EXAMINING SUPPLY GAPS AND SURPLUSES IN THE AUTOMOTIVE CLUSTER IN TENNESSEE

Matthew N. Murray, Associate Director
Center for Business and Economic Research
and Project Director

and

Paula Dowell, Graduate Research Assistant

Prepared by the
Center for Business and Economic Research
College of Business Administration
The University of Tennessee
Knoxville, Tennessee

Prepared for
State of Tennessee
Department of Economic and Community Development

May 1999

Contents

Tables

Figures

EXECUTIVE SUMMARY

The automotive manufacturing cluster plays an important role in the Tennessee economy. Not only is the state home to two major automakers, Nissan and Saturn, but it also harbors hundreds of businesses that provide input to the automotive production process. The Center for Business and Economic Research at the University of Tennessee, Knoxville is conducting an in-depth study of the automotive cluster with the findings to be released in three separate reports. The current report provides an analysis of one aspect of the automotive cluster in Tennessee—the inter-industry linkages of *Tier 1* and *Tier 2* supplier firms. The goal is to identify supply gaps and surpluses that can help target industrial marketing, recruitment, and retention. Future studies will explore the factors that influence firm location and retention within the automotive sector and broadly document and benchmark the automotive cluster in Tennessee and the Southeast.

Key findings include the following:

- **The automotive manufacturing cluster is an attractive economic development option for Tennessee.**

The automotive cluster is attractive as an economic policy option for several reasons. First, the primary market for these assembly plants is all of North America, translating into tremendous wealth generation for the state through exportation of the final automobile product. Secondly, the jobs associated with automotive manufacturing are, on average, high paying skilled jobs. Another attractive feature of automotive manufacturing is the potential for spin-off technologies and businesses as a result of the resources dedicated each year to R&D by major auto manufacturers. Finally, having a strong presence in the automotive industrial cluster can bring national and international recognition to the state—recognition that lead to future business location and economic growth.

- **Industrial clusters, by definition, consist of many inter-related elements concentrated in a specified geographic area.**

The core of industrial clusters is a critical mass of related firms that tend to be export-oriented and highly specialized. The core is then complemented by a network of suppliers of raw materials, components, and support services. Supporting the first two layers of the cluster are responsive economic foundations (e.g., physical infrastructure, labor market conditions, and tax environment) and social infrastructure (e.g., trade organizations and research centers).

- **Tennessee leads the Southeastern states in employment concentration in the manufacturing of motor vehicles and passenger cars**.

Tennessee's *location quotient* (i.e., Tennessee's concentration of employment relative to the nation as a whole) for the motor vehicle and passenger car manufacturing industry (SIC 3711) is 8.04, indicating that the state's concentration of employment in this industry is more than 8 times the national average. Additionally, the state ranked above Kentucky, Georgia, Alabama, North Carolina, and South Carolina in employment concentration for the industry. These states had location quotients ranging from a low of 0.52 in North Carolina to a high of 5.09 in Kentucky. The regional location quotient for this industry is 2.38.

- **Six Tier 1 supplier industries were identified as being underrepresented in Tennessee and the region with the three most noteworthy *gaps* being automotive stamping, vehicular lighting equipment, and paint and allied products.**

Tier 1 suppliers are those firms that supply directly to the auto manufacturer. In Tennessee and the six state regions included in this study, six Tier 1 industries had relatively low location quotients, indicating supply gaps. These industries included automotive stamping, vehicular lighting, paint and allied products, motor vehicle parts and accessories, automotive trim and apparel, and miscellaneous plastic products. All of these industries had regional location quotients of less than 1.50.

- **Supply *gaps* were identified in five Tier 2 supplier industries in Tennessee and the Southeastern region.**

Tier 2 suppliers are those firms that supply inputs to Tier 1 suppliers. Five Tier 2 industries were identified as being underrepresented in Tennessee and bordering states including blast furnaces and steel mills, nonferrous wiredrawing and insulation, sheet metalwork, engine electrical equipment, and chemical preparations. The regional location quotients for the identified industries ranged from 0.71 to 1.35 and Tennessee's location quotients for the same group of industries ranged from 0.21 to 1.02.

- **Supply *surpluses* were identified in several industries including tire and inner tubes, glass and glass products, carburetors, pistons, rings, and valves, and household audio products.**

The analysis also identified surpluses or sectors that should not be the target of active recruiting. Most notable are tire and inner tubes (SIC 3011), glass and glass products (SIC 3211), carburetors, pistons, rings and valves (SIC 3592), and household audio products (SIC 3651). All of these industries have an aggregate location

quotient of 10 or greater for the six state regions and regional location quotients of greater than 1.70.

- **The current trend in the ever-evolving automotive supplier market is toward fewer and larger firms.**

Merger and acquisition activity in the automotive supplier industry is driven by the need to cut costs and provide more integrated modules and components. Given that today's automakers prefer to obtain everything related to a particular component from one or two sources, a core group of Tier 1 suppliers have emerged. These firms, in turn, make decisions on sourcing the subassemblies of components out to Tier 2 suppliers. Further shrinking the roster of suppliers reflects the fact that automakers have started awarding contracts to *original equipment manufacturers* for the life of a vehicle model whereas in the past contracts were awarded on an annual basis.

[blank page]

EXAMINING SUPPLY GAPS AND SURPLUSES IN THE AUTOMOTIVE CLUSTER IN TENNESSEE

I. INTRODUCTION

The automotive manufacturing industrial cluster plays an important role in the Tennessee economy. Not only is the state home to two major automakers, Nissan and Saturn, but it also harbors hundreds of other businesses that provide input to the automotive production process. Moreover, Tennessee suppliers are well integrated into the Southeastern state's automotive sector. The automotive cluster is attractive as an economic development option for Tennessee for several reasons. First, the primary market for these plants is all of North America, translating into tremendous wealth generation for the state through exportation of automotive inputs and the final automobile product. Secondly, the jobs associated with automotive manufacturing are, on average, high paying skilled jobs. For example, the average annual wage for persons in Tennessee employed in the motor vehicle and equipment industry was $41,494 in 1996; the statewide average salary in 1996 was $25,095 and the statewide average salary in manufacturing was $29,695.[1] The high paying jobs, coupled with relatively high levels of fixed capital investment, sharply boost state and local tax bases. Another attractive feature of automotive manufacturing is the potential for spin-off technologies and businesses. A tremendous volume of resources are dedicated each year to R&D by major auto manufacturers and the resulting innovations are often applicable to a vast array of businesses. Finally, having a strong presence in the automotive industrial cluster can bring national and international recognition to the state—recognition that can lead to future

business locations and economic growth. However, it takes more than one or two assembly plants to comprise an automotive cluster.

Industrial clusters are complicated, interwoven networks of suppliers, support businesses, and trade organizations. The purpose of this report is to provide a detailed analysis of one aspect of the automotive cluster in Tennessee—the inter-industry linkages of *Tier 1* and *Tier 2* suppliers. The goal is to look carefully at the automotive supply chain in order to identify supplier gaps and surpluses. In industries where gaps are identified, consideration should be given to policies that can attract firms to the region.

To better understand the dynamics of cluster-based economic development, section 2 of the report discusses the methodology of cluster analysis. Section 3 then examines the supply linkages in Tennessee and surrounding states and section 4 briefly discusses the current trends in the structuring of automotive suppliers. The advantages and disadvantages of cluster-based economic development are considered in section 5, and section 6 concludes the report.

II. THE METHODOLOGY OF CLUSTER ANALYSIS IN ECONOMIC DEVELOPMENT

What is an Economic Cluster?

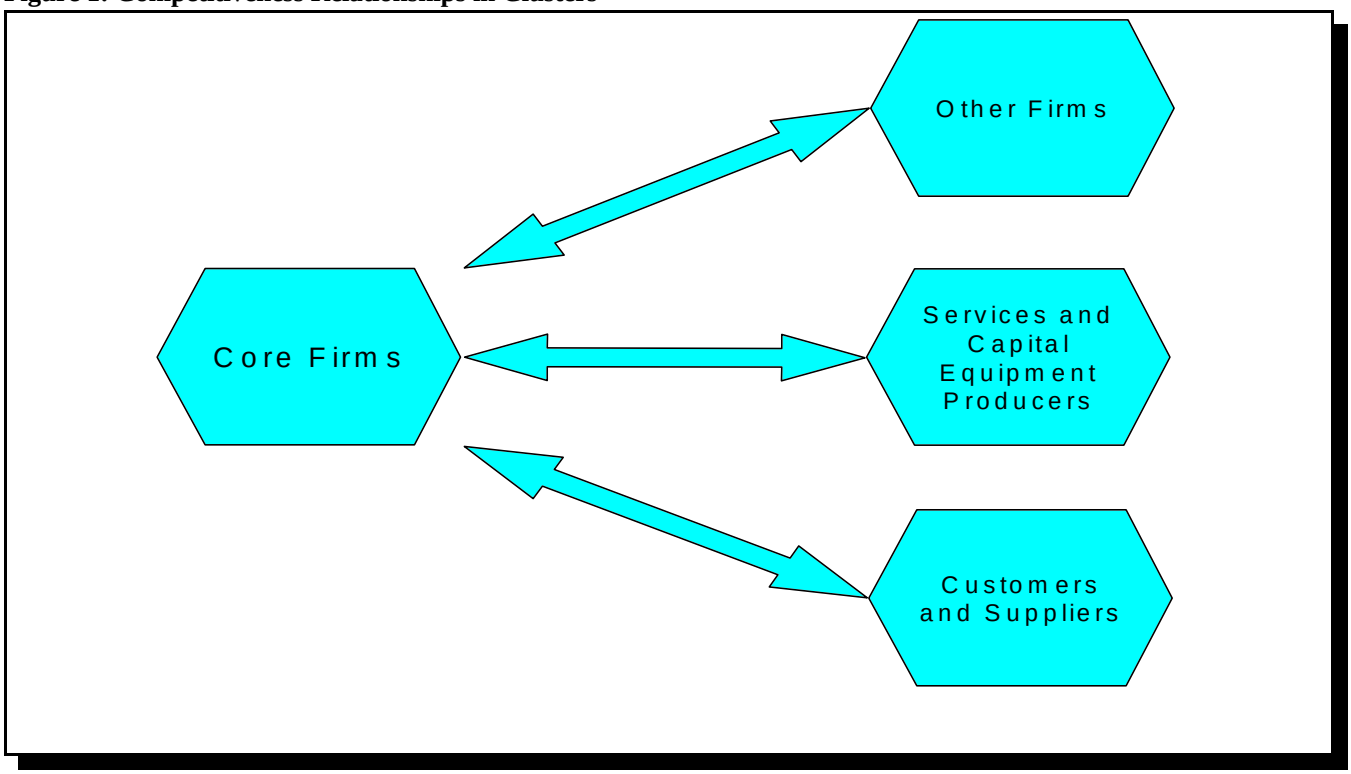
In recent years, the term *industry cluster* has emerged as a buzz-word in economic development policy circles. Clusters offer potential for improved targeting of an integrated network of firms for recruitment and retention. A cluster, as defined by the Council of Governors' Policy Advisors, consists of a pronounced geographic concentration of production chains for one product or a range of similar products, as well as linked institutions and resources that influence the competitiveness of these concentrations (e.g., education, infrastructure, industry groups, and research programs).[2] Firms self-select into clusters based on their mutual interdependencies in order to facilitate business transactions and increase economic activity. The self-selection can be based on proximity to customers or suppliers (i.e., value-added chains), labor markets with specialized skills, sources of information and technology, industry leaders and innovators, or even competitors. Once established, the group of firms comprising an industrial cluster become mutually supporting and benefits flow in all directions—forwards, backwards, and horizontally (see Figure 1).

Examples of industry clusters include the carpet industry in Dalton, Georgia, the computer industry in Silicon Valley, the furniture industry in Hickory, North Carolina, and the fashion industry in New York City.

Elements of Cluster-Driven Economic Development

An industrial cluster, by definition, consists of many elements. Figure 2 provides an illustration of how the elements of cluster-driven development fit together. The top layer or core of a cluster is comprised of a critical mass of similar and related firms that tend to be highly specialized and export-oriented. The cluster of interest in this report is the automotive manufacturing cluster with the core firms in Tennessee being the Nissan

Figure 1: Competitiveness Relationships in Clusters



Source: Stuart Rosenfeld. *Industrial-Strength Strategies: Regional Business Clusters and Public Policy.*

assembly plant in Smyrna, Tennessee and the Saturn assembly plant in Spring Hill, Tennessee. However, since industrial clusters do not necessarily follow political borders, assembly plants throughout the Southeast also constitute core firms. Obviously, these firms are export-oriented and specialize in assembly of passenger vehicles and light trucks.

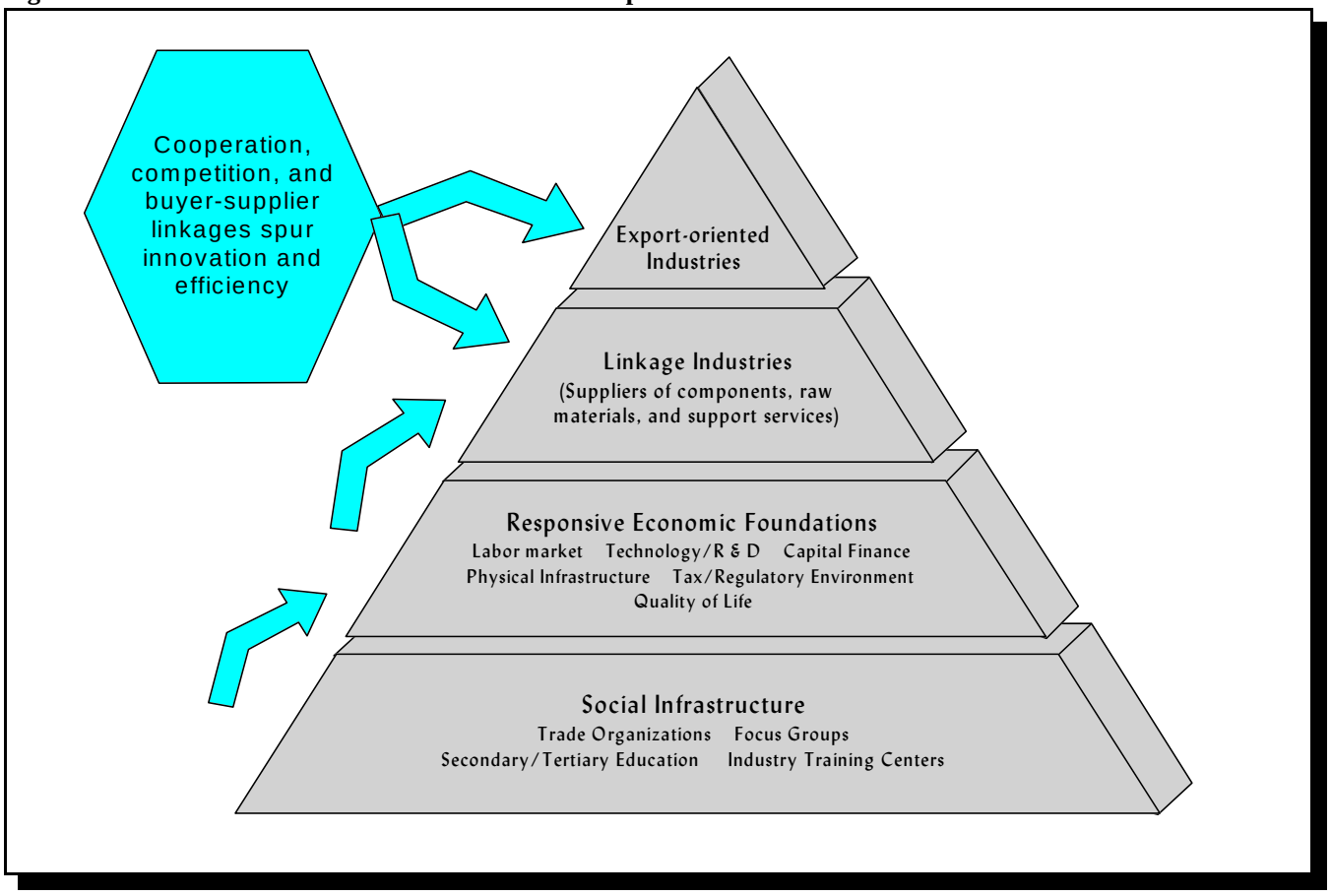
The next crucial element or layer is a network of suppliers which is the focus of this report. These linkage industries include suppliers of raw materials, components, and support services such as utilities and business services. The firms in this layer will be a combination of industry-specific firms and firms producing for a variety of industries. Supporting the first two layers of the pyramid are responsive economic foundations, which consist of traditional business location determinant factors (e.g. physical infrastructure, labor force characteristics, tax environment and quality of life), and social infrastructure. Social infrastructure provides innovative ways in which economic developers can actively influence the networking and building of industrial clusters. Several states have been successful at initiating cooperation among suppliers and buyers by establishing focus groups and organizing state industry associations.[3] For example, the automotive manufacturing cluster in Michigan has a vast array of trade organizations, research centers, and conferences tailored specifically for the industry.

A similar support network is developing in the Southeast as a result of many of the universities and development agencies such as the University of Tennessee, the Tennessee Department of Economic and Community Development, TVA and the Department of Energy, allocating resources to promote industry in the region. *Automotive News* held its first Southeast Conference in Tennessee in April 1998, and the Society of Automotive Engineers held their first Southeastern Automotive Manufacturing Conference and Exposition in the state in August 1998. Other regional initiatives are underway, including the new Transportation Research Center at the University of Tennessee.

Input-Output Analysis and Cluster Identification

Cluster identification can begin with input-output analysis. Using Standard Industry Classifications (SIC) codes, government agencies periodically measure the interrelationships between industries by measuring the amount of input that each industry group receives from, and the portion of its output it sells to, other industry groups. The most recent results are published in the 1992 National Benchmark Input-Output Tables.[4] Using these tables, developers can begin to measure relative levels of economic activity such as number of establishments, employment levels, and payroll in interrelated industries within a

Figure 2: Elements of Cluster-Driven Economic Development



region. For example, if employment of several highly inter-dependent industries tends to be more concentrated in a particular region, it is indicative of an industrial cluster.

One commonly used measure of concentration or specialization is the *location quotient*. The location quotient is the *region's* (i.e., state, county, Southeast) ratio of employees (or number of establishments) in an industry compared to the *nation's* ratio of total employees (or number of establishments) in the same industry. A value greater than 1 indicates regional specialization in that industry. For example, the location quotient for motor vehicle and passenger car bodies (SIC 3711) for Tennessee is 8.04, indicating that the state's concentration of employment in this industry is more than 8 times the national average. Additionally, Tennessee's location quotient ranks higher than Kentucky, Georgia, Alabama, North Carolina, and South Carolina. The location quotients for industry 3711 in these states range from a low of 0.52 in North Carolina to 5.09 in Kentucky. Other measures of concentration and industry growth include gini coefficients, shift-share analysis, and an index of concentration.

Once a core industry, such as motor vehicles, has been identified, the next step in input-output analysis is to identify the industries supplying inputs or buying output from the core industry. Since the industry of ultimate concern in this study manufactures final products, as opposed to components or raw materials, the primary concern is the identification of input suppliers. Using national input-output tables, key supplier industries can be identified. Location quotients for the key industries, calculated using data from *County Business Patterns,* can help identify any gaps or surpluses in the supply chain. This step can be repeated for the second tier in the production process and so on.

If gaps in the production chain are present, the next step for economic developers is to assess the feasibility and desirability of attracting firms from the under-represented industries. It may be the case that these firms are not present in the region due to factors beyond the control of developers such as the absence of key natural resources or a constraining regulatory environment. However, when gaps exist without any predisposed explanation developers should consider targeting such industries. To help evaluate and enhance the targeting of specific input providers, a second report, to be released by CBER at a later date, will investigate business location and retention factors of automotive suppliers in Tennessee and surrounding states.

Other measures of a cluster's competitiveness include: (1) cluster earnings per employee, which reflects the quality of jobs found in each cluster, as well as skill proficiencies and deficiencies; (2) cluster earnings growth, which measures a cluster's ability to provide more value-added through increased productivity and quality compared with the national averages for the same cluster industries; (3) cluster employment growth, which is indicative of the relative health and direction of each cluster; and (4) new business starts as a percentage of total cluster establishments, which reflect a cluster's ability to regenerate and adapt. All these measures can be examined using widely available data published by various federal agencies. A more direct way to

analyze regional clusters involves interviews and focus groups. By talking with company executives and trade experts face-to-face, developers can gain information not always available in the statistics concerning regional differences and industry specific needs.

III. AUTOMOTIVE MANUFACTURING SUPPLY LINKAGES IN TENNESSEE

The Value-Added Production Chain

The first step in analyzing supply linkages is understanding the value-added production chain. In its simplest form, a value-added production chain is the sequence of firms that collectively produce and distribute a product. A production chain for motor vehicles includes not only the assembly plant but also providers of raw materials, firms producing components such as windows and seats, businesses providing services such as marketing and engineering, wholesalers and retailers, and companies providing transportation of inputs and finished automobiles. Figure 3 depicts a general production chain for motor vehicles. Compared with the use of a single SIC code, identifying an industry cluster in terms of the production chain facilitates thinking about how the linkages of industries with different SIC codes affects the competitiveness of the region as a whole.

Figure 3: Illustration of the General Automotive Value-Added Chain

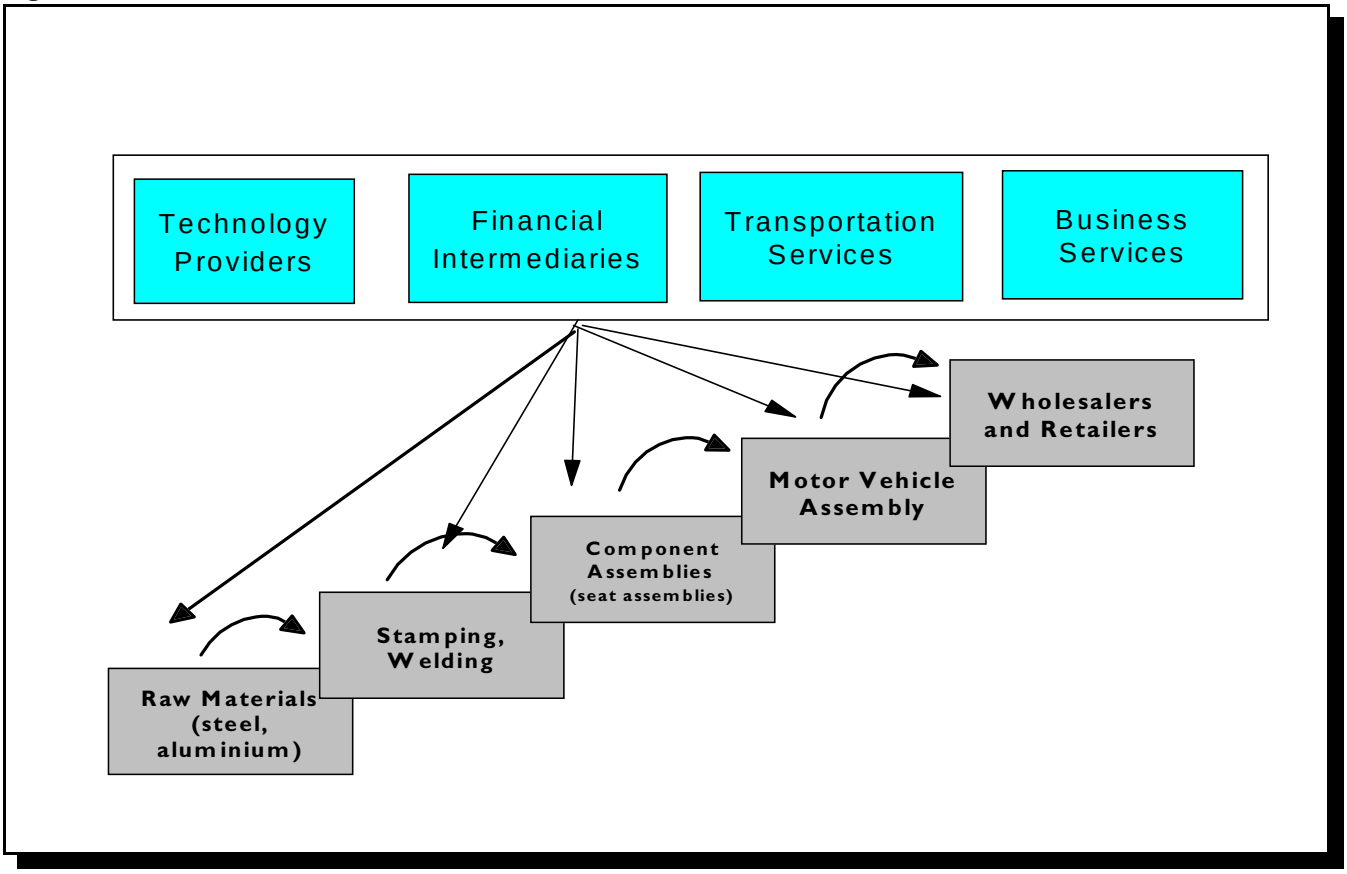


Table 1: Primary Tier 1 Motor Vehicle Manufacturing Supplier Industries

SIC Code	Industry Name
3714	Auto parts and accessories
2396	Auto trim and apparel
3011	Tire and inner tubes
3211	Glass and glass products
308	Miscellaneous plastic products
3465	Automotive stamping
3592	Carburetors, pistons, rings, valves
3647	Vehicular lighting fixtures
3691	Storage batteries
3585	Refrigeration and heating
3651	Household audio
3429	Hardware
285	Paints and allied products

Supply Linkages in Tennessee

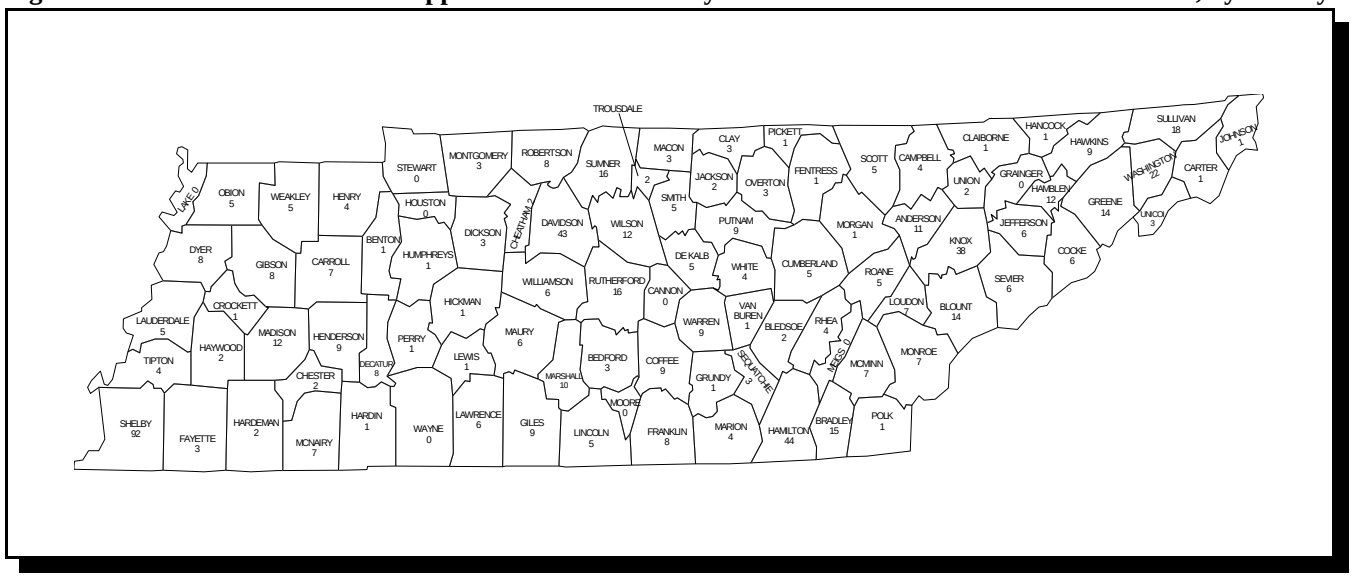
Suppliers in the automotive production chain are categorized by tiers. *Tier 1* suppliers provide inputs directly to the assembly plants, *Tier 2* suppliers provide inputs to Tier 1 suppliers, and so on. Suppliers can be multiple tiered. For the purpose of the current study, the first two tiers were examined. Using input-output analysis and location quotients, industries serving as primary Tier 1 suppliers to motor vehicles manufacturing were identified. Criteria used in determining the importance of suppliers included (1) at least one percent of total inputs to the motor vehicle manufacturing industry were supplied by the industry and (2) at least ten percent of an industry's total output was sold to the motor vehicle manufacturing industry. Table 1 provides a list of the resulting Tier 1 supplier industries. From this list, industries comprising primary Tier 2 suppliers were identified using national input-output tables and the same criteria used in identifying the first tier of suppliers for the relevant industry. The resulting industries of the second round analysis are shown in Table 2.

A variety of data sources were used to identify supplier firms. Identification of supplier firms can prove problematic because data are not always readily available from standard published sources and firms are not willing to reveal supplier chain information. Elm International identified 149 Tier 1 suppliers in Tennessee.[5] Additional suppliers were identified using a database compiled by the Tennessee Department of Economic and Community Development and *The 1998 Directory of Tennessee Manufacturers*.

Table 2: Primary Tier 2 Suppliers in the Motor Vehicle Production Chain

SIC Code	Industry Name
3312	Blast furnaces and steel mills
332	Iron and steel foundries
3334	Primary nonferrous metals
3357	Nonferrous wiredrawing and insulation
3363	Aluminum die-castings
3365	Copper foundries
3444	Sheet metalwork
3562	Ball and roller bearings
3694	Engine electrical equipment
2284	Thread mills
221	Broadwoven fabric mills
2261	Textile finishing plants
227	Carpet and rugs
2899	Chemical preparations
2822	Synthetic rubber
3297	Nonclay refractories
3612	Transformers
3641	Electric lamps
2865	Industrial organic chemicals
3621	Motors and generators

Figure 4: Location of Automotive Supplier Plants for Primary Tier 1 and Tier 2 Industries in Tennessee, by County



Source: M. Lee Smith Publishers LLC, ***Directory of Tennessee Manufacturers, 1998***.

Figure 4 provides a map with the number of primary Tier 1 and Tier 2 automotive supplier industries in Tennessee by county. The locations of manufacturers by SIC code in Tennessee (by county) supplying the inputs identified in Tables 1 and 2 are provided in appendix Table A-1. Additionally, the number of suppliers located in the surrounding states of Kentucky, Georgia, Alabama, North Carolina, and South Carolina is provided in Table A-2.

After identifying major Tier 1 and Tier 2 supplier industries, the next step is to examine the state's and the region's level of economic activity in these industries relative to the nation as a whole by calculating location quotients. The benchmark for comparison of the location quotients will be both the state's and the region's location quotient for SIC category 3711, motor vehicle and car bodies, which are 8.04 and 2.38, respectively. Given that the state has over 8 times the concentration of employment in this industry relative to the national level, other industries selling a significant portion of their output to the motor vehicle industry (10 percent or more was the guideline used in this analysis) could be expected to benefit from a higher concentrated location pattern in the state. Because state boundaries do not necessarily constitute cluster boundaries, it is necessary to also examine the location quotient for these industries in Tennessee's bordering states as well as regional location quotients.

The location quotients for Tennessee, Kentucky, Georgia, Alabama, North Carolina, and South Carolina and the six state region were calculated. The data used in the analysis were obtained from the *1996 County Business Pattern* published by the U.S. Department of Commerce, Bureau of the Census. This provided the most up-to-date data on employment by state by four digit SIC code. Out of the six state region, Tennessee and Kentucky had the highest location quotients

for the core industry, 3711, with 8.04 and 5.09, respectively, and the regional location quotient was 2.38. Location quotients for Tier 1 and Tier 2 supplier industries for the six state region are presented in Tables 3 and 4, respectively.

Again, the general guideline is that if the location quotient is less than 1, the industry is under-represented and if it is greater than 1, the industry is relatively concentrated in the region. However, given the location quotient of 8.04 for industry 3711 in Tennessee and 2.38 for the region, 1 is no longer the relevant benchmark for our purposes. Instead, it becomes more important to look at the concentration of industries across the six state region. For example, industry 3691, storage batteries, has a location quotient of only 1.04 in Tennessee. Without any further analysis, one would assume that the industry was under-represented relative to industry 3711. However, including bordering states in the analysis reveals location quotients for storage batteries ranging from 1.50 to 2.37 in four of the five states included in Table 3. Given the additional information on the region, the supply gap in Tennessee for this industry does not appear to be as substantial.

Supply gaps for Tier 1 industries were identified as any product (industry) in which the aggregate location quotient for the six state region was less than the 8.04—the location quotient for industry 3711 in Tennessee—or a regional location quotient of less than 1.50. The analysis identified several supplier industries that appear to be under-represented in the region (see Table 5). Filling the supply gaps by recruiting under-represented industries for location within the state could enhance the competitiveness of the automotive cluster in Tennessee. At the same time, economic benefits garnered by the state would increase as a result of reducing leakages

Table 3: Location Quotients for Tier 1 Industries

Industry SIC	Tennessee	Kentucky	Georgia	Alabama	North Carolina	South Carolina	Regional
3714*	2.15	1.97	0.40	0.88	1.12	1.45	1.23
2396*	1.84	0.73	0.29	0.48	1.25	1.32	0.98
3011	4.78	2.72	1.06	8.49	3.74	3.25	3.70
3211	8.85	0.11	0.51	0.04	1.25	1.32	2.31
308*	1.26	1.51	0.78	0.69	1.12	1.27	1.07
3465*	0.96	1.47	0.57	0.02	0.01	0.81	0.56
3592	4.08	3.61	0.72	0.00	1.26	1.34	1.73
3647*	0.11	0.00	0.19	0.06	0.00	0.90	0.18
3691	1.04	1.50	2.37	0.00	1.73	2.06	1.56
3585	4.37	1.81	1.47	1.35	0.68	0.67	1.71
3651	5.89	2.00	2.00	0.00	0.45	0.00	1.77
3429	2.88	2.28	0.47	1.69	1.68	0.06	1.56
285*	0.65	1.73	0.92	1.31	1.13	0.48	1.01

* Industries under-represented throughout the region

Table 4: Location Quotients for Tier 2 Supplier Industries

Industry SIC	Tennessee	Kentucky	Georgia	Alabama	North Carolina	South Carolina	Regional
3312*	0.21	1.60	0.20	2.27	0.08	0.85	0.71
332	1.33	0.71	0.33	4.27	0.26	0.29	1.01
3334	1.29	5.18	0.01	0.00	0.00	1.45	0.95
3357*	0.60	2.75	2.00	0.72	3.13	2.29	1.99
3363	1.47	4.73	0.53	0.39	0.34	1.18	1.16
3365	2.61	0.23	0.07	2.19	0.16	0.12	0.82
3444*	0.63	0.82	0.71	1.00	0.82	0.57	0.75
3562	2.37	4.15	2.50	1.63	1.35	12.46	3.40
3694*	0.40	1.99	1.03	4.00	0.35	2.07	1.35
2284	1.01	0.00	10.71	0.00	17.49	3.80	7.40
221	1.20	0.13	8.17	5.18	11.09	12.81	6.95
2261	1.23	0.04	2.28	0.37	1.50	7.17	1.98
227	1.32	0.02	20.85	1.90	1.81	3.49	6.30
2899*	1.02	0.41	1.21	1.76	0.67	2.04	1.12
2822	2.51	5.16	0.52	0.07	0.13	0.40	1.20
3297	1.55	3.25	3.49	0.35	0.64	0.12	1.67
3612	2.02	2.41	1.25	0.82	1.92	0.09	1.49
3641	2.26	10.71	0.00	0.00	0.30	1.28	1.77
2865	4.99	0.24	0.06	1.07	0.19	0.88	1.82
3621	4.22	2.79	0.95	1.03	1.30	0.18	1.07

* Industries under-represented throughout the region

from Tennessee's economy for procurement of inputs from outside the state. The three most noteworthy gaps in Tier 1 industries are automotive stamping, vehicular lighting fixtures, and paints and allied products. Even though all three industries are major players in the automotive production chain, all three industries have low concentration throughout the six state region, an observation that warrants further examination by developers. In fact, vehicular lighting had a location quotient of less than 1 in all six of the states examined and a regional location quotient of only 0.18. Similarly, the location quotient for automotive stamping was less than 1 in five of the six states included, and the regional location quotient was a mere 0.56.

Another noteworthy trend in the location quotients is that Tier 1 industries tend to be more evenly concentrated throughout the region used in the analysis, whereas Tier 2 industries tend to be heavily concentrated in one or two of the six states. For example, electric lamps (SIC 3641) had location quotients ranging from 0 to 2.26 in five of the states and a location quotient of 10.71 in the remaining state of Kentucky. Similar examples include carpets and rugs, synthetic rubber, thread mills, and textile finishing plants. Given this, identifying supply gaps in Tier 2 industries is not as clear cut. For example, SIC 3357, nonferrous wiredrawing and insulation was

Table 5: Under-represented Tier 1 and Tier 2 Industries in the Automotive Production Chain in the Southeastern Region

SIC Code	Industry
Tier 1	
3714	Automotive parts and accessories
2396	Automotive trim and apparel
308	Miscellaneous plastic products
3465	Automotive stamping
3647	Vehicular lighting fixtures
285	Paint and allied products
Tier 2	
3312	Blast furnaces and steel mills
3357	Nonferrous wiredrawing and insulation
3444	Sheet metalwork
3694	Engine electrical equipment
2899	Chemical preparations

identified as a potential supply gap given its location quotient of 0.60 in Tennessee. However, one must consider the fact that the location quotients are above 2 in four of the other five states considered. The decision for policymakers is whether to devote resources to recruiting businesses that are underrepresented in Tennessee and more concentrated in bordering states or to explore other measures in which to enhance the competitiveness of the Tennessee automotive cluster. One option is to concentrate only on the businesses that are clearly under-represented throughout the entire region. Examples of sparsely concentrated suppliers to the automotive cluster in the Southeast region are blast furnaces and steel mills and sheet metalwork.

The analysis also identified surpluses or sectors that should not be the target of active recruiting. Most notable are tire and inner tubes (SIC 3011), glass and glass products (SIC 3211), carburetors, pistons, rings and valves (SIC 3592), and household audio products (SIC 3651). All of these industries have an aggregate location quotient of 10 or greater and regional location quotients of greater than 1.70.

Once potential supply gaps have been identified using location quotients, the developer must then examine the current market trends in the supplier industries as well as the nature of industries themselves before making the decision on whether to target firms in those industries. It may prove infeasible or undesirable to recruit certain businesses. A brief description of the industries identified as potential supply gaps is provided in Table 6. In addition, national trends in the growth of employment and number of establishments from 1987-1996 for the identified industries are depicted in Figures 5-15 and comparative statewide trends are depicted in Figures 16-26.[6]

Nationally, industries displaying a notable upward trend in both number of establishments and employment in more recent years include engine electrical equipment (Figure 14), paint and allied products (Figure 10), and, to a lesser degree, blast furnaces and steel mills (Figure 11). Industries displaying downward trends in both growth rates in recent years include miscellaneous plastic products (Figure 7), nonferrous wiredrawing and insulation (Figure 12), chemical preparations (Figure 15), and sheet metalwork (Figure 13). The other identified industries have displayed converse trends in terms of growth in employment and number of establishments. Statewide, there has been an upward trend in the growth rate of employment in automotive

Table 6: Summary Descriptions of Regional Gaps in the Automotive Supply Chain

SIC Code	Description
3714	Establishments primarily engaged in manufacturing motor vehicle parts and accessories, but not engaged in manufacturing complete motor vehicles or passenger car bodies. Includes: Air brakes, automotive wiring harness sets, axle housings and shafts, axles, ball joints, bearings, brake drums, brakes and brake parts, bumpers and bumperettes, camshafts, cleaners, connecting rods, control equipment, crankshafts, cylinder heads, defrosters, directional signals, drive shafts, dump-truck lifting mechanisms, engines and parts, exhaust systems and parts, filters, frames, fuel pumps, gas tanks, gears, heaters, hoods, horns, hydraulic fluid power pumps, instrument board panels, lubrication systems and parts, manifolds, gasoline engine rebuilding, mufflers, oil filters, PCV valves, fuel pipes, power transmission equipment, oil, water, fuel, and power steering pumps, radiators, rear axle housings, rims, shock absorbers, thermostats, steering mechanisms, tie rods, tire valve cores, transmission housings, universal joints, vacuum brakes, wheels, windshield frames, windshield wiper systems, and wiring harness sets
2396	Establishments primarily engaged in manufacturing automotive trimmings, apparel findings, and related products. Included in this industry are establishments primarily engaged in printing and stamping on fabric articles. Includes: Apparel findings and trimmings, bindings, collar linings, hat findings, linings, shoulder pads, ribbons and bows, silk screening, stamping fabrics for embroidering, straps, sweatbands, fabric trimmings, visors, and waistbands
308	Establishments primarily engaged in the manufacturing of miscellaneous plastic products. Includes: unsupported plastics film and sheets, unsupported plastic profile shapes, laminated plastics plate, sheet, and profile shapes, plastic pipe, plastic bottles, custom compounding of purchased plastic resins, and plastic products not elsewhere classified.
3465	Establishments primarily engaged in manufacturing automotive stampings such as body parts, hubs, and trim. Includes: Fenders, tops, hub caps, body parts, trim, and moldings
3647	Establishments primarily engaged in manufacturing vehicular lighting equipment. Includes: Automotive lighting equipment, clearance lamps and reflectors, dome lights, flasher lights, fog lights, headlights, parking lights, spotlights, and tail lights
285	Establishments primarily engaged in manufacturing paints, varnishes, lacquers, enamels and shellac, putties, wood fillers, sealers, paint removers, and allied paint products. Includes: Calcimines, coatings, thermoplastics and colloidal dispersions, driers, enamels, epoxy coatings, lacquers, marine paint, paint removers, phenol formaldehyde coatings, primers, putty, undercoatings, vinyl coatings, varnishes, and wood stains
3312	Establishments primarily engaged in manufacturing hot metal, pig iron, and silvery pig iron from iron ore and iron and steel scrap; converting pig iron, steel scrap, scrap iron into steel; and in hot-rolling iron and steel into basic shapes such as plates, sheets, strips, rods, bars, and tubing. Merchant blast furnaces and byproduct or beehive coke ovens are also included in this industry.
3357	Establishments primarily engaged in drawing, drawing and insulating, and insulating wire and cable of nonferrous metals from purchased wire bars, rods, or wire. Also included are establishments primarily engaged in manufacturing insulated fiber optic cable.

Table 6: Summary Descriptions of Regional Gaps in the Automotive Supply Chain (Continued)

SIC Code	Description
3444	Establishments primarily engaged in manufacturing sheet metal work for buildings, and manufacturing stovepipes, light tanks, and other products of sheet metal. Includes: Air cowls, awnings, bins, canopies, casings, coal chutes, cooling towers, culverts, dampers, door hoods, ducts, eaves, flooring, flues, furnace casings, guardrails, gutters, hoods, hoppers, joists, louvers, pile shells, pipes, radiator shield and enclosures, sheet metal specialties, studs, and vats
3694	Establishments primarily engaged in manufacturing electrical equipment for internal combustion engines. Important products of this industry include armatures, starting motors, alternators, and generators for automobiles and aircraft; and ignition apparatus for internal combustion engines, including spark plugs, magnetos, coils, and distributors.
2899	Establishments primarily engaged in manufacturing miscellaneous chemical preparations such as fatty acids, essential oils, gelatin, bluing, laundry sours, writing and stamp pad ink, industrial compounds such as boiler and heat insulating compounds, metal, oil, and water treating compounds, waterproofing compounds, and chemical supplies for foundries.

Source: Standard Industrial Classification Manual, 1987

stamping (Figure 19), sheet metalwork (Figure 24), blast furnaces and steel mills (SIC 3312), and engine electrical equipment (Figure 22). The growth rate of the number of establishments has also been trending upward for these industries with the exception of engine electrical equipment. Notable negative trends in recent employment growth rates are recorded for paint and allied products (Figure 21), miscellaneous plastic products (Figure 18), and nonferrous wiredrawing and insulation (Figure 23).

The trend of growth rates by themselves do not tell a complete story. There are many factors which could lead to declining or expanding employment and/or number of establishments, many of which cannot be influenced by public policy. For example, the merger of two companies producing the same product in two separate plants in the state could lead to an expansion in employment at one plant and closure of the other plant. In this scenario, the growth in the number of establishments would decline and employment growth could be either positive or negative depending on the relative magnitudes of new jobs created at the factory remaining open and the number of jobs cut at the closed plant. Not only are the resulting changes in employment and establishments beyond the influence of local policymakers, but the decision on whether or not to actively target this particular industry is not clear cut. The decision to target any of the identified industries requires additional knowledge of the structural changes taking place in the automotive supplier market. The next section briefly discusses some of the more defining structural shifts taking place in the supplier market.

Figure 5: National Growth Rates for Automotive Parts and Accessories (SIC 3714)

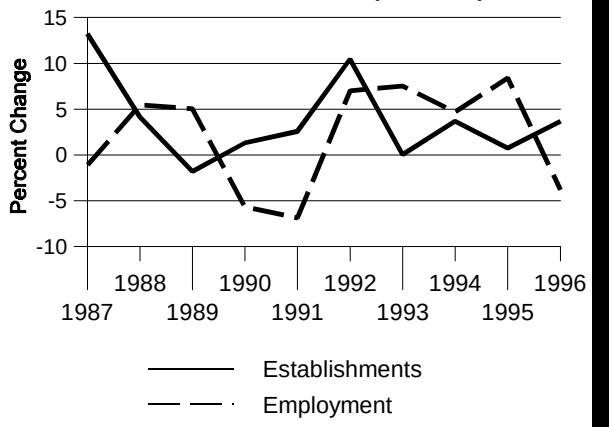


Figure 6: National Growth Rates for Automotive Trim and Apparel (SIC 2396)

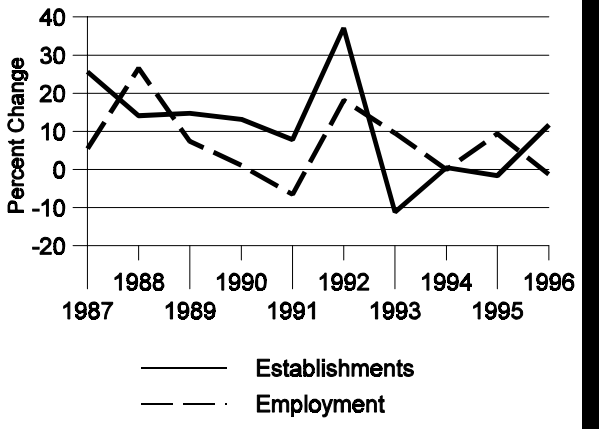


Figure 7: National Growth Rates for Miscellaneous Plastic Products (SIC 308)

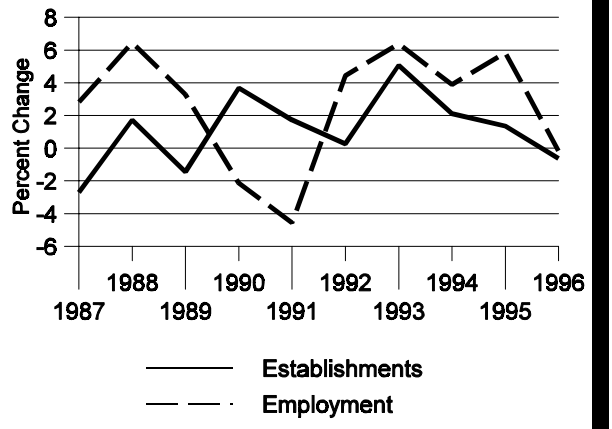


Figure 8: National Growth Rates for Automotive Stamping (SIC 3465)

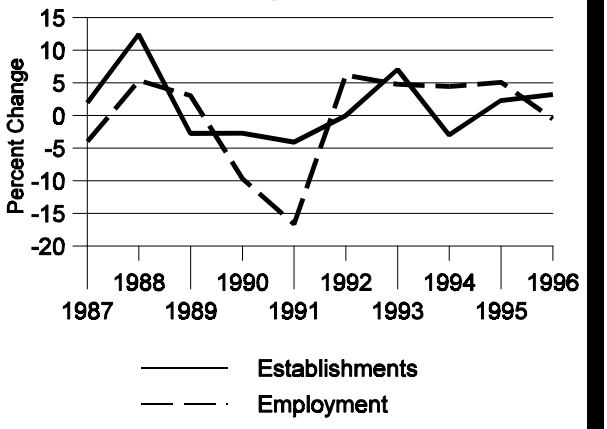


Figure 9: National Growth Rates for Vehicular Lighting Fixtures (SIC 3647)

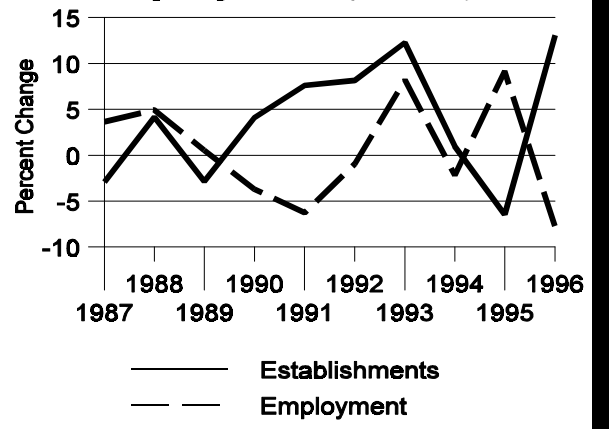


Figure 10: National Growth Rates for Paint and Allied Products (SIC 285)

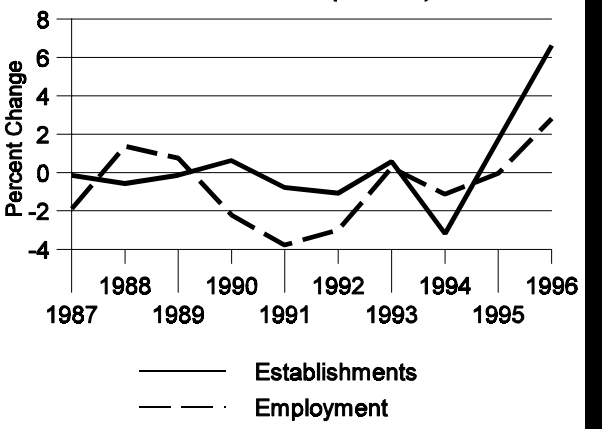


Figure 11: National Growth Rates for Blast Furnaces and Steel Mills (SIC 3312)

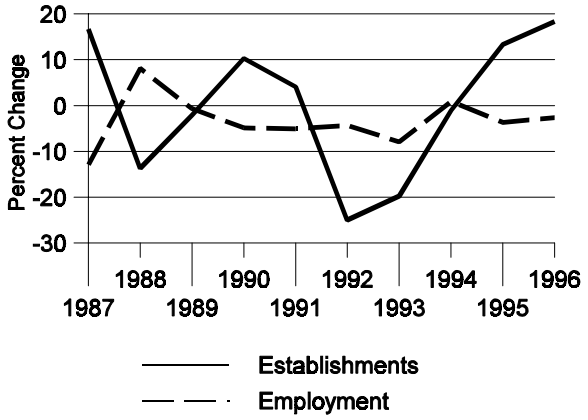


Figure 12: National Growth Rates for Nonferrous Wiredrawing and Insulation (SIC 3357)

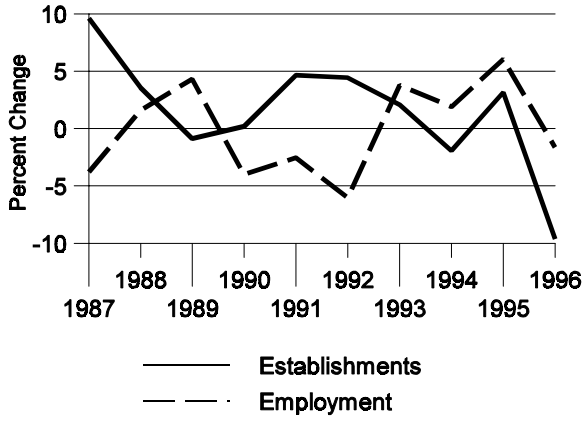


Figure 13: National Growth Rates for Sheet Metalwork (SIC 3444)

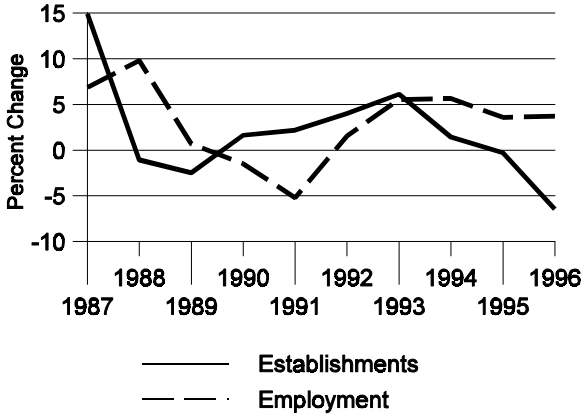


Figure 14: National Growth Rates for Engine Electrical Equipment (SIC 3694)

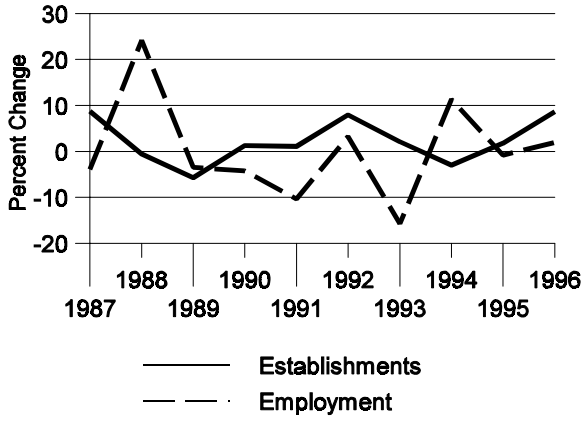


Figure 15: National Growth Rates for Chemical Preparations (SIC 2899)

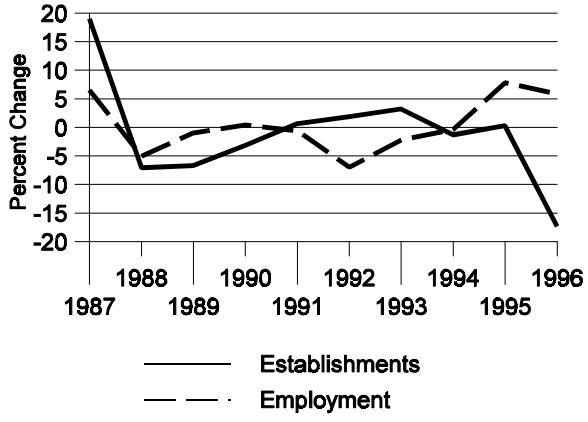


Figure 16: Statewide Growth Rates for Automotive Parts and Accessories (SIC 3714)

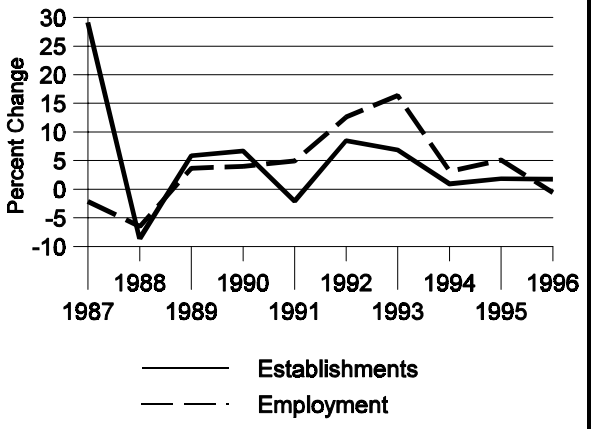


Figure 17: Statewide Growth Rates for Automotive Trim and Apparel (SIC 2396)

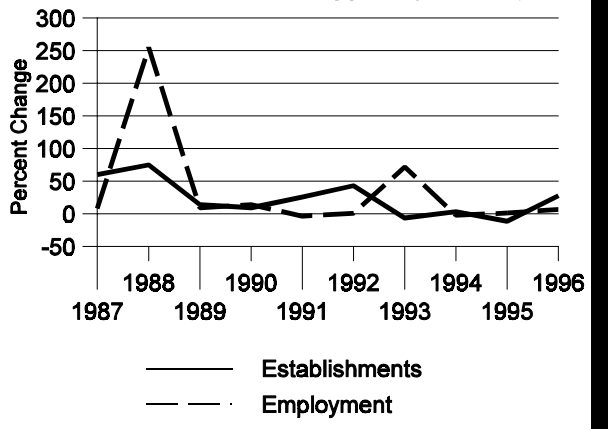


Figure 18: Statewide Growth Rates for Miscellaneous Plastic Products (SIC 308)

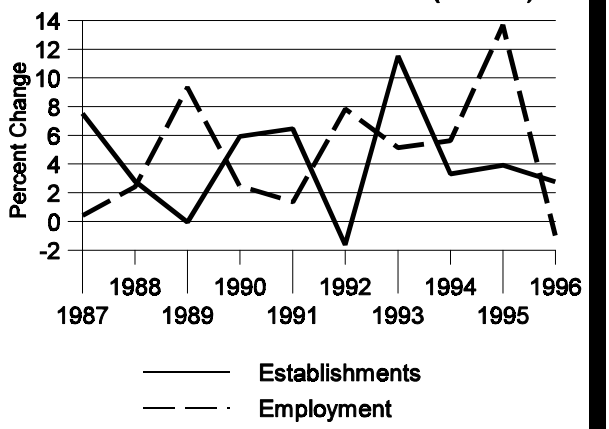


Figure 19: Statewide Growth Rates for Automotive Stamping (SIC 3465)

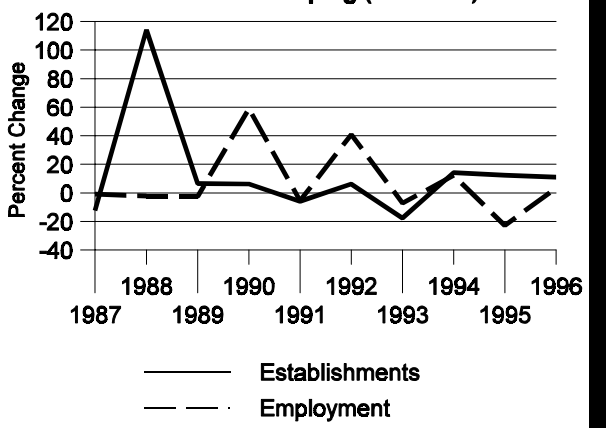


Figure 20: Statewide Growth Rates for Vehicular Lighting Fixtures (SIC 3647)

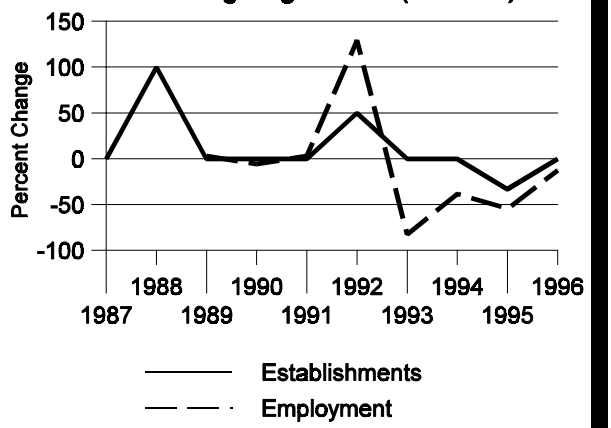


Figure 21: Statewide Growth Rates for Paint and Allied Products (SIC 285)

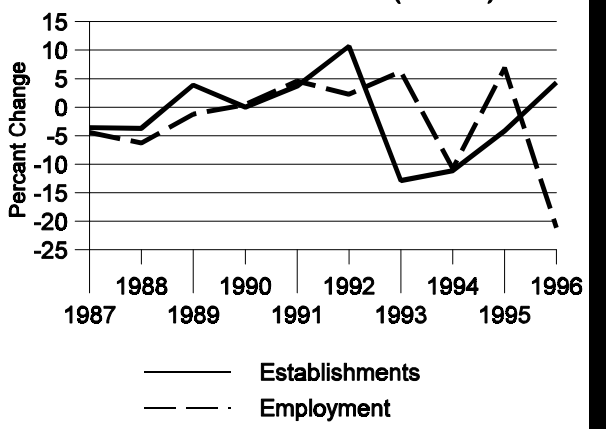
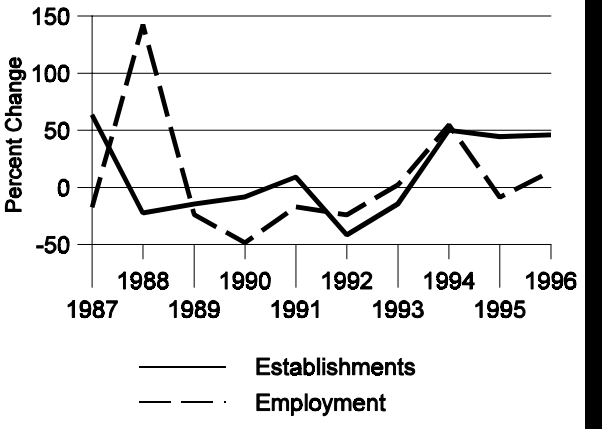
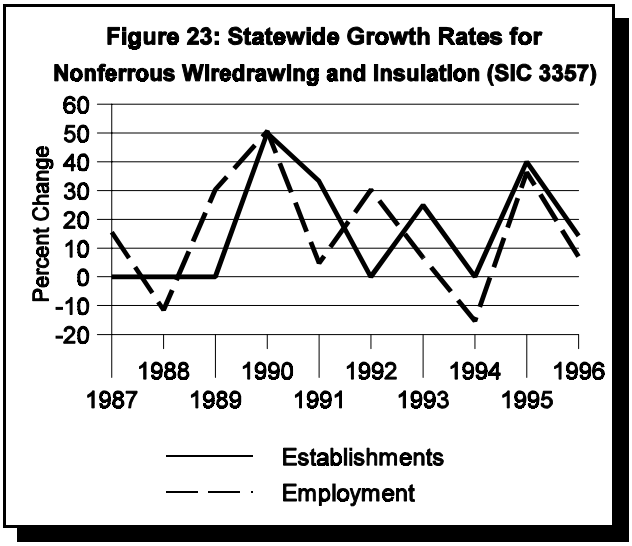
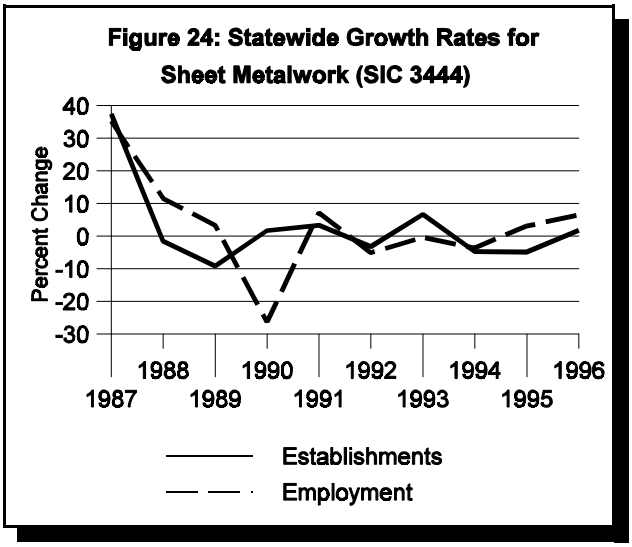
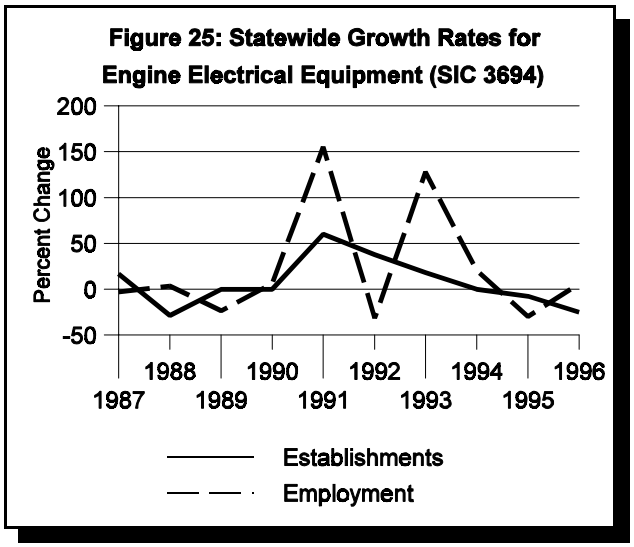


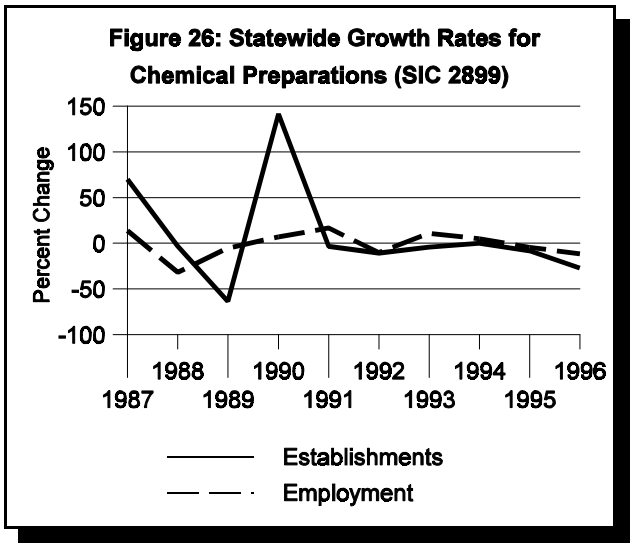
Figure 22: Statewide Growth Rates for Blast Furnaces and Steel Mills (SIC 3312)











IV. MARKET TRENDS IN AUTOMOTIVE PARTS SUPPLIERS

Mergers and Acquisitions

In response to retail pricing pressures, automakers are demanding substantial cost reductions from their outside parts suppliers. Suppliers, in turn, have responded by improving productivity and efficiency. To meet automakers' ever increasing demands, parts suppliers continue to consolidate. Merger and acquisition activity is driven by the need to cut more costs and to provide more modules and systems. Mergers between parts makers can enhance profitability as expenses are reduced and synergies are created. Costs are primarily reduced through the elimination of overhead and redundant staff and plants. In addition, purchasing power can be increased and sales efforts can be leveraged as additional products can be added to distribution channels. An example of recent merger activity in brakes

and safety systems during the 90s is provided in Table 7.

Table 7: Consolidation of Tier 1 Suppliers of Brakes and Safety Systems to North America

1990	1999
Brakes	
Delco Moraine	Delphi Chassis
Robert Bosch GmbH	Robert Bosch GmbH
Lucas Industries	LucasVarity Inc.
Dana Corp	Dana Corp.
ITT Automotive	Continental AG
Varity Corp.	Meritor Automotive Inc.
Kelsey-Hayes Group	
Eaton Corp.	
Bendix	
Budd Co.	
AlliedSignal	
Westinghouse	
Rockwell Automotive	
Safety Systems	
TRW Inc.	TRW Inc.
Autoliv	Autoliv
Breed Technologies	Breed Technologies
Takata	Takata
Morton International	
AlliedSignal	
Bendix Safety Restraints	
General Safety Corp.	
GM Fisher Body	

Source: Automotive News, January 11, 1999

Modules and Components

As the roster of suppliers shorten due to merger activity, automobile manufacturers increasingly favor companies that can deliver entire modules or systems rather than individual parts. Given that automakers prefer to obtain everything related to a particular component from one or two sources, a core group of competent Tier 1 suppliers has emerged. As automaker's primary vendors, these firms are authorized to make decisions on sourcing the subassemblies of components out to Tier 2 suppliers. They are responsible for selecting and monitoring lower level suppliers and ensuring the delivery of modules and components that meet the automaker's specifications. The end product of the move toward systems and modules are fewer and larger automotive suppliers.

OEM's Integral Role in Auto Production

In the past, original equipment manufacturers (OEMs) largely sold their equipment to assemblers by signing annual contracts that covered one model year. The contracts were generally flexible with respect to price and volume deliveries. Today, however, manufacturers normally award contracts for the life of a vehicle model, provided the supplier agrees to specific targets for productivity increases that offset inflation for the manufacturers and can also lower per-unit prices. By doing this, automakers align the suppliers' goals with their own by sharing with them part of the savings they hope to achieve.[7]

V. ECONOMIC CLUSTERS AS A POLICY TOOL

The preceding sections have discussed the automotive cluster in Tennessee, and more specifically, supplier industries. This section examines the more general question of the

utilization of industrial clusters as an economic development tool. Policymakers still have many doubts about the wisdom of focusing on clusters primarily based on the argument of overspecialization and reliance in a particular industry. However, if implemented successfully, cluster-driven economic development can prove very advantageous.

The advantages of a cluster approach as a development strategy are numerous as outlined in Table 8. These advantages arise in large part due to the mutually supporting and/or inter-related nature of the industries included in a cluster. Both close competition and cooperation spur innovation across industries, often giving birth to new companies and industries. Personal contacts between companies facilitate the free flow of information and rapid diffusion of technology, giving clustering firms a competitive advantage in the global marketplace. As they grow, clusters create their own demand for suppliers. Existing suppliers can expand to fill the increased demand and/or new companies can enter the regional market to fill the need for new products.

Advantages also arise due to the fact that cluster companies draw on specialized economic foundations, placing demands on them to provide better services such as more advanced telecommunication links, higher high school graduation rates, and narrowly specialized business services. In return, the companies improve the region's economic foundations by recruiting and training workers or developing special facilities. Better economic foundations, combined with the growing concentration of related firms, increase the attractiveness to outside companies, the potential for spin-offs, and the expansion of existing firms. This activity within the cluster fosters its growth and brings the region's economy national and international recognition as a center of excellence.

Table 8: Summary of Advantages Arising from Industrial Clusters

- Creation of a much deeper pool of specialized labor
- Increased demand for services tailored to specific industry characteristics (e.g., software, insurance policies, advertising)
- More rapid diffusion of new technologies and techniques
- Greater support for publicly funded efforts to serve the cluster
- A greater propensity to generate "spin off" firms within the region and draw in additional suppliers from outside the region, thus increasing the number of small and medium-sized businesses
- Better industry expertise within local financial institutions, thereby improving industry access to financial capital
- Increased opportunities to boost value-added exports
- Greater visibility for the region and local firms

Economic clusters can propel growth in an array of sectors across the regional economy. Key components of the cluster relate to each other, to the rest of the state and regional economy, and to the global economy. Export-oriented firms within

the cluster bring newly created income into the state's economy. The presence of global competition for output of firms on the cluster can translate into increased value added, which often leads to relatively higher wages. In addition, the existence of an intricate network of linkage industries minimizes the amount of export-driven member firms' non-payroll spending that leaks out of the statewide economy. Economic activity in export-driven and linkage industries spurs growth of traditionally population-driven industries such as retail and real estate.

Even though clusters can provide many advantages, economic developers must be aware of possible drawbacks; the most notable being becoming too reliant on a specific product mix. An over-reliance on producing specific products can lead to significant decline in a region's level of economic activity should their competitive advantage in that industry be lost to regions (or nations) with newer technologies or lower wages. For example, textile industries moved first from the Northeast to the South and then to Mexico and overseas. To help overcome this disadvantage, the best approach is to have a balanced *set* of clusters. For example, Arizona cluster-based economic development strategy centers around three industrial clusters—environmental technology, software, and optics. Admittedly, software and optics do not yet represent a significant concentration of economic activity, but have the potential to drive the economy in the future.[8] Clustering and diversification are not contradictory. The most successful clusters are able to generate new clusters by shifting their core competencies into new markets or products or building the capacities of related sectors.[9] A second caveat with regard to targeting clusters is the perception of inequitable treatment of business firms. Firms expect to be treated fairly by governments and targeting clusters leads to preferential treatment of firms fitting within the cluster. This can be especially problematic if existing firms start to feel slighted and look for relocation opportunities. Additionally, the usefulness of cluster-driven economic development policy at the state level is limited by two main factors. First, the increasing ease of operating globally via improved transportation and communications has made physical proximity less important to competitive strength. And second, the interstate nature of clusters makes an effective state policy more difficult to develop and implement. However, despite these drawbacks, there exist many examples of successful economic clusters throughout the U.S.

VI. CONCLUSION

The automotive cluster is an important part of the Tennessee economy. The state's employment concentration in motor vehicles and passenger car bodies is more than 8 times greater than the national average. Only by strengthening the cluster can the state maintain and build on its competitiveness in the industry. There are many ways to nurture cluster development. This report focused on inter-industry linkages and more specifically, the supply chain.

Using input-output analysis and location quotients, several Tier 1 and Tier 2 supplier industries were identified as being under-

represented in the state, most notably automotive stamping, vehicular lighting fixtures, and paint and allied products. Likewise, a few were identified as being over-represented, such as tires and inner tubes and glass. By using this information concerning the regional automotive supply chain, state developers can assess the feasibility of targeting the industries for which gaps are present. Inter-industry linkages are only part of cluster-driven economic development. Other crucial elements in high performing cluster systems include economic foundations and social infrastructure.

ENDNOTES

1. Data used in calculations obtained from *County Business Patterns, 1996.*
2. John Redman, *Understanding State Economies Through Industry Studies*, Council of Governors' Policy Advisors, 1994.
3. See Rosenfeld, Stuart. *Industrial-Strength Strategies*, The Aspen Institute, 1995 for examples.
4. U.S. Department of Commerce, Bureau of Economic Analysis. *Benchmark Input-Output Accounts of the United States, 1992*.
5. Elm International, Inc., The Elm Guide Database, 1998.
6. Data for the graphical presentations were obtained from *County Business Patterns*, U. S. Department of Commerce.
7. Dunn and Bradstreet, Autos and Auto Parts Industry Survey, December 1998.
8. Mary Jo Watts, "Building Exports Through Industry Clusters," *Firm Connections,* Chapel Hill, NC. Vol 4, NO. 4, 1996.
9. Stuart A. Rosenfeld, "Bringing Business Clusters into the Mainstream of Economic Development," *European Planning Studies*, 5(1), 1997.

VII. APPENDIX

Table A-1: Number of Primary Tier 1 and Tier 2 Supplier Plants in Tennessee, by County

County	No. of Plants	County	No. of Plants	County	No. of Plants	County	No. of Plants
SIC 2211							
Claiborne	1	Davidson	2	Dyer	1	Hamblen	2
Hamilton	3	Hawkins	1	Knox	1	Lauderdale	1
Rhea	1	Sullivan	2				
SIC 2261							
Bradley	1	Clay	1	Davidson	2	Dyer 1	
Hamilton	2	Humphreys	1	Knox	3	Madison	2
Scott	1	Warren	1	Washington	2	White	1
SIC 2273							
Bradley	1	Cumberland	1	Davidson	1	Franklin	1
McMinn	3	Polk	1				
SIC 2284							
Davidson	1	Hamilton	2	Rhea	1		
SIC 2396							
Anderson	1	Blount	1	Campbell	1	Davidson	2
Franklin	1	Grundy	1	Hamilton	6	Knox	2
Madison	1	Roane	1	Shelby	6	Sullivan	1
Sumner	1	Union	1	Weakly	1		
SIC 2822							
Carroll	1	Davidson	2	Dyer	1	Hamblen	1
Hamilton	3	Morgan	1	Sullivan	1		
SIC 2851							
Anderson	1	Bradley	1	Cheatham	1	Cumberland	1
Davidson	7	Dickson	1	Greene	1	Hamblen	2
Hamilton	1	Henderson	1	Johnson	1	Knox	3
Lincoln	1	Marshall	1	Putnam	2	Rutherford	1
Shelby	5	Sullivan	1	Sumner	1	Tipton	1
Williamson	1						
SIC 2865							
Hardin	1	Monroe	1	Shelby	1	Williamson	1
SIC 2899							
Bedford	1	Carroll	1	Davidson	1	Fayette	1
Hamilton	3	Hardeman	1	Knox	1	Marion	1
Putnam	1	Shelby	6	Wilson	2		
SIC 3011							
Anderson	1	Cocke	1	Davidson	2	Franklin	1
Giles	1	Hamilton	1	Haywood	1	Obion	1
Rutherford	2	Scott	1	Sullivan	1	Unicoi	1
Warren	1						
SIC 3211							
Blount	1	Bradley	1	Coffee	1	Davidson	1
Hamilton	1	Hawkins	2	Knox	1	Monroe	1
Roane	1	Robertson	1	Shelby	2	Sullivan	1
Sumner	2	Washington	2	Weakly	1	Wilson	1

Table A-1: Number of Primary Tier 1 and Tier 2 Supplier Plants in Tennessee, by County (Continued)

County	No. of Plants	County	No. of Plants	County	No. of Plants	County	No. of Plants
SIC 3297							
Anderson	1	Gibson	2	Hamilton	1	Lawrence	1
Sevier	1	Sumner	1				
SIC 3312							
Anderson	1	Bradley	1	Campbell	1	Carter	1
Coffee	2	Davidson	3	Greene	1	Hamblen	1
Hamilton	2	Henderson	1	Jefferson	2	Knox	5
Lincoln	1	Loudon	3	Macon	1	Madison	1
Marion	1	Maury	1	Roane	1	Robertson	1
Rutherford	3	Shelby	4	Sumner	1	Wilson	1
SIC 3321							
Benton	1	Bradley	3	Campbell	1	Davidson	1
Greene	1	Hamilton	3	Knox	1	Marion	1
Marshall	1	McMinn	1	Monroe	1	Montgomery	1
Sullivan	1	Warren	1				
SIC 3334							
Blount	1	Lauderdale	1	Maury	1		
SIC 3357							
Davidson	1	Knox	1	Lincoln	1	Madison	1
Shelby	1	Tipton	1	Williamson	2		
SIC 3363							
Anderson	1	Giles	1	Hawkins	1	Lauderdale	1
Madison	1	Marshall	2	Washington	1		
SIC 3365							
Bradley	1	Davidson	1	Dekalb	1	Dickson	2
Fayette	1	Greene	1	Hamilton	2	McMinn	1
Putnam	1	Sevier	1	Shelby	1	Sullivan	3
Trousdale	1						
SIC 3429							
Bradley	3	Carroll	1	Chester	1	Cocke	1
Davidson	1	Decatur	1	Dickson	1	Dyer	1
Franklin	2	Greene	3	Hamilton	4	Henderson	3
Jackson	1	Jefferson	1	Knox	2	Lawrence	1
Lincoln	1	Loudon	2	Marshall	1	Obion	1
Pickett	1	Roane	1	Robertson	1	Rutherford	1
Sevier	1	Shelby	5	Sullivan	1	Sumner	1
Van Buren	1	Washington	1	Weakley	1		

Table A-1: Number of Primary Tier 1 and Tier 2 Supplier Plants in Tennessee, by County (Continued)

County	No. of Plants	County	No. of Plants	County	No. of Plants	County	No. of Plants
SIC 3444							
Anderson	2	Blount	3	Bradley	1	Campbell	1
Cheatham	1	Coffee	2	Cumberland	1	Davidson	11
Decatur	1	Dyer	1	Fayette	1	Franklin	1
Giles	3	Hamblen	1	Hamilton	9	Hawkins	1
Henry	1	Jefferson	1	Knox	12	Lawrence	1
Lewis	1	Madison	2	Maury	2	Monroe	2
Obion	1	Putnam	1	Roane	1	Rutherford	2
Shelby	25	Sullivan	4	Warren	1	Washington	6
Wilson	3						
SIC 3465							
Bledsoe	1	Carroll	2	Coffee	1	Davidson	2
DeKalb	1	Lauderdale	1	Overton	1	Scott	1
Sumner	1	Warren	2				
SIC 3562							
Gibson	1	Giles	1	Hawkins	1	Hayward	1
Unicoi	1						
SIC 3385							
Anderson	1	Blount	1	Chester	1	Cocke	1
Cumberland	1	Davidson	1	Decatur	4	Greene	1
Hardeman	1	Henderson	1	Lincoln	1	Madison	2
Marshall	2	Maury	1	McNairy	1	Monroe	1
Montgomery	1	Overton	1	Rhea	1	Rutherford	2
Shelby	5	Smith	1	Tipton	2	Trousdale	1
Warren	1	Washington	2	Weakly	1		
SIC 3592							
Hamblen	1	Robertson	1	Sequatchie	1	Shelby	2
SIC 3612							
Clay	1	Crockett	1	Dyer	1	Greene	2
Hamilton	1	McNairy	1	Shelby	4	Washington	3
SIC 3621							
Blount	2	Coffee	3	DeKalb	1	Gibson	1
Hamblen	1	Hancock	1	Henderson	2	Henry	1
Knox	1	McMinn	1	McNairy	1	Obion	1
Rutherford	1	Sequatchie	1	Shelby	3	Smith	1
Sullivan	1	Sumner	2	Unicoi	1	Warren	1
Washington	1	Wilson					

Table A-1: Number of Primary Tier 1 and Tier 2 Supplier Plants in Tennessee, by County (Continued)

County	No. of Plants	County	No. of Plants	County	No. of Plants	County	No. of Plants
SIC 3641							
Hamblen	1	Robertson	1	Sequatchie	1	Shelby	2
SIC 3612							
Clay	1	Crockett	1	Dyer	1	Greene	2
Hamilton	1	McNairy	1	Shelby	4	Washington	3
SIC 3621							
Blount	2	Coffee	2	DeKalb	1	Gibson	1
Hamblen	1	Hancock	1	Henderson	2	Henry	1
Knox	1	McMinn	1	McNairy	1	Obion	1
Rutherford	1	Sequatchie	1	Shelby	3	Smith	1
Sullivan	1	Sumner	2	Unicoi	1	Warren	1
Washington	1	Wilson	2				
SIC 3641							
Shelby	1	White	1				
SIC 3647							
McNairy	1	Robertson	1	Sevier	1	Sullivan	1
SIC 3651							
Cocke	1	Greene	1	Knox	1	Macon	1
Sevier	1	Shelby	1	Sumner	1	Williamson	1
Wilson	1						
SIC 3691							
Bradley	1	Scott	1				
SIC 3714							
Anderson	2	Bedford	2	Blount	5	Bradley	1
Carroll	2	Clay	1	Cocke	2	Cumberland	1
Davidson	3	Decatur	2	DeKalb	2	Dickson	2
Dyer	2	Fentress	1	Franklin	2	Gibson	4
Giles	3	Hamblen	3	Hamilton	2	Hawkins	3
Henderson	2	Henry	2	Hickman	1	Jackson	1
Jefferson	2	Knox	5	Lauderdale	1	Lawrence	3
Loudon	2	Macon	1	Madison	2	Marshall	3
McMinn	1	McNairy	3	Monroe	1	Montgomery	1
Obion	1	Overton	2	Perry	1	Putnam	4
Rhea	1	Robertson	3	Rutherford	3	Scott	1
Sevier	1	Shelby	21	Smith	3	Sullivan	1
Sumner	6	Warren	1	Washington	5	Weakly	1
White	2	Williamson	2	Wilson	2		

Table A-2: Number of Primary Tier 1 and Tier 2 Automotive Suppliers in Surrounding States

SIC Code	Kentucky	Georgia	Alabama	North Carolina	South Carolina
Tier 1					
3714	63	73	58	104	52
2396	16	75	38	97	57
3011	1	9	12	10	6
3211	1	2	1	2	1
308	180	322	136	397	172
3465	13	9	1	4	9
3592	2	2	0	1	3
3647	0	1	1	0	1
3691	3	7	0	5	2
3585	8	30	8	19	8
3651	10	11	0	8	0
3429	17	17	15	35	8
285	30	48	27	31	10
Tier 2					
3312	8	8	20	14	12
332	7	17	54	18	8
3334	3	2	0	0	1
3357	9	11	7	22	9
3363	6	6	4	4	4
3365	3	6	11	3394	6
3444	56	104	72	106	42
3562	4	10	2	7	14
3694	13	20	11	8	7
2284	0	4	0	18	3
221	3	43	8	42	44
2261	7	20	5	44	42
227	2	260	1554	32	18
2899	9	37	12	40	21
2822	2	4	5	3	4
3297	2	7	3	2	1
3612	4	7	2	10	1
3641	6	0	0	2	1
2865	5	6	5	7	12
3621	9	6	6	13	5

Source: County Business Patterns, 1996.