

**CONTRIBUTION OF THE MOTOR VEHICLE SUPPLIER SECTOR
TO THE ECONOMIES OF THE UNITED STATES
AND ITS 50 STATES**

**PREPARED FOR
THE MOTOR & EQUIPMENT MANUFACTURERS ASSOCIATION**

**BY
ECONOMICS AND BUSINESS GROUP
CENTER FOR AUTOMOTIVE RESEARCH**



JANUARY 2007

The statements, findings, and conclusions herein are those of the authors and do not necessarily reflect the views of the project sponsor

Acknowledgements

This study is the result of a group effort. The authors would like to thank Patrick Miller for his assistance with content. The authors would also like to acknowledge the significant efforts of Diana Douglass. Diana contributed greatly to the production of the document.

At REMI, the authors would like to thank Fred Treyz and Adam Cooper for their input, and assistance with the economic model.

Finally, the authors would like to thank the Motor & Equipment Manufacturers Association for the opportunity to carry out this study.

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Executive Summary

Over the course of the last few decades, the motor vehicle industry has undergone a massive transformation. The motor vehicle assembly companies were once highly integrated, designing and building thousands of parts that (when assembled) became an automobile. By the beginning of the 21st century, most parts-making operations moved out of the assembly companies into independent stand-alone parts supplier operations—selling products to multiple customers. Moreover, these supplier companies are given the responsibility of designing the parts and integrating them into systems that are delivered fully assembled to a motor vehicle assembly plant. By 2004, the supplier companies that became the backbone of the motor vehicle industry employed more than 780,000 people.

In 2004, motor vehicle assembly operations were located in fewer than half of the states, whereas the suppliers' direct parts-making operations (or support operations) existed in all 50 states and the District of Columbia. This report, undertaken at the request of the Motor & Equipment Manufacturers Association (MEMA), will provide an analysis of where and to what extent these jobs are located.

This study's purpose is to estimate the employment and economic contributions of the motor vehicle supplier operations. The companies (classified as automotive suppliers for the purposes of this study) include: parts and systems manufacturing operations; service companies that provide consulting on market trends, financial matters, engineering designs, and more; and companies that supply multiple industries —not just automotive —such as tire, battery, plastics, and rubber companies.

The estimates of jobs' impact were derived using the latest version of a state-of-the-art economic model with direct employment and compensation inputs (as of December 31, 2004) as acquired from BLS, the Census Bureau, and other government databases.

- From the direct motor vehicle supplier-related employment of over 780,000, an estimated 4.5 million private sector jobs are generated by the supplier's total U.S. operations, including new product development and production. This total includes direct employment at the supplier companies in the United States. The total also includes indirect employment (the many tiers of suppliers to the suppliers) and expenditure-induced employment (jobs that are created as a result of the spending of the suppliers' employees and the suppliers to the suppliers' employees in the United States).

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Introduction

The motor vehicle industry is the largest manufacturing industry in the United States. No other single industry is linked so closely to the U.S. manufacturing sector or directly generates so much retail business and employment. When people think of the automobile industry, they most likely picture a very large assembly plant staffed with thousands of people, equipped with conveyor belts and robots as far as the eye can see and producing many hundreds of thousands of motor vehicles year after year. What these same people probably don't see are the many supplier companies that design and manufacture the parts needed by the manufacturers to assemble motor vehicles. Whereas parts-making operations were an integral function of the large motor vehicle assembly companies in years past; that is no longer the case today.

With a growing share of the annual sales coming from automobiles built by foreign-based companies and an increasing foreign direct investment in U.S.-based assembly and support operations, supplier companies have been in upheaval for the past two decades. Many suppliers to U.S.-based motor vehicle companies have seen their businesses shrink as their customers' market share has decreased. Conversely, other suppliers have seen their businesses grow as their motor vehicle company customers claim a larger share of the U.S. market. This shift has led to the movement of many jobs away from the traditional locations for automotive employment to other regions of the country where there is new investment from growing international companies. While it may, at first blush, look like the automobile industry and its supplier sector is shrinking in the United States due to the movement of many basic parts operations to low-wage regions of the globe, the true story is one of continuing operations in a dynamic, hugely successful industry—with some companies shrinking as other companies grow.

The motor vehicle supplier sector has become the backbone of the motor vehicle assembly industry, employing approximately 783,000 people in 2004 —substantially more than the number of people employed by the assemblers. The supplier companies design, engineer and manufacture the vast majority of the parts that go into a modern-day motor vehicle.

This report, undertaken at the request of the Motor & Equipment Manufacturers Association (MEMA), will provide an estimation and analysis of the employment and economic contribution of the supplier-related jobs in all of the fifty states and the District of Columbia.

In a number of past studies, the Center for Automotive Research (CAR) has estimated the motor vehicle industry's economic contribution to the U.S. economy. The most recent estimate of economic contribution was completed by CAR and the Institute of Labor and Industrial Relations at the University of Michigan for the Alliance of Automobile Manufacturers (AAM) in 2004¹, and was an important update of a prior study (also performed by ILIR-UM and CAR) for the AAM and the Association of International Automobile Manufacturers (AIAM) in 2001². The most recent employment and economic contribution study was undertaken by CAR for Toyota Motor Company, and examined Toyota's operations in fourteen states (individually) and the United States as a whole³.

This current report, however, is a first estimate by CAR of the economic contribution associated with the entire motor vehicle parts manufacturing sector in the United States. The importance of this study is directly related to the changing dynamic of the U.S. automotive industry. The relatively high number of jobs impacted by the supplier sector in each of the fifty states and the District of Columbia, their broad dispersion across industries, and the contribution these jobs make to the national economy comprise the most important findings of this study.

¹ Institute of Labor and Industrial Relations, University of Michigan and the Center for Automotive Research. *Contribution of the U.S. Motor Vehicle Industry to the Economies of the United States, California, New York, and New Jersey in 2003*. Prepared for the Alliance of Automobile Manufacturers, Inc., Ann Arbor, May, 2004.

² Institute of Labor and Industrial Relations and the Office for the Study of Automotive Transportation, University of Michigan and the Center for Automotive Research. *Contribution of the Automotive Industry to the U.S. Economy in 1998: The Nation and Its Fifty States. A Study* Prepared for the Alliance of Automobile Manufacturers, Inc. and the Association of International Automobile Manufacturers, Inc. Ann Arbor, Winter 2001.

³ Kim Hill, *Contribution of Toyota to the Economies of Fourteen States and the United States in 2003*, Center for Automotive Research, June 2005

The Study

The study describes the economic contribution of supplier operations in the United States and is divided into two sections. In the first section of the study, we present a short overview of supplier operations in the United States.

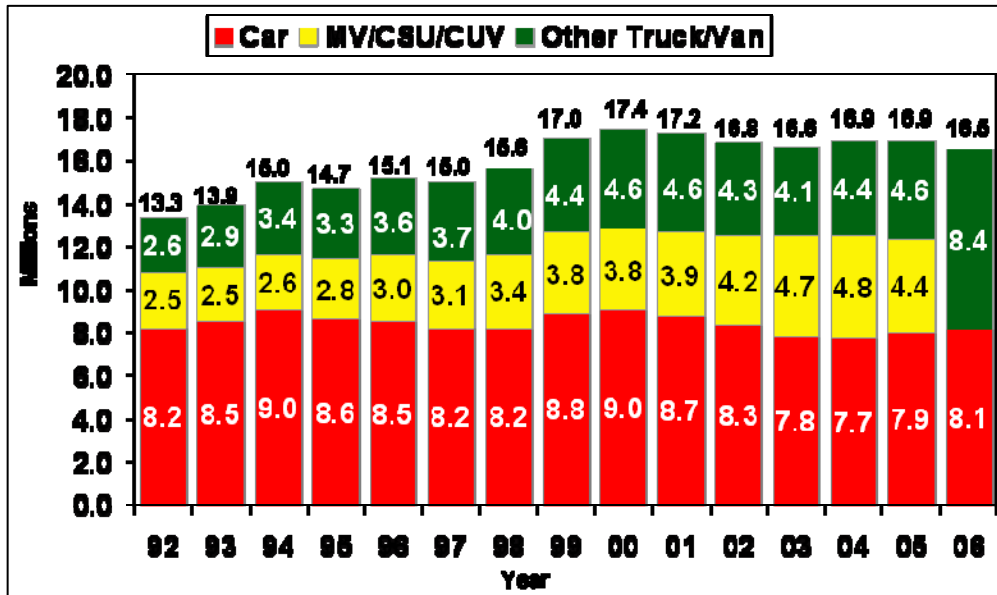
The second section of our study estimates the 2004 contribution of the suppliers' U.S. operations to employment and income in the economies of the fifty states, the District of Columbia, and the United States as a whole. The suppliers' economic contribution has been analyzed using an economic model provided by the Regional Economic Modeling, Inc. (REMI). The data used to perform the research —supplier employment and other data on the U.S. economy and the automotive industry —were collected by CAR from a wide variety of publicly available sources.

The companies (classified as motor vehicle suppliers for the purposes of this study) include light vehicle and heavy duty vehicle original equipment and aftermarket parts and systems manufacturing operations; service companies that provide consulting on market trends, financial matters, engineering designs, and more; and companies that supply multiple industries —not just automotive —such as tire, battery, plastics, and other rubber product companies.

Section I: The Motor Vehicle Suppliers

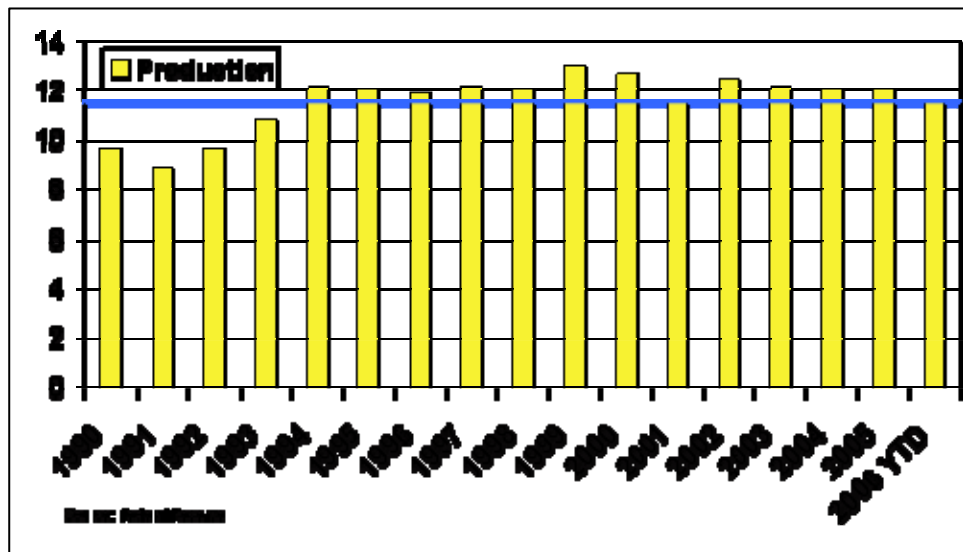
In the automobile industry, U.S. sales of light vehicles have held steady since the late 1990s, hovering above or near 17 million vehicles annually (see Figure 1). U.S. production has also held steady, at approximately 12 million units annually since 1994 (see Figure 2).

Figure 1
Annual U.S. Light Vehicle Sales



Source: CAR Research

Figure 2
Annual U.S. Light Vehicle Production



The heavy duty vehicle market in the United States consists primarily of on-road interstate trucks in the Class 8 category. The annual production and sales of this class of vehicle are highly cyclical. The heavy duty vehicle sector, similar to that of light duty vehicles, is affected by the economic forces of the general economy, but their cycles are also affected by governmental regulation. Most recently, Class 8 sales have been on an upward trend, led by both a need to replace the current fleet of Class 8 rigs as they age and by operators who want to purchase vehicles before new EPA pollution regulations on diesel engines take effect.

U.S. production of Class 8 vehicles ranges from 200,000 to 300,000 units annually with assembly facilities employing approximately 37,000 individuals.⁴ In addition to manufacturing Class 8 rigs, a further 36,900 individuals are employed manufacturing trailers.⁵ This, of course, does not include the considerable number of individuals who work as suppliers to the Class 8 OEMs. These suppliers, in many cases, supply both heavy duty and light duty motor vehicle manufacturers.

The aftermarket manufacturing supply sector provides parts and equipment for the maintenance, repair, and enhancement of the more than 240 million light duty vehicles currently on the road in the United States. As with the heavy duty sector, many parts suppliers in the light duty vehicle manufacturing segment also provide parts and components to the aftermarket sector. Combined, the suppliers to the light vehicle, heavy duty, and aftermarket sectors employ approximately 783,000 people.

In 2004, motor vehicle assembly operations were located in just 21 states, whereas the suppliers' direct parts-making operations existed in all 50 states and the District of Columbia. In many states, motor vehicle suppliers represent a significant portion of the labor force (see Figure 3 and Table 1 below).

⁴ Bureau of Labor Statistic, Employment Statistics Survey www.bls.gov Series 33612

⁵ Bureau of Labor Statistic, Employment Statistics Survey www.bls.gov Series 336212

Figure 3
Direct Employment of Motor Vehicle Parts Supplier Operations by State
Ranked Compared to Other Industries in State

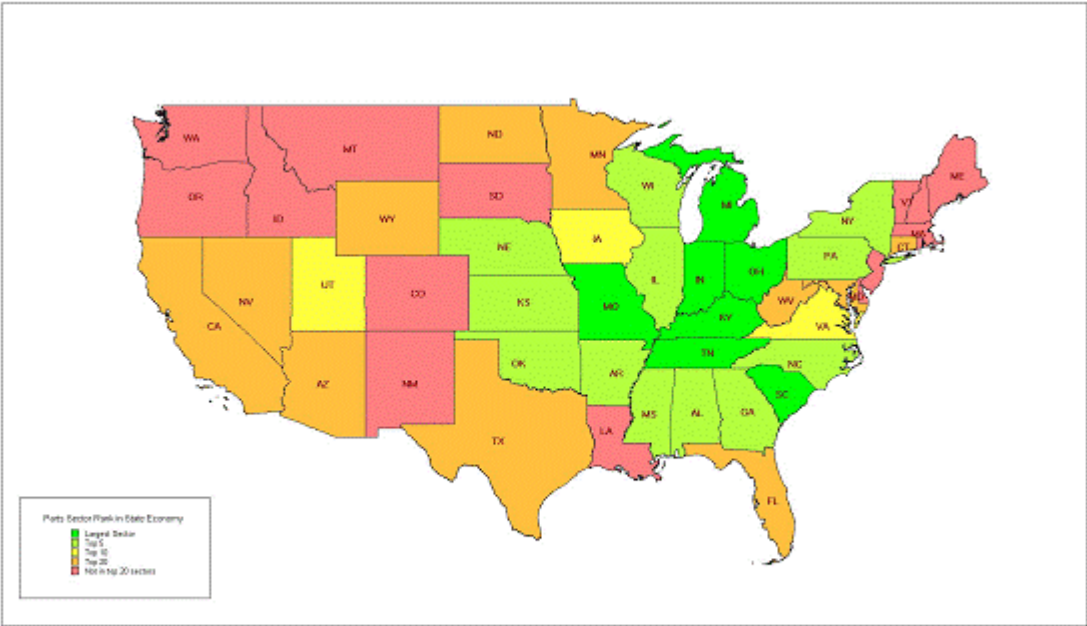
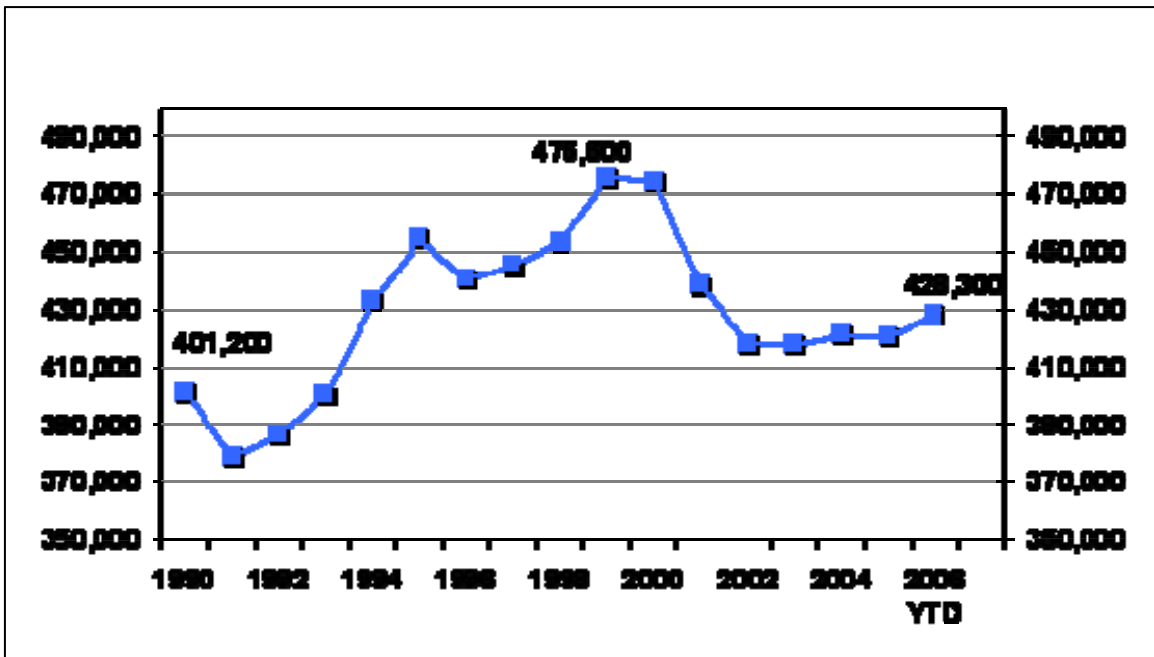


Table 1
Direct Motor Vehicle Employment, Ranked by State

State	Direct Employment
TOTAL	783,061
Michigan	145,818
Ohio	97,323
Indiana	86,934
Tennessee	45,749
Illinois	40,063
Kentucky	35,102
New York	31,017
California	28,596
North Carolina	27,589
Pennsylvania	22,917
Georgia	22,701
Wisconsin	21,502
South Carolina	20,943
Texas	20,175
Missouri	18,888
Alabama	15,965
Mississippi	13,179
Florida	9,273
Arkansas	7,922
Virginia	7,796
Kansas	7,508
Oklahoma	6,986
Iowa	6,680
Minnesota	6,671
Connecticut	4,109
Utah	4,047
Nebraska	4,041
Arizona	3,369
New Jersey	3,356
Maryland	2,413
Washington	1,918
Louisiana	1,868
Oregon	1,783
Colorado	1,756
Massachusetts	1,589
West Virginia	912
Rhode Island	822
Nevada	747
New Hampshire	747
South Dakota	378
Vermont	370
North Dakota	363
Delaware	313
Maine	290
Wyoming	150
Hawaii	125
New Mexico	100
District of Columbia	70
Idaho	68
Montana	50
Alaska	9

As can be seen in Figures 4 and 5, employment—after having steadily increased throughout the decade of the 1990s—has declined among motor vehicle manufacturers and motor vehicle suppliers since 2000. It is important to note that, from just after the 1991 Gulf War until 2000, the U.S. automotive industry experienced unprecedented growth in profitability and a post-war period of historically low prices for commodity goods. During most of the 1990s, capacity utilization remained high, and cost containment was of secondary importance as profits were plentiful for most suppliers. This situation has changed drastically over the past five and a half years as profit margins, particularly among those supplying domestic producers (Ford, GM, and Chrysler Group), have been reduced due to production reductions, commodity price increases, and foreign competition.

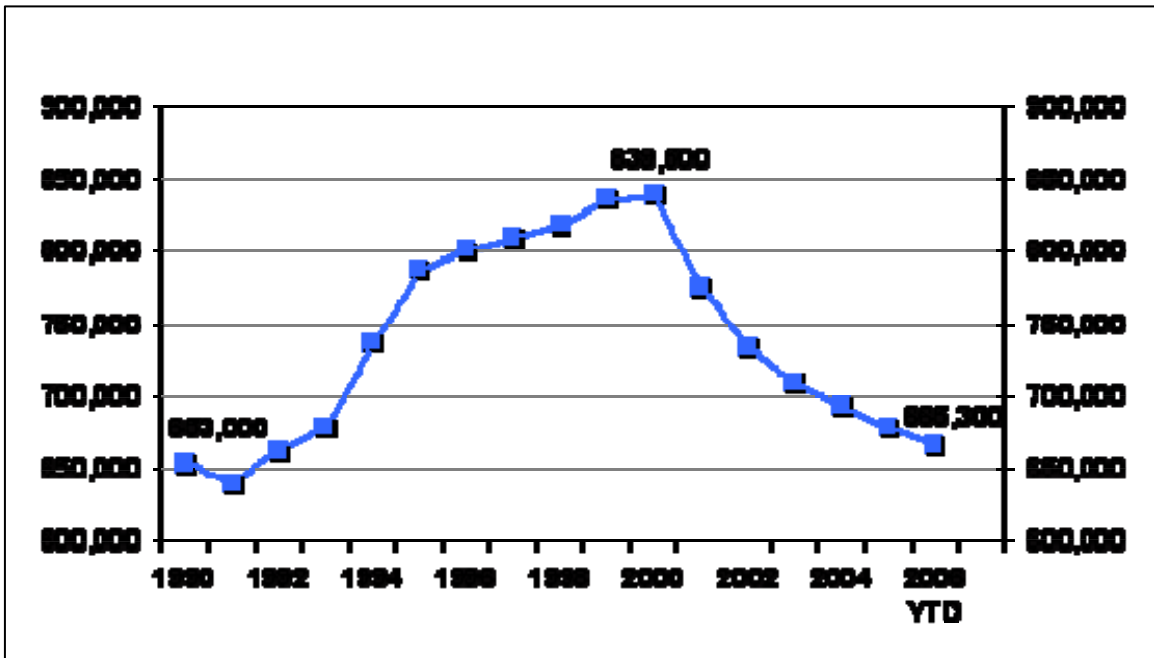
Figure 4
Motor Vehicles and Motor Vehicle Bodies (NAICS 3361 plus 3362)
Annual Employment



Sources: Ward's Automotive Yearbooks 1998 – 2004; Automotive News 100 Year Almanac and the 1996 Market Data Book, Automotive News January 10, 2005 U.S. Light Vehicle Sales by Make p. 49 – 51.

Figure 5

Motor Vehicle Parts Manufacturing (NAICS3363) Annual Employment



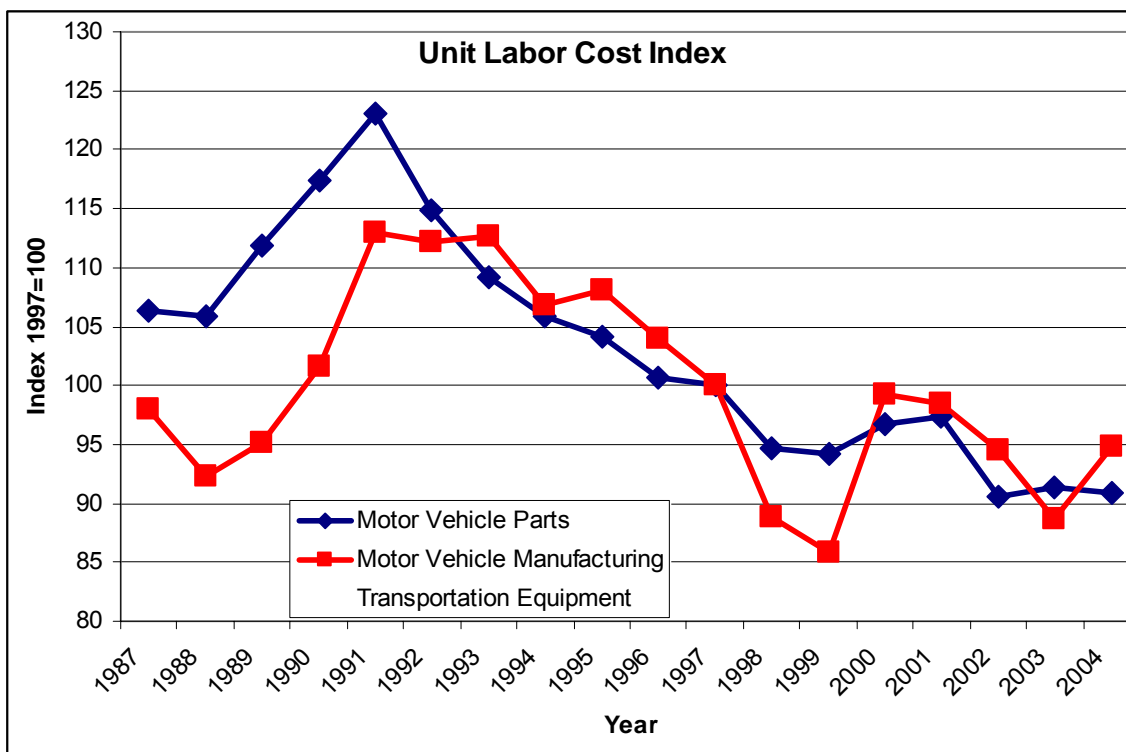
Sources: Automotive News January 10, 2005 North America Car and Truck Production p. 54, Automotive News 100 Year Almanac and the 1996 Market Data Book, Ward's Yearbooks 1986 – 1990.

The North American motor vehicle parts supplier industry has undergone significant changes during the last decade. The continued efforts by original equipment manufacturers (OEMs) to reduce costs has led to an ever-increasing amount of manufacturing, sub-assembly, and R&D work being shifted to suppliers. This is especially true for the domestic OEMs (Ford, GM, Chrysler Group), who have been under tremendous pressure to become more efficient and reduce costs. One solution has been to outsource the production of parts. What was once a highly vertically integrated industry has become ever more dependent on supplier companies to fulfill increasingly complex piece and module design and production.

For the most part, domestic OEMs have merely outsourced design and production to suppliers in order to gain efficiencies, leaving the responsibility to suppliers to innovate ways to make productivity improvements. Until 2000, efforts to improve productivity by the OEMs or suppliers were not paramount, as steady profits from SUVs—along with low commodity prices—helped support a buoyant market. However, in 2000, a small recession caused a decline in demand for light trucks; and in 2001, commodity prices began a steady climb. Both of these factors placed enormous pressure on suppliers' profitabilities, with the result being an increase in the number of bankruptcies, consolidations, and closures in the supplier sector. In addition to these factors,

domestic OEMs began to face stiffer foreign competition—leading to production cuts and further challenging the domestic supplier sector. This competition placed a new emphasis on improving productivity, specifically by reducing labor costs. This can be seen in Figure 6, which illustrates a corresponding reduction in per unit labor costs for motor vehicle manufacturing and motor vehicle parts manufacturing.

Figure 6
Unit Labor Cost Index



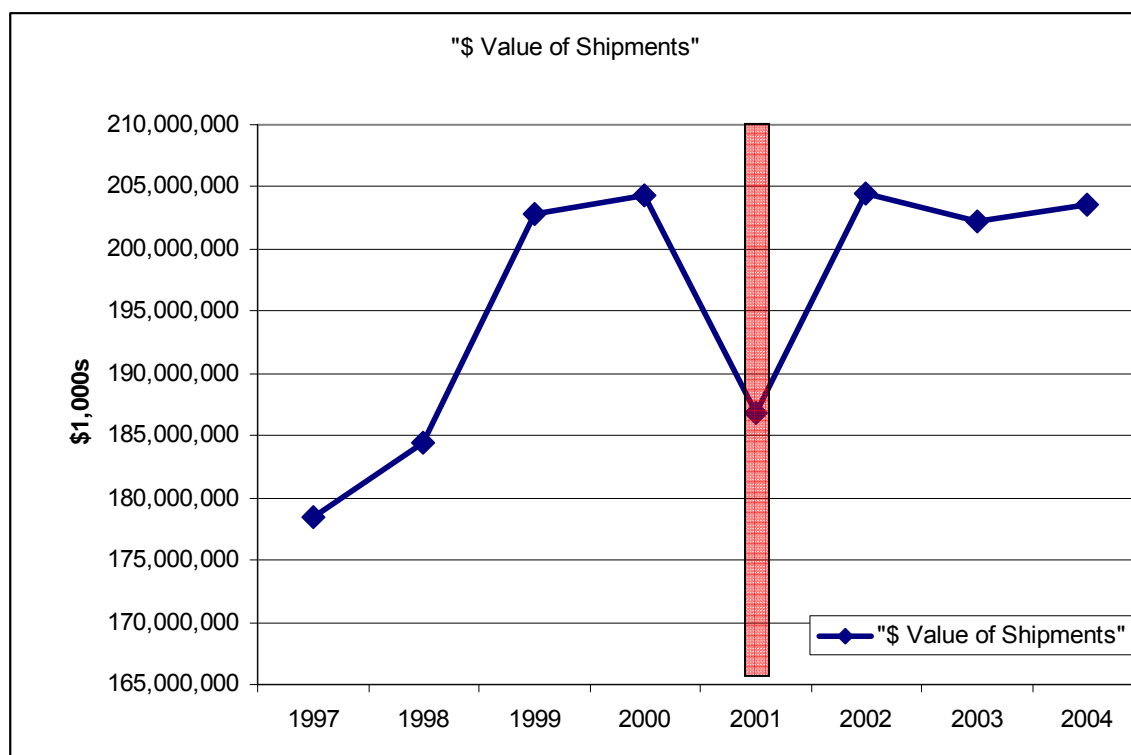
Source: U.S. Department of Labor, Bureau of Labor and Statistics, Productivity and Costs Unit Labor Cost Index.
Series ID: IPUEN3363U100, ZPUEN3361U100

Productivity improvements and the declining market share of domestic OEMs have led to considerable consolidation among motor vehicle parts suppliers. Not surprisingly, the facilities and companies most affected by these changes have been the suppliers to the domestic OEMs. These domestic suppliers with older facilities tend to have outmoded equipment and practices, compared to the newly established facilities owned by Japanese or European companies. The net result of this combination of circumstances has been a rapid decline in the number of workers employed by suppliers since 2000, but it has not reduced the motor vehicle suppliers' importance to the automotive industry. Without this rapid improvement in productivity and the

arrival of new foreign investment in the United States, the motor vehicle sector would be far less competitive and efficient.

An alternative way to examine the importance of the supplier sector is to look at the value of shipments by motor vehicle parts manufacturers (see Figure 7). This further illustrates not only the productivity improvements, but also the growing reliance on suppliers to provide new vehicle components. In 1997, shipments by motor vehicle suppliers totaled \$178.5 billion and, with the exception of a recession in 2001, shipments have grown steadily to over \$203.5 billion in 2004. This increase has occurred even while suppliers have reduced jobs in the supplier sector.

Figure 7
Dollar Value of Shipments

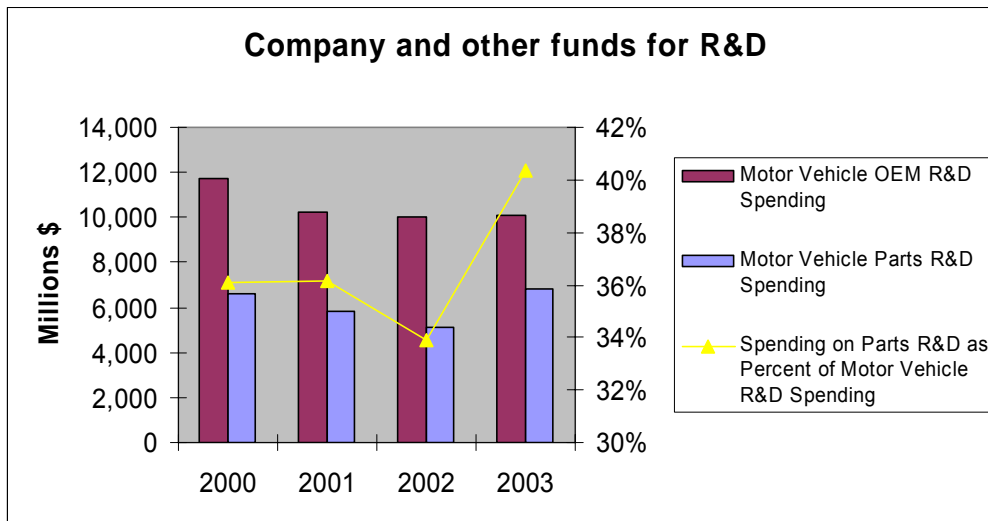


Source: U.S. Census Bureau Annual Survey of Manufacturers

As competition has increased, the pressure to produce a motor vehicle at the least possible cost has resulted in parts-making operations moving away from the assembly companies and becoming stand-alone companies. The present-day parts suppliers not only provide parts to assemblers, they increasingly are designing and developing the parts from the ground up—all while becoming much more proficient and cost-efficient than companies in the past.

As can be seen in the following chart (Figure 8), the suppliers to the light vehicle manufacturers have taken on a large share of the R&D associated with designing, engineering, and producing a modern automobile. Beginning in 2000—the earliest year that suppliers are listed separately—\$6.6 billion was spent by the supplier sector on research and product development. This represented 36% of total automotive-related R&D spending. Industry R&D spending increased in 2003, after a couple of years of downturn (as a result of the recession in the early part of the decade). However, the bulk of the spending increase was borne by the supplier sector, increasing slightly to \$6.8 billion. Although this is a somewhat modest increase in R&D spending over 2000 levels, it represents 40% of total automotive R&D spending in 2003. Clearly, considering the percentage of total auto industry R&D spending, the suppliers are taking on much more of the intellectual responsibility of designing, testing, and engineering the new parts and sub-systems.

Figure 8
Automotive-related R&D Annual Spending by OEMs and Suppliers



Source: National Science Foundation, 2003

Section II: Estimates of the Economic Contribution of the Motor Vehicle Parts Industry to the United States and its Fifty States

The purpose of Section II of this report is to provide the first comprehensive analysis of the estimated economic contribution associated with the activities of the motor vehicle supplier industry in the United States. The motor vehicle parts industry has been thoroughly analyzed in this report; the data used represents the most up-to-date information available. This economic and employment impact analysis focuses on the motor vehicle parts manufacturing industry in the United States and each of its fifty states. The motor vehicle parts manufacturing industry is a combination of three segments: light vehicle original equipment parts manufacturers, heavy duty original equipment parts manufacturers, and aftermarket parts manufacturers (NAICS 3363). Many of the suppliers in this industry group manufacture parts for all three segments.

The aftermarket manufacturers' direct employment data have been included in this analysis only if the industry group supplied parts necessary for the maintenance of the motor vehicle, or the replacement of original equipment on the motor vehicle. The suppliers of tools and other related equipment needed to maintain motor vehicles were not included in the aftermarket segment for this analysis.

At the request of the Motor and Equipment Manufacturers Association, a portion of eight other industries was also included in the analysis. After a thorough examination, it was determined that these eight industry groups would be included because these industries also supply directly to the original equipment manufacturers (light and heavy duty) or to the equipment replacement aftermarket. These industries are:

- tire manufacturing (NAICS 32621);
- hose manufacturing for on- and off-highway motor vehicles (made of rubber and other materials—including plastics and nylon) (NAICS 3262203);
- transportation fabricated plastics products manufacturing (excluding foam and reinforced plastics) (NAICS 3261991);
- motor vehicle hardware manufacturing (lock units, door and window handles, window regulators, hinges, license plate brackets, etc.) (NAICS 3325106);
- motor vehicle instruments manufacturing (NAICS 3345145);
- motor vehicle light bulbs manufacturing (NAICS 3351101);

- motor vehicle batteries manufacturing (NAICS 3359111); and
- other truck and vehicle bodies for sale (including dumptruck mechanisms and kit cars) (NAICS 3362115).

This aggregation of industries—for the purposes of this report—will be referred to henceforth as motor vehicle suppliers.

The aggregate direct employment in this motor vehicle suppliers' industry group in 2004—the most recent year that data was available—was 783,061 people. Employees in the various industries used to compile the industry group are as follows:

- 599,249 in motor vehicle parts manufacturing,
- 72,845 in motor vehicle plastics manufacturing,
- 57,450 in motor vehicle tires manufacturing,
- 14,626 in motor vehicle instrument manufacturing,
- 12,602 in motor vehicle manufacturing,
- 10,907 in other motor vehicle bodies manufacturing,
- 7,552 in motor vehicle instruments manufacturing,
- 5,905 in motor vehicle hose manufacturing,
- and 1,925 in motor vehicle light bulb manufacturing.

A great deal of attention was given to determining the direct employment numbers for each of the eight additional industries to avoid the possibility of double counting, (one job being counted twice in the final employment estimates).⁶ (For a source and description of how these individual motor vehicle supplier employment levels were calculated, see Appendix A.⁷)

⁶ Indirect and expenditure-induced employment results in model simulations are determined by two key relations:

- the interaction of various industries with each other based on input-output tables developed by the U.S. Department of Commerce Bureau of Economic Analysis, and
- the inter-state flow of trade.

To isolate the possible effects of double-counting (that is, the impact of one job being counted twice – as a direct job and as an indirect job), we first examined the underlying data tables in the model that support model algorithms. Secondly, we ran numerous iterations to see actual model behavior relative to incrementally changing direct job inputs to the model. After exhaustive analysis, including consulting with the model developer, REMI, we adjusted our input numbers to offset the possibility of double-counting that results from multiple model iterations during a simulation. We also limited the number of iterations the model used to reduce the impact of the above discussed relations.

Direct jobs were input from 8 NAICS categories beyond the primary focus of our study, NAICS 3363, auto parts manufacturing. The direct jobs from six of the ancillary categories were negligible both in absolute number and as a percent of that NAICS category employment numbers. Of

Results

The tables in this section of the report show the estimates of the economic contribution associated with the motor vehicle parts manufacturing industry in the United States. These estimates are derived from the direct employment associated with motor vehicle parts manufacturing. In addition to estimating the direct employment, this report also estimates indirect and expenditure-induced employment as a result of the parts manufacturing operations in the United States. Indirect employment refers to people who work at the goods and services suppliers who supply the motor vehicle parts manufacturers. Expenditure-induced employment is the employment resulting from consumer spending by the direct and indirect employees who earn an income as a result of the motor vehicle parts manufacturing activities.

Employment and income estimates are derived from analyses using a regional economic software model. (The model and methodology used will be further discussed in a later section.) Data on direct employment and compensation for the manufacturing component of the industry are from the BLS Employment, Hours, and Earnings State and Metro report using the Current Employment Statistics Survey, 2005⁸, with indirect and expenditure-induced effects generated by the model. Direct employment data includes salaried and hourly employment.

Contribution of Motor Vehicle Parts Manufacturing

Summary estimates of the employment contributions of automotive manufacturing to the private sector of the U.S. economy are shown in Table 2. Both production and non-production workers employed by the manufacturing firms are included in the direct effect. In 2004, the motor vehicle parts manufacturing industry directly employed over 783,000 workers nationwide. This is shown as direct employment in Table 2. (Henceforth, in the body of this report, employment figures will be rounded to the nearest 100 workers. Therefore, direct employment is shown as 783,100).

the two remaining categories, the employment numbers for one, NAICS 3261 for Plastics, were about 10% of all direct jobs and about 12% of that industry's total, and it was determined that the model results were not compromised and no adjustment was required. For NAICS 3262, Rubber, model inputs were adjusted at a level of about 10% to account for possible interaction effects inherent in the model's method of calculating results.

⁷ The aggregate employment number for the this motor vehicle suppliers' industry group does not include any captive parts suppliers within the automotive manufacturing operations —such as stamping, transmissions, and engines manufacturing —at original equipment manufacturers (OEMs). These parts manufacturing employees at the OEMs are considered —for the purposes of this study —to be motor vehicle manufacturing employees.

⁸ See Appendix A

Based on the 783,100 direct employees, indirect employment associated with the motor vehicle parts manufacturing activities is estimated to be 1,972,100 jobs. Summing direct and indirect jobs together equals 2,755,100 private sector jobs. The resulting number of jobs, both direct and indirect, created as a result of every direct job can be expressed as an “employment multiplier”⁹. In this case, the employment multiplier is 3.5 $((783,100 + 1,972,100) / 783,100 = 3.5)$. This employment multiplier can be interpreted two ways: (1) there are 3.5 times as many total jobs generated as there are direct jobs, or (2) there are 2.5 indirect jobs in the U.S. economy for every one direct job at a supplier facility (1 direct job + 2.5 indirect jobs).

The bottom of Table 2 shows the estimate for expenditure-induced employment contribution to be 1,704,600 jobs. Adding the 783,100 direct jobs plus the 1,972,000 indirect jobs to the expenditure-induced jobs brings the total employment impact of the motor vehicle industry to 4,459,700 total jobs. The corresponding employment multiplier equals 5.7 $((783,100 + 1,972,100 + 1,704,600) / 783,100 = 5.7)$, or 4.7 additional jobs in the U.S. economy for every one job in a motor vehicle supplier plant.

The contribution of motor vehicle parts manufacturing to compensation in the private sector economy, calculated as the direct plus indirect and expenditure-induced effects, is estimated to be about \$252.3 billion, measured in 2004 dollars. This estimate of compensation is prior to deductions for personal income taxes and contributions to social insurance programs.

To put the employment and compensation contributions in some context, these contributions are represented in Table 2 as a share of the total private sector economy for the United States. The economic contribution of direct, indirect and expenditure-induced automotive manufacturing activities in 2004 represents 2.9 percent of the private sector jobs and 2.2 percent of the private sector compensation in the U.S. economy.

As mentioned earlier, the estimate of compensation is prior to deductions for personal income taxes and contributions to social insurance programs, and does not include transfer payments. A reduction in transfer payments of over \$17.0 billion is associated with automotive parts manufacturing activity in 2004, and personal income tax revenues are increased by over \$28.0 billion. The implication for disposable personal income, or personal income after taxes and including transfers, is an increase of over \$204.2 billion in the domestic economy for 2004.

In summary, the employment contribution associated with motor vehicle parts manufacturing activity in the United States is estimated to be about 2.8 million jobs in the private sector

⁹ The employment multipliers apply to the national economy and are not applicable to, nor can be derived from, any one state's economy. For a further explanation of multipliers, see page 33.

attributed to direct and indirect jobs, and 4.5 million when the expenditure-induced effects are included. The compensation contribution is estimated at about \$252 billion for all 4.5 million jobs.

Table 2
Total Employment Contribution of Motor Vehicle Parts Supplier Manufacturing Operations to the Private Sector Economy in the United States, 2004

Employment (1000s)	
Direct	783
Indirect	1,972
Total (Direct + Indirect)	2,755
Multiplier	3.5
Activities including expenditure-induced effect	
Employment	
Expenditure-induced	1,705
Total (direct + indirect + expenditure-induced)	4,460
Contribution as % of total U.S. economy	
Employment	2.9%
Compensation (Personal income)	2.2%

Due to the demands of one industry on other industries, many jobs are created across the economy by the motor vehicle parts suppliers. An estimate of how these jobs are dispersed across five major sectors is shown in Table 3. Not surprisingly, 32 percent of the estimated jobs are in manufacturing. However, it is estimated that there are a substantial number of jobs estimated to be in three other sectors. An estimated 21 percent of the jobs are located in the business and professional services sector, 21 percent in the education, health and personal services sector, 19 percent in the retail or wholesale trade, warehousing, and transportation sector, and the remaining 7 percent of the jobs are in the raw materials, construction sector.

Table 3
Total Employment Contribution of Motor Vehicle Parts Supplier Operations
(direct, indirect and expenditure-induced) by Major Sector

TOTAL EMPLOYMENT		4,459,700	
Major Sector Employment			
	Manufacturing	1,435,500	32%
	Business & Professional Services	928,700	21%
	Retail or Wholesale Trade, Warehousing, Transportation	850,600	19%
	Education, Health and Personal Services	926,800	21%
	Raw Material Supply, Construction	318,100	7%

As shown in Table 4 below, a substantial number of the estimated indirect jobs are in the manufacturing sector. Within durable manufacturing, major suppliers to motor vehicle parts manufacturers are: plastics and rubber companies, computer, electrical and instrumentation producers, metal fabricators, foundries, and iron and steel suppliers. Within nondurable manufacturing, key suppliers are chemical companies, paper and printing services.

Table 4
Indirect and Expenditure-induced Manufacturing and Non-manufacturing Employment
Contribution for the United States, 2004

Note: Due to rounding, columns or rows may not sum exactly

	INTERMEDIATE	EXPENDITURE- INDUCED
Manufacturing	539,735	112,664
Iron, steel mills, steel or ferroalloy products mfg	34,640	4,310
Alumina, aluminum prod, nonferrous metals process	18,473	1,990
Foundries	39,649	4,750
Fabricated metal prod mfg	105,302	12,010
Motor vehicle mfg	53,924	8,673
Plastics, rubber prod mfg	44,558	5,541
Electrical or computer products	49,176	12,009
Other Manufacturing	194,013	63,381
Non-Manufacturing	1,432,332	1,591,897
Profess, Tech Services	257,669	33,822
Mngmt of Co, Enter	64,323	29,104
Admin, Waste Services	231,792	18,232
Wholesale Trade	164,857	45,507
Retail Trade	69,064	391,113
Transp, Warehousing	153,987	26,054
Finance, Insurance	119,602	84,486
Other Services (excl Gov)	284,299	923,214
Other Non-Manufacturing	86,739	40,363
TOTAL	1,972,067	1,704,561

The high level of indirect employment in the non-manufacturing sector is less well known. Activities such as professional and technical services, wholesale trade, trucking and finance are linked much more closely to the supplier network for motor vehicle parts manufacturing than is often recognized. In fact, it is estimated that the number of indirect non-manufacturing jobs are almost three times as high as those in the indirect manufacturing sector. The industrial sector, in this sense, extends well beyond the official designations for manufacturing activity.

Most of the expenditure-induced activity is in the private non-manufacturing sector, particularly in industries such as services and retail trade, due to household purchasing activity. A complete breakout of the total estimated job impact by manufacturing and non-manufacturing industries is shown here in Table 5.

Table 5
Total Employment Contribution (direct, indirect and expenditure-induced) of Motor Vehicle Parts Supplier Operations by Industry

TOTAL	4,459,700
Manufacturing	
Wood product mfg	15,600
Nonmetallic mineral prod mfg	18,600
Iron, steel or ferroalloy products mfg	39,000
Aluminum prod, nonferrous metals mfg	20,500
Foundries	44,400
Fabricated metal prod mfg	131,900
Machinery mfg	23,500
Computer, electronic prod mfg	53,700
Electrical equip, appliance mfg	29,600
Motor vehicle mfg	664,900
Transp equip mfg. exc. motor veh	3,700
Furniture, related prod mfg	11,800
Miscellaneous mfg	14,800
Food mfg	33,400
Beverage, tobacco prod mfg	4,600
Textile mills	19,600
Textile prod mills	7,100
Apparel mfg	20,200
Leather, allied prod mfg	12,300
Paper mfg	18,700
Printing, rel supp act	18,600
Petroleum, coal prod mfg	3,300
Chemical mfg	31,500
Plastics, rubber prod mfg	194,200
Total Manufacturing	1,435,500
Non-Manufacturing	
Forestry, Fishing, Other	16,000
Mining	7,600
Utilities	13,800
Construction	280,700
Wholesale Trade	210,400
Retail Trade	460,200
Transp, Warehousing	180,000
Information	89,700
Finance, Insurance	204,100
Real Estate, Rental, Leasing	68,700
Profess, Tech Services	291,500
Mngmt of Co, Enter	93,400
Administrative and General Business Svc	250,000
Educational Services	65,000
Health Care, Social Asst	148,000
Arts, Enter, Rec	81,100
Accom, Food Services	285,000
Other Services (excl Gov)	279,000
Total Non-Manufacturing	3,024,200

The following three Tables: 6, 7, and 8, show job impacts for the top 17 states, broken out by indirect jobs (Table 6), expenditure-induced jobs (Table 7), and total jobs (Table 8). Each of these tables shows the states ranked by the number of jobs in each of the three categories.

Table 6
Indirect Employment Contribution by 17 States and Nationally, 2004

Note: Due to rounding, columns or rows may not sum exactly

INTERMEDIATE	U.S.	MI	OH	IN	IL	TX	CA	NY	TN	PA	NC	GA	KY	WI	FL	MO	SC	AL	Balance of U.S.
Manufacturing	539,735	56,036	59,190	42,929	31,675	22,047	24,155	18,573	19,780	28,111	23,255	15,085	16,208	23,161	6,607	10,565	14,199	15,298	112,859
Iron, steel mills, steel or ferroalloy products mfg	34,640	3,321	5,316	4,817	1,769	1,053	1,103	768	1,025	2,755	564	623	1,300	1,655	216	646	480	1,608	5,619
Alumina, aluminum prod, nonferrous metals process	18,473	1,771	2,835	2,569	944	562	588	410	546	1,469	301	332	693	883	115	345	256	858	2,996
Foundries	39,649	3,802	6,085	5,513	2,025	1,206	1,262	879	1,173	3,154	646	714	1,488	1,894	247	740	550	1,841	6,431
Fabricated metal prod mfg	105,302	14,458	13,757	8,103	8,945	4,253	4,592	3,470	3,819	5,574	2,731	1,727	2,354	5,338	1,193	2,058	2,109	2,336	18,484
Motor vehicle mfg	53,924	15,634	7,845	7,373	2,009	626	969	1,625	1,955	868	1,142	731	2,619	1,310	302	1,063	990	1,025	5,839
Plastics, rubber prod mfg	44,558	5,475	6,670	4,261	2,954	1,471	1,347	1,107	2,039	1,662	1,874	1,283	1,370	1,837	329	937	1,447	951	7,546
Electrical or computer products	49,176	1,856	2,575	2,015	3,055	3,077	6,113	2,574	1,324	2,273	2,160	895	725	1,771	1,064	783	828	674	15,413
Other Manufacturing	194,013	9,718	14,106	8,280	9,974	9,800	8,180	7,741	7,899	10,356	13,836	8,779	5,660	8,473	3,142	3,993	7,539	6,005	50,532
Non-Manufacturing	1,432,332	136,697	124,798	76,926	91,590	88,396	86,395	75,240	50,074	54,897	43,263	49,445	34,905	33,392	49,756	30,237	24,381	25,085	356,855
Profess, Tech Services	257,669	26,506	21,811	12,086	16,680	14,505	18,152	16,896	8,223	10,472	6,918	7,747	5,053	5,095	7,122	4,713	3,715	4,427	67,550
Mngmt of Co, Enter	64,323	9,582	7,960	3,885	3,662	2,379	5,032	2,617	2,310	2,231	2,361	2,341	1,227	1,795	1,291	1,561	887	759	12,443
Admin, Waste Services	231,792	22,556	21,059	13,115	15,906	13,869	14,069	10,028	8,788	7,906	7,339	8,560	5,413	4,720	13,313	4,372	4,728	4,249	51,802
Wholesale Trade	164,857	18,999	17,054	11,370	11,208	8,628	8,574	7,754	6,776	6,411	5,657	6,232	4,712	4,499	3,773	3,588	2,977	3,362	33,282
Retail Trade	69,064	8,381	7,032	5,229	3,835	3,727	2,781	2,426	2,795	2,639	2,195	2,177	2,296	1,953	1,696	1,769	1,588	1,428	15,114
Transp, Warehousing	153,987	9,640	12,152	8,514	10,710	9,627	6,937	6,197	7,005	7,060	5,011	6,172	5,139	4,568	5,102	3,996	2,526	2,791	40,841
Finance, Insurance	119,602	9,369	9,222	4,949	9,861	8,713	6,623	9,503	3,318	4,545	3,006	3,512	2,367	2,876	3,883	2,457	1,591	1,634	32,174
Other Services (excl Gov)	284,299	26,776	23,916	14,840	16,856	15,421	20,460	17,211	9,106	10,799	8,457	9,973	6,720	6,536	10,675	6,621	4,722	4,269	70,939
Other Non-Manufacturing	86,739	4,888	4,592	2,936	2,871	11,529	3,769	2,608	1,752	2,832	2,319	2,732	1,979	1,350	2,901	1,161	1,646	2,166	32,709
TOTAL INTERMEDIATE	1,972,067	192,732	183,988	119,855	123,265	110,443	110,550	93,813	69,854	83,008	66,518	64,530	51,113	56,553	56,363	40,802	38,580	40,384	469,714

Table 7
Expenditure-induced Employment Contribution by 17 States and Nationally, 2004

Note: Due to rounding, columns or rows may not sum exactly

Expenditure-induced	U.S.	MI	OH	IN	IL	TX	CA	NY	TN	PA	NC	GA	KY	WI	FL	MO	SC	AL	Balance of U.S.
Manufacturing	112,664	6,687	8,606	5,457	7,308	8,500	6,921	5,047	5,015	5,536	5,268	4,485	2,960	3,514	2,379	2,390	2,378	2,969	27,243
Iron, steel mills, steel or ferroalloy products mfg	4,310	115	461	384	249	305	51	109	175	417	86	129	178	210	53	106	57	254	970
Alumina, aluminum prod, nonferrous metals process	1,990	53	213	177	115	141	23	50	81	192	40	60	82	97	25	49	26	117	448
Foundries	4,750	126	508	423	275	336	56	120	192	459	95	142	196	231	59	117	63	280	1,069
Fabricated metal prod mfg	12,010	610	1,109	544	1,326	761	276	425	572	765	386	296	268	604	245	293	244	291	2,994
Motor vehicle mfg	8,673	1,472	1,067	926	455	281	187	363	459	178	263	223	463	203	109	250	158	200	1,417
Plastics, rubber prod mfg	5,541	302	680	385	400	240	111	144	347	225	302	242	174	197	57	131	197	148	1,258
Electrical or computer products	12,009	400	493	306	726	1,106	1,475	675	423	472	478	323	176	259	365	178	178	148	3,828
Other Manufacturing	63,381	3,610	4,075	2,312	3,761	5,330	4,741	3,159	2,766	2,828	3,618	3,070	1,423	1,713	1,467	1,266	1,454	1,529	15,260
Non-Manufacturing	1,591,897	178,476	150,625	108,804	96,976	90,024	76,552	75,458	62,059	61,336	49,259	50,485	41,973	39,160	40,854	37,202	30,691	29,569	372,392
Profess, Tech Services	33,822	3,560	2,989	1,791	2,161	1,905	2,183	1,813	1,287	1,295	878	1,041	792	624	950	585	578	747	8,645
Mngmt of Co, Enter	29,104	1,510	2,794	503	1,911	26	867	2,580	317	1,032	1,827	933	444	910	249	2,408	143	115	10,534
Admin, Waste Services	18,232	2,092	1,848	1,245	1,005	1,052	867	629	809	601	577	613	467	376	901	368	460	344	3,978
Wholesale Trade	45,507	4,405	4,187	2,518	3,603	3,112	1,983	2,333	1,896	1,626	1,324	2,092	1,045	1,017	1,556	1,002	724	818	10,268
Retail Trade	391,113	49,379	40,522	31,226	21,837	22,228	16,078	14,797	17,332	14,381	12,267	12,685	11,695	9,798	8,885	8,316	8,478	8,495	82,714
Transp, Warehousing	26,054	1,612	1,740	1,183	2,051	2,153	1,391	1,469	1,108	1,065	763	1,054	602	650	957	678	304	339	6,935
Finance, Insurance	84,486	8,719	7,838	4,865	6,122	5,027	3,826	4,171	3,109	3,383	2,477	2,606	1,999	2,260	2,288	1,914	1,518	1,624	20,741
Other Services (excl Gov)	923,214	104,993	86,949	63,311	54,137	52,441	46,640	45,910	35,607	36,150	28,226	28,420	23,722	22,209	23,847	20,615	17,836	16,537	215,666
Other Non-Manufacturing	40,363	2,206	1,758	2,162	4,150	2,079	2,717	1,757	595	1,803	920	1,042	1,207	1,316	1,223	1,317	650	552	12,910
TOTAL EXPENDITURE-INDUCED	1,704,561	185,164	159,231	114,261	104,284	98,524	83,473	80,506	67,075	66,872	54,527	54,970	44,933	42,674	43,233	39,593	33,069	32,537	399,635

Table 8
Total Employment Contribution by the top 17 States and Nationally, 2004

Note: Due to rounding, columns or rows may not sum exactly

	U.S.	MI	OH	IN	IL	TX	CA	NY	TN	PA	NC	GA	KY	WI	FL	MO	SC	AL	Balance of U.S.
DIRECT	783,061	145,818	97,323	86,934	40,063	20,175	28,596	31,017	45,749	22,917	27,589	22,701	35,102	21,502	9,273	18,888	20,943	15,965	92,506
INTERMEDIATE	1,972,067	192,732	183,988	119,855	123,265	110,443	110,550	93,813	69,854	83,008	66,518	64,530	51,113	56,553	56,363	40,802	38,580	40,384	469,714
EXPENDITURE-INDUCED	1,704,561	185,164	159,231	114,261	104,284	98,524	83,473	80,506	67,075	66,872	54,527	54,970	44,933	42,674	43,233	39,593	33,069	32,537	399,635
TOTAL EMPLOYMENT CONTRIBUTION	4,459,689	523,714	440,542	321,050	267,612	229,143	222,620	205,336	182,677	172,797	148,635	142,201	131,148	120,729	108,870	99,283	92,593	88,886	961,856
National Multiplier	5.7																		

Estimates of motor vehicle parts manufacturing's contributions to each of the fifty states and the District of Columbia are shown in Tables 9 and 10. In each state, the estimated employment contributions are shown for direct, indirect and expenditure-induced effects. As shown in Table 9, states with little direct employment (such as Alaska, Idaho, and Montana), as well as the District of Columbia, still benefit from motor vehicle supplier manufacturing activities through indirect employment (as a result of supplying the automotive suppliers) and expenditure-induced jobs.

The direct employment contributions among states ranges from a high of 145,800 direct jobs in Michigan to a low of 9 direct jobs in Alaska, with the respective totals climbing to 523,700 and 1,500 when indirect and expenditure-induced effects are included. As a share of total state employment, the employment contributions associated with automotive parts manufacturing are again highest in Michigan at 10 percent and are lowest in Washington and Hawaii with less than 1 percent each, when including total direct, indirect and expenditure-induced effects (see Table 9). A number of states (e.g., Ohio, Kentucky, Tennessee and Indiana) would be expected to have high shares of employment related to motor vehicle parts manufacturing. However, due to trade with other states, there are states with relatively little direct motor vehicle parts manufacturing activity that nevertheless have a considerable share of auto-related employment (e.g., West Virginia, Louisiana and Delaware).

Table 9
Total Employment Contribution of Motor Vehicle Parts Supplier Operations by
State and as Percent of Labor Force, 2004

State	State Total Contribution	State Total Labor Force April 2005	All Contribution as % Labor Force
AL	88,885	2,146,300	4.1%
AK	4,593	337,700	1.4%
AZ	31,976	2,830,500	1.1%
AR	42,955	1,354,100	3.2%
CA	223,412	17,640,300	1.3%
CO	34,967	2,544,600	1.4%
CT	38,486	1,814,200	2.1%
DE	8,265	435,400	1.9%
DC	9,467	297,600	3.2%
FL	108,870	8,611,700	1.3%
GA	142,201	4,561,500	3.1%
HI	5,000	630,100	0.8%
ID	8,376	735,100	1.1%
IL	267,612	6,463,700	4.1%
IN	321,051	3,196,100	10.0%
IA	44,032	1,657,300	2.7%
KS	50,668	1,473,300	3.4%
KY	131,148	1,993,100	6.6%
LA	42,269	2,108,200	2.0%
ME	11,522	708,400	1.6%
MD	45,875	2,920,900	1.6%
MA	58,933	3,362,900	1.8%
MI	523,715	5,105,900	10.3%
MN	69,441	2,962,600	2.3%
MS	49,349	1,348,100	3.7%
MO	99,283	3,021,500	3.3%
MT	5,892	491,100	1.2%
NE	23,499	985,900	2.4%
NV	17,715	1,210,500	1.5%
NH	12,325	730,400	1.7%
NJ	79,029	4,408,700	1.8%
NM	10,102	933,400	1.1%
NY	205,335	9,397,200	2.2%
NC	148,635	4,311,800	3.4%
ND	4,613	357,900	1.3%
OH	440,543	5,892,200	7.5%
OK	41,299	1,735,300	2.4%
OR	21,929	1,857,300	1.2%
PA	172,797	6,295,800	2.7%
RI	8,122	567,500	1.4%
SC	92,592	2,067,400	4.5%
SD	6,176	431,100	1.4%
TN	182,677	2,912,700	6.3%
TX	229,142	11,176,300	2.1%
UT	26,387	1,261,400	2.1%
VT	6,558	354,100	1.9%
VA	86,391	3,919,900	2.2%
WA	25,850	3,275,500	0.8%
WV	23,189	796,500	2.9%
WI	121,915	3,036,700	4.0%
WY	4,627	282,800	1.6%
TOTAL US	4,459,689	148,950,500	

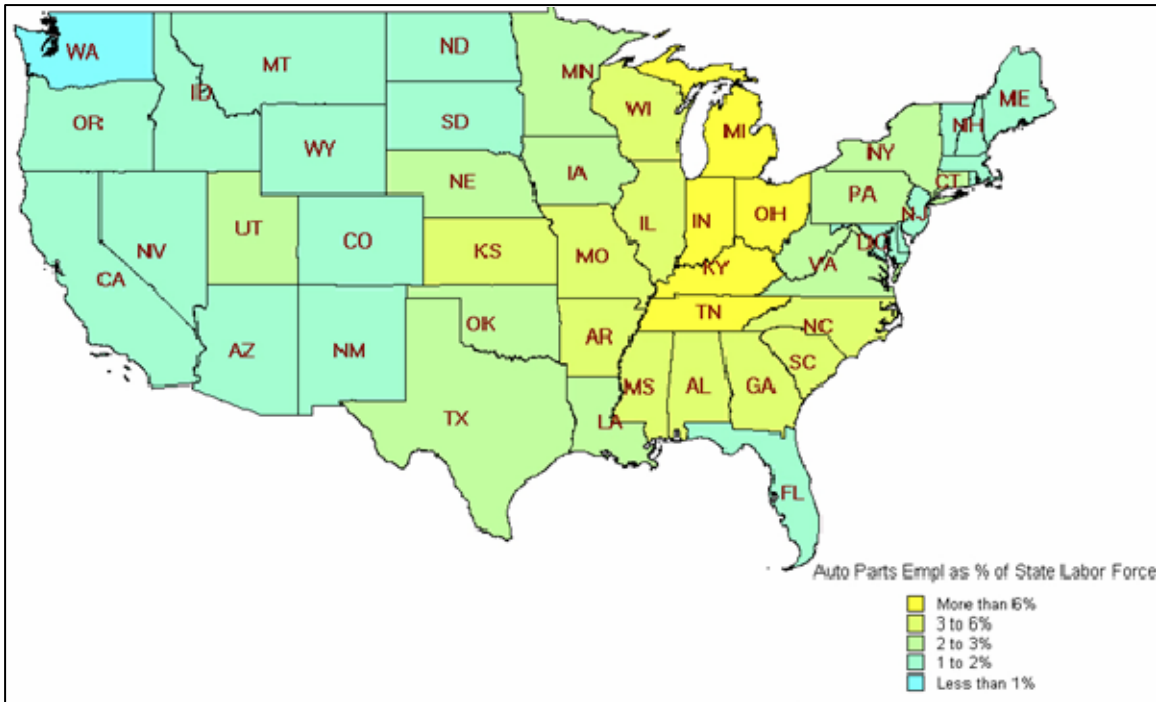
Table 10
Total Employment Contribution of Motor Vehicle Parts Supplier Operations
Ranked by State

Rank	State	Direct Employment	Indirect Employment	Expenditure-Induced Employment	Total Employment Contribution
	TOTAL	783,061	1,972,067	1,704,561	4,459,687
1	Michigan	145,818	192,732	185,164	523,714
2	Ohio	97,323	183,988	159,231	440,542
3	Indiana	86,934	119,855	114,261	321,050
4	Illinois	40,063	123,265	104,284	267,612
5	Texas	20,175	110,443	98,524	229,142
6	California	28,596	110,550	83,473	222,620
7	New York	31,017	93,813	80,506	205,336
8	Tennessee	45,749	69,854	67,075	182,677
9	Pennsylvania	22,917	83,008	66,872	172,797
10	North Carolina	27,589	66,518	54,527	148,635
11	Georgia	22,701	64,530	54,970	142,201
12	Kentucky	35,102	51,113	44,933	131,148
13	Wisconsin	21,502	56,553	42,674	120,729
14	Florida	9,273	56,363	43,233	108,870
15	Missouri	18,888	40,802	39,593	99,283
16	South Carolina	20,943	38,580	33,069	92,592
17	Alabama	15,965	40,384	32,537	88,885
18	Virginia	7,796	42,138	34,605	84,539
19	New Jersey	3,356	40,028	35,918	79,303
20	Minnesota	6,671	33,350	28,889	68,910
21	Massachusetts	1,589	30,165	27,281	59,035
22	Kansas	7,508	18,699	23,136	49,343
23	Mississippi	13,179	18,221	17,758	49,159
24	Maryland	2,413	23,046	20,639	46,098
25	Iowa	6,680	22,260	15,324	44,263
26	Arkansas	7,922	19,984	15,117	43,024
27	Louisiana	1,868	23,034	17,300	42,202
28	Oklahoma	6,986	19,074	15,529	41,589
29	Connecticut	4,109	17,940	16,470	38,519
30	Colorado	1,756	17,206	16,112	35,073
31	Arizona	3,369	15,965	13,306	32,640
32	Utah	4,047	11,382	10,625	26,054
33	Washington	1,918	13,618	10,146	25,682
34	Nebraska	4,041	10,696	8,813	23,550
35	West Virginia	912	13,642	8,692	23,246
36	Oregon	1,783	12,110	8,189	22,082
37	Nevada	747	8,008	9,657	18,412
38	New Hampshire	747	6,289	5,976	13,012
39	Maine	290	6,505	4,992	11,787
40	New Mexico	100	5,582	4,483	10,165
41	District of Columbia	70	6,272	3,190	9,532
42	Rhode Island	822	4,330	3,709	8,860
43	Delaware	313	4,477	3,768	8,558
44	Idaho	68	4,829	3,543	8,440
45	Vermont	370	3,338	3,180	6,888
46	South Dakota	378	3,416	2,732	6,525
47	Montana	50	3,187	2,700	5,937
48	Hawaii	125	2,611	2,386	5,122
49	North Dakota	363	2,604	1,978	4,945
50	Wyoming	150	2,624	1,986	4,760
51	Alaska	9	3,086	1,506	4,601

The map in Figure 9 shows the employment impact of the industry on a state's workforce, by highlighting the contribution of the total motor vehicle parts manufacturing-related jobs as a percentage of the state's total workforce. This map shows a broad

dispersion of states where the impact from the parts suppliers is greater than 2 percent of its total workforce.

Figure 9
Total State Employment Contribution of Motor Vehicle Parts Supplier Operations
as Percent of Total State Labor Force



Further, when grouping the states by census region,¹⁰ it can be seen in Table 11 that direct employment in the motor vehicle parts manufacturing industry is highly concentrated— mainly in the Central region, east of the Mississippi, and in the south-Atlantic region. The three regions contain almost 600,000 of the 783,100 jobs attributable to direct employment in the motor vehicle parts sector. This geographic concentration of direct employment is mainly due to the location of its primary customers —the motor vehicle manufacturers —who have been located in the same regions for many years. However, as the motor vehicle manufacturing industry has grown geographically into the southern parts of these regions —in places such as Alabama and Mississippi— so too have the parts suppliers.

¹⁰ For a definition of the Census Regions, please see Table 2.12 in the Appendix B

Table 11
Direct Employment Contribution of Automotive Parts Supplier Operations by
Census Region, 2004

Region Name	2004 Direct Employment	Rank of Parts Industry in Region's Economy
East North Central	391,649	1
East South Central	109,995	1
South Atlantic	92,010	4
West North Central	44,530	4
Middle Atlantic	57,290	5
West South Central	36,951	8
Mountain	10,287	15
Pacific	32,422	18
New England	7,927	25

In conclusion, the motor vehicle parts manufacturing industry appears to be highly concentrated within three census regions, as a result of direct employment of the industry and the region's close proximity to the motor vehicle manufacturers. However, when factoring in the goods and services demands of the motor vehicle industry from its suppliers and their many tiers of suppliers, along with the expenditure-induced employment effects, the industry contributes to employment in all fifty states and the District of Columbia. In fact, as can be seen in Table 12, the three regions that contain almost 77 percent of direct employment in the industry group, account for only 63 percent of 4.5 million total jobs attributable to the motor vehicle parts manufacturing industry, indicating a broad dispersion of the economic and employment benefits attributable to the industry.

Table 12
Total Employment Contribution of Motor Vehicle Parts Supplier Operations by
Census Region, 2004

Census Region	All Parts Direct Employment	Region % of Total Parts Direct Empl	All employment contributed by Parts sector, incl direct employment	Region % of Total Empl Contribution	All Manufacturing Employment, BLS
East North Central	391,640	50%	1,674,834	38%	3,259,000
East South Central	109,995	14%	452,059	10%	1,146,400
South Atlantic	92,010	12%	665,484	15%	2,211,200
West North Central	44,530	6%	297,712	7%	1,230,500
Middle Atlantic	57,290	7%	457,162	10%	1,590,700
West South Central	36,951	5%	355,667	8%	1,394,500
Mountain	10,287	1%	140,041	3%	625,500
Pacific	32,431	4%	280,785	6%	2,016,800
New England	7,927	1%	135,946	3%	733,800
US Total	783,061	100%	4,459,689	100%	14,208,400

Section III: Methods

The basic approach in these analyses has been to use a specially constructed regional economic impact model, input parts manufacturing industry-specific data, and generate estimates of the economic contribution associated with the sector on state and national levels.

The Macroeconomic Model

For the estimation of employment and compensation associated with the automotive parts supply sector in the United States, we use an economic model supplied and constructed specifically for this study by Regional Economic Models, Inc. (REMI) of Amherst, Massachusetts. We then make adjustments to the model to reflect the general characteristics of the motor vehicle parts manufacturing industry. The REMI model, which has been fully documented and peer-reviewed, was designed for the type of analyses employed in this current study and has been used by CAR and other organizations for over two decades for these types of analyses.

The version of the model used in this study represents the economies of all 50 states (individually) and the District of Columbia, in addition to the U.S. national economy. This model allowed for simulating all the state economies and the national economy, providing for an accounting of interregional trade and migration. The model can simulate economic impacts that may occur in any one state, resulting from changing the manufacturers' level of activities in any or all of the other states.

The data input into this model included employment (at the end of 2004) for each state. Before the data was input, it was coded according to the North American Industry Classification System (NAICS). We then made adjustments in the data to accurately reflect manufacturer employment by netting out non-motor vehicle parts manufacturing-related workers that were not included in the general NAICS 3363 classification.

The general methodology in the analyses is to run baseline simulations for each state's economy, then subtract the parts manufacturer activities in each of the states and run another set of simulations. The difference between the simulations represents the impact the parts manufacture sector has on each state.

This study should not be interpreted as representing the economic activity that would be lost if the automotive industry did not operate in the United States. That scenario would

generate significant compensating adjustments over time in the economy, and is not examined in this study. Our purpose is to dissect the industry's current presence in the domestic economy. This study only represents a snapshot at a particular time (the end of 2004) of the total employment impact of the nation's economy.

To benchmark the results of the regional simulations, comparative runs were made using the same model at the national level, with no state-level detail in the inputs or outputs of the simulation. Both a baseline case and a simulation with motor vehicle parts employment were run. The corresponding results for the nation, when compared to the state-level results, were used to isolate the inter-state trade flow effects within the regional model results. These inter-state trade flow effects vary from state to state. The economies of some states are more isolated than others, and hence, less affected by inter-state trade flows. Therefore, the employment multipliers discussed earlier in the study (beginning on page 18) apply to the national economy and are not applicable to, nor can they be derived from, any one state's economy.

The model used for this study is a multi-regional US (MRUS) model comprised of the 50 U.S. States and the District of Columbia. The multi-regional property of the model allows the user to "shock" a regional economy by causing a change in the level of employment or output for a given sector in any one or all of the regions. When this activity is performed the model calculates the indirect and induced impact of the change within the region of impact as well as the total amount of inter-state trade affected. When you observe the shock on exports as an aggregate value across all regions, it encompasses the total change to trade activity, acknowledging that this trade was done for many purposes.

APPENDIX A: Determination of Direct Employment in Each NAICS Industry

Data for this study were collected using the NAICS system of classifying employment, compensation and output. A total of 9 subsectors, or industry groups, were selected for inclusion in the analysis. These are shown in Table 13.

Table 13
Sectors Comprising Auto Parts Manufacturing Industry

NAICS, Sector.Subsector	Category Description	Employees in sector, attributable to Census data, 2002	Employees auto parts subsector	Sources
3261.991	Transportation fabricated plastics products (excluding foam and reinforced plastics)	109,638	72,845	Ohio Plastics Study. BEA I/O Matrices. Census data at the 7-digit NAICS level, 2002.
3262.1	Tires	68,300	57,450	Rubber Manufacturers Association Use entire sector. Census data at the 7 digit NAICS level, 2002
3262.203	Hoses for on and off highway motor vehicles, made of rubber and other materials	5,905	5,905	Use entire sector. Census data at the 7 digit NAICS level, 2002
3325.106	Motor vehicle hardware - lock units, handles, hinges, license plate brackets, etc.	14,626	14,626	Use entire sector. Census data at the 7 digit NAICS level, 2002
3345.145	Motor vehicle instruments	7,552	7,552	Use entire sector. Census data at the 7 digit NAICS level, 2002
3351.101	Electric lamp bulbs and tubes	9,947	1,925	websites applied to 2004 BLS Current Employment Estimates
3359.111	Storage batteries, lead acid type	11,282	12,602	Battery Council International Use entire sector. Census data at the 7 digit NAICS level, 2002
3362.115	Other truck and vehicle bodies for sale	10,907	10,907	2002
3363	Motor Vehicle Parts	678,000	599,249	Harbour Report 2005

Before running the economic estimation model, it was first necessary to determine the number of jobs in each subsector or industry group, as some of these contain companies that do not produce parts exclusively for motor vehicles. For instance, tire manufacturers also produce tires for airplanes, and light bulb manufacturers produce for a variety of applications besides motor vehicles. Details of the determination of employment in each of the nine categories that make up the motor vehicle parts manufacturing industry group are discussed below.

Automotive Parts Supply: The data were compiled at a 4-digit NAICS Code level. The appropriate code is 3363. For this code, parts manufacturing employment engaged by Original Equipment Manufacturers (OEMs) within OEM assembly, powertrain or stamping operations was excluded from the study. These jobs comprise slightly over 10% of the total sector. All other jobs within this sector, approximately 600,000, were considered direct employment inputs for the model. (Please see Table 14)

Table 14

OEM parts employment excluded from parts sector, NAICS 3363

US DATA	# Establishments	Total Employment
Transmission	12	24,178
Engine	20	20,434
Stamping	35	34,055
TOTALS	67	78,667

Source: CAR Research

Battery manufacturing: Employment in this category was taken from forecasts of battery shipments by type of battery, prepared by the Battery Council International. Motor vehicle-related employment was estimated based on actual historical employment and shipments, compared to forecasts by type of battery. Only batteries destined for motor vehicle use were considered. As noted in Table 15, approximately 70 percent of all battery production in the U.S. is for light motor vehicle use.

Table 15

Determination of auto-related employment in battery manufacture

2004 Data	Shipments of Storage Batteries		Value per unit	All Employees	All Employee Payroll, 2004 \$	Production Workers	Production Payroll, 2004 \$	Percent of Total Storage Battery Market
	\$	# Batteries						
Light Vehicle for OE	476,762,790	15,900,000	30	2,336	93,355,011	1,783	61,714,158	13.88%
Light Vehicle for Replacement	1,925,042,210	64,200,000	30	9,434	376,942,875	7,197	249,185,470	56.06%
Light Vehicle Total	2,401,805,000	80,100,000	30	11,770	470,297,886	8,980	310,899,628	69.95%

12602 Number to use to match 2004 REMI data from County Business Patterns.

Sources
 Annual Survey of Manufacturers 2004, U.S. Census Bureau
 Battery Shipment Review and Three-Year Forecast. By Jim Jelin. The Battery Man magazine. July/August, 2005. Battery Council International.
 North American Industrial Battery Forecast Report. By Bob Cullen. The Battery Man magazine. September, 2005. Battery Council International.

Tire manufacturing: U.S. government data for this industry is at a 4-digit NAICS code level, which includes tires made for aircraft and non-motorized vehicles (wheelbarrows, etc.). Employment in this category was taken from forecasts of tire shipments prepared by the Rubber Manufacturers Association. Employment was estimated based on actual historical employment and shipments compared to forecasts by type of tire. Only tires destined for motor vehicle use were considered. As noted in Table 16, approximately 93 percent of all tire production in the U.S. is for light motor vehicle use.

Table 16

Determination of auto-related employment in tire manufacture

32621 Tires							
2004 Data	Shipments of Tires \$	Thousands of Tires	All Employees	All Employee Payroll, 2004 \$	Production Workers	Production Payroll, 2004 \$	Percent of Total Tire Market
Light Vehicle for OE	2,818,322,060	57,400	11,100	552,693	8,949	428,380	17.87%
Light Vehicle for Replacement	11,768,924,180	239,400	46,350	2,307,968	37,370	1,788,855	74.64%
Light Vehicle Total	14,587,246,240	296,800	57,450	2,860,661	46,320	2,217,235	92.51%

Sources
 Annual Survey of Manufacturers 2004, U.S. Census Bureau
 Press Release, March 13, 2006: Tire Shipments Forecasted to Increase in 2006. Rubber Manufacturers Association

Light bulb manufacture: U.S. government data for this industry is at a 4-digit NAICS code level, which includes all types of light bulbs. Several major international light bulb manufacturers provide a breakdown of production or sales by type of light bulb. This information was used to develop a production profile of auto light bulb manufacturing as a component of the entire industry. Furthermore, many of the major producers provide detailed information on their manufacturing operations. When available, employment at facilities specifically identified as motor vehicle-related manufacturing was used. Approximately 17 percent of all bulbs produced are for the motor vehicle industry. When specific site-related employment was not available, employment was estimated using the percent of motor vehicle bulbs produced within the entire industry production.

Transportation fabricated plastics products: According to 1999 SIC statistics, which break this industrial class into specific transportation sectors, plastics for motor vehicles accounted for approximately two-thirds of total transportation plastics. This percentage was then applied to current employment data to estimate the motor vehicle-related employment contribution from the plastics products manufacturing.

Table 17

Motor Vehicle Parts Supplier Manufacturing Employment by Industry, by State

	Automotive Batteries	Light Bulbs for Automotive Use	Automotive Instrumentation	Automotive Hardware	Auto Bodies	Auto Parts	Rubber Hoses & Belting	Tires	Plastics	Total Direct Employment
Alabama	191		360	220	511	11,150	47	2,622	864	15,965
Alaska						9				9
Arizona						3,346	13	10		3,369
Arkansas			86	115	92	4,379	213	2,437	600	7,922
California	525	55	670	1,998	1,257	23,315	187	589		28,596
Colorado			196	0	264	1,283	3	10		1,756
Connecticut		50	126	596	12	3,322	3			4,109
Delaware						300	13			313
District of Columbia						70				70
Florida		50	215	344	576	6,200	189	948	751	9,273
Georgia	600		157	260	293	17,100	101	2,590	1,600	22,701
Hawaii						125				125
Idaho						65	3			68
Illinois	856	615	360	1,279	424	26,500	205	3,223	6,601	40,063
Indiana	700	500	182	981	1,033	70,900	47	3,705	8,886	86,934
Iowa	400		86	185	292	4,100	213	1,404		6,680
Kansas	600		7	28	200	5,800	213	661		7,509
Kentucky			86	579	252	25,350	101	1,227	7,507	35,102
Louisiana	401		24	7	92	520	213	611		1,868
Maine						290				290
Maryland						2,400	13			2,413
Massachusetts		65	86	167	44	1,180	47			1,589
Michigan	400		1,577	1,543	265	124,345	387	2,402	14,899	145,818
Minnesota			182	328	353	3,730	67	511	1,500	6,671
Mississippi			2	423	66	11,240	13	1,235	200	13,179
Missouri	700		7	28	236	14,010	370	1,503	2,034	18,888
Montana						50				50
Nebraska			446	109	179	2,800	507			4,041
Nevada						700	47			747
New Hampshire						700	47			747
New Jersey	600	60	24	115	81	1,400	103	973		3,356
New Mexico						100				100
New York		70	224	568	362	26,300	101	1,579	1,813	31,017
North Carolina	1,300		233	709	806	18,500	340	4,272	1,429	27,589
North Dakota						350	13			363
Ohio	1,100	290	379	952	518	77,140	663	9,322	6,959	97,323
Oklahoma			27	348	92	4,600	3	1,916		6,986
Oregon						1,750	3	30		1,783
Pennsylvania	1,200	110	913	721	1,055	11,900	208	1,741	5,069	22,917
Rhode Island						800		22		822
South Carolina			86	141	230	16,500	399	2,589	998	20,943
South Dakota						375	3			378
Tennessee	1,200		86	909	97	32,740	514	6,590	3,613	45,749
Texas	700	60	341	286	315	12,500	129	2,413	3,431	20,175
Utah						4,000	47			4,047
Vermont						370				370
Virginia			24	107	97	7,265	3	300		7,796
Washington						1,900	13	5		1,918
West Virginia				28	49	830		5		912
Wisconsin	1,129		360	552	764	14,500	101	5	4,091	21,502
Wyoming						150				150
	12,602	1,925	7,552	14,626	10,907	599,249	5,905	57,450	72,845	783,061

APPENDIX B

Table 18
Census Regions of the United States

Region 1 New England Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont	Region 2 Middle Atlantic New Jersey New York Pennsylvania	Region 3 East North Central Illinois Indiana Michigan Ohio Wisconsin
Region 4 West North Central Iowa Kansas Minnesota Missouri Nebraska North Dakota South Dakota	Region 5 South Atlantic Delaware DC Florida Georgia Maryland North Carolina South Carolina Virginia West Virginia	Region 6 East South Central Alabama Kentucky Mississippi Tennessee
Region 7 West South Central Arkansas Louisiana Oklahoma Texas	Region 8 Mountain Arizona Colorado Idaho Montana Nevada New Mexico Utah Wyoming	Region 9 Pacific Alaska California Hawaii Oregon Washington

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