ECONOMIC STRUCTURE IN APPALACHIA'S URBAN REGIONS: SUPPLEMENT 4

Clustering and Diversification Strategies

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07-Jun-2021

Key words: Industrial Clusters, Location Quotients, Shift-Share, Input-Output Analysis, Cluster Analysis and Diversification (CADS)

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Chapter 1. Pottsville, PA

Study Area Overview

The Pottsville, PA study region occupies 779 square-miles and had a 2018 population of 142,067. The employed share of the regional labor force during the 2014-2018 period averaged 94.9%. The Warehousing and Storage 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 20.71% of the region's economy. The region's 2018 coefficient of specialization (COS) is 38.97, 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 Pottsville, 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 Warehousing and Storage, whose employment grew by 2,668 followed by Individual and Family Services 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 11.53, 1.72, and 8.94.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
104	Warehousing and Storage	2,668	1,455	11.53
155	Individual and Family Services	536	-292	1.72
42	Plastics Product Manufacturing	501	576	8.94
23	Other Food Manufacturing	463	360	10.23
154	Nursing and Residential Care Facilities	390	74	2.11
55	Architectural and Structural Metals Manufacturing	352	359	6.92
136	Employment Services	286	283	0.58
149	Outpatient Care Centers	269	127	1.44
7	Coal Mining	262	314	27.27
78	Other Electrical Equipment and Component Manufacturing	234	216	9.81

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 Pottsville, PA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 6.46, 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 Pottsville, 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.

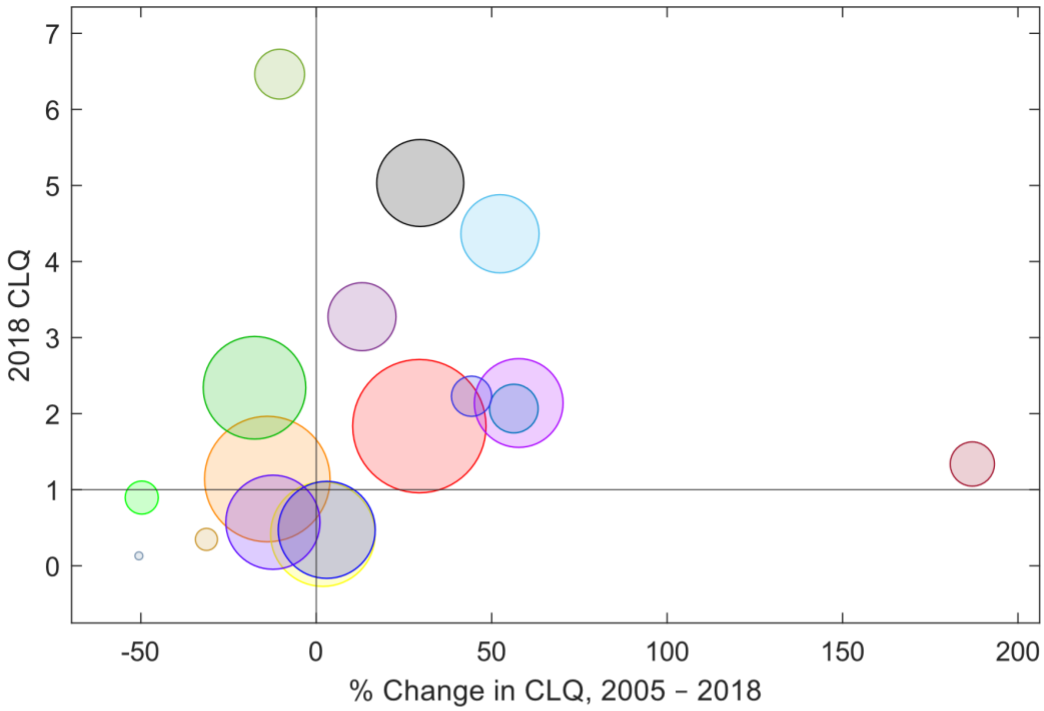
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
16	Transportation and Logistics	1.42	1.84	6,663
4	Biomedical/Biotechnical (Life Sciences)	1.33	1.14	5,861
5	Business and Financial Services	0.41	0.42	3,969
9	Education and Knowledge Creation	2.84	2.34	3,814
8	Defense and Security	0.46	0.47	3,382
3	Arts, Entertainment, Recreation and Visitor Industries	0.65	0.57	3,171
1	Agribusiness, Food Processing and Technology	1.36	2.14	2,791
15	Primary and Fabricated Metal Products	3.88	5.03	2,673
6	Chemicals and Chemical-Based Products	2.86	4.36	2,119
11	Forest and Wood Products	2.90	3.27	1,562
2	Apparel and Textiles	7.22	6.46	782
10	Energy (Fossil and Renewable)	1.32	2.07	739
7	Computer, Electronic, and Electrical Products	0.47	1.34	599
14	Mining, Glass and Ceramics	1.55	2.23	483
13	Machinery	1.78	0.90	310
17	Transportation Equipment	0.51	0.35	128
12	Information Technology and Telecommunications	0.26	0.13	44

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Pottsville, PA



Bubble Size as the Employment for Each Cluster
Transportation and Logistics (6,663)
Biomedical/Biotechnical (Life Sciences) (5,861)
Business and Financial Services (3,969)
Education and Knowledge Creation (3,814)
Defense and Security (3,382)
Arts, Entertainment, Recreation and Visitor Industries (3,171)
Agribusiness, Food Processing and Technology (2,791)
Primary and Fabricated Metal Products (2,673)
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Forest and Wood Products (1,562)
Apparel and Textiles (782)
Energy (Fossil and Renewable) (739)
Computer, Electronic, and Electrical Products (599)
Mining, Glass and Ceramics (483)
Machinery (310)
Transportation Equipment (128)
Information Technology and Telecommunications (44)

2. CADS Analysis

The 2018 CADS analysis of the economy of Pottsville, PA identifies 7 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 Alumina and Aluminum Production 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
15	Primary and Fabricated Metal Products	50	Alumina and Aluminum Production and Processing	985	1,040
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	1,129	1,630
16	Transportation and Logistics	104	Warehousing and Storage	1,375	4,043
1	Agribusiness, Food Processing and Technology	23	Other Food Manufacturing	244	707
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	489	841
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	1,798	2,188
2	Apparel and Textiles	26	Textile Mills and Textile Product Mills	633	587

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
50	Alumina and Aluminum Production and Processing	57.29	246	-19.48	5.51	0.83	0.10
42	Plastics Product Manufacturing	8.94	576	-6.65	44.38	0.68	0.09

104	Warehousing and Storage	11.53	1,455	88.22	194.09	0.88	0.07
23	Other Food Manufacturing	10.23	360	41.93	189.40	0.82	0.06
55	Architectural and Structural Metals Manufacturing	6.92	359	-1.47	71.98	0.83	0.03
154	Nursing and Residential Care Facilities	2.11	74	17.58	21.69	0.90	0.02
26	Textile Mills and Textile Product Mills	8.00	216	-41.39	-7.20	0.75	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 50

Alumina and Aluminum Production and Processing

Industry #	Industry Name	Employment
8	Metal Ore Mining	-19
16	Grain and Oilseed Milling	-0
31	Pulp, Paper, and Paperboard Mills	-4
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	N/A
49	Steel Product Manufacturing From Purchased Steel	-5
60	Coating, Engraving, Heat Treating, and Allied Activities	-35
68	Other General Purpose Machinery Manufacturing	-4
72	Semiconductor and Other Electronic Component Manufacturing	-62
77	Electrical Equipment Manufacturing	-6
81	Motor Vehicle Parts Manufacturing	N/A
97	Rail Transportation	-9
113	Data Processing, Hosting, and Related Services	-5
127	Specialized Design Services	-9
128	Computer Systems Design and Related Services	N/A

129	Management, Scientific, and Technical Consulting Services	N/A
139	Investigation and Security Services	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-21	-2
16	Grain and Oilseed Milling	-2	-2
31	Pulp, Paper, and Paperboard Mills	-12	-8
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-102	-104
49	Steel Product Manufacturing From Purchased Steel	-8	-2
60	Coating, Engraving, Heat Treating, and Allied Activities	-53	-18
68	Other General Purpose Machinery Manufacturing	-8	-4
72	Semiconductor and Other Electronic Component Manufacturing	-90	-28
77	Electrical Equipment Manufacturing	-14	-8
81	Motor Vehicle Parts Manufacturing	-8	-8
97	Rail Transportation	-24	-15
113	Data Processing, Hosting, and Related Services	-11	-6
127	Specialized Design Services	-18	-10
128	Computer Systems Design and Related Services	-18	-20
129	Management, Scientific, and Technical Consulting Services	N/A	-30
139	Investigation and Security Services	N/A	-15

Table 7. Phase 3 Deficits Adding Anchor Industry 104

Warehousing and Storage

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-22	-0
16	Grain and Oilseed Milling	-2	-0
31	Pulp, Paper, and Paperboard Mills	-13	-2
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-103	-1
49	Steel Product Manufacturing From Purchased Steel	-9	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-56	-2
68	Other General Purpose Machinery Manufacturing	-11	-4
72	Semiconductor and Other Electronic Component Manufacturing	-95	-5
77	Electrical Equipment Manufacturing	-20	-5
81	Motor Vehicle Parts Manufacturing	-35	-27
97	Rail Transportation	-26	-2
113	Data Processing, Hosting, and Related Services	-13	-3
127	Specialized Design Services	-21	-2
128	Computer Systems Design and Related Services	-31	-13
129	Management, Scientific, and Technical Consulting Services	N/A	-24
139	Investigation and Security Services	-17	-18

Table 8. Phase 4 Deficits Adding Anchor Industry 23

Other Food Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-22	-0
16	Grain and Oilseed Milling	-23	-20
31	Pulp, Paper, and Paperboard Mills	-20	-7
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-104	-1
49	Steel Product Manufacturing From Purchased Steel	-10	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-58	-2
68	Other General Purpose Machinery Manufacturing	-13	-2
72	Semiconductor and Other Electronic Component Manufacturing	-100	-6
77	Electrical Equipment Manufacturing	-22	-2
81	Motor Vehicle Parts Manufacturing	-40	-4
97	Rail Transportation	-33	-8
113	Data Processing, Hosting, and Related Services	-16	-3
127	Specialized Design Services	-26	-5
128	Computer Systems Design and Related Services	-43	-12
129	Management, Scientific, and Technical Consulting Services	-15	-15
139	Investigation and Security Services	-26	-8

Table 9. Phase 5 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-25	-3
16	Grain and Oilseed Milling	-23	-0
31	Pulp, Paper, and Paperboard Mills	-21	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-105	-1
49	Steel Product Manufacturing From Purchased Steel	-27	-18
60	Coating, Engraving, Heat Treating, and Allied Activities	-65	-7
68	Other General Purpose Machinery Manufacturing	-14	-2
72	Semiconductor and Other Electronic Component Manufacturing	-112	-11
77	Electrical Equipment Manufacturing	-24	-2
81	Motor Vehicle Parts Manufacturing	-43	-3
97	Rail Transportation	-37	-3
113	Data Processing, Hosting, and Related Services	-19	-3
127	Specialized Design Services	-32	-6
128	Computer Systems Design and Related Services	-51	-8
129	Management, Scientific, and Technical Consulting Services	-23	-8
139	Investigation and Security Services	-43	-17

Table 10. Phase 6 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-25	-0
16	Grain and Oilseed Milling	-23	-0
31	Pulp, Paper, and Paperboard Mills	-22	-1

36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-105	-0
49	Steel Product Manufacturing From Purchased Steel	-28	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-66	-0
68	Other General Purpose Machinery Manufacturing	-15	-0
72	Semiconductor and Other Electronic Component Manufacturing	-113	-1
77	Electrical Equipment Manufacturing	-24	-0
81	Motor Vehicle Parts Manufacturing	-44	-1
97	Rail Transportation	-37	-0
113	Data Processing, Hosting, and Related Services	-20	-1
127	Specialized Design Services	-33	-1
128	Computer Systems Design and Related Services	-58	-7
129	Management, Scientific, and Technical Consulting Services	-45	-22
139	Investigation and Security Services	-50	-7

Table 11. Phase 7 Deficits Adding Anchor Industry 26

Textile Mills and Textile Product Mills

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-25	-0
16	Grain and Oilseed Milling	-23	-0
31	Pulp, Paper, and Paperboard Mills	-23	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-121	-16
49	Steel Product Manufacturing From Purchased Steel	-29	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-69	-4
68	Other General Purpose Machinery Manufacturing	-15	-1
72	Semiconductor and Other Electronic Component Manufacturing	-121	-8
77	Electrical Equipment Manufacturing	-25	-1
81	Motor Vehicle Parts Manufacturing	-45	-1
97	Rail Transportation	-39	-1
113	Data Processing, Hosting, and Related Services	-21	-1
127	Specialized Design Services	-34	-1
128	Computer Systems Design and Related Services	-62	-4
129	Management, Scientific, and Technical Consulting Services	-50	-5
139	Investigation and Security Services	-53	-3

Chapter 2. Richmond-Berea, KY

Study Area Overview

The Richmond-Berea, KY study region occupies 754 square-miles and had a 2018 population of 109,118. The employed share of the regional labor force during the 2014-2018 period averaged 94.56%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Junior Colleges, Colleges, Universities, and Professional Schools and Elementary and Secondary Schools. These three industries account for a combined 26.33% of the region's economy. The region's 2018 coefficient of specialization (COS) is 36.85, 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 Richmond-Berea, KY 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 Accounting, Tax Preparation, Bookkeeping, and Payroll Services, whose employment grew by 867 followed by Food Services and Drinking Places and Motor Vehicle Parts 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 3.63, 1.42, and 14.79.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
125	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	867	851	3.63
167	Food Services and Drinking Places	824	-141	1.42
81	Motor Vehicle Parts Manufacturing	697	859	14.79
14	Construction	689	714	0.79
153	Hospitals	674	488	1.40
181	Government and Unclassified	333	258	0.44
129	Management, Scientific, and Technical Consulting Services	325	293	0.93
140	Services to Buildings and Dwellings	288	262	0.59
94	General Merchandise Stores	277	220	1.95
143	Elementary and Secondary Schools	232	-384	9.06

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 Richmond-Berea, KY, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 7.82, followed by Education and Knowledge Creation 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 Richmond-Berea, KY 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.

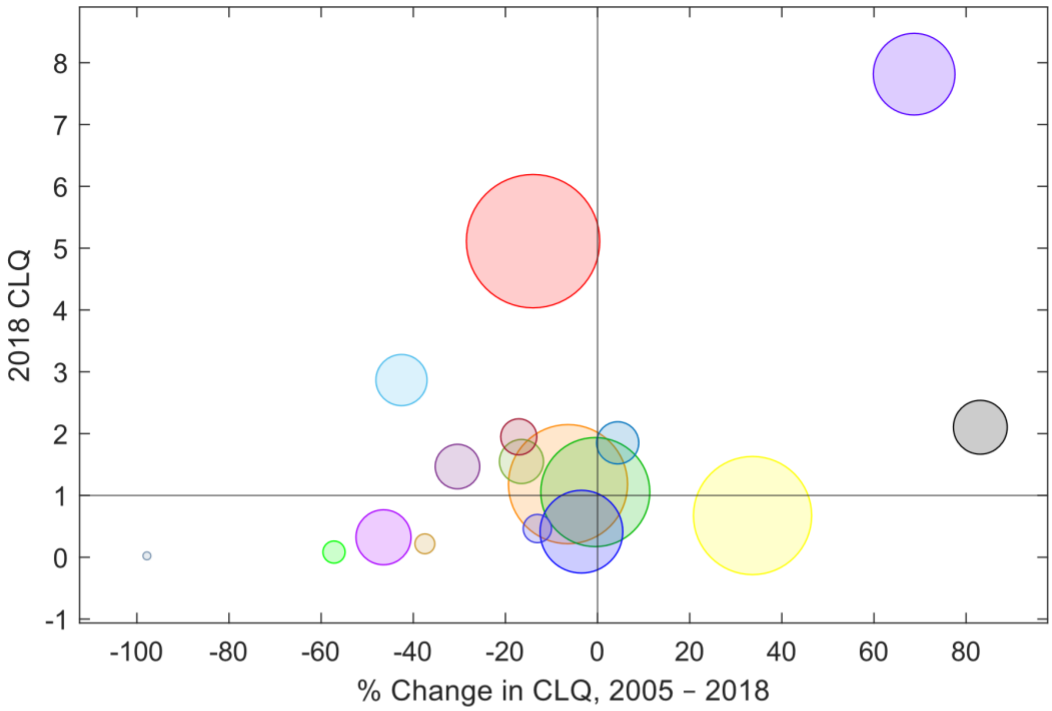
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	5.95	5.11	6,402
3	Arts, Entertainment, Recreation and Visitor Industries	1.26	1.18	5,033
5	Business and Financial Services	0.51	0.67	4,948
4	Biomedical/Biotechnical (Life Sciences)	1.06	1.05	4,162
8	Defense and Security	0.43	0.41	2,278
17	Transportation Equipment	4.63	7.82	2,215
16	Transportation and Logistics	0.60	0.32	902
15	Primary and Fabricated Metal Products	1.15	2.10	858
13	Machinery	4.99	2.87	761
6	Chemicals and Chemical-Based Products	2.11	1.47	547
7	Computer, Electronic, and Electrical Products	1.86	1.55	533
12	Information Technology and Telecommunications	1.77	1.85	480
14	Mining, Glass and Ceramics	2.35	1.95	324
11	Forest and Wood Products	0.53	0.46	170
1	Agribusiness, Food Processing and Technology	0.20	0.08	84
10	Energy (Fossil and Renewable)	0.35	0.22	60
2	Apparel and Textiles	1.05	0.02	2

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Richmond-Berea, KY



Bubble Size as the Employment for Each Cluster
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Arts, Entertainment, Recreation and Visitor Industries (5,033)
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Biomedical/Biotechnical (Life Sciences) (4,162)
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Transportation and Logistics (902)
Primary and Fabricated Metal Products (858)
Machinery (761)
Chemicals and Chemical-Based Products (547)
Computer, Electronic, and Electrical Products (533)
Information Technology and Telecommunications (480)
Mining, Glass and Ceramics (324)
Forest and Wood Products (170)
Agribusiness, Food Processing and Technology (84)
Energy (Fossil and Renewable) (60)
Apparel and Textiles (2)

2. CADS Analysis

The 2018 CADS analysis of the economy of Richmond-Berea, KY 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 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	1,394	2,092
4	Biomedical/Biotechnical (Life Sciences)	153	Hospitals	1,031	1,705

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
81	Motor Vehicle Parts Manufacturing	14.79	859	-11.56	50.01	0.58	0.26
153	Hospitals	1.40	488	18.09	65.43	0.72	0.07

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	-73
48	Iron and Steel Mills and Ferroalloy Manufacturing	-91
52	Foundries	-208
55	Architectural and Structural Metals Manufacturing	-60
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-96
61	Other Fabricated Metal Product Manufacturing	-70
72	Semiconductor and Other Electronic Component Manufacturing	-184
104	Warehousing and Storage	-158
117	Insurance Carriers	-12
133	Management of Companies and Enterprises	-135
137	Business Support Services	-35

Table 6. Phase 2 Deficits Adding Anchor Industry 153

Hospitals

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-75	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-92	-0
52	Foundries	-209	-0
55	Architectural and Structural Metals Manufacturing	-61	-1
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-98	-2
61	Other Fabricated Metal Product Manufacturing	-71	-1
72	Semiconductor and Other Electronic Component Manufacturing	-187	-2
104	Warehousing and Storage	-167	-8
117	Insurance Carriers	-65	-53
133	Management of Companies and Enterprises	-162	-27
137	Business Support Services	-50	-15

Chapter 3. Rome, GA

Study Area Overview

The Rome, GA study region occupies 510 square-miles and had a 2018 population of 97,927. The employed share of the regional labor force during the 2014-2018 period averaged 94.5%. 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 26.65% of the region's economy. The region's 2018 coefficient of specialization (COS) is 38.83, 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 Rome, 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 862 followed by Motor Vehicle Parts Manufacturing 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 1.27, 7.25, and 3.23.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	862	-3	1.27
81	Motor Vehicle Parts Manufacturing	529	591	7.25
153	Hospitals	526	-117	3.23
95	All Other Retail	496	564	1.33
154	Nursing and Residential Care Facilities	342	179	1.54
107	Motion Picture, Video, and Sound Recording Industries	317	306	2.78
17	Sugar and Confectionery Product Manufacturing	290	290	14.88
146	Offices of Physicians	278	-55	2.52
155	Individual and Family Services	251	162	0.54
23	Other Food Manufacturing	174	174	3.16

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 Rome, GA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 7.84, followed by Transportation Equipment 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 Rome, 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.

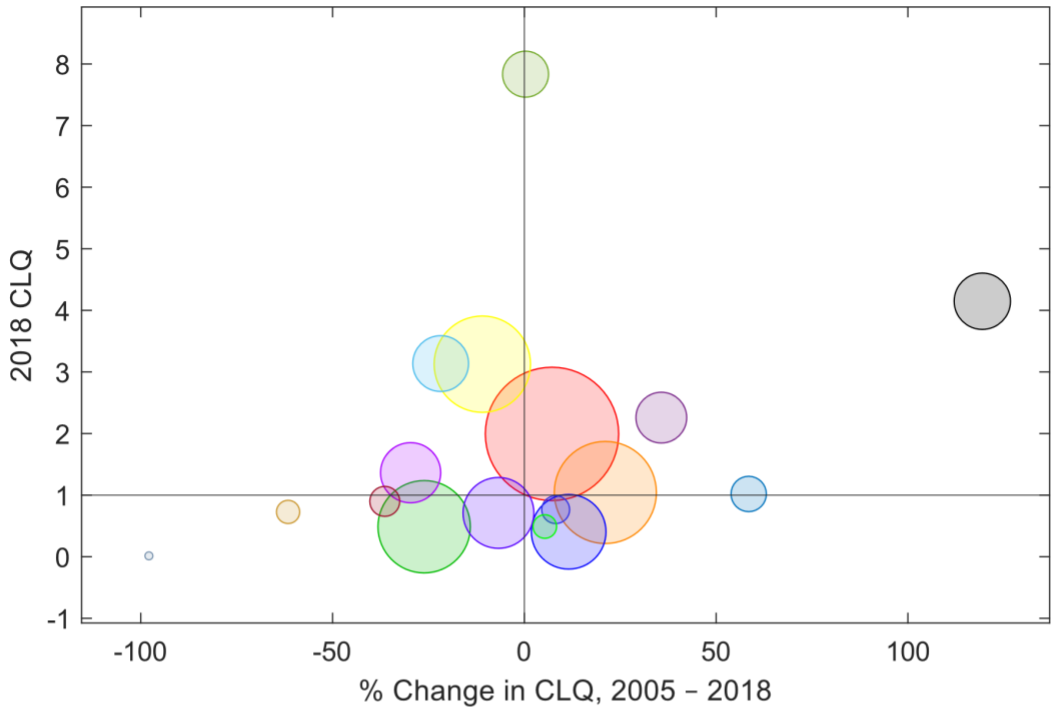
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.86	1.99	8,184
3	Arts, Entertainment, Recreation and Visitor Industries	0.86	1.04	4,614
9	Education and Knowledge Creation	3.51	3.13	4,069
5	Business and Financial Services	0.66	0.49	3,709
8	Defense and Security	0.36	0.40	2,316
16	Transportation and Logistics	0.76	0.71	2,062
1	Agribusiness, Food Processing and Technology	1.94	1.36	1,421
17	Transportation Equipment	1.89	4.15	1,222
11	Forest and Wood Products	4.01	3.14	1,195
15	Primary and Fabricated Metal Products	1.66	2.26	958
2	Apparel and Textiles	7.81	7.84	757
6	Chemicals and Chemical-Based Products	0.64	1.02	395
10	Energy (Fossil and Renewable)	1.41	0.90	256
13	Machinery	0.71	0.76	211
12	Information Technology and Telecommunications	0.47	0.49	132
14	Mining, Glass and Ceramics	1.89	0.73	126
7	Computer, Electronic, and Electrical Products	0.66	0.01	5

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Rome, GA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (8,184)
Arts, Entertainment, Recreation and Visitor Industries (4,614)
Education and Knowledge Creation (4,069)
Business and Financial Services (3,709)
Defense and Security (2,316)
Transportation and Logistics (2,062)
Agribusiness, Food Processing and Technology (1,421)
Transportation Equipment (1,222)
Forest and Wood Products (1,195)
Primary and Fabricated Metal Products (958)
Apparel and Textiles (757)
Chemicals and Chemical-Based Products (395)
Energy (Fossil and Renewable) (256)
Machinery (211)
Information Technology and Telecommunications (132)
Mining, Glass and Ceramics (126)
Computer, Electronic, and Electrical Products (5)

2. CADS Analysis

The 2018 CADS analysis of the economy of Rome, 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 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	537	1,066
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	929	1,272

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
81	Motor Vehicle Parts Manufacturing	7.25	591	-11.56	98.58	0.67	0.12
154	Nursing and Residential Care Facilities	1.54	179	17.58	36.83	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 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment
27	Apparel, Leather and Allied Product Manufacturing	-37
48	Iron and Steel Mills and Ferroalloy Manufacturing	-20
51	Nonferrous Metal (except Aluminum) Production and Processing	-31
52	Foundries	-95
53	Forging and Stamping	-36
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-98
60	Coating, Engraving, Heat Treating, and Allied Activities	-34
72	Semiconductor and Other Electronic Component Manufacturing	-94
104	Warehousing and Storage	-34
133	Management of Companies and Enterprises	-91

Table 6. Phase 2 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-38	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-20	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-32	-0
52	Foundries	-95	-0
53	Forging and Stamping	-36	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-98	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-34	-0
72	Semiconductor and Other Electronic Component Manufacturing	-95	-1
104	Warehousing and Storage	-36	-2
133	Management of Companies and Enterprises	-101	-10

Chapter 4. St. Marys, PA

Study Area Overview

The St. Marys, PA study region occupies 827 square-miles and had a 2018 population of 30,169. The employed share of the regional labor force during the 2014-2018 period averaged 97.7%. The Forging and Stamping industry was the region's largest employer in 2018, followed by Other Electrical Equipment and Component Manufacturing and All Other Retail. These three industries account for a combined 30.55% of the region's economy. The region's 2018 coefficient of specialization (COS) is 51.35, 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 St. Marys, 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 Forging and Stamping, whose employment grew by 225 followed by Coating, Engraving, Heat Treating, and Allied Activities and Navigational, Measuring, Electromedical, and Control Instruments 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 325.37, 29.73, and 5.85.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
53	Forging and Stamping	225	503	325.37
60	Coating, Engraving, Heat Treating, and Allied Activities	143	152	29.73
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	138	144	5.85
167	Food Services and Drinking Places	122	-25	0.54
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	100	91	14.36
14	Construction	95	107	0.64
61	Other Fabricated Metal Product Manufacturing	94	94	4.27
126	Architectural, Engineering, and Related Services	75	68	1.01
51	Nonferrous Metal (except Aluminum) Production and Processing	57	65	18.88
132	Other Professional, Scientific, and Technical Services	55	47	0.91

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 St. Marys, PA, the cluster with the largest CLQ in 2018 is Primary and Fabricated Metal Products with a CLQ of 23.93, followed by Computer, Electronic, and Electrical Products 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 St. Marys, 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.

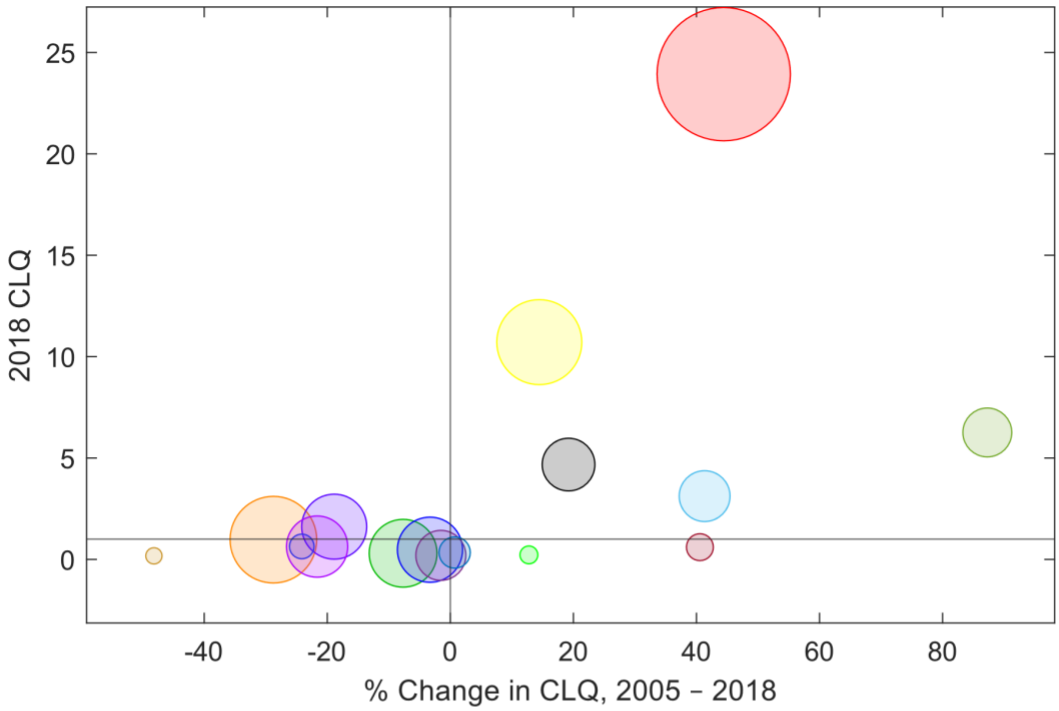
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
15	Primary and Fabricated Metal Products	16.57	23.93	3,860
4	Biomedical/Biotechnical (Life Sciences)	1.37	0.97	1,520
7	Computer, Electronic, and Electrical Products	9.36	10.71	1,457
5	Business and Financial Services	0.33	0.30	880
3	Arts, Entertainment, Recreation and Visitor Industries	0.49	0.48	804
9	Education and Knowledge Creation	1.99	1.62	799
16	Transportation and Logistics	0.81	0.63	697
13	Machinery	3.92	4.68	491
11	Forest and Wood Products	2.21	3.12	452
8	Defense and Security	0.20	0.20	434
14	Mining, Glass and Ceramics	3.34	6.26	412
1	Agribusiness, Food Processing and Technology	0.34	0.34	134
6	Chemicals and Chemical-Based Products	0.43	0.60	89
10	Energy (Fossil and Renewable)	0.84	0.64	69
17	Transportation Equipment	0.20	0.22	25
12	Information Technology and Telecommunications	0.34	0.18	18
2	Apparel and Textiles	0.00	0.03	1

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of St. Marys, PA



Bubble Size as the Employment for Each Cluster
Primary and Fabricated Metal Products (3,860)
Biomedical/Biotechnical (Life Sciences) (1,520)
Computer, Electronic, and Electrical Products (1,457)
Business and Financial Services (880)
Arts, Entertainment, Recreation and Visitor Industries (804)
Education and Knowledge Creation (799)
Transportation and Logistics (697)
Machinery (491)
Forest and Wood Products (452)
Defense and Security (434)
Mining, Glass and Ceramics (412)
Agribusiness, Food Processing and Technology (134)
Chemicals and Chemical-Based Products (89)
Energy (Fossil and Renewable) (69)
Transportation Equipment (25)
Information Technology and Telecommunications (18)
Apparel and Textiles (1)

2. CADS Analysis

The 2018 CADS analysis of the economy of St. Marys, 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 Forging and Stamping, 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
15	Primary and Fabricated Metal Products	53	Forging and Stamping	2,806	3,031

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
53	Forging and Stamping	325.37	503	-9.92	8.02	0.44	0.49

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 53

Forging and Stamping

Industry #	Industry Name	Employment
48	Iron and Steel Mills and Ferroalloy Manufacturing	-241
49	Steel Product Manufacturing From Purchased Steel	-89
50	Alumina and Aluminum Production and Processing	-75
91	Wholesale Trade	-154
104	Warehousing and Storage	-311
133	Management of Companies and Enterprises	-91
136	Employment Services	-178
137	Business Support Services	-76
139	Investigation and Security Services	-80
140	Services to Buildings and Dwellings	-73

Chapter 5. Sayre, PA

Study Area Overview

The Sayre, PA study region occupies 1,147 square-miles and had a 2018 population of 60,833. The employed share of the regional labor force during the 2014-2018 period averaged 95.4%. The Hospitals industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Animal Slaughtering and Processing. These three industries account for a combined 19.88% of the region's economy. The region's 2018 coefficient of specialization (COS) is 43.31, 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 Sayre, 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 Offices of Physicians, whose employment grew by 967 followed by Support Activities for Mining and Truck Transportation. 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 3.06, 14.22, and 3.53.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
146	Offices of Physicians	967	919	3.06
10	Support Activities for Mining	715	715	14.22
99	Truck Transportation	568	565	3.53
154	Nursing and Residential Care Facilities	416	299	2.24
133	Management of Companies and Enterprises	377	309	1.69
155	Individual and Family Services	311	80	1.47
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	256	404	23.20
20	Animal Slaughtering and Processing	235	201	16.80
166	Accommodation	178	169	0.88
14	Construction	144	161	0.62

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 Sayre, PA, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 5.92, followed by Forest and Wood Products 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 Sayre, 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.

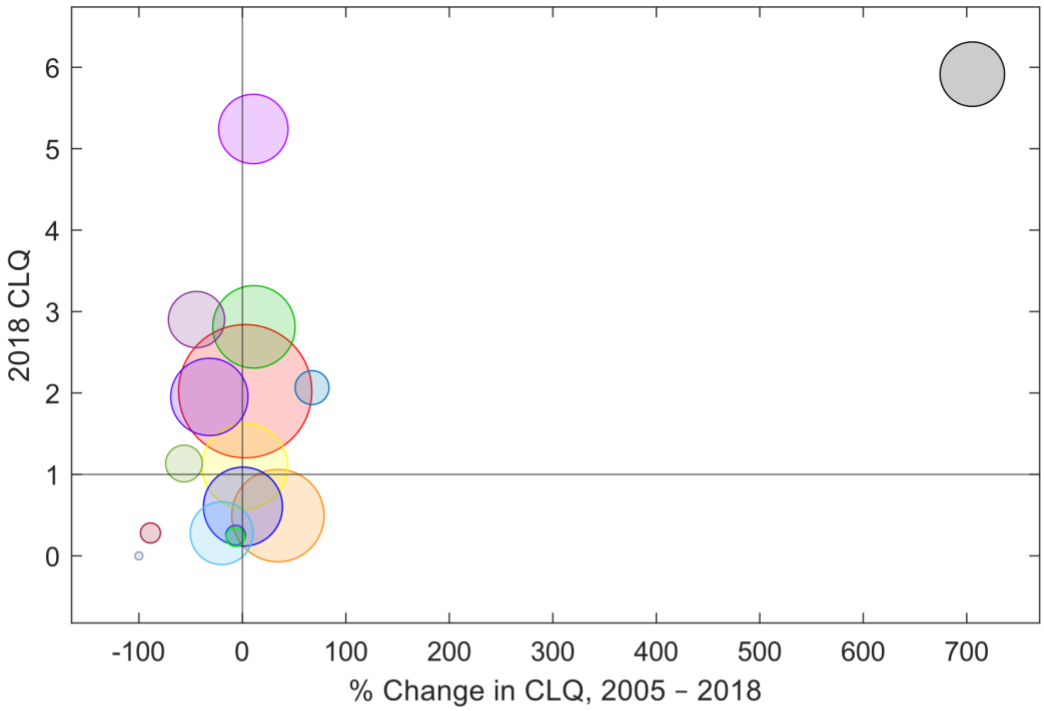
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.97	2.02	4,836
5	Business and Financial Services	0.37	0.49	2,194
16	Transportation and Logistics	1.08	1.10	1,859
1	Agribusiness, Food Processing and Technology	2.53	2.81	1,707
3	Arts, Entertainment, Recreation and Visitor Industries	0.60	0.60	1,557
9	Education and Knowledge Creation	2.87	1.95	1,480
11	Forest and Wood Products	4.74	5.24	1,164
10	Energy (Fossil and Renewable)	0.73	5.92	984
8	Defense and Security	0.35	0.28	927
15	Primary and Fabricated Metal Products	5.21	2.90	717
6	Chemicals and Chemical-Based Products	2.60	1.13	256
14	Mining, Glass and Ceramics	1.23	2.07	208
13	Machinery	2.52	0.28	45
17	Transportation Equipment	0.27	0.25	44
12	Information Technology and Telecommunications	0.25	0.23	36
2	Apparel and Textiles	0.00	0.00	0
7	Computer, Electronic, and Electrical Products	0.10	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Sayre, PA



Bubble Size as the Employment for Each Cluster

- Biomedical/Biotechnical (Life Sciences) (4,836)
- Business and Financial Services (2,194)
- Transportation and Logistics (1,859)
- Agribusiness, Food Processing and Technology (1,707)
- Arts, Entertainment, Recreation and Visitor Industries (1,557)
- Education and Knowledge Creation (1,480)
- Forest and Wood Products (1,164)
- Energy (Fossil and Renewable) (984)
- Defense and Security (927)
- Primary and Fabricated Metal Products (717)
- Chemicals and Chemical-Based Products (256)
- Mining, Glass and Ceramics (208)
- Machinery (45)
- Transportation Equipment (44)
- Information Technology and Telecommunications (36)
- Apparel and Textiles (0)
- Computer, Electronic, and Electrical Products (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Sayre, 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 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	1,028	1,264
16	Transportation and Logistics	99	Truck Transportation	291	859

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	16.80	201	3.38	22.89	0.50	0.18
99	Truck Transportation	3.53	565	1.19	195.19	0.78	0.06

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	-184
2	Animal Production	-1,141
4	Fishing, Hunting and Trapping	-13
32	Converted Paper Product Manufacturing	-23
97	Rail Transportation	-9
103	Couriers and Messengers	-16
131	Advertising and Related Services	-9
137	Business Support Services	-8

Table 6. Phase 2 Deficits Adding Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-185	-1
2	Animal Production	-1,141	-0
4	Fishing, Hunting and Trapping	-13	-0
32	Converted Paper Product Manufacturing	-24	-1
97	Rail Transportation	-12	-3
103	Couriers and Messengers	-47	-31
131	Advertising and Related Services	-11	-2
137	Business Support Services	-12	-4

Chapter 6. Scottsboro, AL

Study Area Overview

The Scottsboro, AL study region occupies 1,078 square-miles and had a 2018 population of 51,736. The employed share of the regional labor force during the 2014-2018 period averaged 95.3%. The Textile Mills and Textile Product Mills 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 31.21% of the region's economy. The region's 2018 coefficient of specialization (COS) is 47, 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 Scottsboro, 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 250 followed by Pulp, Paper, and Paperboard Mills 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 4.91, 28.76, and 0.99.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
42	Plastics Product Manufacturing	250	253	4.91
31	Pulp, Paper, and Paperboard Mills	243	253	28.76
167	Food Services and Drinking Places	225	-61	0.99
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	184	190	8.40
52	Foundries	141	150	14.72
14	Construction	138	147	0.56
50	Alumina and Aluminum Production and Processing	136	136	23.26
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	132	132	15.20
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	87	85	4.41
156	Community and Vocational Rehabilitation Services	61	62	3.03

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 Scottsboro, AL, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 60.68, followed by Forest and Wood 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 Scottsboro, 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.

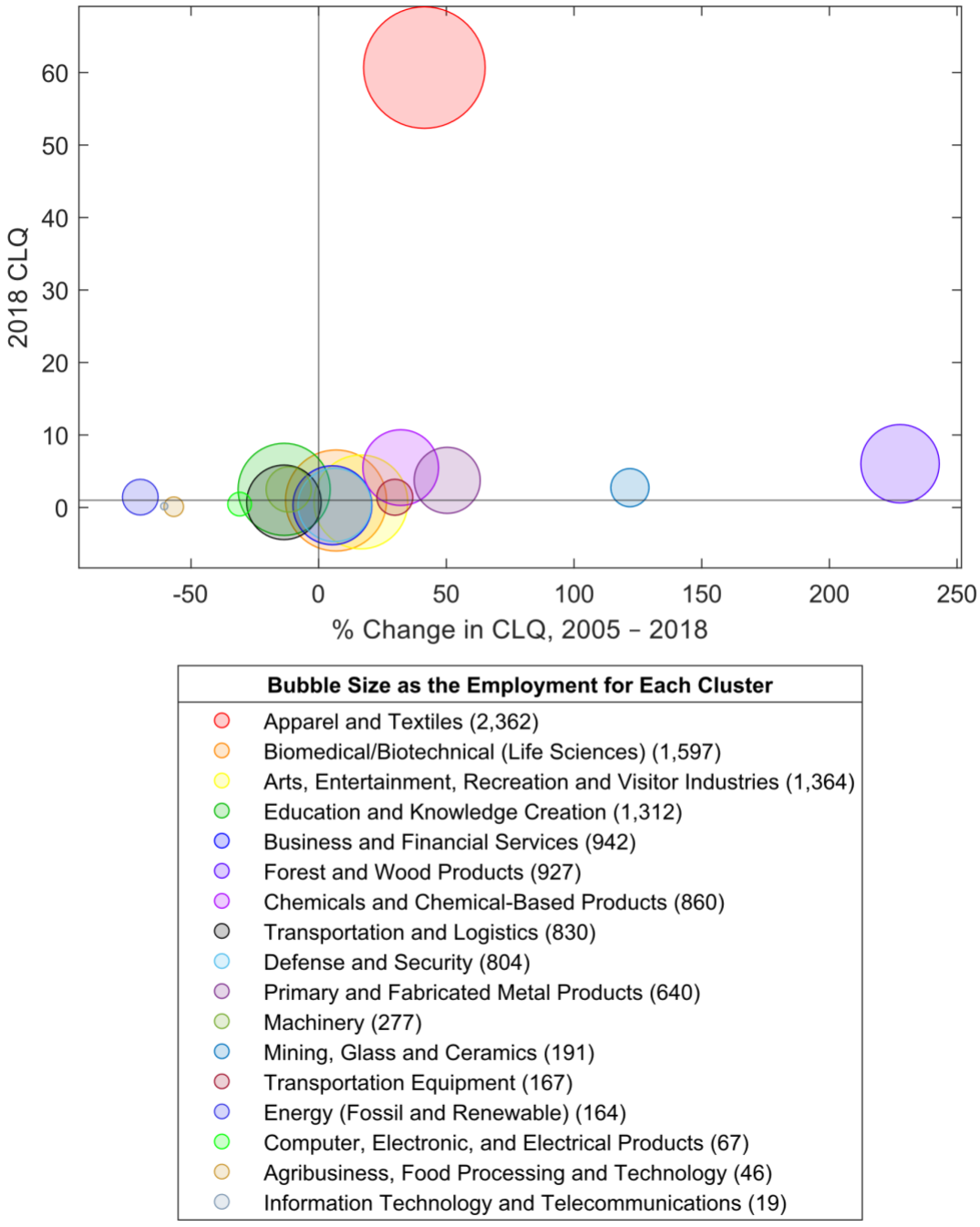
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
2	Apparel and Textiles	42.92	60.68	2,362
4	Biomedical/Biotechnical (Life Sciences)	0.90	0.97	1,597
3	Arts, Entertainment, Recreation and Visitor Industries	0.66	0.77	1,364
9	Education and Knowledge Creation	2.89	2.50	1,312
5	Business and Financial Services	0.29	0.31	942
11	Forest and Wood Products	1.84	6.04	927
6	Chemicals and Chemical-Based Products	4.17	5.50	860
16	Transportation and Logistics	0.82	0.71	830
8	Defense and Security	0.33	0.35	804
15	Primary and Fabricated Metal Products	2.49	3.75	640
13	Machinery	2.82	2.49	277
14	Mining, Glass and Ceramics	1.23	2.74	191
17	Transportation Equipment	1.09	1.41	167
10	Energy (Fossil and Renewable)	4.73	1.43	164
7	Computer, Electronic, and Electrical Products	0.68	0.47	67
1	Agribusiness, Food Processing and Technology	0.25	0.11	46
12	Information Technology and Telecommunications	0.44	0.18	19

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Scottsboro, AL



2. CADS Analysis

The 2018 CADS analysis of the economy of Scottsboro, 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 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	603	543
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	170	167
11	Forest and Wood Products	87	Office Furniture (Including Fixtures) Manufacturing	301	306
15	Primary and Fabricated Metal Products	59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	74	161

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
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	57.51	9	-11.32	-9.89	0.34	0.25
81	Motor Vehicle Parts Manufacturing	2.82	17	-11.56	-1.83	0.65	0.04

87	Office Furniture (Including Fixtures) Manufacturing	28.24	57	-17.39	1.54	0.63	0.03
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	4.41	85	2.18	117.57	0.66	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 36

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

Industry #	Industry Name	Employment
1	Crop Production	-62
32	Converted Paper Product Manufacturing	-16
35	Basic Chemical Manufacturing	-189
60	Coating, Engraving, Heat Treating, and Allied Activities	-14
72	Semiconductor and Other Electronic Component Manufacturing	-29
97	Rail Transportation	-20
104	Warehousing and Storage	-48
128	Computer Systems Design and Related Services	-21
129	Management, Scientific, and Technical Consulting Services	-22
133	Management of Companies and Enterprises	-88
140	Services to Buildings and Dwellings	-13
142	Waste Management and Remediation Services	-16

Table 6. Phase 2 Deficits Adding Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit

1	Crop Production	-63	-1
32	Converted Paper Product Manufacturing	-18	-2
35	Basic Chemical Manufacturing	-190	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-19	-5
72	Semiconductor and Other Electronic Component Manufacturing	-42	-13
97	Rail Transportation	-21	-1
104	Warehousing and Storage	-60	-12
128	Computer Systems Design and Related Services	-24	-3
129	Management, Scientific, and Technical Consulting Services	-27	-5
133	Management of Companies and Enterprises	-102	-14
140	Services to Buildings and Dwellings	-20	-7
142	Waste Management and Remediation Services	-18	-1

Table 7. Phase 3 Deficits Adding Anchor Industry 87

Office Furniture (Including Fixtures) Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-65	-3
32	Converted Paper Product Manufacturing	-21	-3
35	Basic Chemical Manufacturing	-191	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-21	-2
72	Semiconductor and Other Electronic Component Manufacturing	-49	-6
97	Rail Transportation	-22	-1
104	Warehousing and Storage	-76	-16
128	Computer Systems Design and Related Services	-26	-3
129	Management, Scientific, and Technical Consulting Services	-31	-4
133	Management of Companies and Enterprises	-109	-6
140	Services to Buildings and Dwellings	-27	-7
142	Waste Management and Remediation Services	-19	-1

Table 8. Phase 4 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	-66	-0
32	Converted Paper Product Manufacturing	-22	-0
35	Basic Chemical Manufacturing	-191	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-21	-0
72	Semiconductor and Other Electronic Component Manufacturing	-49	-1
97	Rail Transportation	-22	-0
104	Warehousing and Storage	-80	-4
128	Computer Systems Design and Related Services	-27	-1
129	Management, Scientific, and Technical Consulting Services	-31	-0
133	Management of Companies and Enterprises	-111	-2
140	Services to Buildings and Dwellings	-28	-1
142	Waste Management and Remediation Services	-19	-0

Chapter 7. Scranton--Wilkes-Barre, PA

Study Area Overview

The Scranton--Wilkes-Barre, PA study region occupies 1,746 square-miles and had a 2018 population of 555,485. The employed share of the regional labor force during the 2014-2018 period averaged 95.28%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Warehousing and Storage. These three industries account for a combined 17.35% of the region's economy. The region's 2018 coefficient of specialization (COS) is 27.9, 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 Scranton--Wilkes-Barre, 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 Warehousing and Storage, whose employment grew by 9,083 followed by Individual and Family 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 7.03, 1.58, and 2.48.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
104	Warehousing and Storage	9,083	5,967	7.03
155	Individual and Family Services	3,165	-75	1.58
149	Outpatient Care Centers	1,462	-562	2.48
144	Junior Colleges, Colleges, Universities, and Professional Schools	1,414	-118	2.69
136	Employment Services	1,301	1,256	1.23
151	Home Health Care Services	1,043	-633	1.29
113	Data Processing, Hosting, and Related Services	880	775	2.45
133	Management of Companies and Enterprises	733	32	0.73
22	Bakeries and Tortilla Manufacturing	694	582	2.75
137	Business Support Services	647	384	1.98

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 Scranton--Wilkes-Barre, PA, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 2.54, 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 Scranton--Wilkes-Barre, 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.

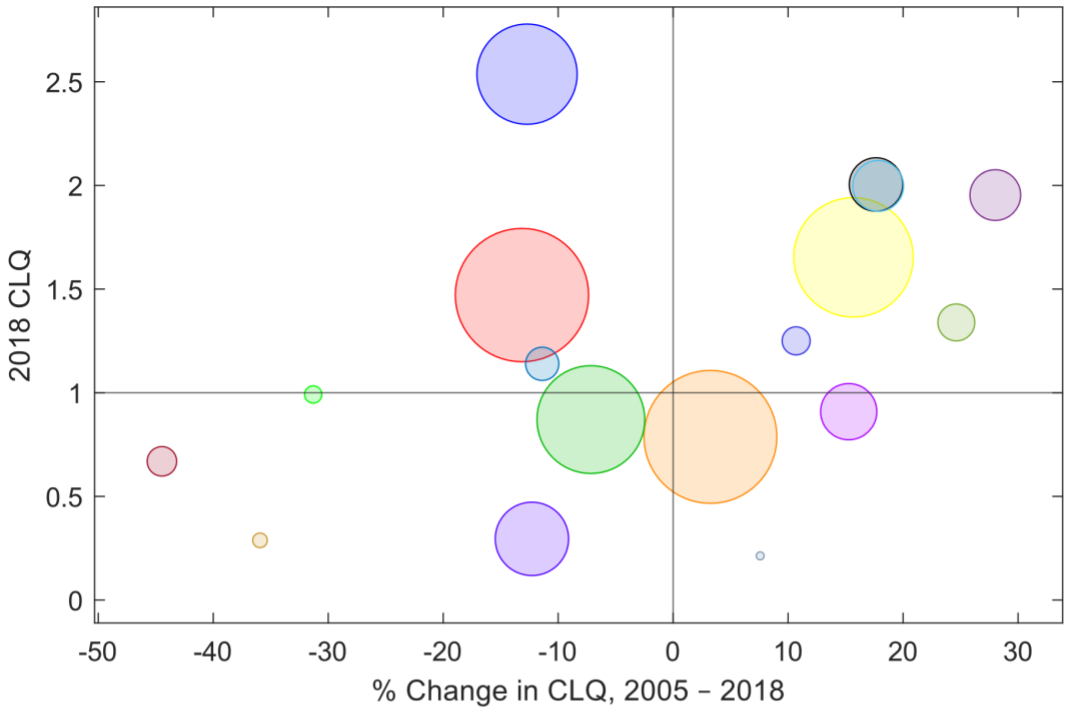
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.69	1.47	38,676
5	Business and Financial Services	0.76	0.79	38,420
16	Transportation and Logistics	1.43	1.65	30,692
3	Arts, Entertainment, Recreation and Visitor Industries	0.94	0.87	24,670
9	Education and Knowledge Creation	2.91	2.54	21,150
8	Defense and Security	0.34	0.30	10,814
1	Agribusiness, Food Processing and Technology	0.79	0.91	6,063
15	Primary and Fabricated Metal Products	1.70	2.00	5,447
11	Forest and Wood Products	1.70	2.00	4,874
6	Chemicals and Chemical-Based Products	1.53	1.95	4,852
10	Energy (Fossil and Renewable)	1.07	1.34	2,449
12	Information Technology and Telecommunications	1.29	1.14	1,966
7	Computer, Electronic, and Electrical Products	1.20	0.67	1,533
14	Mining, Glass and Ceramics	1.13	1.25	1,386
2	Apparel and Textiles	1.44	0.99	614
13	Machinery	0.45	0.29	509
17	Transportation Equipment	0.20	0.21	402

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Scranton--Wilkes-Barre, PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (38,676)
Business and Financial Services (38,420)
Transportation and Logistics (30,692)
Arts, Entertainment, Recreation and Visitor Industries (24,670)
Education and Knowledge Creation (21,150)
Defense and Security (10,814)
Agribusiness, Food Processing and Technology (6,063)
Primary and Fabricated Metal Products (5,447)
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Computer, Electronic, and Electrical Products (1,533)
Mining, Glass and Ceramics (1,386)
Apparel and Textiles (614)
Machinery (509)
Transportation Equipment (402)

2. CADS Analysis

The 2018 CADS analysis of the economy of Scranton--Wilkes-Barre, 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 Warehousing and Storage, 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	104	Warehousing and Storage	3,533	12,616
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	3,688	3,564
5	Business and Financial Services	136	Employment Services	5,822	7,124
5	Business and Financial Services	137	Business Support Services	2,300	2,947

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
104	Warehousing and Storage	7.03	5,967	88.22	257.12	0.98	0.05
42	Plastics Product Manufacturing	3.82	121	-6.65	-3.36	0.73	0.05
136	Employment Services	1.23	1,256	0.78	22.35	0.99	0.02
137	Business Support Services	1.98	384	11.43	28.13	0.98	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 104

Warehousing and Storage

Industry #	Industry Name	Employment
35	Basic Chemical Manufacturing	N/A
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	N/A
48	Iron and Steel Mills and Ferroalloy Manufacturing	-7
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-3
81	Motor Vehicle Parts Manufacturing	N/A
97	Rail Transportation	-7

Table 6. Phase 2 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-111	-133
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-129	-226
48	Iron and Steel Mills and Ferroalloy Manufacturing	-14	-7
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-28	-25
81	Motor Vehicle Parts Manufacturing	-13	-16
97	Rail Transportation	-39	-32

Table 7. Phase 3 Deficits Adding Anchor Industry 136

Employment Services

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-112	-0

36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-130	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-14	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-28	-0
81	Motor Vehicle Parts Manufacturing	-14	-1
97	Rail Transportation	-39	-0

Table 8. Phase 4 Deficits Adding Anchor Industry 137

Business Support Services

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-113	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-130	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-14	-1
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-29	-0
81	Motor Vehicle Parts Manufacturing	-20	-5
97	Rail Transportation	-40	-1

Chapter 8. Selinsgrove, PA

Study Area Overview

The Selinsgrove, PA study region occupies 329 square-miles and had a 2018 population of 40,540. The employed share of the regional labor force during the 2014-2018 period averaged 97.9%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing and Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing. These three industries account for a combined 25.07% of the region's economy. The region's 2018 coefficient of specialization (COS) is 43.78, 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 Selinsgrove, 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 627 followed by Animal Slaughtering and Processing and Construction. 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 3.21, 6.1, and 1.06.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
155	Individual and Family Services	627	411	3.21
20	Animal Slaughtering and Processing	328	328	6.10
14	Construction	251	269	1.06
167	Food Services and Drinking Places	242	-167	1.31
95	All Other Retail	237	268	1.48
151	Home Health Care Services	140	124	1.01
149	Outpatient Care Centers	103	57	1.55
93	Food and Beverage Stores	100	59	2.17
23	Other Food Manufacturing	95	67	7.04
125	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	89	84	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 Selinsgrove, PA, the cluster with the largest CLQ in 2018 is Forest and Wood Products with a CLQ of 16.76, followed by Mining, Glass and Ceramics 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 Selinsgrove, 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.

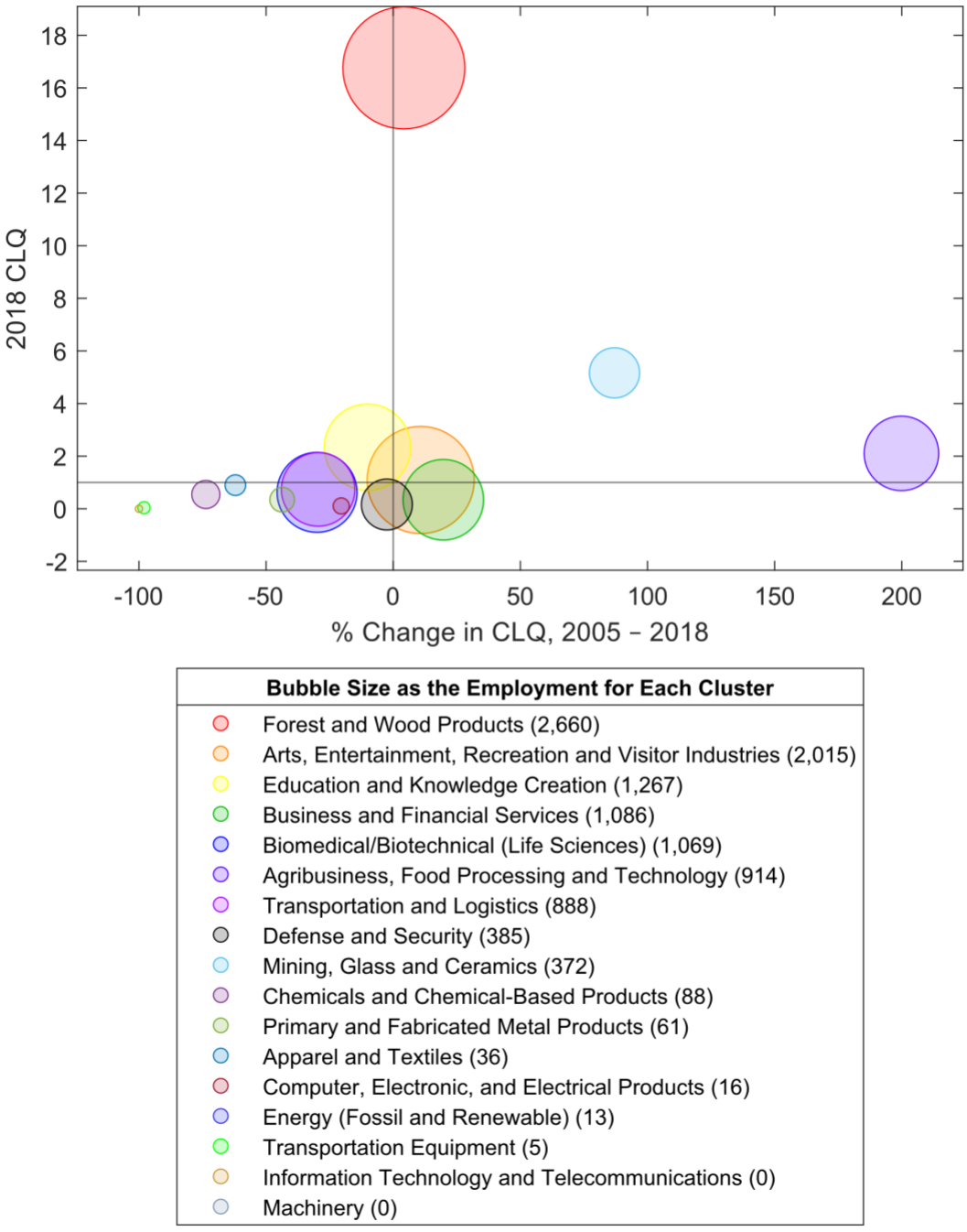
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
11	Forest and Wood Products	16.09	16.76	2,660
3	Arts, Entertainment, Recreation and Visitor Industries	0.99	1.09	2,015
9	Education and Knowledge Creation	2.60	2.34	1,267
5	Business and Financial Services	0.29	0.34	1,086
4	Biomedical/Biotechnical (Life Sciences)	0.89	0.63	1,069
1	Agribusiness, Food Processing and Technology	0.70	2.11	914
16	Transportation and Logistics	1.04	0.74	888
8	Defense and Security	0.17	0.16	385
14	Mining, Glass and Ceramics	2.76	5.17	372
6	Chemicals and Chemical-Based Products	2.06	0.54	88
15	Primary and Fabricated Metal Products	0.61	0.35	61
2	Apparel and Textiles	2.37	0.90	36
7	Computer, Electronic, and Electrical Products	0.13	0.11	16
10	Energy (Fossil and Renewable)	0.00	0.11	13
17	Transportation Equipment	2.02	0.04	5
12	Information Technology and Telecommunications	0.09	0.00	0
13	Machinery	0.00	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Selinsgrove, PA



2. CADS Analysis

The 2018 CADS analysis of the economy of Selinsgrove, 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 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	0	328
14	Mining, Glass and Ceramics	46	Cement and Concrete Product Manufacturing	230	296

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	6.10	328	3.38	N/A	0.59	0.09
46	Cement and Concrete Product Manufacturing	14.73	109	-18.50	28.76	0.63	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 20

Animal Slaughtering and Processing

Industry #	Industry Name	Employment
1	Crop Production	-27
2	Animal Production	-207

Table 6. Phase 2 Deficits Adding Anchor Industry 46

Cement and Concrete Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-28	-2
2	Animal Production	-207	-0

Chapter 9. Seneca, SC

Study Area Overview

The Seneca, SC study region occupies 626 square-miles and had a 2018 population of 78,374. The employed share of the regional labor force during the 2014-2018 period averaged 94.2%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by All Other Retail and Electric Power Generation, Transmission and Distribution. These three industries account for a combined 18.45% of the region's economy. The region's 2018 coefficient of specialization (COS) is 39.49, 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 Seneca, 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 Elementary and Secondary Schools, whose employment grew by 878 followed by Offices of Physicians 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 7.34, 2.14, and 1.11.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
143	Elementary and Secondary Schools	878	781	7.34
146	Offices of Physicians	408	298	2.14
136	Employment Services	408	406	1.11
82	Aerospace Product and Parts Manufacturing	322	321	4.27
155	Individual and Family Services	312	278	0.90
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	302	341	13.97
61	Other Fabricated Metal Product Manufacturing	288	291	12.02
93	Food and Beverage Stores	237	199	1.66
81	Motor Vehicle Parts Manufacturing	217	288	9.28
76	Household Appliance Manufacturing	210	210	21.90

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 Seneca, SC, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 7.91, followed by Computer, Electronic, and Electrical Products 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 Seneca, 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.

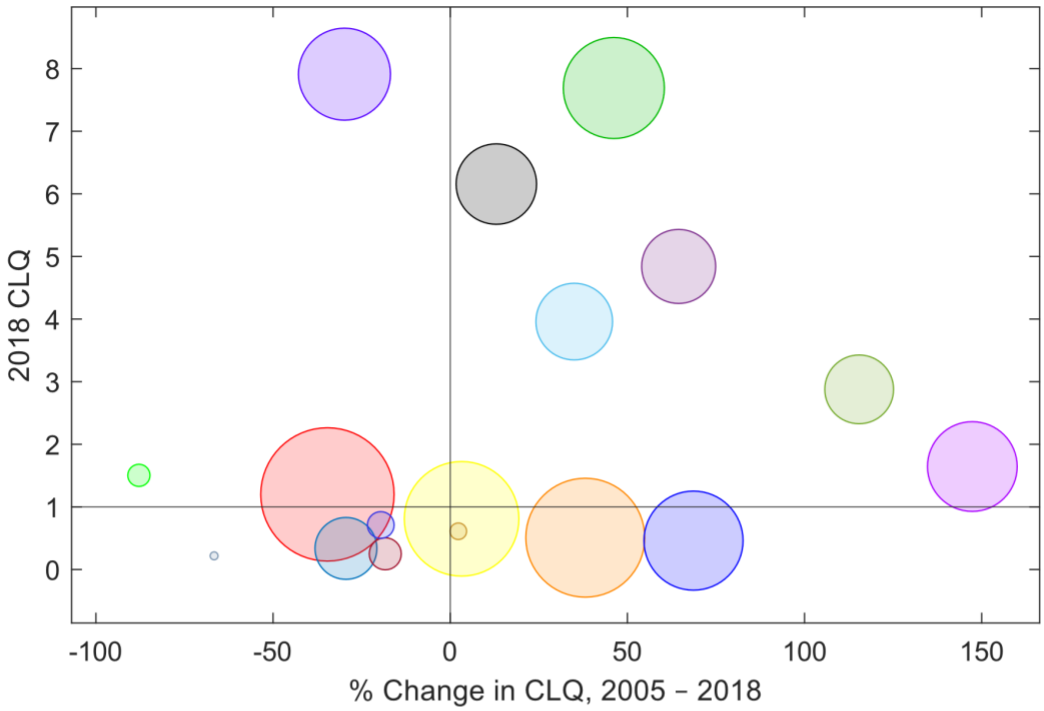
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
4	Biomedical/Biotechnical (Life Sciences)	1.84	1.20	3,021
5	Business and Financial Services	0.37	0.51	2,376
3	Arts, Entertainment, Recreation and Visitor Industries	0.78	0.81	2,199
7	Computer, Electronic, and Electrical Products	5.26	7.69	1,688
8	Defense and Security	0.27	0.46	1,620
10	Energy (Fossil and Renewable)	11.28	7.91	1,386
9	Education and Knowledge Creation	0.66	1.64	1,314
13	Machinery	5.45	6.16	1,043
6	Chemicals and Chemical-Based Products	2.93	3.96	942
17	Transportation Equipment	2.94	4.84	875
15	Primary and Fabricated Metal Products	1.34	2.88	749
16	Transportation and Logistics	0.48	0.34	600
1	Agribusiness, Food Processing and Technology	0.31	0.25	160
12	Information Technology and Telecommunications	0.88	0.71	117
2	Apparel and Textiles	12.40	1.50	89
14	Mining, Glass and Ceramics	0.60	0.61	65
11	Forest and Wood Products	0.65	0.22	51

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Seneca, SC



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (3,021)
Business and Financial Services (2,376)
Arts, Entertainment, Recreation and Visitor Industries (2,199)
Computer, Electronic, and Electrical Products (1,688)
Defense and Security (1,620)
Energy (Fossil and Renewable) (1,386)
Education and Knowledge Creation (1,314)
Machinery (1,043)
Chemicals and Chemical-Based Products (942)
Transportation Equipment (875)
Primary and Fabricated Metal Products (749)
Transportation and Logistics (600)
Agribusiness, Food Processing and Technology (160)
Information Technology and Telecommunications (117)
Apparel and Textiles (89)
Mining, Glass and Ceramics (65)
Forest and Wood Products (51)

2. CADS Analysis

The 2018 CADS analysis of the economy of Seneca, SC 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 Basic Chemical 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	35	Basic Chemical Manufacturing	267	475
17	Transportation Equipment	81	Motor Vehicle Parts Manufacturing	621	838
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	450	858
15	Primary and Fabricated Metal Products	61	Other Fabricated Metal Product Manufacturing	225	513
8	Defense and Security	82	Aerospace Product and Parts Manufacturing	7	329

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
35	Basic Chemical Manufacturing	20.87	206	0.73	77.65	0.65	0.18
81	Motor Vehicle Parts Manufacturing	9.28	288	-11.56	34.87	0.63	0.11
146	Offices of Physicians	2.14	298	24.38	90.67	0.85	0.03
61	Other Fabricated Metal Product Manufacturing	12.02	291	-1.46	127.81	0.71	0.04

82	Aerospace Product and Parts Manufacturing	4.27	321	11.31	4,527.18	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 35

Basic Chemical Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	-177
6	Oil and Gas Extraction	-17
9	Nonmetallic Mineral Mining and Quarrying	-14
41	Other Chemical Product and Preparation Manufacturing	-11
48	Iron and Steel Mills and Ferroalloy Manufacturing	-3
52	Foundries	-3
53	Forging and Stamping	-2
55	Architectural and Structural Metals Manufacturing	-7
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	N/A
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-11
72	Semiconductor and Other Electronic Component Manufacturing	-23
97	Rail Transportation	-20
99	Truck Transportation	-45
103	Couriers and Messengers	-15
104	Warehousing and Storage	-3
129	Management, Scientific, and Technical Consulting Services	N/A
133	Management of Companies and Enterprises	-72

Table 6. Phase 2 Deficits Adding Anchor Industry 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-181	-4
6	Oil and Gas Extraction	-19	-1
9	Nonmetallic Mineral Mining and Quarrying	-15	-1
41	Other Chemical Product and Preparation Manufacturing	-14	-3
48	Iron and Steel Mills and Ferroalloy Manufacturing	-39	-36
52	Foundries	-84	-82
53	Forging and Stamping	-39	-37
55	Architectural and Structural Metals Manufacturing	-36	-29
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-73	-115
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-14	-3
72	Semiconductor and Other Electronic Component Manufacturing	-95	-72
97	Rail Transportation	-28	-7
99	Truck Transportation	-98	-53
103	Couriers and Messengers	-27	-12
104	Warehousing and Storage	-73	-70
129	Management, Scientific, and Technical Consulting Services	-10	-28
133	Management of Companies and Enterprises	-152	-80

Table 7. Phase 3 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-181	-1
6	Oil and Gas Extraction	-19	-0
9	Nonmetallic Mineral Mining and Quarrying	-15	-0
41	Other Chemical Product and Preparation Manufacturing	-15	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-39	-0
52	Foundries	-84	-0
53	Forging and Stamping	-39	-0
55	Architectural and Structural Metals Manufacturing	-36	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-73	-1
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-14	-0
72	Semiconductor and Other Electronic Component Manufacturing	-96	-1
97	Rail Transportation	-28	-0
99	Truck Transportation	-100	-2
103	Couriers and Messengers	-29	-3
104	Warehousing and Storage	-75	-3
129	Management, Scientific, and Technical Consulting Services	-31	-21
133	Management of Companies and Enterprises	-175	-23

Table 8. Phase 4 Deficits Adding Anchor Industry 61

Other Fabricated Metal Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-182	-1
6	Oil and Gas Extraction	-19	-0
9	Nonmetallic Mineral Mining and Quarrying	-16	-0
41	Other Chemical Product and Preparation Manufacturing	-16	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-48	-9
52	Foundries	-93	-9
53	Forging and Stamping	-48	-9
55	Architectural and Structural Metals Manufacturing	-39	-3
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-94	-21
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-15	-0
72	Semiconductor and Other Electronic Component Manufacturing	-105	-9
97	Rail Transportation	-29	-2
99	Truck Transportation	-112	-13
103	Couriers and Messengers	-32	-3
104	Warehousing and Storage	-106	-30
129	Management, Scientific, and Technical Consulting Services	-38	-7
133	Management of Companies and Enterprises	-192	-17

Table 9. Phase 5 Deficits Adding Anchor Industry 82

Aerospace Product and Parts Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-182	-0
6	Oil and Gas Extraction	-20	-0
9	Nonmetallic Mineral Mining and Quarrying	-16	-0
41	Other Chemical Product and Preparation Manufacturing	-16	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-50	-2
52	Foundries	-95	-1
53	Forging and Stamping	-50	-2
55	Architectural and Structural Metals Manufacturing	-44	-5
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-99	-5
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-15	-0
72	Semiconductor and Other Electronic Component Manufacturing	-123	-18
97	Rail Transportation	-30	-0
99	Truck Transportation	-118	-6
103	Couriers and Messengers	-34	-2
104	Warehousing and Storage	-113	-8
129	Management, Scientific, and Technical Consulting Services	-49	-11
133	Management of Companies and Enterprises	-209	-17

Chapter 10. Sevierville, TN

Study Area Overview

The Sevierville, TN study region occupies 592 square-miles and had a 2018 population of 97,892. 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 Accommodation and All Other Retail. These three industries account for a combined 45.12% of the region's economy. The region's 2018 coefficient of specialization (COS) is 50.03, 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 Sevierville, 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 Food Services and Drinking Places, whose employment grew by 3,785 followed by Amusement Parks and Arcades and Other Amusement and Recreation Industries. 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 2.76, 42.17, and 2.78.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	3,785	1,978	2.76
163	Amusement Parks and Arcades	1,085	574	42.17
165	Other Amusement and Recreation Industries	646	489	2.78
166	Accommodation	582	30	9.68
143	Elementary and Secondary Schools	559	288	4.61
24	Beverage Manufacturing	542	522	7.42
181	Government and Unclassified	465	405	0.31
93	Food and Beverage Stores	343	261	1.66
94	General Merchandise Stores	326	295	1.05
119	Real Estate and Owner-Occupied Dwellings	318	223	1.89

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 Sevierville, TN, the cluster with the largest CLQ in 2018 is Arts, Entertainment, Recreation and Visitor Industries with a CLQ of 4.13, followed by Energy (Fossil and Renewable) 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 Sevierville, 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.

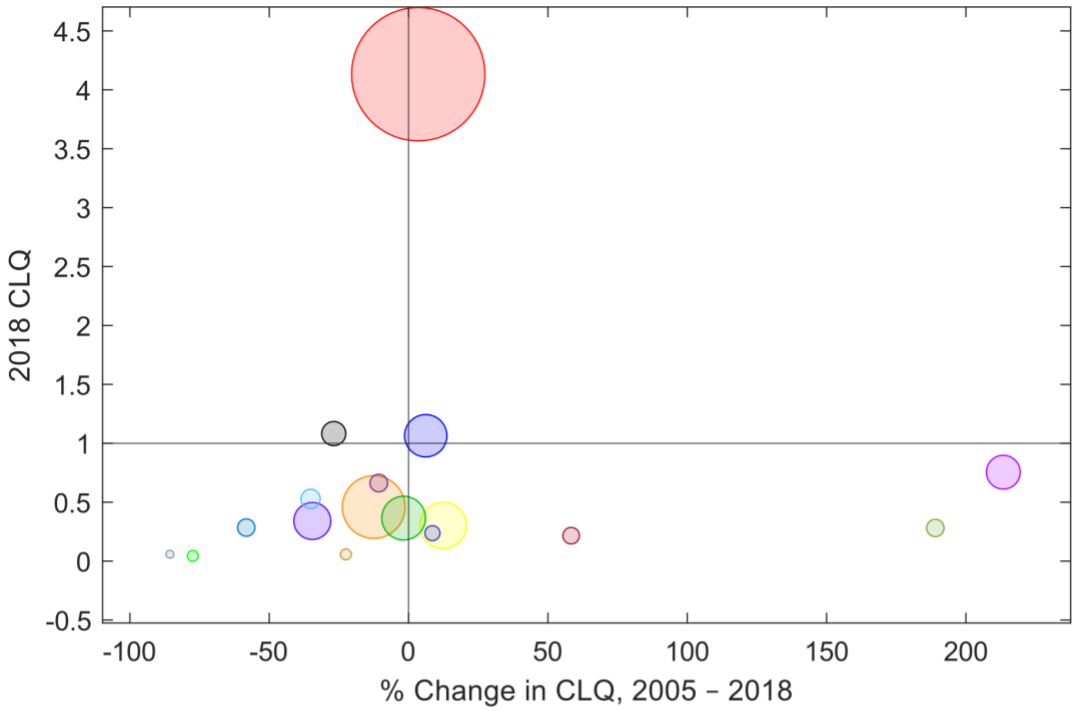
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
3	Arts, Entertainment, Recreation and Visitor Industries	3.99	4.13	21,964
5	Business and Financial Services	0.52	0.46	4,199
8	Defense and Security	0.27	0.30	2,088
4	Biomedical/Biotechnical (Life Sciences)	0.37	0.36	1,799
9	Education and Knowledge Creation	1.00	1.06	1,664
16	Transportation and Logistics	0.52	0.34	1,186
1	Agribusiness, Food Processing and Technology	0.24	0.75	944
10	Energy (Fossil and Renewable)	1.48	1.08	371
17	Transportation Equipment	0.81	0.53	187
14	Mining, Glass and Ceramics	0.74	0.66	138
6	Chemicals and Chemical-Based Products	0.10	0.28	131
11	Forest and Wood Products	0.68	0.28	130
15	Primary and Fabricated Metal Products	0.14	0.22	110
12	Information Technology and Telecommunications	0.22	0.24	77
7	Computer, Electronic, and Electrical Products	0.20	0.04	19
13	Machinery	0.07	0.06	19
2	Apparel and Textiles	0.41	0.06	7

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Sevierville, TN



Bubble Size as the Employment for Each Cluster
Arts, Entertainment, Recreation and Visitor Industries (21,964)
Business and Financial Services (4,199)
Defense and Security (2,088)
Biomedical/Biotechnical (Life Sciences) (1,799)
Education and Knowledge Creation (1,664)
Transportation and Logistics (1,186)
Agribusiness, Food Processing and Technology (944)
Energy (Fossil and Renewable) (371)
Transportation Equipment (187)
Mining, Glass and Ceramics (138)
Chemicals and Chemical-Based Products (131)
Forest and Wood Products (130)
Primary and Fabricated Metal Products (110)
Information Technology and Telecommunications (77)
Computer, Electronic, and Electrical Products (19)
Machinery (19)
Apparel and Textiles (7)

2. CADS Analysis

The 2018 CADS analysis of the economy of Sevierville, 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 Real Estate and Owner-Occupied Dwellings, 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	119	Real Estate and Owner-Occupied Dwellings	866	1,184

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
119	Real Estate and Owner-Occupied Dwellings	1.89	223	11.04	36.77	0.80	0.31

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 119

Real Estate and Owner-Occupied Dwellings

Industry #	Industry Name	Employment
1	Crop Production	-11
61	Other Fabricated Metal Product Manufacturing	-11
104	Warehousing and Storage	-20
117	Insurance Carriers	-81
126	Architectural, Engineering, and Related Services	-60
127	Specialized Design Services	-14
136	Employment Services	-89
139	Investigation and Security Services	-13
140	Services to Buildings and Dwellings	-37

Chapter 11. Somerset, KY

Study Area Overview

The Somerset, KY study region occupies 658 square-miles and had a 2018 population of 64,623. The employed share of the regional labor force during the 2014-2018 period averaged 92.5%. 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 20.1% of the region's economy. The region's 2018 coefficient of specialization (COS) is 35.21, 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 Somerset, KY 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 510 followed by Home Health Care Services 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 13.69, 2.4, and 1.37.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
81	Motor Vehicle Parts Manufacturing	510	601	13.69
151	Home Health Care Services	383	218	2.40
153	Hospitals	334	191	1.37
167	Food Services and Drinking Places	303	-229	1.09
128	Computer Systems Design and Related Services	301	300	0.85
146	Offices of Physicians	272	142	1.91
137	Business Support Services	205	201	1.58
181	Government and Unclassified	184	150	0.30
93	Food and Beverage Stores	176	147	1.19
143	Elementary and Secondary Schools	128	-319	9.55

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 Somerset, KY, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 7.45, followed by Forest and Wood 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 Somerset, KY 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.

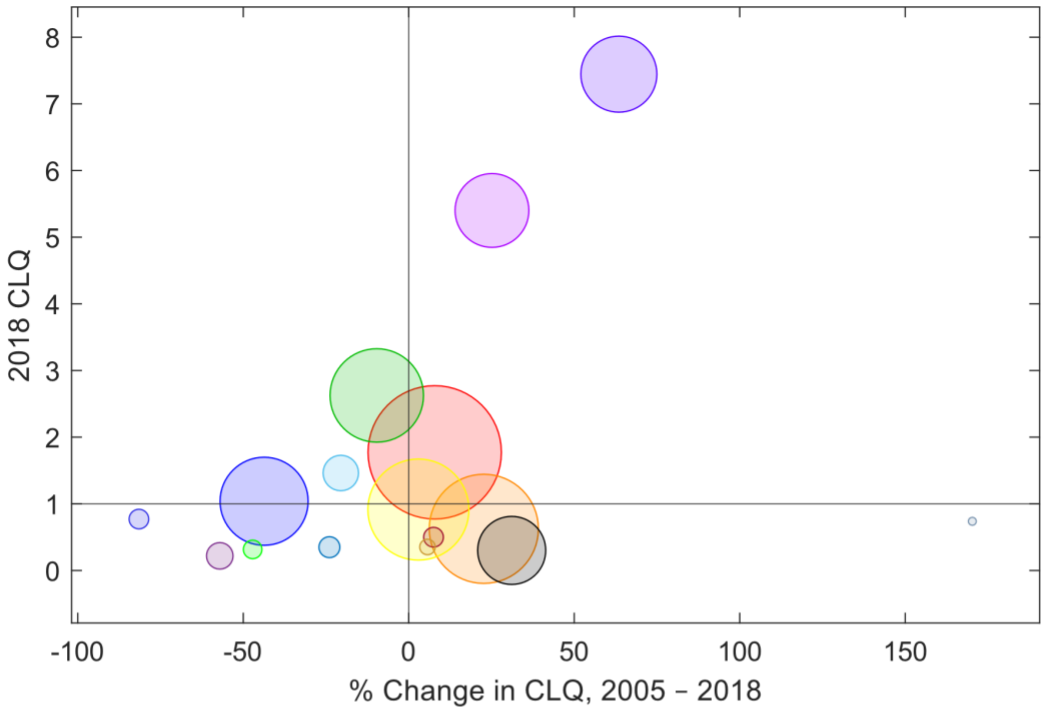
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	1.77	4,706
5	Business and Financial Services	0.51	0.63	3,081
3	Arts, Entertainment, Recreation and Visitor Industries	0.89	0.91	2,615
9	Education and Knowledge Creation	2.91	2.63	2,211
16	Transportation and Logistics	1.84	1.04	1,948
17	Transportation Equipment	4.55	7.45	1,419
11	Forest and Wood Products	4.32	5.40	1,331
8	Defense and Security	0.23	0.30	1,115
10	Energy (Fossil and Renewable)	1.84	1.46	270
1	Agribusiness, Food Processing and Technology	0.51	0.22	148
7	Computer, Electronic, and Electrical Products	0.00	0.49	114
15	Primary and Fabricated Metal Products	0.46	0.35	96
12	Information Technology and Telecommunications	0.46	0.50	87
14	Mining, Glass and Ceramics	4.17	0.77	86
6	Chemicals and Chemical-Based Products	0.60	0.32	79
13	Machinery	0.33	0.35	63
2	Apparel and Textiles	0.27	0.74	46

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Somerset, KY



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (4,706)
Business and Financial Services (3,081)
Arts, Entertainment, Recreation and Visitor Industries (2,615)
Education and Knowledge Creation (2,211)
Transportation and Logistics (1,948)
Transportation Equipment (1,419)
Forest and Wood Products (1,331)
Defense and Security (1,115)
Energy (Fossil and Renewable) (270)
Agribusiness, Food Processing and Technology (148)
Computer, Electronic, and Electrical Products (114)
Primary and Fabricated Metal Products (96)
Information Technology and Telecommunications (87)
Mining, Glass and Ceramics (86)
Chemicals and Chemical-Based Products (79)
Machinery (63)
Apparel and Textiles (46)

2. CADS Analysis

The 2018 CADS analysis of the economy of Somerset, KY 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 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	792	1,302
4	Biomedical/Biotechnical (Life Sciences)	153	Hospitals	789	1,123
4	Biomedical/Biotechnical (Life Sciences)	151	Home Health Care Services	208	591

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
81	Motor Vehicle Parts Manufacturing	13.69	601	-11.56	64.34	0.54	0.22
153	Hospitals	1.37	191	18.09	42.27	0.81	0.06
151	Home Health Care Services	2.40	218	79.39	184.13	0.81	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 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment
27	Apparel, Leather and Allied Product Manufacturing	-25
42	Plastics Product Manufacturing	-72
48	Iron and Steel Mills and Ferroalloy Manufacturing	-57
49	Steel Product Manufacturing From Purchased Steel	-34
51	Nonferrous Metal (except Aluminum) Production and Processing	-38
52	Foundries	-130
53	Forging and Stamping	-59
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-159
60	Coating, Engraving, Heat Treating, and Allied Activities	-42
72	Semiconductor and Other Electronic Component Manufacturing	-115
129	Management, Scientific, and Technical Consulting Services	-22

Table 6. Phase 2 Deficits Adding Anchor Industry 153

Hospitals

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-26	-1
42	Plastics Product Manufacturing	-76	-4
48	Iron and Steel Mills and Ferroalloy Manufacturing	-57	-0
49	Steel Product Manufacturing From Purchased Steel	-34	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-39	-0
52	Foundries	-130	-0
53	Forging and Stamping	-59	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-160	-1
60	Coating, Engraving, Heat Treating, and Allied Activities	-42	-1
72	Semiconductor and Other Electronic Component Manufacturing	-116	-2

129	Management, Scientific, and Technical Consulting Services	-58	-36

Table 7. Phase 3 Deficits Adding Anchor Industry 151

Home Health Care Services

Industry #	Industry Name	Employment	Added to Deficit
27	Apparel, Leather and Allied Product Manufacturing	-26	-0
42	Plastics Product Manufacturing	-77	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-57	-0
49	Steel Product Manufacturing From Purchased Steel	-34	-0
51	Nonferrous Metal (except Aluminum) Production and Processing	-39	-0
52	Foundries	-130	-0
53	Forging and Stamping	-59	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-160	-0
60	Coating, Engraving, Heat Treating, and Allied Activities	-42	-0
72	Semiconductor and Other Electronic Component Manufacturing	-117	-0
129	Management, Scientific, and Technical Consulting Services	-60	-3

Chapter 12. Somerset, PA

Study Area Overview

The Somerset, PA study region occupies 1,074 square-miles and had a 2018 population of 73,952. The employed share of the regional labor force during the 2014-2018 period averaged 95.4%. The Government and Unclassified 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 21.93% of the region's economy. The region's 2018 coefficient of specialization (COS) is 31.19, 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 Somerset, 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 Warehousing and Storage, whose employment grew by 382 followed by Home Health Care Services and Navigational, Measuring, Electromedical, and Control Instruments 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 2.22, 0.99, and 4.26.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
104	Warehousing and Storage	382	382	2.22
151	Home Health Care Services	219	209	0.99
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	213	216	4.26
48	Iron and Steel Mills and Ferroalloy Manufacturing	168	188	23.80
181	Government and Unclassified	109	33	0.63
155	Individual and Family Services	107	-304	1.33
140	Services to Buildings and Dwellings	99	71	0.50
148	Offices of Other Health Practitioners	90	48	0.98
149	Outpatient Care Centers	83	49	0.82
153	Hospitals	67	-142	1.57

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 Somerset, PA, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 4.8, followed by Primary and Fabricated Metal 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 Somerset, 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.

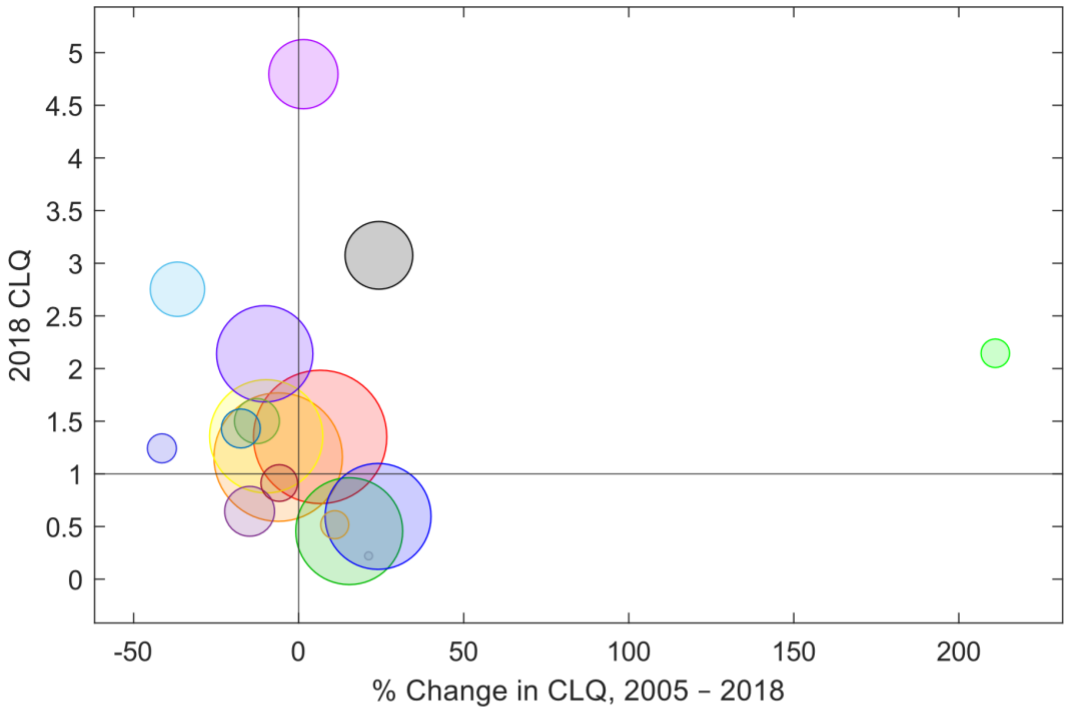
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.27	1.35	3,411
3	Arts, Entertainment, Recreation and Visitor Industries	1.24	1.16	3,154
16	Transportation and Logistics	1.50	1.36	2,419
5	Business and Financial Services	0.40	0.46	2,138
8	Defense and Security	0.48	0.60	2,098
9	Education and Knowledge Creation	2.39	2.14	1,713
10	Energy (Fossil and Renewable)	4.73	4.80	842
15	Primary and Fabricated Metal Products	2.47	3.08	802
17	Transportation Equipment	4.35	2.75	499
1	Agribusiness, Food Processing and Technology	0.76	0.64	413
7	Computer, Electronic, and Electrical Products	1.72	1.50	330
13	Machinery	1.73	1.43	243
11	Forest and Wood Products	0.97	0.91	214
14	Mining, Glass and Ceramics	2.12	1.24	132
2	Apparel and Textiles	0.69	2.15	128
6	Chemicals and Chemical-Based Products	0.47	0.52	123
12	Information Technology and Telecommunications	0.18	0.22	37

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Somerset, PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (3,411)
Arts, Entertainment, Recreation and Visitor Industries (3,154)
Transportation and Logistics (2,419)
Business and Financial Services (2,138)
Defense and Security (2,098)
Education and Knowledge Creation (1,713)
Energy (Fossil and Renewable) (842)
Primary and Fabricated Metal Products (802)
Transportation Equipment (499)
Agribusiness, Food Processing and Technology (413)
Computer, Electronic, and Electrical Products (330)
Machinery (243)
Forest and Wood Products (214)
Mining, Glass and Ceramics (132)
Apparel and Textiles (128)
Chemicals and Chemical-Based Products (123)
Information Technology and Telecommunications (37)

2. CADS Analysis

The 2018 CADS analysis of the economy of Somerset, 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 Coal Mining, 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)	7	Coal Mining	644	663
15	Primary and Fabricated Metal Products	48	Iron and Steel Mills and Ferroalloy Manufacturing	137	305

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
7	Coal Mining	83.08	202	-28.42	2.93	0.75	0.17
48	Iron and Steel Mills and Ferroalloy Manufacturing	23.80	188	-14.74	122.46	0.68	0.13

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 7

Coal Mining

Industry #	Industry Name	Employment
8	Metal Ore Mining	-1
32	Converted Paper Product Manufacturing	-3
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-10
43	Rubber Product Manufacturing	-18
49	Steel Product Manufacturing From Purchased Steel	-3
51	Nonferrous Metal (except Aluminum) Production and Processing	-2
60	Coating, Engraving, Heat Treating, and Allied Activities	-4
62	Agriculture, Construction, and Mining Machinery Manufacturing	-20
81	Motor Vehicle Parts Manufacturing	-15
97	Rail Transportation	-20
127	Specialized Design Services	-4
129	Management, Scientific, and Technical Consulting Services	N/A
133	Management of Companies and Enterprises	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 48

Iron and Steel Mills and Ferroalloy Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
8	Metal Ore Mining	-28	-27
32	Converted Paper Product Manufacturing	-14	-11
37	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	-10	-0
43	Rubber Product Manufacturing	-21	-2
49	Steel Product Manufacturing From Purchased Steel	-31	-29
51	Nonferrous Metal (except Aluminum) Production and Processing	-46	-44
60	Coating, Engraving, Heat Treating, and Allied Activities	-18	-14
62	Agriculture, Construction, and Mining Machinery Manufacturing	-22	-2
81	Motor Vehicle Parts Manufacturing	-26	-12
97	Rail Transportation	-40	-19
127	Specialized Design Services	-12	-8
129	Management, Scientific, and Technical Consulting Services	-15	-18

133	Management of Companies and Enterprises	-19	-32

Chapter 13. Spartanburg, SC

Study Area Overview

The Spartanburg, SC study region occupies 808 square-miles and had a 2018 population of 313,888. The employed share of the regional labor force during the 2014-2018 period averaged 95.3%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Food Services and Drinking Places and Motor Vehicle Manufacturing. These three industries account for a combined 22.09% of the region's economy. The region's 2018 coefficient of specialization (COS) is 33.77, 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 Spartanburg, 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 Motor Vehicle Manufacturing, whose employment grew by 4,128 followed by Truck Transportation 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 40.28, 2.99, and 1.07.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
79	Motor Vehicle Manufacturing	4,128	4,301	40.28
99	Truck Transportation	2,982	2,964	2.99
167	Food Services and Drinking Places	2,548	-87	1.07
81	Motor Vehicle Parts Manufacturing	2,346	2,658	9.52
136	Employment Services	2,203	2,180	1.59
143	Elementary and Secondary Schools	2,150	-584	11.91
95	All Other Retail	1,650	1,849	1.11
134	Office Administrative Services	1,544	1,492	3.63
155	Individual and Family Services	1,412	1,218	0.71
153	Hospitals	1,120	674	0.79

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 Spartanburg, SC, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 13.48, 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 Spartanburg, 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.

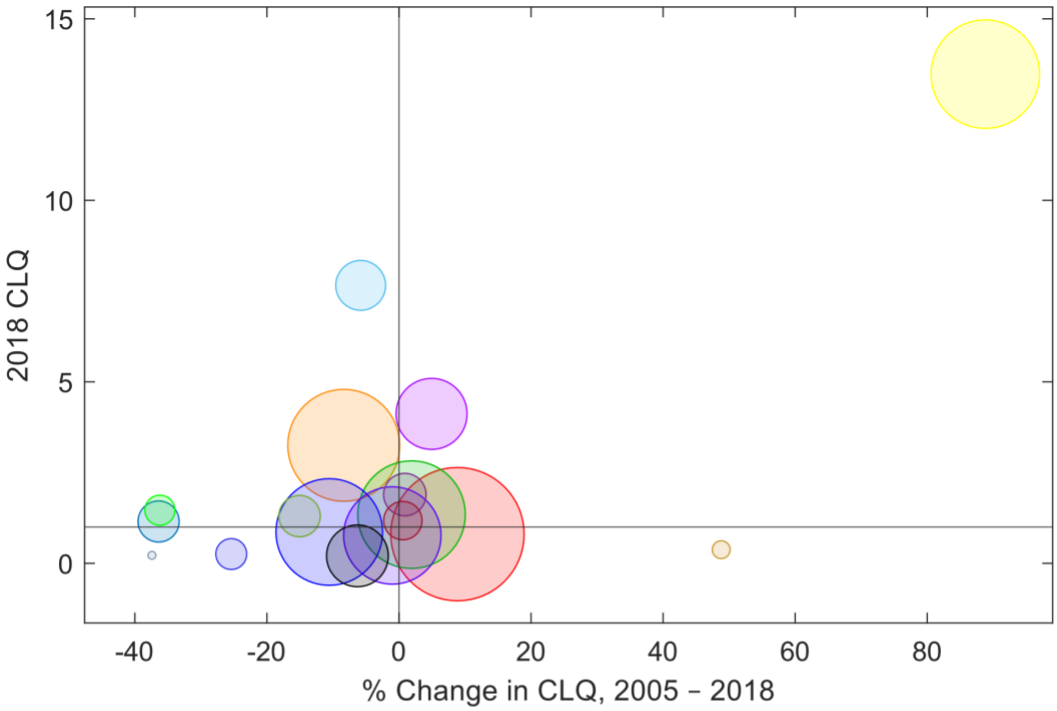
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	0.74	0.80	22,053
9	Education and Knowledge Creation	3.55	3.25	15,232
17	Transportation Equipment	7.14	13.48	14,291
16	Transportation and Logistics	1.32	1.34	14,001
3	Arts, Entertainment, Recreation and Visitor Industries	0.97	0.86	13,749
4	Biomedical/Biotechnical (Life Sciences)	0.77	0.77	11,334
6	Chemicals and Chemical-Based Products	3.92	4.12	5,746
8	Defense and Security	0.22	0.21	4,242
2	Apparel and Textiles	8.13	7.66	2,663
13	Machinery	1.88	1.89	1,882
11	Forest and Wood Products	1.53	1.30	1,784
15	Primary and Fabricated Metal Products	1.81	1.15	1,761
7	Computer, Electronic, and Electrical Products	1.17	1.18	1,515
1	Agribusiness, Food Processing and Technology	0.34	0.26	960
14	Mining, Glass and Ceramics	2.29	1.46	911
12	Information Technology and Telecommunications	0.25	0.38	364
10	Energy (Fossil and Renewable)	0.35	0.22	228

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Spartanburg, SC



Bubble Size as the Employment for Each Cluster
Business and Financial Services (22,053)
Education and Knowledge Creation (15,232)
Transportation Equipment (14,291)
Transportation and Logistics (14,001)
Arts, Entertainment, Recreation and Visitor Industries (13,749)
Biomedical/Biotechnical (Life Sciences) (11,334)
Chemicals and Chemical-Based Products (5,746)
Defense and Security (4,242)
Apparel and Textiles (2,663)
Machinery (1,882)
Forest and Wood Products (1,784)
Primary and Fabricated Metal Products (1,761)
Computer, Electronic, and Electrical Products (1,515)
Agribusiness, Food Processing and Technology (960)
Mining, Glass and Ceramics (911)
Information Technology and Telecommunications (364)
Energy (Fossil and Renewable) (228)

2. CADS Analysis

The 2018 CADS analysis of the economy of Spartanburg, 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	4,363	8,491

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	40.28	4,301	-3.98	94.60	0.52	0.65

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
48	Iron and Steel Mills and Ferroalloy Manufacturing	-742
52	Foundries	-1,579
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-2,264
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-905
71	Audio and Video Equipment Manufacturing	-1,689
72	Semiconductor and Other Electronic Component Manufacturing	-1,943
81	Motor Vehicle Parts Manufacturing	-9,467
91	Wholesale Trade	-900
104	Warehousing and Storage	-1,307
133	Management of Companies and Enterprises	-926

Chapter 14. Starkville, MS

Study Area Overview

The Starkville, MS study region occupies 458 square-miles and had a 2018 population of 49,599. 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 All Other Retail and Business Support Services. These three industries account for a combined 31.13% of the region's economy. The region's 2018 coefficient of specialization (COS) is 40.14, 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 Starkville, MS 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 948 followed by Offices of Other Health Practitioners and Individual and Family 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 2.54, 3.61, and 1.42.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
167	Food Services and Drinking Places	948	347	2.54
148	Offices of Other Health Practitioners	351	336	3.61
155	Individual and Family Services	233	115	1.42
95	All Other Retail	218	246	1.41
93	Food and Beverage Stores	179	168	1.13
119	Real Estate and Owner-Occupied Dwellings	146	130	1.40
90	Other Miscellaneous Manufacturing	139	142	4.81
140	Services to Buildings and Dwellings	94	50	1.01
91	Wholesale Trade	92	91	0.64
94	General Merchandise Stores	81	54	2.08

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 Starkville, MS, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 6.51, followed by Forest and Wood 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 Starkville, MS 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.

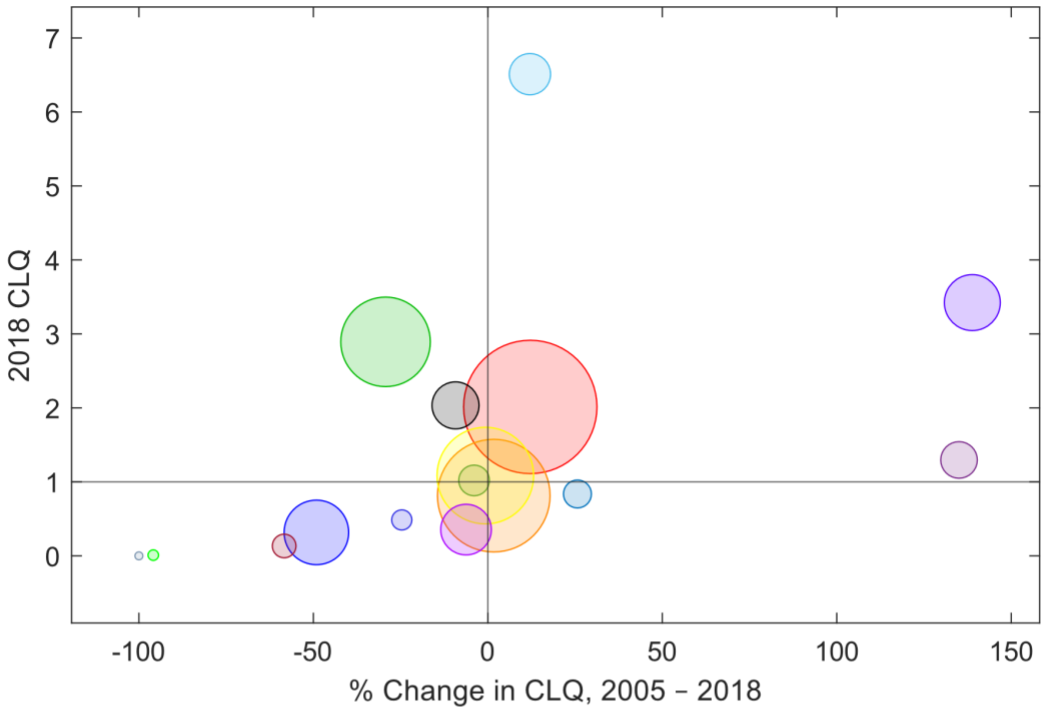
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	1.79	2.01	3,496
5	Business and Financial Services	0.80	0.81	2,435
4	Biomedical/Biotechnical (Life Sciences)	1.09	1.08	1,748
9	Education and Knowledge Creation	4.09	2.89	1,478
8	Defense and Security	0.62	0.32	712
11	Forest and Wood Products	1.43	3.42	512
16	Transportation and Logistics	0.38	0.36	404
15	Primary and Fabricated Metal Products	2.24	2.03	339
2	Apparel and Textiles	5.81	6.51	247
7	Computer, Electronic, and Electrical Products	0.55	1.30	182
10	Energy (Fossil and Renewable)	1.06	1.02	114
12	Information Technology and Telecommunications	0.67	0.84	88
1	Agribusiness, Food Processing and Technology	0.32	0.13	55
14	Mining, Glass and Ceramics	0.64	0.49	33
6	Chemicals and Chemical-Based Products	0.24	0.01	2
17	Transportation Equipment	0.00	0.01	2
13	Machinery	0.44	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Starkville, MS



Bubble Size as the Employment for Each Cluster
Arts, Entertainment, Recreation and Visitor Industries (3,496)
Business and Financial Services (2,435)
Biomedical/Biotechnical (Life Sciences) (1,748)
Education and Knowledge Creation (1,478)
Defense and Security (712)
Forest and Wood Products (512)
Transportation and Logistics (404)
Primary and Fabricated Metal Products (339)
Apparel and Textiles (247)
Computer, Electronic, and Electrical Products (182)
Energy (Fossil and Renewable) (114)
Information Technology and Telecommunications (88)
Agribusiness, Food Processing and Technology (55)
Mining, Glass and Ceramics (33)
Chemicals and Chemical-Based Products (2)
Transportation Equipment (2)
Machinery (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Starkville, MS 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 Real Estate and Owner-Occupied Dwellings, 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	119	Real Estate and Owner-Occupied Dwellings	142	288
3	Arts, Entertainment, Recreation and Visitor Industries	166	Accommodation	265	338
11	Forest and Wood Products	86	Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing	216	264
11	Forest and Wood Products	90	Other Miscellaneous Manufacturing	16	155

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
119	Real Estate and Owner-Occupied Dwellings	1.40	130	11.04	103.05	0.81	0.22
166	Accommodation	1.70	45	10.44	27.39	0.82	0.03

86	Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing	9.96	122	-34.24	22.35	0.62	0.02
90	Other Miscellaneous Manufacturing	4.81	142	-16.56	887.58	0.62	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 119

Real Estate and Owner-Occupied Dwellings

Industry #	Industry Name	Employment
42	Plastics Product Manufacturing	-1
104	Warehousing and Storage	-3
117	Insurance Carriers	-15
131	Advertising and Related Services	-7

Table 6. Phase 2 Deficits Adding Anchor Industry 166

Accommodation

Industry #	Industry Name	Employment	Added to Deficit
42	Plastics Product Manufacturing	-2	-1
104	Warehousing and Storage	-5	-2
117	Insurance Carriers	-16	-1
131	Advertising and Related Services	-9	-2

Table 7. Phase 3 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
42	Plastics Product Manufacturing	-7	-5
104	Warehousing and Storage	-17	-12
117	Insurance Carriers	-17	-0
131	Advertising and Related Services	-10	-1

Table 8. Phase 4 Deficits Adding Anchor Industry 90

Other Miscellaneous Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
42	Plastics Product Manufacturing	-11	-4
104	Warehousing and Storage	-25	-8
117	Insurance Carriers	-17	-0
131	Advertising and Related Services	-11	-1

Chapter 15. State College, PA

Study Area Overview

The State College, PA study region occupies 1,110 square-miles and had a 2018 population of 162,805. 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 Construction. These three industries account for a combined 30.65% of the region's economy. The region's 2018 coefficient of specialization (COS) is 32.48, 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 State College, 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 Junior Colleges, Colleges, Universities, and Professional Schools, whose employment grew by 10,354 followed by Business Support Services and Construction. 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 14.19, 5.94, and 1.13.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
144	Junior Colleges, Colleges, Universities, and Professional Schools	10,354	10,136	14.19
137	Business Support Services	2,059	2,018	5.94
14	Construction	981	1,068	1.13
93	Food and Beverage Stores	866	748	1.91
153	Hospitals	751	431	1.14
154	Nursing and Residential Care Facilities	579	359	1.27
167	Food Services and Drinking Places	384	-1,151	1.07
146	Offices of Physicians	377	197	0.98
181	Government and Unclassified	372	265	0.34
151	Home Health Care Services	371	208	0.87

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 State College, PA, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 6.57, followed by Computer, Electronic, and Electrical Products 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 State College, 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.

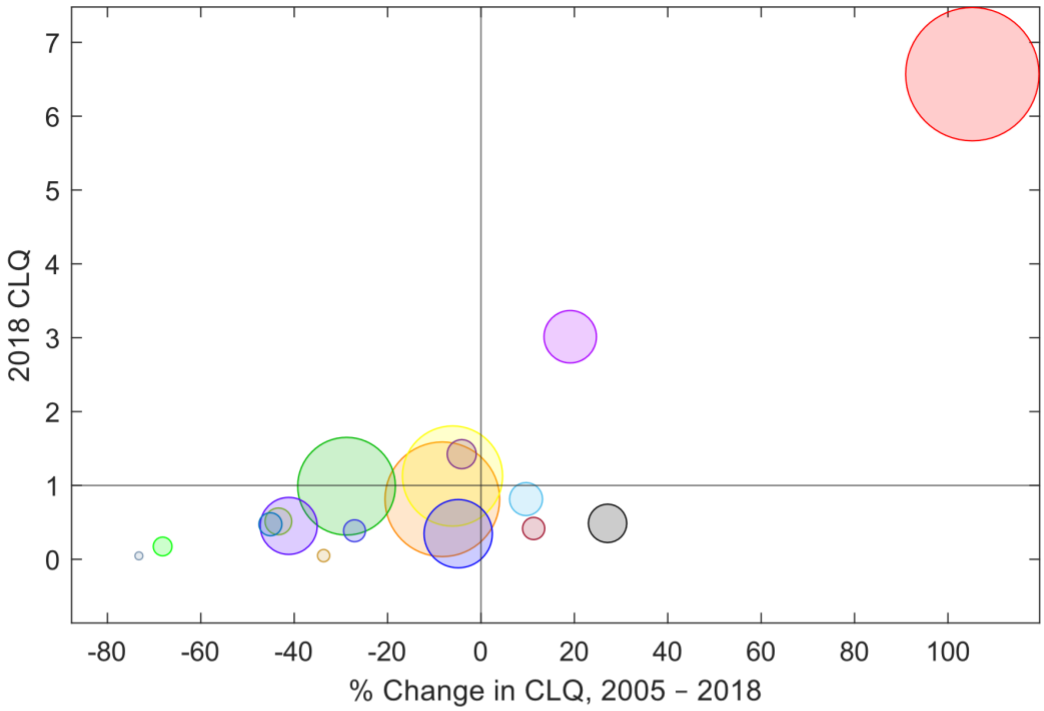
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
9	Education and Knowledge Creation	3.20	6.57	14,924
5	Business and Financial Services	0.89	0.81	10,806
4	Biomedical/Biotechnical (Life Sciences)	1.20	1.13	8,075
3	Arts, Entertainment, Recreation and Visitor Industries	1.39	0.99	7,642
8	Defense and Security	0.36	0.35	3,461
16	Transportation and Logistics	0.77	0.45	2,287
7	Computer, Electronic, and Electrical Products	2.53	3.01	1,881
1	Agribusiness, Food Processing and Technology	0.38	0.49	885
15	Primary and Fabricated Metal Products	0.74	0.82	604
14	Mining, Glass and Ceramics	1.48	1.42	430
11	Forest and Wood Products	0.91	0.51	342
12	Information Technology and Telecommunications	0.86	0.47	223
13	Machinery	0.37	0.42	201
10	Energy (Fossil and Renewable)	0.53	0.39	193
6	Chemicals and Chemical-Based Products	0.55	0.17	118
17	Transportation Equipment	0.07	0.05	25
2	Apparel and Textiles	0.17	0.05	8

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of State College, PA



Bubble Size as the Employment for Each Cluster

- Education and Knowledge Creation (14,924)
- Business and Financial Services (10,806)
- Biomedical/Biotechnical (Life Sciences) (8,075)
- Arts, Entertainment, Recreation and Visitor Industries (7,642)
- Defense and Security (3,461)
- Transportation and Logistics (2,287)
- Computer, Electronic, and Electrical Products (1,881)
- Agribusiness, Food Processing and Technology (885)
- Primary and Fabricated Metal Products (604)
- Mining, Glass and Ceramics (430)
- Forest and Wood Products (342)
- Information Technology and Telecommunications (223)
- Machinery (201)
- Energy (Fossil and Renewable) (193)
- Chemicals and Chemical-Based Products (118)
- Transportation Equipment (25)
- Apparel and Textiles (8)

2. CADS Analysis

The 2018 CADS analysis of the economy of State College, 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	914	11,269
7	Computer, Electronic, and Electrical Products	73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	1,026	1,089
5	Business and Financial Services	137	Business Support Services	354	2,413
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	1,252	1,831

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	14.19	10,136	23.90	1,132.43	0.92	0.17
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	6.20	134	-6.94	6.15	0.89	0.04
137	Business Support Services	5.94	2,018	11.43	581.54	0.92	0.04
154	Nursing and Residential Care Facilities	1.27	359	17.58	46.25	0.94	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
1	Crop Production	-18
22	Bakeries and Tortilla Manufacturing	-10
32	Converted Paper Product Manufacturing	-6
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-3

Table 6. Phase 2 Deficits Adding Anchor Industry 73

Navigational, Measuring, Electromedical, and Control Instruments Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-18	-1
22	Bakeries and Tortilla Manufacturing	-10	-0
32	Converted Paper Product Manufacturing	-8	-1
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-9	-6

Table 7. Phase 3 Deficits Adding Anchor Industry 137

Business Support Services

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-20	-2

22	Bakeries and Tortilla Manufacturing	-10	-0
32	Converted Paper Product Manufacturing	-11	-4
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-12	-3

Table 8. Phase 4 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-23	-3
22	Bakeries and Tortilla Manufacturing	-11	-1
32	Converted Paper Product Manufacturing	-14	-3
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	-12	-0

Chapter 16. Steubenville-Weirton, OH-WV

Study Area Overview

The Steubenville-Weirton, OH-WV study region occupies 580 square-miles and had a 2018 population of 117,064. The employed share of the regional labor force during the 2014-2018 period averaged 93.94%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Elementary and Secondary Schools and Hospitals. These three industries account for a combined 19.73% of the region's economy. The region's 2018 coefficient of specialization (COS) is 36.26, 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 Steubenville-Weirton, OH-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 Accommodation, whose employment grew by 715 followed by Warehousing and Storage and Individual and Family 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 1.81, 3.15, and 1.09.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
166	Accommodation	715	699	1.81
104	Warehousing and Storage	609	404	3.15
155	Individual and Family Services	286	-85	1.09
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	259	257	4.58
51	Nonferrous Metal (except Aluminum) Production and Processing	204	265	42.75
145	Other Educational Services	203	152	1.35
144	Junior Colleges, Colleges, Universities, and Professional Schools	196	-148	3.77
136	Employment Services	159	158	0.40
142	Waste Management and Remediation Services	154	110	2.92
100	Transit and Ground Passenger Transportation	106	76	1.15

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 Steubenville-Weirton, OH-WV, the cluster with the largest CLQ in 2018 is Mining, Glass and Ceramics with a CLQ of 8.52, followed by Primary and Fabricated Metal Products 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 Steubenville-Weirton, OH-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.

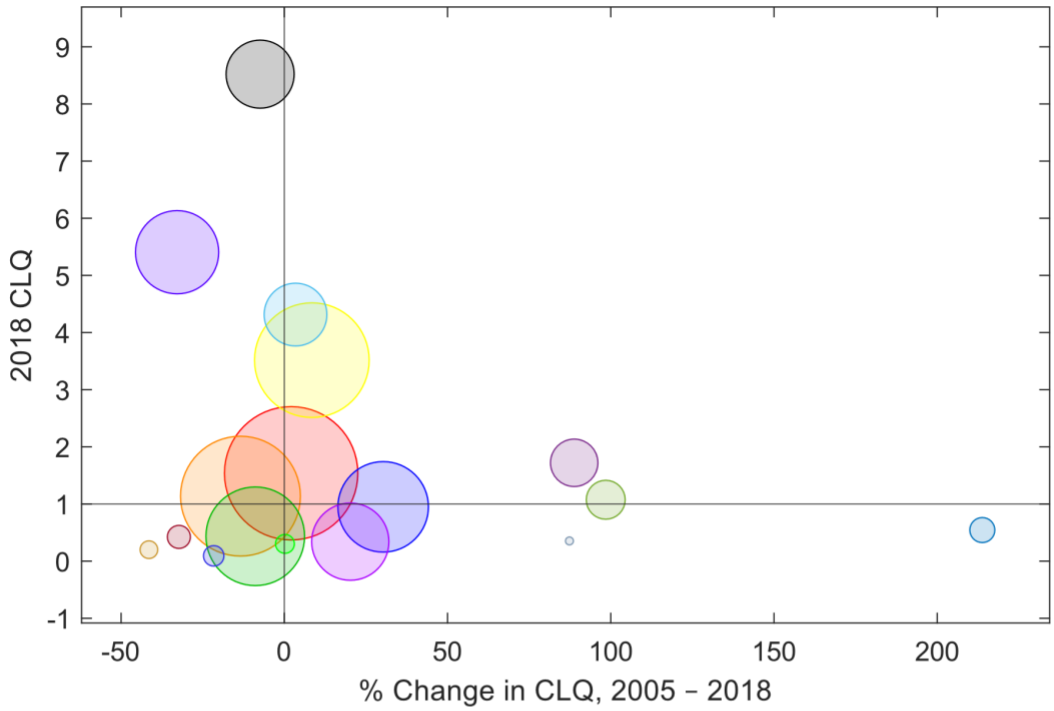
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.51	1.54	6,009
3	Arts, Entertainment, Recreation and Visitor Industries	1.31	1.14	4,792
9	Education and Knowledge Creation	3.24	3.52	4,360
5	Business and Financial Services	0.48	0.43	3,156
16	Transportation and Logistics	0.73	0.95	2,622
15	Primary and Fabricated Metal Products	8.05	5.41	2,184
8	Defense and Security	0.28	0.34	1,856
14	Mining, Glass and Ceramics	9.20	8.52	1,405
10	Energy (Fossil and Renewable)	4.17	4.31	1,173
11	Forest and Wood Products	0.91	1.72	624
6	Chemicals and Chemical-Based Products	0.54	1.07	397
13	Machinery	0.17	0.54	143
17	Transportation Equipment	0.63	0.42	119
1	Agribusiness, Food Processing and Technology	0.12	0.09	92
12	Information Technology and Telecommunications	0.30	0.30	77
7	Computer, Electronic, and Electrical Products	0.34	0.20	68
2	Apparel and Textiles	0.19	0.35	33

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Steubenville-Weirton, OH-WV



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (6,009)
Arts, Entertainment, Recreation and Visitor Industries (4,792)
Education and Knowledge Creation (4,360)
Business and Financial Services (3,156)
Transportation and Logistics (2,622)
Primary and Fabricated Metal Products (2,184)
Defense and Security (1,856)
Mining, Glass and Ceramics (1,405)
Energy (Fossil and Renewable) (1,173)
Forest and Wood Products (624)
Chemicals and Chemical-Based Products (397)
Machinery (143)
Transportation Equipment (119)
Agribusiness, Food Processing and Technology (92)
Information Technology and Telecommunications (77)
Computer, Electronic, and Electrical Products (68)
Apparel and Textiles (33)

2. CADS Analysis

The 2018 CADS analysis of the economy of Steubenville-Weirton, OH-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 Nonferrous Metal (except Aluminum) Production 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
15	Primary and Fabricated Metal Products	51	Nonferrous Metal (except Aluminum) Production and Processing	403	606
16	Transportation and Logistics	99	Truck Transportation	543	582
3	Arts, Entertainment, Recreation and Visitor Industries	166	Accommodation	153	869
14	Mining, Glass and Ceramics	60	Coating, Engraving, Heat Treating, and Allied Activities	428	429
16	Transportation and Logistics	104	Warehousing and Storage	233	841
15	Primary and Fabricated Metal Products	59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	136	396

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
51	Nonferrous Metal (except Aluminum) Production and Processing	42.75	265	-15.34	50.55	0.74	0.08
99	Truck Transportation	1.46	33	1.19	7.18	0.90	0.02

166	Accommodation	1.81	699	10.44	467.04	0.88	0.02
60	Coating, Engraving, Heat Treating, and Allied Activities	13.10	17	-3.57	0.31	0.80	0.02
104	Warehousing and Storage	3.15	404	88.22	261.71	0.92	0.02
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	4.58	257	2.18	190.18	0.82	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 51

Nonferrous Metal (except Aluminum) Production and Processing

Industry #	Industry Name	Employment
1	Crop Production	-4
8	Metal Ore Mining	-58
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	-9
39	Paint, Coating, and Adhesive Manufacturing	-1
49	Steel Product Manufacturing From Purchased Steel	-5
66	Metalworking Machinery Manufacturing	-2
72	Semiconductor and Other Electronic Component Manufacturing	-21
78	Other Electrical Equipment and Component Manufacturing	-21
97	Rail Transportation	-5
133	Management of Companies and Enterprises	N/A
137	Business Support Services	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-5	-1
8	Metal Ore Mining	-59	-0
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	-10	-0
39	Paint, Coating, and Adhesive Manufacturing	-1	-0
49	Steel Product Manufacturing From Purchased Steel	-5	-0
66	Metalworking Machinery Manufacturing	-2	-0
72	Semiconductor and Other Electronic Component Manufacturing	-22	-1
78	Other Electrical Equipment and Component Manufacturing	-21	-0
97	Rail Transportation	-7	-2
133	Management of Companies and Enterprises	N/A	-12
137	Business Support Services	-1	-3

Table 7. Phase 3 Deficits Adding Anchor Industry 166

Accommodation

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-8	-4
8	Metal Ore Mining	-59	-0
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	-11	-1
39	Paint, Coating, and Adhesive Manufacturing	-1	-0
49	Steel Product Manufacturing From Purchased Steel	-5	-0
66	Metalworking Machinery Manufacturing	-2	-0
72	Semiconductor and Other Electronic Component Manufacturing	-23	-1
78	Other Electrical Equipment and Component Manufacturing	-22	-0
97	Rail Transportation	-8	-0
133	Management of Companies and Enterprises	N/A	-35
137	Business Support Services	-4	-4

Table 8. Phase 4 Deficits Adding Anchor Industry 60

Coating, Engraving, Heat Treating, and Allied Activities

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-10	-2
8	Metal Ore Mining	-60	-1
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	-12	-1
39	Paint, Coating, and Adhesive Manufacturing	-10	-8
49	Steel Product Manufacturing From Purchased Steel	-11	-5
66	Metalworking Machinery Manufacturing	-3	-1
72	Semiconductor and Other Electronic Component Manufacturing	-28	-5
78	Other Electrical Equipment and Component Manufacturing	-22	-1
97	Rail Transportation	-9	-2
133	Management of Companies and Enterprises	N/A	-12

137	Business Support Services	-7	-3

Table 9. Phase 5 Deficits Adding Anchor Industry 104

Warehousing and Storage

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-10	-0
8	Metal Ore Mining	-60	-0
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	-13	-1
39	Paint, Coating, and Adhesive Manufacturing	-10	-0
49	Steel Product Manufacturing From Purchased Steel	-11	-0
66	Metalworking Machinery Manufacturing	-3	-0
72	Semiconductor and Other Electronic Component Manufacturing	-29	-1
78	Other Electrical Equipment and Component Manufacturing	-22	-0
97	Rail Transportation	-10	-0
133	Management of Companies and Enterprises	-3	-4
137	Business Support Services	-9	-3

Table 10. Phase 6 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	-11	-0
8	Metal Ore Mining	-60	-0
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	-13	-0
39	Paint, Coating, and Adhesive Manufacturing	-10	-0
49	Steel Product Manufacturing From Purchased Steel	-14	-3
66	Metalworking Machinery Manufacturing	-10	-7
72	Semiconductor and Other Electronic Component Manufacturing	-34	-5
78	Other Electrical Equipment and Component Manufacturing	-23	-0
97	Rail Transportation	-10	-1
133	Management of Companies and Enterprises	-15	-11
137	Business Support Services	-13	-3

Chapter 17. Summerville, GA

Study Area Overview

The Summerville, GA study region occupies 313 square-miles and had a 2018 population of 24,790. The employed share of the regional labor force during the 2014-2018 period averaged 93.5%. The Textile Mills and Textile Product Mills industry was the region's largest employer in 2018, followed by Government and Unclassified and Elementary and Secondary Schools. These three industries account for a combined 47.77% of the region's economy. The region's 2018 coefficient of specialization (COS) is 56.43, 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 Summerville, 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 Government and Unclassified, whose employment grew by 190 followed by Hospitals 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 0.7, 0.94, and 0.79.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
181	Government and Unclassified	190	174	0.70
153	Hospitals	188	188	0.94
167	Food Services and Drinking Places	148	82	0.79
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	111	148	118.28
56	Boiler, Tank, and Shipping Container Manufacturing	63	63	17.74
15	Animal Food Manufacturing	57	49	33.17
81	Motor Vehicle Parts Manufacturing	38	48	5.20
40	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	34	34	7.33
157	Child Day Care Services	20	20	0.48
91	Wholesale Trade	18	18	0.47

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 Summerville, GA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 120.46, 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 Summerville, 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.

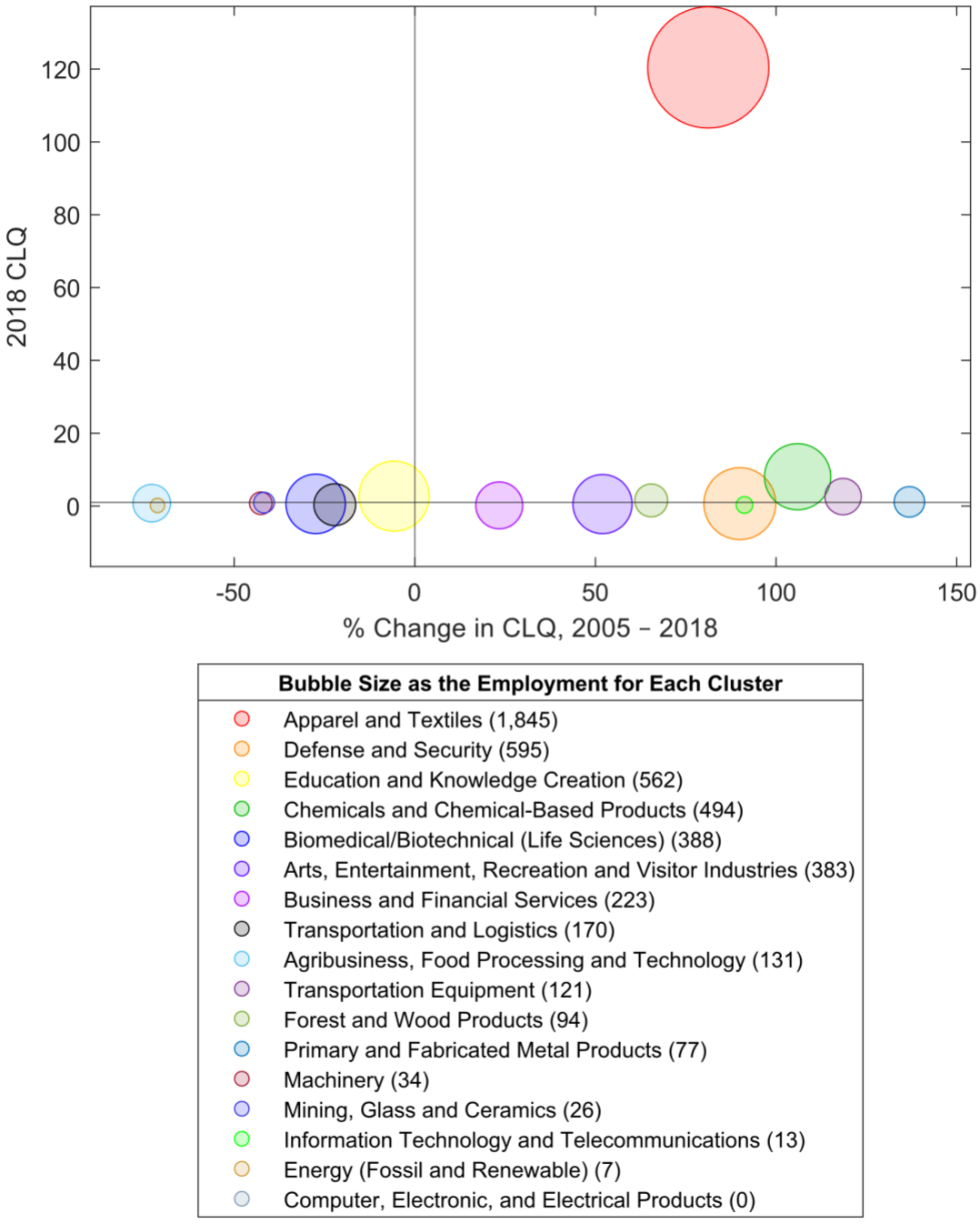
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	66.47	120.46	1,845
8	Defense and Security	0.35	0.66	595
9	Education and Knowledge Creation	2.89	2.72	562
6	Chemicals and Chemical-Based Products	3.91	8.04	494
4	Biomedical/Biotechnical (Life Sciences)	0.82	0.60	388
3	Arts, Entertainment, Recreation and Visitor Industries	0.36	0.55	383
5	Business and Financial Services	0.15	0.18	223
16	Transportation and Logistics	0.48	0.37	170
1	Agribusiness, Food Processing and Technology	2.93	0.79	131
17	Transportation Equipment	1.19	2.59	121
11	Forest and Wood Products	0.94	1.55	94
15	Primary and Fabricated Metal Products	0.49	1.15	77
13	Machinery	1.34	0.77	34
14	Mining, Glass and Ceramics	1.62	0.94	26
12	Information Technology and Telecommunications	0.15	0.29	13
10	Energy (Fossil and Renewable)	0.56	0.16	7
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 Summerville, GA



2. CADS Analysis

The 2018 CADS analysis of the economy of Summerville, GA 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 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	328	440

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
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	118.28	148	-11.32	33.86	0.20	0.39

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	-67
35	Basic Chemical Manufacturing	-153
42	Plastics Product Manufacturing	-35
91	Wholesale Trade	-69
99	Truck Transportation	-54
104	Warehousing and Storage	-46
126	Architectural, Engineering, and Related Services	-25
133	Management of Companies and Enterprises	-109
136	Employment Services	-38
140	Services to Buildings and Dwellings	-48

Chapter 18. Sunbury, PA

Study Area Overview

The Sunbury, PA study region occupies 458 square-miles and had a 2018 population of 91,083. The employed share of the regional labor force during the 2014-2018 period averaged 96.4%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Nursing and Residential Care Facilities and Government and Unclassified. These three industries account for a combined 20.84% of the region's economy. The region's 2018 coefficient of specialization (COS) is 39.54, 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 Sunbury, 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 Nursing and Residential Care Facilities, whose employment grew by 436 followed by Amusement Parks and Arcades 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 3.31, 21.88, and 4.53.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
154	Nursing and Residential Care Facilities	436	173	3.31
163	Amusement Parks and Arcades	375	234	21.88
42	Plastics Product Manufacturing	320	330	4.53
18	Fruit and Vegetable Preserving and Specialty Food Manufacturing	304	300	30.96
155	Individual and Family Services	296	-43	1.43
104	Warehousing and Storage	291	-172	4.14
99	Truck Transportation	274	263	4.15
167	Food Services and Drinking Places	204	-190	0.73
133	Management of Companies and Enterprises	183	63	1.28
151	Home Health Care Services	161	-27	1.49

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 Sunbury, PA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 2.74, 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 Sunbury, 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.

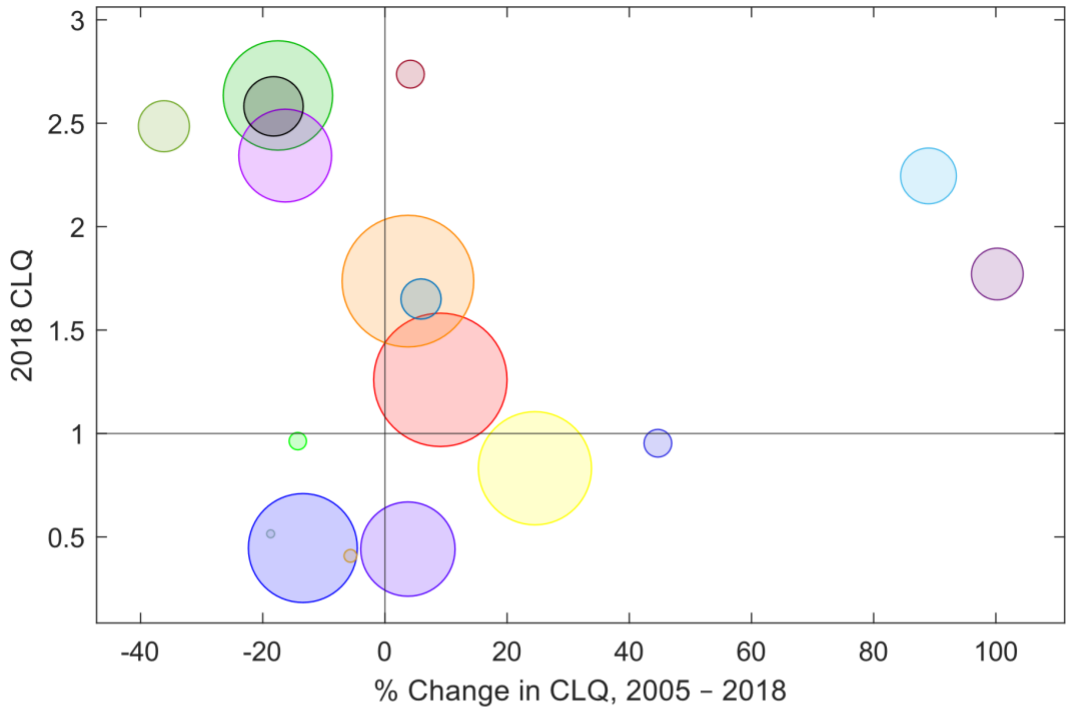
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.15	1.26	3,635
16	Transportation and Logistics	1.67	1.74	3,540
3	Arts, Entertainment, Recreation and Visitor Industries	0.67	0.83	2,588
9	Education and Knowledge Creation	3.19	2.63	2,411
5	Business and Financial Services	0.52	0.45	2,391
8	Defense and Security	0.43	0.44	1,775
1	Agribusiness, Food Processing and Technology	2.80	2.34	1,717
11	Forest and Wood Products	3.16	2.58	692
6	Chemicals and Chemical-Based Products	1.19	2.25	612
15	Primary and Fabricated Metal Products	0.88	1.77	528
17	Transportation Equipment	3.89	2.49	515
10	Energy (Fossil and Renewable)	1.56	1.65	331
2	Apparel and Textiles	2.63	2.74	186
13	Machinery	0.66	0.95	185
14	Mining, Glass and Ceramics	1.12	0.96	117
7	Computer, Electronic, and Electrical Products	0.43	0.41	103
12	Information Technology and Telecommunications	0.63	0.52	98

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Sunbury, PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (3,635)
Transportation and Logistics (3,540)
Arts, Entertainment, Recreation and Visitor Industries (2,588)
Education and Knowledge Creation (2,411)
Business and Financial Services (2,391)
Defense and Security (1,775)
Agribusiness, Food Processing and Technology (1,717)
Forest and Wood Products (692)
Chemicals and Chemical-Based Products (612)
Primary and Fabricated Metal Products (528)
Transportation Equipment (515)
Energy (Fossil and Renewable) (331)
Apparel and Textiles (186)
Machinery (185)
Mining, Glass and Ceramics (117)
Computer, Electronic, and Electrical Products (103)
Information Technology and Telecommunications (98)

2. CADS Analysis

The 2018 CADS analysis of the economy of Sunbury, PA 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 Fruit and Vegetable Preserving and Specialty Food 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
1	Agribusiness, Food Processing and Technology	18	Fruit and Vegetable Preserving and Specialty Food Manufacturing	631	935
16	Transportation and Logistics	99	Truck Transportation	945	1,219
6	Chemicals and Chemical-Based Products	42	Plastics Product Manufacturing	144	464
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	1,494	1,930
3	Arts, Entertainment, Recreation and Visitor Industries	163	Amusement Parks and Arcades	436	810

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
18	Fruit and Vegetable Preserving and Specialty Food Manufacturing	30.96	300	0.63	48.26	0.75	0.13
99	Truck Transportation	4.15	263	1.19	28.99	0.81	0.08
42	Plastics Product Manufacturing	4.53	330	-6.65	223.19	0.54	0.05
154	Nursing and Residential Care Facilities	3.31	173	17.58	29.18	0.87	0.04
163	Amusement Parks and Arcades	21.88	234	32.27	86.06	0.87	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 18

Fruit and Vegetable Preserving and Specialty Food Manufacturing

Industry #	Industry Name	Employment
1	Crop Production	-219
4	Fishing, Hunting and Trapping	-16
5	Support Activities for Agriculture and Forestry	-8
35	Basic Chemical Manufacturing	-5
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-3
45	Glass and Glass Product Manufacturing	-8
56	Boiler, Tank, and Shipping Container Manufacturing	-35
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-11
81	Motor Vehicle Parts Manufacturing	-7
97	Rail Transportation	-9
129	Management, Scientific, and Technical Consulting Services	N/A
134	Office Administrative Services	-1
136	Employment Services	-25

Table 6. Phase 2 Deficits Adding Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-220	-1
4	Fishing, Hunting and Trapping	-16	-0

5	Support Activities for Agriculture and Forestry	-9	-0
35	Basic Chemical Manufacturing	-6	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-3	-1
45	Glass and Glass Product Manufacturing	-8	-0
56	Boiler, Tank, and Shipping Container Manufacturing	-35	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-11	-0
81	Motor Vehicle Parts Manufacturing	-15	-9
97	Rail Transportation	-15	-6
129	Management, Scientific, and Technical Consulting Services	N/A	-13
134	Office Administrative Services	-8	-7
136	Employment Services	-131	-107

Table 7. Phase 3 Deficits Adding Anchor Industry 42

Plastics Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-228	-8
4	Fishing, Hunting and Trapping	-16	-0
5	Support Activities for Agriculture and Forestry	-10	-1
35	Basic Chemical Manufacturing	-21	-16
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-30	-27
45	Glass and Glass Product Manufacturing	-10	-2
56	Boiler, Tank, and Shipping Container Manufacturing	-36	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-14	-3
81	Motor Vehicle Parts Manufacturing	-17	-2
97	Rail Transportation	-18	-4
129	Management, Scientific, and Technical Consulting Services	N/A	-7
134	Office Administrative Services	-10	-2
136	Employment Services	-145	-14

Table 8. Phase 4 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-231	-3
4	Fishing, Hunting and Trapping	-17	-1
5	Support Activities for Agriculture and Forestry	-10	-0
35	Basic Chemical Manufacturing	-22	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-30	-0
45	Glass and Glass Product Manufacturing	-11	-0
56	Boiler, Tank, and Shipping Container Manufacturing	-36	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-15	-1
81	Motor Vehicle Parts Manufacturing	-18	-1
97	Rail Transportation	-19	-0

129	Management, Scientific, and Technical Consulting Services	-13	-19
134	Office Administrative Services	-17	-7
136	Employment Services	-188	-43

Table 9. Phase 5 Deficits Adding Anchor Industry 163

Amusement Parks and Arcades

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-235	-4
4	Fishing, Hunting and Trapping	-18	-1
5	Support Activities for Agriculture and Forestry	-11	-0
35	Basic Chemical Manufacturing	-22	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-30	-0
45	Glass and Glass Product Manufacturing	-11	-0
56	Boiler, Tank, and Shipping Container Manufacturing	-36	-0
65	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	-15	-0
81	Motor Vehicle Parts Manufacturing	-18	-0
97	Rail Transportation	-19	-0
129	Management, Scientific, and Technical Consulting Services	-16	-3
134	Office Administrative Services	-18	-1
136	Employment Services	-200	-11

Chapter 19. Talladega-Sylacauga, AL

Study Area Overview

The Talladega-Sylacauga, AL study region occupies 737 square-miles and had a 2018 population of 79,828. The employed share of the regional labor force during the 2014-2018 period averaged 93.8%. The Motor Vehicle Manufacturing 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 27.94% of the region's economy. The region's 2018 coefficient of specialization (COS) is 45.49, 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 Talladega-Sylacauga, 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 729 followed by Motor Vehicle Parts Manufacturing and Motor Vehicle 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 1.97, 7.07, and 107.39.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
136	Employment Services	729	724	1.97
81	Motor Vehicle Parts Manufacturing	592	614	7.07
79	Motor Vehicle Manufacturing	543	710	107.39
104	Warehousing and Storage	397	30	3.86
86	Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing	298	437	13.83
144	Junior Colleges, Colleges, Universities, and Professional Schools	296	75	3.58
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	214	205	9.23
99	Truck Transportation	196	192	1.79
76	Household Appliance Manufacturing	194	195	16.66
167	Food Services and Drinking Places	173	-331	0.83

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 Talladega-Sylacauga, AL, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 24.89, 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 Talladega-Sylacauga, 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.

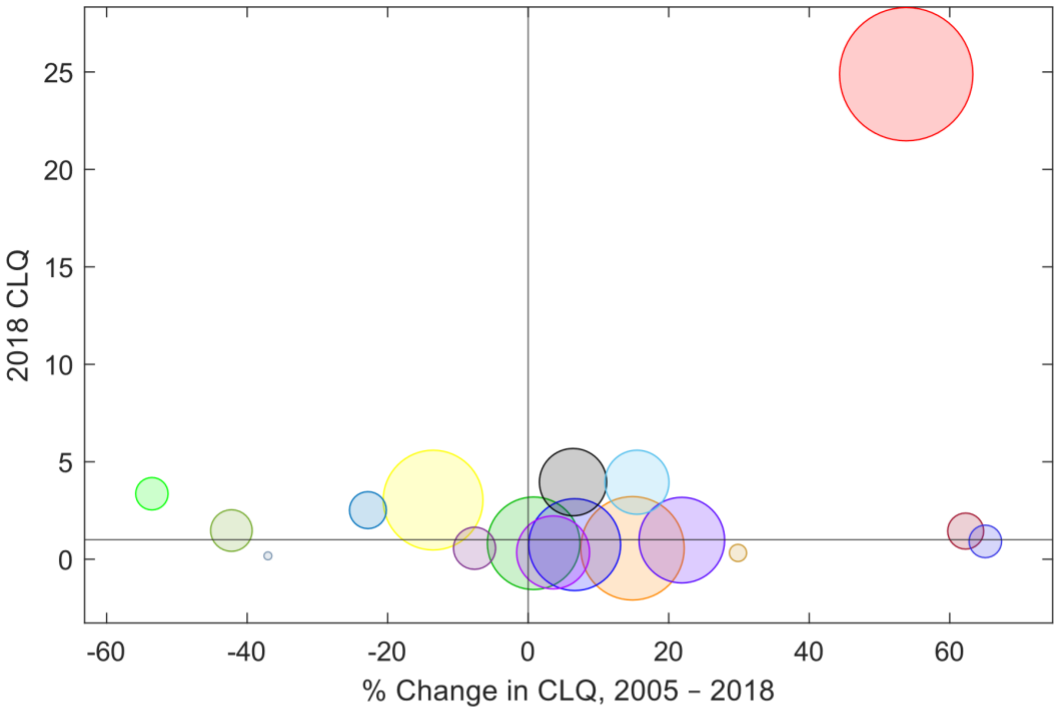
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
17	Transportation Equipment	16.18	24.89	5,520
5	Business and Financial Services	0.49	0.56	3,217
9	Education and Knowledge Creation	3.51	3.03	2,973
4	Biomedical/Biotechnical (Life Sciences)	0.81	0.82	2,532
3	Arts, Entertainment, Recreation and Visitor Industries	0.70	0.75	2,491
16	Transportation and Logistics	0.80	0.98	2,139
8	Defense and Security	0.34	0.35	1,508
15	Primary and Fabricated Metal Products	3.72	3.96	1,263
11	Forest and Wood Products	3.42	3.95	1,133
1	Agribusiness, Food Processing and Technology	0.61	0.56	443
6	Chemicals and Chemical-Based Products	2.55	1.47	430
14	Mining, Glass and Ceramics	3.26	2.52	328
10	Energy (Fossil and Renewable)	0.89	1.44	310
7	Computer, Electronic, and Electrical Products	0.55	0.91	246
2	Apparel and Textiles	7.24	3.36	244
12	Information Technology and Telecommunications	0.25	0.32	66
13	Machinery	0.28	0.17	36

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Talladega-Sylacauga, AL



Bubble Size as the Employment for Each Cluster
Transportation Equipment (5,520)
Business and Financial Services (3,217)
Education and Knowledge Creation (2,973)
Biomedical/Biotechnical (Life Sciences) (2,532)
Arts, Entertainment, Recreation and Visitor Industries (2,491)
Transportation and Logistics (2,139)
Defense and Security (1,508)
Primary and Fabricated Metal Products (1,263)
Forest and Wood Products (1,133)
Agribusiness, Food Processing and Technology (443)
Chemicals and Chemical-Based Products (430)
Mining, Glass and Ceramics (328)
Energy (Fossil and Renewable) (310)
Computer, Electronic, and Electrical Products (246)
Apparel and Textiles (244)
Information Technology and Telecommunications (66)
Machinery (36)

2. CADS Analysis

The 2018 CADS analysis of the economy of Talladega-Sylacauga, AL 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	4,192	4,734

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	107.39	710	-3.98	12.95	0.20	0.79

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
42	Plastics Product Manufacturing	-896
43	Rubber Product Manufacturing	-598
52	Foundries	-517
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-833
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-755
71	Audio and Video Equipment Manufacturing	-942
72	Semiconductor and Other Electronic Component Manufacturing	-1,129
81	Motor Vehicle Parts Manufacturing	-7,307
91	Wholesale Trade	-3,752
133	Management of Companies and Enterprises	-1,482

Chapter 20. Toccoa, GA

Study Area Overview

The Toccoa, GA study region occupies 179 square-miles and had a 2018 population of 26,035. The employed share of the regional labor force during the 2014-2018 period averaged 92.8%. The Management of Companies and Enterprises 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 20.47% of the region's economy. The region's 2018 coefficient of specialization (COS) is 40.59, 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 Toccoa, 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 Management of Companies and Enterprises, whose employment grew by 337 followed by Office Furniture (Including Fixtures) Manufacturing and General Merchandise Stores. 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 4.84, 84.28, and 2.18.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
133	Management of Companies and Enterprises	337	227	4.84
87	Office Furniture (Including Fixtures) Manufacturing	288	329	84.28
94	General Merchandise Stores	140	128	2.18
155	Individual and Family Services	127	85	1.17
55	Architectural and Structural Metals Manufacturing	107	107	5.47
68	Other General Purpose Machinery Manufacturing	88	84	27.29
51	Nonferrous Metal (except Aluminum) Production and Processing	84	84	24.44
151	Home Health Care Services	65	-19	1.95
89	Medical Equipment and Supplies Manufacturing	60	60	3.28
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	53	53	9.62

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 Toccoa, GA, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 13.9, followed by Forest and Wood Products 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 Toccoa, 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.

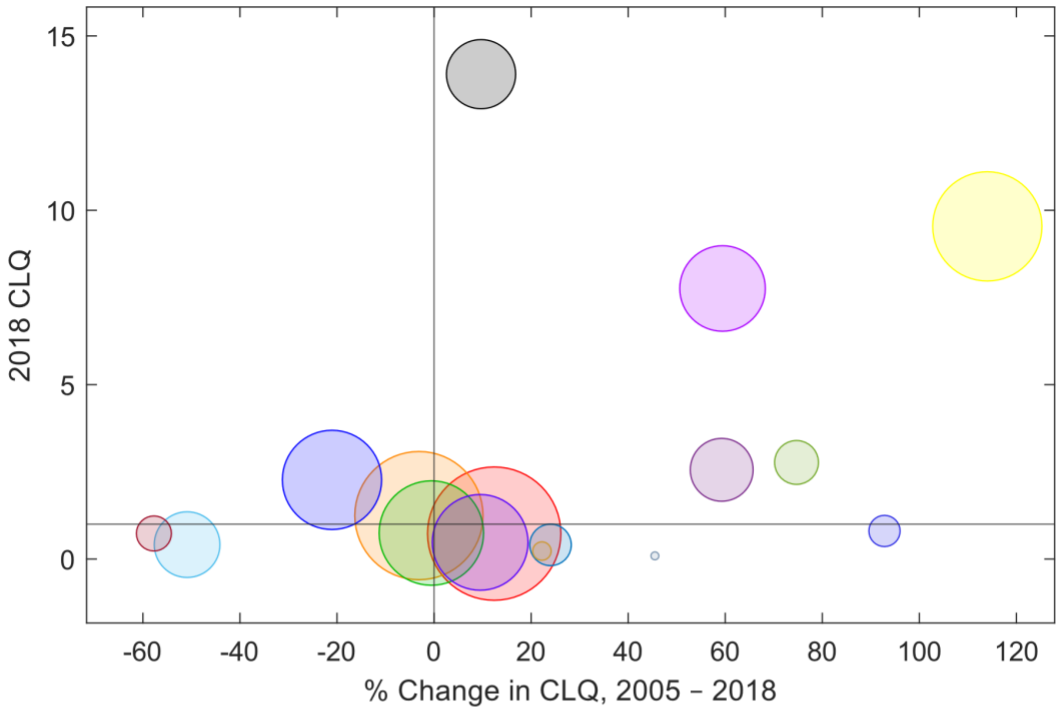
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
5	Business and Financial Services	0.65	0.73	1,281
4	Biomedical/Biotechnical (Life Sciences)	1.29	1.25	1,180
11	Forest and Wood Products	4.46	9.54	838
3	Arts, Entertainment, Recreation and Visitor Industries	0.75	0.75	761
9	Education and Knowledge Creation	2.87	2.27	682
8	Defense and Security	0.44	0.48	631
13	Machinery	4.87	7.76	494
2	Apparel and Textiles	12.68	13.90	310
16	Transportation and Logistics	0.84	0.41	276
15	Primary and Fabricated Metal Products	1.61	2.56	250
14	Mining, Glass and Ceramics	1.59	2.77	111
1	Agribusiness, Food Processing and Technology	0.33	0.41	98
6	Chemicals and Chemical-Based Products	1.73	0.73	66
12	Information Technology and Telecommunications	0.42	0.80	50
7	Computer, Electronic, and Electrical Products	0.00	0.56	46
10	Energy (Fossil and Renewable)	0.19	0.23	15
17	Transportation Equipment	0.06	0.09	6

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Toccoa, GA



Bubble Size as the Employment for Each Cluster

- Business and Financial Services (1,281)
- Biomedical/Biotechnical (Life Sciences) (1,180)
- Forest and Wood Products (838)
- Arts, Entertainment, Recreation and Visitor Industries (761)
- Education and Knowledge Creation (682)
- Defense and Security (631)
- Machinery (494)
- Apparel and Textiles (310)
- Transportation and Logistics (276)
- Primary and Fabricated Metal Products (250)
- Mining, Glass and Ceramics (111)
- Agribusiness, Food Processing and Technology (98)
- Chemicals and Chemical-Based Products (66)
- Information Technology and Telecommunications (50)
- Computer, Electronic, and Electrical Products (46)
- Energy (Fossil and Renewable) (15)
- Transportation Equipment (6)

2. CADS Analysis

The 2018 CADS analysis of the economy of Toccoa, 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 Other General Purpose 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	68	Other General Purpose Machinery Manufacturing	339	427
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	15	123

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
68	Other General Purpose Machinery Manufacturing	27.29	84	1.24	25.90	0.60	0.14
55	Architectural and Structural Metals Manufacturing	5.47	107	-1.47	700.43	0.58	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 68

Other General Purpose Machinery Manufacturing

Industry #	Industry Name	Employment
48	Iron and Steel Mills and Ferroalloy Manufacturing	-10
52	Foundries	-14
61	Other Fabricated Metal Product Manufacturing	-13
72	Semiconductor and Other Electronic Component Manufacturing	-18
104	Warehousing and Storage	-11

Table 6. Phase 2 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
48	Iron and Steel Mills and Ferroalloy Manufacturing	-14	-4
52	Foundries	-15	-1
61	Other Fabricated Metal Product Manufacturing	-14	-1
72	Semiconductor and Other Electronic Component Manufacturing	-20	-2
104	Warehousing and Storage	-17	-6

Chapter 21. Tupelo, MS

Study Area Overview

The Tupelo, MS study region occupies 1,481 square-miles and had a 2018 population of 140,552. The employed share of the regional labor force during the 2014-2018 period averaged 94.83%. The Household and Institutional Furniture and Kitchen Cabinet Manufacturing, Excluding Wood TV, Radio and Sewing Machine Cabinet Manufacturing 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 25.4% of the region's economy. The region's 2018 coefficient of specialization (COS) is 38.72, 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 Tupelo, MS 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 2,567 followed by Food Services and Drinking Places and Motor Vehicle Parts 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 2.26, 0.96, and 4.71.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
136	Employment Services	2,567	2,557	2.26
167	Food Services and Drinking Places	1,202	9	0.96
81	Motor Vehicle Parts Manufacturing	1,128	1,145	4.71
155	Individual and Family Services	890	560	1.06
154	Nursing and Residential Care Facilities	684	474	1.24
144	Junior Colleges, Colleges, Universities, and Professional Schools	489	274	1.67
95	All Other Retail	387	510	1.18
113	Data Processing, Hosting, and Related Services	334	334	2.22
140	Services to Buildings and Dwellings	318	241	0.50
92	Motor Vehicle and Parts Dealers	302	265	1.21

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 Tupelo, MS, the cluster with the largest CLQ in 2018 is Forest and Wood Products with a CLQ of 14.91, followed by Chemicals and Chemical-Based Products 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 Tupelo, MS 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.

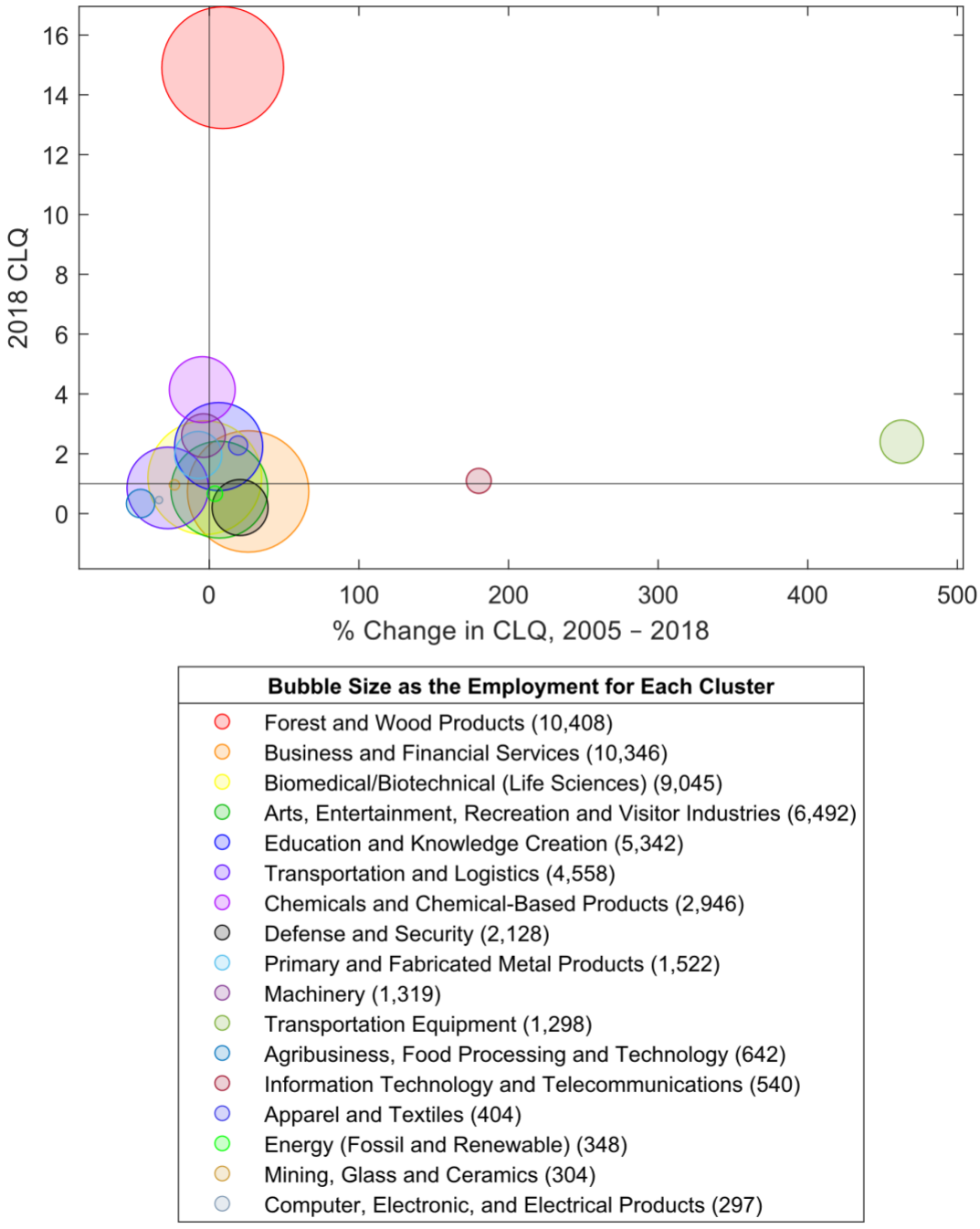
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
11	Forest and Wood Products	13.68	14.91	10,408
5	Business and Financial Services	0.59	0.74	10,346
4	Biomedical/Biotechnical (Life Sciences)	1.24	1.20	9,045
3	Arts, Entertainment, Recreation and Visitor Industries	0.75	0.80	6,492
9	Education and Knowledge Creation	2.11	2.24	5,342
16	Transportation and Logistics	1.19	0.86	4,558
6	Chemicals and Chemical-Based Products	4.35	4.15	2,946
8	Defense and Security	0.17	0.20	2,128
15	Primary and Fabricated Metal Products	2.11	1.96	1,522
13	Machinery	2.71	2.61	1,319
17	Transportation Equipment	0.43	2.40	1,298
1	Agribusiness, Food Processing and Technology	0.62	0.34	642
12	Information Technology and Telecommunications	0.39	1.09	540
2	Apparel and Textiles	1.91	2.28	404
10	Energy (Fossil and Renewable)	0.64	0.67	348
14	Mining, Glass and Ceramics	1.25	0.96	304
7	Computer, Electronic, and Electrical Products	0.68	0.45	297

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Tupelo, MS



2. CADS Analysis

The 2018 CADS analysis of the economy of Tupelo, MS 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 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	141	1,269
6	Chemicals and Chemical-Based Products	43	Rubber Product Manufacturing	1,348	1,456
5	Business and Financial Services	136	Employment Services	1,166	3,733
9	Education and Knowledge Creation	144	Junior Colleges, Colleges, Universities, and Professional Schools	900	1,389
4	Biomedical/Biotechnical (Life Sciences)	154	Nursing and Residential Care Facilities	1,199	1,883

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	4.71	1,145	-11.56	803.07	0.64	0.09
43	Rubber Product Manufacturing	23.27	340	-17.19	8.01	0.62	0.06
136	Employment Services	2.26	2,557	0.78	220.10	0.91	0.03
144	Junior Colleges, Colleges, Universities, and Professional Schools	1.67	274	23.90	54.32	0.90	0.02
154	Nursing and Residential Care Facilities	1.24	474	17.58	57.08	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 81

Motor Vehicle Parts Manufacturing

Industry #	Industry Name	Employment
35	Basic Chemical Manufacturing	-12
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-12
48	Iron and Steel Mills and Ferroalloy Manufacturing	-55
50	Alumina and Aluminum Production and Processing	-16
52	Foundries	-126
53	Forging and Stamping	-57
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-88
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-17
72	Semiconductor and Other Electronic Component Manufacturing	-112
77	Electrical Equipment Manufacturing	-14
78	Other Electrical Equipment and Component Manufacturing	-21
97	Rail Transportation	-12

Table 6. Phase 2 Deficits Adding Anchor Industry 43

Rubber Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-62	-50
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-57	-45

48	Iron and Steel Mills and Ferroalloy Manufacturing	-67	-11
50	Alumina and Aluminum Production and Processing	-18	-2
52	Foundries	-129	-2
53	Forging and Stamping	-70	-13
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-140	-52
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-18	-1
72	Semiconductor and Other Electronic Component Manufacturing	-145	-33
77	Electrical Equipment Manufacturing	-18	-5
78	Other Electrical Equipment and Component Manufacturing	-23	-2
97	Rail Transportation	-19	-7

Table 7. Phase 3 Deficits Adding Anchor Industry 136

Employment Services

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-62	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-57	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-67	-0
50	Alumina and Aluminum Production and Processing	-18	-0
52	Foundries	-129	-0
53	Forging and Stamping	-70	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-141	-1
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-18	-0
72	Semiconductor and Other Electronic Component Manufacturing	-146	-1
77	Electrical Equipment Manufacturing	-19	-1
78	Other Electrical Equipment and Component Manufacturing	-23	-0
97	Rail Transportation	-19	-0

Table 8. Phase 4 Deficits Adding Anchor Industry 144

Junior Colleges, Colleges, Universities, and Professional Schools

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-62	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-57	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-67	-0
50	Alumina and Aluminum Production and Processing	-18	-0
52	Foundries	-129	-0
53	Forging and Stamping	-71	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-141	-1
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-18	-0
72	Semiconductor and Other Electronic Component Manufacturing	-147	-1
77	Electrical Equipment Manufacturing	-19	-0
78	Other Electrical Equipment and Component Manufacturing	-24	-0
97	Rail Transportation	-19	-0

Table 9. Phase 5 Deficits Adding Anchor Industry 154

Nursing and Residential Care Facilities

Chapter 21. Tupelo, MS

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-63	-1
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-58	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-67	-0
50	Alumina and Aluminum Production and Processing	-18	-0
52	Foundries	-129	-0
53	Forging and Stamping	-71	-0
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-142	-1
67	Engine, Turbine, and Power Transmission Equipment Manufacturing	-18	-0
72	Semiconductor and Other Electronic Component Manufacturing	-148	-1
77	Electrical Equipment Manufacturing	-19	-0
78	Other Electrical Equipment and Component Manufacturing	-24	-0
97	Rail Transportation	-20	-0

Chapter 22. Tuskegee, AL

Study Area Overview

The Tuskegee, AL study region occupies 609 square-miles and had a 2018 population of 18,439. The employed share of the regional labor force during the 2014-2018 period averaged 90.8%. The Hospitals industry was the region's largest employer in 2018, followed by Junior Colleges, Colleges, Universities, and Professional Schools and Government and Unclassified. These three industries account for a combined 40.71% of the region's economy. The region's 2018 coefficient of specialization (COS) is 55.54, 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 Tuskegee, 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 Other Educational Services, whose employment grew by 297 followed by Junior Colleges, Colleges, Universities, and Professional Schools 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 10.22, 13.15, and 21.16.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
145	Other Educational Services	297	296	10.22
144	Junior Colleges, Colleges, Universities, and Professional Schools	106	-40	13.15
135	Facilities Support Services	86	83	21.16
1	Crop Production	32	12	2.44
81	Motor Vehicle Parts Manufacturing	24	34	6.46
146	Offices of Physicians	19	17	0.34
92	Motor Vehicle and Parts Dealers	11	11	0.27
167	Food Services and Drinking Places	11	-83	0.91
94	General Merchandise Stores	11	8	0.73
157	Child Day Care Services	9	8	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 Tuskegee, AL, the cluster with the largest CLQ in 2018 is Education and Knowledge Creation with a CLQ of 8.95, followed by Transportation Equipment 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 Tuskegee, 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.

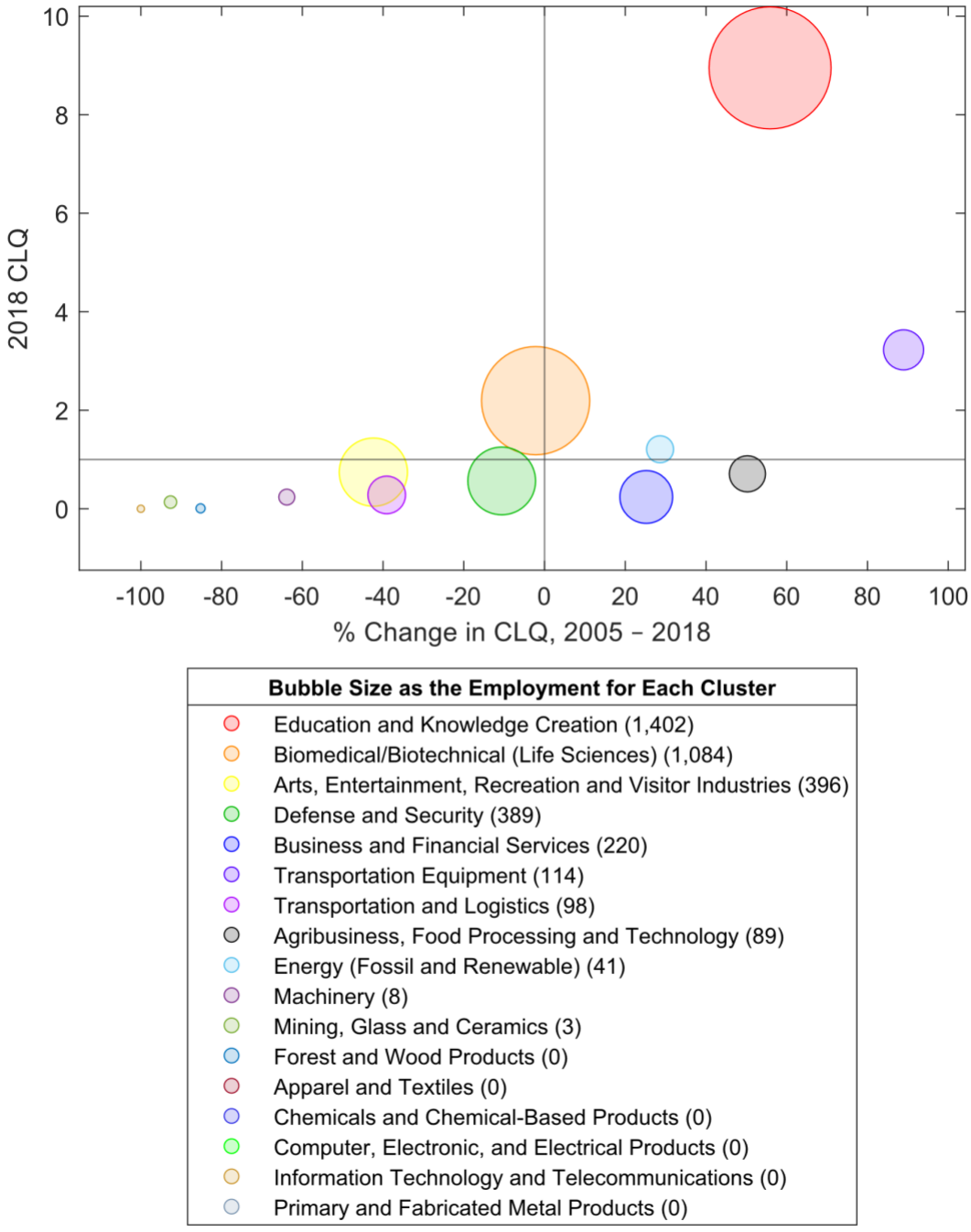
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
9	Education and Knowledge Creation	5.74	8.95	1,402
4	Biomedical/Biotechnical (Life Sciences)	2.24	2.19	1,084
3	Arts, Entertainment, Recreation and Visitor Industries	1.29	0.74	396
8	Defense and Security	0.63	0.57	389
5	Business and Financial Services	0.19	0.24	220
17	Transportation Equipment	1.71	3.23	114
16	Transportation and Logistics	0.46	0.28	98
1	Agribusiness, Food Processing and Technology	0.47	0.71	89
10	Energy (Fossil and Renewable)	0.94	1.21	41
13	Machinery	0.66	0.24	8
14	Mining, Glass and Ceramics	1.85	0.14	3
11	Forest and Wood Products	0.06	0.01	0
2	Apparel and Textiles	0.00	0.00	0
6	Chemicals and Chemical-Based Products	0.00	0.00	0
7	Computer, Electronic, and Electrical Products	0.00	0.00	0
12	Information Technology and Telecommunications	0.11	0.00	0
15	Primary and Fabricated Metal Products	0.00	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Tuskegee, AL



2. CADS Analysis

The 2018 CADS analysis of the economy of Tuskegee, AL 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 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	91	114

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
81	Motor Vehicle Parts Manufacturing	6.46	34	-11.56	25.98	0.28	0.11

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
52	Foundries	-11
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-16
72	Semiconductor and Other Electronic Component Manufacturing	-10

Chapter 23. Valley, AL

Study Area Overview

The Valley, AL study region occupies 597 square-miles and had a 2018 population of 33,615. The employed share of the regional labor force during the 2014-2018 period averaged 96.5%. The Motor Vehicle Parts Manufacturing 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 26.54% of the region's economy. The region's 2018 coefficient of specialization (COS) is 46.61, 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 Valley, 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 861 followed by Animal Slaughtering and Processing 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 27.65, 10.23, and 4.35.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
81	Motor Vehicle Parts Manufacturing	861	861	27.65
20	Animal Slaughtering and Processing	280	280	10.23
137	Business Support Services	167	162	4.35
104	Warehousing and Storage	138	138	2.33
100	Transit and Ground Passenger Transportation	73	18	5.95
93	Food and Beverage Stores	73	61	1.54
151	Home Health Care Services	69	60	0.99
128	Computer Systems Design and Related Services	68	64	0.62
28	Sawmills and Wood Preservation	56	78	31.61
30	Other Wood Product Manufacturing, Including Wood TV, Radio and Sewing Machine Cabinet Manufacturing	55	66	7.53

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 Valley, AL, the cluster with the largest CLQ in 2018 is Transportation Equipment with a CLQ of 14.63, followed by Forest and Wood Products 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 Valley, 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.

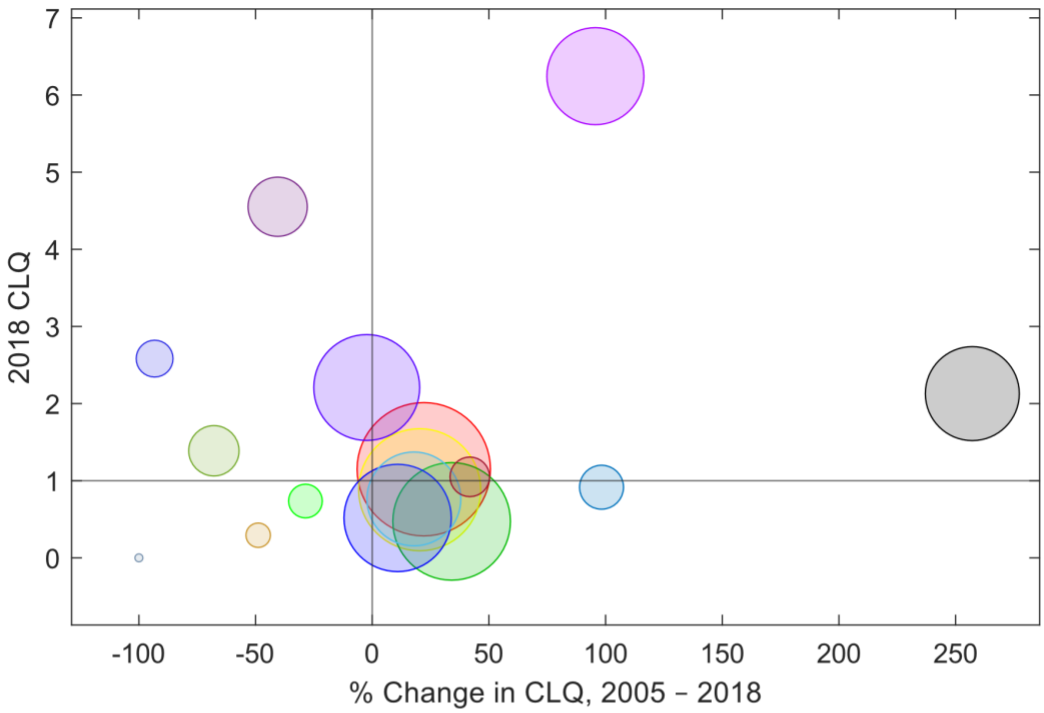
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	0.94	1.15	998
17	Transportation Equipment	0.00	14.63	913
3	Arts, Entertainment, Recreation and Visitor Industries	0.73	0.88	827
5	Business and Financial Services	0.35	0.47	763
8	Defense and Security	0.47	0.52	626
9	Education and Knowledge Creation	2.26	2.21	609
11	Forest and Wood Products	3.19	6.24	504
1	Agribusiness, Food Processing and Technology	0.60	2.13	470
16	Transportation and Logistics	0.65	0.76	469
14	Mining, Glass and Ceramics	7.65	4.55	167
6	Chemicals and Chemical-Based Products	4.32	1.39	114
15	Primary and Fabricated Metal Products	0.46	0.92	82
10	Energy (Fossil and Renewable)	0.74	1.05	63
2	Apparel and Textiles	38.36	2.58	53
12	Information Technology and Telecommunications	1.03	0.74	42
13	Machinery	0.57	0.29	17
7	Computer, Electronic, and Electrical Products	0.88	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Valley, AL



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (998)
Transportation Equipment (913)
Arts, Entertainment, Recreation and Visitor Industries (827)
Business and Financial Services (763)
Defense and Security (626)
Education and Knowledge Creation (609)
Forest and Wood Products (504)
Agribusiness, Food Processing and Technology (470)
Transportation and Logistics (469)
Mining, Glass and Ceramics (167)
Chemicals and Chemical-Based Products (114)
Primary and Fabricated Metal Products (82)
Energy (Fossil and Renewable) (63)
Apparel and Textiles (53)
Information Technology and Telecommunications (42)
Machinery (17)
Computer, Electronic, and Electrical Products (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Valley, AL 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 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	0	861

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
81	Motor Vehicle Parts Manufacturing	27.65	861	-11.56	N/A	0.34	0.36

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	-30
48	Iron and Steel Mills and Ferroalloy Manufacturing	-38
52	Foundries	-86
53	Forging and Stamping	-39
59	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	-121
61	Other Fabricated Metal Product Manufacturing	-29
72	Semiconductor and Other Electronic Component Manufacturing	-76
91	Wholesale Trade	-121
133	Management of Companies and Enterprises	-79
136	Employment Services	-29

Chapter 24. Warren, PA

Study Area Overview

The Warren, PA study region occupies 884 square-miles and had a 2018 population of 39,498. The employed share of the regional labor force during the 2014-2018 period averaged 95.6%. The All Other Retail industry was the region's largest employer in 2018, followed by Hospitals and Nursing and Residential Care Facilities. These three industries account for a combined 18.72% of the region's economy. The region's 2018 coefficient of specialization (COS) is 45.93, 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 Warren, 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 Management of Companies and Enterprises, whose employment grew by 579 followed by Warehousing and Storage and Monetary Authorities, Credit Intermediation, and Related Activities. 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 2.91, 4.75, and 3.32.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
133	Management of Companies and Enterprises	579	563	2.91
104	Warehousing and Storage	272	81	4.75
115	Monetary Authorities, Credit Intermediation, and Related Activities	248	295	3.32
136	Employment Services	195	194	0.75
94	General Merchandise Stores	192	182	1.38
99	Truck Transportation	170	168	2.33
15	Animal Food Manufacturing	169	157	36.27
34	Petroleum and Coal Products Manufacturing	101	90	41.60
167	Food Services and Drinking Places	90	-122	0.73
154	Nursing and Residential Care Facilities	75	-58	2.74

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 Warren, PA, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 6.44, 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 Warren, 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.

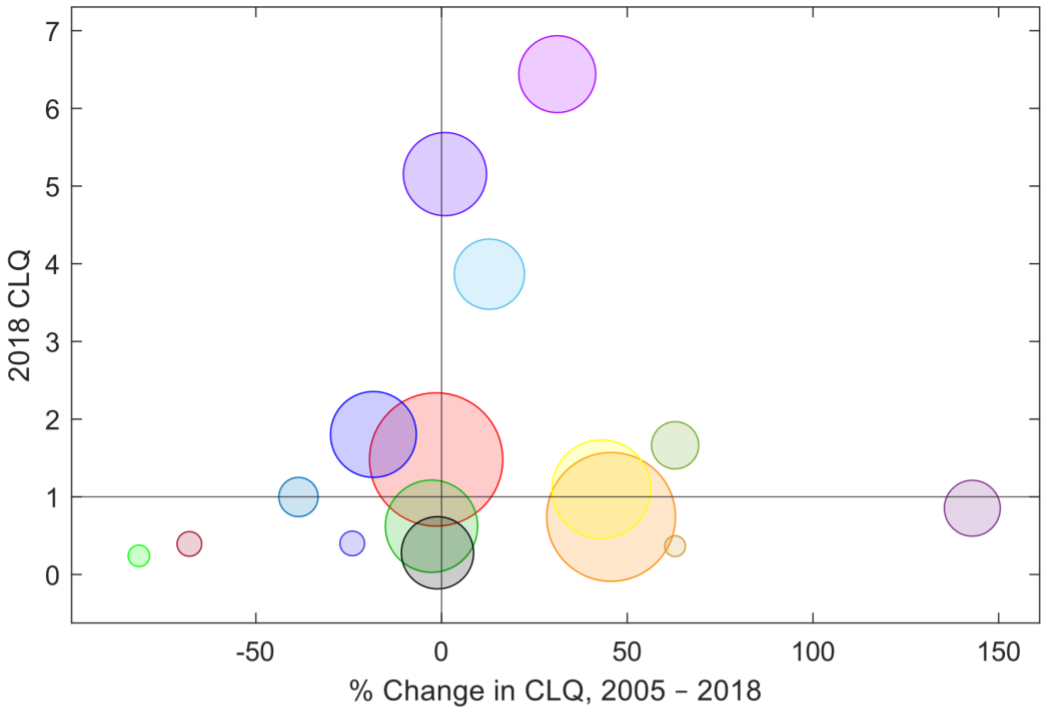
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.50	1.48	2,237
5	Business and Financial Services	0.51	0.74	2,080
16	Transportation and Logistics	0.77	1.10	1,171
3	Arts, Entertainment, Recreation and Visitor Industries	0.64	0.62	1,013
9	Education and Knowledge Creation	2.21	1.80	864
15	Primary and Fabricated Metal Products	5.11	5.15	805
10	Energy (Fossil and Renewable)	4.91	6.44	677
8	Defense and Security	0.28	0.28	588
6	Chemicals and Chemical-Based Products	3.43	3.87	552
1	Agribusiness, Food Processing and Technology	0.35	0.85	327
7	Computer, Electronic, and Electrical Products	1.02	1.66	219
11	Forest and Wood Products	1.62	1.00	140
13	Machinery	1.23	0.39	40
12	Information Technology and Telecommunications	0.53	0.40	40
17	Transportation Equipment	1.30	0.24	26
14	Mining, Glass and Ceramics	0.22	0.36	23
2	Apparel and Textiles	0.00	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Warren, PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (2,237)
Business and Financial Services (2,080)
Transportation and Logistics (1,171)
Arts, Entertainment, Recreation and Visitor Industries (1,013)
Education and Knowledge Creation (864)
Primary and Fabricated Metal Products (805)
Energy (Fossil and Renewable) (677)
Defense and Security (588)
Chemicals and Chemical-Based Products (552)
Agribusiness, Food Processing and Technology (327)
Computer, Electronic, and Electrical Products (219)
Forest and Wood Products (140)
Machinery (40)
Information Technology and Telecommunications (40)
Transportation Equipment (26)
Mining, Glass and Ceramics (23)
Apparel and Textiles (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of Warren, 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 Petroleum and Coal Products 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
10	Energy (Fossil and Renewable)	34	Petroleum and Coal Products Manufacturing	333	434

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
34	Petroleum and Coal Products Manufacturing	41.60	90	3.12	30.27	0.38	0.62

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 34

Petroleum and Coal Products Manufacturing

Industry #	Industry Name	Employment
6	Oil and Gas Extraction	-347
91	Wholesale Trade	-233
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	-72
117	Insurance Carriers	-78
124	Legal Services	-79
126	Architectural, Engineering, and Related Services	-65
128	Computer Systems Design and Related Services	-164
129	Management, Scientific, and Technical Consulting Services	-89
139	Investigation and Security Services	-58
140	Services to Buildings and Dwellings	-129

Chapter 25. West Point, MS

Study Area Overview

The West Point, MS study region occupies 410 square-miles and had a 2018 population of 19,386. The employed share of the regional labor force during the 2014-2018 period averaged 89.2%. The Elementary and Secondary Schools industry was the region's largest employer in 2018, followed by Rubber Product Manufacturing and Food Services and Drinking Places. These three industries account for a combined 26.17% of the region's economy. The region's 2018 coefficient of specialization (COS) is 44.25, 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 West Point, MS 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 Rubber Product Manufacturing, whose employment grew by 455 followed by Truck Transportation and Accommodation. 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 99.26, 5.44, and 1.67.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
43	Rubber Product Manufacturing	455	455	99.26
99	Truck Transportation	84	81	5.44
166	Accommodation	80	77	1.67
167	Food Services and Drinking Places	75	-23	1.01
165	Other Amusement and Recreation Industries	69	40	3.62
94	General Merchandise Stores	49	39	2.53
35	Basic Chemical Manufacturing	49	49	11.69
154	Nursing and Residential Care Facilities	45	14	2.01
181	Government and Unclassified	45	35	0.43
2	Animal Production	40	45	2.94

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 West Point, MS, the cluster with the largest CLQ in 2018 is Chemicals and Chemical-Based Products with a CLQ of 9.91, 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 West Point, MS 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.

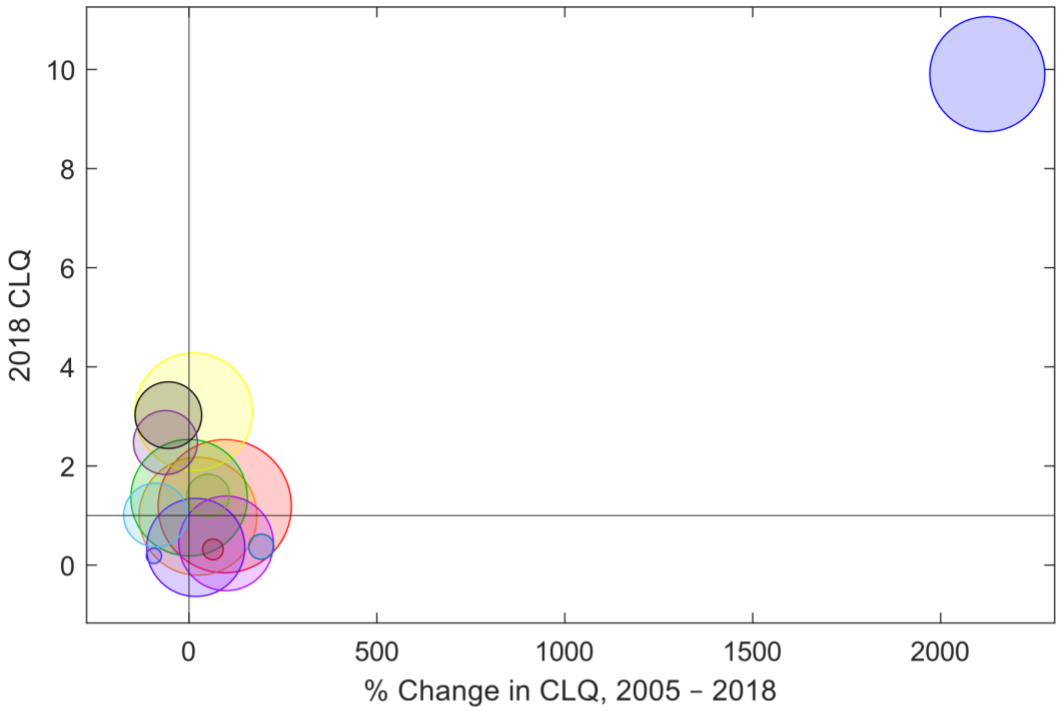
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	0.61	1.19	706
4	Biomedical/Biotechnical (Life Sciences)	0.80	0.99	544
9	Education and Knowledge Creation	2.75	3.09	541
16	Transportation and Logistics	1.36	1.36	530
6	Chemicals and Chemical-Based Products	0.45	9.91	516
5	Business and Financial Services	0.30	0.36	366
8	Defense and Security	0.22	0.44	338
11	Forest and Wood Products	6.69	3.03	155
1	Agribusiness, Food Processing and Technology	8.74	1.01	141
15	Primary and Fabricated Metal Products	6.58	2.47	141
10	Energy (Fossil and Renewable)	0.93	1.41	54
12	Information Technology and Telecommunications	0.13	0.37	13
14	Mining, Glass and Ceramics	0.19	0.32	7
2	Apparel and Textiles	2.76	0.19	2
7	Computer, Electronic, and Electrical Products	0.00	0.00	0
13	Machinery	0.00	0.00	0
17	Transportation Equipment	0.00	0.00	0

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of West Point, MS



Bubble Size as the Employment for Each Cluster

- Arts, Entertainment, Recreation and Visitor Industries (706)
- Biomedical/Biotechnical (Life Sciences) (544)
- Education and Knowledge Creation (541)
- Transportation and Logistics (530)
- Chemicals and Chemical-Based Products (516)
- Business and Financial Services (366)
- Defense and Security (338)
- Forest and Wood Products (155)
- Agribusiness, Food Processing and Technology (141)
- Primary and Fabricated Metal Products (141)
- Energy (Fossil and Renewable) (54)
- Information Technology and Telecommunications (13)
- Mining, Glass and Ceramics (7)
- Apparel and Textiles (2)
- Computer, Electronic, and Electrical Products (0)
- Machinery (0)
- Transportation Equipment (0)

2. CADS Analysis

The 2018 CADS analysis of the economy of West Point, MS 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 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	0	455

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	99.26	455	-17.19	N/A	0.55	0.25

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
3	Forestry and Logging	-17
26	Textile Mills and Textile Product Mills	-37
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-14
72	Semiconductor and Other Electronic Component Manufacturing	-11

Chapter 26. Wheeling, WV-OH

Study Area Overview

The Wheeling, WV-OH study region occupies 943 square-miles and had a 2018 population of 140,045. The employed share of the regional labor force during the 2014-2018 period averaged 96%. The Food Services and Drinking Places industry was the region's largest employer in 2018, followed by Construction and Hospitals. These three industries account for a combined 23.64% of the region's economy. The region's 2018 coefficient of specialization (COS) is 29.41, 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 Wheeling, WV-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 Construction, whose employment grew by 2,119 followed by Support Activities for Mining and Accommodation. 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 1.49, 11.6, and 1.15.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
14	Construction	2,119	2,202	1.49
10	Support Activities for Mining	1,339	1,184	11.60
166	Accommodation	636	603	1.15
94	General Merchandise Stores	592	523	1.59
6	Oil and Gas Extraction	412	411	7.31
167	Food Services and Drinking Places	368	-1,212	1.17
133	Management of Companies and Enterprises	358	159	0.98
140	Services to Buildings and Dwellings	333	219	0.71
47	Lime, Gypsum and Other Nonmetallic Mineral Product Manufacturing	321	320	8.72
91	Wholesale Trade	229	217	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 Wheeling, WV-OH, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 10.06, 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 Wheeling, WV-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.

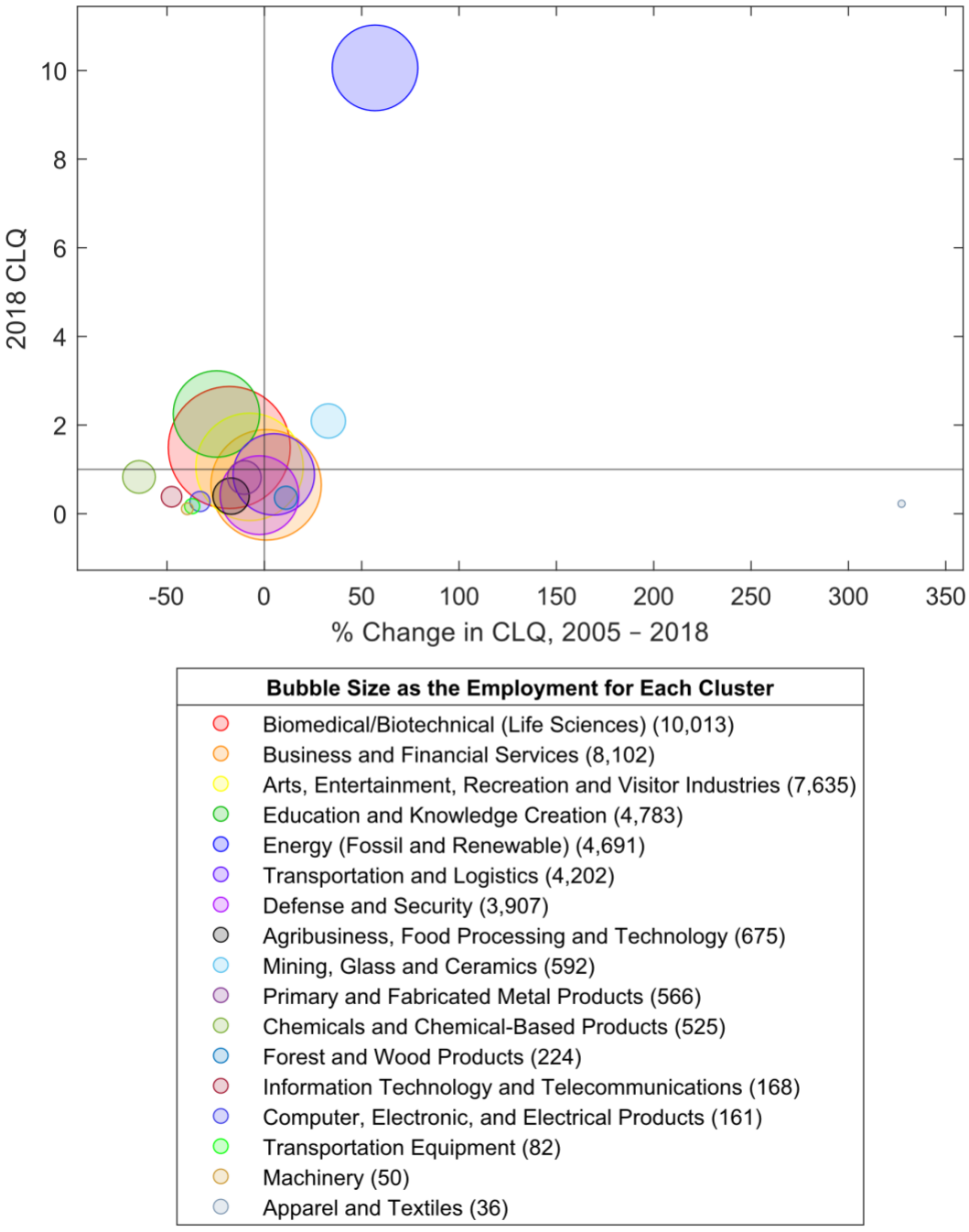
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.82	1.49	10,013
5	Business and Financial Services	0.65	0.65	8,102
3	Arts, Entertainment, Recreation and Visitor Industries	1.14	1.06	7,635
9	Education and Knowledge Creation	2.98	2.25	4,783
10	Energy (Fossil and Renewable)	6.41	10.06	4,691
16	Transportation and Logistics	0.85	0.89	4,202
8	Defense and Security	0.43	0.42	3,907
1	Agribusiness, Food Processing and Technology	0.48	0.40	675
14	Mining, Glass and Ceramics	1.57	2.09	592
15	Primary and Fabricated Metal Products	0.91	0.82	566
6	Chemicals and Chemical-Based Products	2.33	0.83	525
11	Forest and Wood Products	0.32	0.36	224
12	Information Technology and Telecommunications	0.73	0.38	168
7	Computer, Electronic, and Electrical Products	0.41	0.28	161
17	Transportation Equipment	0.27	0.17	82
13	Machinery	0.18	0.11	50
2	Apparel and Textiles	0.05	0.23	36

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Wheeling, WV-OH



2. CADS Analysis

The 2018 CADS analysis of the economy of Wheeling, WV-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 Coal Mining, 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)	7	Coal Mining	2,040	2,211
10	Energy (Fossil and Renewable)	10	Support Activities for Mining	295	1,635

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
7	Coal Mining	104.37	751	-28.42	8.41	0.78	0.19
10	Support Activities for Mining	11.60	1,184	52.54	453.46	0.88	0.06

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 7

Coal Mining

Industry #	Industry Name	Employment
1	Crop Production	-14
3	Forestry and Logging	-21
28	Sawmills and Wood Preservation	-18
41	Other Chemical Product and Preparation Manufacturing	-30
43	Rubber Product Manufacturing	-61
61	Other Fabricated Metal Product Manufacturing	-18
62	Agriculture, Construction, and Mining Machinery Manufacturing	-74
66	Metalworking Machinery Manufacturing	-9
68	Other General Purpose Machinery Manufacturing	-33
72	Semiconductor and Other Electronic Component Manufacturing	-25
97	Rail Transportation	-68
126	Architectural, Engineering, and Related Services	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 10

Support Activities for Mining

Industry #	Industry Name	Employment	Added to Deficit
1	Crop Production	-20	-6
3	Forestry and Logging	-23	-2
28	Sawmills and Wood Preservation	-20	-2
41	Other Chemical Product and Preparation Manufacturing	-41	-10
43	Rubber Product Manufacturing	-63	-2
61	Other Fabricated Metal Product Manufacturing	-27	-8
62	Agriculture, Construction, and Mining Machinery Manufacturing	-99	-25
66	Metalworking Machinery Manufacturing	-39	-30
68	Other General Purpose Machinery Manufacturing	-48	-15
72	Semiconductor and Other Electronic Component Manufacturing	-34	-9
97	Rail Transportation	-72	-4
126	Architectural, Engineering, and Related Services	-23	-159

Chapter 27. Williamsport, PA

Study Area Overview

The Williamsport, PA study region occupies 1,229 square-miles and had a 2018 population of 113,664. 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 17.04% of the region's economy. The region's 2018 coefficient of specialization (COS) is 30.2, 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 Williamsport, 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 Support Activities for Mining, whose employment grew by 957 followed by Home Health Care 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 8.51, 2.02, and 0.98.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
10	Support Activities for Mining	957	957	8.51
151	Home Health Care Services	769	584	2.02
167	Food Services and Drinking Places	506	-476	0.98
126	Architectural, Engineering, and Related Services	421	375	1.83
137	Business Support Services	418	393	2.12
155	Individual and Family Services	409	-603	1.72
146	Offices of Physicians	363	157	1.42
156	Community and Vocational Rehabilitation Services	313	314	2.61
141	Other Support Services	277	274	2.62
118	Agencies, Brokerages, and Other Insurance Related Activities	271	220	1.22

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 Williamsport, PA, the cluster with the largest CLQ in 2018 is Energy (Fossil and Renewable) with a CLQ of 3.39, followed by Chemicals and Chemical-Based Products 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 Williamsport, 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.

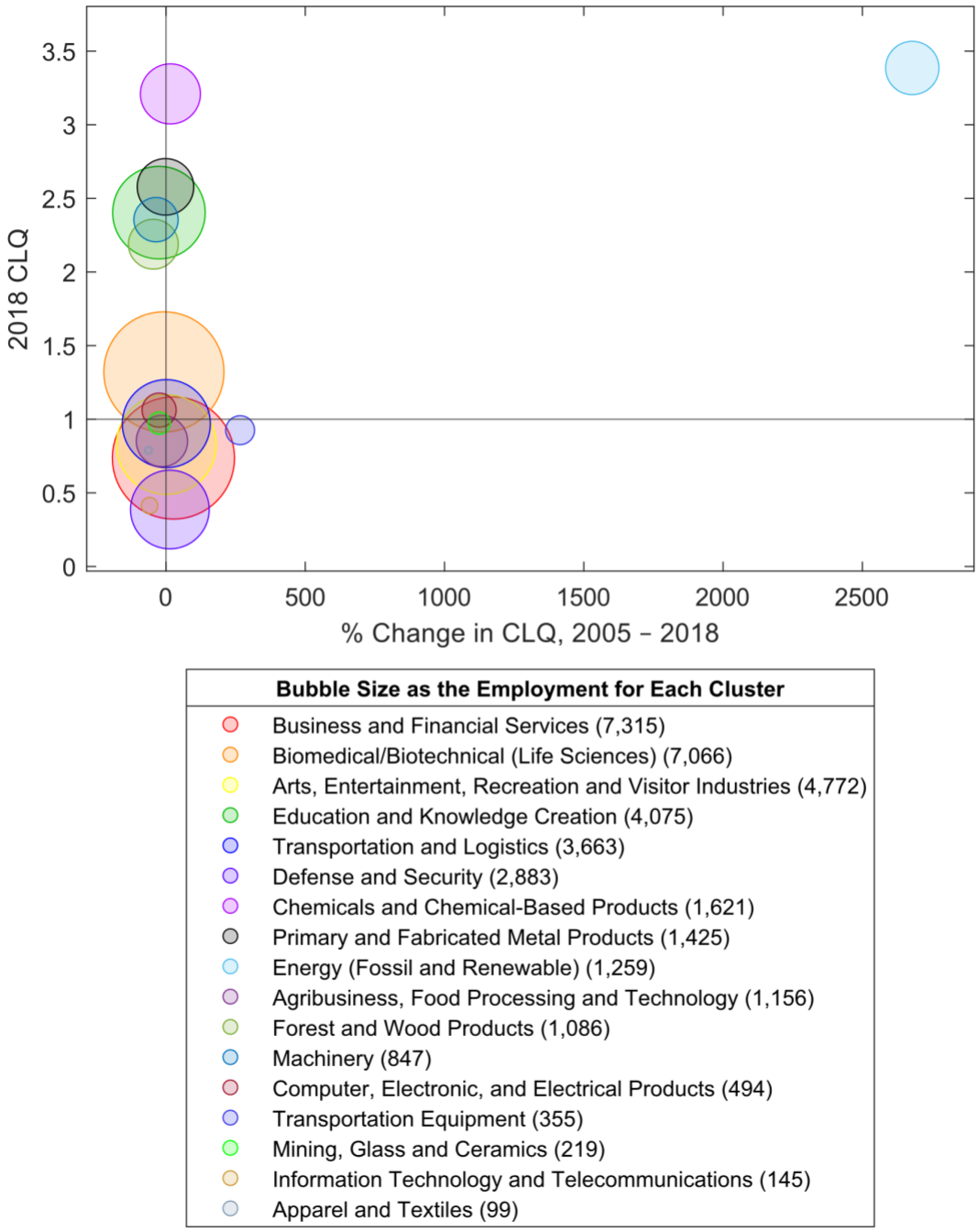
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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	0.58	0.74	7,315
4	Biomedical/Biotechnical (Life Sciences)	1.43	1.32	7,066
3	Arts, Entertainment, Recreation and Visitor Industries	0.82	0.83	4,772
9	Education and Knowledge Creation	3.22	2.40	4,075
16	Transportation and Logistics	0.96	0.97	3,663
8	Defense and Security	0.34	0.39	2,883
6	Chemicals and Chemical-Based Products	2.77	3.21	1,621
15	Primary and Fabricated Metal Products	2.62	2.58	1,425
10	Energy (Fossil and Renewable)	0.12	3.39	1,259
1	Agribusiness, Food Processing and Technology	1.00	0.85	1,156
11	Forest and Wood Products	4.01	2.19	1,086
13	Machinery	3.67	2.36	847
7	Computer, Electronic, and Electrical Products	1.41	1.06	494
17	Transportation Equipment	0.25	0.93	355
14	Mining, Glass and Ceramics	1.29	0.97	219
12	Information Technology and Telecommunications	1.01	0.41	145
2	Apparel and Textiles	2.13	0.79	99

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Williamsport, PA



2. CADS Analysis

The 2018 CADS analysis of the economy of Williamsport, PA 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 Support Activities for Mining, 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)	10	Support Activities for Mining	0	957
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	847	1,210
5	Business and Financial Services	126	Architectural, Engineering, and Related Services	494	915
15	Primary and Fabricated Metal Products	55	Architectural and Structural Metals Manufacturing	556	549
5	Business and Financial Services	137	Business Support Services	225	643
4	Biomedical/Biotechnical (Life Sciences)	151	Home Health Care Services	233	1,002

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
10	Support Activities for Mining	8.51	957	52.54	N/A	0.86	0.05
146	Offices of Physicians	1.42	157	24.38	42.86	0.82	0.03
126	Architectural, Engineering, and Related Services	1.83	375	9.37	85.33	0.86	0.03

55	Architectural and Structural Metals Manufacturing	4.34	1	-1.47	-1.26	0.71	0.02
137	Business Support Services	2.12	393	11.43	186.03	0.89	0.01
151	Home Health Care Services	2.02	584	79.39	330.04	0.82	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 10

Support Activities for Mining

Industry #	Industry Name	Employment
35	Basic Chemical Manufacturing	-4
41	Other Chemical Product and Preparation Manufacturing	-7
48	Iron and Steel Mills and Ferroalloy Manufacturing	-4
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-4
81	Motor Vehicle Parts Manufacturing	-7
134	Office Administrative Services	N/A
150	Medical and Diagnostic Laboratories	N/A

Table 6. Phase 2 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-6	-2
41	Other Chemical Product and Preparation Manufacturing	-7	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-4	-0

73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-9	-5
81	Motor Vehicle Parts Manufacturing	-8	-1
134	Office Administrative Services	N/A	-8
150	Medical and Diagnostic Laboratories	-27	-31

Table 7. Phase 3 Deficits Adding Anchor Industry 126

Architectural, Engineering, and Related Services

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-8	-2
41	Other Chemical Product and Preparation Manufacturing	-8	-1
48	Iron and Steel Mills and Ferroalloy Manufacturing	-5	-1
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-10	-1
81	Motor Vehicle Parts Manufacturing	-9	-1
134	Office Administrative Services	-10	-13
150	Medical and Diagnostic Laboratories	-27	-0

Table 8. Phase 4 Deficits Adding Anchor Industry 55

Architectural and Structural Metals Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-9	-1
41	Other Chemical Product and Preparation Manufacturing	-11	-3
48	Iron and Steel Mills and Ferroalloy Manufacturing	-22	-17
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-10	-0
81	Motor Vehicle Parts Manufacturing	-12	-2
134	Office Administrative Services	-12	-1
150	Medical and Diagnostic Laboratories	-27	-0

Table 9. Phase 5 Deficits Adding Anchor Industry 137

Business Support Services

Industry #	Industry Name	Employment	Added to Deficit
35	Basic Chemical Manufacturing	-10	-0
41	Other Chemical Product and Preparation Manufacturing	-11	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-22	-0
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-10	-0
81	Motor Vehicle Parts Manufacturing	-13	-1
134	Office Administrative Services	-16	-5
150	Medical and Diagnostic Laboratories	-27	-0

Table 10. Phase 6 Deficits Adding Anchor Industry 151

Home Health Care Services

Industry #	Industry Name	Employment	Added to Deficit

35	Basic Chemical Manufacturing	-10	-1
41	Other Chemical Product and Preparation Manufacturing	-11	-0
48	Iron and Steel Mills and Ferroalloy Manufacturing	-22	-0
73	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	-11	-1
81	Motor Vehicle Parts Manufacturing	-13	-0
134	Office Administrative Services	-19	-3
150	Medical and Diagnostic Laboratories	-27	-0

Chapter 28. Winston-Salem, NC

Study Area Overview

The Winston-Salem, NC study region occupies 1,456 square-miles and had a 2018 population of 504,842. The employed share of the regional labor force during the 2014-2018 period averaged 94.75%. The Hospitals 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 23.93% of the region's economy. The region's 2018 coefficient of specialization (COS) is 27.98, 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 Winston-Salem, 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 Hospitals, whose employment grew by 7,560 followed by Food Services and Drinking Places and Management of Companies and Enterprises. 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 3.01, 1.19, and 1.96.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
153	Hospitals	7,560	5,151	3.01
167	Food Services and Drinking Places	4,453	2	1.19
133	Management of Companies and Enterprises	2,536	1,233	1.96
181	Government and Unclassified	1,134	829	0.31
125	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	1,068	978	1.10
104	Warehousing and Storage	937	-500	1.67
140	Services to Buildings and Dwellings	933	239	1.00
69	Computer and Peripheral Equipment Manufacturing, Excluding Digital Camera Manufacturing	793	802	3.93
134	Office Administrative Services	716	571	1.46
94	General Merchandise Stores	666	440	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 Winston-Salem, NC, the cluster with the largest CLQ in 2018 is Apparel and Textiles with a CLQ of 6.14, followed by Education and Knowledge Creation 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 Winston-Salem, 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.

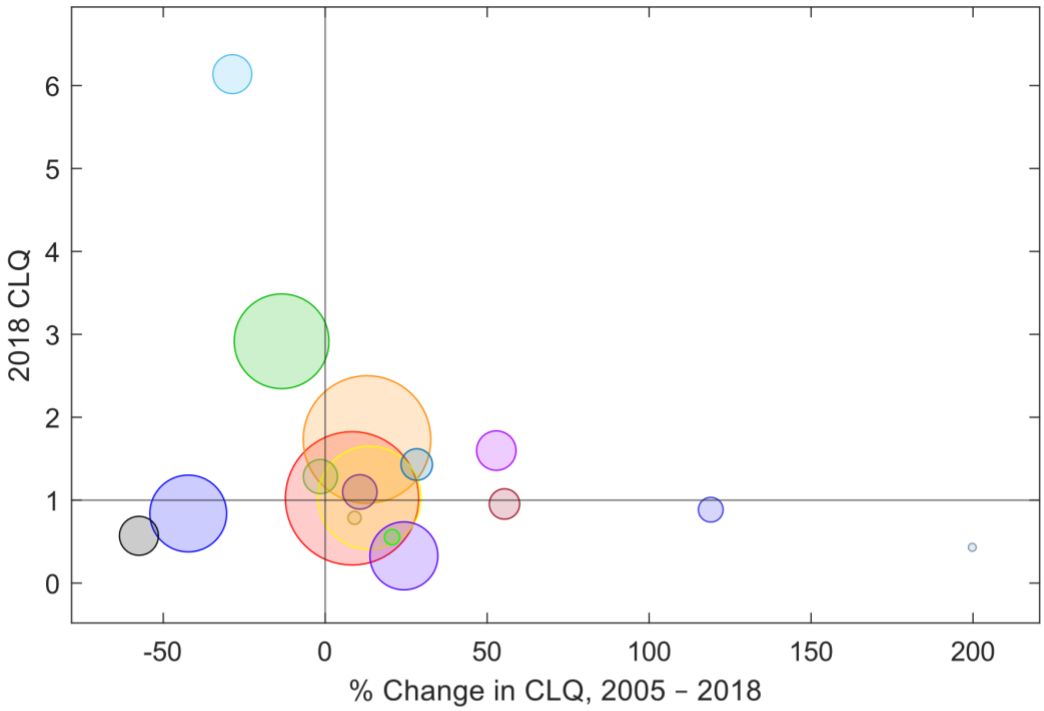
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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
5	Business and Financial Services	0.94	1.02	42,820
4	Biomedical/Biotechnical (Life Sciences)	1.53	1.73	39,064
3	Arts, Entertainment, Recreation and Visitor Industries	0.91	1.03	25,032
9	Education and Knowledge Creation	3.37	2.92	20,865
16	Transportation and Logistics	1.45	0.84	13,379
8	Defense and Security	0.26	0.33	10,339
11	Forest and Wood Products	1.05	1.60	3,346
1	Agribusiness, Food Processing and Technology	1.34	0.57	3,267
2	Apparel and Textiles	8.60	6.14	3,260
15	Primary and Fabricated Metal Products	0.99	1.10	2,565
7	Computer, Electronic, and Electrical Products	1.30	1.28	2,525
13	Machinery	1.12	1.43	2,170
6	Chemicals and Chemical-Based Products	0.61	0.95	2,034
17	Transportation Equipment	0.40	0.89	1,434
12	Information Technology and Telecommunications	0.46	0.55	821
14	Mining, Glass and Ceramics	0.72	0.79	749
10	Energy (Fossil and Renewable)	0.14	0.43	677

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Winston-Salem, NC



Bubble Size as the Employment for Each Cluster
Business and Financial Services (42,820)
Biomedical/Biotechnical (Life Sciences) (39,064)
Arts, Entertainment, Recreation and Visitor Industries (25,032)
Education and Knowledge Creation (20,865)
Transportation and Logistics (13,379)
Defense and Security (10,339)
Forest and Wood Products (3,346)
Agribusiness, Food Processing and Technology (3,267)
Apparel and Textiles (3,260)
Primary and Fabricated Metal Products (2,565)
Computer, Electronic, and Electrical Products (2,525)
Machinery (2,170)
Chemicals and Chemical-Based Products (2,034)
Transportation Equipment (1,434)
Information Technology and Telecommunications (821)
Mining, Glass and Ceramics (749)
Energy (Fossil and Renewable) (677)

2. CADS Analysis

The 2018 CADS analysis of the economy of Winston-Salem, NC identifies 4 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 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	13,317	20,877
5	Business and Financial Services	115	Monetary Authorities, Credit Intermediation, and Related Activities	6,191	5,831
5	Business and Financial Services	133	Management of Companies and Enterprises	3,740	6,276
5	Business and Financial Services	136	Employment Services	7,846	8,369

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	3.01	5,151	18.09	56.77	0.97	0.14
115	Monetary Authorities, Credit Intermediation, and Related Activities	1.60	161	-8.42	-5.81	0.97	0.06
133	Management of Companies and Enterprises	1.96	1,233	34.84	67.80	0.96	0.05
136	Employment Services	1.69	462	0.78	6.67	0.98	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 153

Hospitals

Industry #	Industry Name	Employment
4	Fishing, Hunting and Trapping	-11
6	Oil and Gas Extraction	-9
19	Dairy Product Manufacturing	-12
21	Seafood Product Preparation and Packaging	-14
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-11
53	Forging and Stamping	-9
70	Communications Equipment Manufacturing	-6
75	Electric Lighting Equipment Manufacturing	-8
97	Rail Transportation	-10
114	Other Information Services	N/A
129	Management, Scientific, and Technical Consulting Services	N/A
161	Independent Artists, Writers, and Performers	-11

Table 6. Phase 2 Deficits Adding Anchor Industry 115

Monetary Authorities, Credit Intermediation, and Related Activities

Industry #	Industry Name	Employment	Added to Deficit
4	Fishing, Hunting and Trapping	-12	-1
6	Oil and Gas Extraction	-13	-4
19	Dairy Product Manufacturing	-13	-1
21	Seafood Product Preparation and Packaging	-14	-0

36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-13	-1
53	Forging and Stamping	-10	-1
70	Communications Equipment Manufacturing	-9	-3
75	Electric Lighting Equipment Manufacturing	-9	-2
97	Rail Transportation	-12	-2
114	Other Information Services	-24	-27
129	Management, Scientific, and Technical Consulting Services	N/A	-331
161	Independent Artists, Writers, and Performers	-33	-22

Table 7. Phase 3 Deficits Adding Anchor Industry 133

Management of Companies and Enterprises

Industry #	Industry Name	Employment	Added to Deficit
4	Fishing, Hunting and Trapping	-12	-0
6	Oil and Gas Extraction	-15	-2
19	Dairy Product Manufacturing	-13	-0
21	Seafood Product Preparation and Packaging	-14	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-14	-1
53	Forging and Stamping	-12	-2
70	Communications Equipment Manufacturing	-34	-24
75	Electric Lighting Equipment Manufacturing	-11	-1
97	Rail Transportation	-14	-2
114	Other Information Services	-54	-30
129	Management, Scientific, and Technical Consulting Services	-95	-196
161	Independent Artists, Writers, and Performers	-54	-20

Table 8. Phase 4 Deficits Adding Anchor Industry 136

Employment Services

Industry #	Industry Name	Employment	Added to Deficit
4	Fishing, Hunting and Trapping	-13	-0
6	Oil and Gas Extraction	-15	-0
19	Dairy Product Manufacturing	-13	-0
21	Seafood Product Preparation and Packaging	-15	-0
36	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	-14	-0
53	Forging and Stamping	-12	-0
70	Communications Equipment Manufacturing	-34	-1
75	Electric Lighting Equipment Manufacturing	-11	-0
97	Rail Transportation	-14	-0
114	Other Information Services	-58	-4
129	Management, Scientific, and Technical Consulting Services	-116	-21
161	Independent Artists, Writers, and Performers	-56	-2

Chapter 29. Youngstown-Warren-Boardman, OH-PA

Study Area Overview

The Youngstown-Warren-Boardman, OH-PA study region occupies 1,703 square-miles and had a 2018 population of 538,952. The employed share of the regional labor force during the 2014-2018 period averaged 94.69%. 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 22.42% of the region's economy. The region's 2018 coefficient of specialization (COS) is 29.07, 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 Youngstown-Warren-Boardman, OH-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 1,809 followed by Management of Companies and Enterprises 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 1.25, 0.83, and 1.3.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
155	Individual and Family Services	1,809	-587	1.25
133	Management of Companies and Enterprises	1,066	541	0.83
167	Food Services and Drinking Places	1,012	-4,802	1.30
146	Offices of Physicians	913	-259	1.65
154	Nursing and Residential Care Facilities	809	-1,116	2.67
149	Outpatient Care Centers	492	-941	1.69
145	Other Educational Services	482	148	0.94
157	Child Day Care Services	428	396	0.82
102	Scenic and Sightseeing Transportation and Support Activities for Transportation	371	181	1.01
135	Facilities Support Services	359	269	3.24

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 Youngstown-Warren-Boardman, OH-PA, the cluster with the largest CLQ in 2018 is Primary and Fabricated Metal Products with a CLQ of 5.1, 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 Youngstown-Warren-Boardman, OH-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.

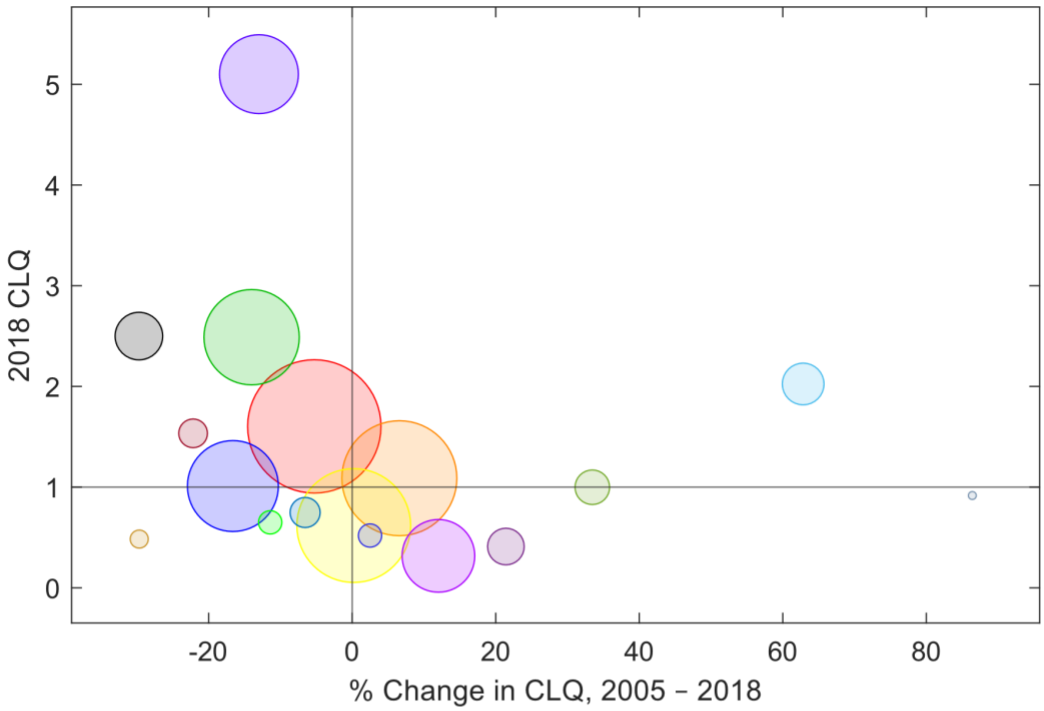
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.69	1.60	35,026
3	Arts, Entertainment, Recreation and Visitor Industries	1.02	1.09	25,637
5	Business and Financial Services	0.62	0.62	25,091
9	Education and Knowledge Creation	2.89	2.49	17,246
16	Transportation and Logistics	1.21	1.01	15,597
15	Primary and Fabricated Metal Products	5.86	5.10	11,520
8	Defense and Security	0.28	0.32	9,669
17	Transportation Equipment	3.56	2.50	3,921
13	Machinery	1.24	2.02	2,975
1	Agribusiness, Food Processing and Technology	0.34	0.41	2,274
11	Forest and Wood Products	0.75	1.00	2,026
6	Chemicals and Chemical-Based Products	0.80	0.75	1,544
14	Mining, Glass and Ceramics	1.97	1.53	1,413
7	Computer, Electronic, and Electrical Products	0.51	0.52	989
10	Energy (Fossil and Renewable)	0.73	0.65	988
12	Information Technology and Telecommunications	0.69	0.48	694
2	Apparel and Textiles	0.49	0.92	471

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Youngstown-Warren-Boardman, OH-PA



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (35,026)
Arts, Entertainment, Recreation and Visitor Industries (25,637)
Business and Financial Services (25,091)
Education and Knowledge Creation (17,246)
Transportation and Logistics (15,597)
Primary and Fabricated Metal Products (11,520)
Defense and Security (9,669)
Transportation Equipment (3,921)
Machinery (2,975)
Agribusiness, Food Processing and Technology (2,274)
Forest and Wood Products (2,026)
Chemicals and Chemical-Based Products (1,544)
Mining, Glass and Ceramics (1,413)
Computer, Electronic, and Electrical Products (989)
Energy (Fossil and Renewable) (988)
Information Technology and Telecommunications (694)
Apparel and Textiles (471)

2. CADS Analysis

The 2018 CADS analysis of the economy of Youngstown-Warren-Boardman, OH-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 Iron and Steel Mills and Ferroalloy 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
15	Primary and Fabricated Metal Products	48	Iron and Steel Mills and Ferroalloy Manufacturing	1,980	2,150

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
48	Iron and Steel Mills and Ferroalloy Manufacturing	19.38	462	-14.74	8.59	0.90	0.13

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 48

Iron and Steel Mills and Ferroalloy Manufacturing

Industry #	Industry Name	Employment
7	Coal Mining	-49
8	Metal Ore Mining	-195
31	Pulp, Paper, and Paperboard Mills	-17
58	Spring and Wire Product Manufacturing	-33
78	Other Electrical Equipment and Component Manufacturing	-54
84	Ship and Boat Building	-11
97	Rail Transportation	-143
98	Water Transportation	-11
127	Specialized Design Services	-27
161	Independent Artists, Writers, and Performers	-12

Chapter 30. Zanesville, OH

Study Area Overview

The Zanesville, OH study region occupies 665 square-miles and had a 2018 population of 86,183. The employed share of the regional labor force during the 2014-2018 period averaged 94.2%. 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 26.47% of the region's economy. The region's 2018 coefficient of specialization (COS) is 37.51, 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 Zanesville, 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 Warehousing and Storage, whose employment grew by 483 followed by Food Services and Drinking Places and Offices of Physicians. 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 4.13, 1.36, and 2.08.

Table 1. Top Ten Growth Industries

Industry #	Industry Name	Employment Change	RS	LQ
104	Warehousing and Storage	483	47	4.13
167	Food Services and Drinking Places	386	-516	1.36
146	Offices of Physicians	385	199	2.08
99	Truck Transportation	376	373	1.86
110	Wired Telecommunications Carriers	353	380	4.26
145	Other Educational Services	278	248	1.68
23	Other Food Manufacturing	233	195	7.00
136	Employment Services	217	213	0.94
128	Computer Systems Design and Related Services	184	184	0.40
33	Printing and Related Support Activities	165	200	2.89

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 Zanesville, OH, the cluster with the largest CLQ in 2018 is Mining, Glass and Ceramics with a CLQ of 3.45, 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 Zanesville, 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.

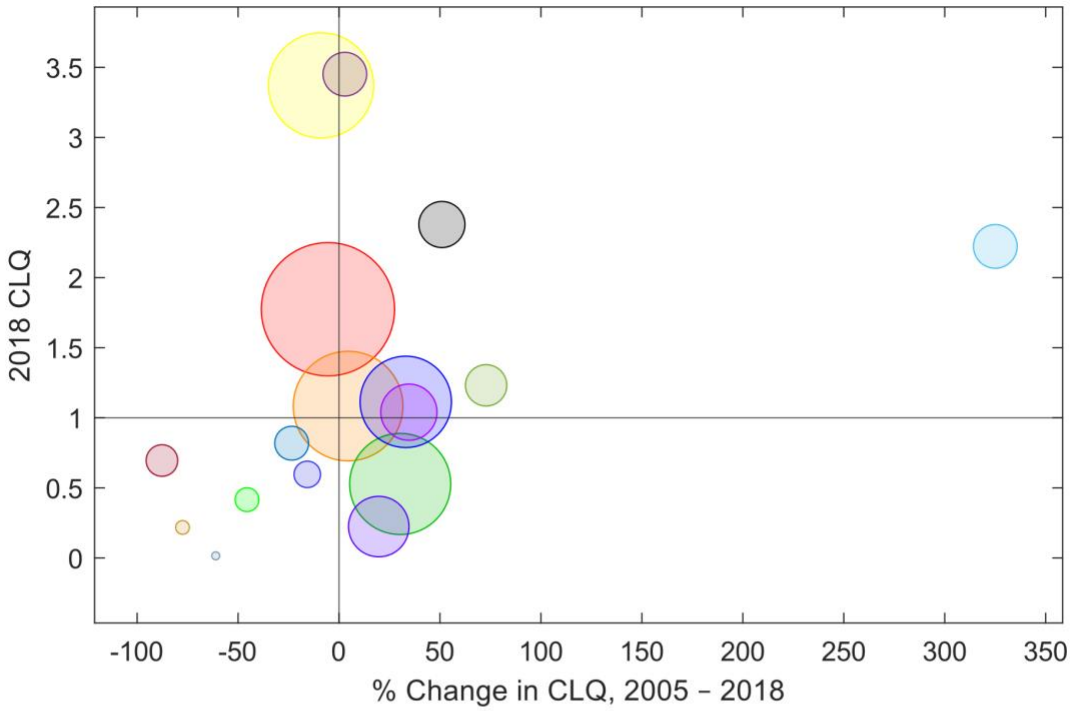
As a result of this categorization, the Star clusters that display in quadrant I are specialized and becoming more so. The Mature clusters that display in quadrant II are specialized but have become less so. Emerging clusters, those in quadrant IV, are not specialized in the region, but have gained in 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)	1.88	1.77	6,148
3	Arts, Entertainment, Recreation and Visitor Industries	1.04	1.08	4,047
9	Education and Knowledge Creation	3.70	3.37	3,704
5	Business and Financial Services	0.41	0.53	3,397
16	Transportation and Logistics	0.84	1.11	2,725
8	Defense and Security	0.19	0.22	1,082
1	Agribusiness, Food Processing and Technology	0.77	1.04	915
10	Energy (Fossil and Renewable)	1.58	2.38	573
12	Information Technology and Telecommunications	0.52	2.22	505
14	Mining, Glass and Ceramics	3.35	3.45	504
15	Primary and Fabricated Metal Products	0.71	1.23	441
6	Chemicals and Chemical-Based Products	1.07	0.82	268
11	Forest and Wood Products	5.66	0.70	224
13	Machinery	0.71	0.60	139
17	Transportation Equipment	0.76	0.42	103
2	Apparel and Textiles	0.97	0.22	18
7	Computer, Electronic, and Electrical Products	0.04	0.02	5

Note: Increasing cluster concentrations are highlighted in blue.

Figure 1: Cluster Bubble Chart of Zanesville, OH



Bubble Size as the Employment for Each Cluster
Biomedical/Biotechnical (Life Sciences) (6,148)
Arts, Entertainment, Recreation and Visitor Industries (4,047)
Education and Knowledge Creation (3,704)
Business and Financial Services (3,397)
Transportation and Logistics (2,725)
Defense and Security (1,082)
Agribusiness, Food Processing and Technology (915)
Energy (Fossil and Renewable) (573)
Information Technology and Telecommunications (505)
Mining, Glass and Ceramics (504)
Primary and Fabricated Metal Products (441)
Chemicals and Chemical-Based Products (268)
Forest and Wood Products (224)
Machinery (139)
Transportation Equipment (103)
Apparel and Textiles (18)
Computer, Electronic, and Electrical Products (5)

2. CADS Analysis

The 2018 CADS analysis of the economy of Zanesville, OH 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 Wired Telecommunications Carriers, 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	110	Wired Telecommunications Carriers	131	484
4	Biomedical/Biotechnical (Life Sciences)	146	Offices of Physicians	763	1,148
16	Transportation and Logistics	99	Truck Transportation	281	657
14	Mining, Glass and Ceramics	45	Glass and Glass Product Manufacturing	364	339
16	Transportation and Logistics	104	Warehousing and Storage	494	977
9	Education and Knowledge Creation	145	Other Educational Services	68	346

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
110	Wired Telecommunications Carriers	4.26	380	-20.94	269.68	0.67	0.07
146	Offices of Physicians	2.08	199	24.38	50.50	0.79	0.05
99	Truck Transportation	1.86	373	1.19	133.81	0.87	0.04
45	Glass and Glass Product Manufacturing	18.56	64	-24.49	-6.94	0.75	0.03

104	Warehousing and Storage	4.13	47	88.22	97.65	0.86	0.03
145	Other Educational Services	1.68	248	44.75	409.62	0.90	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 110

Wired Telecommunications Carriers

Industry #	Industry Name	Employment
72	Semiconductor and Other Electronic Component Manufacturing	-12
81	Motor Vehicle Parts Manufacturing	-1
97	Rail Transportation	-1
107	Motion Picture, Video, and Sound Recording Industries	-69
117	Insurance Carriers	N/A
150	Medical and Diagnostic Laboratories	N/A
161	Independent Artists, Writers, and Performers	-60

Table 6. Phase 2 Deficits Adding Anchor Industry 146

Offices of Physicians

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-13	-1
81	Motor Vehicle Parts Manufacturing	-2	-1
97	Rail Transportation	-1	-0
107	Motion Picture, Video, and Sound Recording Industries	-69	-0
117	Insurance Carriers	-5	-6
150	Medical and Diagnostic Laboratories	-24	-29
161	Independent Artists, Writers, and Performers	-61	-1

Table 7. Phase 3 Deficits Adding Anchor Industry 99

Truck Transportation

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-15	-1
81	Motor Vehicle Parts Manufacturing	-7	-5
97	Rail Transportation	-5	-4
107	Motion Picture, Video, and Sound Recording Industries	-69	-0
117	Insurance Carriers	-16	-10
150	Medical and Diagnostic Laboratories	-24	-0
161	Independent Artists, Writers, and Performers	-62	-1

Table 8. Phase 4 Deficits Adding Anchor Industry 45

Glass and Glass Product Manufacturing

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-22	-7
81	Motor Vehicle Parts Manufacturing	-9	-2
97	Rail Transportation	-12	-7
107	Motion Picture, Video, and Sound Recording Industries	-69	-0
117	Insurance Carriers	-17	-2
150	Medical and Diagnostic Laboratories	-24	-0
161	Independent Artists, Writers, and Performers	-63	-0

Table 9. Phase 5 Deficits Adding Anchor Industry 104

Warehousing and Storage

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-23	-1
81	Motor Vehicle Parts Manufacturing	-15	-6
97	Rail Transportation	-12	-0
107	Motion Picture, Video, and Sound Recording Industries	-70	-0
117	Insurance Carriers	-20	-3
150	Medical and Diagnostic Laboratories	-24	-0
161	Independent Artists, Writers, and Performers	-63	-0

Table 10. Phase 6 Deficits Adding Anchor Industry 145

Other Educational Services

Industry #	Industry Name	Employment	Added to Deficit
72	Semiconductor and Other Electronic Component Manufacturing	-23	-0
81	Motor Vehicle Parts Manufacturing	-16	-0
97	Rail Transportation	-12	-0
107	Motion Picture, Video, and Sound Recording Industries	-71	-1
117	Insurance Carriers	-21	-1
150	Medical and Diagnostic Laboratories	-24	-0
161	Independent Artists, Writers, and Performers	-63	-0