



THE ECONOMIC IMPACT OF THE AUTOMOTIVE INDUSTRY IN KENTUCKY

Kentucky long has been known for its ties to coal, horses, tobacco and bourbon. But as the Commonwealth's 21st Century economy evolves, no other industry is driving growth like automotive manufacturing.

The Commonwealth already is home of four major automotive assembly plants. Ford, General Motors and Toyota each have grown deep roots in Kentucky, which now produces about one of every nine passenger vehicles made in the United States.

More importantly, automotive-related manufacturers have become key contributors to Kentucky's economy by:

- Bringing in billions of dollars from vehicle and parts exports.
- Creating tens of thousands of jobs at hundreds of suppliers and related businesses.
- Supporting wages, benefits and thousands of businesses across the spectrum of industries.

This study by the University of Louisville Urban Studies Institute provides the first comprehensive look at the dramatic, growing impact of the automotive industry on Kentucky. It provides detailed data on the size and economic importance of what arguably has become Kentucky's signature industry – autos.

The report, commissioned by the Kentucky Automotive Industry Association, also highlights the depth and breadth of the industry across the Commonwealth and details the millions of public tax dollars generated from statewide employment tied to automotive production.

Finally, the report highlights many of the advantages and opportunities for the automotive industry in Kentucky, helping industry, state and local leaders to identify additional ways to leverage and build on Kentucky's position as one of the nation's torchbearers for automotive production.

AMONG THE KEY FINDINGS:

- The industry contributes **\$14.3 billion to, or 7.8 percent of,** Kentucky's gross state product (GSP) – more than coal, horses, tobacco, bourbon or tourism.

Roughly **\$1** of every **\$13** in the state's economy is tied to the automotive industry.

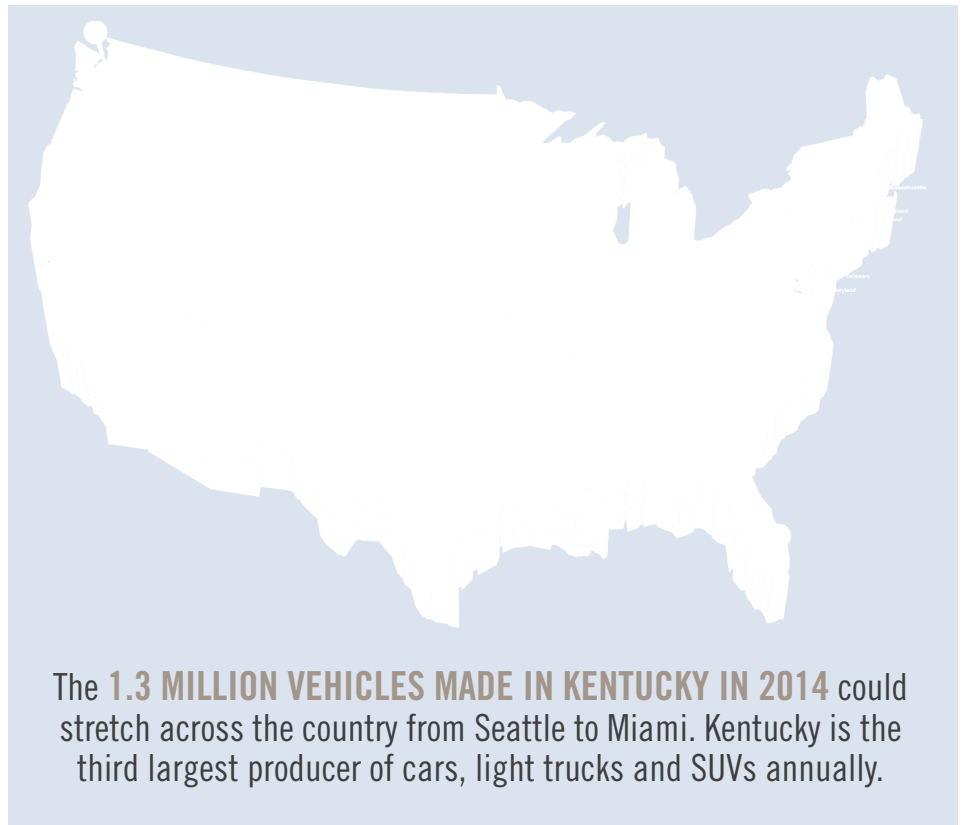
KENTUCKY'S AUTOMOTIVE
MANUFACTURERS AND
SUPPLIERS CONTRIBUTE
**\$6.1 BILLION TO PAYROLLS
ANNUALLY. THAT'S**

**12 TIMES
THE AMOUNT OF
PRIZES & JACKPOTS
WON IN THE STATE LOTTERY
LAST YEAR.**

- If auto workers lived in one place, it would be the state's third-largest city. Automotive-related businesses directly employ **85,552 workers** at more than **470 establishments** in Kentucky.

**ONE-FIFTH OF THE
STATE'S EXPORTS LAST YEAR
WERE TIED TO THE AUTO
INDUSTRY.**

The value of Kentucky's automotive-related exports totaled **\$5.9 billion** last year.

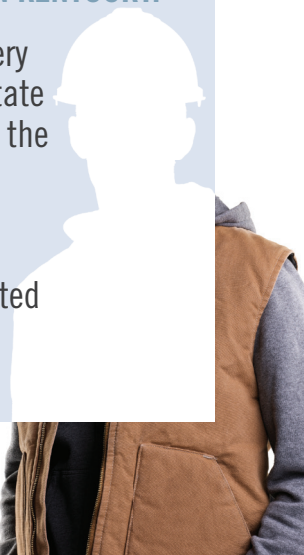


The **1.3 MILLION VEHICLES MADE IN KENTUCKY IN 2014** could stretch across the country from Seattle to Miami. Kentucky is the third largest producer of cars, light trucks and SUVs annually.

- Existing and new employers in Kentucky's automotive industry have announced **\$5 billion in investments and nearly 20,000 new jobs over the last five years.**
- Cities and counties collect about **\$116 million annually in occupational taxes** resulting from the automotive industry.
- Kentucky's concentration of motor vehicle manufacturing employment – an indication of a comparative advantage in the industry – is **4.5 times as high as the national average.**
- The spinoff effect of Kentucky's automotive-related employment is significant. Among industries with more than 3,000 employees in Kentucky, **six of the top seven are automotive-related.**
- Since 1990, **Kentucky's automotive employment has risen 72 percent** compared with a 26 percent decline nationwide.
- The automotive industry has been a primary driver in retaining **higher-than-average paying jobs** in the manufacturing sector of the economy.
- The automotive industry is more than OEMs and Tier 1 suppliers. **Automotive-related manufacturing has significant impact on employment by staffing agencies, tool-and-die shops, warehouses, trucking companies and metal-stamping operations.**

**AUTOMOTIVE-RELATED
MANUFACTURERS &
SUPPLIERS SUPPORT
136,500 JOBS IN KENTUCKY.**

Roughly 1 of every 18 jobs in the state is supported by the direct, indirect or induced effects of automotive-related manufacturers.



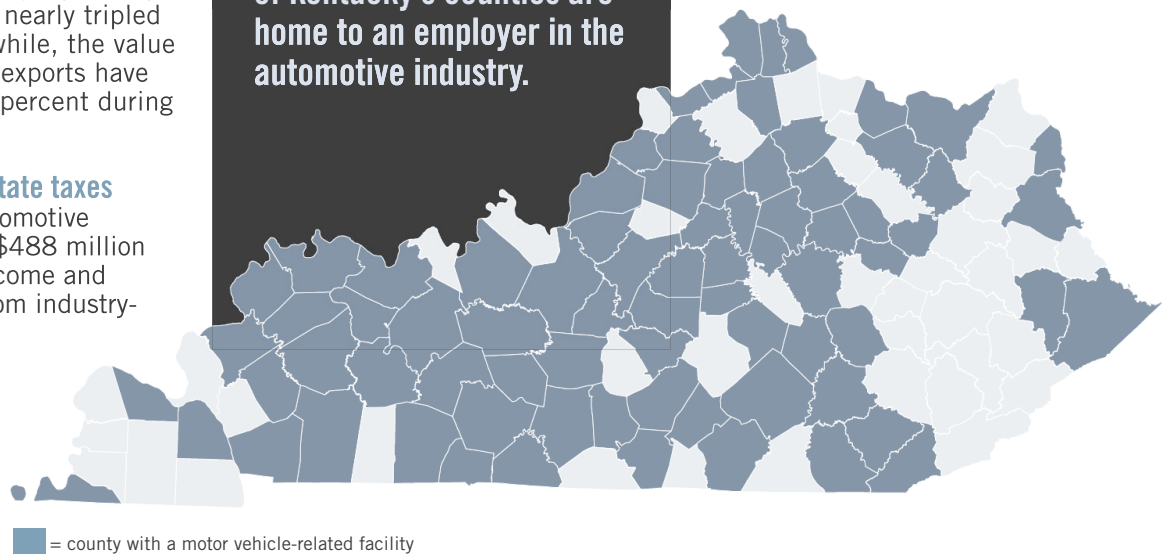


Recent job growth at Ford, General Motors and Toyota plants has been the equivalent of adding three new OEM assembly plants in Kentucky.

The average annual wage of a manufacturing employee in the automotive sector is **\$58,280**.

- The value of Kentucky's passenger vehicle exports has nearly tripled since 2009. Meanwhile, the value of the state's other exports have grown by about 40 percent during that period.
- **\$1 of every \$14 in state taxes** results from the automotive industry. A total of \$488 million annually in state income and sales taxes come from industry-supported jobs.

Employment in automotive production is concentrated around the Bowling Green, Lexington and Louisville metro areas, but **two-thirds of Kentucky's counties are home to an employer in the automotive industry.**



AUTOMOTIVE GROWTH FACTORS

LOCATION

Kentucky has the shortest average distance to assembly plants in other states in the region, making it a prime location for Tier 1 suppliers to serve multiple factories.

LOGISTICS

Kentucky's system of interstates and parkways is important to continued growth. Automotive manufacturers have developed their facilities primarily in counties with four-lane, high-speed roads.

VALUE

Kentucky's low utility costs are another advantage in growing the automotive industry. Average annual utility costs in Kentucky are among the lowest in the nation and are the least expensive among peer states.

WORKFORCE

Modernized automotive manufacturers seek a higher-skilled labor pool, and location decisions can be swayed by the availability of customized training for potential workers through the community and technical college systems.



This report has been prepared for the Kentucky Automotive Industry Association (KAIA) by the University of Louisville Urban Studies Institute..

THE ECONOMIC IMPACT OF THE AUTOMOTIVE INDUSTRY IN KENTUCKY

AN URBAN STUDIES INSTITUTE RESEARCH REPORT

Prepared for the
Kentucky Automotive Industry Association

by

Barry Kornstein, Research Manager
Janet M. Kelly, Ph.D., Executive Director

and

Joe Slaughter, Graduate Research Assistant
Jay Lockett, Graduate Research Assistant

Urban Studies Institute
University of Louisville
426 West Bloom Street
Louisville KY 40208
usi.louisville.edu

Table of Contents

Executive Summary	4
Concentration of Suppliers.....	4
Recent Investment in the Automotive Industry in Kentucky.....	5
Economic and Fiscal Importance of the Industry.....	5
Introduction	7
Kentucky's Private Sector Economy.....	8
Regional Shifts in the Automotive Industry	11
Automotive Industry in Kentucky	13
Trends in Automotive Employment and Earnings in Kentucky	16
Kentucky's Success in Automotive Industry Growth	17
Car and Light Truck Production by State	20
Motor Vehicle Exports by State	23
Industry Employment Trends and Location Quotients	27
Employment data issues	29
Motor vehicle manufacturing employment trends	30
Location Quotients	31
Assembly and chassis manufacturing (NAICS 3361) job and LQ trends	32
Body and trailer manufacturing (NAICS 3362) job and LQ trends	34
Parts manufacturing (NAICS 3363) job and LQ trends	35
Body manufacturing (NAICS 336211) job and LQ trends	37
Gasoline engine & engine parts mfg. (NAICS 336310) job & LQ trends	38
Electrical & electronic equipment mfg. (NAICS 336320) job & LQ trends.....	40
Steering & suspension components mfg. (NAICS 336330) job & LQ trends	42
Brake system manufacturing (NAICS 336340) job & LQ trends	43
Transmission & power train parts mfg. (NAICS 336350) job & LQ trends	45
Seating & interior trim manufacturing (NAICS 336360) job & LQ trends	46
Metal stamping (NAICS 336370) job & LQ trends	48
Other motor vehicle parts mfg. (NAICS 336390) job & LQ trends	49
Subsector employment and location quotient summary	51

Geographic Distribution of Automotive Industry Establishments and
Employment in Kentucky 52

 Maps: visualizing the geographic distribution of the industry in Kentucky 55

Recent Investment in the Automotive Industry in Kentucky 67

Tooling: An Important Related Industry 69

Aluminum: An Opportunity for the Future 71

The Economic and Fiscal Importance of the Automotive Industry in Kentucky 73

 Employment multipliers for the automotive industry and other large industries 73

 The economic contribution of the auto assembly plants to Kentucky’s economy 76

 The economic contribution of automotive parts manufacturing to Kentucky’s economy 80

 The fiscal impact to state and local governments of the automotive industry in Kentucky 86

Appendix: Regional Close-up Maps 90

EXECUTIVE SUMMARY

Kentucky is home to four auto manufacturing assembly plants: the Ford Motor Kentucky Truck Plant and Louisville Assembly Plant in Louisville, Toyota Motor Manufacturing, Kentucky, in Georgetown and General Motors in Bowling Green. Since 1991 Kentucky has had the highest concentration of assembly plant jobs of any of the thirteen peer states analyzed.

Kentucky ranks fifth in the nation in automotive industry employment, behind Michigan, Indiana, Ohio and Tennessee. About 85,500 Kentuckians work in auto-related manufacturing. From 1990 through 2013, Kentucky had the third highest growth rate in the nation for auto manufacturing employment. The average annual wage of a manufacturing employee in the automotive sector is \$58,280. The automotive industry has been one of the primary drivers in the retention of higher-than-average paying jobs in the manufacturing sector of the economy.

With nearly 1.3 million passenger vehicles produced in Kentucky during 2014, the state ranks third in the nation. One out of every nine passenger cars, light trucks or SUVs made in the U.S. rolls out of a Kentucky assembly plant.

Over 20% of Kentucky's exports are auto-related. Motor vehicle manufacturing is the second largest industrial export sector in the state. In 2014 Kentucky exported \$5.9 billion worth of motor vehicles, bodies, trailers and parts. Car and light truck exports, which make up about 70 percent of the total, have increased in value by 272 percent since 2002. The Commonwealth's share of all U.S. motor vehicle exports is at an all-time high of 4.4 percent and has been growing steadily since 2008. Kentucky ranks tenth in motor vehicle export value.

We looked at how Kentucky has been faring in the industry over the last two decades in relation to its seven bordering states and five additional southeastern states. These states represent the bulk of the industry and embody the southerly shift the industry has experienced since the 1980s. Ten of these 13 states have passenger vehicle assembly plants, a statistic which applies to only four other states in the nation.

Location quotients, indicators of regional comparative advantages, were used to evaluate concentration of employment in Kentucky and the regional peer states. Kentucky has the third highest concentration of motor vehicle manufacturing employment in the nation, second highest among the regional states we focus on in depth. Motor vehicle manufacturing employment in Kentucky is 4.5 times as concentrated as the national average and since 1990 has increased the most of any state in the country. Although the focus of the popular press is often on states to the south of Kentucky, it is in the Commonwealth where the automotive industry has increased the most in importance. This is especially true for parts manufacturing, where Kentucky has added over 4,000 more jobs than the second best state.

Kentucky seems to be well placed to take advantage of the industry shift to light-weight aluminum auto bodies. The state's two aluminum smelters have survived a recent industry contraction and appear to be thriving. They currently account for just over a quarter of primary aluminum output in the U.S. Their presence was no doubt a factor in Aleris' decision to invest \$350 million in expanding their Lewisport rolling mill to equip it to produce wide aluminum sheet for use in the automotive industry. Other large plants in Kentucky's aluminum industry have strong corporate ties to automotive aluminum sheet manufacturers, as well.

CONCENTRATION OF SUPPLIERS

Suppliers of direct inputs to the assembly process cluster around assembly plants and major transportation routes like interstate highways and parkways. USI examined eight Tier I (or direct suppliers into the assembly process) statewide and regionally. The statewide findings include:

- **Parts manufacturing:** Kentucky had the second best employment growth from 1990 to 2013, 87 percent, starting with the sixth most parts manufacturing jobs among the peer states and finishing with the fourth most. This was a far cry from the national situation, which saw a decrease of 30 percent in parts manufacturing jobs during the period.
- **Gasoline and engine parts manufacturing:** KY was one of only two states to gain jobs in this area from 2001-2013. KY is also the 3rd most highly concentrated state in this industry.
- **Electrical and electronic equipment manufacturing:** Kentucky's total employment in the industry fell 60 percent from 2001-2013. However, this was the parts manufacturing sector that experienced the greatest employment decline nationally (55 percent) and across our 13 states (53 percent) during that time period.
- **Steering and suspension components manufacturing:** Kentucky had strong growth in the sector and the location quotients show a high and growing degree of concentration in the industry in Kentucky.
- **Brake system manufacturing:** Kentucky has a strong competitive advantage in this industry. Brakes and steering and suspension components are both industries with a significant presence in a small number of states, Kentucky being foremost among them.
- **Transmission and power train parts manufacturing:** While Kentucky saw an increase of 17 percent in jobs in this industry it is still a sector that is dominated by the older, northern areas of the automotive industry.
- **Seating and interior trim manufacturing:** Kentucky ranks second among four states with a strong clustering of employment in the industry. The density of seating and interior trim manufacturing employment in the four states is far greater than it is for any other state except for Michigan.
- **Metal stamping:** Kentucky was one of two states that posted job gains from 2001 to 2013, showing a competitive advantage in this area.
- **Other motor vehicle parts manufacturing:** Kentucky was one of three peer states to gain jobs in the industry, and remains among the leaders in employment concentration.

Altogether, Kentucky currently has the highest location quotient in four of the nine automotive supply chain industries we have examined, the second highest in another and the third highest in another industry. No other state comes close to such consistency across industries. Since the location quotient is a measure of the relative size of an industry in a given location compared to the national average, it is indicative of industrial clustering. On balance, Kentucky seems to have been the best state at leveraging its assets to create and maintain competitive advantage in the automotive industry over the last couple decades.

One reason for this success is Kentucky's location at the center of the "auto alley" running from Michigan to the Gulf of Mexico. We calculated the average driving distance (along interstates and major highways) from the geographic center of each of the 13 states in the region to each of the 29 automotive assembly plants located in those states. At 327 miles, Kentucky has the shortest average distance from its center (near Richmond) to each of those assembly plants. That is just two-thirds the distance or less than the average for eight of the twelve peer states. Clearly suppliers wishing to service clients up and down the "auto alley" and minimize transportation costs must consider a Kentucky location.

RECENT INVESTMENT IN THE AUTOMOTIVE INDUSTRY IN KENTUCKY

Each year for the past five years, 60 to 70 business expansion or relocation projects related to the automotive industry have been announced for a total of 339 projects. These projects involved pledges to invest \$4.5 billion in the Kentucky economy buying land, constructing buildings, and outfitting factories and offices with equipment. Currently, firms are planning to bring nearly 20,000 additional jobs to the Commonwealth.

ECONOMIC AND FISCAL IMPORTANCE OF THE INDUSTRY

The four assembly plants create the most spinoff jobs. One way to describe the relationship between direct jobs and spinoff jobs is the employment multiplier. The multiplier for light truck and utility vehicle manufacturing is 4.24, which means that for every 100 jobs in light truck and utility vehicle manufacturing a total of 424 jobs are supported, the 100 jobs in the assembly plant and 324 more spread throughout the broader economy. The multiplier for passenger vehicle

manufacturing is 3.71, which means that for every 100 jobs, 371 jobs are supported; the 100 assembly plant jobs and 271 spread throughout the economy. These are among the largest employment multipliers of any industry in the state.

The economic contribution of assembly plants in Kentucky can be summarized this way: Almost 70,000 jobs, nearly \$9 billion gross state product and about \$3.5 billion in payroll. The Louisville and Lexington regions of the Commonwealth show the largest direct employment contribution from assembly plants, followed by Bowling Green because the plants are sited there. However, the indirect (business-to-business) effects and the induced (household spending as a result of increased earnings) effect are spread throughout the Commonwealth based on where suppliers locate and workers live and shop.

The economic contribution of automotive parts manufacturing in Kentucky is close to 67,000 jobs, over \$5.4 billion in gross state product and \$2.7 billion in payroll. The employment multiplier of 2.43 means that for every 100 direct jobs in automotive parts manufacturing, 243 jobs are supported. While concentration of parts manufacturers around assembly plants means that the Louisville, Lexington and Bowling Green regions experience around 75% of the total effect, but the remaining 25% is distributed throughout the Commonwealth.

Combining assembly and parts manufacturing, the economic contribution of automotive manufacturing is 136,500 jobs, \$14.3 billion in gross state product and over \$6 billion in payroll. The multiplier for assembly and parts is 3.14. Once again, the effects cluster around assembly plants but are spread throughout the state.

Statewide, the automotive manufacturing industry through its direct, indirect, and induced effects contributes 5.6 percent of the state's employment. The contribution of the industry varies widely among the nine economic regions. At the low end, the auto manufacturing industry contributes to less than one percent of the jobs in the far eastern and western parts of the state (the Ashland, Mountain, and Paducah-Purchase regions). But in Bowling Green-Hopkinsville the industry contributes to seven percent of all employment, in the Louisville region it contributes to 7.3 percent of all jobs, and in the Lexington region the auto manufacturing industry contributes to 8.4 percent of all employment.

The \$14.3 billion that the industry contributes to gross state product represents 7.8 percent of Kentucky's gross state product. Roughly one out of every thirteen dollars that Kentucky adds to the national economy can be tied to the automotive industry. Only the healthcare and wholesale trade industries add more value to the Commonwealth's GSP (although 15 percent of wholesale trade employment is related to the auto industry).

We estimate that automotive industry-related payrolls contributed about \$116.5 million in occupational taxes to cities and counties (and a few school districts) in 2013, the bulk of that going to places in the Lexington and Louisville regions. In the Lexington region it amounted to nearly \$1,000 per job, and in the Louisville region about \$890 in local government revenue per job.

State government coffers benefitted by about \$488 million in income and sales taxes related to automotive manufacturing. Here, too, the Lexington and Louisville regions accounted to a bit over three-quarters of the tax revenue. State income and sales taxes combined amounted to about \$3,900 per job in the Louisville region and roughly \$3,725 per job in the Lexington region.

Payroll related to and supported by automotive manufacturing in Kentucky made up an estimated 7.2 percent of all state tax collections from income and sales taxes in 2013. Clearly the automotive manufacturing industry is one of the most important industries in the Commonwealth of Kentucky.

INTRODUCTION

Just a few months ago Daimler AG announced its decision to move Mercedes-Benz USA's headquarters from Montvale, New Jersey to suburban Atlanta, Georgia. Other finalist cities for USA headquarters were Dallas, Raleigh and Charlotte – all in the south and southeast. Daimler's decision is just the latest development in a decades-long geographic evolution of the auto industry. While the popular press often focuses on state tax incentive packages, most economic development experts agree that strategic location relative to transportation systems and lower overall costs of doing business are the deciding factors in the relocation decision.

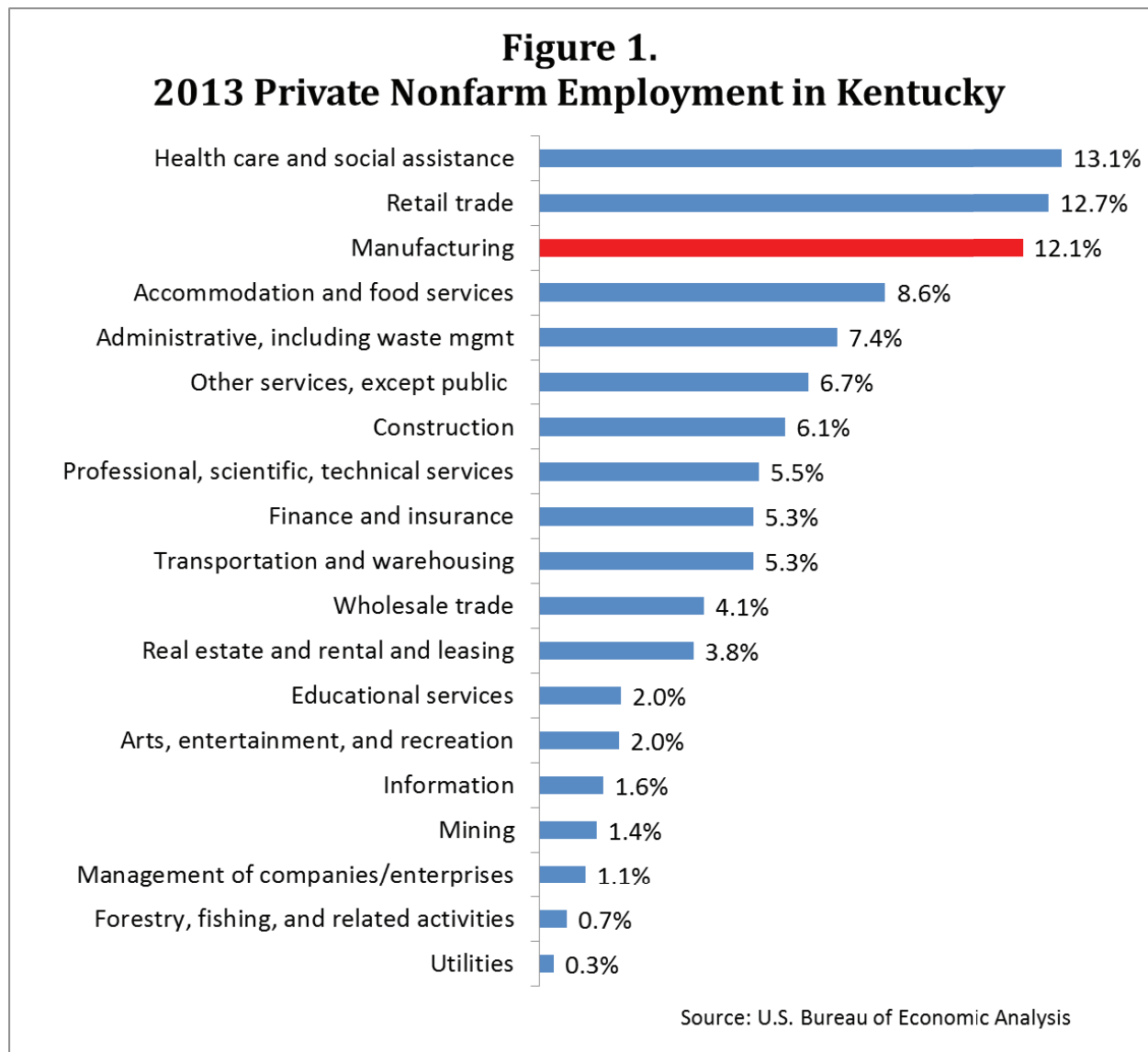
Kentucky has been the beneficiary of the migration of automobile makers and suppliers southward. This report will begin with a look at the composition of Kentucky's manufacturing sector relative to other private sector industries, and automotive manufacturing employment and wages within the manufacturing sector. The remainder of the report is focused exclusively on the automotive industry, beginning with a discussion of some of the factors that drew the industry to Kentucky and employment trends from the early 1970s to present day. We will also discuss the regional employment effects of the industry.

Then we will look at the industry by sector, separating original equipment manufacturers (OEM), or companies that makes a final product for the consumer marketplace, from Tier I suppliers that provide a product directly to the OEM. The central section of the report estimates the economic importance of the automotive industry to the Commonwealth and its regions. That includes jobs, output, income and value added. We also estimate the tax revenues that the industry provides to state and local governments in the Commonwealth. Finally, we forecast growth for the industry as a whole and for several important Tier I suppliers with the goal of identifying future opportunities for economic development based around the automotive industry.

KENTUCKY'S PRIVATE SECTOR ECONOMY

In 2013 (the last data year available) almost 2 million persons were employed by private industry in Kentucky, approximately 81% of all those employed. Most of the remaining 19% were employed by government (15.5%) and the remainder were either farm or nonfarm proprietors.

Figure 1 shows private nonfarm employment by sector. While Kentucky's national image may involve horses, coal, bourbon (and basketball!), the economic reality is that Kentucky is a manufacturing, retail and health care economy.



Approximately 236,100 Kentuckians are employed by manufacturers. About 62.5% in industries manufacturing durable goods (automobiles, furniture, appliances, etc.), while 37.5% are employed by manufacturers of nondurable goods

(food, clothing, plastics, etc.). Manufacturing contributes a little over 18% of the Commonwealth’s GDP, more than any other sector of the economy. Among durable goods manufacturers, the automotive industry dominates both in terms of jobs and wages.

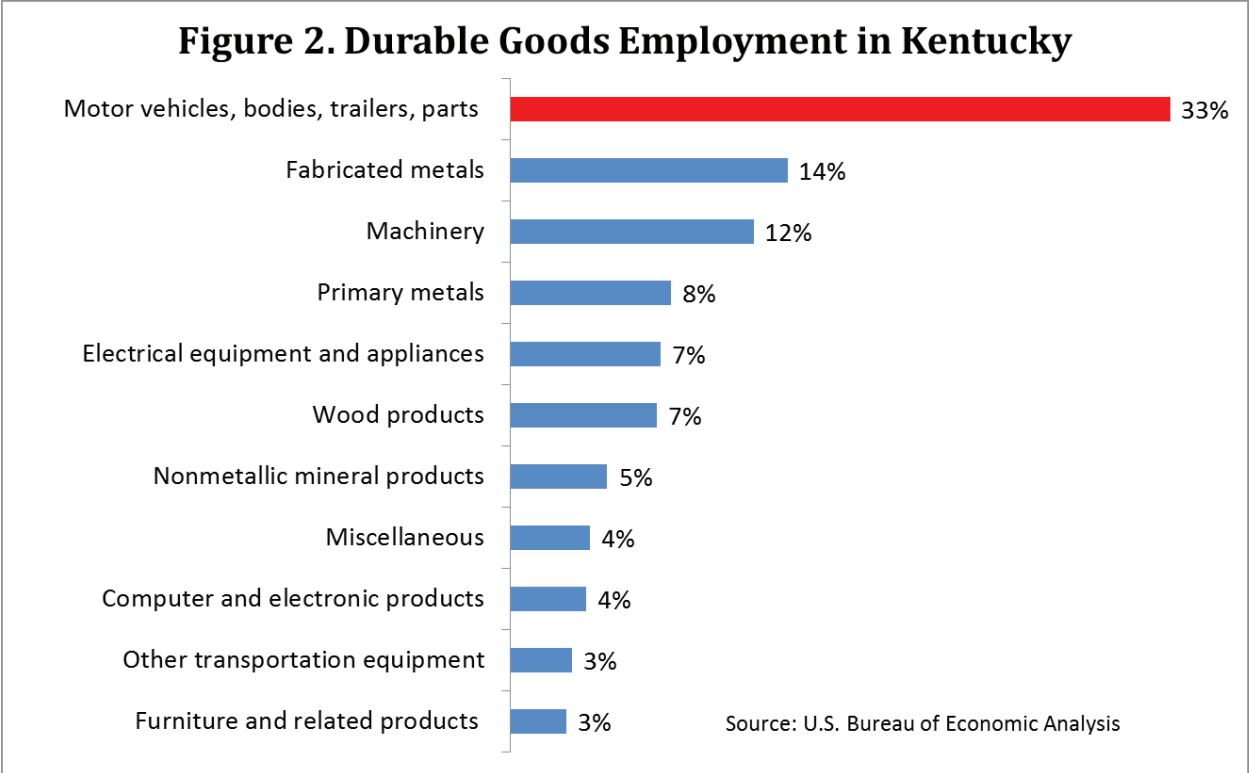


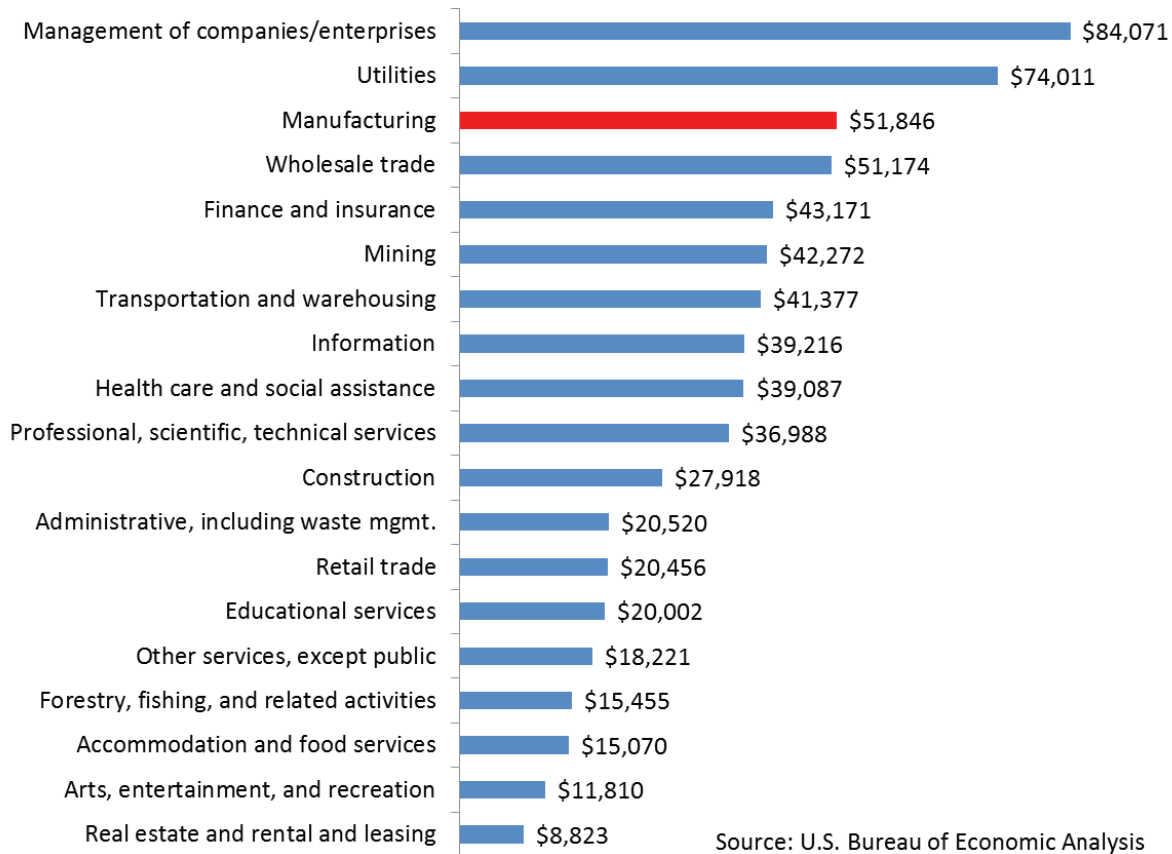
Figure 3 shows annual wage per employee for private, nonfarm industries. Manufacturing wages per employee are nearly \$52,000 per year. Manufacturing wages are exceeded only by management wages and wages of private utility workers. Few would be surprised that management wages per employee would be the highest. However a comparison between manufacturing employees and utility employees may be instructive.

According to a recent US Department of Energy report on the utility industry, electric line workers are one of the highest paid professions in the United States that does not require a post-secondary education. While the average annual regular wage of a line worker (\$52,290) was close to the Kentucky average wage for manufacturing, the availability of overtime pay, especially during weather events, tends to push their total annual wage rate higher.

Considering the manufacturing sector alone, the average annual wage rate for a durable goods manufacturing employee (\$51,846) is slightly higher than that of an employee engaged in the manufacture of nondurable goods (\$49,073). However there is considerable wage variability among durable and nondurable goods manufacturing as indicated in Table 1.

Within durable goods manufacturing, computer and electronics manufacturing has the highest average annual wage. Appliance manufacturing has a slightly higher average annual wage in Kentucky than does motor vehicle manufacturing. National average wage rates give automotive manufacturing wages the edge over appliance manufacturing, which suggests that Kentucky’s manufacturing sector may have a different composition than the national average.

**Figure 3. Average Annual Wage Per Employee
by Major Industry, 2013**



Within the nondurable goods manufacturing industry, petroleum and coal products manufacturing is the industry leader in wages. Table 1 compares the annual wages per employees for the durable goods and nondurable goods sectors in Kentucky.

The focus of the report now turns exclusively to the automotive industry, beginning with a discussion of how automobile manufacturing has been spatially distributed in the United States historically and some factors that have changed and are continuing to change that pattern.

Table 1. Average Annual Wages per Employee, Kentucky's Manufacturing Sector, 2013

Wage (\$000)	Durable Goods Industry	Wage (\$000)	Non-durable Goods Industry
\$27.93	Wood products	\$13.95	Leather and allied products
\$33.36	Furniture and related products	\$25.93	Apparel
\$36.42	Miscellaneous	\$28.55	Textile product mills
\$46.82	Fabricated metal products	\$39.23	Printing and related activities
\$48.94	Nonmetallic mineral products	\$40.71	Food
\$53.34	Machinery	\$41.79	Textile mills
\$56.30	Other transportation equipment	\$44.83	Plastics and rubber products
\$58.28	Motor vehicles, bodies, trailers, parts	\$58.23	Paper
\$63.04	Primary metals	\$67.45	Chemical
\$65.18	Electrical equipment and appliances	\$70.13	Beverage and tobacco products
\$79.49	Computer and electronic products	\$89.20	Petroleum and coal products

Source: U.S. Bureau of Economic Analysis

REGIONAL SHIFTS IN THE AUTOMOTIVE INDUSTRY

Detroit's dominance of the American automobile industry in the early twentieth century is usually explained by two factors: luck and agglomeration economics. Early innovators like Henry Ford and Ransom Olds lived in the area and started their businesses there. Access to inputs and to transportation systems made the location feasible.

Then agglomeration economics took over. Labor migrated to take auto jobs, suppliers migrated to sell to multiple manufacturers and research and development produced knowledge spillovers. Klepper (2007) contends that spinoffs drove the agglomeration around Detroit. Ambitious employees of the major manufacturers started up their own automobile companies, with varying degrees of success. Whether concentration drove spinoff companies or spinoff companies drove concentration, by the end of the 1920s three companies dominated the market, all located in the Detroit area.

As the industry matured, transportation cost economics drove the location of assembly operations. Manufacturers can locate to maximize access to inputs or to maximize access to markets. A finished motor vehicle is a non-trivial product to take to market. As manufacturers expanded their product lines in the 1970s, assembly plants with smaller production runs were sited closer to markets. Rubenstein (1992) noted that an individual model supports at most one assembly plant, and those assembly plants concentrated mostly in the south and Midwest.

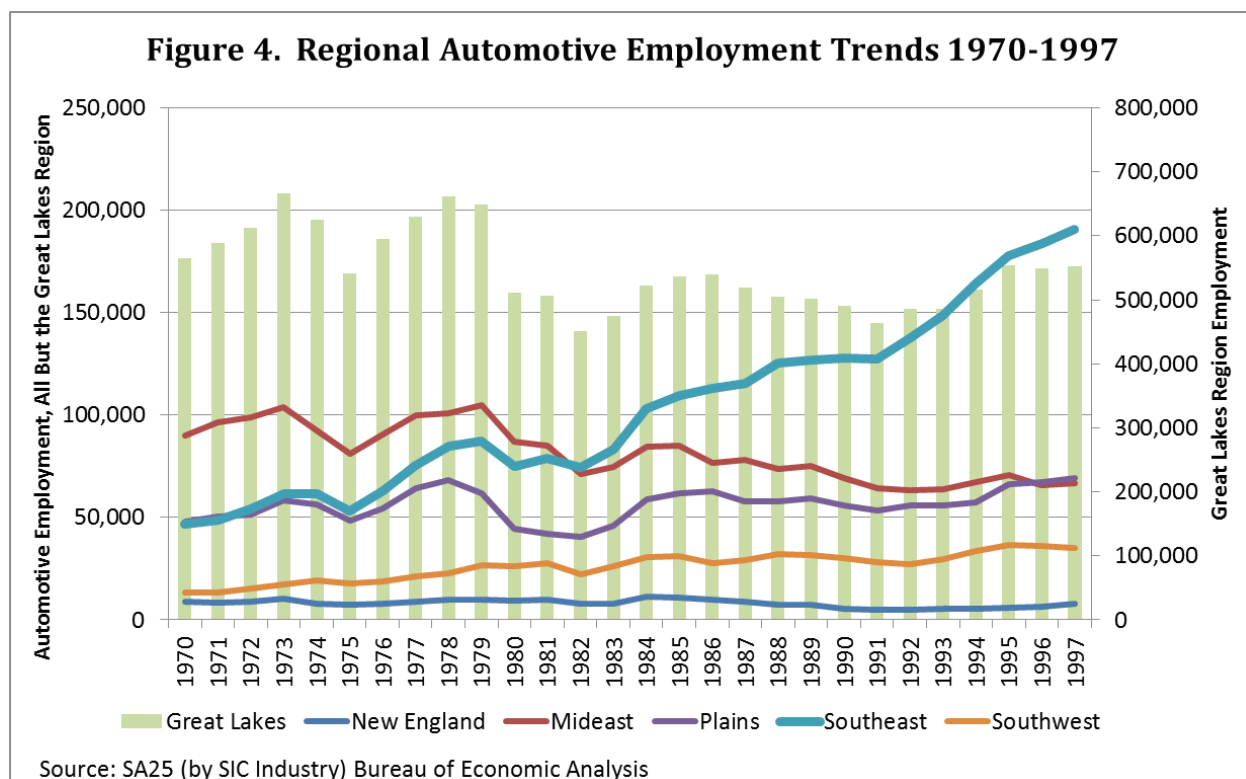


Figure 4 shows that regional employment in the industry was relatively stagnant in the Great Lakes region from 1980-1997 while the southeast began growing in the mid-1970s. Greater Detroit still has more employment in the industry than any other place in the United States, but the growth in the industry, both in manufacturing and suppliers, has a decidedly southern momentum.

Supplier plants follow the assembly plants, as expected, but the most critical factor for their location has always been access to transportation systems, specifically highways. Klier and McMillen (2006) examined about 5,000 supplier plants in North America to determine whether plant location decisions had changed over time. They noted that the presence of an interstate highway in a county significantly increases the likelihood of a supplier plant locating there. New suppliers were more likely to choose the East South Central US Census region (Kentucky, Tennessee, Mississippi and Alabama), suggesting that the modern automotive industry extends south from Detroit.

AUTOMOTIVE INDUSTRY IN KENTUCKY

Kentucky is home to four auto manufacturing assembly plants: the Ford Motor Kentucky Truck Plant and Louisville Assembly Plant in Louisville, Toyota Motor Manufacturing, Kentucky, in Georgetown and General Motors in Bowling Green. Suppliers of direct inputs to the assembly process are also clustered in these areas.

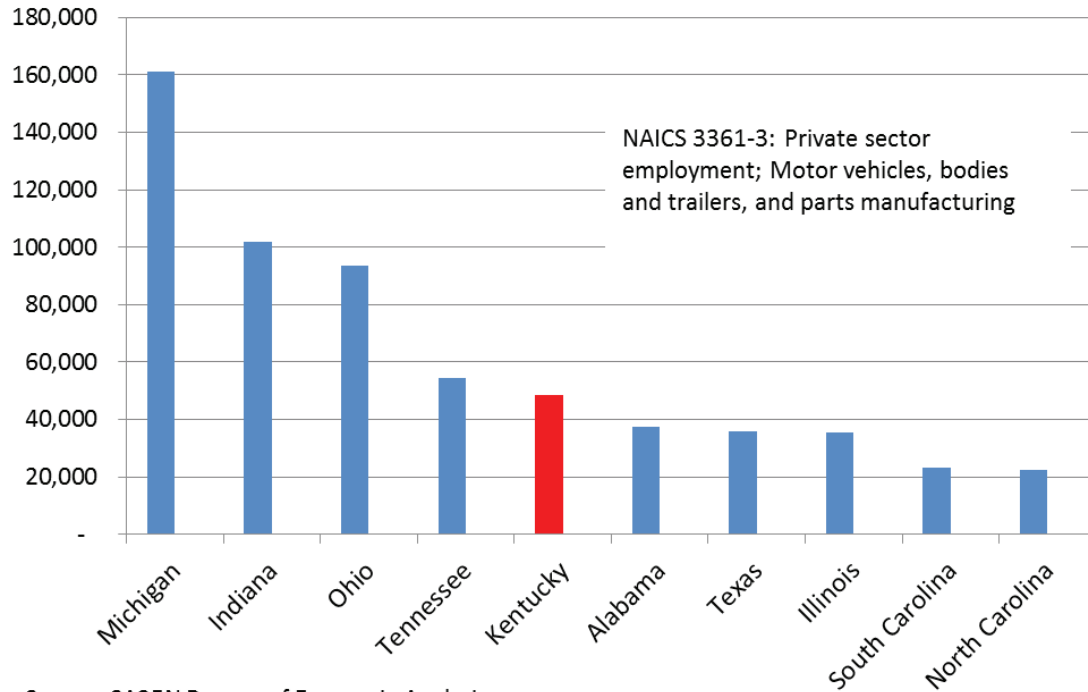
The Bureau of Economic Analysis reports industry employment data at both the state and county levels. Nearly all business statistics compiled by the federal government utilize the North American Industry Classification System (NAICS). The NAICS is a hierarchical system that uses two, three, four, five, and six digit codes, with each additional digit indicating a more narrow focus. NAICS codes beginning with 31, 32, and 33 are used for all manufacturing industries. Three subsectors of the industry Transportation Equipment Manufacturing (NAICS 336) comprise the motor vehicle manufacturing industry. They are group 3361, motor vehicle manufacturing (which includes assembly and chassis manufacturing), group 3362, motor vehicle body and trailer manufacturing, and group 3363, motor vehicle parts manufacturing.

The first two groups are self-explanatory. The motor vehicle parts manufacturing industry group includes companies that manufacture or rebuild gasoline engines and engine parts (which may or may not be for vehicle use), vehicle lighting, electrical and electronic equipment; steering mechanisms and suspension components (except springs); brake systems and related components; transmission and power train parts; seats, seat frames, seat belts, and interior trim; stampings, such as fenders, tops, body parts, trim, and molding; and other motor vehicle parts and accessories.

All OEMS and Tier I suppliers are included in these industry groups, although the latter two groups also include aftermarket manufacturers. Additionally, companies included in the parts manufacturing group may also make products unrelated to the automotive industry.

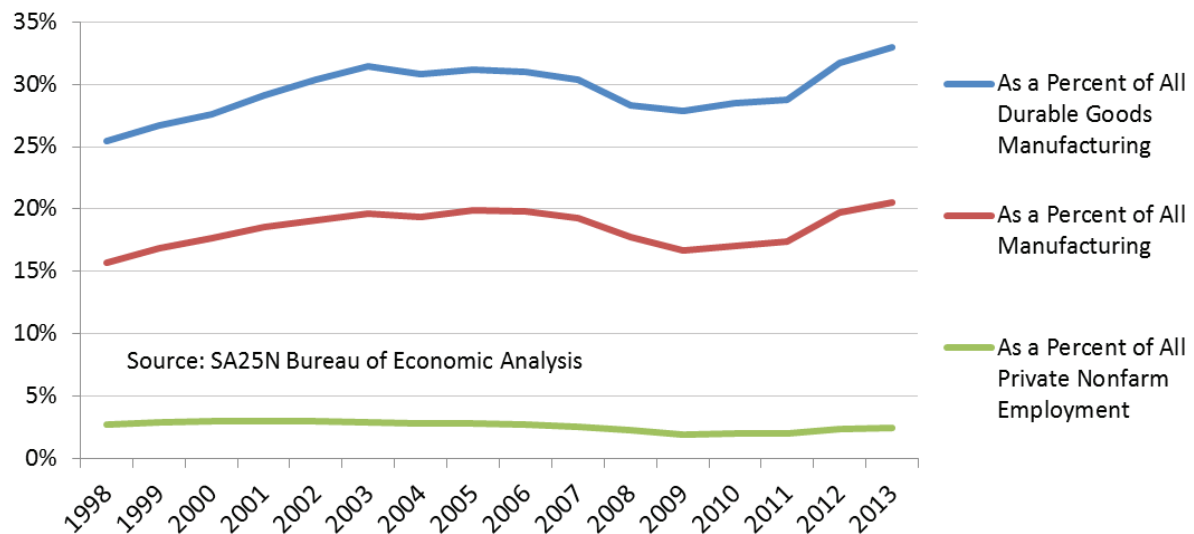
Using this definition, Kentucky ranks fifth in the nation in employment in the industry, just behind Tennessee. Figure 5 shows employment for the “top 10” states in the industry.

Figure 5. Full Time and Part Time Employment in the Automotive Industry, 2013



While the share of Kentucky's automotive industry employment as a percentage of all state employment remains steady, its share of all the state's manufacturing employment continues to increase. This shouldn't surprise as manufacturing's share of employment is decreasing nationwide and has been for past half-century. Concern about the share of manufacturing jobs in the state economy intensified during the Great Recession as manufacturing jobs declined rapidly. While manufacturing expands and contracts based on aggregate demand, after the recession inventory stockpiles slowed the manufacturing recovery.

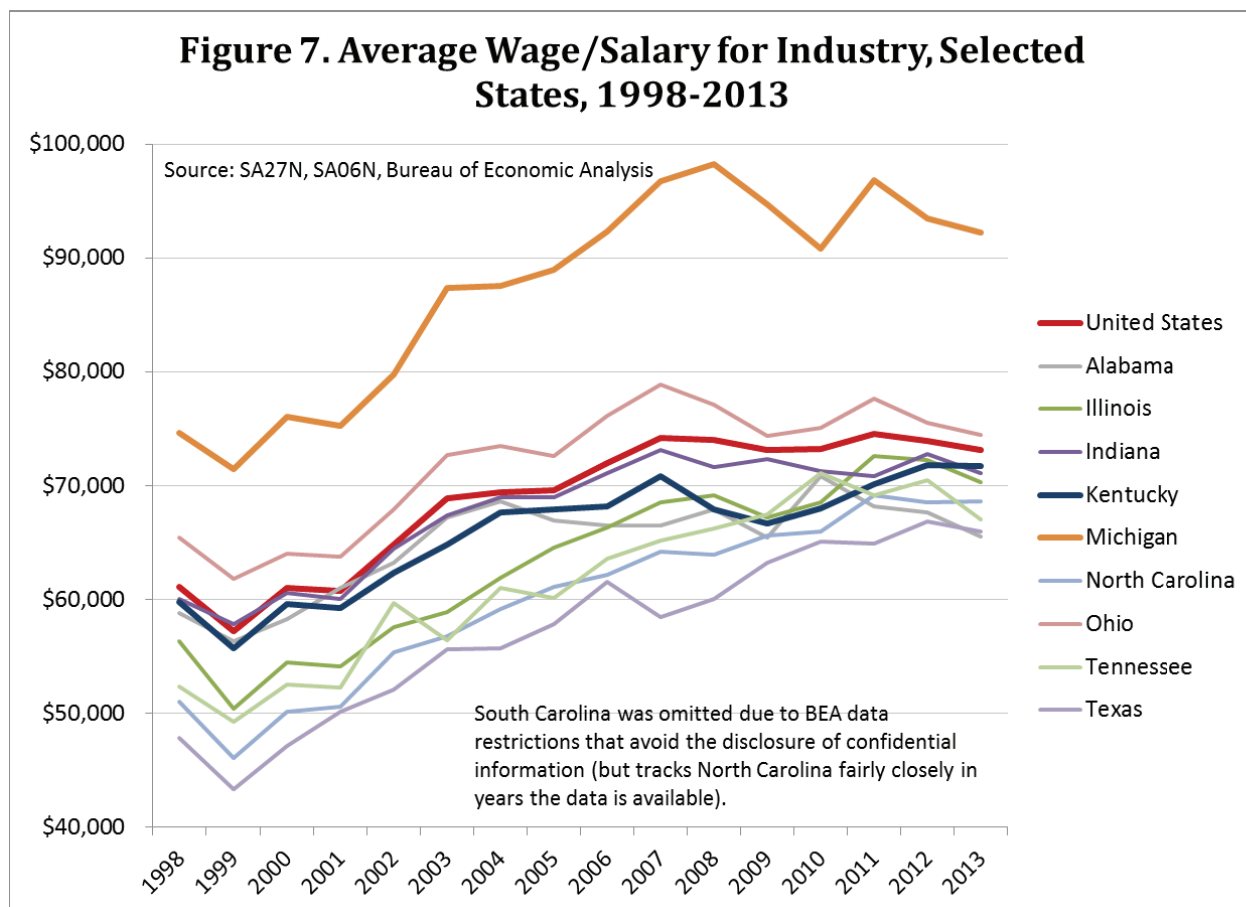
Figure 6. Motor Vehicles and Parts Manufacturing, Kentucky, 1998-2013



However, the uptick in industry employment as a percent of all durable goods manufacturing and as a percent of all manufacturing mirrored each other after the recession (see Figure 6). Kentucky's post-recession recovery in the industry was faster than the national average. This could be explained by the demand for the types of vehicles produced in the state as well as a healthy industry recovery.

Industry wages in Kentucky are close to the national average, as illustrated by the “spaghetti graph” in Figure 7. The average wages and salaries per job for the United States are the bold red line and Kentucky the bold navy blue line. The other states are the top nine employers in the industry (NAICS 3361-3).

Note that Kentucky's wages and salaries were considerably higher than Texas, Tennessee, North Carolina and Illinois in the late 1990s. The difference does not necessary reflect a wage differential for line workers, however. A greater proportion of highly skilled workers or managers can also account for average wage and salary differentials.



A 2005 Bureau of Labor Statistics report on industry wages found a “wage premium” of about \$2.30, meaning that a worker in any occupation in the automotive industry could expect to earn that amount more per hour than a worker in the average industry occupation (Holt, 2005).

The premium was not evenly distributed, however. Employees with skilled occupations (i.e., production managers) were paid more than their counterparts in other industries while employees with highly skilled occupations (i.e., engineers) were paid less than their counterparts in other industries. Holt (2005) also reported that while team assembly workers were the largest occupational group in the industry, they only accounted for about 20% of industry workers.

Aside from the overall trend of higher wages over time, it is notable that, outside of Michigan, state level wages in the motor vehicles and parts manufacturing industry have been converging towards the national average. The amount of regional variation in 2013 was only about half of what it was as late as 2007. As the diffusion of the automotive industry matures and the industry becomes well established in more states we may see an erosion of regional wage differentials in the industry.

Finally, the amber line at the top of the graph is the average wage and salary for Michigan. While the concentration of automotive engineers and other highly skilled professionals in the area certainly drives the apparent “income gap” it is the case that salaries are higher in Michigan across occupations, including team assembly workers.

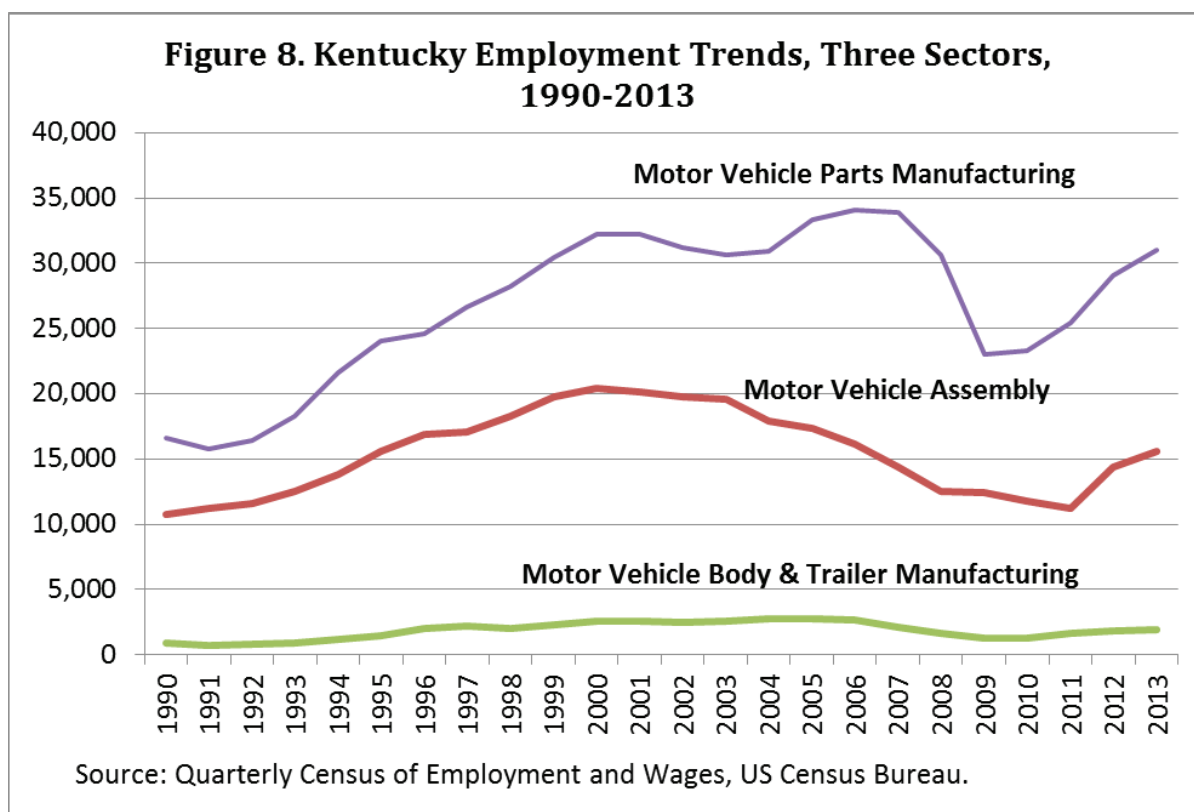
TRENDS IN AUTOMOTIVE EMPLOYMENT AND EARNINGS IN KENTUCKY

Patterns of job creation and job loss in automobile manufacturing are subject to multiple interpretations. Since 2000, a third of the net job loss in the industry has taken place in Michigan (Cooney, 2007). Job loss in Ohio and Indiana was less severe over the same period. Kentucky was one of only four states to gain jobs during this period.

Investments by foreign-owned manufacturers have been concentrated in Kentucky and other southern states. In 2014, domestic automakers had 45% of market share, slightly up from 2013. Foreign automakers, primarily Toyota (14.4%), Honda (9.3%), Nissan (8.4%) and Hyundai (4.4%), have the rest of market share.

Shifts in consumer preferences from trucks and SUVs helped many foreign-owned manufacturers to the detriment of domestic manufacturers. Additionally, new fuel economy standards may have worked to the advantage of foreign manufacturers who were already producing vehicles that met the standards for the international market.

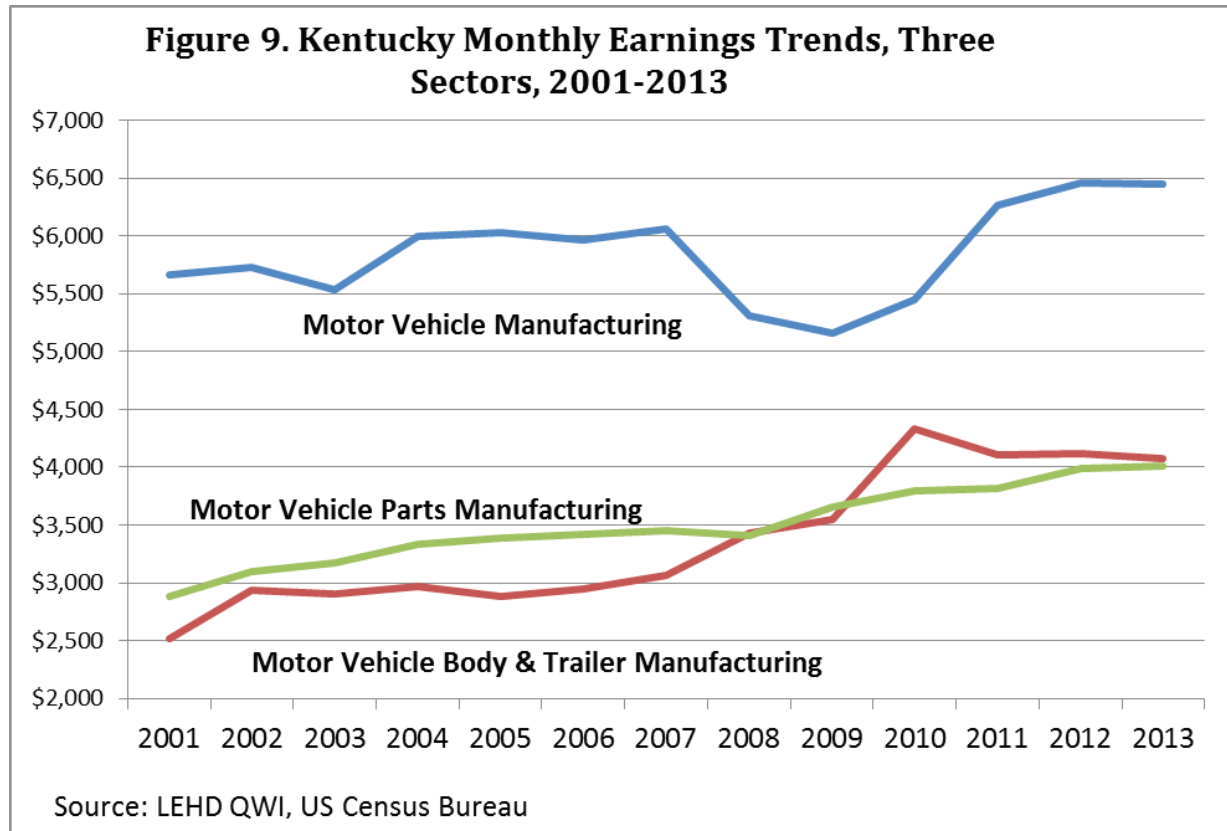
The red line in Figure 8 follows the national business cycle, lagging recessions and persisting through early years of the recovery as vehicles in inventory are sold before more are produced. Despite the downtick in employment in motor vehicle assembly in Kentucky since 2000, there was a noticeable upsurge beginning in 2011. Developments since 2013 and announced plans by Ford, Toyota, and General Motors all suggest that motor vehicle assembly plant employment in Kentucky may reach previous peak levels in the next few years.



Motor vehicle parts manufacturing suffered a severe loss of jobs during the recession, but has rebounded rapidly and should return to pre-recession levels in the next few years. Kentucky does not have a large number of manufacturers of motor vehicle bodies and trailers, but employment in that sector has been quite stable.

Monthly earnings by Kentucky’s workers in the three sectors show considerable variation. First, there is the much higher wage for persons employed in motor vehicle manufacturing than the other two sectors. As employment was gradually falling, wages were gradually rising, suggesting that manufacturers may be compensating more highly skilled workers and that less skilled workers may be leaving the industry.

The trend is especially evident after the recession, as wages rise quickly and to higher levels. The blue line in Figure 9 suggests that when automakers rehired after the recession, they may have made a structural adjustment to hire workers with higher skill levels (and hence higher productivity) who would command a higher wage rate.



Wages for workers in motor vehicle parts manufacturing experienced a slow but steady rise over the period. Note that although there are relatively few workers in motor vehicle body and trailer manufacturing in Kentucky, this sector has experienced the most dramatic wage growth. In fact, wages peaked during the recession years while motor vehicle manufacturing wages fell.

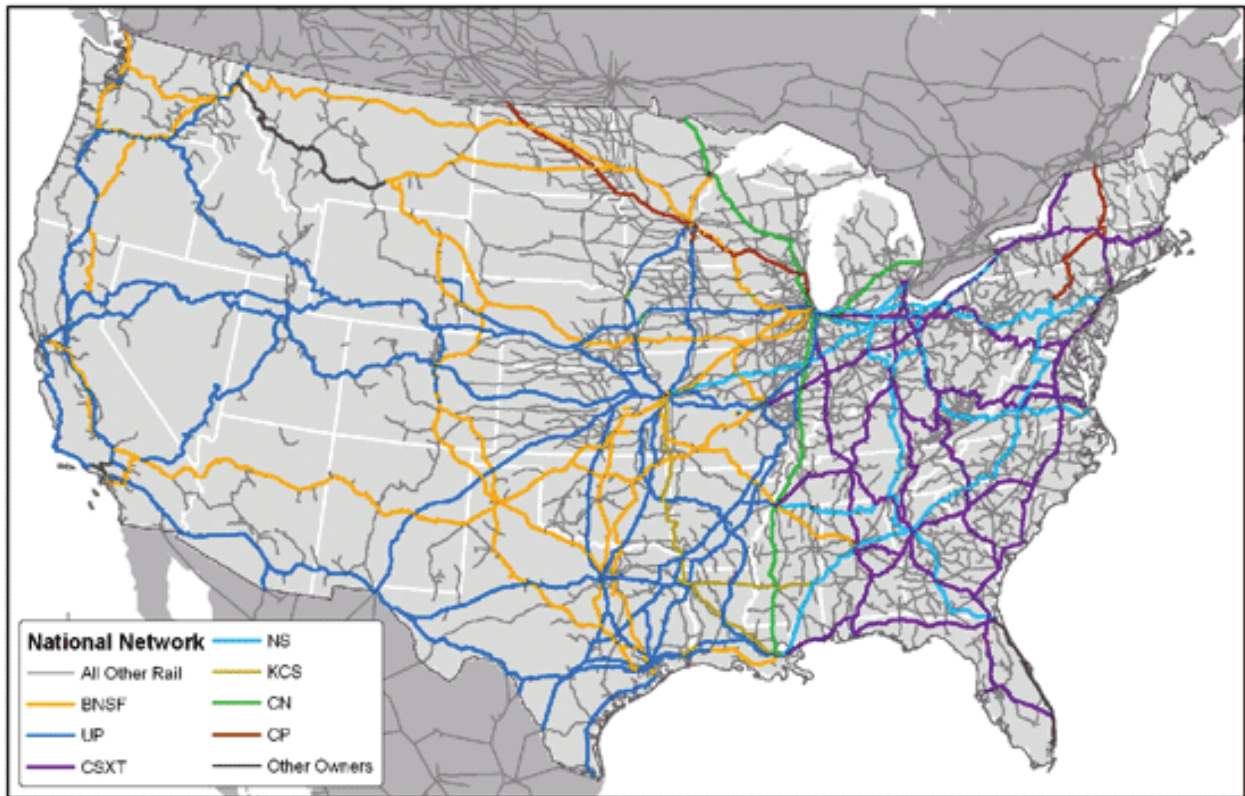
KENTUCKY'S SUCCESS IN AUTOMOTIVE INDUSTRY GROWTH

All states provide location or relocation incentives to automotive manufacturers. The incentives vary by the needs and preferences of the manufacturer and the characteristics of the state. All location decisions have the same priorities: access to markets and access to materials and labor. Once these priorities are satisfied, automakers have a small number of locations from which to choose. At that point incentives matter.

Geography explains much of Kentucky's success at attracting manufacturers. As the industry began its migration south from Michigan, the interstate highway system connected Kentucky to major markets in the south and Midwest. Maps we present in later sections include the interstate highway system as well as Kentucky's parkways. The proximity of manufacturers to interstates and parkways can readily be seen.

The US rail system map also positions Kentucky favorably along a corridor from the upper Midwest, through the southern markets to ports on the Gulf and Atlantic coast. The freight rail system map below shows Kentucky well covered by the two major rail systems in the eastern U.S. CSX Transportation and Norfolk Southern both cover Kentucky. The former has intermodal terminals in Louisville, Evansville, and Cincinnati, while the latter operates intermodal terminals in Louisville, Shelbyville, Georgetown, and two near Cincinnati. Since most transportation to market is intermodal, easy access to the modes from the manufacturer to the market is critical.

Map 1: U.S. Freight Rail Network



Labor is also a location issue, though priorities have changed as the industry changed. Early location decisions were influenced by a pool of relatively low skilled, low wage, non-union labor. The automotive industry capitalized, adopting mechanized assembly and needing workers with higher skill levels. Evidence of this can be seen in state incentive packages that offer free or reduced price training for potential workers through the community and technical college system that is customized to the need of the manufacturer.

An important, but often overlooked, component of the manufacturing location decision is utility costs. Again, as the industry mechanized, competitive utility rates became more important. Some states included reduced utility costs in their incentive packages. Kentucky's industrial customer electrical rates (measured in cents per kilowatt hour) are among the nation's lowest, as shown the Table 2 below.

**Table 2. Annual Average Industrial Electricity Price
Cents per Kilowatt Hour by State, 2014**

Rank	State	Rate	Rank	State	Rate
1	Washington	4.32	15	Illinois	6.35
2	Montana	5.47	16	Idaho	6.42
3	Oklahoma	5.61	17	North Carolina	6.43
4	Kentucky	5.67	18	New Mexico	6.48
5	Iowa	5.77	19	New York	6.50
6	West Virginia	5.87	20	Georgia	6.52
7	Arkansas	5.93	21	Tennessee	6.58
8	Louisiana	6.00	22	Ohio	6.62
9	Utah	6.07	23	Wyoming	6.62
10	Oregon	6.08	24	Arizona	6.64
11	Texas	6.16	25	Mississippi	6.75
12	Missouri	6.19	26	Indiana	6.87
13	Alabama	6.21	27	Virginia	6.97
14	South Carolina	6.25			
National Average			7.01		

Source: Electronic Data Browser, Energy Information

Only states with rates below the national average shown.

As the previous section revealed, most of Kentucky's industry employment is in motor vehicle parts manufacturing. Access to manufacturers is the most important part of the location decision for Tier 1 manufacturers. Kentucky's geographic location - between the historical Michigan manufacturers and the emerging southern manufacturing base - is ideal for parts manufacturing. In a subsequent section, the location of parts manufacturing will be shown to cluster on interstate highway and parkway systems convenient both to Kentucky automobile and light truck manufacturing and to manufacturers in other states. In fact, most of the parts manufactured in Kentucky are shipped to auto manufacturers in other states.

CAR AND LIGHT TRUCK PRODUCTION BY STATE

From this point forward, the data and analysis presented focuses on car and light truck production and the deep supply chains utilized in the process that results in an automobile rolling off the assembly line. Cars and light trucks (e.g. SUVs and pickup trucks) are also referred to as passenger vehicles because their primary purpose is to move people from place to place.

Passenger vehicles have made up about 97.5 percent of all motor vehicles produced in the United States over the past thirty years and nearly all of the vehicles produced in Kentucky. The remainder is made up of medium and heavy trucks, which are mostly used in commerce. We will often use the terms “motor vehicle manufacturing” and “automotive industry” in this report, but we are always referring to cars and light trucks.

There were 11.4 million cars and light trucks produced in the United States during 2014. Over the last thirty years there has been an average of 10.6 million passenger vehicles produced annually, with a low of 5.6 million in 2009 and a high of 12.6 million in 1999. The Center for Automotive Research forecasts a compound annual growth rate of about 2.4 percent over the next few years, with production reaching 12.2 million passenger vehicles in 2018.

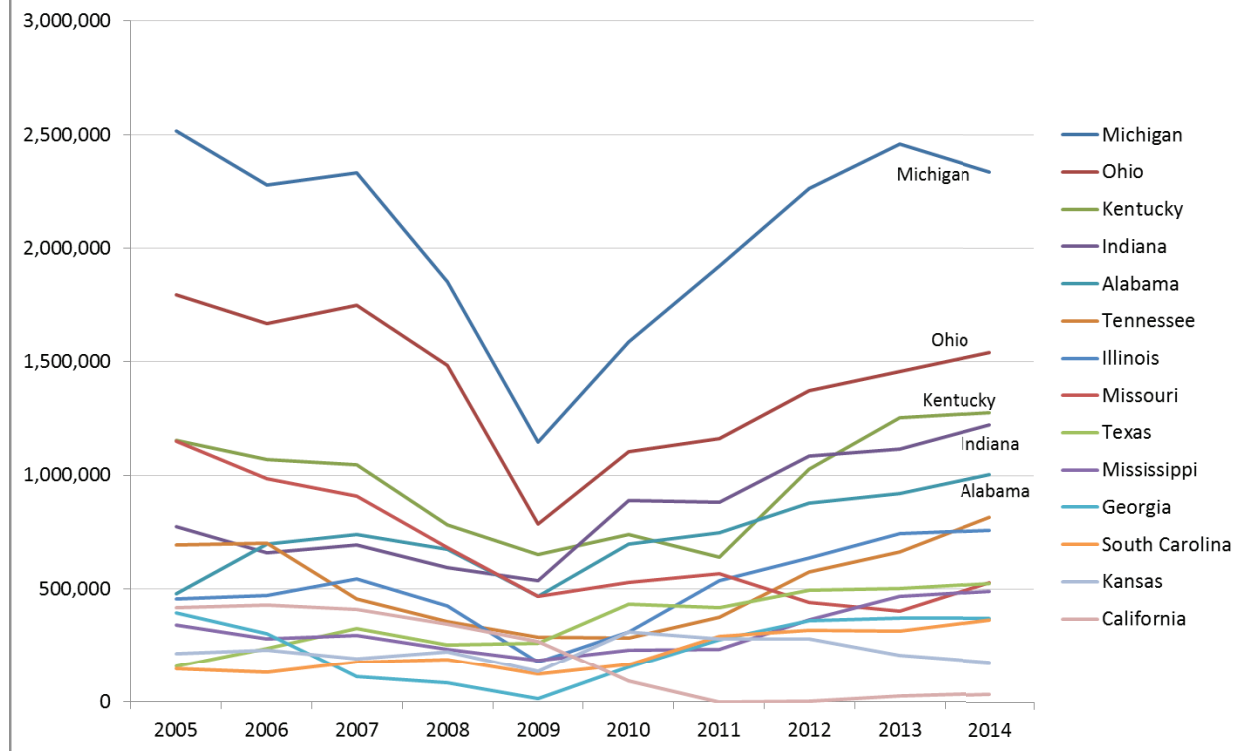
Table 3.
Car and Light Truck Production by State, 2014

	Vehicles	Rank, 2014	Rank, 2005
United States	11,437,273		
Michigan	2,335,292	1	1
Ohio	1,541,103	2	2
Kentucky	1,276,557	3	3
Indiana	1,222,003	4	5
Alabama	1,004,828	5	7
Tennessee	815,420	6	6
Illinois	759,064	7	8
Missouri	527,075	8	4
Texas	522,789	9	13
Mississippi	488,362	10	11
Georgia	369,379	11	10
South Carolina	364,542	12	14
Kansas	174,823	13	12
California	36,036	14	9

Source: Automotive News Data Center. Provided by
Kentucky Cabinet for Economic Development, Office of
Research and Public Affairs.

There were 1.28 million cars and light trucks produced in Kentucky during 2014, the third most of any state (Table 3). Over the last ten years, Kentucky has been the third, fourth, or fifth highest producing state depending on the timing of assembly plant closures for retooling for new models. When all four of Kentucky’s assembly plants are up and running the Commonwealth is consistently in third place behind just Michigan and Ohio (Figure 10).

Figure 10.
Car and Light Truck Production by State, 2005-2014
States with Currently Operating Assembly Plants Only



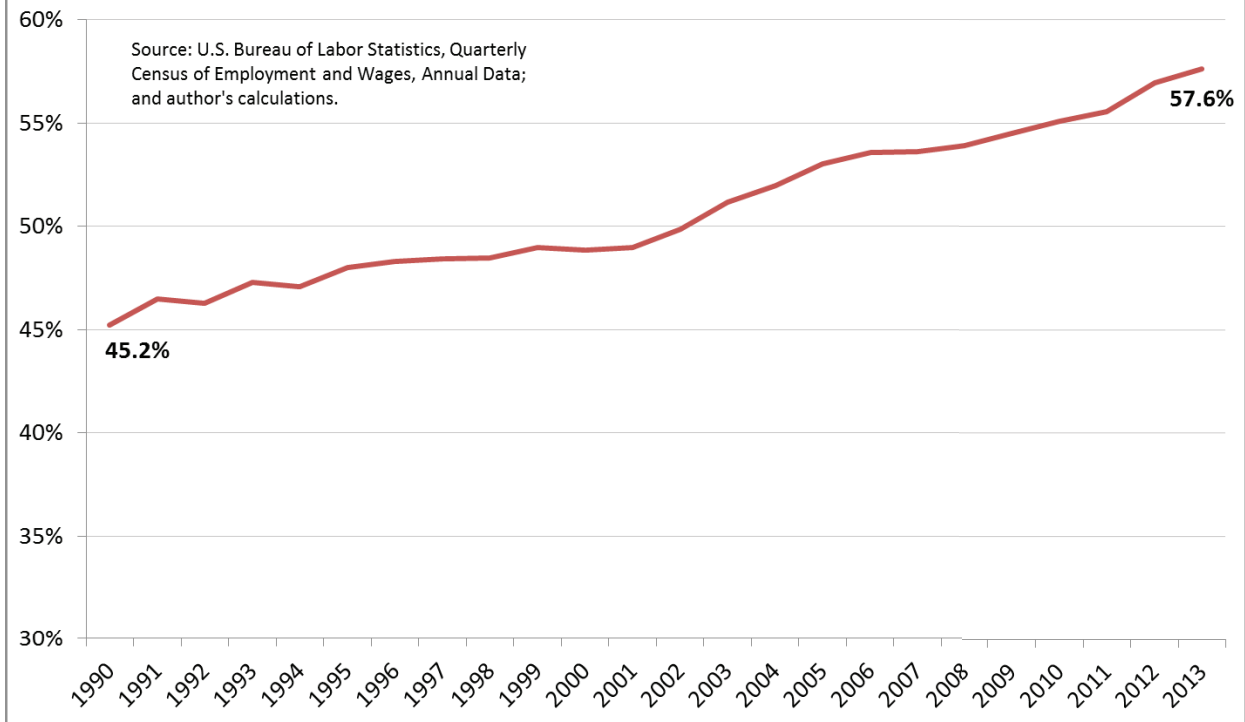
There are currently passenger car assembly plants in just 14 states, down from 22 states in 2005. All of the states that no longer have assembly plants are located either west of the Mississippi River or east of the Appalachian Mountains. Of the remaining 14 states just Texas, South Carolina, Kansas, and California are not located between those two geographic features.

Given this geographic concentration of the industry, when we compare Kentucky to other states in this report we will be focusing on a similar region – the seven states which border Kentucky (Missouri, Illinois, Indiana, Ohio, West Virginia, Virginia, and Tennessee) plus five additional southeastern states (Mississippi, Alabama, Georgia, North Carolina, and South Carolina). We can think of these states as Kentucky’s peers in the automotive industry.

We do not usually include Michigan in our comparisons given its unique place in the history of the industry, and because it still accounts for nearly twenty percent of industry employment and is the headquarters location for three of the largest automotive manufacturers in the world. Michigan is just different. But our region of interest is the next most important geographic area in the industry.

In 2013 motor vehicle manufacturing employment in our thirteen states accounted for about 58 percent of all such employment in the country. This percentage has been steadily increasing since 1990 (Figure 11).

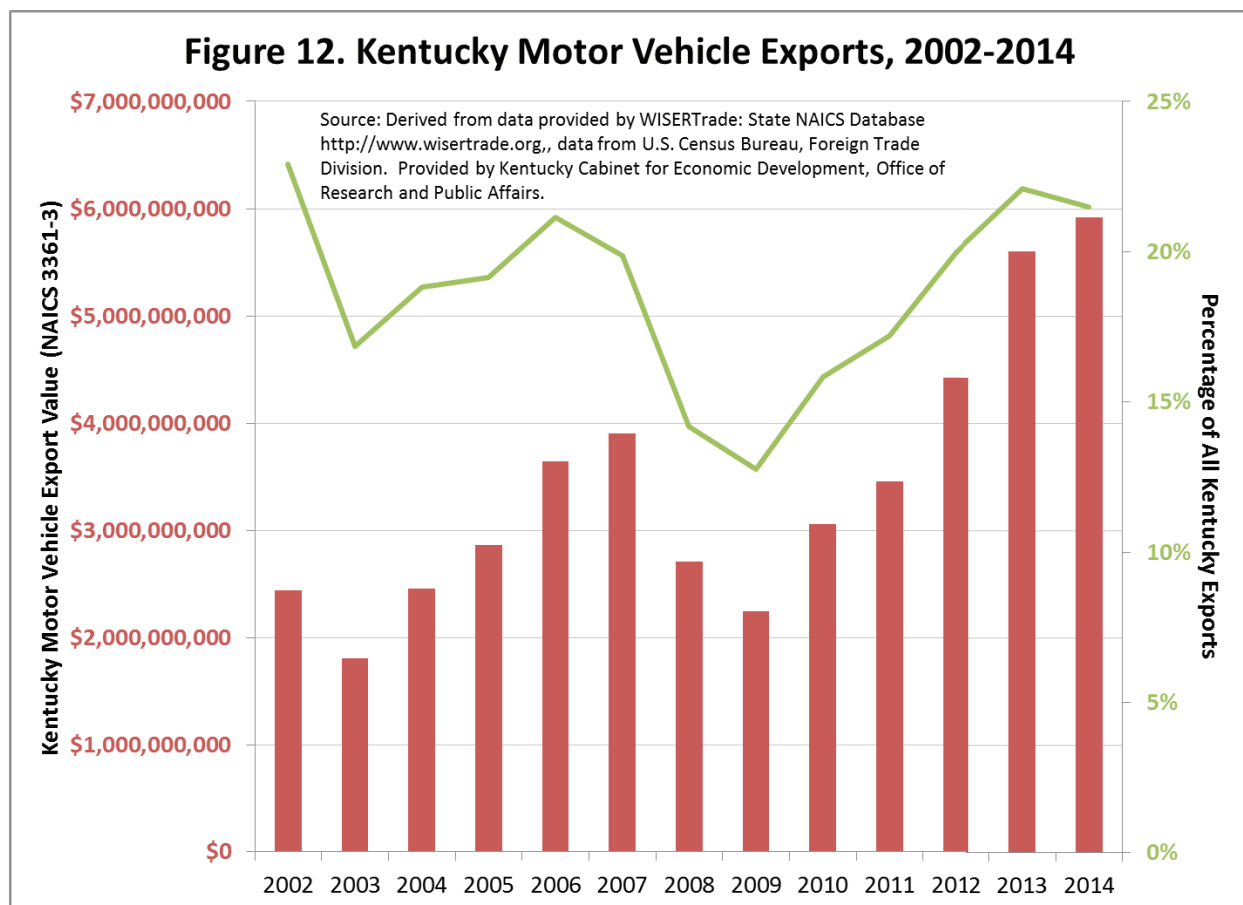
Figure 11.
**Thirteen State Region Share of U.S. Motor Vehicle
Manufacturing Employment, 1990-2013**



MOTOR VEHICLE EXPORTS BY STATE

Kentucky manufacturers exported \$5.9 billion worth of motor vehicles, bodies, trailers, and parts in 2014. Aside from a four-year dip during the Great Recession and recovery, Kentucky has experienced steady year-over-year increases in motor vehicle exports since 2003.

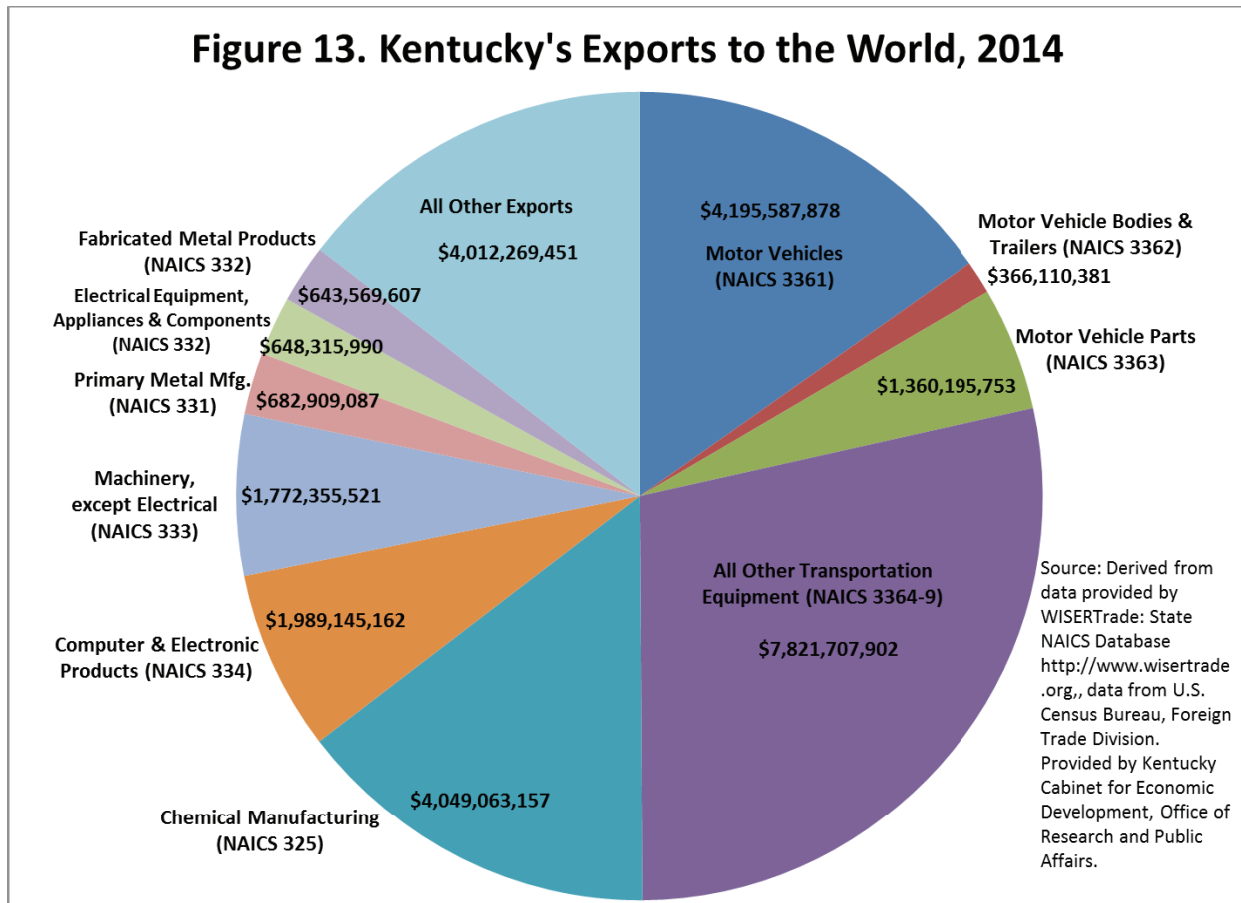
In 2014 motor vehicle exports represented 21.5 percent of all Kentucky exports. This is near the record high after falling steeply to just 12.7 percent of all the state's exports at the nadir of the recession in 2009 (Figure 12).



From 2002 to 2014, Kentucky's motor vehicle exports have grown by 142 percent, compared with Kentucky's overall export growth of 162 percent over the same period. But within the motor vehicle category, car and light truck exports (NAICS 3361) have grown by 272 percent since 2002.

Since the recovery from the recession, however, motor vehicles, bodies, trailers, and parts have been leading Kentucky's export growth. Passenger vehicle export value has nearly tripled and overall motor vehicle exports are up 163 percent while the state's other exports have only increased 40 percent by value since 2009.

Figure 13. Kentucky's Exports to the World, 2014



As shown in Figure 13, Kentucky exported \$4.2 billion worth of motor vehicles, \$366 million worth of bodies and trailers, and \$1.4 billion of motor vehicle parts in 2014. Collectively, this was the second largest industrial sector for exports behind other transportation equipment (which includes aircraft and aerospace products, ships and boats, rail products, motorcycles, bikes, and military vehicles). Chemicals and computer and electronic products combined just equal motor vehicle exports.

Table 4 shows that Kentucky ranked tenth in motor vehicle export value among the states in 2014. Seven of the 13 Kentucky border and southeastern states are in the top 10, and 10 of them are among the top 18 motor vehicle exporters. Kentucky ranks lower in export value than a number of other states that produce fewer cars and trucks because of the particular mix of vehicles produced in each state. Nearly all of the light trucks and utility vehicles produced in Kentucky are for the domestic market. In contrast, many of the cars produced in South Carolina, for example, are exported to Canada, Mexico, and even overseas. Texas (and likely also California) benefits from its proximity to the increasing number of assembly plants in Mexico.

Table 4.
Total Motor Vehicle Exports by State, 2014
Top Ten States
plus Other Kentucky Border and Southeastern States

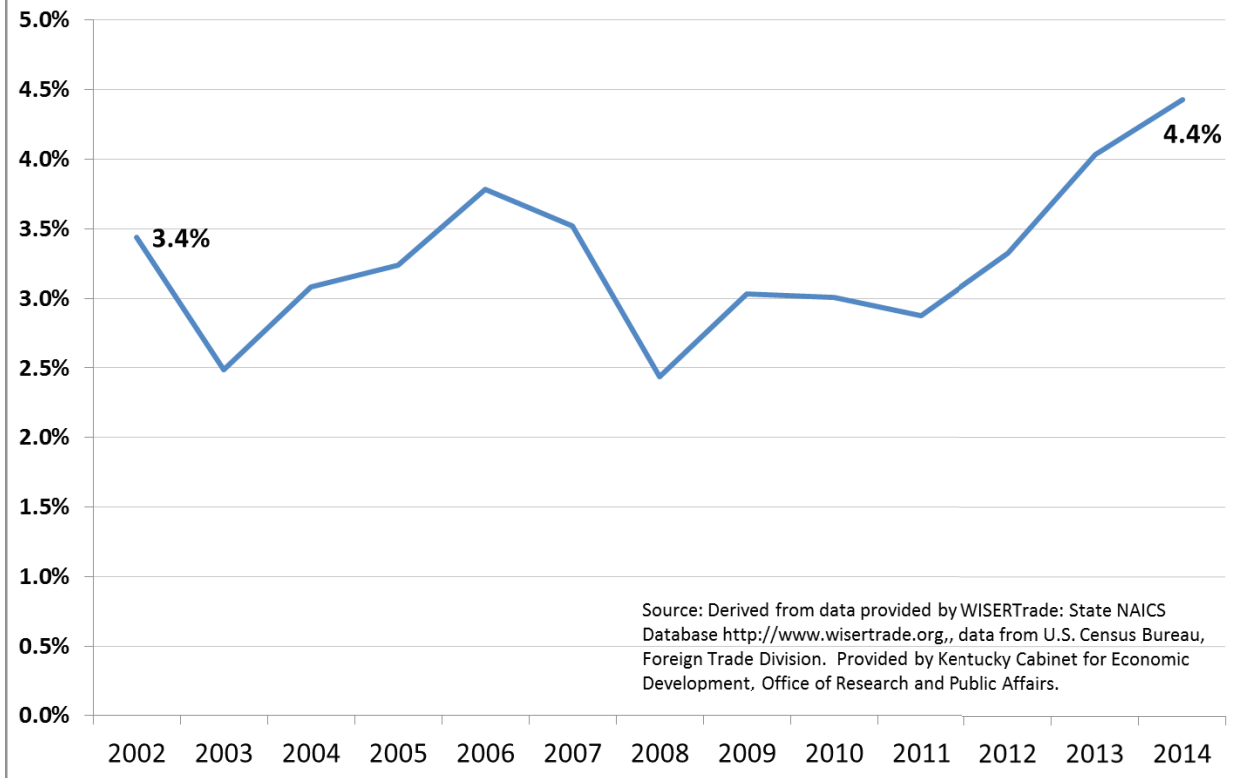
	Export Value	Rank, 2014	Rank, 2002
United States	\$133,770,000,000		
Michigan	\$24,891,000,000	1	1
Texas	\$15,435,000,000	2	3
Ohio	\$10,873,000,000	3	2
South Carolina	\$10,499,000,000	4	5
Indiana	\$8,561,000,000	5	4
Alabama	\$7,783,000,000	6	9
California	\$6,881,000,000	7	12
Illinois	\$6,036,000,000	8	6
Tennessee	\$5,940,000,000	9	9
Kentucky	\$5,922,000,000	10	7
Georgia	\$2,356,000,000	14	14
Missouri	\$2,117,000,000	16	8
North Carolina	\$1,703,000,000	18	19
Virginia	\$1,221,000,000	21	20
Mississippi	\$742,000,000	25	43
West Virginia	\$66,000,000	41	35

Source: Derived from data provided by WISERTrade: State NAICS Database <http://www.wisertrade.org>, data from U.S. Census Bureau, Foreign Trade Division. Provided by Kentucky Cabinet for Economic Development, Office of Research and Public Affairs.

Note: Includes motor vehicles, bodies and trailers, and parts (NAICS 3361-3).

Kentucky's share of all U.S. motor vehicle exports is at an all-time high of 4.4 percent and has been growing steadily since 2008 (Figure 14).

**Figure 14. Kentucky's Share of U.S. Motor Vehicle Exports
2002-2014**



INDUSTRY EMPLOYMENT TRENDS AND LOCATION QUOTIENTS

There are several ways to measure the size, importance, and health of an industry. We have already discussed two measures relevant to the automotive industry, the volume of finished product and the value of exports. Other ways include number of establishments, company revenues, shipments, employees, and payrolls. There are several reputable data sources for many of these measures but, because of survey, reporting and classification differences used by the data sources, the numbers often do not match precisely.

In this section we will focus on employment in Kentucky relative to what is occurring in other states and nationwide. Total employment numbers are interesting, but since the workforce required to produce a given volume of autos has changed dramatically over the years, analysis should take the overall context into account.

Therefore, in this section we will examine state level employment trends over time for our group of bordering states and other southeastern states. We will do so using a concept called the location quotient (described below). But first, since there are multiple sources with different measurement methods, we will discuss the issue of which data we chose to use.

Table 5. Comparison of Data Sources for Establishments and Employment in the Kentucky Automotive Industry

Motor Vehicle Assembly & Chassis Manufacturing						Motor Vehicle Body and Trailer Manufacturing						Motor Vehicle Parts Manufacturing					
NAICS 3361						NAICS 3362						NAICS 3363					
County	Quarterly Census of Business Patterns	Economic Census	Employment & Wages	IMPLAN®	Select Kentucky	County	Quarterly Census of Business Patterns	Economic Census	Employment & Wages	IMPLAN®	Select Kentucky	County	Quarterly Census of Business Patterns	Economic Census	Employment & Wages	IMPLAN®	Select Kentucky
Establishments						Establishments						Establishments					
1998	9	-	7	-	-	24	-	32	-	-	-	123	-	140	-	-	1998
1999	10	-	8	-	-	23	-	30	-	-	-	128	-	151	-	-	1999
2000	9	-	8	-	-	23	-	30	-	-	-	123	-	153	-	-	2000
2001	10	-	9	-	-	20	-	29	-	-	-	132	-	155	-	-	2001
2002	11	11	10	-	-	22	28	31	-	-	-	137	138	164	-	-	2002
2003	12	-	10	-	-	25	-	27	-	-	-	133	-	162	-	-	2003
2004	11	-	10	-	-	27	-	28	-	-	-	145	-	170	-	-	2004
2005	13	-	9	-	-	23	-	27	-	-	-	151	-	185	-	-	2005
2006	12	-	9	-	-	22	-	28	-	-	-	153	-	191	-	-	2006
2007	11	10	9	-	-	23	24	28	-	-	-	153	165	190	-	-	2007
2008	11	-	11	-	-	25	-	33	-	-	-	161	-	180	-	-	2008
2009	11	-	11	-	-	21	-	29	-	-	-	155	-	176	-	-	2009
2010	9	-	10	-	4	21	-	28	-	-	14	147	-	174	-	-	2010
2011	11	-	9	-	4	20	-	26	-	-	14	142	-	178	-	-	2011
2012	9	9	9	-	4	21	21	24	-	-	14	147	146	171	-	-	2012
2013	-	-	11	-	4	-	-	26	-	-	14	-	-	179	-	-	2013
2014	-	-	-	-	4	-	-	-	-	-	14	-	-	-	-	-	2014
Employment						Employment						Employment					
1998	17,657	-	18,290	-	-	1,201	-	2,064	-	-	-	24,612	-	28,235	-	-	1998
1999	18,995	-	19,815	-	-	1,212	-	2,308	-	-	-	25,908	-	30,461	-	-	1999
2000	20,273	-	20,426	20,092	-	1,000-2,499	-	2,598	2,523	-	-	27,506	-	32,220	27,170	-	2000
2001	19,564	-	20,180	-	-	1,000-2,499	-	2,580	-	-	-	28,362	-	32,194	-	-	2001
2002	19,216	18,589	19,741	-	-	500-999	1,649	2,523	-	-	-	25,612	27,419	31,187	-	-	2002
2003	18,535	-	19,573	-	-	1,742	-	2,590	-	-	-	27,418	-	30,631	-	-	2003
2004	10,000-24,999	-	17,873	-	-	1,794	-	2,790	-	-	-	28,990	-	30,962	-	-	2004
2005	17,442	-	17,399	-	-	1,865	-	2,772	-	-	-	30,561	-	33,366	-	-	2005
2006	18,025	-	16,108	-	-	2,045	-	2,654	-	-	-	31,465	-	34,097	-	-	2006
2007	16,243	16,173	14,388	-	-	1,465	1,483	2,108	-	-	-	32,637	33,573	33,905	-	-	2007
2008	15,195	-	12,545	14,469	-	1,468	-	1,684	1,893	-	-	33,824	-	30,609	35,245	-	2008
2009	12,056	-	12,404	11,609	-	1,192	-	1,288	1,257	-	-	26,035	-	23,058	22,854	-	2009
2010	12,511	-	11,800	12,323	12,398	1,257	-	1,316	1,256	1,324	-	24,330	-	23,311	22,664	27,531	2010
2011	12,681	-	11,177	11,166	13,727	1,264	-	1,626	1,626	1,234	-	24,310	-	25,405	25,543	29,660	2011
2012	13,760	15,748	14,426	14,661	16,931	1,373	1,000-2,499	1,831	1,880	1,527	-	25,886	26,406	29,044	29,776	34,962	2012
2013	-	-	15,606	16,105	17,188	-	-	1,905	1,872	1,589	-	-	-	31,016	30,302	37,007	2013
2014	-	-	-	-	17,191	-	-	-	-	1,607	-	-	-	-	-	38,874	2014

Sources: U.S. Census Bureau, U.S. Bureau of Labor Statistics, IMPLAN® Group LLC, and Kentucky Cabinet for Economic Development.

EMPLOYMENT DATA ISSUES

Table 5 presents data on establishments and employment from five different (though sometimes related) sources – the Federal government’s County Business Patterns, Economic Census, Quarterly Census of Employment and Wages, private economic impact software company IMPLAN®, and the Select Kentucky database of the Kentucky Cabinet for Economic Development (KCED).

The three federal sources are the primary sources for state level industry data on employment and payroll. County Business Patterns (CBP) is produced by the US Census Bureau and is based primarily on company filings of payroll taxes, including Social Security, at the federal level. The Quarterly Census (QCEW) is compiled by the U.S. Bureau of Labor Statistics, and is based on company payments of unemployment insurance taxes through state workforce agencies. Aside from being based on different data they also have different master lists of business establishments.

The County Business Patterns establishment list is derived from a database called the Business Register, which consolidates and links administrative, Census, and survey data. Information for single establishment businesses is updated continuously, while information for establishments of multi-unit companies is updated annually based on responses to the Census Bureau’s Company Organization Survey and Annual Survey of Manufactures. The QCEW establishment list relies upon the state workforce agencies, and multi-establishment data is derived from quarterly Multiple Worksite reports filed by companies. However, not all multi-unit companies file the reports and some aggregate establishments within them.

The other data source, the Economic Census, produced by the U.S. Census Bureau, also relies on the Business Register and is the most comprehensive, but is only available every five years (years ending in the numbers 2 and 7). The IMPLAN® database uses a combination of the QCEW (the basic structure), CBP (to help estimate non-disclosed data), and controls the totals to information in the U.S. Bureau of Economic Analysis’ Regional Economic Accounts. Select Kentucky relies on annual surveys of establishments.

For establishments there is broad agreement among the data source, though for both body and trailer manufacturing and parts manufacturing the QCEW reports more establishments than the other sources, and the Select Kentucky database has fewer establishments across the board. The latter is most likely due to KCED not surveying some of the smallest establishments or some multi-location businesses reporting combined data.

The employment differences are more important for this report. Differences in employment totals can sometimes be attributed to how the statistic is reported. CBP reports employees as of March 12 each year, the Economic Census averages employees at four points in the year, and the QCEW is an average of twelve monthly values. Employment volatility over the course of a year can result in very different estimates. The QCEW employment numbers are generally higher than CBP or the Economic Census for the assembly and parts subsectors except during the recession and recovery years 2007-2011 (the gap for bodies and trailers shrinks during this time). As might be expected, the IMPLAN® data tracks the QCEW very well. The Select Kentucky data for the assembly and parts subsectors, especially in the most recent years, is higher than the other sources. The difference is most pronounced for parts manufacturing, amounting to between 17 and 20 percent of the QCEW employment (or 14 to 17 percent of the Select Kentucky employment).

We believe that this is the result of the recent trend in the industry towards variable staffing. In order to better manage the ebb and flow of business volume, some workers are hired on a temporary basis, most often through an outside staffing agency. In the formal federal government statistics these workers are not formally employees of the manufacturer, but of the staffing agency. Anecdotal evidence suggests that such workers may make up about 15 percent of the workforce in the state’s motor vehicle parts manufacturing sector. We believe it is likely that when answering the KCED survey plant managers are often reporting the total workforce regardless to who actually employs the worker.

Another data issue arising from comparative research is making sure data is consistent across geographies. Table 6 presents some self-reported establishment and employment figures from state auto industry associations and state government sponsored research. At first glance they might seem comparable, but closer inspection reveals problems for comparability.

The Kentucky data comes from the Select Kentucky database and includes all businesses with a minimum of ten employees that have ongoing relationships with the OEMs and suppliers within the state. The Alabama and Georgia figures come from Georgia Power’s Community and Economic Development database. The numbers in the table for those states appear to be comparable to Kentucky, but the data reported by Georgia Power for South Carolina and Mississippi are at odds with the QCEW (fewer establishments when we should expect more), and undercount both

establishments and employment for Tennessee (the former is much lower than the QCEW while the latter is only a bit higher than the QCEW). The upshot is that when compared to Kentucky's database, we do not know how comparable the databases are for other states.

The Tennessee data in the table are likely compiled in a process much like Kentucky's, but the establishment figure is so high that the comparability is called into question. There is no source cited for the Mississippi figures in the table, though they likely come from the Mississippi Development Authority, a state agency. Though we think that the Kentucky Cabinet for Economic Development has done a very good job here (and we use it to make many maps below), without knowing how comprehensive the various databases are or the criteria used to associate a business with the automotive industry, this type of data from industry associations should be viewed with caution and not used to make direct comparisons.

**Table 6. Total Auto-Related Businesses in the Southeast
Self-Reported Figures from State Industry Associations**

State	Establishments	Employment
Kentucky	470	85,552
Tennessee	1,000	115,939
Alabama	201	49,389
Mississippi	200	40,000
Georgia	296	40,385
South Carolina	319	30,000

Sources: Tennessee Automotive Manufacturers Association. Official organization brochure. 2014.

Office of the Governor, Mississippi. "Governor Bryant Proclaims Automotive Industry Week in Mississippi." Feb. 27, 2015.

Georgia Power. "Automotive Manufacturing. Georgia: The Epicenter of Growth in the Southeastern Auto Corridor." 2014.

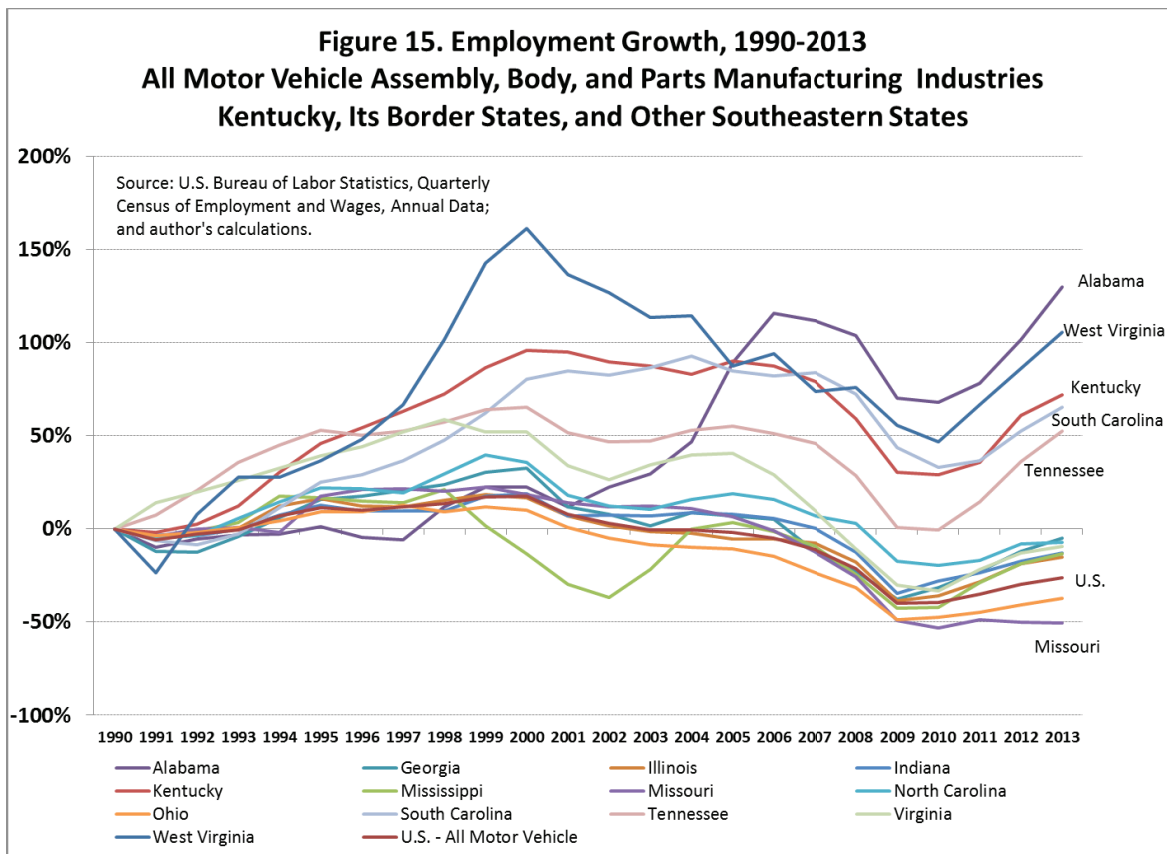
Moore School of Business, University of South Carolina (USC). "The Economic Impact of South Carolina's Automotive Cluster." Jan. 2011.

In the following charts we use the QCEW because it is the most consistent, allows us to have the longest history, and conforms best to the IMPLAN® data we will be using later to assess the overall economic importance of the industry.

MOTOR VEHICLE MANUFACTURING EMPLOYMENT TRENDS

Figure 15 shows employment growth since 1990 for the entire motor vehicle manufacturing sector for the 13 comparison states plus the U.S. total. Kentucky had the third highest growth rate, with 72 percent more jobs since 1990 (48,527 versus 28,193).

Nationally, industry employment dropped 26 percent in the period. In total, motor vehicle manufacturing jobs in the thirteen peer states was down nearly six percent in 2013 from 1990 levels.



LOCATION QUOTIENTS

A location quotient is a way to quantify the relative concentration of employment in an industry in a given location as compared to the national average. It is the percentage of local employment in a given industry divided by the percentage of employment nationally in that industry.

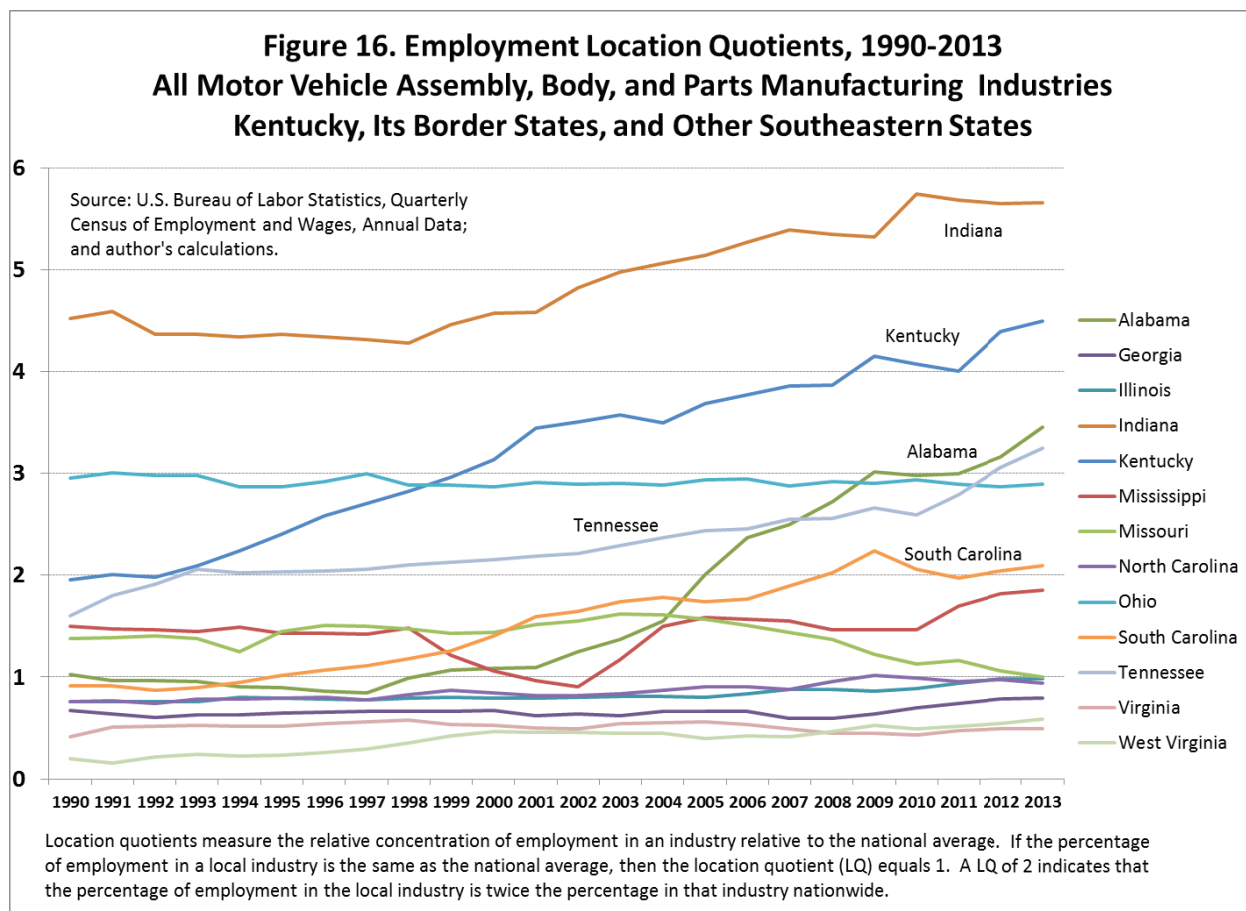
For example, if 10 percent of all employment in a state is in NAICS code 3361 and that is also the case for the nation as a whole, then that state's location quotient is equal to one for motor vehicle parts manufacturing. If the local percentage of all employment is 20 percent, then the location quotient is two. The latter indicates that locally employment in the industry is twice as concentrated as it is nationally.

Location quotients are a good way to see how unique a given area is and where particular industries tend to cluster spatially. Location quotients (LQs) tell a different story than job numbers or job growth. Industries with high LQs are typically (but not always) export-oriented industries, which are important because they bring money into the region. Industries which have both high LQs and relatively high total job numbers typically form a region's economic base and create jobs in other dependent industries and services.

Another way to think of LQs is that they are an indicator of regional comparative advantage. A high LQ implies that there are factors influencing firm location decisions that are leading to a higher than normal presence of the industry in the local economy. These factors could be geographic, resource or human capital-based, the prior presence of other firms, or any number of other factors.

In trade theory a country does not have to have the best or cheapest version of a product to engage in trade, but it will find that it is easiest and best to trade in the products it does best, even if other places do those things better. Similarly, a region can have a very high LQ without having the most employment in an industry. The high LQ indicates that there are reasons firms are locating in that state and making it an export platform.

Figure 16 shows employment location quotients over the 1990 to 2013 period for the thirteen peer states.



Kentucky has the second highest LQ among its peer states, rising from just under two in 1990 to 4.5 in 2013. Since Kentucky also has the fourth most total jobs in the industry among the peers, the Commonwealth has a significant and growing industry cluster in motor vehicles. The following sections break this down into the industry subsectors, showing that the clustering is strongest in particular aspects of the industry.

ASSEMBLY AND CHASSIS MANUFACTURING (NAICS 3361) JOB AND LQ TRENDS

Figure 17 demonstrates how the “lumpiness” of assembly plant employment can create swings in employment growth. Despite all of Kentucky’s assembly plants being well established prior to 1990, employment still increased 46 percent over 1990 levels. Among the peers, Kentucky ranks second in total assembly plant employment. Nationwide, employment in motor vehicle assembly and chassis manufacturing fell by nearly 30 percent from 1990 to 2013.

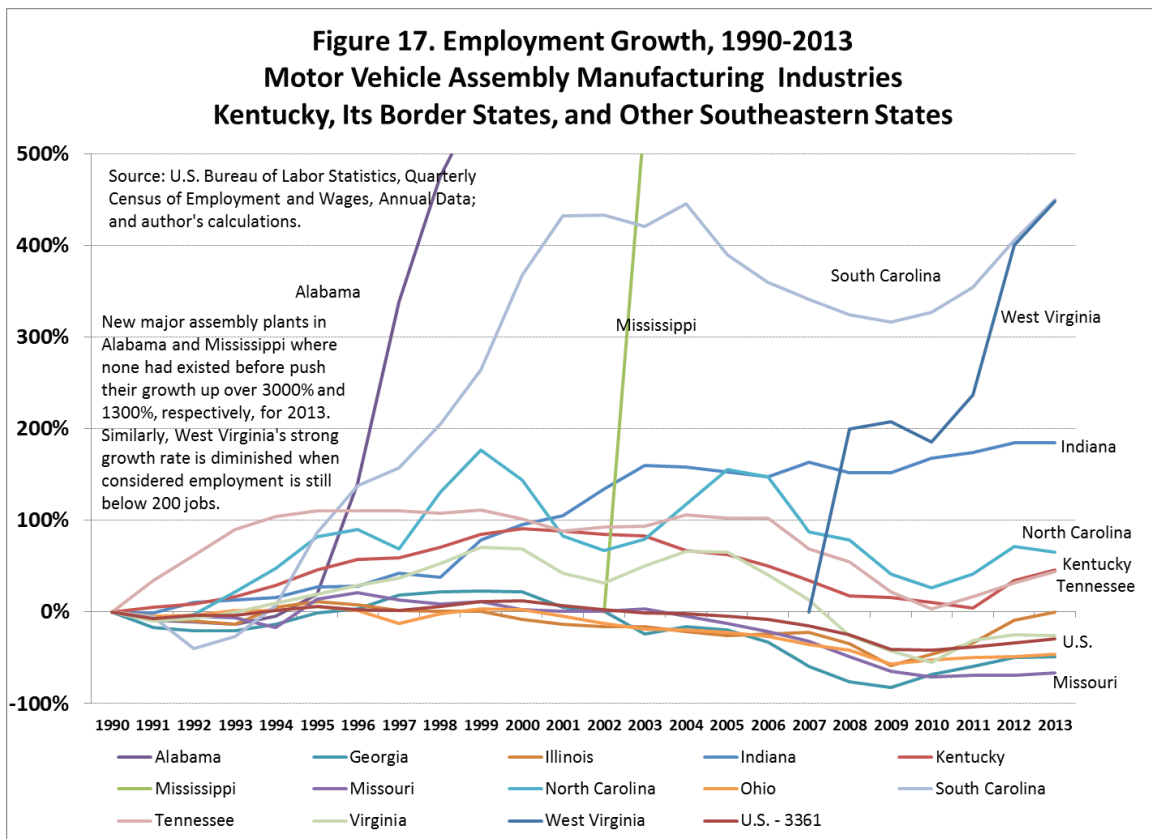
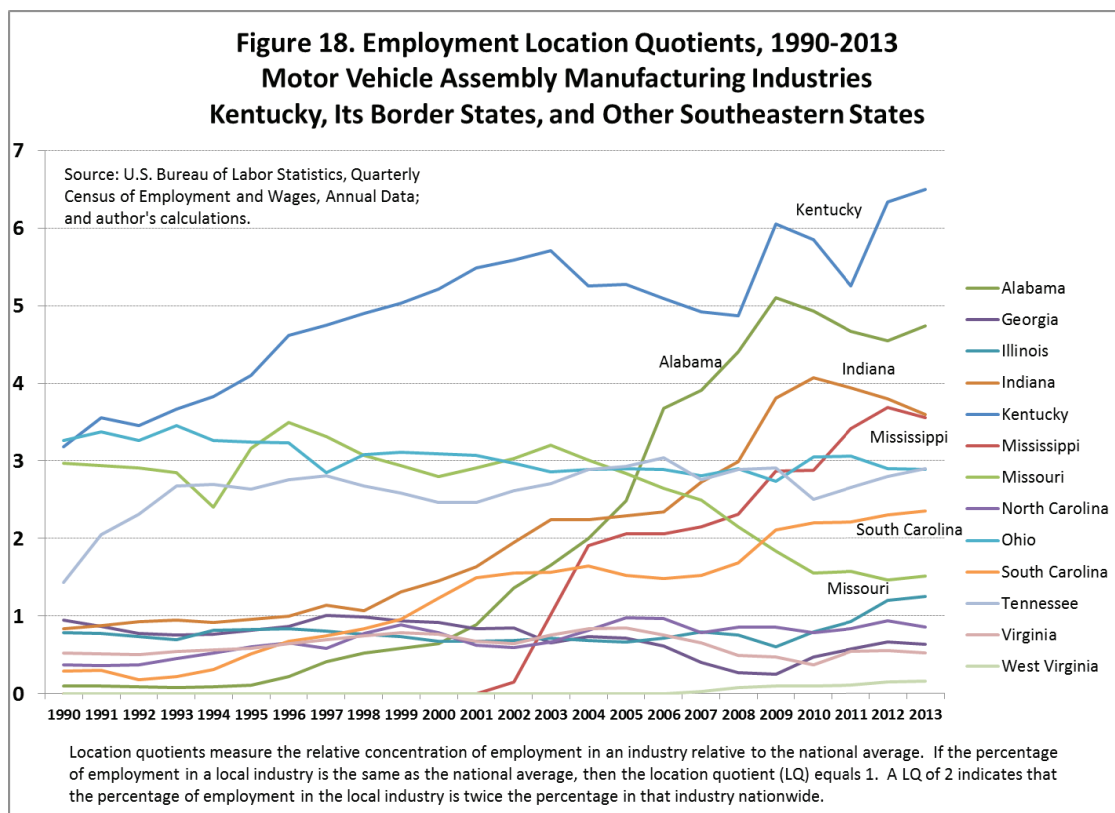


Figure 18 shows the employment location quotients in motor vehicle manufacturing for the 13 states since 1990.

Since 1991 Kentucky has had the highest concentration of assembly plant jobs among the peer states. Currently the industry is 6.5 times more important in the Kentucky economy than it is nationally.



BODY AND TRAILER MANUFACTURING (NAICS 3362) JOB AND LQ TRENDS

Body and trailer manufacturing is the smallest of the three major motor vehicle subsectors, making up just sixteen percent of the industry's employment nationwide. Nationally, employment grew just four percent from 1990 to 2013 in this subsector. But here, too, Kentucky stands out by having experienced 110 percent job growth in the period, third highest among the peer states (Figure 19).

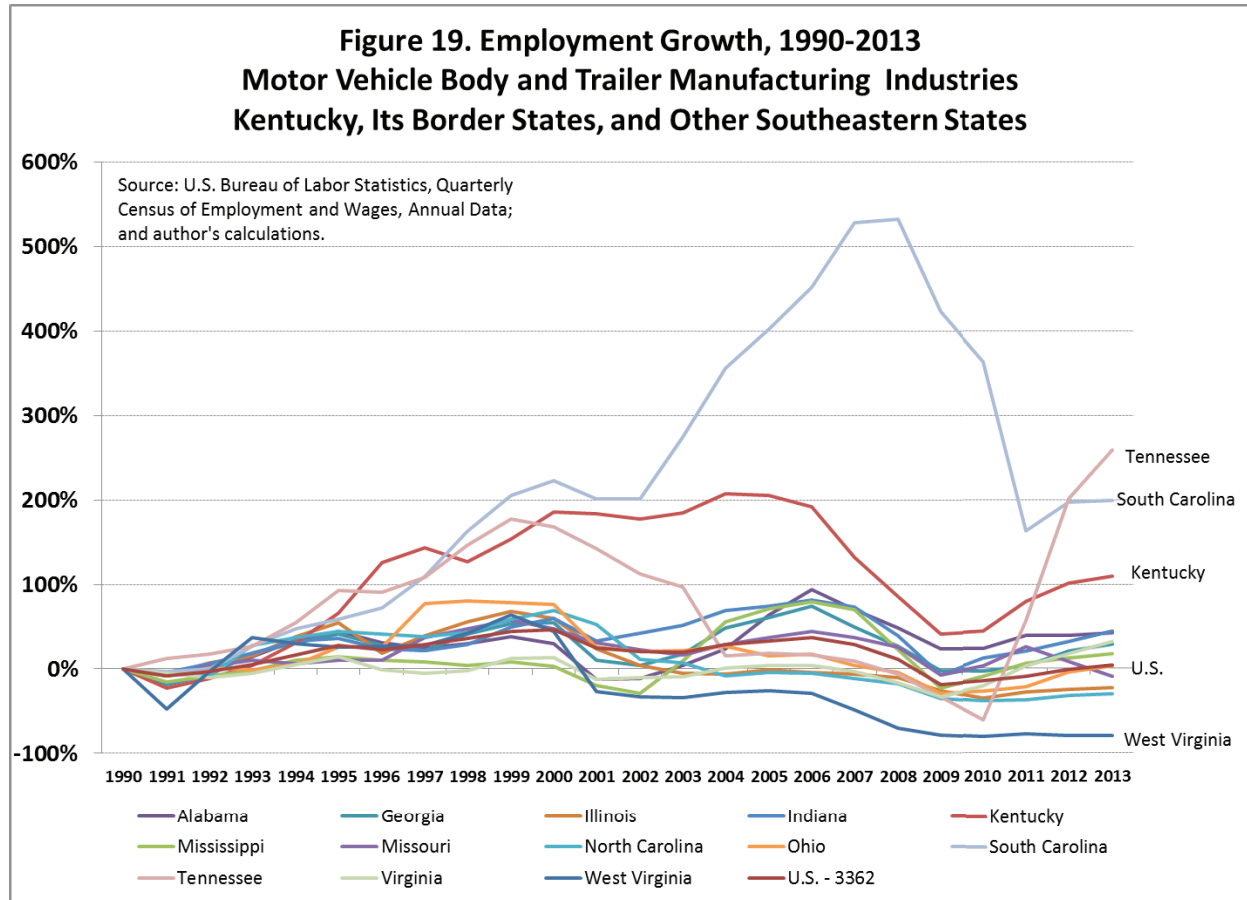
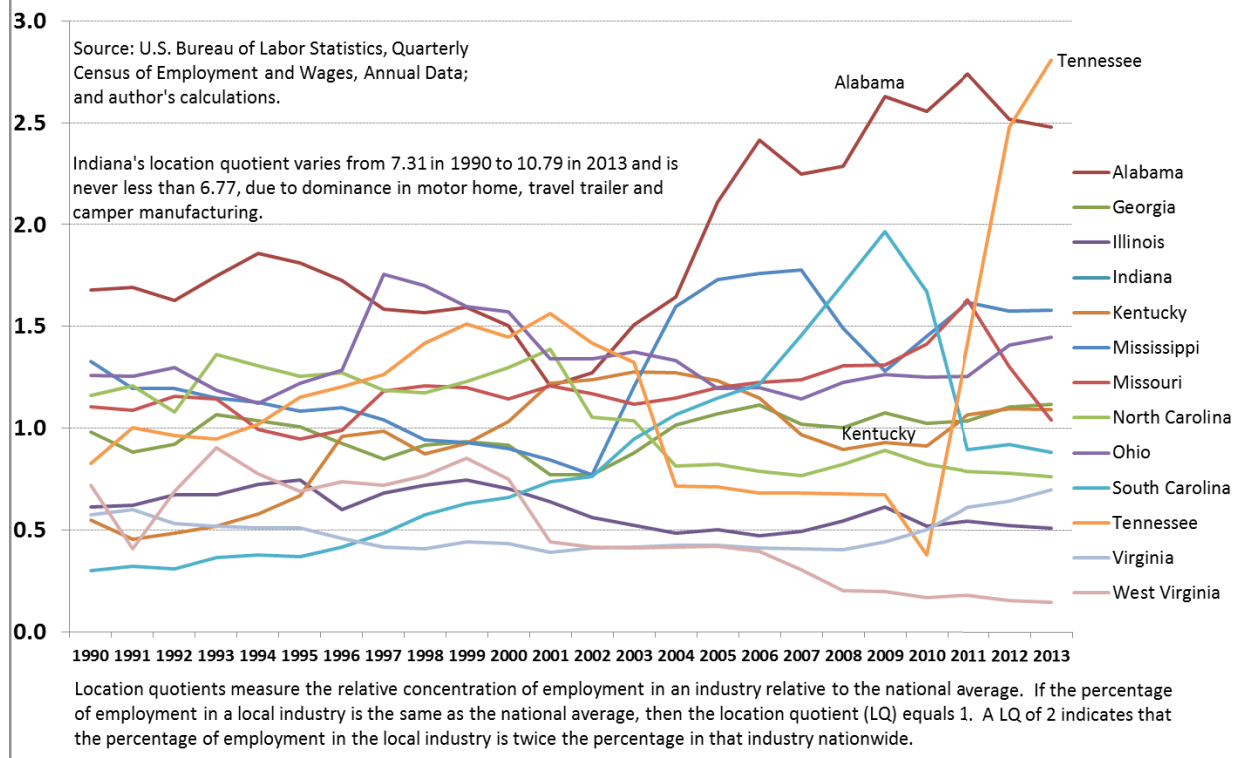


Figure 20 illustrates how just looking at employment growth can be misleading. Despite a high growth rate, KY's LQ of 1.1 indicates the industry sub-sector is not as impactful in terms of competitive advantage or economic contribution as other sub-sectors of automotive manufacturing in Kentucky.

Figure 20. Employment Location Quotients, 1990-2013
Motor Vehicle Body and Trailer Manufacturing Industries
Kentucky, Its Border States, and Other Southeastern States

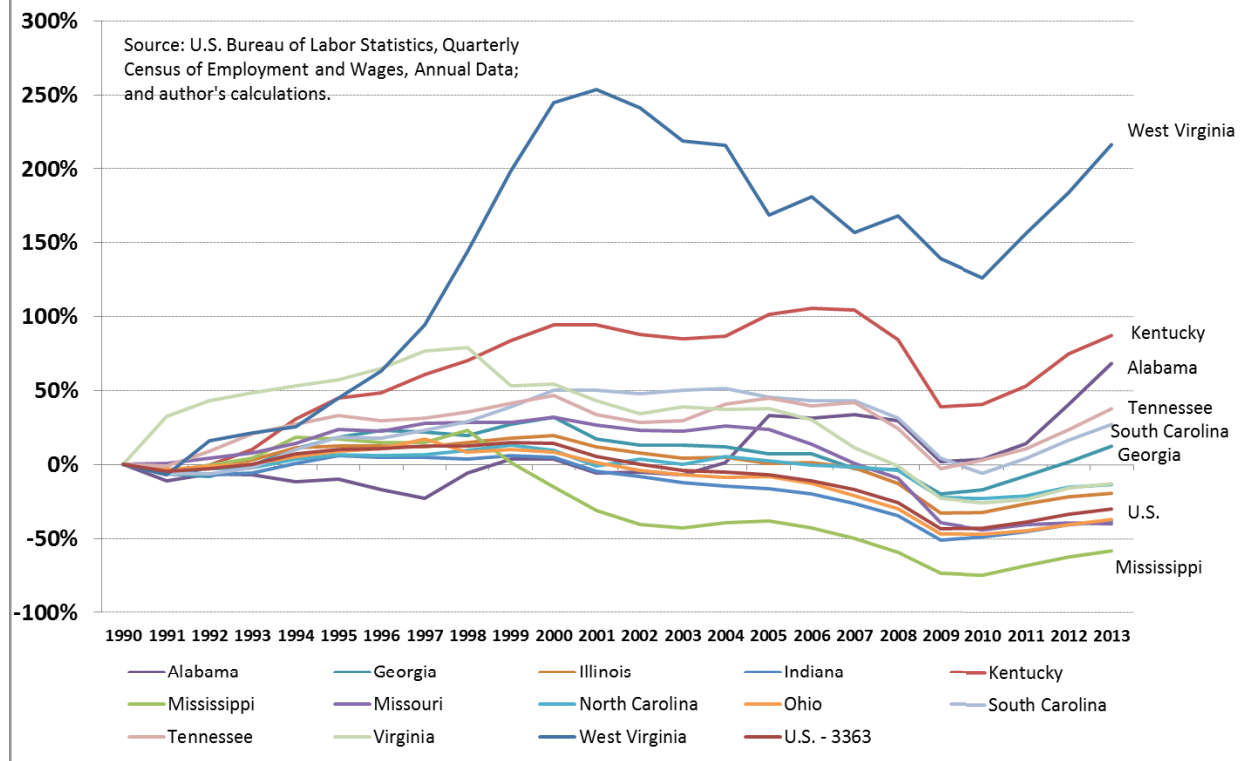


PARTS MANUFACTURING (NAICS 3363) JOB AND LQ TRENDS

Jobs in motor vehicle parts manufacturing establishments more than tripled in West Virginia from 1990 to 2013, but that was from a very low base of about 700 jobs. Kentucky had the second best employment growth during the time period, 87 percent, starting with the sixth most parts manufacturing jobs among the peer states and finishing with the fourth most. This was a far cry from the national situation, which saw a decrease of 30 percent in parts manufacturing jobs during the period.

Of the peers, Indiana (-38%), Mississippi (-58%), Missouri (-40%), and Ohio (-37%) all lost a larger percentage of their automotive parts manufacturing jobs than that. Mississippi, which experienced terrific employment growth and a big positive change in the LQ for assembly plants, saw its parts jobs fall from 12,000 in 1990 to just 5,000 in 2013 (Figure 21).

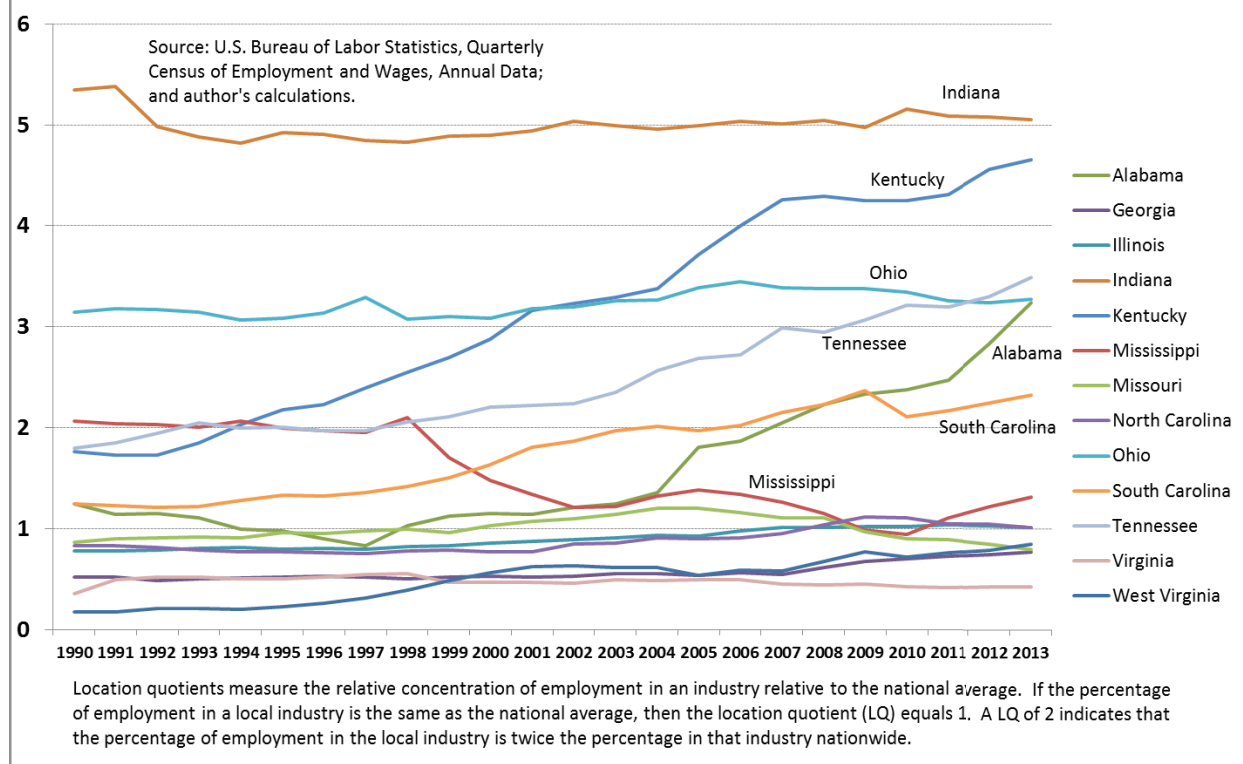
Figure 21. Employment Growth, 1990-2013
Motor Vehicle Parts Manufacturing Industries
Kentucky, Its Border States, and Other Southeastern States



This is a reminder that the location of an assembly plant does not guarantee that suppliers will cluster around the assembly plant. There are many other factors involved, including the fact that many suppliers have contracts with multiple OEMs, so being more centrally located is an asset. Mississippi, being on the edge of the region yet still far from the Texas assembly plants, may be at a competitive disadvantage in this regard.

As shown in Figure 22, Kentucky's LQ for parts manufacturing has risen from 1.8 to 4.7 since 1990. Kentucky is now approaching the kind of industry concentration that Indiana has historically had in auto parts manufacturing due to its proximity to the large assembly plants in Michigan and Ohio. Among the five states with location quotients above three for parts manufacturing, Interstate 65 runs right through the middle of four states.

Figure 22. Employment Location Quotients, 1990-2013
Motor Vehicle Parts Manufacturing Industries
Kentucky, Its Border States, and Other Southeastern States



BODY MANUFACTURING (NAICS 336211) JOB AND LQ TRENDS

The following nine sections look at the individual body and parts supplier industries. Knowing which supplier industries are located where will help in assessing the strengths and weaknesses of the Commonwealth along the automotive supply chain. These sections include twelve states, and omit West Virginia. West Virginia does not have very much employment in these industry subsectors. As a result, the Bureau of Labor Statistics does not disclose the data to protect the privacy of the manufacturers.

Figures 23 and 24 show the employment and location quotient trends from 2001 to 2013 for the thirteen comparison states in motor vehicle body manufacturing. During the time period, two primary trends emerged. The U.S. as a whole lost 30 percent of its jobs in this industry, with Kentucky mirroring the national trend. There were some limited jobs gained during this time, however, occurring solely in the southeastern states again indicating a shift of the industry southward. Kentucky's LQ is slightly above the national average at 1.7.

Figure 23. Employment Growth, 2001-2013
Motor Vehicle Body Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States

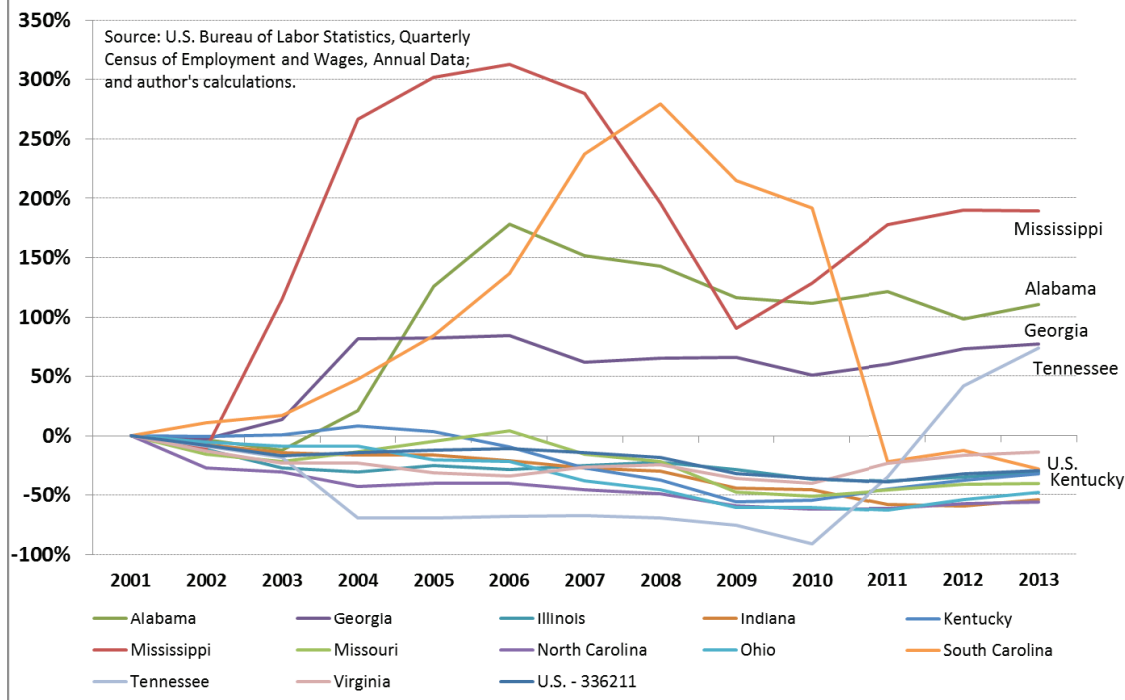
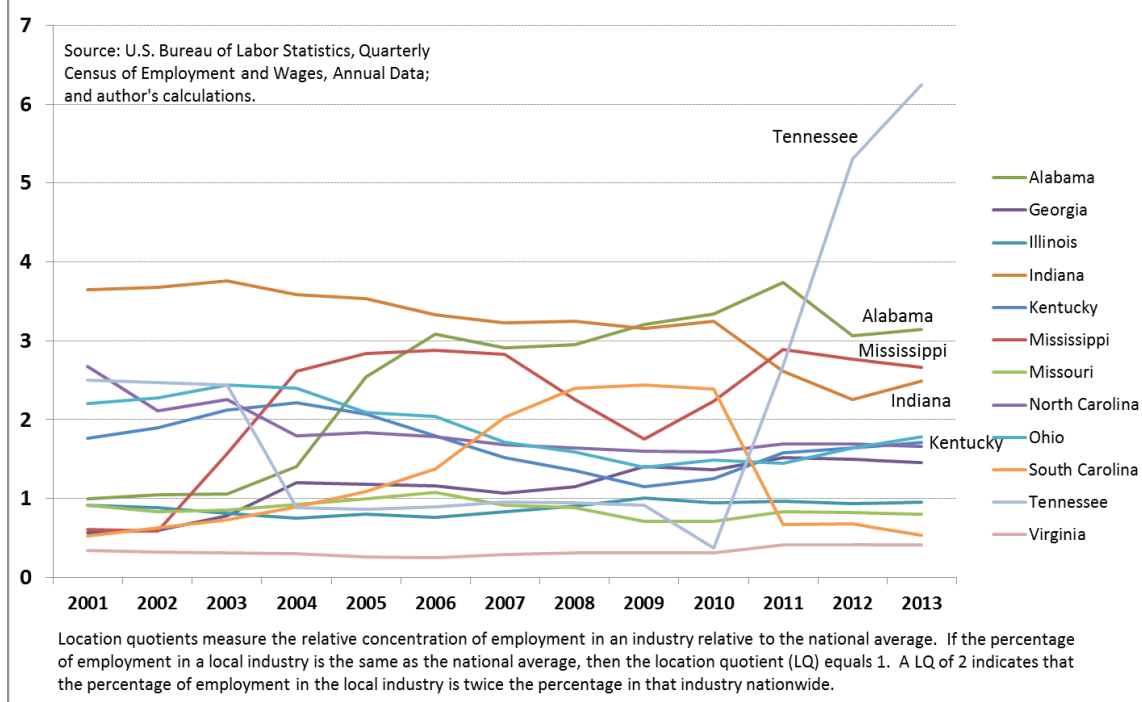


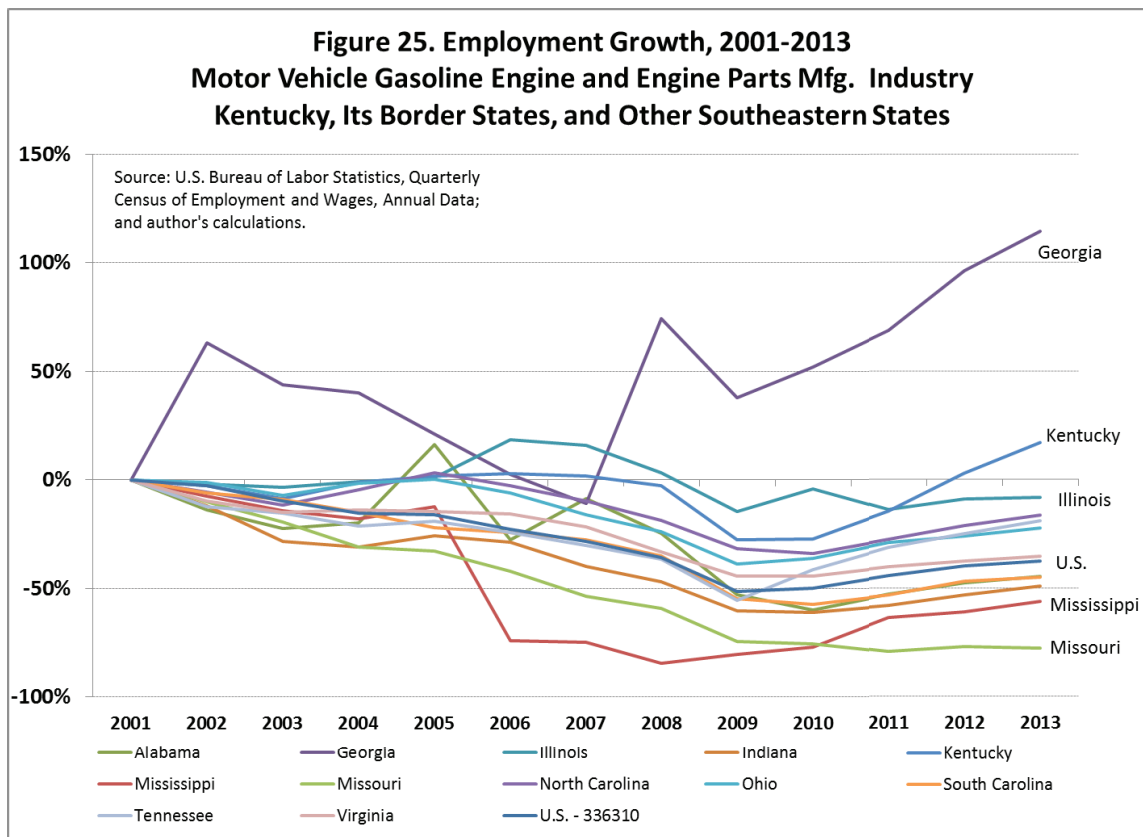
Figure 24. Employment Location Quotients, 2001-2013
Motor Vehicle Body Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States



GASOLINE ENGINE & ENGINE PARTS MFG. (NAICS 336310) JOB & LQ TRENDS

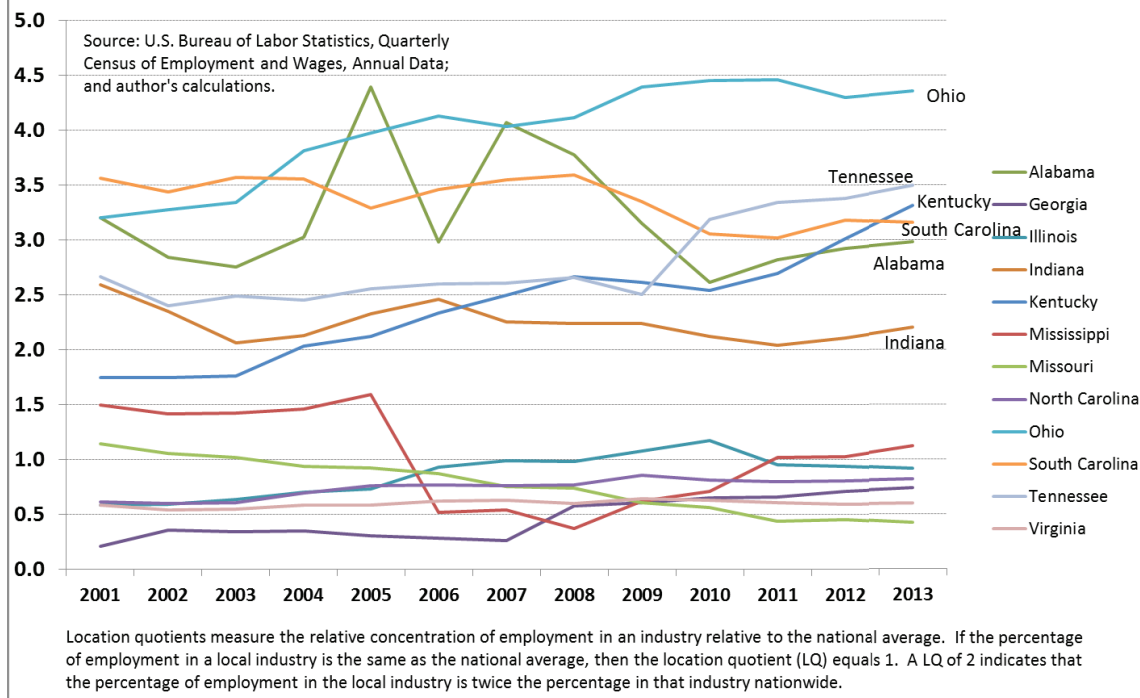
Figures 25 and 26 show the employment and location quotient trends for the gasoline engine and engine parts manufacturing industry. Nationally, employment dropped 37 percent in this industry and most states in the region

were not immune to the trend. Only Kentucky and Georgia gained jobs from 2001 to 2013. Employment in the gasoline engine and parts industry more than doubled in Georgia, but Georgia began the period with the fewest jobs in the industry among the peers (about 600).



The location quotient chart (Figure 26) reveals two tiers of competitiveness in this industry, with Kentucky near the top of the more competitive tier. Also notable is that Kentucky was not part of the more highly concentrated group in 2001. The Commonwealth's LQ has increased from 1.7 in 2001 to 3.3 in 2013.

Figure 26. Employment Location Quotients, 2001-2013
Motor Vehicle Gasoline Engine and Engine Parts Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States



ELECTRICAL & ELECTRONIC EQUIPMENT MFG. (NAICS 336320) JOB & LQ TRENDS

Figures 27 and 28 show the employment and location quotient trends for the electrical and electronic equipment manufacturing industry. Nationally, job losses in this sector of the automotive industry were dramatic, with 55 percent fewer jobs in 2013 than in 2001 (the decline was 53 percent across the 12 regional states). Kentucky was no exception, with total employment in the industry falling 60 percent in the time period. However, its LQ remained fairly steady during the time period. In general, electrical and electronic equipment manufacturers are a bit more geographically dispersed than some of the other types of parts suppliers.

Figure 27. Employment Growth, 2001-2013
Motor Vehicle Electrical and Electronic Equipment Mfg. Industry
Kentucky, Its Border States, and Other Southeastern States

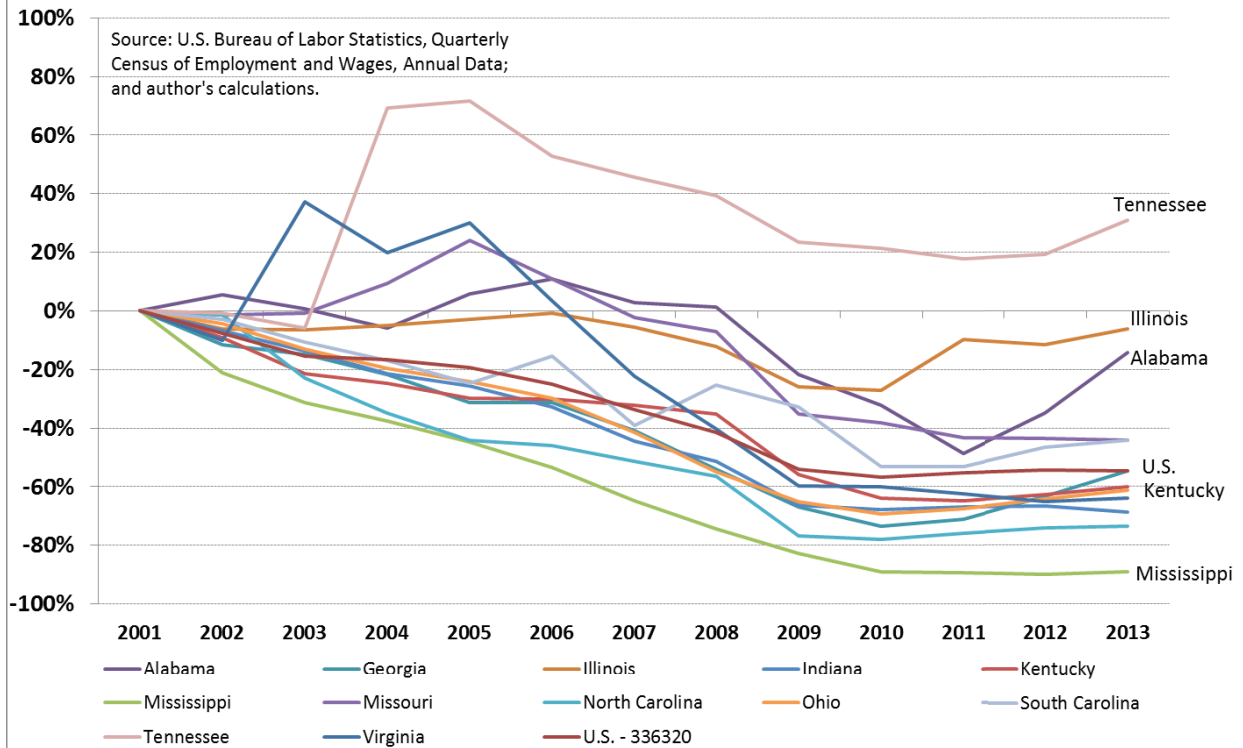
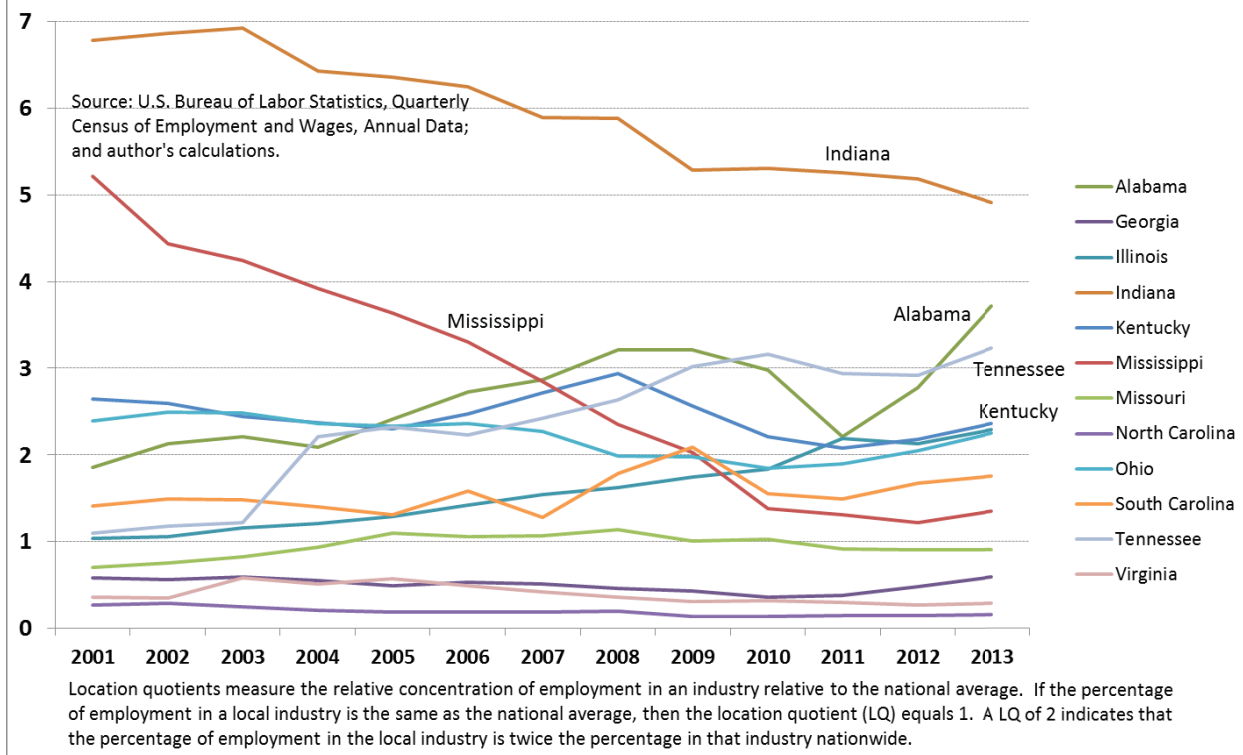


Figure 28. Employment Location Quotients, 2001-2013
Motor Vehicle Electrical and Electronic Equipment Mfg. Industry
Kentucky, Its Border States, and Other Southeastern States



STEERING & SUSPENSION COMPONENTS MFG. (NAICS 336330) JOB & LQ TRENDS

Figures 29 and 30 show the employment and location quotient trends for the steering and suspension components manufacturing industry. Nationally, job losses in this industry were 37 percent in the period. Only four of the peer states that began with significant numbers of employees in the industry posted job gains (Virginia began with just about 120 jobs and Mississippi still only has just 20). Kentucky increased its employment in steering and suspension components by half.

Indiana, which lost 62 percent of its jobs in the industry, fell from being the dominant player. The location quotient chart clearly shows a high and growing degree of concentration in this industry centered firmly in Kentucky. Therefore, steering and suspension components manufacturing has developed into a relative area of strength for the Commonwealth.

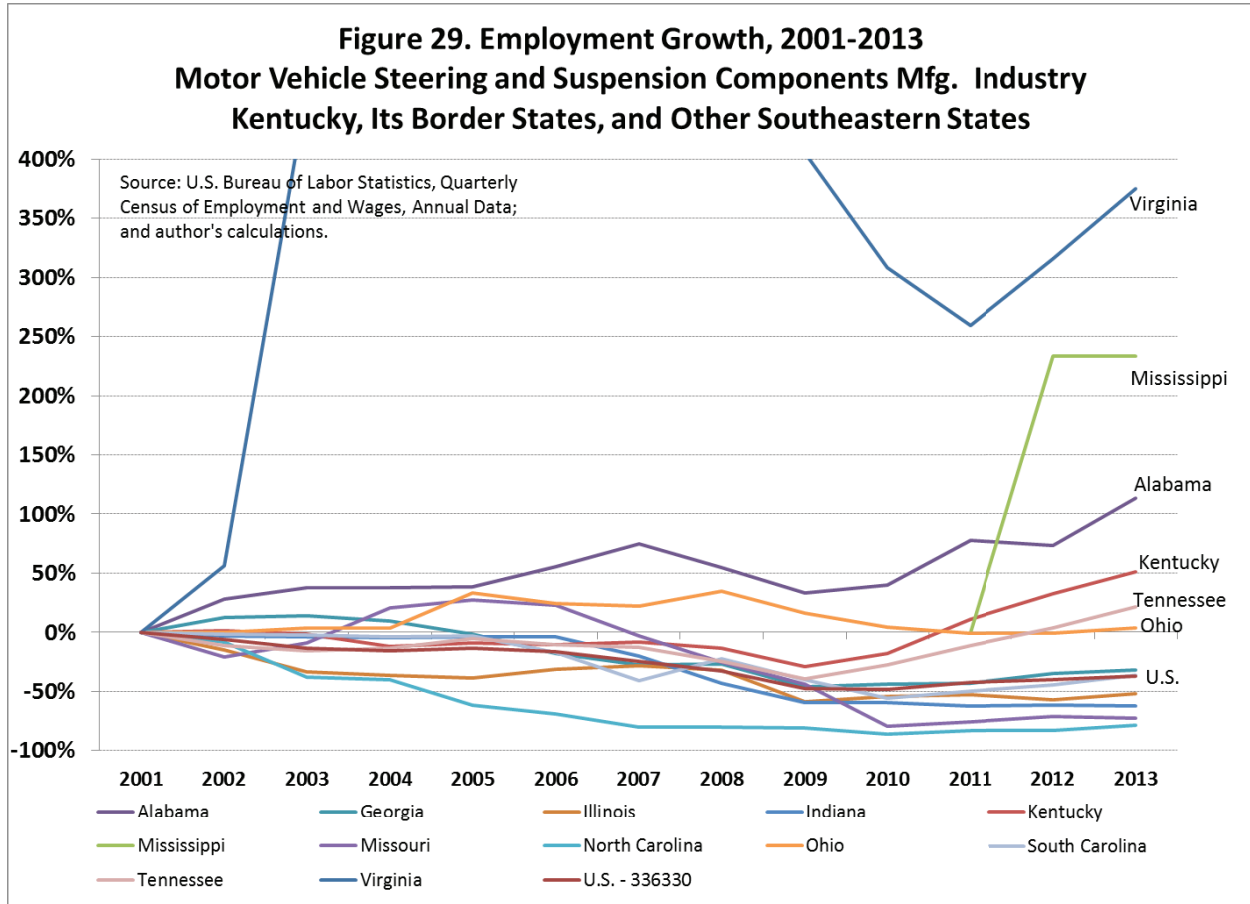
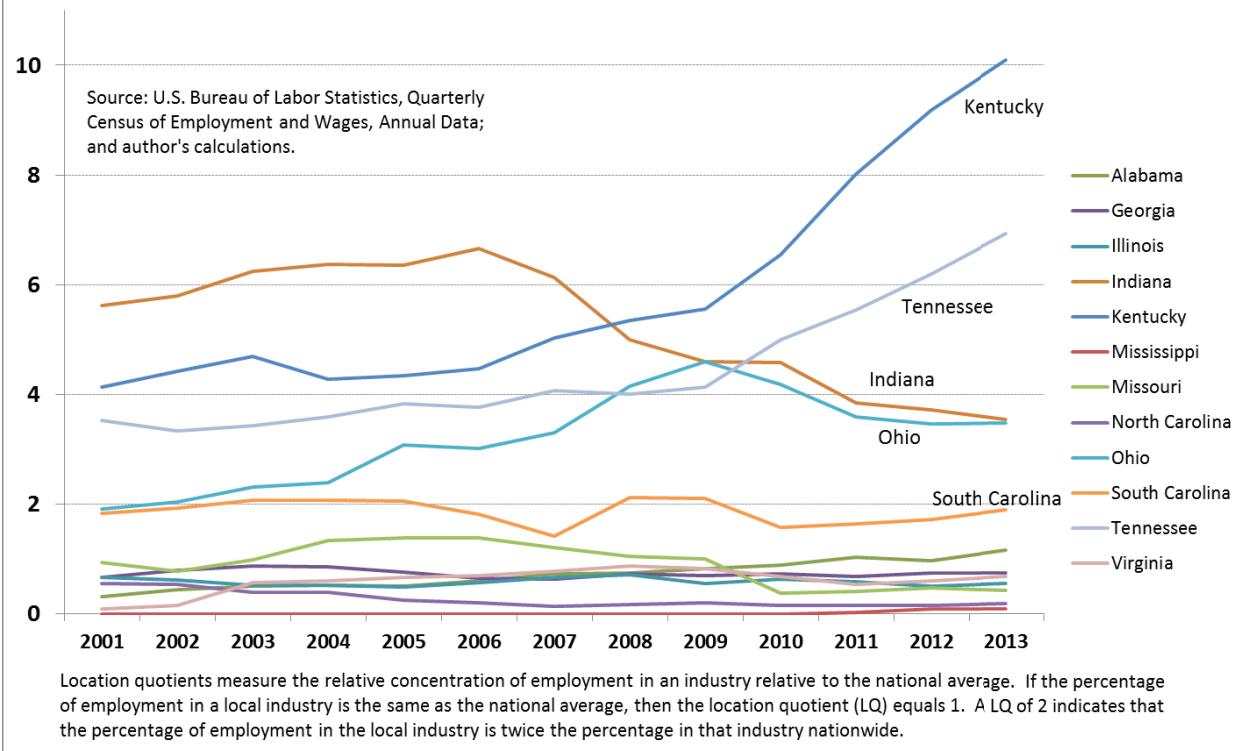


Figure 30. Employment Location Quotients, 2001-2013
Motor Vehicle Steering and Suspension Components Mfg. Industry
Kentucky, Its Border States, and Other Southeastern States



BRAKE SYSTEM MANUFACTURING (NAICS 336340) JOB & LQ TRENDS

Figures 31 and 32 show the employment and location quotient trends for the brake system manufacturing industry. Nationally, job losses in this industry were 49 percent over the period 2001-2013. Kentucky, therefore, did relatively well, losing about 20 percent of jobs in the industry. Kentucky now has the most jobs in the industry in the region, passing Ohio.

Brakes systems manufacturing is another industry that has a very significant presence in a small number of states, in this case Kentucky and South Carolina. Kentucky's LQ is 10.4, while South Carolina's is 8.8. As with steering and suspension components, Kentucky seems to have a very strong competitive advantage in brake systems.

Figure 31. Employment Growth, 2001-2013
Motor Vehicle Brake System Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States

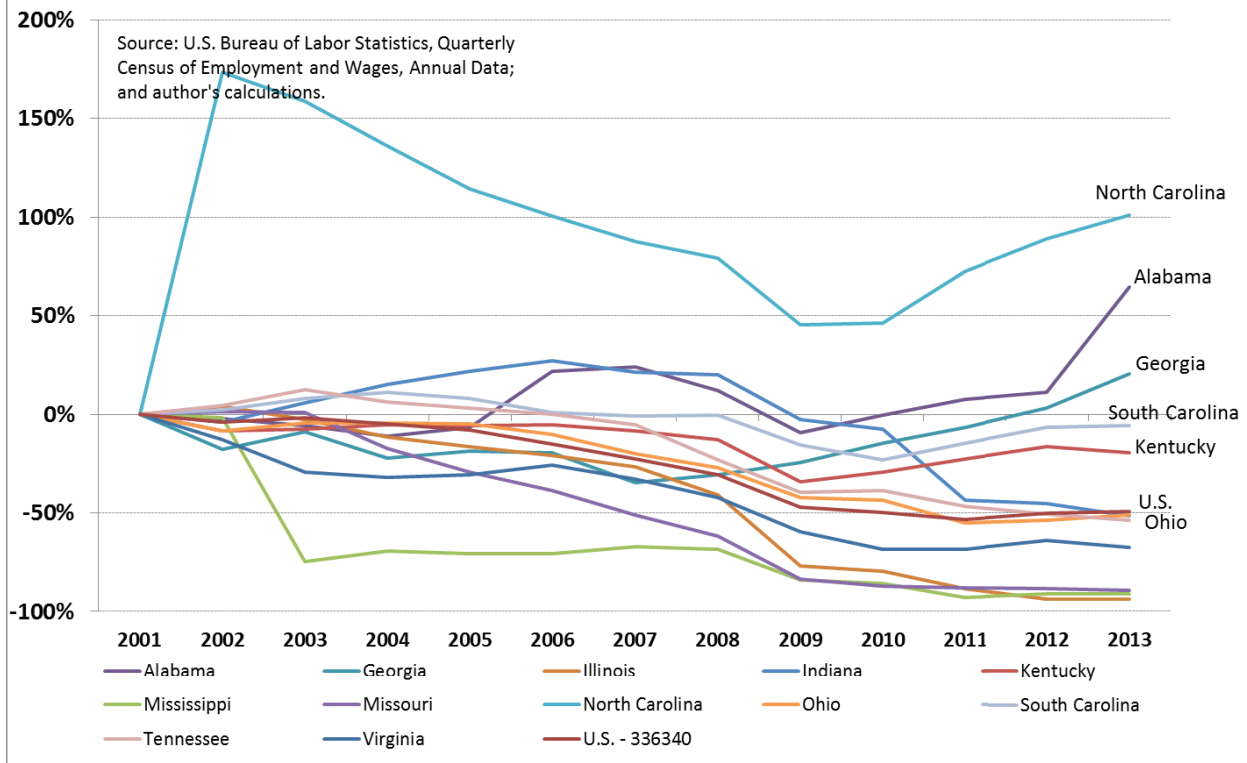
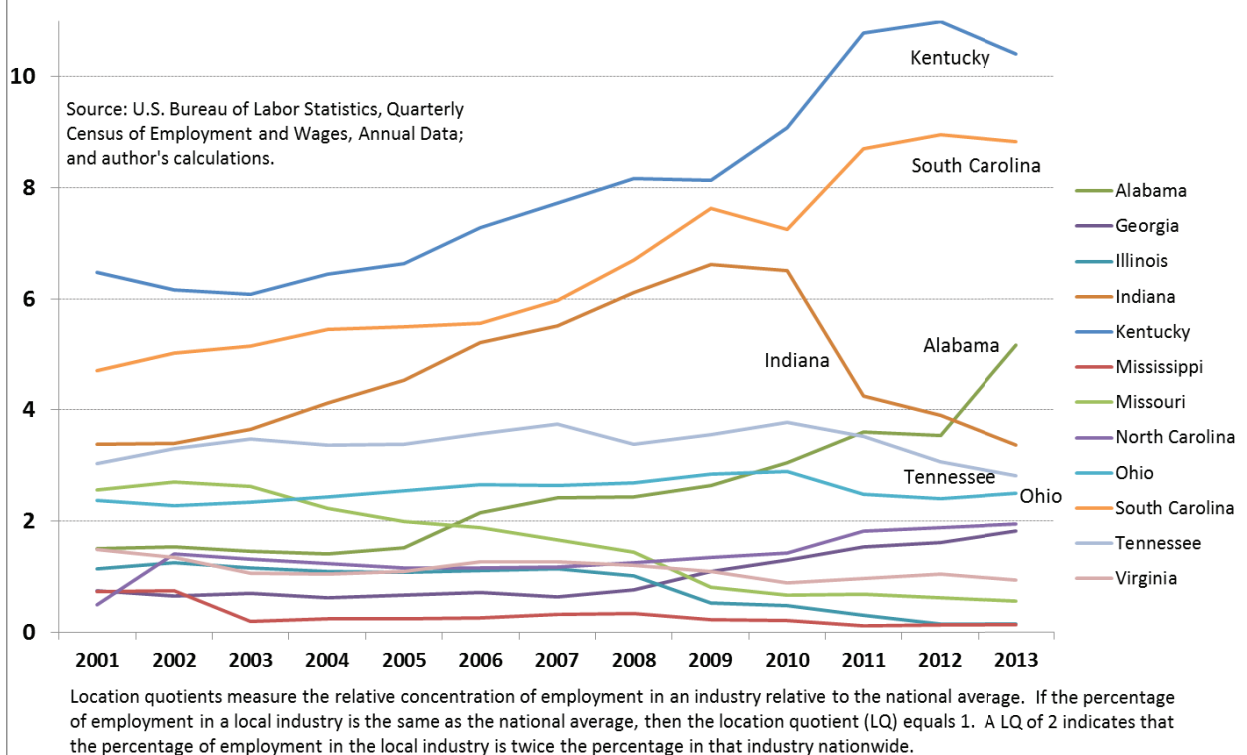


Figure 32. Employment Location Quotients, 2001-2013
Motor Vehicle Brake System Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States



TRANSMISSION & POWER TRAIN PARTS MFG. (NAICS 336350) JOB & LQ TRENDS

Figures 33 and 34 show the employment and location quotient trends for the transmission and power train parts manufacturing industry. Nationally, job losses in this industry were 27 percent from 2001 to 2013.

Alabama, Mississippi, and South Carolina all increased employment in this industry by 2.5 to 3.5 times, but began the period with the three lowest numbers of jobs in the industry among the peer states. Most of the southeast region did better than the U.S. as a whole, and Kentucky saw a 17 percent increase in transmission and power train jobs.

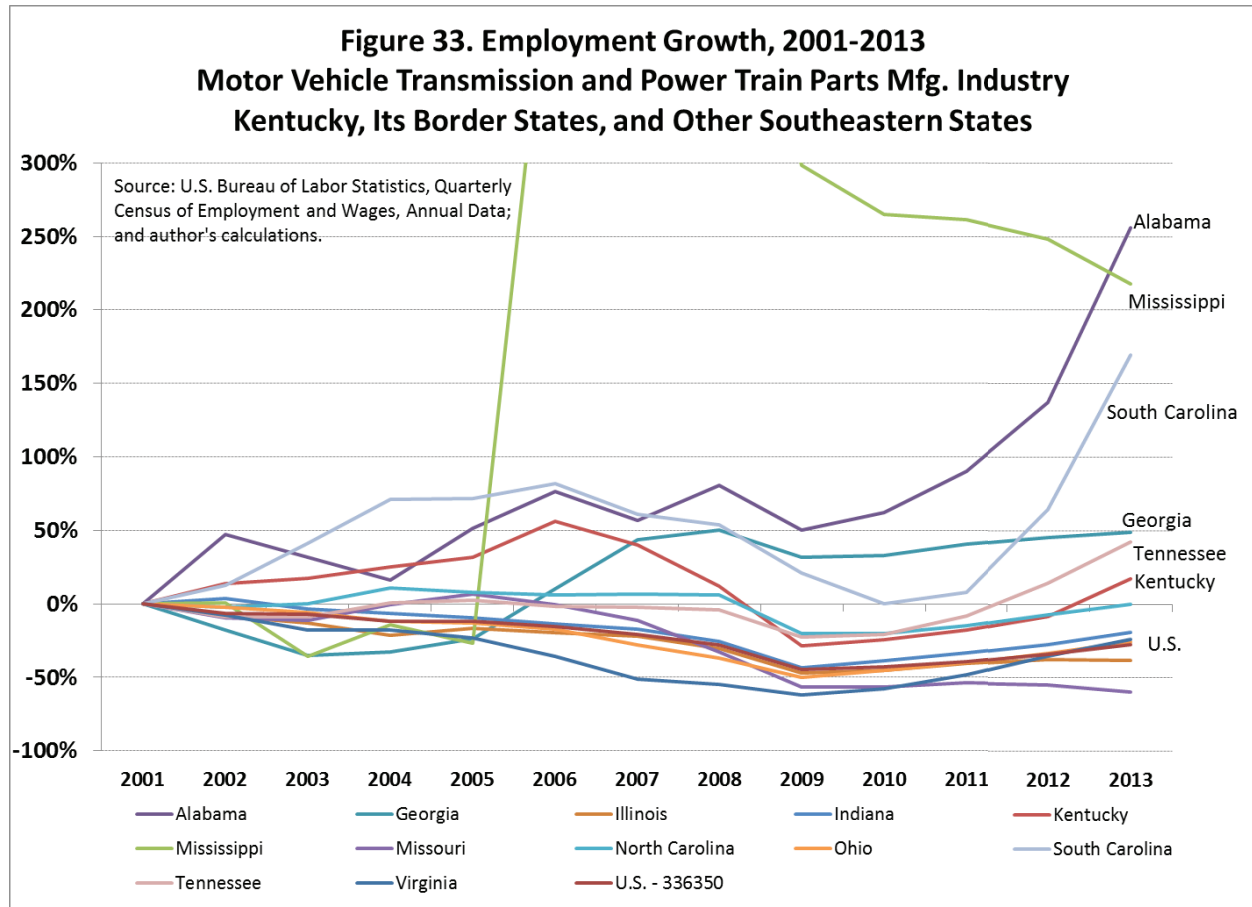
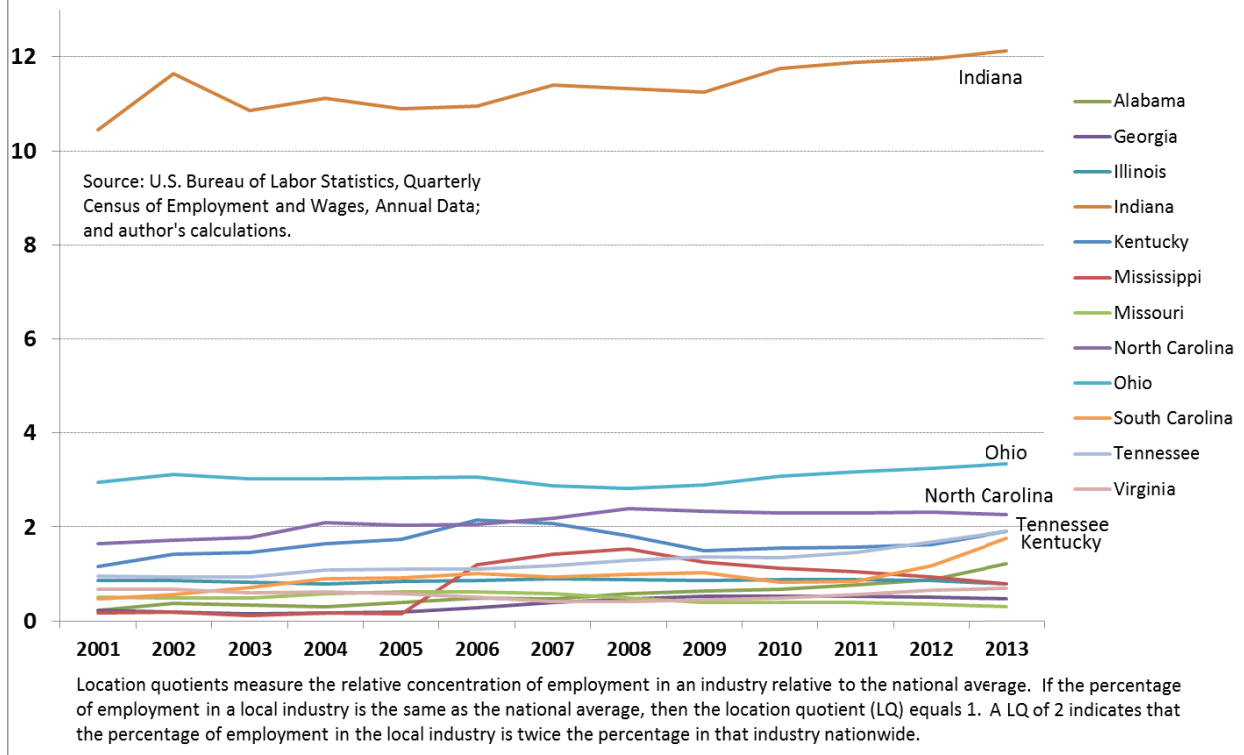


Figure 34. Employment Location Quotients, 2001-2013
Motor Vehicle Transmission and Power Train Parts Mfg. Industry
Kentucky, Its Border States, and Other Southeastern States



SEATING & INTERIOR TRIM MANUFACTURING (NAICS 336360) JOB & LQ TRENDS

Figures 35 and 36 show the employment and location quotient trends for the seating and interior trim manufacturing industry. This was the best performing parts sector nationally, experiencing job losses of just seven percent from 2001 to 2013. While Kentucky lost a third of its jobs in the automotive seating and interior trim industry during those years, 2001 marked the high point in employment in the industry in the state and the end of a ten year period during which jobs in seating and interior trim manufacturing increased three-fold in the Commonwealth. The sector has begun rebounding in the state over the past three years, and job growth was 7.8 percent over the first three quarters of 2014, second best in the region.

Kentucky, along with Alabama, Indiana, and Tennessee lead in terms of employment concentration for seating and interior trim manufacturing. These four states, all with location quotients above 5 form a very strong clustering of employment in this industry.

Figure 35. Employment Growth, 2001-2013
Motor Vehicle Seating and Interior Trim Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States

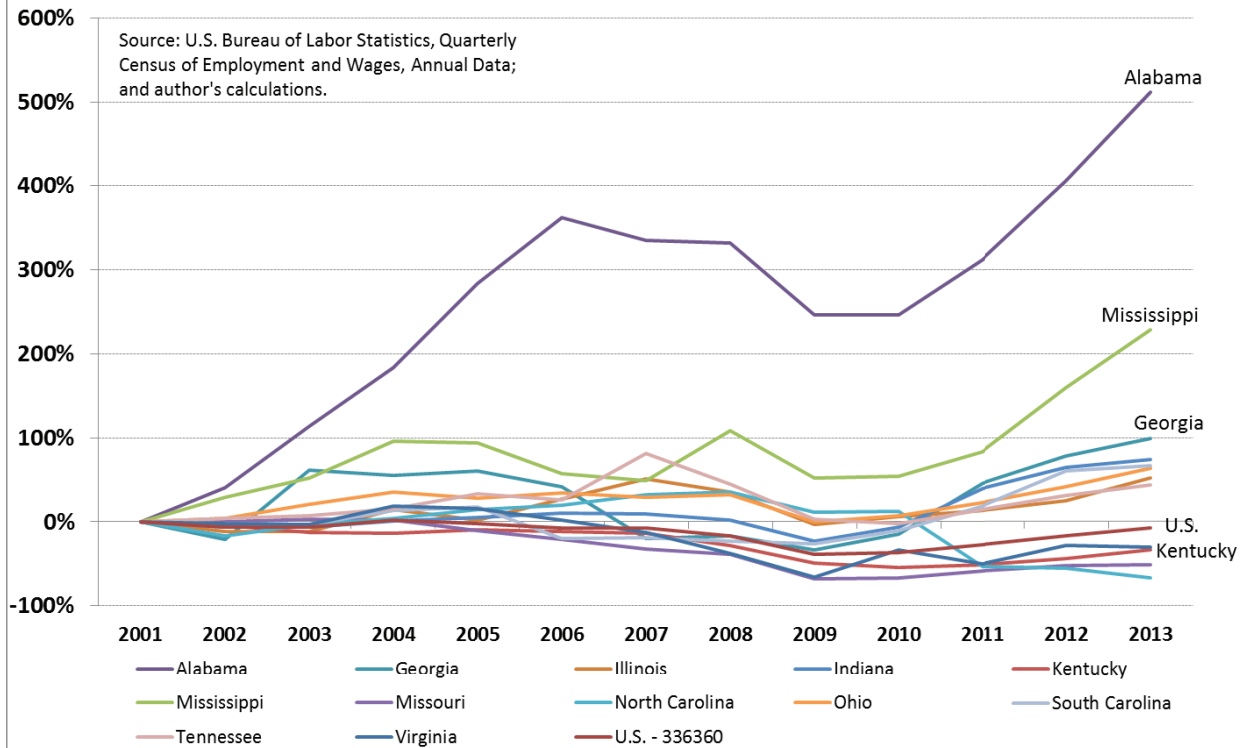
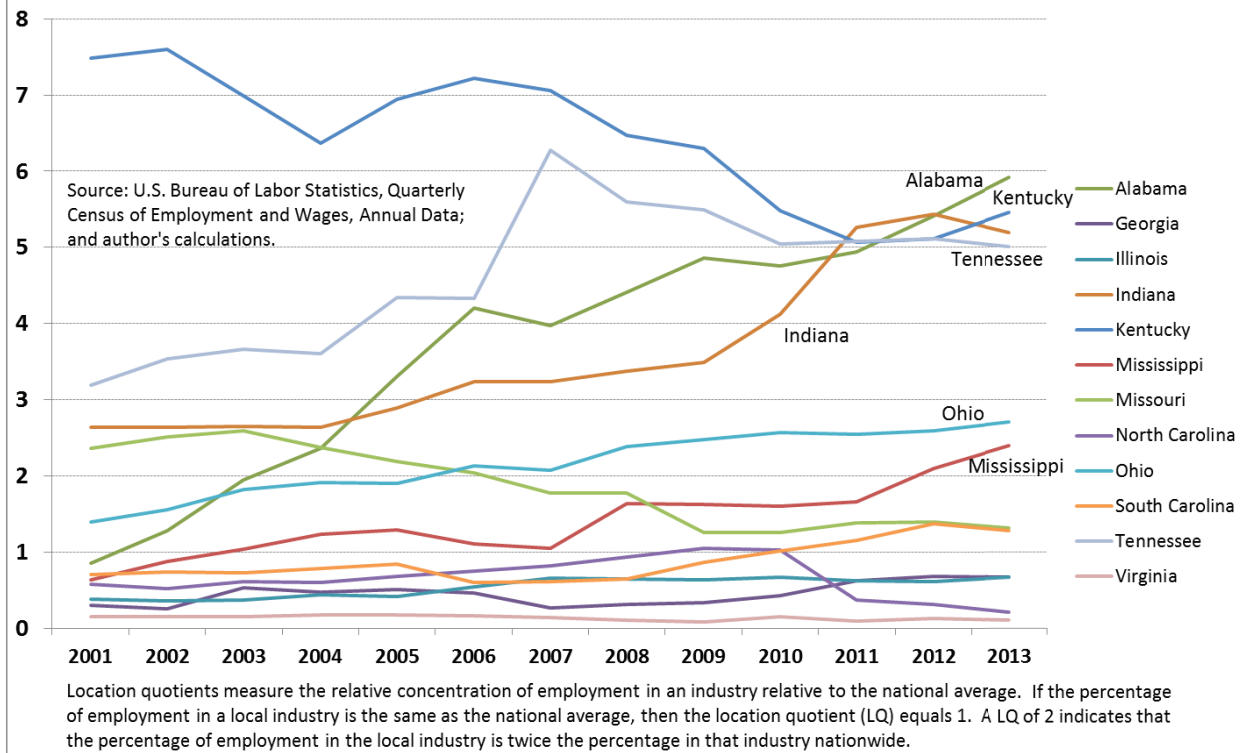


Figure 36. Employment Location Quotients, 2001-2013
Motor Vehicle Seating and Interior Trim Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States



METAL STAMPING (NAICS 336370) JOB & LQ TRENDS

Figures 37 and 38 show the employment and location quotient trends for the motor vehicle metal stamping industry. Nationally, the metal stamping industry lost a third of its jobs during the 2001 to 2013 period but Kentucky saw a 14 percent increase in employment. Of the six states in the group to have more than a couple thousand employees in the industry as of 2001, Kentucky was one of only two states to have posted job gains in the period.

The location quotient chart shows that the industry is fairly concentrated, but that whereas there were three states with a clear comparative advantage in 2001 (Ohio, Kentucky, and Indiana), there are now five, with the addition of Alabama and Tennessee.

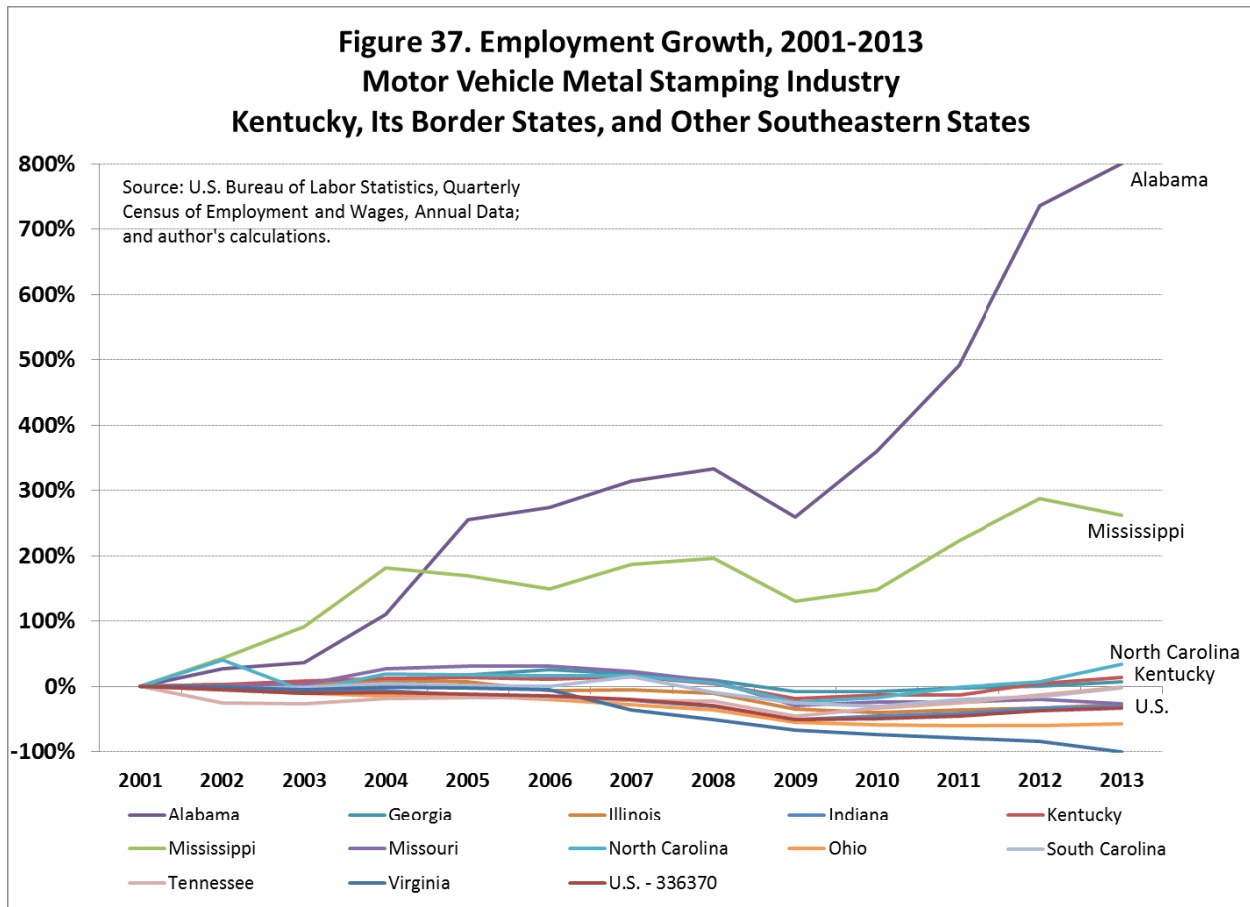
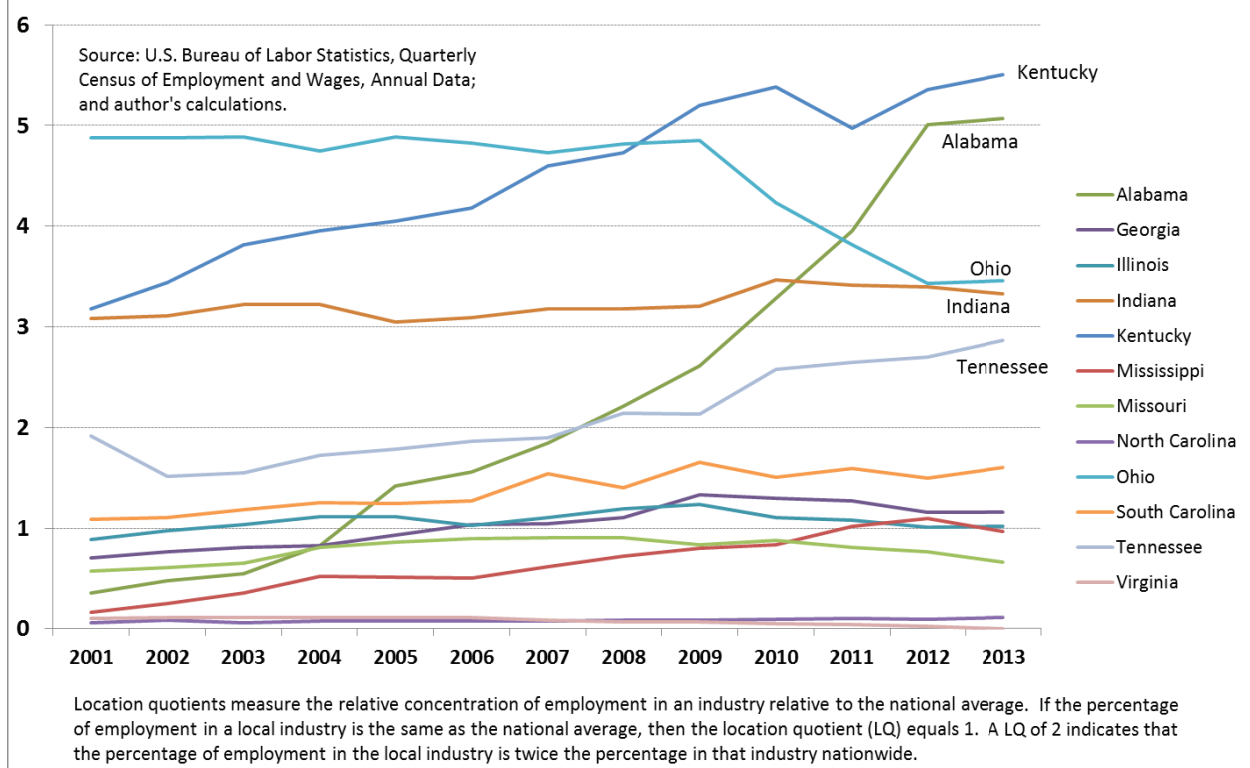


Figure 38. Employment Location Quotients, 2001-2013
Motor Vehicle Metal Stamping Industry
Kentucky, Its Border States, and Other Southeastern States



OTHER MOTOR VEHICLE PARTS MFG. (NAICS 336390) JOB & LQ TRENDS

Figures 39 and 40 show the employment and location quotient trends for the other motor vehicle parts manufacturing industry. Nationally, the industry lost 26 percent of its jobs from 2001 to 2013. But Kentucky was just one of three states in the region to gain jobs in the industry (24 percent increase).

As one might expect from an industry category that covers a lot of miscellaneous products, even the highest location quotients tend to be lower than the other industry subsectors. Additionally the LQ values are more dispersed. Although the competitive advantage of the region is demonstrated by 8 of the 12 states having location quotients of at least 1.7, Kentucky leads with LQ of 4.5.

Figure 39. Employment Growth, 2001-2013
Other Motor Vehicle Parts Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States

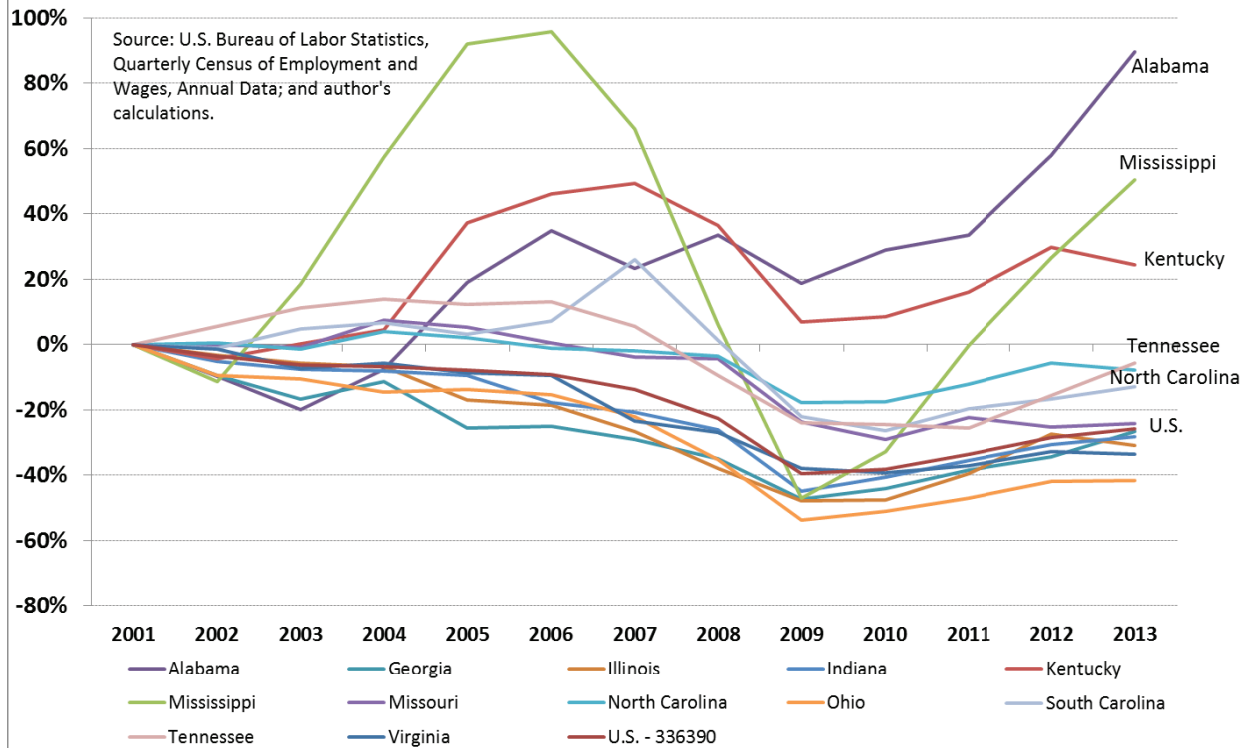
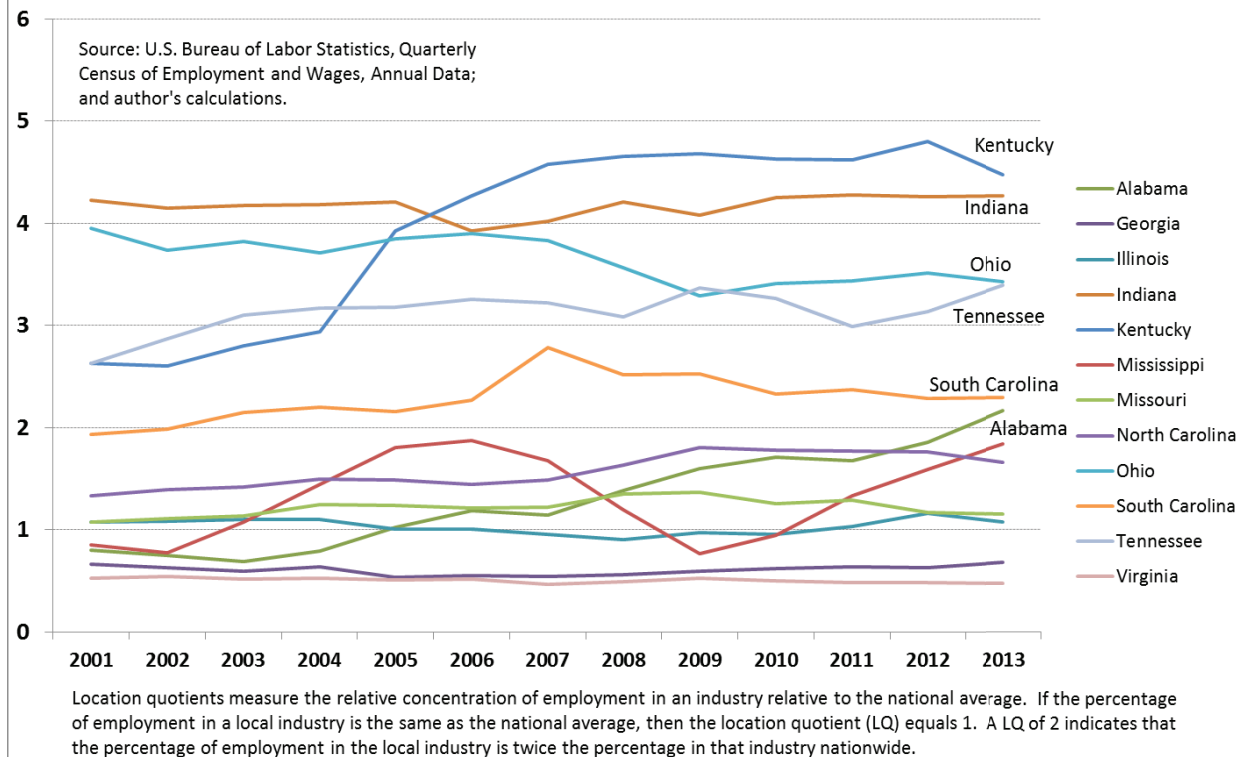


Figure 40. Employment Location Quotients, 2001-2013
Other Motor Vehicle Parts Manufacturing Industry
Kentucky, Its Border States, and Other Southeastern States



SUBSECTOR EMPLOYMENT AND LOCATION QUOTIENT SUMMARY

In summary, what we have seen is that the performance and competitiveness of Kentucky's automotive supply industries is not uniform but varies across the different manufacturing industries.

Compared to the national statistics, Kentucky has done extremely well. While all nine of the automotive body and parts supply sectors declined in employment from 2001 to 2013, Kentucky experienced growth in five of them. Kentucky also had a better percentage change in jobs over the period than the national rate in six of those nine industry sectors, and by large margins (at least 30 percentage points higher).

Both motor vehicle body manufacturing (NAICS 336211) and electrical and electronic equipment manufacturing (NAICS 336320) were sectors in which the Commonwealth's employment record was not quite as good as some of its peers. Kentucky's location quotients for these two industries are still above a majority of the twelve states in the charts but well below the leading states.

For motor vehicle transmission and power train parts manufacturing (NAICS 336350) job growth was far better than the national average but the Commonwealth still has progress to make if it intends to develop a competitive advantage (as measured by the location quotient).

In motor vehicle seating and interior trim manufacturing (NAICS 336360) Kentucky was the dominant state in terms of location quotient but that situation has changed recently. Kentucky lost a much greater percentage of jobs in the industry than was the case nationally. It still exhibits a strong comparative advantage here, but faces competition from other states along the Interstate 65 corridor.

There are five industry subsectors for which Kentucky's employment growth was both markedly more positive than the national average (usually strong gains while the national totals dropped by a third or more) and for which the Commonwealth had one of the highest (if not the highest) location quotient. For gasoline engine and engine parts manufacturing (NAICS 336310), Kentucky experienced great employment growth and now has the third best location quotient, joining a group of four other states which seem to be much more competitive in attracting those businesses than the other peer states.

Despite losing some jobs in the brake system manufacturing industry (NAICS 336340), Kentucky actually outpaced neighboring and regional states and now has an employment concentration in the industry over ten times the national average. Kentucky has a similarly high and top ranked location quotient in steering and suspension components manufacturing (NAICS 336330). For both motor vehicle metal stamping (NAICS 336370) and other motor vehicle parts manufacturing (NAICS 336390) the Commonwealth had markedly different (and positive) employment growth than the nation over 2001 to 2013 and now also has the highest location quotient among the twelve bordering and other southeastern states.

Altogether, Kentucky currently has the highest location quotient in four of the nine automotive supply chain industries we have examined, the second highest in another and the third highest in a third industry. No other state can demonstrate this level of consistency across industries. On balance, Kentucky seems to have been the best state at leveraging its assets to create and maintain competitive advantage in the automotive industry.

GEOGRAPHIC DISTRIBUTION OF AUTOMOTIVE INDUSTRY ESTABLISHMENTS AND EMPLOYMENT IN KENTUCKY

We now turn to the geographic distribution of automotive industry establishments and employment across the Commonwealth. We will present a number of maps to illustrate the geographic clustering of businesses and importance of the interstate highway system and state parkways.

In this section we exclusively use the data from the Kentucky Cabinet for Economic Development's Select Kentucky industry database. The data is derived from annual surveys of plant managers, so some of the employment statistics are undoubtedly rounded estimates. Additionally, survey respondents do not always update the employment numbers each year. Of the 470 establishments identified as being part of the automotive industry supply chain, 395 provided employment data on the 2014 survey. For the remaining 75 establishments we used the 2013 survey results. But despite these drawbacks this dataset does provide us with good county level employment information while the available federal data is mostly undisclosed.

Table 7 shows the industrial distribution of the auto-related manufacturing, service, and technology businesses in Kentucky. As noted above, there are 470 businesses in the state identified as being part of the automotive industry supply chain. They employ roughly 85,550 people. Of those, 171 establishments are in the motor vehicle manufacturing industries examined in the previous sections. All of the OEMs and Tier I suppliers are here. They employ about 57,670 people. This is a higher number than what will likely be seen in the QCEW statistics for 2014 when they become available (which was just over 51,000 through the third quarter), but we believe it is because the Select Kentucky database is reflecting the use of variable staffing personnel in many of the motor vehicle parts plants who are technically employees of a staffing agency and are counted as such in the federal statistics (rather than as employees of the manufacturer).

All other auto-related establishments include tool-and-die shops, warehouses, trucking companies, and any other business regularly used by the automotive industry in Kentucky. There are 299 such establishments employing about 27,900 people.

The table also presents the breakdown of the various manufacturing industries. Roughly two-thirds of the motor vehicle manufacturing employment is in parts manufacturing, and over 40 percent of those jobs are in miscellaneous vehicle parts manufacturing rather than the major component systems given their own NAICS codes. Of those industries metal stamping employs the most people (7,000).

The two industries that have location quotients above ten and are so much more concentrated in Kentucky than in the other states, steering and suspension components and brake systems, both employ just a few thousand people, but have the largest average size in terms employees per establishment.

Table 7. Kentucky's Auto-Related Manufacturing, Service, and Technology Businesses, 2014

Industries	Establishments	Employment
All Auto-Related Businesses	470	85,552
Motor Vehicle Assembly, Body & Trailer, and Parts Manufacturing (NAICS 3361-3)	171	57,672
All Other Auto-Related Manufacturing, Service, & Technology Businesses	299	27,880
Assembly, Body & Trailer, and Parts Manufacturing Breakdown		
Motor Vehicle Assembly or Chassis Manufacturing (NAICS 3361)	4	17,191
Motor Vehicle Body & Trailer Manufacturing (NAICS 3362)	14	1,607
Motor Vehicle Parts Manufacturing (NAICS 3363)	153	38,874
Parts Manufacturing Breakdown		
Gasoline Engine and Engine Parts Manufacturing NAICS 336310)	10	2,351
Electrical and Electronic Equipment Manufacturing NAICS 336320)	15	3,374
Steering & Suspension Components (except Spring) Mfg. (NAICS 336330)	7	2,214
Brake System Manufacturing (NAICS 336340)	8	3,168
Transmission and Power Train Parts Manufacturing (NAICS 336350)	6	673
Seating and Interior Trim Manufacturing NAICS 336360)	16	3,574
Metal Stamping (NAICS 336370)	23	7,011
Other Motor Vehicle Parts Manufacturing (NAICS 336390)	68	16,509

Source: Kentucky Cabinet for Economic Development, Office of Research and Public Affairs. Queried from Select Kentucky Industry Database on February 26, 2015.

Employment numbers are based on 2014 survey results for 395 establishments and 2013 survey results for the remaining 75 establishments.

In the maps below we will be showing Kentucky divided up into nine economic regions. These are regions derived from the work of Paul Coomes, PhD., retired Professor Emeritus of economics at the University of Louisville, and currently a consultant to the Urban Studies Institute. They are based on commuting patterns, media markets, and years of practical knowledge traveling and studying the state. The regions and the counties that comprise them are shown in Table 8.

Table 8. Kentucky's Nine Economic Regions

Ashland		Bowling Green-Hopkinsville		Cumberland	
Boyd	Lawrence	Allen	Metcalfe	Adair	McCreary
Carter	Lewis	Barren	Monroe	Casey	Pulaski
Elliott	Rowan	Butler	Simpson	Clinton	Rockcastle
Greenup		Christian	Taylor	Cumberland	Russell
		Edmonson	Todd	Knox	Wayne
		Green	Trigg	Laurel	Whitley
		Hart	Warren		
		Logan			
Lexington		Louisville		Mountain	
Anderson	Lincoln	Breckinridge	Marion	Bell	Letcher
Bath	Madison	Bullitt	Meade	Breathitt	Magoffin
Bourbon	Mercer	Carroll	Nelson	Clay	Martin
Boyle	Montgomery	Grayson	Oldham	Estill	Menifee
Clark	Nicholas	Hardin	Shelby	Floyd	Morgan
Fayette	Owen	Henry	Spencer	Harlan	Owsley
Franklin	Robertson	Jefferson	Trimble	Jackson	Perry
Garrard	Scott	Larue	Washington	Johnson	Pike
Harrison	Woodford			Knott	Powell
Jessamine				Lee	Wolfe
				Leslie	
Northern Kentucky		Owensboro-Henderson		Paducah-Purchase	
Boone	Grant	Crittenden	McLean	Ballard	Hickman
Bracken	Kenton	Daviess	Muhlenberg	Caldwell	Livingston
Campbell	Mason	Hancock	Ohio	Calloway	Lyon
Fleming	Pendleton	Henderson	Union	Carlisle	Marshall
Gallatin		Hopkins	Webster	Fulton	McCracken
				Graves	

These regions are based upon the work of Paul Coomes, PhD., Professor Emeritus, University of Louisville.

Table 9 reorganizes the information in Table 7 according to the geography of the nine economic regions.

As we might expect, the four assembly plants (two in Jefferson County, and one each in Scott and Warren counties) act as magnets for auto-related businesses of all kinds. But industry establishments are spread all over the state, though the far eastern (Ashland and Mountain) and western (Paducah-Purchase) areas of the state do not have many.

The regional homes of the assembly plants (Bowling Green-Hopkinsville, Lexington, and Louisville) account for 82 percent of the motor vehicle manufacturing (NAICS 3361-3) employment, but just 63 percent of the miscellaneous other auto-related manufacturing, service and technology business employment. Most of the difference is due to the very large sizes of the assembly plants.

**Table 9. Kentucky's Auto-Related Manufacturing, Service, and Technology Businesses
Establishments and Employment by Region of the State, 2014**

Region	All Auto-Related Businesses		Motor Vehicle Assembly, Body & Trailer, and Parts Manufacturing (NAICS 3361-3)		Other Auto-Related Manufacturing, Service, & Technology Businesses	
	Establishments	Employment	Establishments	Employment	Establishments	Employment
Ashland	5	1,687	2	143	3	1,544
Bowling Green-Hopkinsville	83	14,562	39	9,932	44	4,630
Cumberland	28	4,646	14	3,990	14	656
Lexington	117	23,305	40	17,235	77	6,070
Louisville	138	27,167	48	20,188	90	6,979
Mountain	7	142	2	63	5	79
Northern Kentucky	42	8,841	12	3,691	30	5,150
Owensboro-Henderson	40	4,872	12	2,373	28	2,499
Paducah-Purchase	10	330	2	57	8	273
Kentucky Total	470	85,552	171	57,672	299	27,880

Source: Kentucky Cabinet for Economic Development, Office of Research and Public Affairs. Queried from Select Kentucky Industry Database on February 26, 2015.

Employment numbers are based on 2014 survey results for 395 establishments and 2013 survey results for the remaining 75 establishments.

MAPS: VISUALIZING THE GEOGRAPHIC DISTRIBUTION OF THE INDUSTRY IN KENTUCKY

All the maps presented in this section are structured the same way. We show county level establishment and employment data together. The former is shown as a numeral within the county and the latter is represented through shading each county. Additionally, we overlay the outlines of the nine regions, and show all of the interstate highways and state parkways.

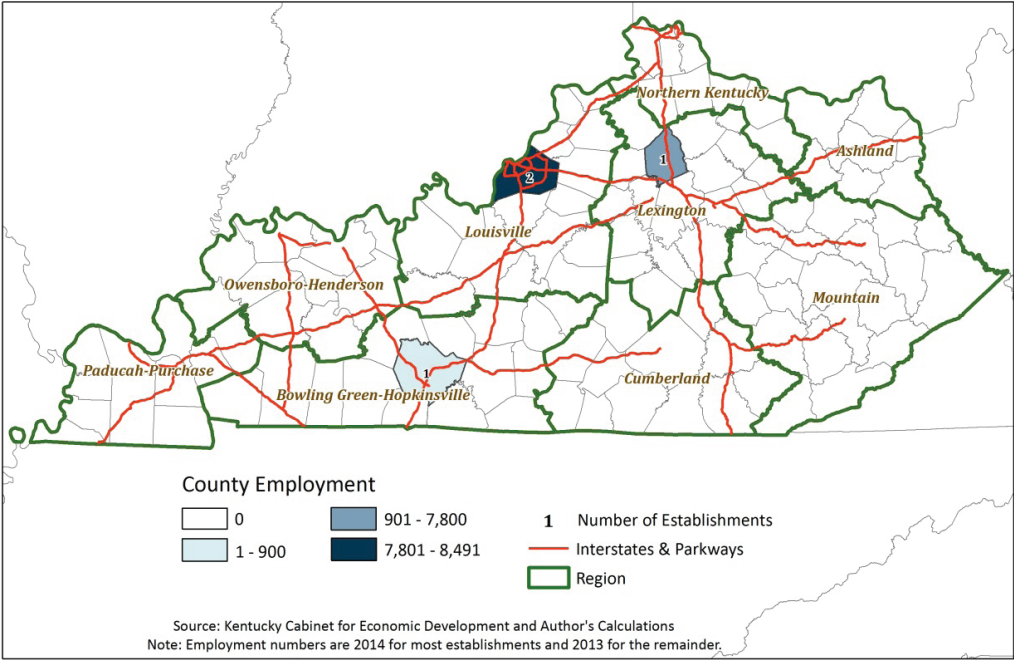
Map 2 shows the four assembly plants. We present it first because the location of these plants, along with the highways and parkways, sets the stage for many of the location decisions other auto-related businesses make.

Map 3 shows all 470 auto-related businesses in the state. While much of the employment is concentrated in the three assembly plant counties (Jefferson, Scott, and Warren), establishments and employment are spread all over the state with the exception of the mountainous areas of eastern Kentucky.

We can also see that all but one of the 16 counties shaded one of the three darkest colors (indicating it has at least 1,276 auto-related jobs) has an interstate highway or parkway running through it.

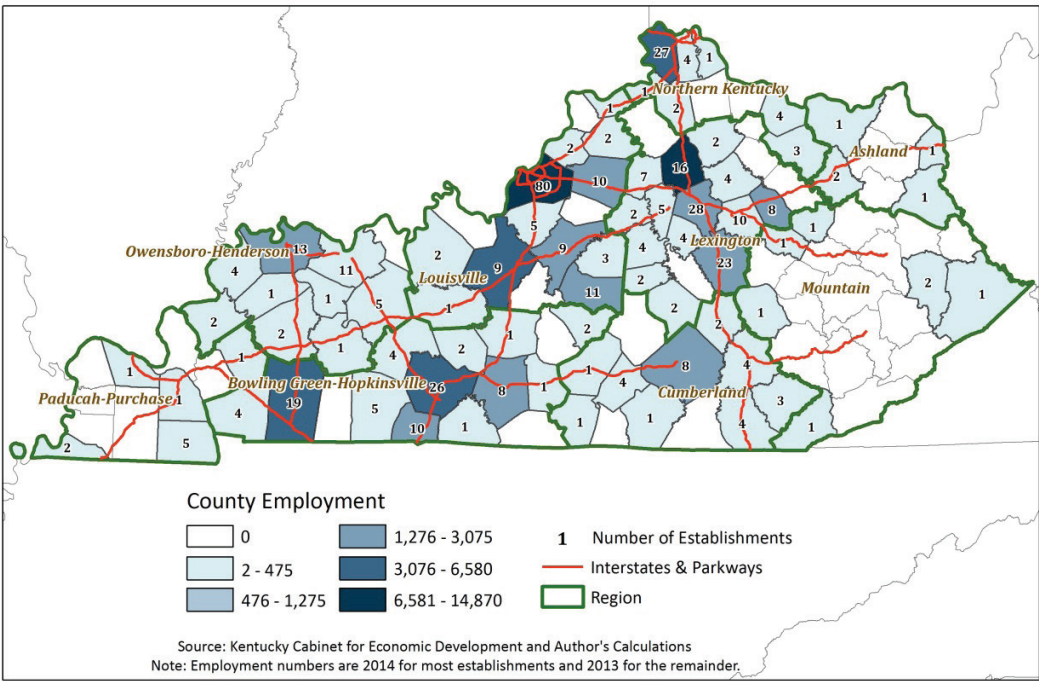
Map 2.

Motor Vehicle Assembly and Chassis Manufacturing
Businesses in Kentucky, 2014



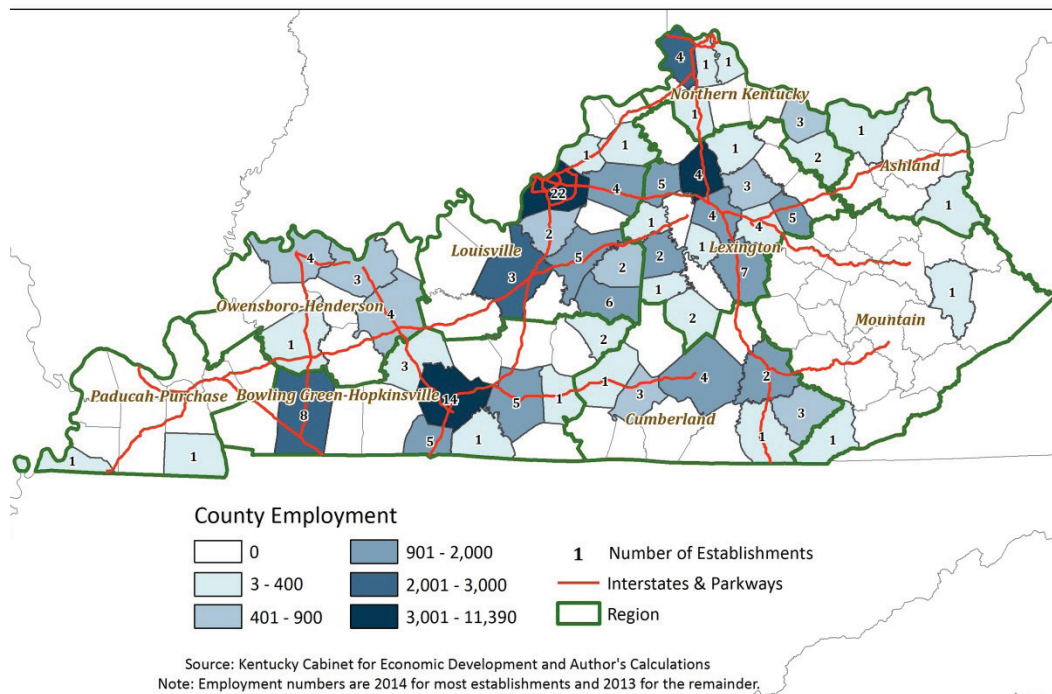
Map 3.

All Auto-Related Manufacturing, Service, and Technology
Businesses in Kentucky, 2014



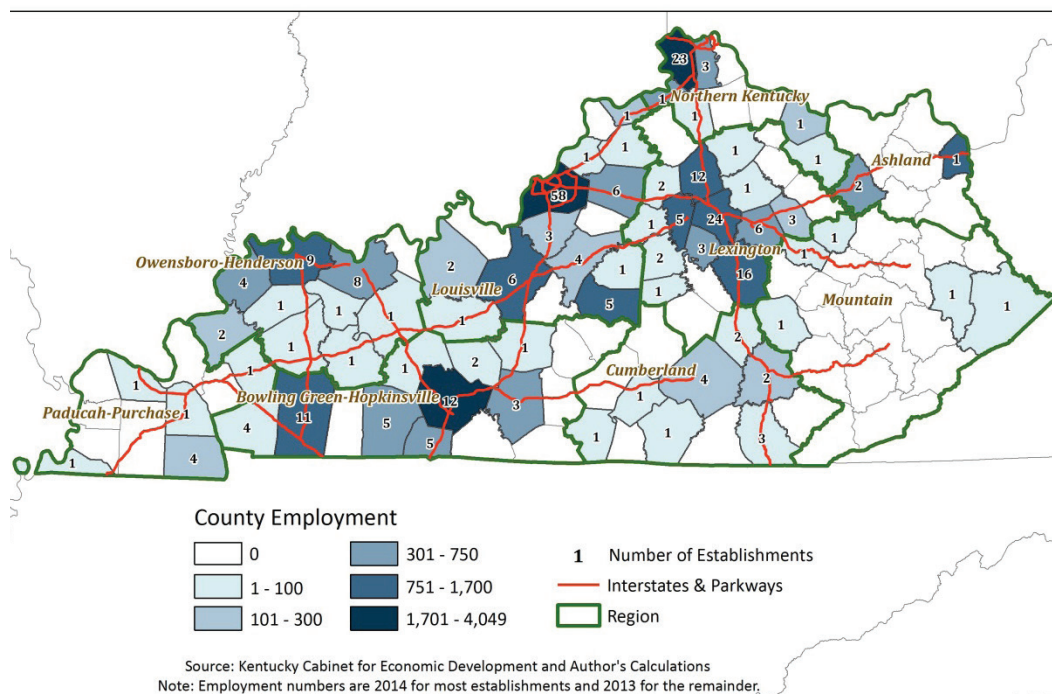
Map 4.

Motor Vehicle Related Manufacturing in Kentucky, 2014



Map 5.

All Other Auto-Related Businesses in Kentucky, 2014



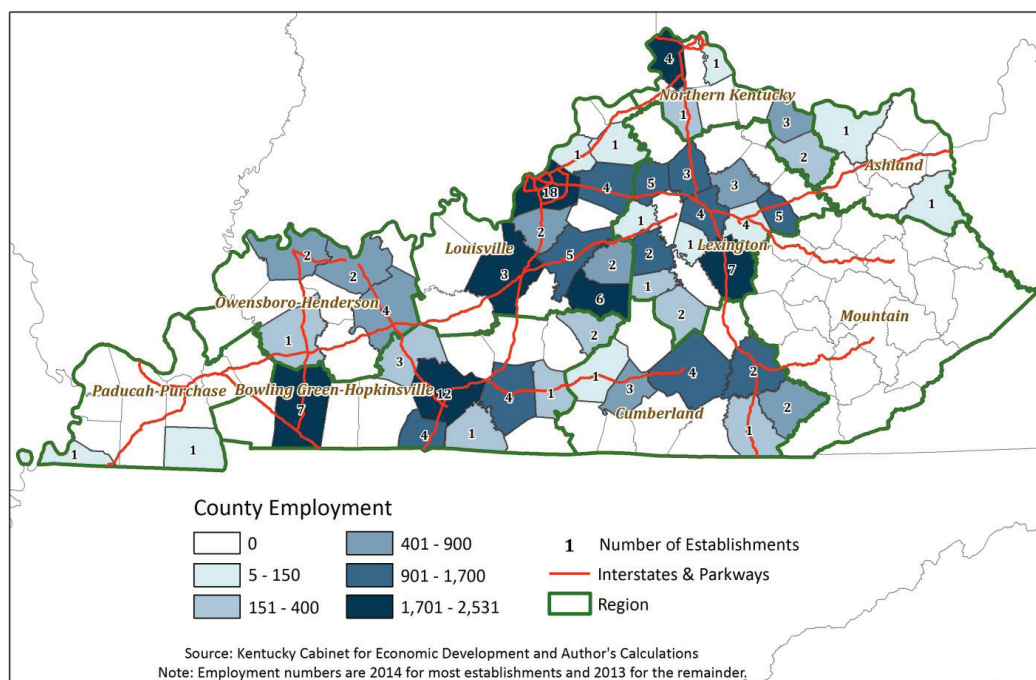
The second pair of maps (Maps 4 and 5) shows the auto-related businesses broken out by motor vehicle manufacturing establishments (NAICS 3361-3, top) and all other manufacturing, service, and technology businesses (bottom). They are similar, but there are some important differences.

In geographic regions where there is not as much motor vehicle manufacturing activity, the establishments are concentrated along the interstate and parkway systems, especially in western and southcentral Kentucky (Owensboro-Henderson, Bowling Green-Hopkinsville, and Cumberland regions). Map 5 depicts a wide variety of businesses establishments spread out more evenly in the west and southcentral regions.

In the Louisville, Lexington, and Northern Kentucky regions the non-motor vehicle manufacturing businesses cluster around the bigger cities more than the auto manufacturing establishments. In both maps the pull of interstate 75 seems to be greater than that of interstate 65.

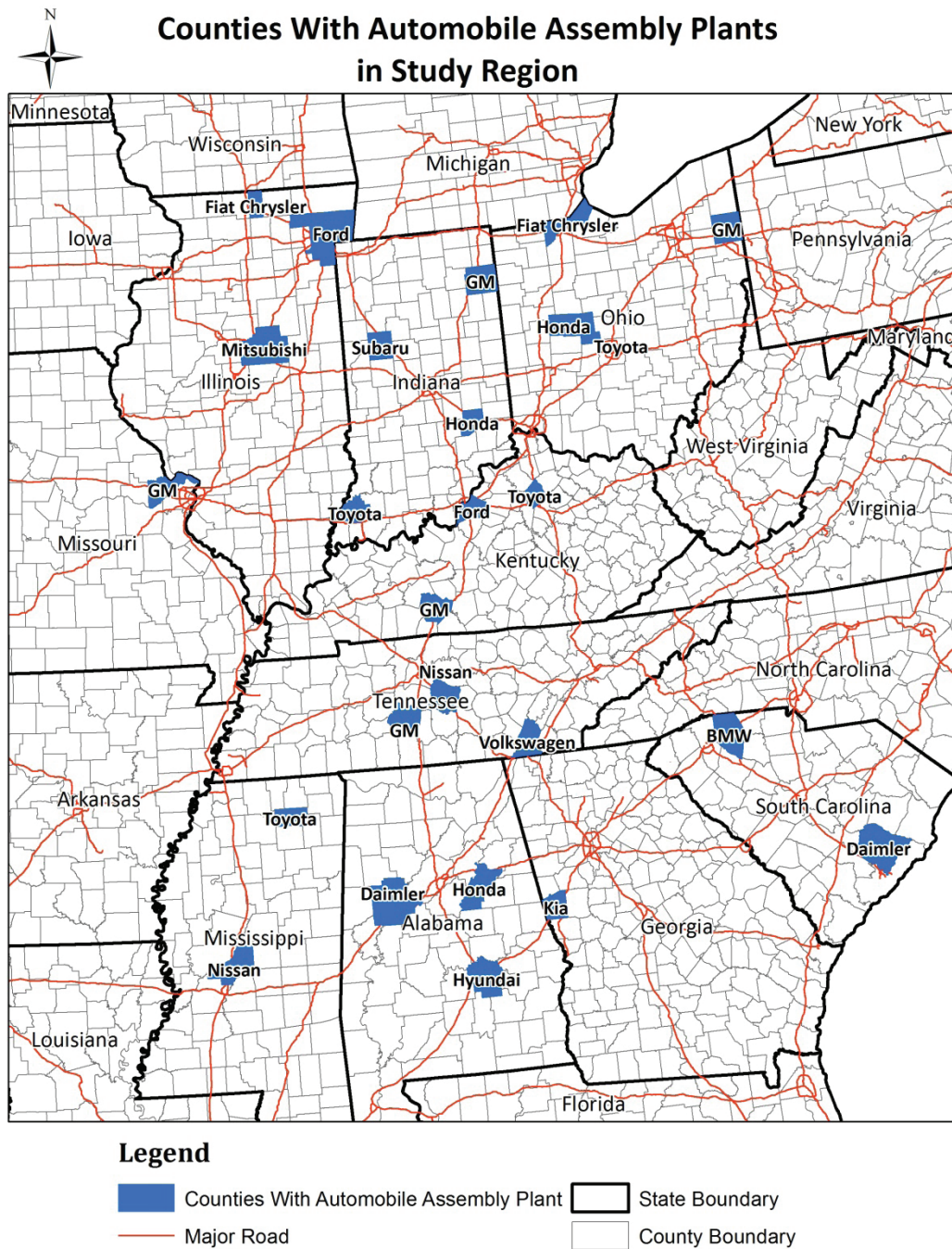
Map 6.

Motor Vehicle Parts Manufacturing Businesses in Kentucky, 2014



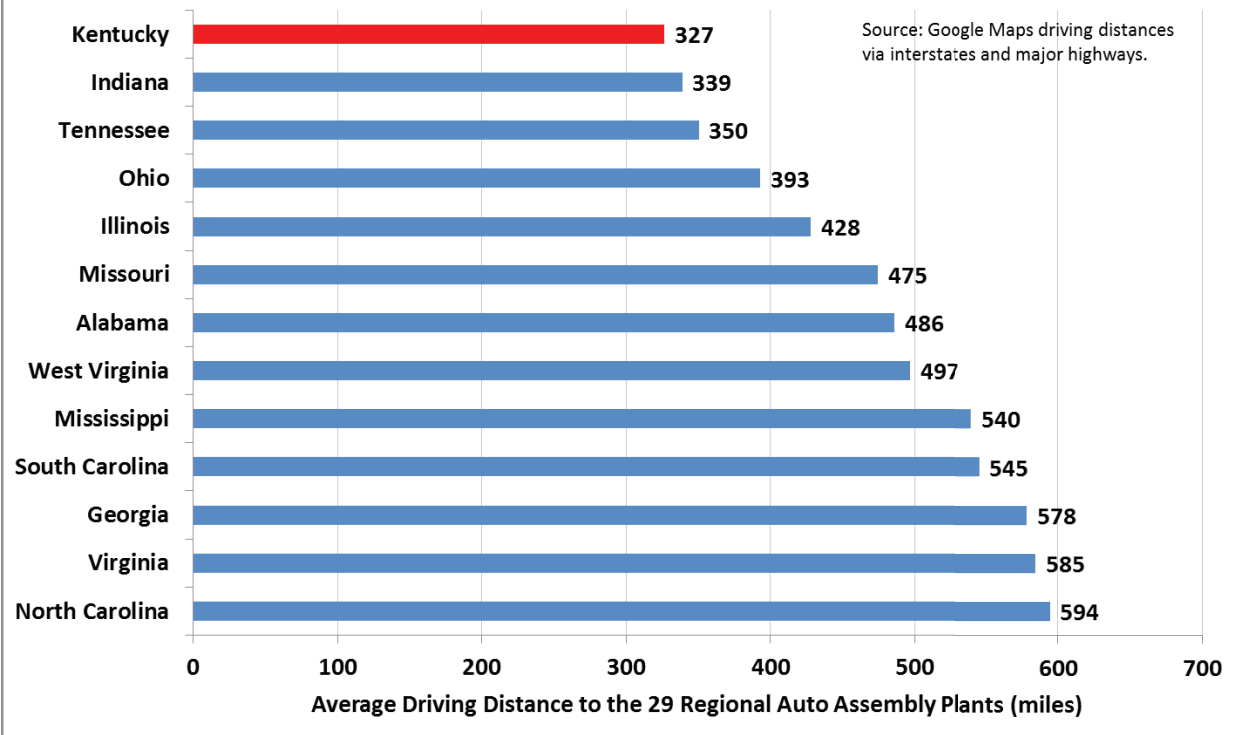
Map 6, above, showing just parts manufacturers (NAICS 3363), makes the importance of the highways system very clear. There does not seem to be a great deal of clustering specifically around the assembly plants. Since many of these businesses have (or would like to have) contracts with multiple OEMs, their location decisions must take into account travel times and costs to more than one destination.

Map 7.



Map 7 shows the location of each county that has an automobile assembly plant within the study region. With just a little imagination, one could see south central Kentucky as being at the center of an “X” or perhaps hour-glass shaped area of the country which encompasses all of these assembly plants. While there is not always a direct route along the interstate highway system from Kentucky to all of these plants, the Commonwealth is uniquely placed in terms of being able to reach the greatest number with the shortest average distance. We used Google Maps to calculate the average driving distance (along interstates and major highways) from the geographic center of each of the 13 states in the region to each of the 29 automotive assembly plants located in those states (Figure 41). At 327 miles, Kentucky has the shortest average distance from its center (near Richmond) to the 29 assembly plants. That is just two-thirds the distance or less than the average for eight of the twelve peer states. Clearly suppliers wishing to service clients up and down the “auto alley” and minimize transportation costs must consider a Kentucky location.

Figure 41. Average Driving Distance from the Geographic Centers of Kentucky, Its Border States, and Other Southeast States to Each Automobile Assembly Plant in the Region

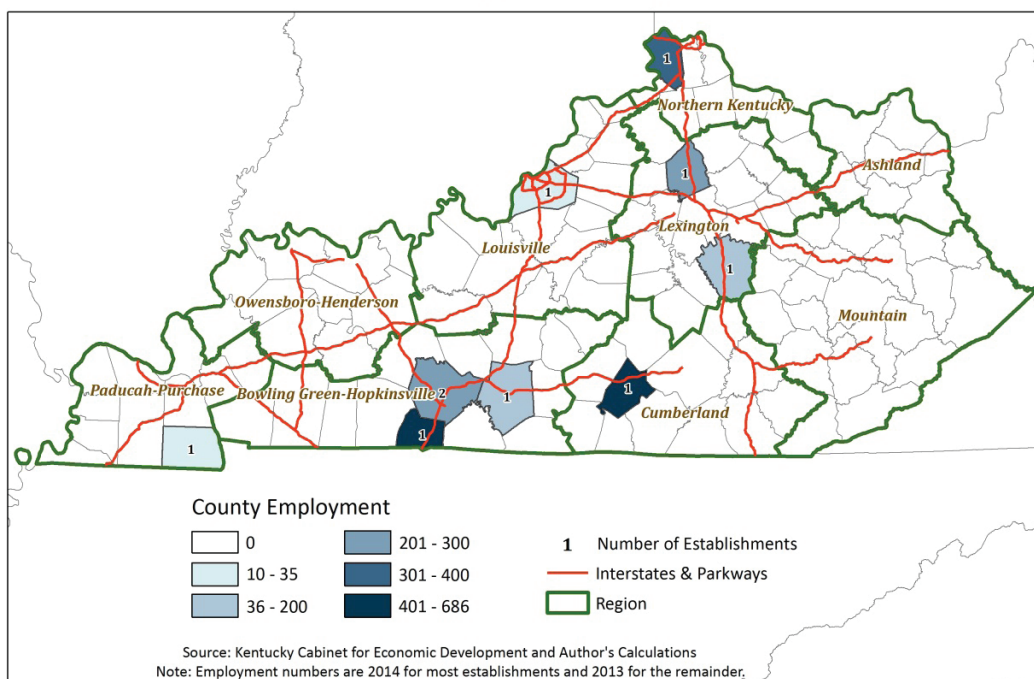


Below are maps showing each of the eight motor vehicle parts manufacturing industry sectors. The map of regional assembly plants is an excellent anchoring reference when examining the parts manufacturing maps. Frequently, the locations of the parts suppliers do not seem to be tied closely to the locations of Kentucky's four assembly plants. A recent study by the Center for Automotive Research (CAR) noted that nearly all of the state's parts manufacturers export their products worldwide and throughout the United States. In general, according to the CAR study, anywhere from 10 to 70 percent of products made by each of these Kentucky companies is shipped out of the state.

Below are maps showing each of the eight motor vehicle parts manufacturing industry sectors. Blow up maps of each of the nine regions showing all auto-related manufacturing, service and technology businesses are supplied in the appendix.

Map 8.

Motor Vehicle Gasoline Engine and Engine Parts Manufacturing in Kentucky, 2014

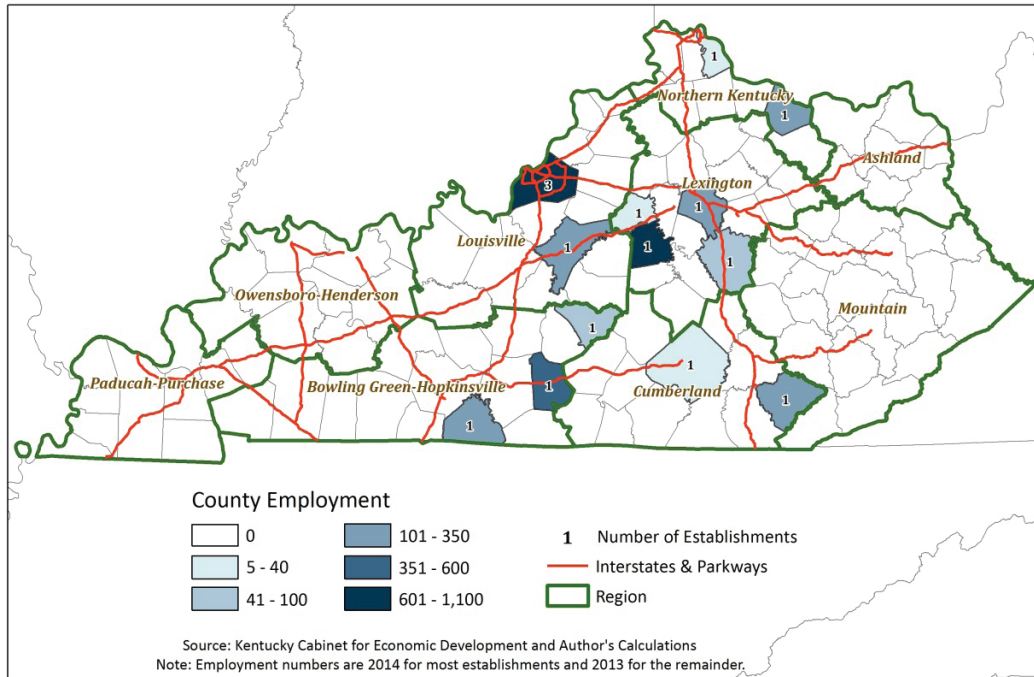


The largest gasoline engine establishments are located near state borders (Map 8). Franklin Precision Industry in Simpson County is the largest with nearly 700 employees. Two manufacturers are located near the assembly plant in Bowling Green, Holley Performance Products and Quick Fuel Technology, both in Warren County.

The next map of electrical and electronic equipment manufacturers (Map 9) shows the concentration of facilities in the Louisville-Lexington area. There are 15 manufacturers in the state, the largest of which is Hitachi Automotive Systems Americas, Inc. in Mercer County (approximately 1,100 employees). Sumitomo Electric Wiring Systems, Inc., located in Metcalfe County, is the next largest employer with over 350 employees.

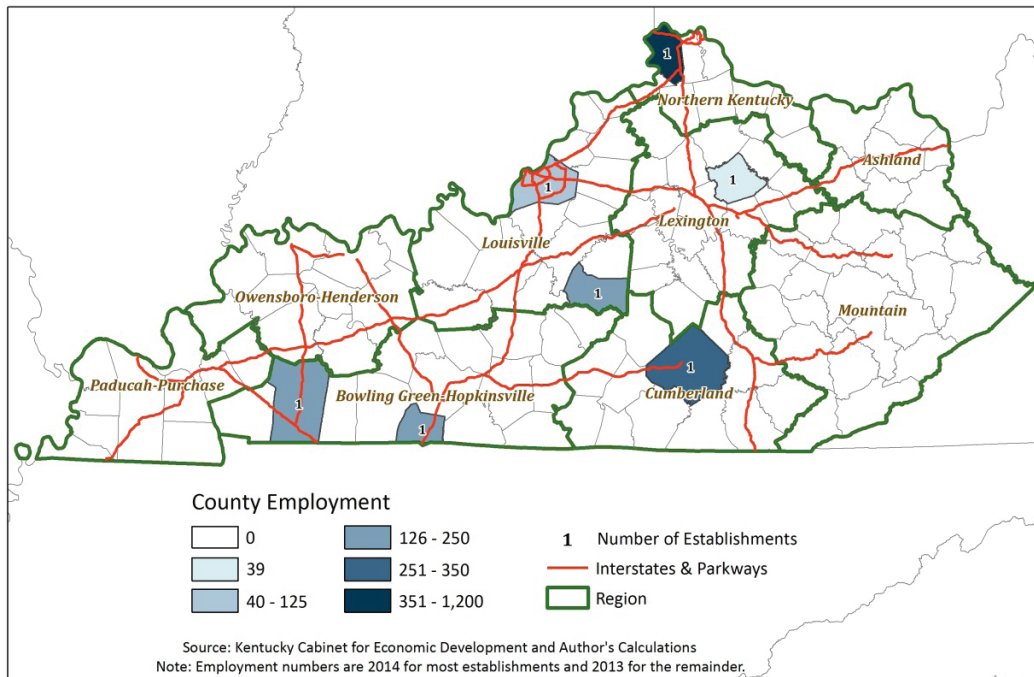
Map 9.

Motor Vehicle Electrical and Electronic Equipment Manufacturing in Kentucky, 2014



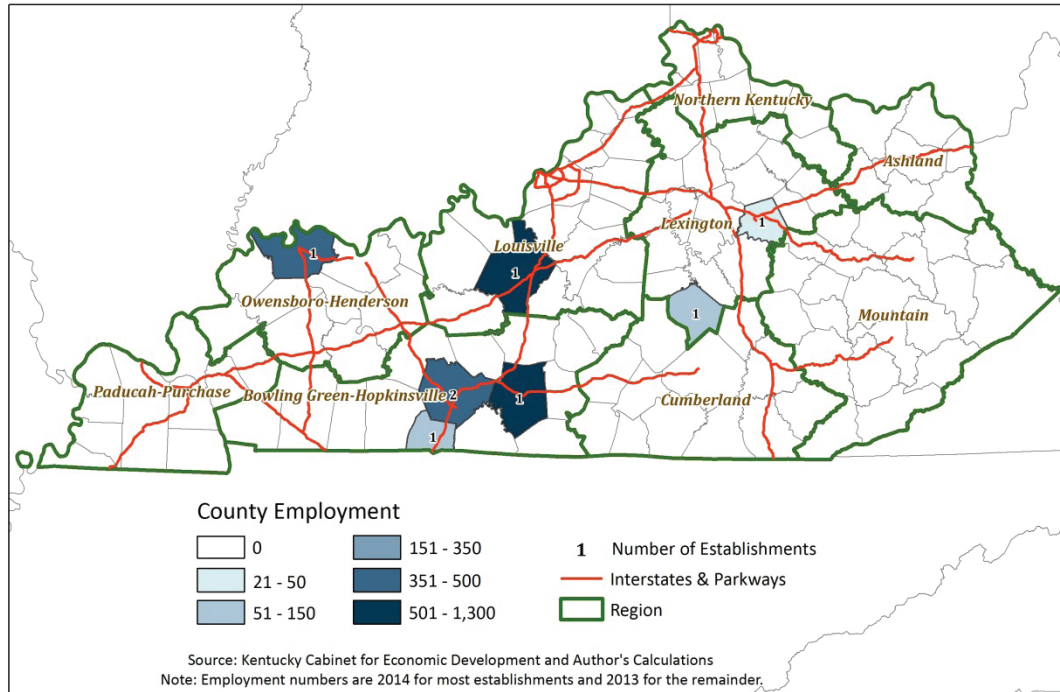
Map 10.

Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing Businesses in Kentucky, 2014



Map 11.

Motor Vehicle Brake System Manufacturing in Kentucky, 2014



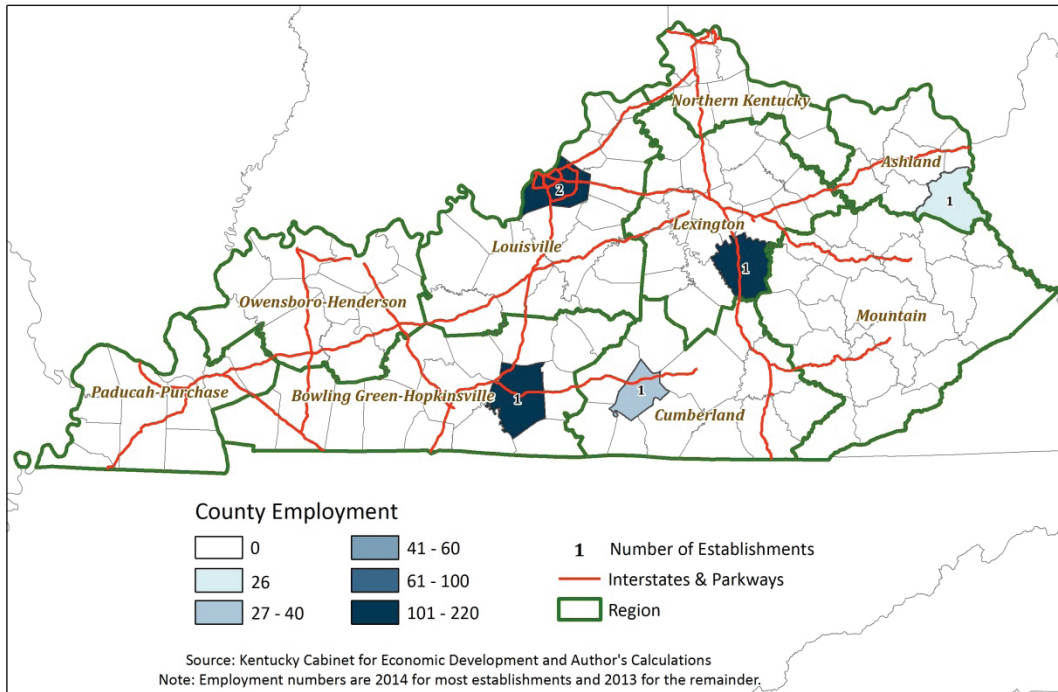
The largest manufacturer of steering and suspension components (Map 10) is Robert Bosch Automotive Steering, LLC, in Boone County in Northern Kentucky (approximately 1,200 employees). Hendrickson USA (approximately 330 employees) is located in Pulaski County near the termination of the Cumberland Parkway.

One manufacturer of brake systems operating in two locations dominates the state (Map 11). Akebono Brake – Elizabethtown Plant has approximately 1,300 employees. The Akebono Brake – Glasgow plant, located in Barren County, has approximately 900 employees.

Other facilities tend to specialize in certain types of brake systems, such as for commercial vehicles or heavy duty vehicles. Akebono Brake was the General Motors 2014 Supplier Quality Excellence Award winner among 1,506 suppliers located worldwide for supplying the highest levels of quality performance over the past 12 months.

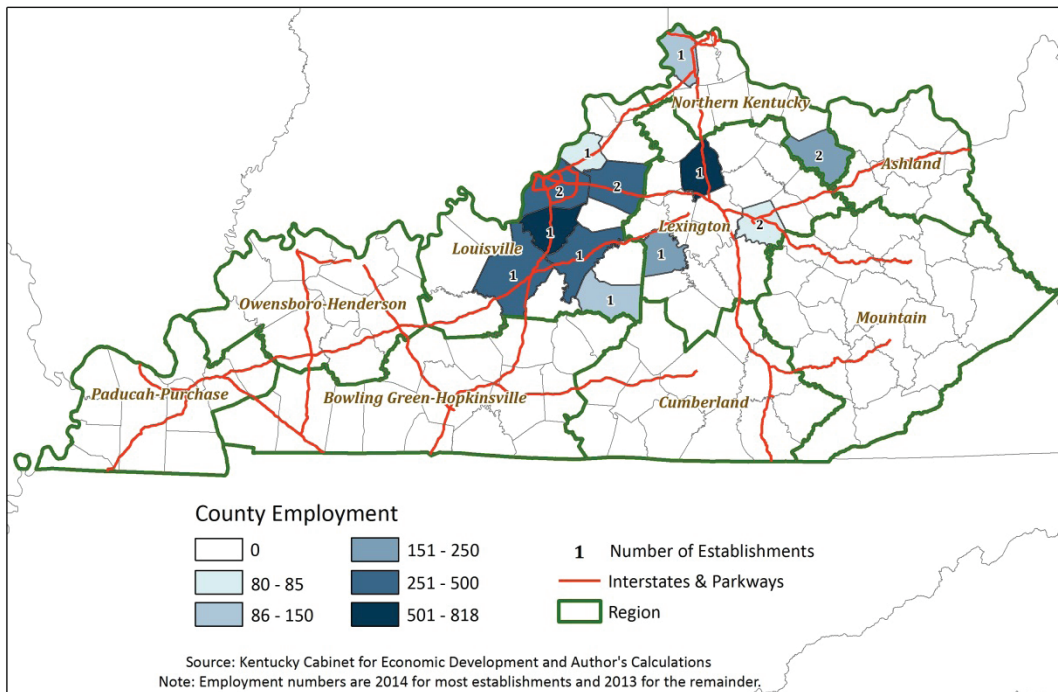
Map 12.

Motor Vehicle Transmission and Power Train Parts Manufacturing Businesses in Kentucky, 2014



Map 13.

Motor Vehicle Seating and Interior Trim Manufacturing Businesses in Kentucky, 2014

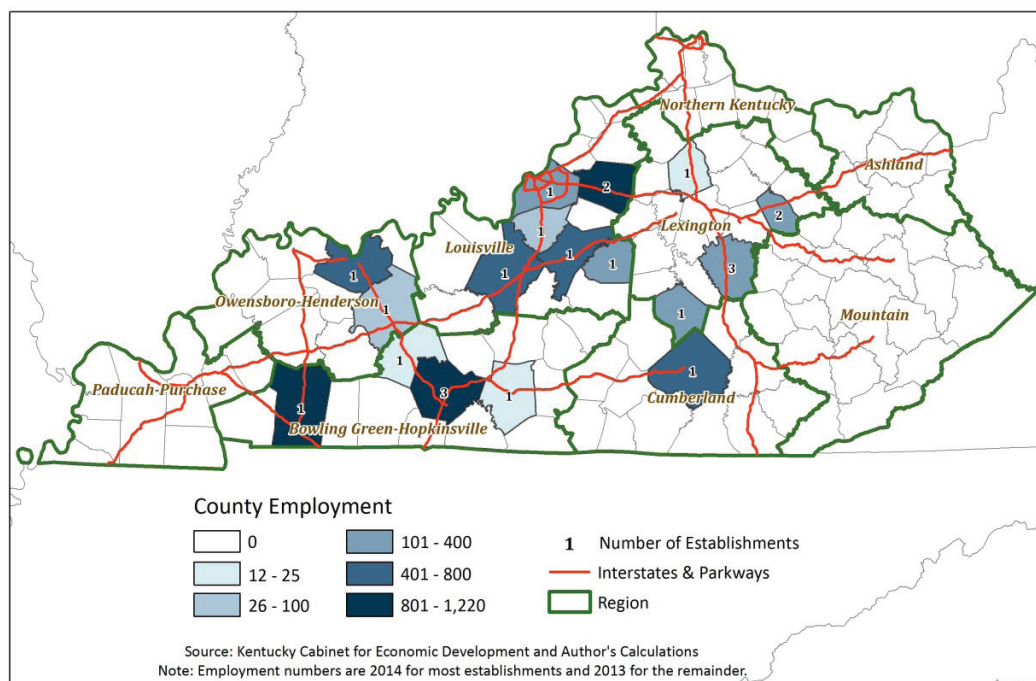


There are only six manufacturers of transmission and power train parts in Kentucky, all located near OEM plants (Map 12). Most are rather small operations with employment between 100-200 per plant. The AXM Heavy Duty (Formerly Trax Mechanical Systems) opened its first North American manufacturing facility in Louisville in 2001. The \$6.6 million facility is the primary location of the North American customer base.

The Louisville region is home to most automotive seating and trim manufacturing (Map 13). Seven of the sixteen facilities are located in the Louisville region, but the largest employer, Johnson Controls, Inc. is located in Georgetown near the Toyota OEM. Johnson Controls has over 800 employees. The next largest is TBKY, Inc., located in Nelson County with approximately 350 employees.

Map 14.

Motor Vehicle Metal Stamping Businesses in Kentucky, 2014

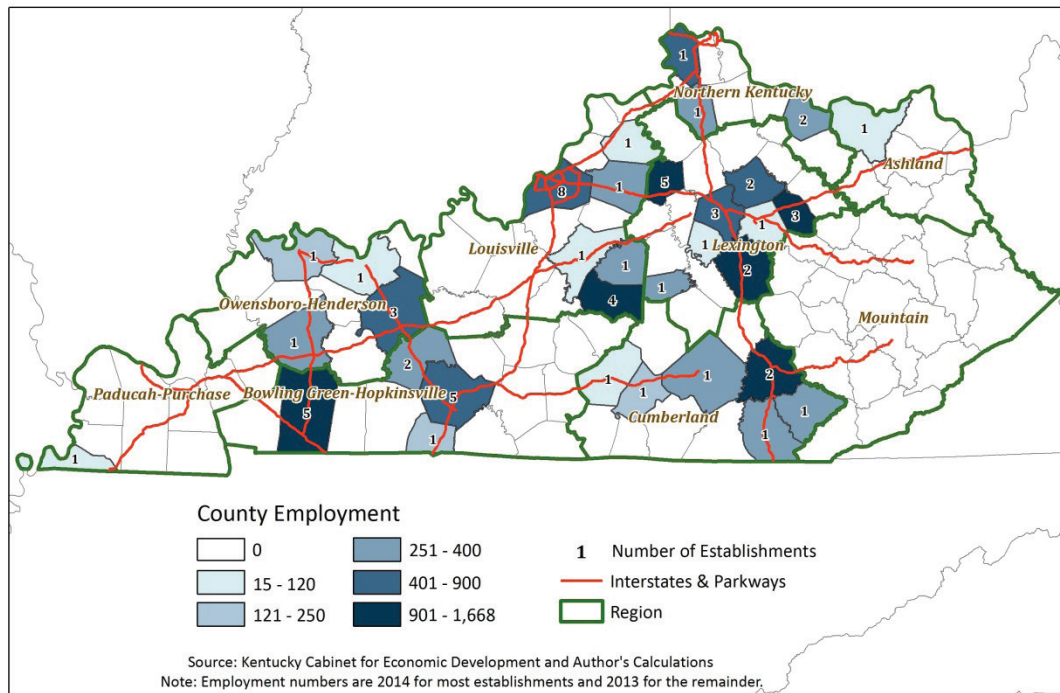


Metal stamping is one of the few specific Tier I industries that is spread out geographically (Map 14). The patterns still follows the OEM locations and is situated along major transportation routes. Most of the 23 facilities tend to have 100 or fewer employees. However, three plants are large employers.

Martinrea, Bowling Green Metalforming, LLC and Toyotestu America, Inc. are located in the Bowling Green-Hopkinsville region. Martinrea (Christian County) has nearly 1000 employees and Bowling Green Metalforming (Warren County) and Toyotestu America (Pulaski County) about 800 employees. Tower International, Inc. in Nelson County was established in 1994 and employs about 500 workers. In 2014 Tower International opened a new stamping plant in Shepherdsville (about 75 employees).

Map 15.

Other Motor Vehicle Parts Manufacturing Businesses in Kentucky, 2014



Other parts manufacturing includes very small operations with fewer than ten employees producing customized parts to major employers with over 1,000 employees (Map 15). The map affirms what the research suggests – parts manufacturers locate on or near major transportation systems. With the exception of the Mountain and Paducah-Purchase regions, manufacturers are distributed throughout the state along major transportation routes, clustered near OEMs in Kentucky, Tennessee and Ohio.

TG Kentucky, LLC in Marion County is a plastic injection molding company established in 1999 currently employing over 1,000 workers. Hitachi Automotive Systems Americas, Inc. of Madison and Mercer Counties is the largest employer in the subsector with nearly 1,300 employees. Hitachi Automotive Systems made news in 2011 when Governor Beshear announced the company selected the Mercer County plant as the site of its North American lithium-ion battery packs production. Hitachi, which has existing locations in Harrodsburg and Berea recently completed construction of a 153,000-square-foot factory on its existing 85-acre Harrodsburg site to produce battery control electronics.

RECENT INVESTMENT IN THE AUTOMOTIVE INDUSTRY IN KENTUCKY

Each year for the past five years, 60 to 70 business expansion or relocation projects related to the automotive industry have been announced, a total of 339 projects (Table 10). These projects involved pledges to invest \$4.5 billion in the Kentucky economy through land purchases, building construction, and outfitting factories and offices with equipment. This investment was forecast to bring nearly 20,000 additional jobs to the Commonwealth.

The figures in the Table 10 represent intentions rather than realized benefits. Some projects reach their investment and job goals within a year or two while others may take longer. Nevertheless, given that there are now 85,000 auto-related jobs in the state, an additional 20,000 jobs worth of projects indicates that the announced projects are a substantial amount of investment. If fully realized, these expansions and relocations could be equivalent to job growth of three to five percent per year over several years.

Eighty percent of both the announced investment dollars and jobs was to come from assembly, body and trailer, and parts manufacturing (NAICS 3361-3) businesses. These businesses require expensive factory equipment and drive employment and investment in the other auto-related manufacturing, service, and technology businesses.

Table 10. Total Number of Projects, Estimated Investment, and Projected Additional Jobs Announced by All Auto-Related Manufacturing, Service, and Technology Businesses in Kentucky January, 2010 through January 2015

	Number of Projects	Investment	Additional Jobs
All Auto-Related Businesses	339	\$4,532,736,014	19,865
Motor Vehicle Assembly, Body & Trailer, and Parts Manufacturing	161	\$3,640,179,193	15,661
All Other Auto-Related Manufacturing, Service, & Technology Businesses	178	\$892,556,821	4,204
New Facilities Only			
All Auto-Related Businesses, New	29	\$479,884,124	2,561
Motor Vehicle Assembly, Body & Trailer, and Parts Manufacturing, New	18	\$292,264,974	1,890
All Other Auto-Related Mfg., Service, & Technology Businesses, New	11	\$187,619,150	671

Source: Kentucky Cabinet for Economic Development, Office of Research and Public Affairs. Queried from Select Kentucky Industry Database on February 26, 2015.

Only ten percent of the announced investment will result in brand new facilities. Expansions of existing facilities signal the confidence of those businesses in the automotive industry in Kentucky.

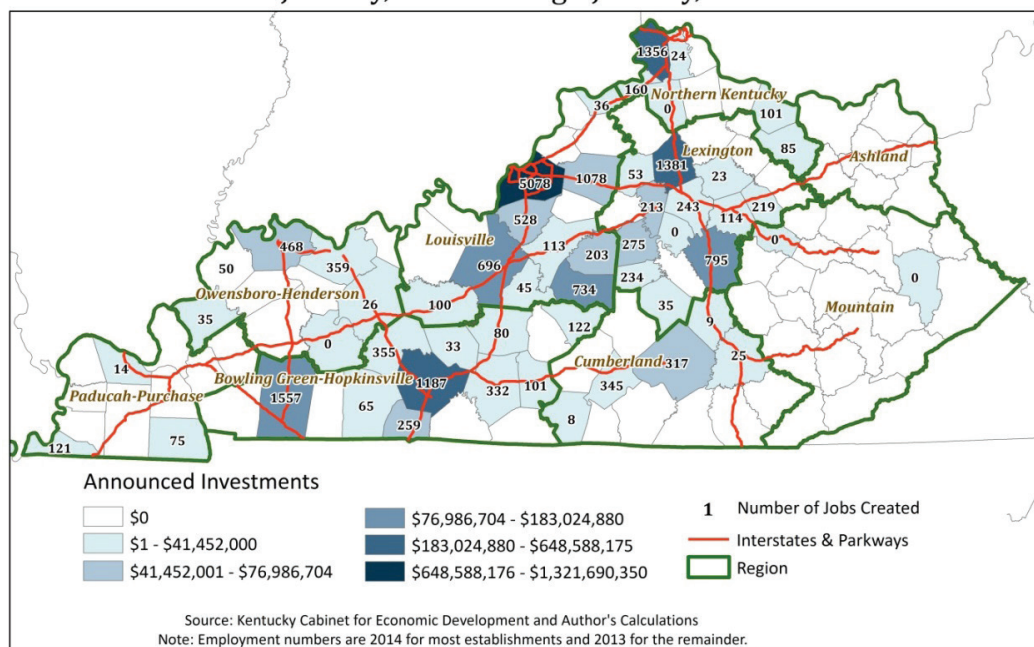
The distribution of projects around the state mirrors the existing business distribution quite closely (Table 11 and Map 16). The exceptions to this are that for motor vehicle assembly, body and trailer, and parts manufacturing projects.

Northern Kentucky is getting a much bigger share of the investment than it currently has in employment (see Table 9), while the Cumberland region has a much smaller share of the investment than it has in employment.

A comparison of the map below and that of all auto-related businesses shows that the latest investment is concentrated a bit more closely to the interstate highways and state parkways than previously, especially the interstates.

Map 16.

**Estimated Investment and Projected Additional Jobs
Announced by All-Auto Related Businesses in Kentucky
January, 2010 through January, 2015**



**Table 11. Total Number of Projects, Estimated Investment, and Projected Additional Jobs
Announced by Kentucky's Auto-Related Manufacturing, Service, and Technology Businesses
By Region of the State, January, 2010 through January 2015**

Region	Motor Vehicle Assembly, Body & Trailer, and Parts Manufacturing			Other Auto-Related Manufacturing, Service, & Technology Businesses		
	Number of Projects	Investment	Additional Jobs	Number of Projects	Investment	Additional Jobs
Ashland	0	\$0	0	0	\$0	0
Bowling Green-Hopkinsville	33	\$373,116,880	2,956	33	\$350,365,576	1,135
Cumberland	7	\$63,320,525	506	8	\$33,330,800	198
Lexington	42	\$928,487,801	2,749	40	\$192,477,478	836
Louisville	50	\$1,799,609,332	7,535	49	\$131,657,367	1,076
Mountain	0	\$0	0	2	\$600,000	0
Northern Kentucky	17	\$390,188,775	1,306	23	\$109,744,499	420
Owensboro-Henderson	10	\$55,368,300	413	21	\$72,526,700	525
Paducah-Purchase	2	\$30,087,580	196	2	\$1,854,401	14
Kentucky Total	161	\$3,640,179,193	15,661	178	\$892,556,821	4,204

Source: Kentucky Cabinet for Economic Development, Office of Research and Public Affairs. Queried from Select Kentucky Industry Database on February 26, 2015.

TOOLING: AN IMPORTANT RELATED INDUSTRY

A recent report by the Center for Automotive Research (2014) made special mention of the tooling industry as an opportunity for the auto industry in the southeastern U.S. The report argued that the auto manufacturing has historically not been dense enough in the southeast to attract a large tooling industry presence. Even though the auto manufacturing industry has shifted southward, 21 of the 41 assembly plants are located in Michigan, Ohio, or Indiana. Since the tooling industry is largely comprised of small shops (20 to 25 employees) that rely on relationships with trusted clients, it is not surprising that the tooling industry remains concentrated north of Kentucky. The custom work done by these shops requires communication between the parties, so proximity is valued.

Table 12 shows the number of employees, state rank, and location quotients for tool-and-die shops (NAICS 333514) in our set of thirteen states, plus Michigan. We also include the figures for the broader metalworking machinery manufacturing industry and machine shops because the Select Kentucky database often cross-references too-and-die shops with the other four industries that make up NAICS 3335 and machine shops (establishments of this type often have multiple capabilities).

Table 12. Tool and Die Shop Employment in the Region

	Special Die and Tool, Die Set, Jig, and Fixture Manufacturing (333514)			Metalworking machinery manufacturing (3335)			Machine Shops (332710)		
	Employment		Location	Employment		Location	Employment		Location
	2013	Rank	Quotient	2013	Rank	Quotient	2013	Rank	Quotient
Michigan	16,910	1	8.43	35,902	1	6.54	20,168	3	2.30
Ohio	8,696	2	3.41	22,323	2	3.20	17,408	4	1.56
Illinois	4,895	3	1.73	13,672	3	1.76	17,303	5	1.40
Indiana	3,768	6	2.65	6,997	7	1.80	11,089	9	1.78
Missouri	2,343	8	1.82	5,011	9	1.42	3,644	23	0.65
Tennessee	1,792	9	1.36	3,523	13	0.97	3,626	24	0.63
Kentucky	1,046	14	1.22	3,292	14	1.41	2,531	30	0.68
North Carolina	725	16	0.38	2,737	18	0.52	5,922	12	0.71
Georgia	603	20	0.32	1,285	25	0.25	4,767	18	0.58
Alabama	570	21	0.66	848	30	0.36	5,405	15	1.44
Virginia	351	23	0.21	1,279	26	0.27	3,866	21	0.52
Mississippi	285	25	0.58	835	32	0.62	1,066	36	0.49
South Carolina	150	30	0.17	2,299	20	0.96	3,604	25	0.94
West Virginia	25	44	0.08	71	44	0.08	2,087	32	1.46
United States	65,381			179,060			285,514		

Source: U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2013 Annual Data.
South Carolina and West Virginia figures for NAICS 333514 are the author's estimates.

Michigan dominates the tooling industry. Ohio, Illinois, and Indiana are in the second tier. All of the states below Kentucky in the table are well south where manufacturing is concentrated. Of those states, only Alabama and West Virginia's machine shop industries have a location quotient above one.

In the Select Kentucky database, roughly 74 establishments, with 2,900 employees, are categorized as either tool-

and-die shops or machine shops (or both). So it appears that nearly all such operations in Kentucky have ties to the automotive industry.

As the CAR (2014) report notes, existing establishments are “straining to satisfy current contracts,” and the auto industry is gradually moving south, so the tooling industry is ripe for expansion. The Kentucky automotive manufacturing industry is already fairly concentrated, with 82 percent of employment in the Bowling Green-Hopkinsville, Lexington, and Louisville regions (see Table 9). Further manufacturing growth in the central regions of the Commonwealth may be enough to create the synergies needed to grow the tooling industry. While the CAR report points out workforce issues, a growing tooling industry could also make the area more attractive to manufacturers.

ALUMINUM: AN OPPORTUNITY FOR THE FUTURE

Until recently, aluminum has only been used in mechanical components in cars, with all-aluminum vehicle bodies being the preserve of high end or specialist vehicles. That's changing as mass-market models begin to utilize the recyclable material in chassis and bodies. In the United States, Ford recently became the first producer of a large volume, mass-market aluminum-bodied vehicle with the introduction of the 2015 F-150 pickup truck. This is just the beginning of a significant change in the industry. Automakers are accelerating their shift to aluminum for new car and light truck construction, as they seek to safely and cost-effectively lower the weight of vehicles and provide consumers with the fuel efficient vehicles they demand. According to industry experts, manufacturers will significantly increase the use of aluminum in passenger vehicles over the next decade, doubling aluminum's percent of vehicle curb weight from 8 to 16 percent. It is forecast that by 2025 more than 75% of pickup trucks and 20% of SUVs and large sedans produced in North America will be aluminum-bodied. This represents an aluminum body sheet content ten times greater than 2012 levels, with even more room to grow beyond 2025.

The aluminum industry sees this as a tremendous opportunity for growth and conferences have been held worldwide covering the topic. Many of the major corporations in the industry are currently spending hundreds of millions of dollars expanding rolling mills to service this new market or are actively planning to do so. Kentucky has had a relatively large and vibrant aluminum industry for years and is now well-positioned to take advantage of this activity. Indeed, in October of 2014, Aleris, a worldwide producer of aluminum rolled products that has been producing automotive body sheet in Belgium for high end European vehicles for over a decade, broke ground on a \$350 million expansion of its Lewisport rolling mill in Hancock County to equip the site with the additional heat treatment and finishing capabilities required for the production of wide aluminum auto body sheet. This is just one of three such projects currently underway in the U.S.

All three projects are expanding and partially converting large plants that previously produced unrelated products, such as sheet for beverage cans. Kentucky is home to a leading manufacturer of flat rolled aluminum sheet for the beverage industry that employs a thousand people and is part owned by one of Ford's two aluminum sheet suppliers.

One of the reasons the Lewisport expansion was attractive to Aleris is the fact that the major raw material needed is produced in large quantities nearby. Over the last decade or so primary aluminum smelter capacity in the U.S. has shrunk markedly as several large plants have been permanently shuttered due to low worldwide aluminum prices and high operating costs, largely due to electricity. As seen in Table 2, above, Kentucky's industrial electricity costs are very low. Perhaps due in part to this advantage, Kentucky's primary aluminum industry has remained strong, with two large smelters in the north central part of the state near Henderson and Owensboro. Aleris' Lewisport mill is located between the two smelters. Kentucky smelters currently account for just over a quarter of all primary aluminum production in the country. In addition, Century Aluminum, which owns both Kentucky smelters, also owns a shuttered smelter in nearby West Virginia that it would like to reopen.

**Table 13. Primary Aluminum Smelters in the United States
with Capacity and Current Output**

State	City	Company	Smelter Capacity	Idle Capacity (tons per year)	Current Operations
IN	Evansville	Alcoa - Warrick Operations	269,000		269,000
MO	New Madrid	Noranda Aluminum Inc.	263,000		263,000
KY	Hawesville	Century Aluminum of Kentucky LLC	244,000		244,000
WA	Ferndale	Alcoa - Intalco Aluminum Corp.	279,000	49,000	230,000
SC	Mount Holly	Century - Mt. Holly	224,000		224,000
KY	Sebree	Century Sebree Works	205,000		205,000
WA	Wenatchee	Alcoa - Wenatchee Works	184,000	41,000	143,000
NY	Massena	Alcoa - Massena Operations	130,000		130,000
TX	Rockdale	Alcoa - Rockdale Works	191,000	191,000	0
WV	Ravenswood	Century Aluminum of West Virginia Inc. (RAC)	170,000	170,000	0
			2,159,000	451,000	1,708,000

Sources: Light Metal Age magazine website (http://www.lightmetallage.com/producers_primary.php) supplemented by information from Alcoa, Century Aluminum, and Noranda Aluminum corporate websites.

A key aspect of the auto industry's shift to aluminum bodies is recycling of unused aluminum. Ford generates thousands of pounds of scrap every day because only 60 percent of each roll of aluminum is actually used to make body parts for the F-150. Ford invested \$60 million in equipment to separate and shred the scrap before shipping it back to suppliers. One of Ford's two aluminum sheet suppliers relies on scrap material for producing 50 percent of its automotive aluminum sheet. Kentucky has several large scale aluminum recycling facilities, including a high tech facility owned by this Ford supplier which produces aluminum ingots from recycled beverage cans.

Kentucky's leadership in aluminum smelting and its existing corporate connections to leaders in the production of aluminum auto body sheet make it well positioned to take advantage of this growing market opportunity.

THE ECONOMIC AND FISCAL IMPORTANCE OF THE AUTOMOTIVE INDUSTRY IN KENTUCKY

We characterized Kentucky's automotive industry in the first sections of this report with estimates of production, exports, jobs and payrolls. In the parlance of economic impact studies, these are called the direct impacts. Of course, the impacts do not end there. Because the products are purchased primarily by consumers outside the state, the industry brings in new dollars to Kentucky, dollars that recirculate among vendors, employees and households. We turn to these spinoff impacts in this section, and aggregate all components to a total economic impact estimate.

We use a custom input-output model of Kentucky to investigate the linkages between the automotive industry and other industries in the state. Input-output models are the standard method for measuring sales among industries. Our IMPLAN model of Kentucky has details on 536 industries, and can predict how much each industry buys from every other industry in the state, as well as how much must be imported from outside the state to support a given level of production.

It is insightful to think of an input-output table as a set of production recipes, with each industry column showing how much must be purchased from each row industry to produce its annual output. For example, the automotive industry nationally is a large purchaser of gasoline engines, transmissions, interior trim, stamped metal, truck transportation, and wholesale trade distribution services among other things. These are identified from national industry surveys. These national tables are 'regionalized' by IMPLAN using economic data on the presence and size of industries at the state, metropolitan area, or county level as needed.

The resulting regional models and industry multipliers take account of the ability of the regional economy to supply inputs to each industry. In the case of the automotive industry, for example, IMPLAN predicts that a much higher percentage of the steering and suspension components needed by the state's assembly plants can be supplied by Kentucky firms than can transmission and power train parts. Nearly all of the latter must be imported, with the result that those purchasing dollars leak out to other states (or countries).

The automotive industry's purchases of intermediate goods and services in Kentucky, as well as its payments to workers and business owners in the state, cause rounds of re-spending across other industries. The inter-industry impacts are often referred to as 'indirect' effects, since changes in activity at OEMs will quickly cause changes in activity at suppliers. The household spending impacts are often referred to as 'induced' effects, since changes in industrial production ultimately hit the regional economy through employees' wages and the associated spending on goods and services.

At each round of re-spending, a portion of the dollars leak out due to saving, purchases of imported goods, and tax payments, so that the re-spending ultimately goes to zero. The cumulative impact of the re-spending is measured in economic multipliers, which are the ratio of total economic activity to activity in the automotive industry.

EMPLOYMENT MULTIPLIERS FOR THE AUTOMOTIVE INDUSTRY AND OTHER LARGE INDUSTRIES

Our IMPLAN model of Kentucky contains detailed estimates of output, employment, payroll, and value added for 536 detailed industries in the state. We can use those estimates to make some observations about the relative importance of the automotive industry. We compare the employment multipliers of the various industries making up the broad automotive industry to other industries with a significant presence in the state.

Table 14 shows the industries with the largest employment multipliers in the state among the 212 industries with at least a thousand employees, plus the remaining automotive related industries. The two industries comprising

Kentucky's four assembly plants are both among the industries that create the most spin-off jobs. For every 100 jobs in light truck and utility vehicle manufacturing a total of 424 jobs are supported, the 100 direct jobs and 324 more spread around the broader economy. Most of the industries with larger multipliers than the two passenger vehicle assembly industries are related to food, especially animal, production, chemicals, and metals. All of the motor vehicle parts manufacturing industries rank fairly high. Even the lowest is at the midpoint of the 212 larger sized industries.

Except for water transportation and wireless telecommunications carriers, all of the industries in the table are manufacturers. However, there are several non-manufacturing industries that receive considerable public attention and it is interesting to compare their impacts to that of the automotive industry.

Our IMPLAN model estimates that the insurance carriers sector, which includes Humana, employs 23,150 people, and has an employment multiplier of 2.87 (ranked 22nd). Coal mining employs 12,400, but has an employment multiplier of just 2.13. The courier and messenger industry, which includes UPS, Kentucky's largest private employer, has direct employment of nearly 28,600, but its employment multiplier is only 1.64.

**Table 14. Largest Employment Multipliers in Kentucky
Among 212 Industries with 1,000 or More Jobs**

Industry	Employment		
	Employment	Multiplier	Rank
Animal, except poultry, slaughtering	1,678	7.73	1
Other animal food manufacturing	1,132	5.98	2
Other basic organic chemical manufacturing	1,383	5.44	3
Tobacco product manufacturing	1,007	5.42	4
Fluid milk manufacturing	1,218	4.97	5
Water transportation	2,911	4.26	6
Light truck and utility vehicle manufacturing	7,262	4.24	7
Wireless telecommunications carriers (except satellite)	1,735	4.19	8
Iron and steel mills and ferroalloy manufacturing	1,346	4.16	9
Meat processed from carcasses	2,141	4.05	10
Aluminum sheet, plate, and foil manufacturing	2,249	4.00	11
Paper mills	1,364	3.76	12
Automobile manufacturing	8,820	3.71	13
Electric power transmission and distribution	4,188	3.65	14
Motor vehicle gasoline engine and engine parts manufacturing	2,488	2.76	27
Motor vehicle transmission and power train parts manufacturing	1,697	2.68	30
Mot. veh. steering, suspension component, & brake systems mfg.	7,350	2.45	42
Other motor vehicle parts manufacturing	7,660	2.43	44
Motor vehicle electrical and electronic equipment manufacturing	1,603	2.33	52
Motor vehicle seating and interior trim manufacturing	4,279	2.22	60
Motor vehicle metal stamping	5,224	2.02	75
Motor vehicle body manufacturing	1,172	1.79	107

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Note: Multiplier is the change in total jobs in Kentucky per job in the given industry .

Much larger employment multipliers than those in Table 14 are often seen in the literature on the automotive industry, including, for example, the very recent study by the Center for Automotive Research (2014) cited previously. That study reports a multiplier of 7.6 for the automakers (Ford, GM, BMW, Toyota, etc.) and 6.1 for parts manufacturers. The automakers category includes jobs in headquarters, engineering, finance, administrative, warehousing, and wholesale functions as well as vehicle assembly. When considering only assembly line employment the authors note that the employment multiplier is approximately 11. Higher multipliers such as those in the CAR report and the ones reported here can coexist peacefully and, indeed, are not contradictory.

The reason for the differing multipliers is because the CAR results (and others) are the nationwide effects of the industry. This analysis concentrates on the effects that stay within Kentucky's borders. The material components that make up any single auto, pickup truck, or SUV are many and complex, and the processes of their manufacture and assembly involve hundreds of transactions, many of which cross state borders. As the authors of the CAR study point out, the employment contribution of the auto industry in one state is not due just to the investment in that state, but also partly results from investments and activities in many other states. Therefore, industry activities in Kentucky are helping to create jobs in other states as well as Kentucky.

Table 15 shows the indirect effects multipliers for the automotive manufacturing industries for Kentucky, Indiana, and the United States. We include Indiana to show that its multipliers are only slightly higher than Kentucky's despite also having a large and mature motor vehicle manufacturing sector and an overall state economy more than 50 percent larger than Kentucky's.

The indirect effect multiplier refers to only those jobs created through business-to-business spending on intermediate inputs. As seen in the table, the U.S. multipliers are much greater than the state level multipliers. This is because any spending outside of the state is "lost" and not included in the rounds of re-spending as the multiplier is calculated. This is true even in the larger setting of Indiana's economy and underscores the national scope of the automotive industry. In any state the automotive industry operates only a fraction of the spin-off jobs it creates stays within that state.

Table 15. National and State-Based Multipliers
Kentucky Jobs Create Jobs Across the United States

Industry	Kentucky Indirect Effects Multiplier	Indiana Indirect Effects Multiplier	U.S. Indirect Effects Multiplier	Jobs Created Outside KY For Each Job in KY
Automobile manufacturing	2.56	2.77	8.78	6.2
Light truck and utility vehicle manufacturing	2.95	3.25	10.99	8.0
Motor vehicle body manufacturing	1.33	1.34	2.27	0.9
Motor vehicle gasoline engine and engine parts mfg.	2.09	2.15	4.33	2.2
Motor vehicle electrical and electronic equipment mfg.	1.74	1.71	2.79	1.0
Mot. veh. steering, suspension comp., & brake sys. mfg.	1.81	1.86	3.38	1.6
Motor vehicle transmission and power train parts mfg.	2.00	2.06	4.18	2.2
Motor vehicle seating and interior trim manufacturing	1.68	1.69	3.44	1.8
Motor vehicle metal stamping	1.51	1.59	2.52	1.0
Other motor vehicle parts manufacturing	1.83	1.88	3.54	1.7

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, models of Kentucky, Indiana, and United States using 2013 economic data.

Notes: Indirect effects multiplier is the change in total jobs within the geography per job in the given industry, but only those jobs due to business-to-business spending on intermediate inputs.

The number of jobs created outside Kentucky for each job within Kentucky assumes that the overall average U.S. indirect effects multiplier applies to Kentucky jobs. For example, an auto assembly plant job would lead to 7.78 additional jobs nationwide, 1.56 of which would be located within Kentucky, so roughly 6.2 jobs would be in other states. Household spending would add additional jobs, both within and outside of Kentucky.

If we were to construct a fifty-state model of the U.S. it would be possible for IMPLAN to calculate the number of jobs in each state that are associated with the automotive industry in Kentucky, and the sum of all those jobs would likely give us multipliers close to those in the U.S. column of Table 15, but only a fraction would actually be in Kentucky.

The last column of table 15 is an estimate of the number of jobs the Kentucky automotive industry contributes to outside of Kentucky due to business-to-business spending. For example, acquiring all the inputs up and down the supply chain for the Ford plants in Louisville, and the subsequent re-spending, contributes to eight jobs outside of Kentucky for each job at one of the assembly plants.

THE ECONOMIC CONTRIBUTION OF THE AUTO ASSEMBLY PLANTS TO KENTUCKY'S ECONOMY

In this and the following sections we will be looking at the economic “contribution” of the automotive industry to Kentucky’s economy rather than its “impact.” The term economic impact is properly reserved for those situations that involve a change to the existing activities in an industry, such as new investment increasing capacity and/or jobs or a contraction of output and/or jobs short of a full shutdown. The impact is then the changes to employment, output, and payroll resulting from the changed circumstances.

The term economic contribution is more appropriate when discussing the effects that an entire industry has on the broader regional economy. The emphasis is on the current presence of an industry rather than a proposed change. Nevertheless, in practice, we simulate the industry’s contribution by essentially pretending that it no longer exists in the regional economy. This requires us to be careful about forward and backwards linkages to other industries and to make sure we eliminate trade flows that would no longer apply. The IMPLAN software allows for these nuances and we have made the necessary adjustments here and in the following sections.

An additional wrinkle with the automotive industry is that it is naturally organized in a hierarchy (to which the industry terms OEM, Tier I, Tier II, etc. allude). The assembly plants are at the very top of the hierarchy, outputting the finished product. Just below this level are all of the companies making the bodies, brake, electrical, and suspension systems, trim, engine and other major components used in the assembly plants. The bottom levels of the hierarchy contain the makers of specialty nuts, bolts, hoses, and other parts (along with tool and die shops) that are used by those in the upper levels. In this hierarchy, the assembly plants are the clear “top of the food chain,” with the industry’s effects rippling down from them. We therefore examine the economic contribution emanating from the state’s four assembly plants separate from the rest of the industry (in this section) and tackle the remaining major component system suppliers in a later section.

Table 16 shows the statewide results of our economic contribution analysis of the four automotive assembly plants. The direct effect refers to the assembly plants themselves, while the indirect effect refers to the business-to-business spending that results from the assembly plants and their suppliers acquiring intermediate inputs in order to produce their goods and services. The induced effect refers to the household spending of all the employees of the businesses affected by assembly plant operations.

After accounting for all the supplier networks and the household spending the roughly 16,100 jobs at the assembly plants in 2013 contributed to a total of nearly 69,900 jobs in Kentucky. Collectively, these jobs had a payroll of about \$3.5 billion, and the businesses added \$8.9 billion of value to the state’s Gross State Product (GSP). The value added column includes employee compensation, indirect business taxes (sales and other excise taxes, property taxes that are shifted to the consumer) and proprietary and other property income, but not the inputs that a business purchases from outside itself. In other words, it includes just what value each business adds to the inputs it uses. Value added avoids the problem of double counting intermediate inputs up and down the supply chain, and when summed up over all businesses it equals the total value of all business activity in a region.

The overall employment multiplier was 4.34, meaning that each assembly plant job was able to support an additional 3.34 jobs. This multiplier is larger than either of the multipliers for assembly plants shown in Table 14 because of the way our analysis was conducted. The contribution analysis was run as a multi-region model. That is, we had separate input-output models for each of the nine economic regions of the Commonwealth along with the corresponding trade flows for commodities between them. This allowed us to model the contribution of each of the assembly plants separately along with how each one affected jobs and payrolls in each of the nine regions.

It is this feedback between regions (a major component manufacturer in the Cumberland region supplying the GM plant in Bowling Green, for example) that leads to the larger multipliers. The multipliers in Table 14 represent statewide averages of trade flows within Kentucky, and therefore mask some of the cross-region synergies. This kind of analysis involving any of the industries listed in Table 14 would produce larger multipliers, so the relative ranks shown in that table would likely change very little.

The value added and payroll multipliers are significantly lower due to the idiosyncrasies of assembly plants. The increased value of fully assembled pickup trucks, SUVs, sports cars, and sedans is very high relative to the parts that make them up and any goods and services households regularly buy so comparatively little extra value is added along the supply chain compared to the number of added jobs. The payroll multiplier is well below the employment multiplier largely because of the high average wages paid by the assembly plants. The average annual wage per job for the assembly

plants is a bit over \$84,000. This is very high compared to the rest of the state's economy, so the jobs supported by the operations of the assembly plants will have lower average wages, thus making the payroll multiplier lower than the employment multiplier.

In this case the jobs resulting from the business-to-business spin-off from the assembly plants have an average annual wage of \$46,200 and the jobs resulting from household spending have an average annual wage of just \$28,300. The lower payroll multiplier should not be a concern, however, because the number of jobs in the induced effect is relatively high due to the high household incomes of the assembly plant employees (compare to Table 19, below).

**Table 16. Annual Economic Contribution
of the Automotive Assembly Plants in Kentucky**

Impact Type	Employment	Value Added	Payroll Estimate
Direct Effect	16,082	\$4,280,835,365	\$1,353,388,750
Indirect Effect	32,347	\$3,211,628,280	\$1,494,433,810
Induced Effect	21,434	\$1,452,006,889	\$606,496,820
Total Effect	69,863	\$8,944,470,535	\$3,454,319,380
Multiplier	4.34	2.09	2.55

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Note: Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

All of the economic contribution results reported analyze a snapshot in time, utilizing 2013 data. However, since input-output models are by design linear and symmetric, all of the ratios between the various rows and columns of the results tables should remain constant given relatively small changes in the direct employment, output, or payroll, as long as the inputs from regional suppliers also remain fairly stable over time. Major changes in supplier relationships (for instance a large new engine manufacturing facility that replaces components imported from other states) can alter the indirect effects (and thereby the induced effects, as well).

Table 17 breaks down the employment contribution of the assembly plants by the nine economic regions of the state. As might be expected, most of the contribution of the assembly plants is concentrated in the three regions in which they are located (Bowling Green-Hopkinsville, Lexington, and Louisville) plus Northern Kentucky.

Relative to the number of assembly plant jobs in Bowling Green compared to Georgetown and Louisville, that region captures a large percentage of the business-to-business spin-off effects. But it also does relatively poorly with household effects due to significantly lower average pay the automotive suppliers and other downstream businesses. The Northern Kentucky region does well capturing the indirect effects of the Toyota assembly plant in Georgetown and to a lesser extent the Ford plants in Louisville. Aside from Northern Kentucky, the Louisville and Cumberland regions have the strongest ties to the Georgetown assembly plant. The Lexington and Bowling Green-Hopkinsville regions have the strongest ties to the two Louisville assembly plants, and the Louisville region has by far the strongest connections to the GM Corvette plant in Bowling Green.

In general, 95 percent of the combined indirect and induced spin-off effects of the assembly plants occur within the home region of the assembly plant or the adjacent regions. Eighty-four percent of the spin-off effects of the two Ford plants stay in the Louisville region, while just about 73 percent of the spin-off of the other two assembly plants stays in their home region.

Table 17.
Employment Contribution of the Automotive Assembly Plants in Kentucky
by Economic Region of the State

Region	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Ashland	0	193	61	254
Bowling Green-Hopkinsville	978	2,327	826	4,131
Cumberland	0	927	283	1,210
Lexington	7,842	10,345	8,227	26,415
Louisville	7,262	15,908	10,969	34,138
Mountain	0	228	76	304
Northern Kentucky	0	1,970	841	2,811
Owensboro-Henderson	0	347	112	459
Paducah-Purchase	0	102	40	141
Total Statewide Contribution	16,082	32,347	21,434	69,863

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Note: Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Table 18 shows the employment contribution of the auto assembly plants by industry sector. Aside from the two categories of assembly plant, by far the greatest number of jobs supported by the state's assembly plants is in wholesale trade. These are the enterprises engaged in storing, distributing, and transporting all of the individual parts that make up an automobile. It is important to note that the input-output model is constructed on an establishment basis. This means that a parts manufacturing business that has a separate distribution warehouse is recorded as two establishments under different industries, one manufacturing and the other wholesale trade.

**Table 18. Employment Contribution of the Automotive Assembly Plants in Kentucky
by Industry Sector**

Industry Sector	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Wholesale trade	0	9,194	415	9,609
Automobile manufacturing	8,820	0	0	8,820
Light truck and utility vehicle manufacturing	7,262	0	0	7,262
Management of companies and enterprises	0	2,522	99	2,621
Truck transportation	0	2,425	178	2,603
Real estate	0	720	1,013	1,733
Employment services	0	1,153	566	1,719
Full-service restaurants	0	294	1,245	1,539
Limited-service restaurants	0	242	1,143	1,385
Hospitals	0	0	1,250	1,250
Other motor vehicle parts manufacturing	0	962	1	963
Mot. veh. steering, suspension component, & brake systems mfg.	0	866	1	867
Retail - General merchandise stores	0	143	667	809
Motor vehicle seating and interior trim manufacturing	0	721	0	721
Offices of physicians	0	0	718	718
Services to buildings	0	440	239	679
Warehousing and storage	0	567	103	670
Retail - Food and beverage stores	0	30	580	610
Monetary authorities and depository credit intermediation	0	269	333	602
Management consulting services	0	490	111	601
Motor vehicle metal stamping	0	419	0	419
Motor vehicle gasoline engine and engine parts manufacturing	0	209	0	209
Motor vehicle transmission & power train parts manufacturing	0	195	0	195
Motor vehicle electrical & electronic equipment manufacturing	0	156	0	157
Motor vehicle body manufacturing	0	81	0	81
All other industries	0	10,250	12,772	23,022
Total	16,082	32,347	21,434	69,863

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Note: Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Other industries to note are truck transportation and employment services. The latter is likely a reflection of the variable staffing issue we discuss above.

Finally, the eight industries comprising motor vehicle body and parts manufacturing account for just 3,610 of the more than 32,300 jobs supported by the assembly plants through the business-to-business spending associated with them. This is just seven percent (body manufacturing) to 17 percent (seating and interior trim manufacturing) of the total statewide employment in these eight industries. This is an indication of two different aspects of the broader industry in Kentucky. First, although when sourcing within the state the assembly plants usually stay pretty close to home (95 percent of spin-off effects are with the home or adjacent regions), they also source the majority of their inputs from outside the Commonwealth. Second, Kentucky's parts suppliers often have contracts with multiple OEMs in several states and each can ship anywhere from ten to 70 percent of their products out-of-state. This tells us that Kentucky's automotive parts suppliers have a significant economic contribution separate from their ties to the state's assembly plants. We examine this in the next section.

THE ECONOMIC CONTRIBUTION OF AUTOMOTIVE PARTS MANUFACTURING TO KENTUCKY'S ECONOMY

In this analysis we were careful to exclude all of the effects associated with the assembly plants. This means adjusting all of the employment numbers for those eight body and parts manufacturing sectors downward to eliminate the effects of the assembly plants. We also eliminated the assembly plants from the data and altered trade flows between industries so that no Kentucky industry would be buying these industries' products and they would all be exported out of state. In effect, we eliminated the within-state forward linkages so that we would not be including interactions that had already been accounted for in the previous assembly plant analysis. We also do not include in the direct effect any industry other than the major manufacturing components of motor vehicles (as is sometimes seen in other reports) because they are part of the downstream effects of the automotive industry.

Table 19 shows the results of the analysis of auto body and parts manufacturing. The 27,400 jobs in those industries that were not implicated in the assembly plant analysis contributed to a total of about 66,700 jobs statewide, with a total payroll of \$2.7 billion and producing \$5.4 billion worth of value added in 2013. Every job in motor vehicle body or parts manufacturing contributed to the support of 1.43 additional jobs throughout the state economy. The average annual wage per job across the eight body and parts manufacturing industries was just under \$48,000. This is a bit higher than the rest of the state's economy, so the jobs supported by the operations of the body and parts manufacturers will have lower average wages, thus making the payroll multiplier lower than the employment multiplier. In this case the jobs resulting from the business-to-business spin-off from the assembly plants have an average annual wage of \$40,300 and the jobs resulting from household spending have an average annual wage of just \$27,500.

**Table 19. Annual Economic Contribution
of Automotive Body and Parts Manufacturing in Kentucky**

Impact Type	Employment	Value Added	Payroll Estimate
Direct Effect	27,394	\$2,455,104,042	\$1,313,884,041
Indirect Effect	22,147	\$1,809,703,137	\$892,431,665
Induced Effect	17,143	\$1,138,175,562	\$470,923,682
Total Effect	66,684	\$5,402,982,742	\$2,677,239,388
Multiplier	2.43	2.20	2.04

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Notes: The analysis represents the contribution of motor vehicle parts manufacturing after removing the employment and output tied to the assembly plants in the assembly plant contribution analysis, and assumes all remaining output would be consumed out of state. Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Table 20 breaks down the employment contribution of the assembly plants by the nine economic regions of the state. As might be expected since these results are not tied to servicing the needs of the state's assembly plants, the results are far less geographically concentrated.

The Bowling Green-Hopkinsville, Cumberland, and Owensboro-Henderson regions all have much greater economic contributions to the state's economy from their body and parts industries independent of the assembly plants than they did associated with the four assembly plants. The Bowling Green-Hopkinsville and Cumberland regions are situated farthest south and north-south interstates I-24, I-65, and I-75 run through them. The Owensboro-Henderson region is very near the Toyota assembly plant in Princeton, Indiana.

Table 20.
Employment Contribution of Auto Body & Parts Manufacturing in Kentucky
by Economic Region of the State

Region	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Ashland	168	118	118	404
Bowling Green-Hopkinsville	6,283	5,100	2,528	13,912
Cumberland	2,492	1,972	1,438	5,901
Lexington	6,367	4,755	4,169	15,291
Louisville	8,231	7,448	6,493	22,173
Mountain	44	13	14	71
Northern Kentucky	1,987	1,807	1,542	5,336
Owensboro-Henderson	1,653	794	738	3,185
Paducah-Purchase	169	140	103	412
Total Statewide Contribution	27,394	22,147	17,143	66,684

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Notes: The analysis represents the contribution of motor vehicle parts manufacturing after removing the employment and output tied to the assembly plants in the assembly plant contribution analysis, and assumes all remaining output would be consumed out of state. Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Table 21 shows the employment contribution of the automotive body and parts manufacturing industries by industry sector.

Wholesale trade, management of companies and enterprises, truck transportation, and employment services are again the top four industries supported by business-to-business activity. Much of the rest of the list is related to household spending.

**Table 21. Employment Contribution of Auto Body & Parts Manufacturing in Kentucky
by Industry Sector**

Industry Sector	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Other motor vehicle parts manufacturing	6,698	0	0	6,698
Mot. veh. steering, suspension component, & brake systems mfg.	6,482	0	0	6,482
Motor vehicle metal stamping	4,805	0	0	4,805
Motor vehicle seating and interior trim manufacturing	3,558	0	0	3,558
Wholesale trade	0	3,148	397	3,545
Management of companies and enterprises	0	2,299	83	2,382
Motor vehicle gasoline engine and engine parts manufacturing	2,279	0	0	2,279
Truck transportation	0	1,389	167	1,555
Employment services	0	1,098	446	1,544
Motor vehicle transmission and power train parts manufacturing	1,502	0	0	1,502
Motor vehicle electrical and electronic equipment manufacturing	1,447	0	0	1,447
Limited-service restaurants	0	336	958	1,293
Full-service restaurants	0	333	957	1,290
Real estate	0	411	720	1,130
Hospitals	0	0	1,055	1,055
Retail - General merchandise stores	0	461	551	1,011
Retail - Motor vehicle and parts dealers	0	640	239	880
Securities and commodity contracts intermediation & brokerage	0	609	165	774
Services to buildings	0	490	180	670
Motor vehicle body manufacturing	623	26	0	649
All other industries	0	10,909	11,225	22,134
Total	27,394	22,147	17,143	66,684

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Notes: The analysis represents the contribution of motor vehicle parts manufacturing after removing the employment and output tied to the assembly plants in the assembly plant contribution analysis, and assumes all remaining output would be consumed out of state. Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Table 22 combines tables 16 and 19 to show the total economic contribution of the automotive manufacturing industry to the Kentucky economy in 2013. It is important to remember that the direct employment in Table 19 is not the same as the total employment in the automotive manufacturing industry in the state because some of the body and parts manufacturing employment (3,610 jobs) is included among the indirect effects of the assembly plants. Altogether, the automotive manufacturing industry in Kentucky contributes just over 136,500 jobs to the state's economy. Those jobs have \$6.1 billion in payroll and contributed \$14.3 billion to Gross State Product.

**Table 22. Annual Economic Contribution
of Automotive Manufacturing in Kentucky**

Impact Type	Employment	Value Added	Payroll Estimate
Direct Effect	43,475	\$6,735,939,407	\$2,667,272,792
Indirect Effect	54,495	\$5,021,331,417	\$2,386,865,475
Induced Effect	38,577	\$2,590,182,451	\$1,077,420,502
Total Effect	136,547	\$14,347,453,277	\$6,131,558,769
Multiplier	3.14	2.13	2.30

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Notes: The analysis represents combined contributions of the motor vehicle assembly plants and motor vehicle parts manufacturing. Parts manufacturing effects exclude the indirect and induced effects on those industries resulting from the activities of the assembly plants. Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

**Table 23.
Employment Contribution of Automotive Manufacturing in Kentucky
by Economic Region of the State**

Region	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Ashland	168	311	179	658
Bowling Green-Hopkinsville	7,261	7,427	3,354	18,043
Cumberland	2,492	2,898	1,721	7,111
Lexington	14,209	15,100	12,397	41,705
Louisville	15,493	23,357	17,462	56,312
Mountain	44	241	90	375
Northern Kentucky	1,987	3,777	2,383	8,147
Owensboro-Henderson	1,653	1,141	850	3,644
Paducah-Purchase	169	242	143	553
Total Statewide Contribution	43,476	54,495	38,577	136,548

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Notes: The analysis represents combined contributions of the motor vehicle assembly plants and motor vehicle parts manufacturing. Parts manufacturing effects exclude the indirect and induced effects on those industries resulting from the activities of the assembly plants. Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Table 23 combines tables 17 and 20 to show the contribution of the automotive manufacturing industry to each of the nine regions of the state.

**Table 24. Employment Contribution of Automotive Manufacturing in Kentucky
by Industry Sector**

Industry Sector	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Wholesale trade	0	12,341	812	13,154
Automobile manufacturing	8,820	0	0	8,820
Other motor vehicle parts manufacturing	6,698	962	1	7,660
Mot. veh. steering, suspension component, & brake systems mfg.	6,482	866	1	7,350
Light truck and utility vehicle manufacturing	7,262	0	0	7,262
Motor vehicle metal stamping	4,805	419	0	5,224
Management of companies and enterprises	0	4,821	182	5,003
Motor vehicle seating and interior trim manufacturing	3,558	721	0	4,279
Truck transportation	0	3,814	345	4,158
Employment services	0	2,251	1,012	3,263
Real estate	0	1,130	1,733	2,863
Full-service restaurants	0	627	2,202	2,829
Limited-service restaurants	0	578	2,100	2,678
Motor vehicle gasoline engine and engine parts manufacturing	2,279	209	0	2,488
Hospitals	0	0	2,305	2,305
Retail - General merchandise stores	0	604	1,217	1,821
Motor vehicle transmission and power train parts manufacturing	1,502	195	0	1,697
Motor vehicle electrical and electronic equipment manufacturing	1,447	156	0	1,603
Services to buildings	0	929	420	1,349
Offices of physicians	0	0	1,305	1,305
Securities and commodity contracts intermediation and brokerage	0	920	374	1,294
Retail - Motor vehicle and parts dealers	0	753	531	1,284
Warehousing and storage	0	1,025	190	1,215
Monetary authorities and depository credit intermediation	0	588	613	1,202
Retail - Food and beverage stores	0	124	1,070	1,194
Automotive repair and maintenance, except car washes	0	345	737	1,082
Business support services	0	892	182	1,074
Nursing and community care facilities	0	0	1,071	1,071
Maintenance and repair construction of nonresidential structures	0	793	211	1,004
Motor vehicle body manufacturing	623	107	0	730
All other industries	0	18,324	19,961	38,285
Total	43,475	54,495	38,577	136,547

Source: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data.

Notes: The analysis represents combined contributions of the motor vehicle assembly plants and motor vehicle parts manufacturing. Parts manufacturing effects exclude the indirect and induced effects on those industries resulting from the activities of the assembly plants. Indirect impact refers to business-to-business spin-off spending; Induced impact refers to household spending that is a result of increased earnings.

Table 24 combines the information making up tables 18 and 21 to show the economic contribution of the automotive manufacturing industry by industry sector.

Table 25.
The Contribution of the Automotive Manufacturing Industry as a Percentage of Total Employment

Region	Total Effect	Percent of Total Employment
Ashland	658	0.9%
Bowling Green-Hopkinsville	18,043	7.0%
Cumberland	7,111	5.0%
Lexington	41,705	8.4%
Louisville	56,312	7.3%
Mountain	375	0.3%
Northern Kentucky	8,147	3.2%
Owensboro-Henderson	3,644	2.4%
Paducah-Purchase	553	0.4%
Total Statewide Contribution	136,548	5.6%

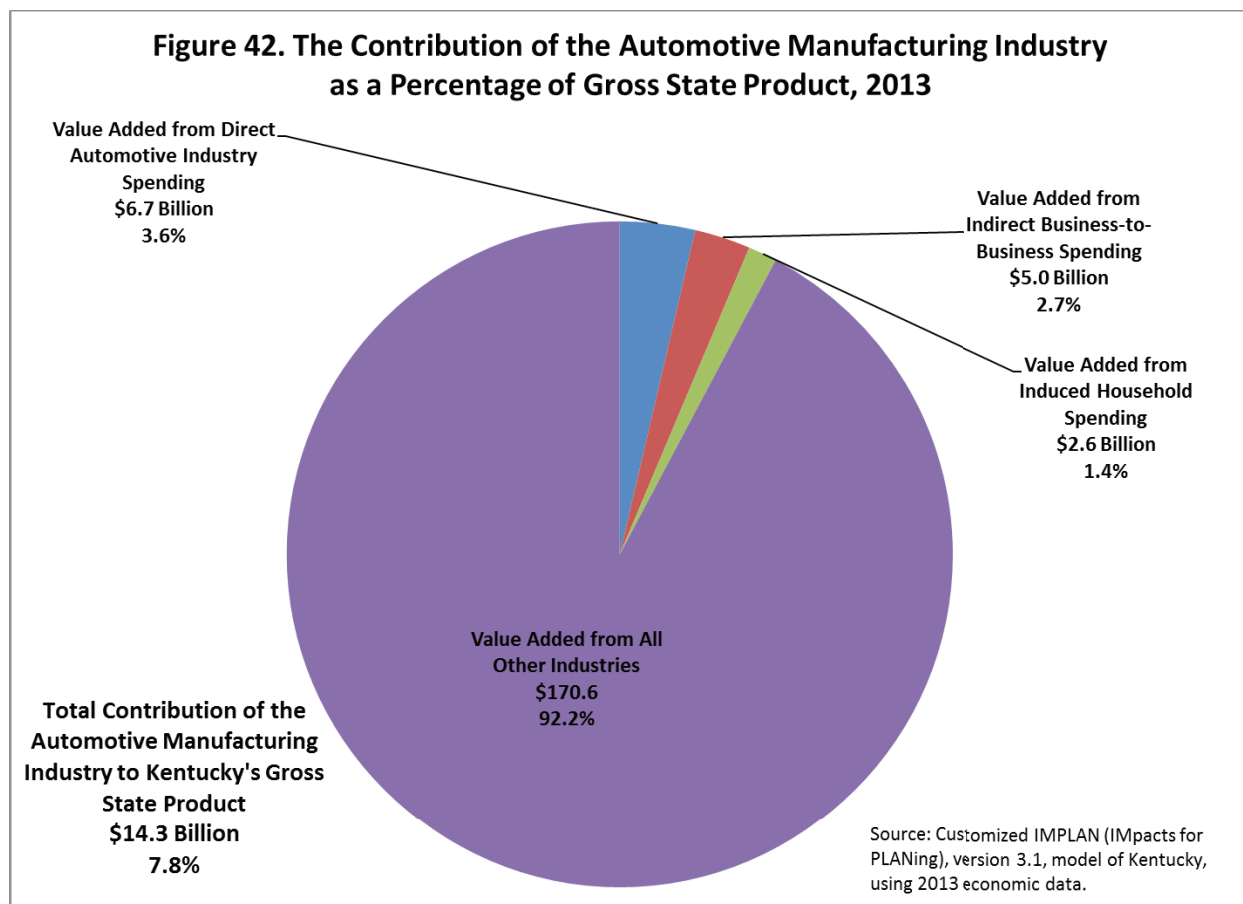
Sources: Customized IMPLAN (IMpacts for PLANing), version 3.1, model of Kentucky, using 2013 economic data. U.S. Bureau of Economic Analysis.

Finally, Table 25 and Figure 42 give a big picture view of just how important automotive manufacturing industry is to the overall Kentucky economy.

Statewide, the automotive manufacturing industry through its direct, indirect, and induced effects contributes 5.6 percent of the state's employment.

The contribution of the industry varies widely among the nine economic regions. At the low end, the auto manufacturing industry contributes to less than one percent of the jobs in the far eastern and western parts of the state (the Ashland, Mountain, and Paducah-Purchase regions). But in Bowling Green-Hopkinsville the industry contributes to seven percent of all employment, in the Louisville region it contributes to 7.3 percent of all jobs, and in the Lexington region the auto manufacturing industry contributes to 8.4 percent of all employment.

The \$14.3 billion of value added contribution represents 7.8 percent of Kentucky's gross state product. Roughly one out of every thirteen dollars that Kentucky adds to the national economy can be tied to the automotive industry. Only the healthcare and wholesale trade industries add more value to the Commonwealth's GSP (although, from Table 24, fifteen percent of wholesale trade employment is related to the auto industry).



THE FISCAL IMPACT TO STATE AND LOCAL GOVERNMENTS OF THE AUTOMOTIVE INDUSTRY IN KENTUCKY

The automotive industry pays many different types of taxes to state and local governments in Kentucky. Among those taxes are property taxes on land, buildings, and tangible property (including manufacturing equipment), and corporate income taxes. Additionally, employees own homes and vehicles and pay property taxes on those, as well as on insurance policies. All these taxes depend on local or firm specific factors that are beyond the scope of this report. Instead, our estimates focus on the taxes most directly associated with employment income, local occupational taxes and state income and sales taxes. At the state level, income and sales taxes make up nearly three-quarters of general fund revenue, and for many localities occupational taxes are significant.

Kentucky income and sales tax receipts associated with automotive industry related payrolls can be estimated using effective tax rates. Effective tax rates are calculated by dividing historical tax revenues by payrolls. We have taken county level data on income and sales tax collections and wage and salary income and aggregated each to the nine economic regions of the state. We use the average effective tax rate for each region over the last three years of available tax collection data.

Calculating effective occupational tax rates received by local governments is a bit more complicated. When we know the exact location of an establishment we can simply apply the appropriate rate for the jurisdiction. We do this for the four assembly plants. But for indirect and induced effects, where the location of jobs could be anywhere in the region, and where jurisdictions have differing occupational tax rates (or none), we must calculate regional average rates. This also applies to direct effects that can include many different establishments, such as the body and parts manufacturing analysis.

We have weighted the occupational tax rate of each local government jurisdiction by an estimate of the total payroll in each jurisdiction derived from the Census Bureau's Local Employment Dynamics database. In this way we created a countywide effective tax rate estimate for each county which assumes that auto industry related jobs are spread between jurisdictions in the same proportions as current payrolls. We created nine regional effective occupational tax rates by weighting the county level rates in each region by the total payrolls in each county. In this analysis, our estimates include school district occupational taxes.

Table 26 shows the local occupational and state income and sales tax revenues that can be attributed to the direct, indirect, and induced effects of payrolls in the automotive manufacturing industry in 2013. We estimate that automotive industry-related payrolls contributed about \$116.5 million in occupational taxes to cities and counties (and a few school districts) in 2013, the bulk of that going to places in the Lexington and Louisville regions. In the Lexington region it amounted to nearly \$1,000 per job, and in the Louisville region about \$890 in local government revenue per job.

State government coffers benefitted by about \$488 million in income and sales taxes related to automotive manufacturing. Here, too, the Lexington and Louisville regions accounted to a bit over three-quarters of the tax revenue. Income and sales taxes combined amounted to about \$3,900 per job in the Louisville region and roughly \$3,725 per job in the Lexington region.

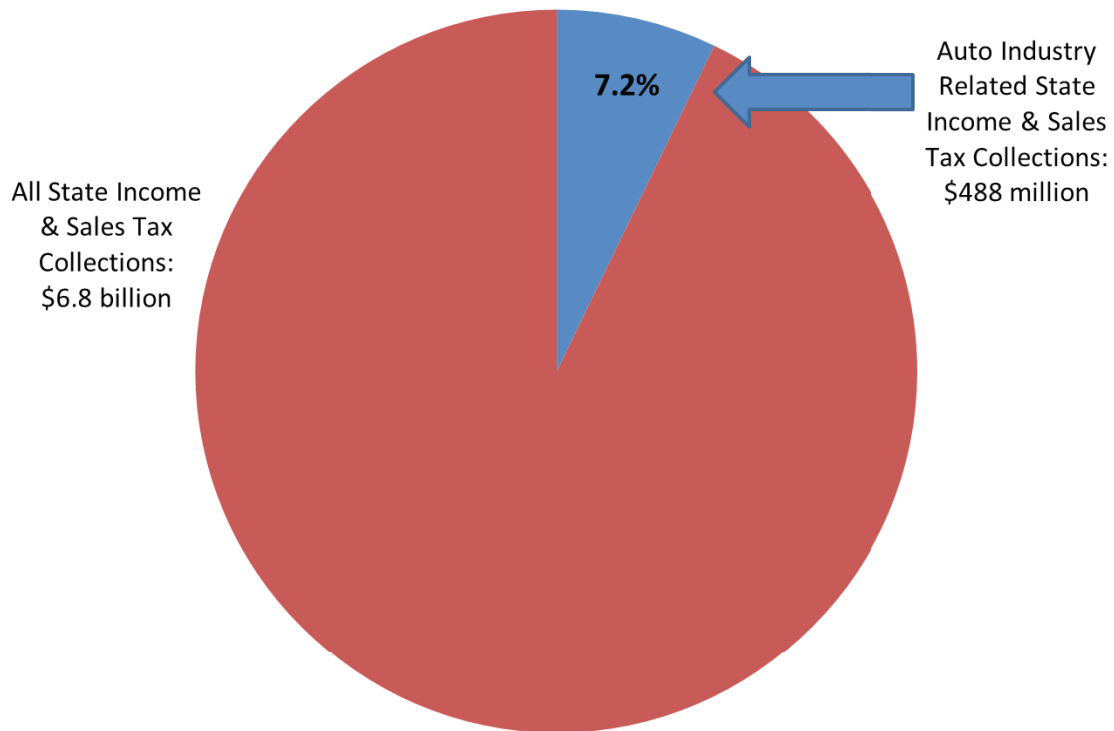
**Table 26. Estimated Annual Local and State Tax Revenues
Derived from Automotive Manufacturing in Kentucky, 2013
(only taxes directly related to payrolls)**

Region	Direct Effect	Indirect Effect	Induced Effect	Total
Local Occupational Taxes				
Ashland	\$135,053	\$159,550	\$58,437	\$353,040
Bowling Green-Hopkinsville	\$6,797,813	\$5,655,592	\$1,628,635	\$14,082,040
Cumberland	\$1,047,534	\$946,002	\$358,175	\$2,351,711
Lexington	\$19,915,533	\$14,240,634	\$7,454,741	\$41,610,908
Louisville	\$19,856,488	\$20,415,605	\$9,732,375	\$50,004,468
Mountain	\$14,432	\$90,643	\$21,459	\$126,534
Northern Kentucky	\$1,863,229	\$3,167,561	\$1,274,213	\$6,305,004
Owensboro-Henderson	\$680,340	\$458,492	\$217,790	\$1,356,622
Paducah-Purchase	\$122,621	\$126,413	\$47,557	\$296,592
Total Statewide Contribution	\$50,433,043	\$45,260,493	\$20,793,381	\$116,486,917
State Income Taxes				
Ashland	\$458,944	\$542,189	\$198,582	\$1,199,715
Bowling Green-Hopkinsville	\$11,039,567	\$9,378,698	\$2,700,774	\$23,119,038
Cumberland	\$4,616,130	\$4,168,715	\$1,578,356	\$10,363,201
Lexington	\$40,470,916	\$27,309,153	\$14,295,898	\$82,075,967
Louisville	\$40,999,036	\$45,729,992	\$21,800,061	\$108,529,089
Mountain	\$72,724	\$456,757	\$108,132	\$637,613
Northern Kentucky	\$5,017,000	\$8,529,092	\$3,430,993	\$16,977,085
Owensboro-Henderson	\$3,393,903	\$2,287,209	\$1,086,454	\$6,767,565
Paducah-Purchase	\$405,734	\$418,282	\$157,360	\$981,376
Total Statewide Contribution	\$106,473,954	\$98,820,085	\$45,356,610	\$250,650,649
State Sales Taxes				
Ashland	\$453,560	\$535,828	\$196,253	\$1,185,641
Bowling Green-Hopkinsville	\$11,579,386	\$9,837,303	\$2,832,838	\$24,249,526
Cumberland	\$4,225,956	\$3,816,358	\$1,444,946	\$9,487,260
Lexington	\$36,203,873	\$24,429,818	\$12,788,613	\$73,422,304
Louisville	\$41,886,828	\$46,720,228	\$22,272,119	\$110,879,175
Mountain	\$65,241	\$409,756	\$97,005	\$572,001
Northern Kentucky	\$3,301,427	\$5,612,552	\$2,257,758	\$11,171,737
Owensboro-Henderson	\$2,711,301	\$1,827,192	\$867,940	\$5,406,432
Paducah-Purchase	\$567,286	\$584,830	\$220,016	\$1,372,132
Total Statewide Contribution	\$100,994,857	\$93,773,863	\$42,977,488	\$237,746,208

Note: There are other tax impacts, such as on real estate and motor vehicle property or insurance policies, but they depend on local factors that are beyond the scope of our analysis. At the state level, income and sales taxes make up nearly three-quarters of general fund revenue, and for many localities occupational taxes are very significant.

Figure 43 illustrates that payroll related to and supported by automotive manufacturing in Kentucky made up an estimated 7.2 percent of all state tax collections from income and sales taxes in 2013.

Figure 43. Portion of Kentucky State Income and Sales Tax Revenues Derived from Payroll Related to and Supported by Automotive Manufacturing, 2013

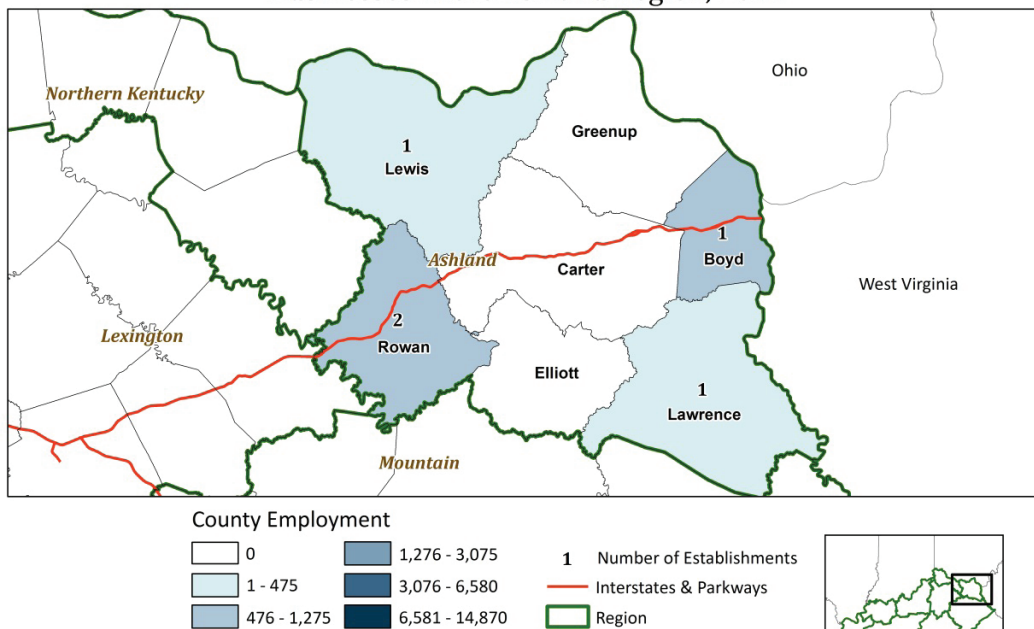


In terms of its contribution to the state's economy and to the public sector that supports that economy and provides needed social services, the automotive manufacturing industry is one of the most important industries in the Commonwealth of Kentucky.

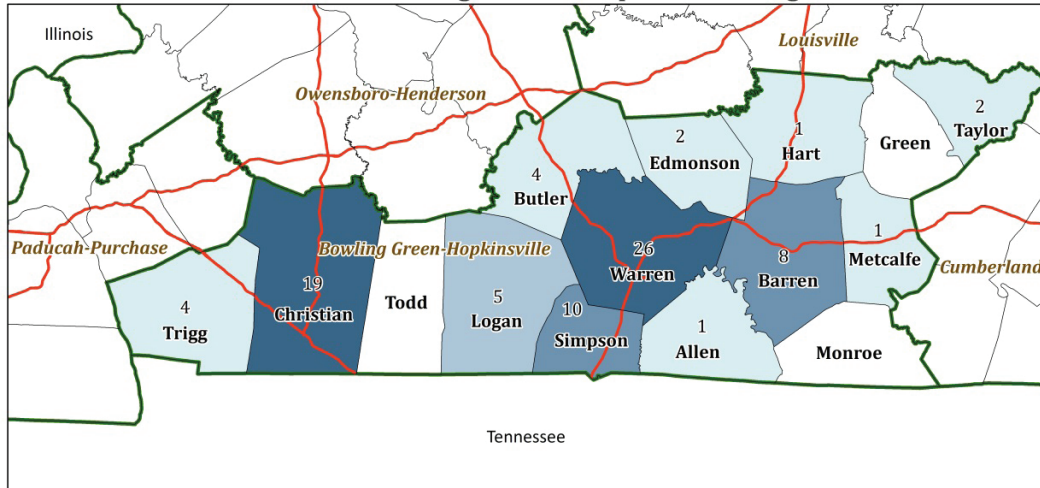
APPENDIX: REGIONAL CLOSE-UP MAPS

Below are close-up views of the nine economic regions of the state showing the county location of all auto-related manufacturing, service, and technology businesses in each region.

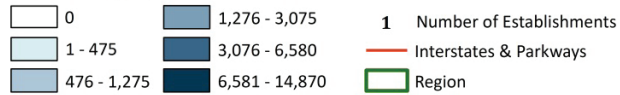
All Auto-Related Manufacturing, Service and Technology Businesses in the Ashland Region, 2014



All Auto-Related Manufacturing, Service and Technology Businesses in the Bowling Green - Hopkinsville Region, 2014



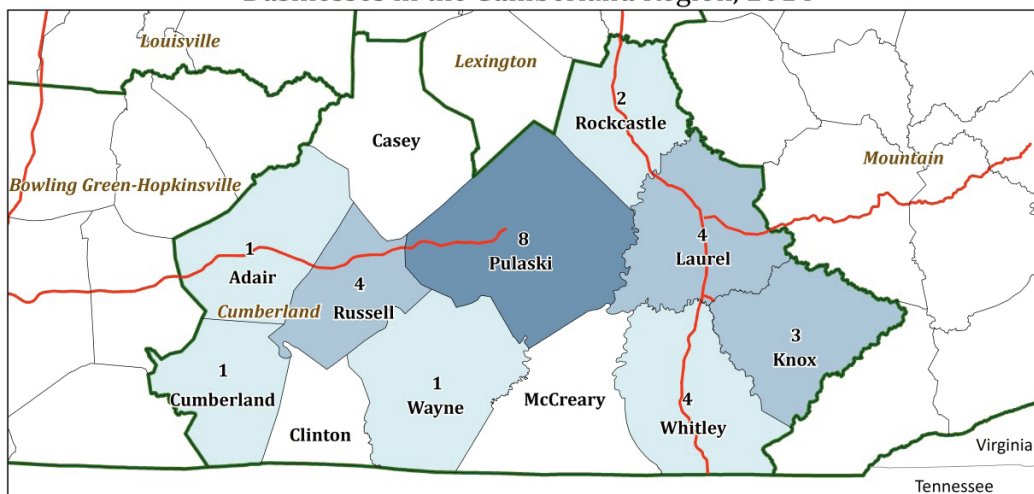
County Employment



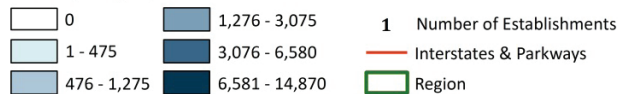
Source: Kentucky Cabinet for Economic Development and Author's Calculations
Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.



All Auto-Related Manufacturing, Service and Technology Businesses in the Cumberland Region, 2014



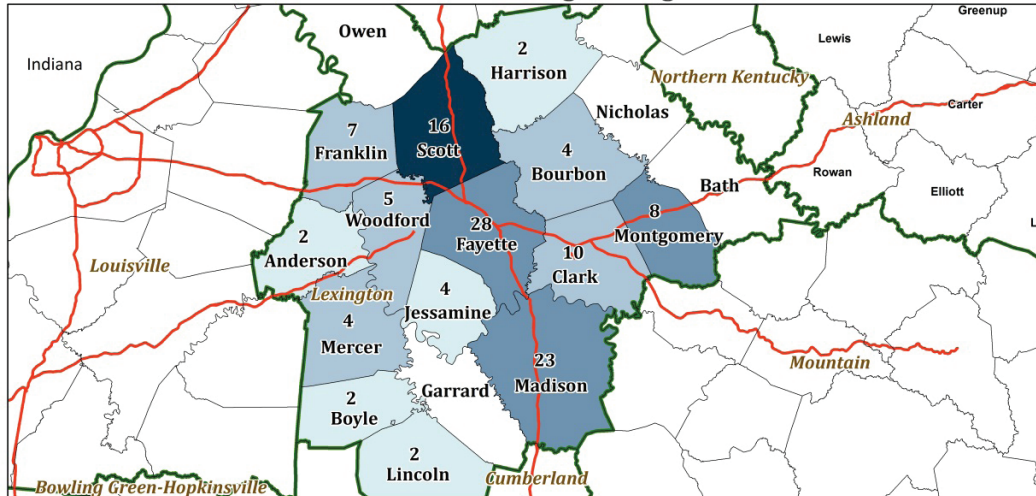
County Employment



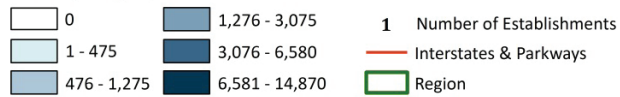
Source: Kentucky Cabinet for Economic Development and Author's Calculations
Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.



All Auto-Related Manufacturing, Service and Technology Businesses in the Lexington Region, 2014

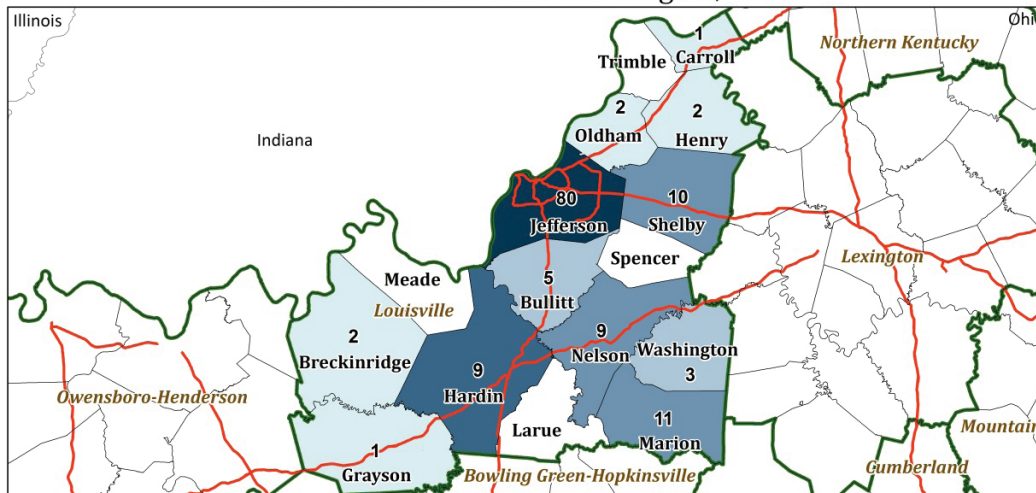


County Employment

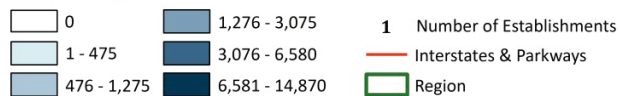


Source: Kentucky Cabinet for Economic Development and Author's Calculations
Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.

All Auto-Related Manufacturing, Service and Technology Businesses in the Louisville Region, 2014

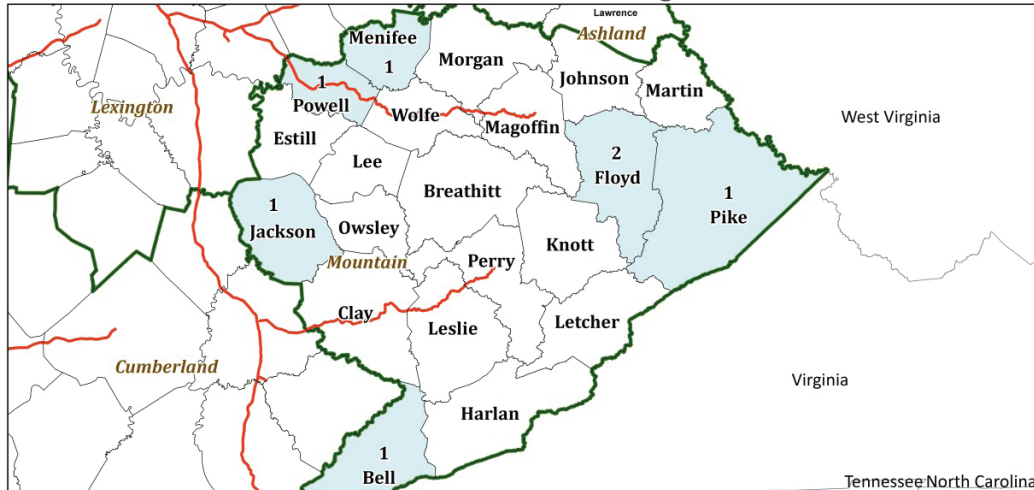


County Employment



Source: Kentucky Cabinet for Economic Development and Author's Calculations
Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.

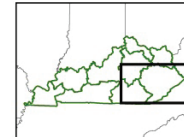
All Auto-Related Manufacturing, Service and Technology Businesses in the Mountain Region, 2014



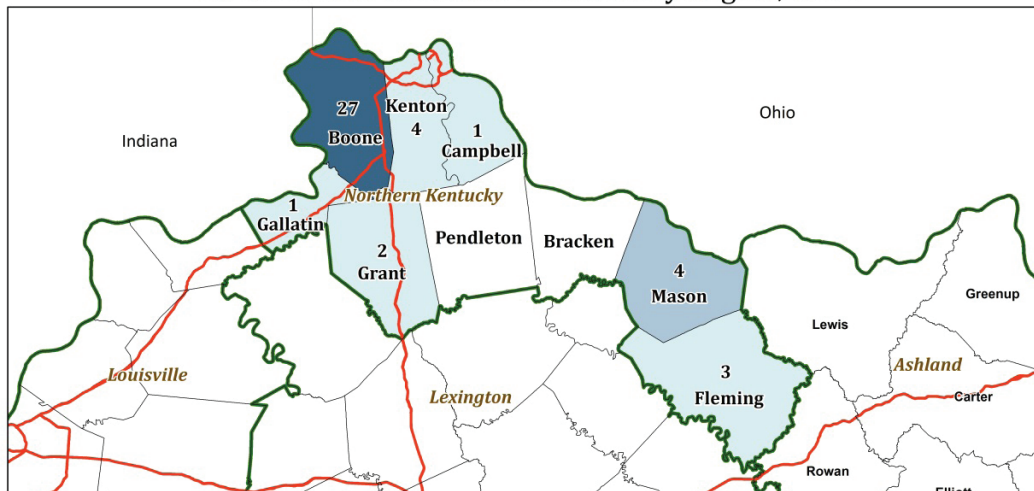
County Employment



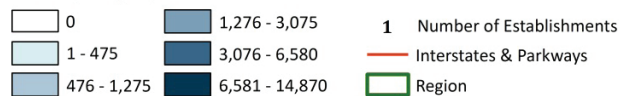
Source: Kentucky Cabinet for Economic Development and Author's Calculations
Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.



All Auto-Related Manufacturing, Service and Technology Businesses in the Northern Kentucky Region, 2014



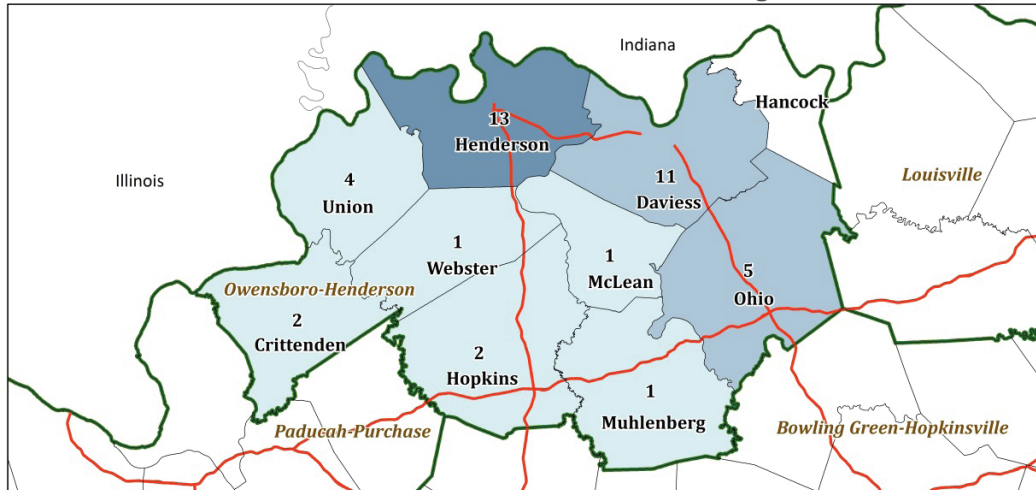
County Employment



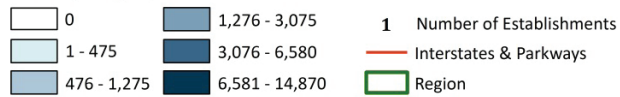
Source: Kentucky Cabinet for Economic Development and Author's Calculations
Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.



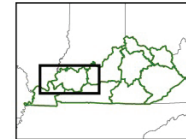
All Auto-Related Manufacturing, Service and Technology Businesses in the Owensboro - Henderson Region, 2014



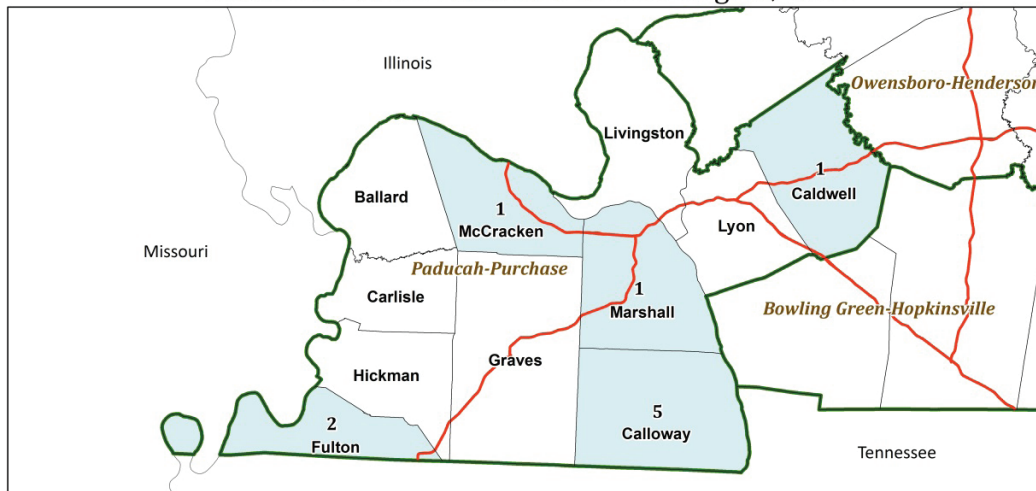
County Employment



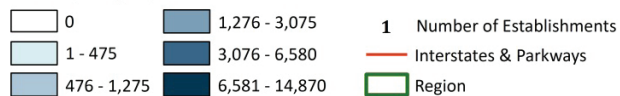
Source: Kentucky Cabinet for Economic Development and Author's Calculations
 Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.



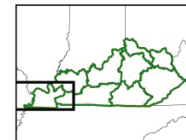
All Auto-Related Manufacturing, Service and Technology Businesses in the Paducah Purchase Region, 2014



County Employment



Source: Kentucky Cabinet for Economic Development and Author's Calculations
 Note: Employment numbers are 2014 for most establishments and 2013 for the remainder.



REFERENCES

Center for Automotive Research (2014). Accelerating the Growth of the U.S. Automotive Manufacturing Industry at Home, Rather than Abroad. Center for Automotive Research. Prepared for Southern Automotive Research Alliance (SARA), http://accelerating_the_growth_of+the_u.s._automotive_manufacturing_industry_-_sara_11-16-14.pdf. Accessed 4/6/2015.

Cooney, Stephen (2007). Motor Vehicle Manufacturing Employment: National and State Trends and Issues. Congressional Research Service, http://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1478&context=key_workplace. Accessed 2/3/2015.

Hill, Kim, Debra Menk, Joshua Cregger, and Michael Schultz (2015). Contribution of the Automotive Industry to the Economies of All Fifty States and the United States. Center for Automotive Research. Prepared for Alliance of Automobile Manufacturers.

Holt, Jeffrey (2005). Wages and employment of workers in automobile manufacturing. Bureau of Labor Statistics, <http://www.bls.gov/oes/2005/may/cars.pdf>. Accessed 2/13/2015.

Klepper, Steven (2007). Disagreements, spinoffs and the evolution of the Detroit as the capital of the US automobile industry. *Management Science* 53(4):616-631.

Rubenstein, James M. (1992). *The Changing US Auto Industry: A Geographical Analysis*. Routledge: London.

Klier, Thomas H. and Daniel P. McMillen (2006). The geographic evolution of the US auto industry. *Economic Perspectives* (2nd Quarter). Federal Reserve Bank of Chicago.