oil and Gas Extraction	-12
7	Coal Mining	-13
97	Rail Transportation	-12
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-38
137	Business Support Services	-11

Chapter 25. Huntingdon, PA

Study Area Overview

The Huntingdon, PA study region occupies 875 square-miles and had a 2018 population of 45,168. The employed share of the regional labor force during the 2014-2018 period averaged 95%. The Government and Unclassified industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Food Services and Drinking Places. These three industries account for a combined 28.26% of the region's economy. The region's 2018 coefficient of specialization (COS) is 32.51, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Huntingdon, PA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Individual and Family Services, whose employment grew by 255 followed by General Merchandise Stores and Offices of Other Health Practitioners. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 2.24, 1.4, and 3.27.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
155	Individual and Family Services	255	60	2.24
94	General Merchandise Stores	249	245	1.40
148	Offices of Other Health Practitioners	215	178	3.27
144	Junior Colleges, Colleges, Universities, and Professional Schools	215	134	3.83
167	Food Services and Drinking Places	142	-73	0.91
56	Boiler, Tank, and Shipping Container Manufacturing	81	81	11.36
78	Other Electrical Equipment and Component Manufacturing	79	79	6.89
141	Other Support Services	67	66	2.49
54	Cutlery and Handtool Manufacturing	62	62	20.73
81	Motor Vehicle Parts Manufacturing	59	59	1.25

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Huntingdon, PA, the cluster with the largest CLQ in 2018 is Forest and Wood Products with a CLQ of 3.93, followed by Education and Knowledge Creation and Mining, Glass and Ceramics. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Huntingdon, PA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

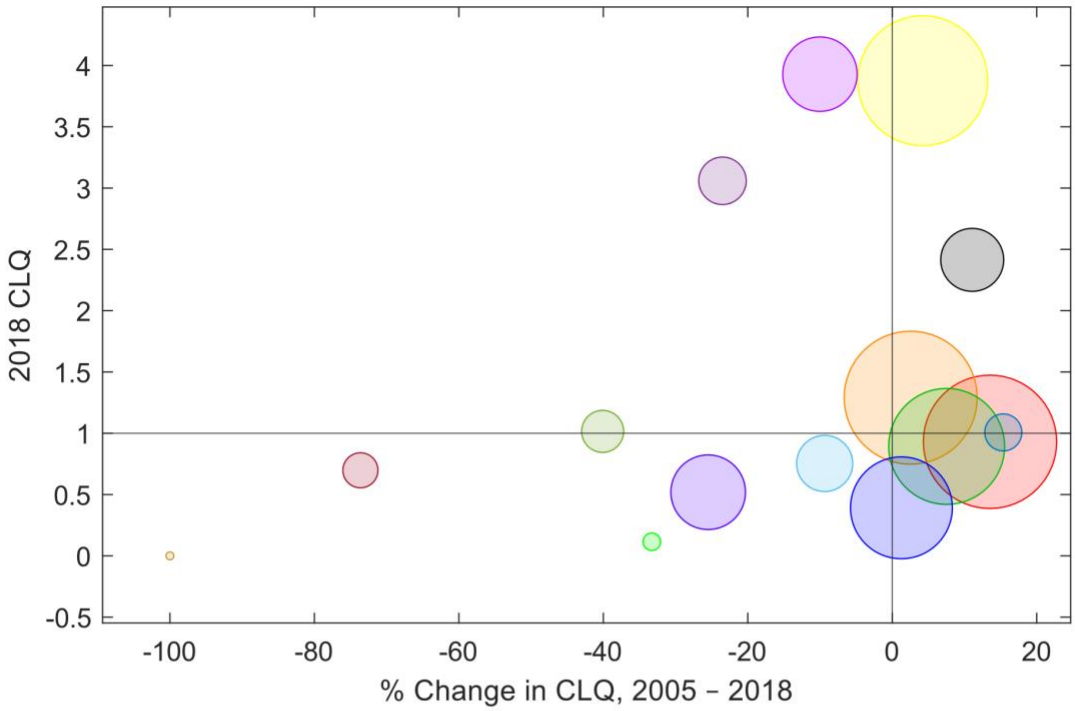
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
8	Defense and Security	0.82	0.93	1,694
4	Biomedical/Biotechnical (Life Sciences)	1.26	1.29	1,685
9	Education and Knowledge Creation	3.72	3.88	1,606
3	Arts, Entertainment, Recreation and Visitor Industries	0.83	0.89	1,257
5	Business and Financial Services	0.39	0.39	950
16	Transportation and Logistics	0.70	0.52	479
11	Forest and Wood Products	4.37	3.93	476
15	Primary and Fabricated Metal Products	2.17	2.41	326
1	Agribusiness, Food Processing and Technology	0.83	0.75	250
14	Mining, Glass and Ceramics	4.00	3.06	169
6	Chemicals and Chemical-Based Products	1.69	1.02	125
10	Energy (Fossil and Renewable)	0.87	1.01	91
7	Computer, Electronic, and Electrical Products	2.65	0.70	79
17	Transportation Equipment	0.00	0.63	59
12	Information Technology and Telecommunications	0.17	0.11	10
2	Apparel and Textiles	5.28	0.00	0
13	Machinery	0.00	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Huntingdon, PA



Bubble Size as the Employment for Each Cluster
Defense and Security (1,694)
Biomedical/Biotechnical (Life Sciences) (1,685)
Education and Knowledge Creation (1,606)
Arts, Entertainment, Recreation and Visitor Industries (1,257)
Business and Financial Services (950)
Transportation and Logistics (479)
Forest and Wood Products (476)
Primary and Fabricated Metal Products (326)
Agribusiness, Food Processing and Technology (250)
Mining, Glass and Ceramics (169)
Chemicals and Chemical-Based Products (125)
Energy (Fossil and Renewable) (91)
Computer, Electronic, and Electrical Products (79)
Transportation Equipment (59)
Information Technology and Telecommunications (10)
Apparel and Textiles (0)
Machinery (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Huntingdon, PA identifies 4 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Junior Colleges, Colleges, Universities, and Professional Schools, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
9	Education and Knowledge Creation	144	Junior Colleges, Colleges, Universities, and Professional Schools	340	555
1	Agribusiness, Food Processing and Technology	2	Animal Production	149	204
3	Arts, Entertainment, Recreation and Visitor Industries	166	Accommodation	183	235
4	Biomedical/Biotechnical (Life Sciences)	148	Offices of Other Health Practitioners	62	277

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

Anchor #	Anchor Industry Name	LQ	RS	Industry Growth Rate (%) National	Industry Growth Rate (%) Regional	AS	AD
144	Junior Colleges, Colleges, Universities, and Professional Schools	3.83	134	23.90	63.20	0.82	0.05
2	Animal Production	3.29	75	-13.46	36.91	0.61	0.04
166	Accommodation	1.46	33	10.44	28.42	0.77	0.02
148	Offices of Other Health Practitioners	3.27	178	59.61	346.77	0.64	0.02

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 144

Junior Colleges, Colleges, Universities, and Professional Schools

Industry #	Industry Name	Employment

Table 6. Phase 2 Deficits Adding Anchor Industry 2

Animal Production

Industry #	Industry Name	Employment	Added to Deficit

Table 7. Phase 3 Deficits Adding Anchor Industry 166

Accommodation

Industry #	Industry Name	Employment	Added to Deficit

Table 8. Phase 4 Deficits Adding Anchor Industry 148

Offices of Other Health Practitioners

Industry #	Industry Name	Employment	Added to Deficit

Note: If no industries with deficits greater than 10 employees are identified for a given analysis phase, deficit tables will include only column headings.

Chapter 26. Huntington-Ashland, WV-KY-OH

Study Area Overview

The Huntington-Ashland, WV-KY-OH study region occupies 1,744 square-miles and had a 2018 population of 275,542. The employed share of the regional labor force during the 2014-2018 period averaged 94.48%. The Hospitals industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and All Other Retail. These three industries account for a combined 28.02% of the region's economy. The region's 2018 coefficient of specialization (COS) is 33.57, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Huntington-Ashland, WV-KY-OH can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Hospitals, whose employment grew by 1,906 followed by Individual and Family Services and Food Services and Drinking Places. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 3.36, 1.69, and 1.31.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
153	Hospitals	1,906	219	3.36
155	Individual and Family Services	1,668	513	1.69
167	Food Services and Drinking Places	933	-1,870	1.31
151	Home Health Care Services	876	319	1.56
149	Outpatient Care Centers	504	-278	2.22
146	Offices of Physicians	494	-307	2.19
34	Petroleum and Coal Products Manufacturing	418	401	12.98
132	Other Professional, Scientific, and Technical Services	271	108	1.14
145	Other Educational Services	256	113	0.89
89	Medical Equipment and Supplies Manufacturing	222	201	3.42

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Huntington-Ashland, WV-KY-OH, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 2.81, followed by Primary and Fabricated Metal Products and Biomedical/Biotechnical (Life Sciences). The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Huntington-Ashland, WV-KY-OH cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

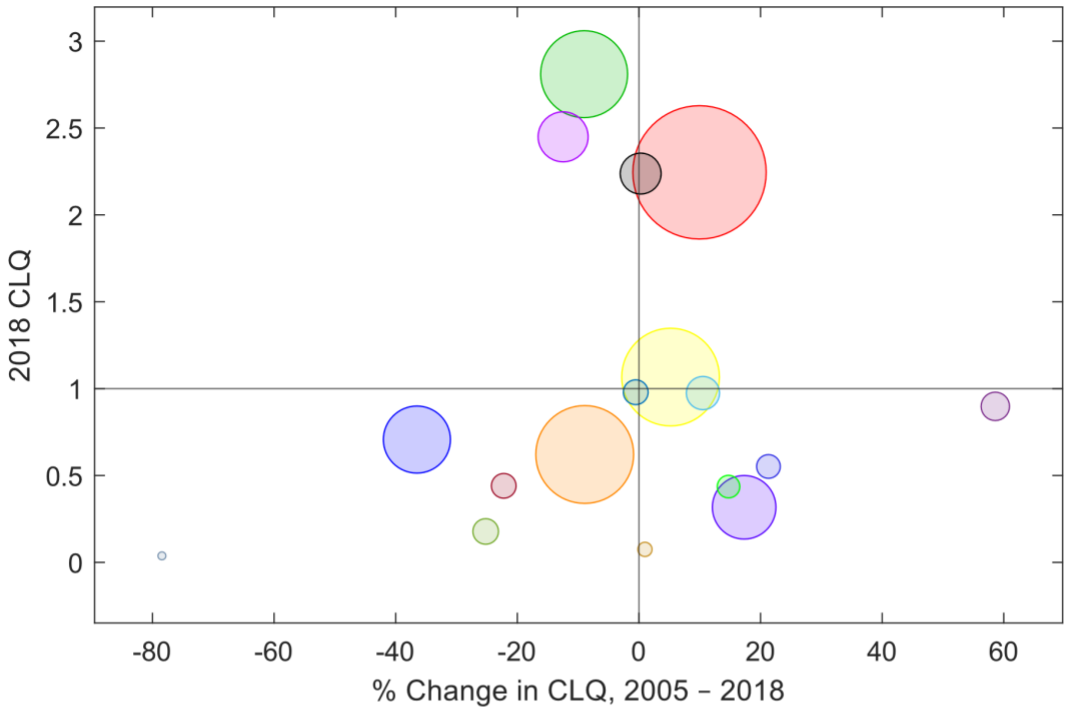
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	2.04	2.24	24,404
5	Business and Financial Services	0.68	0.62	12,534
3	Arts, Entertainment, Recreation and Visitor Industries	1.01	1.07	12,497
9	Education and Knowledge Creation	3.09	2.81	9,688
16	Transportation and Logistics	1.11	0.71	5,426
8	Defense and Security	0.27	0.32	4,804
15	Primary and Fabricated Metal Products	2.80	2.45	2,752
10	Energy (Fossil and Renewable)	2.23	2.24	1,692
6	Chemicals and Chemical-Based Products	0.88	0.97	1,001
13	Machinery	0.57	0.90	657
1	Agribusiness, Food Processing and Technology	0.24	0.18	491
14	Mining, Glass and Ceramics	0.98	0.98	449
11	Forest and Wood Products	0.57	0.44	444
12	Information Technology and Telecommunications	0.46	0.55	394
17	Transportation Equipment	0.38	0.44	340
7	Computer, Electronic, and Electrical Products	0.07	0.07	71
2	Apparel and Textiles	0.17	0.04	10

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Huntington-Ashland, WV-KY-OH



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (24,404)
Business and Financial Services (12,534)
Arts, Entertainment, Recreation and Visitor Industries (12,497)
Education and Knowledge Creation (9,688)
Transportation and Logistics (5,426)
Defense and Security (4,804)
Primary and Fabricated Metal Products (2,752)
Energy (Fossil and Renewable) (1,692)
Chemicals and Chemical-Based Products (1,001)
Machinery (657)
Agribusiness, Food Processing and Technology (491)
Mining, Glass and Ceramics (449)
Forest and Wood Products (444)
Information Technology and Telecommunications (394)
Transportation Equipment (340)
Computer, Electronic, and Electrical Products (71)
Apparel and Textiles (10)

2. CADS Analysis

The 2018 CADS analysis of the economy of Huntington-Ashland, WV-KY-OH identifies 2 anchor industries in 1 different cluster. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Hospitals, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
4	Biomedical/Biotechnical (Life Sciences)	153	Hospitals	9,329	11,235
4	Biomedical/Biotechnical (Life Sciences)	151	Home Health Care Services	701	1,577

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
153	Hospitals	3.36	219	18.09	20.43	0.84	0.14
151	Home Health Care Services	1.56	319	79.39	124.87	0.97	0.01

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 153

Hospitals

Industry #	Industry Name	Employment
1	Crop Production	-14
2	Animal Production	-30
26	Textile Mills and Textile Product Mills	-14
38	Pharmaceutical and Medicine Manufacturing	-26
72	Semiconductor and Other Electronic Component Manufacturing	-17
117	Insurance Carriers	-297
129	Management, Scientific, and Technical Consulting Services	-40
135	Facilities Support Services	-30
136	Employment Services	-74
161	Independent Artists, Writers, and Performers	-19

Table 6. Phase 2 Deficits Adding Anchor Industry 151

Home Health Care Services

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-14	-1
2	Animal Production	-30	-0
26	Textile Mills and Textile Product Mills	-15	-0
38	Pharmaceutical and Medicine Manufacturing	-27	-1
72	Semiconductor and Other Electronic Component Manufacturing	-18	-1
117	Insurance Carriers	-298	-1
129	Management, Scientific, and Technical Consulting Services	-47	-7
135	Facilities Support Services	-31	-1
136	Employment Services	-110	-36
161	Independent Artists, Writers, and Performers	-20	-1

Chapter 27. Huntsville, AL

Study Area Overview

The Huntsville, AL study region occupies 1,362 square-miles and had a 2018 population of 462,693. The employed share of the regional labor force during the 2014-2018 period averaged 94.81%. The Government and Unclassified industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Architectural, Engineering, and Related Services. These three industries account for a combined 24.15% of the region's economy. The region's 2018 coefficient of specialization (COS) is 30.02, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Huntsville, AL can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Food Services and Drinking Places, whose employment grew by 4,169 followed by Computer Systems Design and Related Services and Employment Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 1.06, 3.33, and 1.54.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	4,169	64	1.06
128	Computer Systems Design and Related Services	3,929	-469	3.33
136	Employment Services	3,880	3,849	1.54
143	Elementary and Secondary Schools	3,517	212	9.73
181	Government and Unclassified	3,400	2,720	0.69
82	Aerospace Product and Parts Manufacturing	2,233	1,811	8.36
14	Construction	2,125	2,286	0.67
130	Scientific Research and Development Services	2,018	1,495	5.11
126	Architectural, Engineering, and Related Services	1,819	557	7.03
79	Motor Vehicle Manufacturing	1,332	1,341	4.67

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Huntsville, AL, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 3.47, followed by Computer, Electronic, and Electrical Products and Transportation Equipment. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Huntsville, AL cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

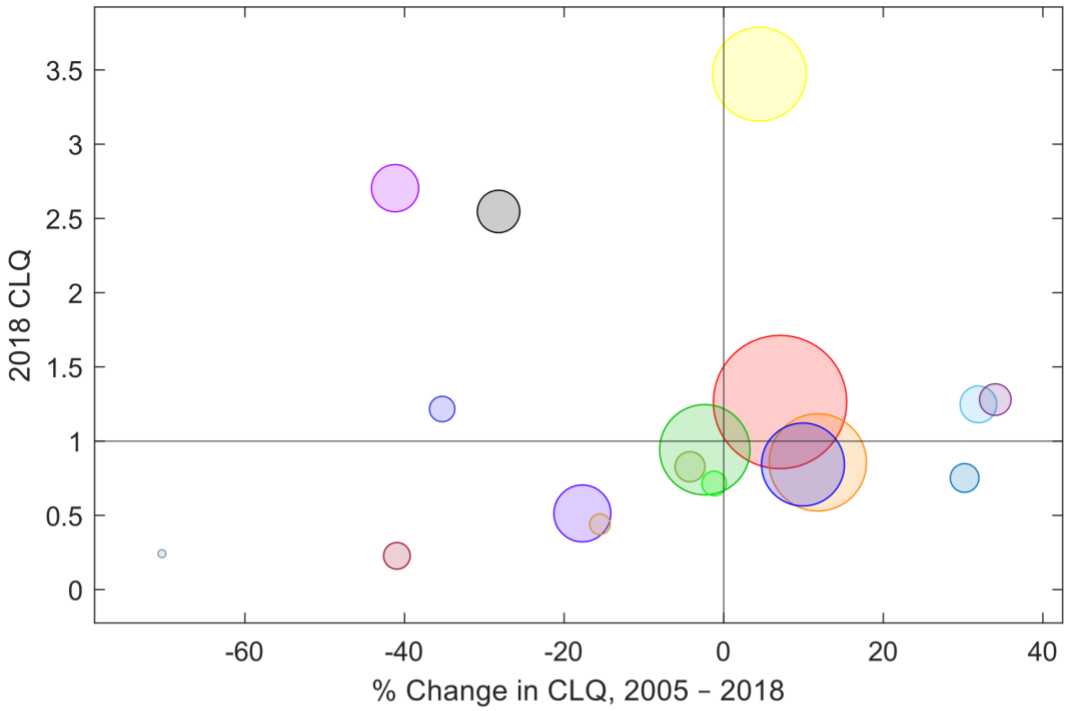
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
5	Business and Financial Services	1.18	1.26	54,716
8	Defense and Security	0.77	0.86	27,865
9	Education and Knowledge Creation	3.32	3.47	25,678
3	Arts, Entertainment, Recreation and Visitor Industries	0.97	0.94	23,689
4	Biomedical/Biotechnical (Life Sciences)	0.77	0.84	19,660
16	Transportation and Logistics	0.62	0.51	8,456
7	Computer, Electronic, and Electrical Products	4.60	2.70	5,494
17	Transportation Equipment	3.55	2.55	4,264
15	Primary and Fabricated Metal Products	0.95	1.25	3,008
10	Energy (Fossil and Renewable)	0.95	1.28	2,076
6	Chemicals and Chemical-Based Products	0.86	0.83	1,824
11	Forest and Wood Products	0.58	0.75	1,628
1	Agribusiness, Food Processing and Technology	0.39	0.23	1,347
14	Mining, Glass and Ceramics	1.88	1.22	1,196
12	Information Technology and Telecommunications	0.72	0.71	1,094
13	Machinery	0.52	0.44	691
2	Apparel and Textiles	0.82	0.24	133

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Huntsville, AL



Bubble Size as the Employment for Each Cluster
Business and Financial Services (54,716)
Defense and Security (27,865)
Education and Knowledge Creation (25,678)
Arts, Entertainment, Recreation and Visitor Industries (23,689)
Biomedical/Biotechnical (Life Sciences) (19,660)
Transportation and Logistics (8,456)
Computer, Electronic, and Electrical Products (5,494)
Transportation Equipment (4,264)
Primary and Fabricated Metal Products (3,008)
Energy (Fossil and Renewable) (2,076)
Chemicals and Chemical-Based Products (1,824)
Forest and Wood Products (1,628)
Agribusiness, Food Processing and Technology (1,347)
Mining, Glass and Ceramics (1,196)
Information Technology and Telecommunications (1,094)
Machinery (691)
Apparel and Textiles (133)

2. CADS Analysis

The 2018 CADS analysis of the economy of Huntsville, AL identifies 6 anchor industries in 4 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Architectural, Engineering, and Related Services, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
5	Business and Financial Services	126	Architectural, Engineering, and Related Services	13,473	15,293
8	Defense and Security	82	Aerospace Product and Parts Manufacturing	3,733	5,966
9	Education and Knowledge Creation	130	Scientific Research and Development Services	2,964	4,981
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	3,778	5,094
5	Business and Financial Services	136	Employment Services	4,004	7,884
5	Business and Financial Services	137	Business Support Services	2,208	2,733

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
126	Architectural, Engineering, and Related Services	7.03	557	9.37	13.50	0.94	0.12
82	Aerospace Product and Parts Manufacturing	8.36	1,811	11.31	59.81	0.94	0.09
130	Scientific Research and Development Services	5.11	1,495	17.65	68.08	0.95	0.06

146	Offices of Physicians	1.37	395	24.38	34.83	0.98	0.03
136	Employment Services	1.54	3,849	0.78	96.91	0.98	0.02
137	Business Support Services	2.07	273	11.43	23.78	0.97	0.01

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 126

Architectural, Engineering, and Related Services

Industry #	Industry Name	Employment
31	Pulp, Paper, and Paperboard Mills	-9
35	Basic Chemical Manufacturing	-14
43	Rubber Product Manufacturing	-22
49	Steel Product Manufacturing From Purchased Steel	-10
50	Alumina and Aluminum Production and Processing	-7
57	Hardware Manufacturing	-6
58	Spring and Wire Product Manufacturing	-10
97	Rail Transportation	-12
104	Warehousing and Storage	N/A
127	Specialized Design Services	-47
131	Advertising and Related Services	N/A
133	Management of Companies and Enterprises	N/A
134	Office Administrative Services	-92
141	Other Support Services	-14
161	Independent Artists, Writers, and Performers	-23

Table 6. Phase 2 Deficits Adding Anchor Industry 82

Aerospace Product and Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
31	Pulp, Paper, and Paperboard Mills	-14	-5
35	Basic Chemical Manufacturing	-25	-11
43	Rubber Product Manufacturing	-39	-17
49	Steel Product Manufacturing From Purchased Steel	-36	-26
50	Alumina and Aluminum Production and Processing	-29	-22
57	Hardware Manufacturing	-29	-24
58	Spring and Wire Product Manufacturing	-63	-53
97	Rail Transportation	-22	-10
104	Warehousing and Storage	-50	-151
127	Specialized Design Services	-91	-44
131	Advertising and Related Services	N/A	-23
133	Management of Companies and Enterprises	N/A	-316
134	Office Administrative Services	-108	-17
141	Other Support Services	-55	-41
161	Independent Artists, Writers, and Performers	-30	-7

Table 7. Phase 3 Deficits Adding Anchor Industry 130

Scientific Research and Development Services

Industry #	Industry Name	Employment	Added to Deficit
31	Pulp, Paper, and Paperboard Mills	-19	-5
35	Basic Chemical Manufacturing	-36	-11
43	Rubber Product Manufacturing	-69	-30
49	Steel Product Manufacturing From Purchased Steel	-40	-4
50	Alumina and Aluminum Production and Processing	-32	-3
57	Hardware Manufacturing	-32	-3
58	Spring and Wire Product Manufacturing	-66	-3
97	Rail Transportation	-29	-7
104	Warehousing and Storage	-97	-47
127	Specialized Design Services	-108	-17
131	Advertising and Related Services	-74	-75
133	Management of Companies and Enterprises	-133	-179
134	Office Administrative Services	-199	-91
141	Other Support Services	-86	-31
161	Independent Artists, Writers, and Performers	-44	-14

Table 8. Phase 4 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
31	Pulp, Paper, and Paperboard Mills	-20	-2
35	Basic Chemical Manufacturing	-43	-6
43	Rubber Product Manufacturing	-70	-1
49	Steel Product Manufacturing From Purchased Steel	-41	-1
50	Alumina and Aluminum Production and Processing	-33	-0
57	Hardware Manufacturing	-32	-0
58	Spring and Wire Product Manufacturing	-67	-0
97	Rail Transportation	-31	-2

104	Warehousing and Storage	-114	-17
127	Specialized Design Services	-122	-14
131	Advertising and Related Services	-89	-15
133	Management of Companies and Enterprises	-270	-137
134	Office Administrative Services	-233	-33
141	Other Support Services	-99	-13
161	Independent Artists, Writers, and Performers	-51	-7

Table 9. Phase 5 Deficits Adding Anchor Industry 136

Employment Services

Industry #	Industry Name	Employment	Added to Deficit
31	Pulp, Paper, and Paperboard Mills	-21	-0
35	Basic Chemical Manufacturing	-43	-0
43	Rubber Product Manufacturing	-70	-0
49	Steel Product Manufacturing From Purchased Steel	-41	-0
50	Alumina and Aluminum Production and Processing	-33	-0
57	Hardware Manufacturing	-32	-0
58	Spring and Wire Product Manufacturing	-67	-0
97	Rail Transportation	-31	-0
104	Warehousing and Storage	-119	-5
127	Specialized Design Services	-123	-2
131	Advertising and Related Services	-93	-4
133	Management of Companies and Enterprises	-322	-52
134	Office Administrative Services	-250	-17
141	Other Support Services	-101	-2
161	Independent Artists, Writers, and Performers	-52	-2

Table 10. Phase 6 Deficits Adding Anchor Industry 137

Business Support Services

Industry #	Industry Name	Employment	Added to Deficit
31	Pulp, Paper, and Paperboard Mills	-22	-1
35	Basic Chemical Manufacturing	-44	-1
43	Rubber Product Manufacturing	-71	-1
49	Steel Product Manufacturing From Purchased Steel	-41	-0
50	Alumina and Aluminum Production and Processing	-33	-0
57	Hardware Manufacturing	-32	-0
58	Spring and Wire Product Manufacturing	-67	-0
97	Rail Transportation	-32	-0
104	Warehousing and Storage	-128	-9
127	Specialized Design Services	-125	-2
131	Advertising and Related Services	-99	-6
133	Management of Companies and Enterprises	-348	-26
134	Office Administrative Services	-264	-14
141	Other Support Services	-107	-6
161	Independent Artists, Writers, and Performers	-54	-2

Chapter 28. Indiana, PA

Study Area Overview

The Indiana, PA study region occupies 827 square-miles and had a 2018 population of 84,501. The employed share of the regional labor force during the 2014-2018 period averaged 95.1%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Wholesale Trade and Elementary and Secondary Schools. These three industries account for a combined 19.59% of the region's economy. The region's 2018 coefficient of specialization (COS) is 34.77, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Indiana, PA can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Wholesale Trade, whose employment grew by 739 followed by Offices of Physicians and Business Support Services. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 1.54, 1.37, and 1.98.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
91	Wholesale Trade	739	734	1.54
146	Offices of Physicians	278	182	1.37
137	Business Support Services	223	209	1.98
167	Food Services and Drinking Places	198	-487	1.12
133	Management of Companies and Enterprises	170	69	1.05
151	Home Health Care Services	164	-39	1.47
155	Individual and Family Services	155	-478	1.65
181	Government and Unclassified	149	104	0.33
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	99	98	2.34
148	Offices of Other Health Practitioners	66	-218	2.72

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Indiana, PA, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 9.98, followed by Education and Knowledge Creation and Primary and Fabricated Metal Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Indiana, PA cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

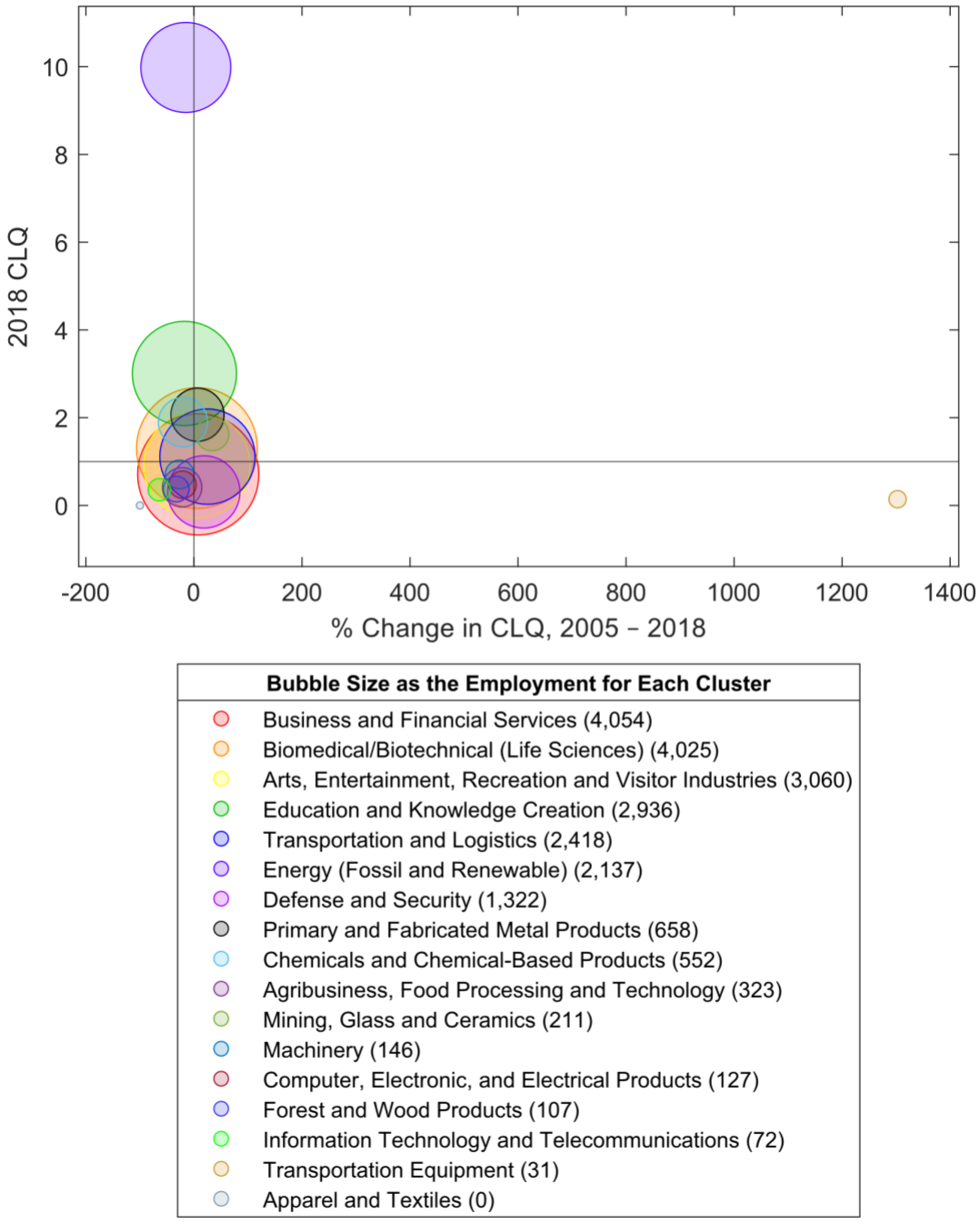
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
5	Business and Financial Services	0.66	0.71	4,054
4	Biomedical/Biotechnical (Life Sciences)	1.24	1.31	4,025
3	Arts, Entertainment, Recreation and Visitor Industries	0.87	0.92	3,060
9	Education and Knowledge Creation	3.65	3.01	2,936
16	Transportation and Logistics	0.89	1.11	2,418
10	Energy (Fossil and Renewable)	11.75	9.98	2,137
8	Defense and Security	0.26	0.31	1,322
15	Primary and Fabricated Metal Products	1.94	2.07	658
6	Chemicals and Chemical-Based Products	2.38	1.90	552
1	Agribusiness, Food Processing and Technology	0.53	0.41	323
14	Mining, Glass and Ceramics	1.21	1.62	211
13	Machinery	0.96	0.71	146
7	Computer, Electronic, and Electrical Products	0.60	0.47	127
11	Forest and Wood Products	0.56	0.37	107
12	Information Technology and Telecommunications	1.00	0.36	72
17	Transportation Equipment	0.01	0.14	31
2	Apparel and Textiles	0.06	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Indiana, PA



2. CADS Analysis

The 2018 CADS analysis of the economy of Indiana, PA identifies 2 anchor industries in 2 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Wholesale Trade, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
16	Transportation and Logistics	91	Wholesale Trade	949	1,688
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	392	670

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
91	Wholesale Trade	1.54	734	0.53	77.87	0.80	0.12
146	Offices of Physicians	1.37	182	24.38	70.92	0.83	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at

any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 91

Wholesale Trade

Industry #	Industry Name	Employment
104	Warehousing and Storage	-55
136	Employment Services	-49
139	Investigation and Security Services	-25

Table 6. Phase 2 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
104	Warehousing and Storage	-57	-2
136	Employment Services	-76	-27
139	Investigation and Security Services	-31	-5

Chapter 29. Ithaca, NY

Study Area Overview

The Ithaca, NY study region occupies 475 square-miles and had a 2018 population of 102,793. The employed share of the regional labor force during the 2014-2018 period averaged 96.9%. The Junior Colleges, Colleges, Universities, and Professional Schools industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Elementary and Secondary Schools. These three industries account for a combined 45.17% of the region's economy. The region's 2018 coefficient of specialization (COS) is 44.86, which indicates that it is more specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Ithaca, NY can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Food Services and Drinking Places, whose employment grew by 1,052 followed by Management of Companies and Enterprises and Nursing and Residential Care Facilities. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 1.01, 0.42, and 1.94.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	1,052	215	1.01
133	Management of Companies and Enterprises	275	262	0.42
154	Nursing and Residential Care Facilities	262	-54	1.94
177	Grantmaking and Giving Services and Social Advocacy Organizations	192	121	3.14
85	Other Transportation Equipment Manufacturing	174	174	15.98
165	Other Amusement and Recreation Industries	161	97	0.84
181	Government and Unclassified	159	81	0.32
168	Automotive Repair and Maintenance	143	142	1.02
130	Scientific Research and Development Services	133	67	2.30
145	Other Educational Services	131	29	1.14

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Ithaca, NY, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 12, followed by Transportation Equipment and Computer, Electronic, and Electrical Products. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Ithaca, NY cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

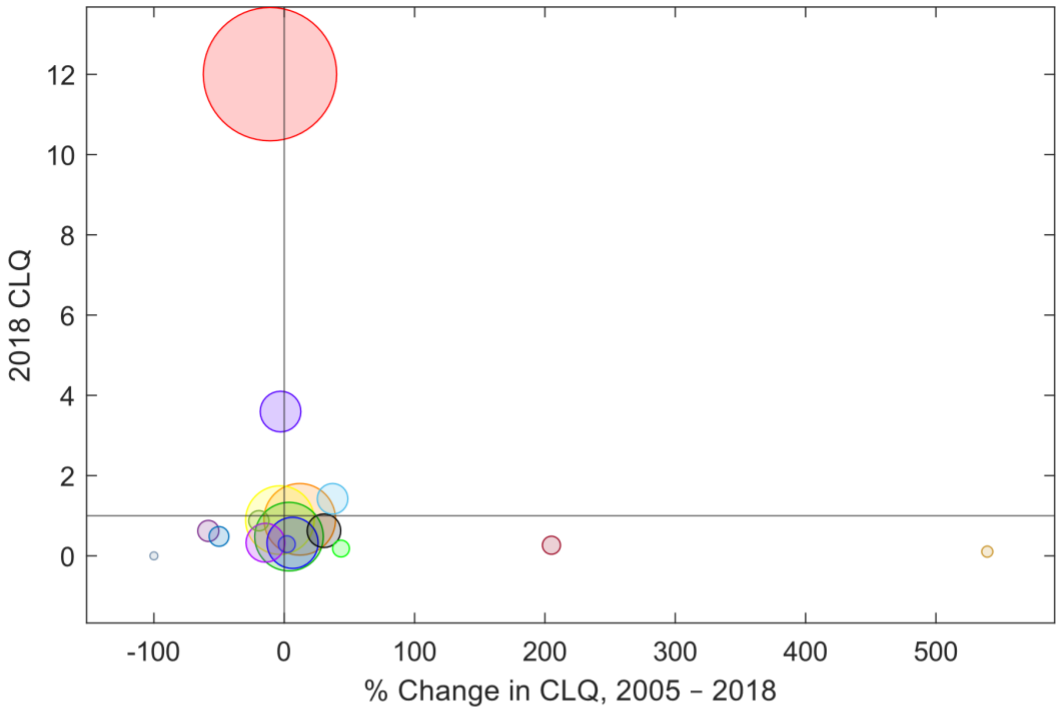
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
9	Education and Knowledge Creation	13.48	12.00	20,035
3	Arts, Entertainment, Recreation and Visitor Industries	0.81	0.91	5,165
4	Biomedical/Biotechnical (Life Sciences)	0.92	0.89	4,686
5	Business and Financial Services	0.46	0.48	4,683
8	Defense and Security	0.30	0.32	2,373
17	Transportation Equipment	3.70	3.60	1,359
16	Transportation and Logistics	0.38	0.33	1,216
1	Agribusiness, Food Processing and Technology	0.48	0.63	836
7	Computer, Electronic, and Electrical Products	1.04	1.42	652
13	Machinery	1.49	0.62	220
14	Mining, Glass and Ceramics	1.09	0.87	194
10	Energy (Fossil and Renewable)	0.97	0.48	177
11	Forest and Wood Products	0.09	0.27	129
12	Information Technology and Telecommunications	0.28	0.29	100
15	Primary and Fabricated Metal Products	0.13	0.18	99
2	Apparel and Textiles	0.02	0.11	13
6	Chemicals and Chemical-Based Products	0.04	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Ithaca, NY



Bubble Size as the Employment for Each Cluster
Education and Knowledge Creation (20,035)
Arts, Entertainment, Recreation and Visitor Industries (5,165)
Biomedical/Biotechnical (Life Sciences) (4,686)
Business and Financial Services (4,683)
Defense and Security (2,373)
Transportation Equipment (1,359)
Transportation and Logistics (1,216)
Agribusiness, Food Processing and Technology (836)
Computer, Electronic, and Electrical Products (652)
Machinery (220)
Mining, Glass and Ceramics (194)
Energy (Fossil and Renewable) (177)
Forest and Wood Products (129)
Information Technology and Telecommunications (100)
Primary and Fabricated Metal Products (99)
Apparel and Textiles (13)
Chemicals and Chemical-Based Products (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Ithaca, NY identifies 1 anchor industry in 1 cluster. Identified anchor and its parent cluster are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industry and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Scientific Research and Development Services, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
9	Education and Knowledge Creation	130	Scientific Research and Development Services	374	507

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
130	Scientific Research and Development Services	2.30	67	17.65	35.56	0.86	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The

tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 130

Scientific Research and Development Services

Industry #	Industry Name	Employment

Note: If no industries with deficits greater than 10 employees are identified for a given analysis phase, deficit tables will include only column headings.

Chapter 30. Jamestown-Dunkirk-Fredonia, NY

Study Area Overview

The Jamestown-Dunkirk-Fredonia, NY study region occupies 1,060 square-miles and had a 2018 population of 127,939. The employed share of the regional labor force during the 2014-2018 period averaged 94.6%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Government and Unclassified. These three industries account for a combined 23.56% of the region's economy. The region's 2018 coefficient of specialization (COS) is 32.58, which indicates that it is less specialized than the average micropolitan and metropolitan region fully within the Appalachian Region. The average COS for all of these regions is 37.73.

Employment changes in Jamestown-Dunkirk-Fredonia, NY can reveal important recent trends in underlying economic structure. Table 1 shows the top ten employment growth industries from 2005 to 2018. We rank employment growth rather than employment growth rate because some industries with high growth rates might be quite small and insignificant relative to regional totals. The highest growth industry was Nursing and Residential Care Facilities, whose employment grew by 517 followed by Other Educational Services and Outpatient Care Centers. The regional shift (RS) values in Table 1 measure industry employment growth attributable to regional factors unrelated to overall national or industry-specific growth trends. Table 1 also shows location quotients (LQ) for these industries. Industry LQs reflect their relative concentrations within the region. Values exceeding 1.0 indicate regional concentration and imply potential advantage relative to national averages. The three fastest growing regional industries have LQ values of 2.79, 1.54, and 1.22.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
154	Nursing and Residential Care Facilities	517	108	2.79
145	Other Educational Services	382	344	1.54
149	Outpatient Care Centers	319	280	1.22
19	Dairy Product Manufacturing	241	201	11.90
14	Construction	186	225	0.62
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	183	172	50.11
137	Business Support Services	173	170	0.69
94	General Merchandise Stores	160	107	1.31
24	Beverage Manufacturing	153	98	3.12
167	Food Services and Drinking Places	144	-992	1.08

Cluster Analysis Results

1. Regional Cluster Concentrations, 2005 and 2018

Table 2 presents a high-level view of the existing distribution of industry employment relative to the 17 clusters. Just as an industry whose location quotient value exceeds 1.0 implies relative regional concentration, cluster location quotient (CLQ) values exceeding 1.0 also imply relative concentration of the set of industries in the cluster. Likewise, clusters whose CLQ are less than 1.0 are relatively less concentrated in the region than they are in the national economy. In Jamestown-Dunkirk-Fredonia, NY, the cluster with the largest CLQ in 2018 is Machinery with a CLQ of 5.25, followed by Primary and Fabricated Metal Products and Education and Knowledge Creation. The CLQs for 2005 and 2018 are presented to further illuminate the trends in cluster specialization and regional structural change.

Figure 1 illustrates the Jamestown-Dunkirk-Fredonia, NY cluster characteristics graphically. The size of each cluster bubble is proportional to its 2018 employment level and the legend is presented in order of decreasing cluster size. Cluster employment appears in parentheses in each legend entry. So, in addition to identifying the clusters by color code and by reference to the values in Table 2, the largest bubble in the chart corresponds to the first cluster listed in the legend, the second largest bubble corresponds to the second largest cluster, and so on. The vertical axis marks the 2018 value of the CLQ, and the horizontal axis marks the change in CLQ from 2005 to 2018. CLQ changes can be positive or negative and CLQ values can be greater than or less than 1.0, which allows us to define four chart quadrants numbered I – IV beginning at the top right and moving counter-clockwise. Clusters centered in quadrants I and II have CLQ values greater than 1.0 indicating relative concentration, implying some degree of specialization relative to national averages. Clusters centered in quadrants I and IV have become more specialized within the region during the period of analysis, while those in II and III have become relatively less concentrated within the region.

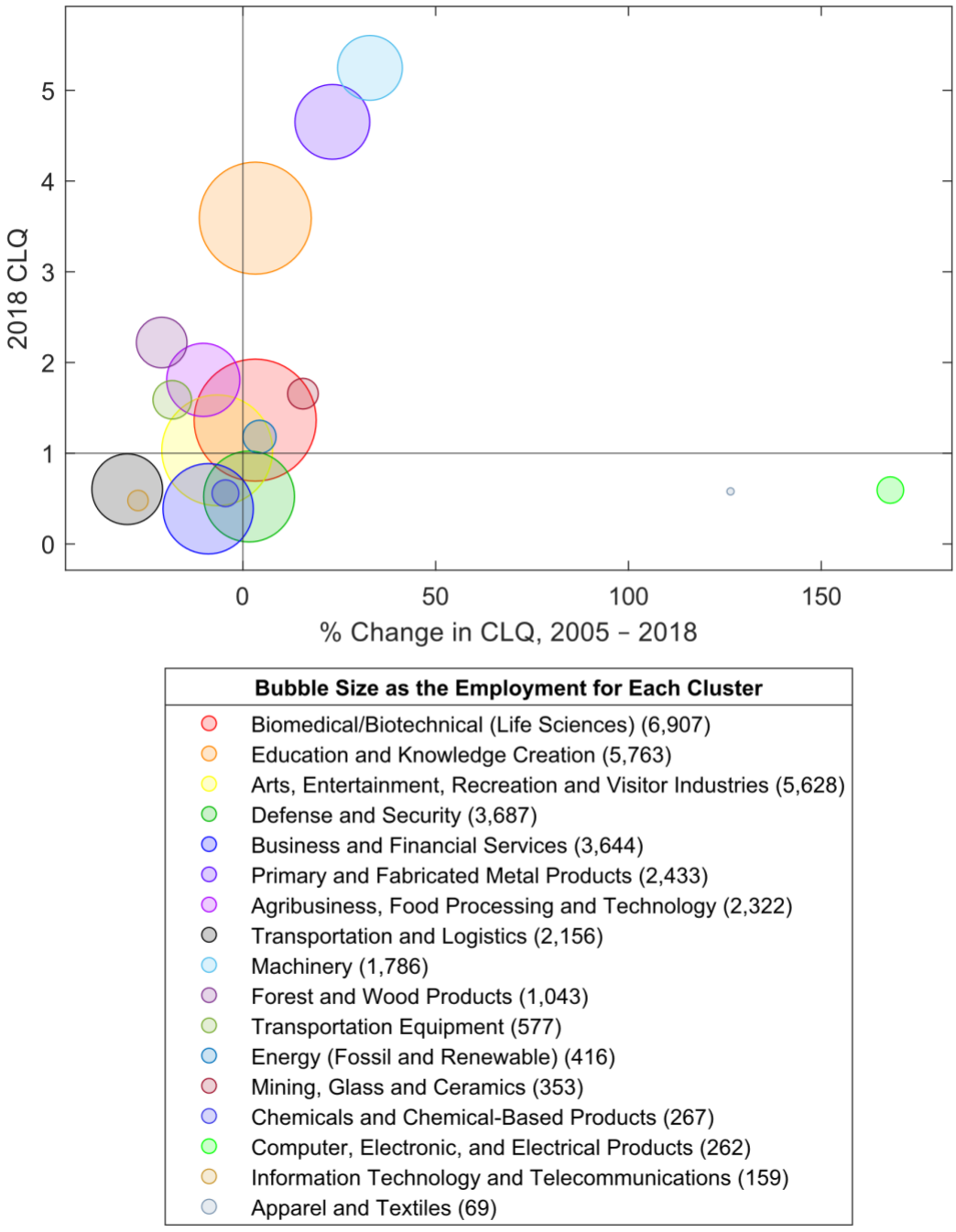
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in share of regional employment relative to the national industry's share of national employment, both of which can have changed over time due to industry specific and total employment changes within the region, in the entire nation, or both. Clusters in quadrant III are relatively less concentrated in the region than in the nation and have become even less so between 2005 and 2018.

Table 2. Cluster Concentrations, 2005 and 2018

Cluster #	Cluster Name	2005 CLQ	2018 CLQ	Employment
4	Biomedical/Biotechnical (Life Sciences)	1.32	1.36	6,907
9	Education and Knowledge Creation	3.48	3.59	5,763
3	Arts, Entertainment, Recreation and Visitor Industries	1.11	1.03	5,628
8	Defense and Security	0.51	0.52	3,687
5	Business and Financial Services	0.43	0.39	3,644
15	Primary and Fabricated Metal Products	3.78	4.65	2,433
1	Agribusiness, Food Processing and Technology	2.01	1.81	2,322
16	Transportation and Logistics	0.86	0.60	2,156
13	Machinery	3.95	5.25	1,786
11	Forest and Wood Products	2.81	2.22	1,043
17	Transportation Equipment	1.94	1.59	577
10	Energy (Fossil and Renewable)	1.13	1.18	416
14	Mining, Glass and Ceramics	1.43	1.66	353
6	Chemicals and Chemical-Based Products	0.58	0.56	267
7	Computer, Electronic, and Electrical Products	0.22	0.59	262
12	Information Technology and Telecommunications	0.66	0.48	159
2	Apparel and Textiles	0.26	0.58	69

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Jamestown-Dunkirk-Fredonia, NY



2. CADS Analysis

The 2018 CADS analysis of the economy of Jamestown-Dunkirk-Fredonia, NY identifies 3 anchor industries in 3 different clusters. Identified anchors and their parent clusters are presented in Table 3 along with 2005 and 2018 employment. Table 4 provides additional industry-specific information for the identified anchors. Both tables list anchor industries and related information in the order in which industries were added to the set of anchors, which also corresponds, according to the CADS algorithm, to their importance to the regional economy. The leading anchor industry is Engine, Turbine, and Power Transmission Equipment Manufacturing, which is the most dominant regional industry that also meets the CADS analysis criteria.

To further understand the potential influence of an anchor industry on the existing local economy, anchor strength (AS) and anchor dominance (AD) indicators are provided in Table 4. As described in the Section 3 of the accompanying overview and technical document, both AS and AD range from zero to one. The AS value shown in Table 4 measures the extent to which regional industry output can satisfy the input requirements for the anchor industry. A low AS value implies that the industry must rely heavily on other regions to satisfy its direct and indirect input demands, whereas higher AS values identify industries whose direct and indirect input demands can be satisfied more fully by local industries. The AD value measures the extent to which the industry dominates the local economy, directly and indirectly. Regions are more heavily dependent, again directly and indirectly, on industries with larger AD values on industries with smaller AD values. The AS measures the industry's dependence on the region while the AD measures the region's dependence on the industry. The fortunes of the regional economy are clearly more strongly tied to industries with larger AS and AD values than to those with lower AS and AD values.

Table 3. Anchors, Clusters, and Employment

Cluster #	Cluster Name	Anchor #	Anchor Industry Name	Anchor Emp. 2005	Anchor Emp. 2018
13	Machinery	67	Engine, Turbine, and Power Transmission Equipment Manufacturing	1,306	1,489
1	Agribusiness, Food Processing and Technology	19	Dairy Product Manufacturing	304	544
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	2,327	2,844

Table 4. Anchors, Location Quotients, Regional Shift, and Growth Rates

				Industry Growth Rate (%)	Industry Growth Rate (%)		
Anchor #	Anchor Industry Name	LQ	RS	National	Regional	AS	AD
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	50.11	172	0.82	14.03	0.76	0.14
19	Dairy Product Manufacturing	11.90	201	13.17	79.29	0.73	0.08
154	Nursing and Residential Care Facilities	2.79	108	17.58	22.22	0.92	0.03

The remaining tables report the results for each phase of the CADS analysis. The reported values for Phase 1 in Table 5 refer to the CADS analysis of the first identified anchor. Then, if a second anchor has been identified, Table 6 reports the Phase 2 analysis results and reported values in the Employment column refer to the results for the first two identified anchors combined. The Added to Deficit column reports the contributions to deficits from the newly added anchor industry. These negative values can be larger than their corresponding Employment column values when no deficits for this industry were reported in the prior phase. If a third anchor has been identified, Phase 3 results will be reported in Table 7 and refer to values for the first three anchors combined and third anchor added, and so on. The tables report estimated employment deficits for all industries whose employment deficits exceed 10 at any phase of the CADS analysis. Because the top ten deficit industries for each phase can change, there can be more than ten reported industries in these tables. There can also be CADS results tables with fewer than ten entries, which happens when there are fewer than ten support industries with identified supply deficits.

The results reported for each CADS analysis phase identify the industries whose further development could most substantially strengthen the cluster support infrastructure at that phase of the analysis. The values estimate the additional employment required to satisfy supporting industry output deficits at each phase of the analysis. Because these estimates are based on average nationwide inter-industry sales, purchases, and productivity data, they are not precise but should provide useful guidance for further analysis by region planners and other decision-makers who have a greater depth of knowledge of their local economies.

Table 5. Phase 1 Deficits for Anchor Industry 67

Engine, Turbine, and Power Transmission Equipment Manufacturing

Industry #	Industry Name	Employment
2	Animal Production	N/A
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-15
43	Rubber Product Manufacturing	-26
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-16
49	Steel Product Manufacturing From Purchased Steel	-21
50	Alumina and Aluminum Production and Processing	-16
51	Nonferrous Metal (except Aluminum) Production and Processing	-35
52	Foundries	-131
68	Other General Purpose Machinery Manufacturing	-30
72	Semiconductor and Other Electronic Component Manufacturing	-12
77	Electrical Equipment Manufacturing	-39
104	Warehousing and Storage	-49
133	Management of Companies and Enterprises	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 19

Dairy Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
2	Animal Production	-441	-654
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-15	-1
43	Rubber Product Manufacturing	-27	-2
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-17	-1
49	Steel Product Manufacturing From Purchased Steel	-22	-1

50	Alumina and Aluminum Production and Processing	-19	-3
51	Nonferrous Metal (except Aluminum) Production and Processing	-36	-2
52	Foundries	-133	-2
68	Other General Purpose Machinery Manufacturing	-32	-2
72	Semiconductor and Other Electronic Component Manufacturing	-20	-8
77	Electrical Equipment Manufacturing	-42	-3
104	Warehousing and Storage	-86	-36
133	Management of Companies and Enterprises	-53	-69

Table 7. Phase 3 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
2	Animal Production	-449	-9
29	Veneer, Plywood, and Engineered Wood Product Manufacturing	-16	-0
43	Rubber Product Manufacturing	-28	-1
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	-18	-0
49	Steel Product Manufacturing From Purchased Steel	-23	-0
50	Alumina and Aluminum Production and Processing	-19	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-37	-0
52	Foundries	-133	-0
68	Other General Purpose Machinery Manufacturing	-32	-0
72	Semiconductor and Other Electronic Component Manufacturing	-22	-2
77	Electrical Equipment Manufacturing	-43	-1
104	Warehousing and Storage	-91	-5
133	Management of Companies and Enterprises	-75	-22