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by

David L. Barkley
and
Mark S. Henry

Regional Economic Development Research Laboratory
Department of Applied Economics and Statistics
Clemson University, Clemson, South Carolina

Clemson University Public Service Activities

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David L. Barkley
Professor, Department of Applied Economics & Statistics
And Co-Coordinator, REDRL

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Regional Economic Development Research Laboratory
Clemson University
Clemson, South Carolina

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Abstract

An industry cluster is a geographically bounded collection of similar and/or related firms that together create competitive advantages for member firms and the local economy. The targeting of economic development programs at industry clusters provides three principal advantages: multiplier effects are stronger, employment growth potential is enhanced, and new firm spin-offs are promoted. The Clemson University Regional Economic Development Research Laboratory (REDRL) targeting method uses a screening process to identify local industry clusters with high potential for future growth. The region's industries must pass five screens to be selected as a targeted cluster: substantial local presence as indicated by number of establishments and employees, industry employment in the region is growing, the region is relatively specialized in the industry (LQ> 1.0), and local employment growth exceeds the national industry average. Next, industry value chains are identified to determine if linked industries are good prospects for targeting. Finally, the identified high potential industry clusters are rated according to workers' wages, potential future employment growth, import substitution potential, average plant size, and linkages to the local economy. Comparisons of these industry characteristics provide communities with insights regarding the potential economic and fiscal impacts associated with the attraction of an establishment in one of the target industries. In summary, the industry cluster targeting approach provides community leaders with (1) a list of industries for which they have a reasonable likelihood of attracting and (2) information regarding the likely benefits and costs associated with each industry. As such, a targeting approach permits communities to use their limited industrial development resources more efficiently to meet their industrial development goals.

Targeting Industry Clusters for Regional Economic Development:

An Overview of the REDRL Approach

I. Introduction

Industry targeting is the process of focusing industrial development programs and efforts at specific industries or clusters of related industries. The principal objectives of a industry targeting program is to identify: (1) industries that have a high potential for locating in the area, and (2) industries that provide attractive local economic development impacts in terms of future job growth, wages paid, and contributions to the local tax base. A targeting approach enables communities to focus their recruitment, retention and expansion, and small business development programs rather than provide assistance for many different industry types. Thus, targeting permits a more efficient use of the community's limited economic development resources.

The purpose of this paper is to provide an overview of the industry targeting approach developed and used by the Regional Economic Development Research Laboratory (REDRL) of Clemson University. This approach focuses on identifying industry clusters with (1) a high potential for locating in the study area and (2) significant positive economic impacts on the local economy. The discussion of the REDRL targeting methodology is organized as follows. First, we summarize the advantages and disadvantages of targeting industry clusters as an economic development strategy. Second, we present the screening methodology for identifying industry clusters and the clusters' value chains. Third, we rank the clusters based on potential impacts on the local economy. The REDRL cluster targeting methodology was used for

the South Carolina secondary wood products (Lamie et al., 1997) and food and fiber industries (Wright, Henry, Barkley, 1998), and for manufacturing industries in Anderson County (Barkley, Henry, and Wright, 1998) and Lancaster County (Barkley, Henry, and Warner, 2002).

II. Targeting Industry Clusters

Industry clusters are "geographic concentrations of interconnected companies, specialized supplies, service providers, firms in related industries, and associated institutions" (Porter, 2001, p. 7). Firms in an industry cluster may interact through purchase-sale relationships; interfirm collaboration in product development, marketing, or research; or a shared reliance on specialized services and labor markets. Industry clusters are unique as a result of their historical development, and the local organizations and institutions that evolved to serve them (Cortright and Mayer, 2001). However, commonalities exist among industry clusters that influence their potential for growth and the policies and programs appropriate for cluster promotion and development. Industry clusters may be classified according to core industry, foundation or economic stimulus for clustering, and intra-cluster firm structure or organization. The agglomeration of establishments in a location may have resulted from (1) an incidental co-location based on proximity to markets or natural resources (Gordon and McCann, 2000); (2) the availability of localization economies derived from specialized goods and services (Marshal, 1920); (3) the evolution of a local value chain (end-market sectors and their

primary, secondary, and tertiary supplies), and/or (4) the availability of pools of

specialized labor (Feser, 2003).

A. Advantages of Targeting Industry Clusters

The targeting of industrial development programs at specific industry clusters generally will provide greater economic development benefits than those associated with a more unfocused industrialization efforts. Five principal benefits result from the development of industry clusters in a county or region (Barkley and Henry, 1997).

- Clustering Strengthens Localization Economies. The concentration of an industry at a particular location may result in significant cost savings to firms in the cluster. These cost savings are referred to as *localization economies.* Sources of potential savings include a greater availability of specialized input suppliers and business services; a larger pool of trained, specialized workers; public infrastructure investments geared to the needs of a particular industry; financial markets familiar with the industry; and an enhanced likelihood of interfirm technology and information transfers.
- Clustering Facilitates Industrial Reorganization. The transition in industrial organization from large firms engaged in mass production to small firms focused on specialty production is well documented. This change in industrial structure is attributed to increased global competition and the emergence of new production technologies (e.g., computer-aided manufacturing). Clusters are attractive locations for the small, specialized, computer-aided manufacturers for several reasons.
    (1) The adoption of new production technologies is more prominent and easily attained among firms in industry clusters.
    (2) Proximity between the more specialized firms and their input

suppliers and product markets enhances the flow of goods through the production system.

(3) Ready access to product and input markets enables firms to quickly adapt to market changes.

(4) A concentration of firms provides the pool of skilled labor required by the computer-aided technologies.

- Clustering Encourages Networking Among Firms. Networking is cooperation among firms to take advantage of complimentaries, exploit new markets, integrate activities, or pool resources or knowledge. This cooperation occurs more naturally and frequently within industry clusters. Surveys of firms in manufacturing networks show that networks generate significant advantages for firms through cooperation with their counterparts. Networking firms are more likely than non-networking firms to engage in collaboration and information sharing in marketing, new product development, and technological upgrading. The networking firms also report that their competitiveness and profitability are enhanced by interfirm cooperation and collaboration.
- Clustering Results in Larger Local Economic Impacts. The total employment and income effects associated with attracting a new firm include the direct effects (firm employment and income) and indirect effects (employment and income changes at input suppliers for the new firm). The indirect employment and income changes generally are referred to as the multiplier effects. Programs supporting cluster development will have relatively large multiplier effects for the local economy because of strong linkages among cluster firms. That is, the total employment and

income gains from recruiting (or retaining) cluster members will likely exceed those associated with non-cluster firms of similar size.

- Clusters Facilitate Entrepreneurial Activity. Industry clusters encourage new firm start-ups and growth by fostering innovation and facilitating the commercialization of new products and technologies. Entrepreneurial activity, in turn, leads to further cluster growth. Thus, industry clusters and entrepreneurial activity reinforce one another, leading to more rapid local economic development through cumulative causation (Feldman and Francis, 2004). The role of entrepreneurial activity in cluster development is especially important in areas where clusters are small or existing clusters are in declining industries.

B. Disadvantages of Targeting Industry Clusters

The principal shortcoming with an industry targeting approach is the difficulty of "picking winners." A prerequisite to targeting industries is the identification of future regional competitive advantage based on past labor force characteristics, unique regional attributes, and proximity to input and product markets. Industrialization efforts next must identify the industries that best fit the regional competitive advantage. The industry targeting approach also must assess industry prospects for growth and potential local economic impacts. This process of "picking winners" is complicated by the volatility of the market place - - today's "rapid growth" sectors may be "slow growth" or "declining' industries in the future (Buss, 1999).

Industry targeting is not an exact science. Industries identified through a targeting study may choose not to locate in the region. Or, firms in a targeted industry may be attracted to the region but not provide the anticipated employment and income

effects. Thus the targeting of specific industries for recruitment or retention and expansion does not guarantee that the desired employment and income gains will result. However, industry targeting does increase the probability that the region will be successful in developing an industrial base that provides characteristics desired by the community.

The remainder of this section provides the methods, data, and findings of our industry clusters targeting approach.

III. Criteria for Selecting Industry Clusters

The REDRL approach to cluster identification and targeting follows three principal steps.

Step 1. Identify industry concentrations for which the region has experienced recent employment growth.

Step 2. Construct value chains for the industry clusters selected in Step 1. Identify industries in the value chains with the greatest linkages to the local industry concentrations.

Step 3. Rank the selected industries from Steps 1 and 2 by expected economic and fiscal impacts on the local economy.

The industry cluster targeting approach will be demonstrated using the findings of the 1998 study of Anderson County, SC; a small, single county metropolitan area with total employment of approximately 50,000. Clusters of manufacturing establishments in Anderson County were targeted at the four-digit SIC level.

A. Step 1: To identify expanding industry clusters in Anderson County, five screening criteria were used:

1. Three or more establishments in Anderson County in 1996.
2. County industry employment was greater than 200 in 1996.
3. Industry employment in Anderson County increased from 1988 to 1996.
4. An industry specialization index--the Location Quotient (LQ)--for Anderson County exceeded 1.00 in 1996 or the LQ increased from 1988 to 1996.
5. An industry competitiveness index-- the Competitiveness Differential (CD) component of Shift-Share Analysis-- for Anderson County was positive for the period 1988 to 1996.

Screening criteria 1, 2, and 3 identify four-digit SIC manufacturing industries that had a significant presence in the County in 1996 and promising employment generation potential (based on 1988 to 1996 employment growth rates). The “Location Quotient” and “Competitiveness Differential” criteria are used to identify industries for which Anderson County has exhibited a competitive advantage in attracting or developing. A location quotient greater than one indicates that the region has been, over time, relatively successful in attracting or nurturing employment in a specific industry. An increase in an industry's LQ from 1988 to 1996 indicates that the industry has become more important to the local economy compared to the average county in the U.S. Thus, a high and increasing LQ implies the region has a competitive advantage in maintaining and attracting employment in that industry. The competitiveness differential (CD) provides an indicator of how well a local industry is performing over a specific time period relative to the nation as a whole. A positive competitiveness differential indicates that industry employment in the area grew at a more rapid rate than for the nation, or area industry employment declined at a less rapid rate than for the nation. A positive competitiveness differential, in conjunction with a positive area industry

employment growth rate, indicates that the area had a competitive advantage in attracting and generating employment in that industry over the specified time period. Eight Anderson County industry clusters were identified using the above screening criteria (table 1).

Large and expanding industry clusters in the other Upstate counties (Oconee, Pickens, Greenville, Laurens, Spartanburg, and Cherokee) may also be promising manufacturing industries for Anderson County. The presence of an industry cluster in the South Carolina Upstate indicates that the area provides locational characteristics that are attractive to members of these industries. In addition, the availability of Upstate clusters provides advantages to new cluster firms in terms of proximity to product markets and input suppliers, labor familiar with the industry's production process, and the availability of specialized business services.

Industry clusters in the South Carolina Upstate counties also were targeted at the four-digit SIC level (table 2). The screening criteria used to identify promising manufacturing clusters were:

1. Five or more establishments in the S.C. Upstate in 1996.
2. Upstate industry employment was greater than 1000 in 1996.
3. Industry employment in the Upstate counties increased from 1988 to 1996.
4. Industry Location Quotient (LQ) for the Upstate counties exceeded 1.00 in 1996 or increased from 1988 to 1996.
5. Industry Competitiveness Differential (CD) of Shift-Share Analysis for Upstate counties was positive for the period 1988 to 1996.

The screening methodology for Anderson County and the S.C. Upstate identified 22 industry clusters with high potentials for employment growth in the area - - four

industry clusters that the Upstate and Anderson County have in common, four clusters unique to Anderson County, and 14 clusters unique to the Upstate counties.

B. Step 2: Value Chains for Clusters.

Manufacturing industries supplying inputs to or purchasing outputs from the 22 cluster industries may be good candidates for industry targeting and recruiting. Industries linked to the cluster industries may find Anderson County a competitive location if proximity to input suppliers and product markets is desired. Such proximity is especially valued by: (1) manufacturers using "just-in-time" inventory replacement, or (2) firms producing specialized goods in small-batch production runs.

The IMPLAN database was used to identify the top five inputs suppliers and top five product markets for the 22 industry clusters. Manufacturing industries with five or more input or product market linkages to the 22 cluster industries were identified as industries that will find Anderson County an attractive location if the 22 cluster industries continue to develop in the Upstate (table 3). The manufacturers with the strongest buy-sell relationships to cluster industries include: miscellaneous plastics products (SIC 3080); broadwoven fabric mills (SIC 221-226); plastics materials (SIC 2821); cyclic organic crudes and intermediates (SIC 2865); industrial organic chemicals, NEC (SIC 2869); manmade organic fibers (SIC 2824); and yarn spinning mills (SIC 2281). Plastics materials and yarn spinning mills also were identified as two of the 22 high potential industry clusters.

The recruitment of manufacturers with strong buy-sell linkages to the 22 cluster industries may be a second phase of a targeted industrial development strategy. Additional development of the identified industry clusters should be the initial focus of the county's industrial development program. Expansion of existing industry clusters will make the area a more attractive location for linked manufacturers, and thus, reduce the efforts/incentives required to attract

establishments in the linked industries.

C. Step 3: Ranking Industry Clusters

The 22 industry clusters selected for the Upstate and Anderson County are good prospects for industrial recruitment since the area provides a competitive advantage for these manufacturers. However, all 22 clusters may not be equally attractive prospects based on the expected economic and fiscal impacts on Anderson County. Insights into the potential county-level impacts associated with successfully recruiting an additional establishment were provided by comparing six characteristics for the cluster industries.

U. S. Employment Growth Rate. Establishments in industries with rapid national employment growth are more likely to expand and create new jobs more rapidly than establishments in slow growth or declining industries.

Average Establishment Size. Industries with large average establishment employment provide greater potential for immediate job generation than industries whose operations require, on average, fewer employees.

Average Production Worker Wages. Other establishment characteristics held equal, a manufacturing plant paying high wages will provide greater local economic development impacts than a manufacturing establishment offering primarily low wage jobs.

Fixed Assets Per Employee. The local fiscal impacts of a new manufacturing establishment are related to (1) the establishment's contribution to public revenues through property taxes paid and (2) public expenditures through increased services

required by the establishment's employees. Establishments that contribute much to public revenues relative to public expenditures will be preferred to those that add much to public costs relative to tax revenues.

Industry Multipliers. Income multipliers for the 22 industries were estimated for the Upstate counties using IMPLAN. The multipliers provide a means of comparing the relative cumulative effect of additional income generated by the cluster industry.

Import Substitution. A location consideration for many manufacturing industries is the size of the local market for the manufacturer's product. One measure of potential local market size is the dollar value of imports of the manufacturer's product to the region. The potential to substitute for Upstate imports may make Anderson County an attractive location for manufacturers. Total Upstate imports by four-digit SIC industry for the 22 manufacturing clusters were estimated using IMPLAN. Total imports were divided by average establishment size to provide an estimate of the number of new local establishments, by industry, the Upstate counties could support based on import substitution.

Summary Index of Industry Characteristics. Comparisons among industry characteristics are complicated by the fact that an industry may “rate” high on one characteristic and “rate” low on another. For example, establishments in the yarn spinning mills industry (SIC 2281) have large average plant sizes but pay relatively low wages to production workers, while establishments in the pharmaceutical

preparations industry provide, on average, large plant size and high wages. Thus, from a community development standpoint, adding a pharmaceutical preparations plant would be preferred to the attraction of a new yarn spinning mill (everything else held equal).

A ranking of the 22 cluster industries based on the industry characteristics is provided through the calculation of a summary index. This index is estimated as follows:

(1) The national averages for the industry establishment characteristics are standardized. That is, the 22 values for each characteristic are treated as observations from a standard normal distribution (a distribution with a mean of 0.0 and standard deviation of 1.0). Standardization of characteristic data permits comparisons across characteristics that have different measures (for example, employment vs. wages vs. assets).

(2) The actual value for the characteristic is replaced by its corresponding standardized value. This standardized value is the number of standard deviations above (+) or below (-) the mean for the 22 industries. Standardized values near 0.0 reflect actual values near the average for the 22 industries. Negative standardized values reflect below average actual values and positive standardized values represent above average actual values. The larger the standardized value (+ or -) the further above or below the characteristic mean. For example, a standardized value of +1.00 or higher places the industry in approximately the top 15 percent of the 22 industries, while a value of -1.00 or lower places the industry

in the bottom 15 percent. Or, an alternative perspective is that the middle 50 percent of the industries will have standardized values between approximately -.70 and +.70.

(3) The standardized values for the industry characteristics are summed for each industry (table 4). This sum represents an unweighted total, that is, each of the industry characteristics is given equal weight in construction of the index. The reader should note that the index rankings reflect the relative potential impacts of only the 22 selected industry clusters. All 22 industries were selected as good candidates for industrial recruitment based on the presence of a growing industry cluster in Anderson County or the Upstate. However, the rankings indicate that some of the 22 industries may be "more desirable" than others based on potential economic and fiscal impacts on the host region.

IV. Summary of the Targeting Approach

Twenty-two 4-digit SIC manufacturing industries were selected based on the targeted industry clusters approach. Seven of the industries were in Textiles (SIC 22) or Apparel (SIC 23), five industries were in industrial and commercial machinery (SIC 35), and three industries were in chemicals and allied products (SIC 28). The remaining seven industry clusters were in plastics (SIC 30), paper products (SIC 26), printing and publishing (SIC 27), electronic equipment (SIC 36), and automobile

parts and assembly (SIC 37). All 22 industry clusters are promising targets for industrial recruitment based on recent local employment growth and the attractiveness of Anderson County and the South Carolina Upstate as locations for their production activities. However, establishments in the 22 industries will provide different economic and fiscal impacts for Anderson County. Based on the selected industry characteristics, the manufacturing clusters with the most favorable economic and fiscal impact potentials for Anderson County were:

- motor vehicle parts and accessories (3714)
- nonwoven fabrics (2297)
- pharmaceutical preparations (2834)
- surface active agents (2843)
- plastics materials and resins (2821)
- turbines and turbine generator sets (3511)

The Anderson County industry targeting study was completed in 1998. The six years between the study and 2004 is sufficient time to determine if the industries selected by the REDRL clustering methodology were "good" targets for industry recruiting. Table 5 provides the 22 target industries for the South Carolina Upstate and the number of new manufacturing plants established from 1998 to 2004 according to the South Carolina Department of Commerce (SCDOC) records on new plant investments. The SCDOC reports 35 new plant investments in the 6 county Upstate area. Seventeen of these investments were in the 4-digit SIC industries selected for targeting and 21 were in the more inclusive 3-digit SIC industries. Thus, the REDRL methodology was successful in "predicting" the industry of approximately one-half of the new manufacturing establishments in the Upstate. This

result should not be too surprising since the selected target clusters were those industries in which the Upstate experienced growth in the recent past.

V. References

Barkley, D. L., M. S. Henry, and S. Wright. 1998. "Industry Targeting for Economic Development, Anderson County, 1998." EER 170, Clemson University, Department of Applied Economics and Statistics, Clemson University.

Barkley, D. L. and M. S. Henry. 1997. "Rural Industrial Development: To Cluster or Not to Cluster?" Review of Agricultural Economics 19(2), pp. 308-325.

Buss, T. F. 1999. "The Case Against Targeted Industry Strategies." Economic Development Quarterly 13(4):339-356.

Cortright, J. and H. Mayer. 2001. "High Tech Specialization: A Comparison of High Tech Centers." Washington, D.C., The Brookings Institute.

Feldman, M. P., and H. Mayer. 2001. "Homegrown Solutions: Fostering Cluster Formation." Economic Development Quarterly 18(2):127-137.

Feser, E. J. 2003. "What Regions Do Rather Than Make: A Proposed Set of Knowledge-Based Occupation Clusters." Urban Studies 40(10):1937-1958.

Gordon, I. R. and P. McCann. 2000. "Industrial Clusters: Complexes, Agglomeration and/or Social Networks?" Urban Studies 37(3):513-532.

Lamie, R. D., D. L. Barkley, M. S. Henry, and J. H. Syme. 1997. "Targeting Secondary Wood Products Manufacturing: Identifying High Impact, High Potential Sectors." RR97-1, Department of Agricultural and Applied Economics, January.

Porter, M. 2001. "Cluster of Innovation: Regional Foundations of U.S. Competitiveness." Council of Competitiveness, Washington, D.C.

Wright, S., M. S. Henry, D. L. Barkley. 1998. "Targeting Food, Fiber, and Forestry Industries for Development of Rural South Carolina." Research Report 98-2, Department of Agricultural and Applied Economics, Clemson University, July.

Table 1. Anderson County Clusters

I.	Positive U.S. Employment Change, 1988-1996		
1.	3714	-	Motor Vehicle Parts & Accessories*
	1996 Employment	-	2312
	1996 Establishments	-	7
	U.S. Emp. Change, 88-96	-	+ 33.8%
2.	3089	-	Plastics Products, NEC*
	1996 Employment	-	259
	1996 Establishments	-	9
	U.S. Emp. Change, 88-96	-	+ 21.8%
3.	3599	-	Industrial Machinery, NEC*
	1996 Employment	-	205
	1996 Establishments	-	19
	U.S. Emp. Change, 88-96	-	+ 23.3%
4.	2392	-	Housefurnishings Except Curtains & Draperies *
	1996 Employment	-	308
	1996 Establishments	-	3
	U.S. Emp. Change, 88-96	-	+ 6.9%
5.	2273	-	Carpets & Rugs
	1996 Employment	-	525
	1996 Establishments	-	3
	U.S. Emp. Change, 88-96	-	+ 3.9%
6.	2759	-	Commercial Printing, NEC *
	1996 Employment	-	228
	1996 Establishments	-	3
	U.S. Emp. Change, 88-96	-	+ 0.6%
II.	Negative U.S. Employment Change, 1988-1996		
1.	2399	-	Fabricated Textile Products, NEC
	1996 Employment	-	340
	1996 Establishments	-	3
	U.S. Emp. Change, 88-96	-	- 6.0%
2.	2281	-	Yarn Spinning Mills
	1996 Employment	-	287
	1996 Establishments	-	5
	U.S. Emp. Change, 88-96	-	- 24.0%

*Also designated as an Upstate Cluster (see (Table 2). Source: ES202 Data Files

Table 2. South Carolina Upstate Clusters

I. Positive U.S. Employment Change, 1988-1996

1.	3714	-	Motor Vehicle Parts & Accessories*
	1996 Employment	-	1630
	1996 Establishments	-	12
	U.S. Emp. Change, 88-96	-	+ 33.8%
2.	3089	-	Plastics Products, NEC*
	1996 Employment	-	2623
	1996 Establishments	-	34
	U.S. Emp. Change, 88-96	-	+ 21.8%
3.	3599	-	Industrial Machinery, NEC*
	1996 Employment	-	1492
	1996 Establishments	-	119
	U.S. Emp. Change, 88-96	-	+ 23.3%
4.	2834	-	Pharmaceutical Prep
	1996 Employment	-	1788
	1996 Establishments	-	3
	U.S. Emp. Change, 88-96	-	+ 10.1%
5.	2653	-	Corrugated & Solid Fiber Boxes
	1996 Employment	-	1065
	1996 Establishments	-	14
	U.S. Emp. Change, 88-96	-	+ 15.4%
6.	2752	-	Commercial Printing, Lithographic
	1996 Employment	-	1684
	1996 Establishments	-	102
	U.S. Emp. Change, 88-96	-	+ 3.1%
7.	2261	-	Finishing Plants, Cotton
	1996 Employment	-	3033
	1996 Establishments	-	25
	U.S. Emp. Change, 88-96	-	+ 37.8%
8.	2673	-	Bags; Plastic, Laminated, & Coated
	1996 Employment	-	1680
	1996 Establishments	-	6
	U.S. Emp. Change, 88-96	-	+ 18.4%

Table 2. South Carolina Upstate Clusters* (Cont.)

9. 2297	-	Nonwoven Fabrics
1996 Employment	-	1334
1996 Establishments	-	11
U.S. Emp. Change, 88-96	-	+ 43.4%
10. 2392	-	Housefurnishings, Except Curtains & Draperies
1996 Employment	-	2703
1996 Establishments	-	12
U.S. Emp. Change, 88-96	-	+ 6.9%
11. 3566	-	Speed Changers, Drives & Gears
1996 Employment	-	1161
1996 Establishments	-	7
U.S. Emp. Change, 88-96	-	+ 12.9%
12. 2843	-	Surface Active Agents
1996 Employment	-	1038
1996 Establishments	-	15
U.S. Emp. Change, 88-96	-	+ 11.9%

II. Negative U.S. Employment Change, 1988-1996

1. 3511	-	Turbines & Turbine Generator Sets
1996 Employment	-	1808
1996 Establishments	-	4
U.S. Emp. Change, 88-96	-	- 0.2%
2. 3562	-	Ball & Roller Bearings
1996 Employment	-	3637
1996 Establishments	-	5
U.S. Emp. Change, 88-96	-	- 6.5%
3. 2299	-	Textile Goods, NEC
1996 Employment	-	1178
U.S. Emp. Change, 88-96	-	16
	-	- 14.9%
4. 3545	-	Machine Tool Accessories
1996 Employment	-	2233
1996 Establishments	-	18
U.S. Emp. Change, 88-96	-	- 6.9%

Table 2. South Carolina Upstate Clusters* (Cont.)

5.	3675	-	Electronic Capacitors
	1996 Employment	-	3548
	1996 Establishments	-	5
	U.S. Emp. Change, 88-96	-	- 16.6%
6.	2821	-	Plastics Materials & Resins
	1996 Employment	-	1195
	1996 Establishments	-	7
	U.S. Emp. Change, 88-96	-	- 7.4%

*Less Anderson County

Source: ES202 Data Files

Table 3. Manufacturing Industries with Numerous Backward (Input) or Forward (Output Linkages) to Upstate or Anderson County Cluster Industries[a]

IMPLAN Sector	SIC Industries in IMPLAN SECTOR	Number of Linkages To Cluster Industries
220	Miscellaneous Plastic Products (308)	9
108	Broadwoven Fabric Mills, Cotton (221) Broadwoven Fabric Mills, Manmade (222) Broadwoven Fabric Mills, Wool (223) Dyeing and Finishing Textiles (226)	8
191	Plastics Materials, Synthetic Resins, Nonvulcanizable Elastomers (2821)[b]	6
190	Cyclic Organic Crudes and Intermediates, and Organic Dyes and Pigments (2865) Industrial Organic Chemicals, nec (2869)	6
194	Manmade Organic Fibers, Except Cellulosic (2824)	6
116	Finishers of Textiles, nec (2269) Yarn Spinning Mills (2281)[b] Yarn Texturizing, Throwing, and Winding Mills (2282)	6
162	Paper Mills (262)	5

[a] Manufacturers listed by IMPLAN as one of the top five input suppliers or product markets for five or more of the cluster industries.

[b] Industries are classified as Anderson County or Upstate clusters.

Table 4. Standardized Distributions of the Variables Growth Ration, Mean Plant Size, Assets Per Employee, And Mean Wage Rate and Their Sum for the Selected Anderson County and Upstate S.C. Clusters.

SIC	Industry	Growth Ratio 1988-1996	Mean Plant Size	Assets Per Employee	Mean Wage Rate	Sum
2821	Plastics Materials and Resins	-0.83	0.22	3.99	2.12	5.49
3714	Motor Vehicle Parts and Accessories	1.49	0.76	0.11	1.25	3.61
2834	Pharmaceutical Preparations	0.16	1.84	0.63	0.90	3.53
2297	Nonwoven Fabrics	2.03	0.65	0.44	-0.03	3.10
3511	Turbines and Turbine Generator Sets	-0.42	0.94	0.12	2.02	2.66
3562	Ball and Roller Bearings	-0.78	1.81	0.23	0.79	2.05
2843	Surface Active Agents	0.26	-0.59	1.01	0.97	1.65
3566	Speed Changers, Drives, and Gears	0.32	-0.51	-0.20	0.62	0.22
2653	Corrugated and Solid Fiber Boxes	0.46	-0.22	-0.18	-0.11	-0.06
2673	Bags: Plastics, Laminated, and Coated	0.63	-0.13	-0.15	-0.41	-0.07
2261	Finishing Plants, Cotton	1.72	-0.64	-0.42	-0.83	-0.17
3599	Industrial Machinery	0.90	-1.25	-0.53	-0.01	-0.89
3089	Plastics Products, NEC	0.82	-0.63	-0.42	-0.68	-0.92
3675	Electronic Capacitors	-1.35	1.53	-0.48	-0.70	-1.01
2273	Carpets and Rugs	-0.19	0.41	-0.48	-0.89	-1.15
2281	Yarn Spinning Mills	-1.76	1.26	-0.19	-0.99	-1.69
2752	Commercial Printing, Lithographic	-0.24	-1.20	-0.47	0.00	-1.91
3545	Machine Tool Accessories	-0.80	-0.96	-0.46	0.08	-2.14
2392	House Furnishings, NEC	-0.02	-0.54	-0.79	-1.34	-2.70
2759	Commercial Printing, NEC	-0.38	-1.17	-0.64	-0.69	-2.88
2299	Textile Good, NEC	-1.25	-0.67	-0.33	-0.80	-3.05
2399	Fabricated Textile Products, NEC	-0.75	-0.90	-0.77	-1.27	-3.69

Source: ES202 Data Files and 1992 Census of Manufacturers

Table 5. New Establishment Start-Ups in Target Industries, Upstate, SC 1998-2004.

SIC	Industry	4-Digit SIC	3-Digit SIC	Total New Establishments
2821	Plastics Materials and Resins	2	3	
3714	Motor Vehicle Parts and Accessories	3	4	
2834	Pharmaceutical Preparations			
2297	Nonwoven Fabrics			
3511	Turbines and Turbine Generator Sets	3	3	
3562	Ball and Roller Bearings			
2843	Surface Active Agents			
3566	Speed Changers, Drives, and Gears			
2653	Corrugated and Solid Fiber Boxes			
2673	Bags: Plastics, Laminated, and Coated			
2261	Finishing Plants, Cotton			
3599	Industrial Machinery	1	1	
3089	Plastics Products, NEC	6	7	
3675	Electronic Capacitors			
2273	Carpets and Rugs			
2281	Yarn Spinning Mills			
2752	Commercial Printing, Lithographic			
3545	Machine Tool Accessories	1	2	
2392	House Furnishings, NEC			
2759	Commercial Printing, NEC			
2299	Textile Good, NEC			
2399	Fabricated Textile Products, NEC	1	1	
	TOTAL	17	21	35

Source: ES202 Data Files and 1992 Census of Manufacturers