Downstream Automotive and Transportation Employment in the State of California

A Study Prepared for the Alliance of Automobile Manufacturers

May 17, 2004

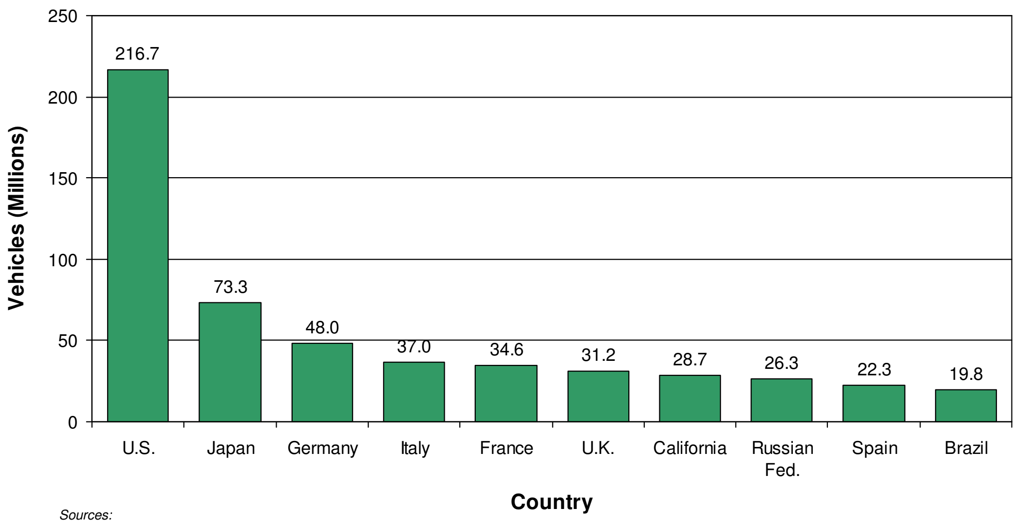
Steven Szakaly
Sean P. McAlinden
Economics and Business Group
Center for Automotive Research
Ann Arbor, MI

CAR
CENTER FOR AUTOMOTIVE RESEARCH

Introduction

In 2001, almost 29 million vehicles were registered in California or 13 percent of total U.S. vehicle registrations.[1] California is clearly one of the largest markets in the world for motor vehicles sales and use. As shown in Figure 1, California ranked eighth in world motor vehicle sales in 2001, behind China but ahead of Spain. In terms of motor vehicle registrations, California ranked seventh in the world in 2001, behind the United Kingdom, but ahead of the Russian Federation.
Of course, each of California's motor vehicles requires fuel, service, and roads. The extensive use of the automobile in the day-to-day life of California is such that there is significant downstream automotive employment in addition to employment directly related to the manufacture or sale of new vehicles. These jobs, of course, are primarily related to the use of the motor vehicle.

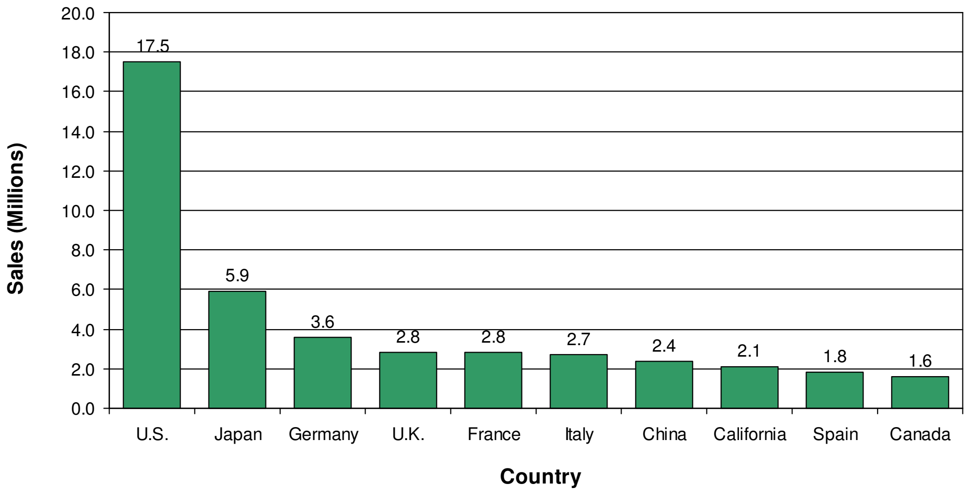
Figure 1: Top 2001 Motor Vehicle Industries - Vehicles in Operation



Sources:
Ward's Motor Vehicle Data 2003, Vehicles in Operation by Country, p. 232
Ward's Automotive Yearbook 2003, U.S. Total Vehicle Registrations by Type by State, 2001, p. 259

[1] California Department of Motor Vehicles, Wards Motor Vehicle Data 2003, Vehicles in Operations by State, and by Country, p.232

Figure 2: Top 2001 Motor Vehicle Industries - Sales



Sources:
Ward's Motor Vehicle Data 2003, Total Vehicle Sales by Company by Country, p. 226
Ward's Motor Vehicle Facts & Figures 2002, New Passenger Car and Truck Registrations by State, p. 31

Employment in these downstream (from the sale and manufacture of new vehicles) industries can be significant, especially when taking into account all the necessary services related to the operation of a motor vehicle. Obvious examples of downstream automotive employment include jobs in gasoline service stations or in road construction projects. Given the large number of vehicles on the road in California, considerable employment can be attributed to services related to a vehicle's use. We estimate downstream automotive employment in California to total about 468,000. A breakdown of the various sectors where this employment is located and a brief explanation of how it is related to the auto industry are provided below. Also shown below are totals for a second type of motor vehicle related employment – jobs in the transportation sector. These jobs amount to about 144,000 in California in 2001. The combination of the two types of employment is just over 613,000 jobs or almost 5 percent of total employment in California in 2001.

I. Downstream Automotive Employment

Road Construction & Maintenance

The 2001 U.S. Census Bureau Survey of County Business Patterns shows employment levels for construction activity relating to roads, bridges and highways. Employment in this area of course also must include the manufacture of concrete and asphalt which in California employs some 2,436 people.[2] California also employs a further 24,383 in maintaining and building roads, bridges and other infrastructure.[3] Indeed in 2000 the California state government spent over $4.23 billion on highways and other infrastructure.[4] In total state and local government spending amounted to more than $8.6 billion for road construction and maintenance.[5]

Fuel

The purchase of fuel for vehicles creates both state employment and state revenues. Jobs are located in the refining of crude oil into petroleum products. A smaller portion of related jobs also exist in the distribution of petroleum and related products. This distribution includes the wholesale pipeline distribution of both unrefined and refined petroleum, regional and local terminals as well

[2] US Census County Business Patterns NAICS basis 2001 accessed 4/19/04
[3] Ibid.
[4] US Census Statistical Abstract of the United States 2003 accessed 5/11/04
[5] Ibid.

as transit to retail service stations. California in 2001 employed some 9,298 individuals in refining operations and 7,789 people in the distribution of petroleum. A certain portion of these jobs would doubtless exist even if there were no motor vehicles but given that over 50 percent of every barrel of crude oil is refined into gasoline and a further 10 percent into diesel oil,[6] the number of individuals involved in petroleum refining would be significantly lower if not for the fuel demands of motor vehicles.

The second major source of employment related to fuel distribution is the retail gasoline station. So ubiquitous is the gasoline station that in California alone there are over 12,000 such establishments many with convenience stores. These stations together employ 66,700 individuals.[7] Related to gasoline are oil and lubrication service centers, separate from gas stations or dealers, these retail centers employ a further 5,480 people.[8]

A third area that benefits the state is through the assessment of a fuel tax. Revenue generated by the state fuel tax totaled $3.24 billion in FY 2001.[9] Fuel taxes are allocated to improving infrastructure for motor vehicles as well as subsidizing mass transit and other expenditures not directly related to motor vehicles.

Parking & Other Services Related to Motor Vehicle Use

With 29 million vehicles on the road in California there are significant needs in terms of parking, road service, and other services like car washes. These services exist solely to serve, service, or provide a product related to the use of motor vehicles.

Parking requires significant labor in terms of lot attendants, valets, and general maintenance of parking facilities like parking decks. In California parking and related services employ 18,594 individuals.[10]

Other services related to the use of motor vehicles include car washes, road services like tow trucks and educational services like driver's education. In California there are over 1,600 car wash establishments employing 21,866 individuals by far the largest of the three categories.[11] Towing and other road services support activities employ 12,012 people.[12] Automobile driving schools these employ a further 2,114 individuals throughout the state of California.[13] Finally there repossession services that deal with vehicles these employ 1,006 individuals.[14]

Automobile Repair & Maintenance Services

Automobile accidents and required repairs are hopefully rare inconveniences related to owning a motor vehicle. In spite of the headaches that drivers face there are considerable employment benefits.

The general repair and maintenance of motor vehicles consists of several different areas from the repair of electrical systems to powertrain and body work. Employment within the repair and maintenance sector is 114,927 not including body work, glass repair or interior repairs.[15] The repair of car bodies, interiors and glass employs an additional 35,874 people.[16]

---

[6] American Petroleum Institute accessed 4/20/04
[7] US Census County Business Patterns NAICS basis 2001 accessed 4/19/04
[8] Ibid.
[9] California Board of Equalization 2001-2002 Annual Report accessed 05/04/04
[10] US Census County Business Patterns NAICS basis 2001 accessed 4/19/04
[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] Ibid.
[15] Ibid.
[16] Ibid.

Tires, Accessories, & New Parts
Vehicle tire manufacturing and wholesaling are not included within direct employment though such work is clearly directly related to vehicle use. The tire industry in California employs 1,751 people in the manufacture or retreading of tires. Most tire manufacturing will be captured as supplier employment to OEMs, retreading employment though includes an additional 1,041 workers. In addition there is wholesale distribution of tires which employs another 2,481 people.[17] There also exist in California a considerable chain of retail establishments that specialize in just tire retailing. There are over 2,000 such dedicated tire dealers in California and these retail outlets employ some 16,615 individuals throughout the state.[18]

There also exists sizeable consumer demand for aftermarket retail goods. This segment includes various accessories from vanity items to replacement parts. Though many of these retailers may sell tires they are not considered exclusively tire retailers and are thus not included among dedicated tire retailers. This segment also excludes new vehicle dealers who also sell parts and accessories. In California there are more than 4,000 of these stand alone retail outlets that deal with parts and accessories. In total these retail establishments employ some 36,933 people.[19]

Used Parts
Used parts for vehicles are a significant business as vehicles are taken out of useful service they are often recycled with certain constituent parts remanufactured or reused. The wholesaling of these parts employs 4,879 workers.[20] An exact number of individuals employed in motor vehicle scrap yards and related services could not be attained. An estimate based on the total number of individuals involved in work at materials recovery facilities as well as approximate vehicle scrapping rates provides an estimate of between 750 and 1,200 workers.[21] This would not include those employed in the actual remanufacture or rebuilding of used components.

Used Car Sales
Although many used cars are sold by dealers who combine new and used car operations there remains a large segment of automobile resale business that is solely dedicated to used cars. These retailers specialize only in the sale of used vehicles and are therefore not included among employment levels for new vehicle dealers. In California some 9,424 people are employed by retailers dedicated solely to used motor vehicles.[22]

Leasing, Renting, & Insuring
Insurance remains an important and required portion of driving motor vehicles. California like most states requires that drivers be insured before obtaining a vehicle registration certificate. This means that significant employment exists in the area of insuring motor vehicles. A specific breakdown of the number of individuals directly employed in the motor vehicle insurance business could not be obtained, however given that the majority of claims are filed for motor vehicles and that premiums collected for motor vehicles are far greater than those for homes we estimated that total employment related to motor vehicle insurance is 29,157 or half of all employment in the direct property and causality insurance sector.[23]

---

[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Ibid.
[21] Workers in this category fall under several possible NAICS categories depending on their facilities primary business purpose. The disposal and recycling of the primary vehicle body and components, for example, would fall under ‘Materials Recovery Facilities’ while the disposal may be included under ‘Waste Treatment & Disposal’. In California approximately 1 million vehicles are scrapped every year within the state according to the Department of Motor Vehicles.
[22] U.S. Census Bureau County Business Patterns 2001 NAICS Basis accessed 4/19/04
[23] Employment in this sector would include property insurance related to homes as well as other property. Total employment in this sector from the County Business Patterns 2001 is 58,314.

California also has a significant leasing and renting business related to motor vehicles. There are almost 700 car rental businesses in the state of California just related to renting passenger cars. Further employment exists in renting RVs, trailers, and other motor vehicles. In addition to renting motor vehicles there exist stand alone firms outside of captive finance companies of OEMs that support the leasing of motor vehicles. These leasing establishments are not as widespread but nevertheless add to the total employment level. Those employed in renting & leasing motor vehicles of all types is 23,529.[24]

Total downstream automotive employment is shown by category or industry in Table 1 – and totals 468,900 in 2001.

Table 1
Downstream Employment Connected to the Use of the Motor Vehicle

Cement & Asphalt Manufacturing	2,436
Highway, street, bridge & tunnel construction	24,383
Petroleum Refineries	9,298
Petroleum Distribution Incl. Pipelines & Terminals	7,879
Gasoline Stations	66,700
Gasoline Stations with Convenience Stores	34,284
Automotive Oil Change & Lubrication Shops	5,480
Parking Lots & Garages	18,594
Car Washes	21,866
Automobile Driving Schools	2,114
Repossession Services	1,006
Automotive Repair & Maintenance	114,927
Automotive Body, Paint, Interior & Glass Repair	35,874
Automotive Parts, Accessories & Tire stores	36,933
Tire Retreading	1,041
Tire & Tube Wholesale	2,481
Tire Dealers	16,615
Used Car Dealers	9,424
Motor Vehicle Used Parts Wholesale	4,879
Direct Property & Causality Insurance*	29,157
Automotive Equipment Rental & Leasing	23,529
Total Downstream Employment	468,900

II. Motor Vehicle Transportation Employment

An additional segment of employment connected directly to the operation of motor vehicles covers the use of vehicles for freight and public transportation. For example, this segment includes truck transportation which in the state of California employs more than 119,000 individuals. Employment in the transportation sector also includes the operation and maintenance of buses and taxis. In California the bus transportation sector employs 5,548 people, while there are approximately 2,000 taxi cab drivers. Limousine or similar services employs some 5,186 people. Other transportation employment in the public and private sectors includes school and employee bus drivers employing some 8,620 people and the charter bus industry which employs 3,958 people. As shown in Table 2, transportation employment in California in 2001 amounted to 144,821.

[24] Ibid.

Table 2
Motor Vehicle Operator Employment

Truck Transportation	119,509
Bus & Other Motor Vehicle Transit Systems	5,548
Taxi Service*	2,000
Limousine Service	5,186
School & Employee Bus Transportation	8,620
Charter Bus Industry	3,958
Total	144,821

Conclusion and a Postscript on Automotive Electronics Employment

As shown in Tables 1 and 2, the sum total of downstream automotive and transportation employment in California in 2001 is 613,721. According to the U.S. Census, total employment in California in 2001 was 13,239,616.[25] Automotive downstream and transportation employment, then, constituted 4.6 percent of California employment in 2001. It should be noted that this type of automotive employment does not include the 25,000 employees of motor vehicle manufacturing firms in California, or the 133,000 employees of new vehicle sales dealerships, or thousands of jobs located in automotive parts manufacturing in the state.

Electronics in the Motor Vehicle
The world motor vehicle industry contributes thousands of jobs to a special sector of the California economy – electronics manufacturing. In 2001, over 1.74 million Californians worked in the manufacturing sector, and about 224,662 (about 13 percent) worked in the strategic industry that produces electronic products, devices and parts.[26] Thousands of these jobs involved the manufacture of electronic goods for use in motor vehicles. As shown in Table 3, the U.S. Census estimates that in 2001, about 7,600 Californians worked in 156 auto parts facilities that produce final use motor vehicle electronics such as vehicular lighting or other electronics equipment. In addition to these specific automotive components, thousands of other California electronics jobs depend on automotive industry demand for essential components such as printed circuit boards and semiconductor devices such as microprocessors.

The U.S. Department of Commerce (USDOC) estimated in 2000 that 10 percent of world demand for printed circuit boards was for automotive use.[27] California total employment in this industry was 25,693 in 2001. A reasonable assessment of automotive share of this employment would be 2,569. Similarly, the USDOC estimates that 5.8 percent of total world demand for semiconductor devices was for automotive purposes.[28] Total California manufacturing employment in the industry amounted to 50,901 in 2001. About 2,952 jobs in California, then, can be attributed to semiconductor sales to the automotive industry. Combined with actual automotive electronics parts manufacturing employment, additional employment from these two industries, printed circuit boards and semiconductors and related devices, produce a sum total of 13,121 California jobs connected to motor vehicle manufacturing and aftermarket parts demand.

---

[25] U.S. Census Bureau County Business Patterns 2001 NAICS Basis accessed 4/19/04
[26] Ibid. This excludes communications equipment, computers, and optical & magnetic media reproduction.
[27] The McGraw Hill companies and the U.S. Department of Commerce/International Trade Administration, U.S. Industry & Trade Outlook 2000. McGraw Hill, New York, N.Y., 2000. p. 16-6.
[28] Ibid, p. 16-10.

Table 3
California Automotive Electronics Manufacturing Employment

NAIC	Industry	Employees	Establishments
336321	Vehicular Lighting Equip.	378	14
336322	Other MV Electronic equip. mfg.	7,209	142
334412	Bare Printed circuit board mfg.	2,569 (25,693)*	39 (390)
334413	Semiconductor & related device mfg.	2,952 (50,901)*	42 (422)
Total Auto Electronics California employment.		13,108	237

* Number in parentheses refers to total Calif. Industry employment.

Electronics employment in California contributed by the motor vehicle industry is very likely greater than the total shown in Table 3. In 2000, the Center for Automotive Research (CAR) completed a study for the state of Michigan on hi-tech content and employment in the motor vehicle.[29] A detailed survey of major motor vehicle manufacturers performed for that study estimated that electronics content constituted 7.6 percent of total cost of producing a motor vehicle – a number expected to rise further for many years. This percentage does not include the content of “electrical” components such as wiring, batteries, or electric motors. The electronic content section of the Michigan study is reproduced in Appendix 2.[30] California’s vast electronics industry certainly contributes to almost every electronic system of the vehicle – including instruments, controls, sensors, and new navigations devices. These hi-tech markets contained in the vehicle contribute to the California economy in many ways and vice-versa.

[29] McAlinden, S.P., et. al., Michigan: The High Technology Automotive State, Office for the Study of Automotive Transportation, University of Michigan Transportation Research Institute, April 2000. UMTRI Report No. 2000-24-2.
[30] Ibid, pp. 36-41.

Appendix I

California New Vehicle Registrations	
1994	1,600,000
1995	1,700,000
1996	1,750,000
1997	1,790,000
1998	1,860,000
1999	2,160,000
2000	2,500,000
2001	2,400,000
2002	2,360,000

Taken from: The High Technology Automotive State, Office for the Study of Automotive Transportation, University of Michigan Transportation Research Institute, April 2000. UMTRI Report No. 2000-24-2.

Appendix II

Vehicle Electronics Content Assessment

There are several current estimates of the electronics content of motor vehicles. The estimates usually take one of two forms: dollars of electronic content per vehicle, or electronics content as percentage of vehicle cost. These estimates typically suffer from problems of limited coverage and changing definitions. For example, DaimlerChrysler has recently stated that electronics comprise 30 percent of the total cost of Mercedes Benz vehicles. DaimlerChrysler has also stated that Mercedes vehicles typically contain about 80 microprocessors. Of course, Mercedes cars are overwhelmingly high-end, luxury-segment vehicles, which would typically contain a significantly higher level of electronics than the average North American vehicle.

Semiconductors are integral parts in many automotive components. One recent estimate suggests that there are from 20 to 30 microprocessors in the average vehicle.[31] Table 8 shows a dollar forecast of computer chip automotive sales from a well-known automotive electronics consultant. The table charts the growth in chip usage for automotive applications for the years 1993 to 1998, and provides a forecast of automotive chip sales through 2004. As can be seen, the growth in dollar value is impressive during the period 1993 to1997. However, the relative flatness of chip sales to the auto industry in 1997 and 1998 probably reflects price pressures faced by chip manufacturers with overcapacity during this period. This underscores the flaw in dollar assessments of electronic content in the motor vehicle. Many electronics components have faced declining price schedules in recent years. Yet the electronics content of the vehicle has clearly increased.

Table 8
World Wide Annual Motor Vehicle Computer Chip Usage
(actual and forecast)

Year	Total value ($ millions)	Average Content per Vehicle
1993	$4,300.8	$91.47
1994	5,840.6	109.48
1995	6,826.8	122.83
1996	8,037.3	134.74
1997	8,427.9	134.42
1998	8,393.2	128.99
1999*	10,003.3	148.55
2000*	11,127.4	156.88
2001*	12,209.3	161.68
2002*	13,195.5	172.38
2003*	14,001.2	178.82
2004*	15,103.7	182.94
* Forecast		

Source: Zgymont, Jeff, Automotive Electronics Explores New Fronts in Electric Drive and the Internet. 1999 Ward's Automotive Yearbook, Ward's communication, pp.68-70

Another estimate of automotive electronics content in the vehicle is available from the results the Delphi X: Forecast and Analysis of the North American Automotive Industry Technology Volume. The OSAT study produces an estimate of current and future electronic content in vehicles sold in

[31] Daniel Holt, "How many IC's" Automotive Engineering International, September 1999, 6.

North America. The Delphi technology survey relies on responses from 86 industry executive panelists surveyed in 1999. The panelists were asked for their estimate of overall electronics content as a percentage of current vehicle cost. The median response was 10 percent. The panelists also forecast that by 2009, electronics will account for 20 percent of the cost of a vehicle.

Vehicle Electronics Content Assessment Survey Results

OSAT recently surveyed the three largest Michigan vehicle firms on the subject of electronic content in the motor vehicle. The three firms were asked to compute electronic content, as a percentage of cost, for six vehicle systems/component groups. The companies were also asked to estimate overall electronic content in the total vehicle. The six vehicle systems/component groups are:

Engine (including, but not limited to):
Engine Control Module (ECM) - Computer that controls engine fuel, ignition, and emission control systems; throttle position sensor, mass airflow meter, engine speed sensor, oil temperature sensor, oil pressure sensor, electronic ignition system, diagnostic systems monitor, drive-by-wire

Transmission (including, but not limited to):
Locking torque converter – controlled by ECM, shift speed control, vehicle speed sensor

Chassis (including, but not limited to):
Antilock brake system, traction control, power steering electronic control for steering effort, tire pressure sensing devices, brake-by-wire, steer-by-wire, active suspension, semi-active suspension

Safety (including, but not limited to):
Airbag actuators, GPS/cellular-phone-based safety systems (On-Star), blind-spot detection, collision warning systems, Navigation systems, in-vehicle message systems, automatic toll collection, self-dimming rear-view mirror, passenger sensing to control airbag-deployment rate

Interior (including, but not limited to):
Radio, CD player, electronic instrumentation/gauges, voice-activated controls, cellular phone, memory seats, air conditioning controls, trip computer (fuel economy, distance, etc.), controls for heated seats, rear view mirrors and windows, digital compass, outside air temperature readout, Instrument panel light dimmer switch, clock

Miscellaneous (including, but not limited to):
Antitheft system, cruise control, adaptive cruise control, electronic keyless entry, pulsed windshield wipers, battery saver – timed accessories, voltage regulator, alternator

The companies were also asked to provide separate estimates for five vehicle segments: small car, medium car, large car, and large truck. The responding firms were also asked to estimate the percentage of electronic content in each component group produced within the traditional automotive industry (i.e., not including components supplied by firms primarily associated with other industries, such as computer chip manufacturers). This estimate is meant to separate the value of electronics produced within the auto industry from that purchased from other (electronic) industries. It should be noted that several of the responding firms strongly suggested that the definition for traditional automotive suppliers include companies such as computer chip manufacturers—for the respondents certainly considered them as such. However, the survey instructions clearly asked respondents to consider such electronic content as nonautomotive in origin.

A complication in the overall assessment was that one of the firms failed to estimate overall electronics content in the vehicle. This forced the study authors to rely on separate, although dated, information concerning the component group shares in overall vehicle parts costs.[32] Table 9 shows our method of estimating the electronic content share of total vehicle parts cost. Column 1 contains the independent estimate of component share of total vehicle parts cost for three final groups: powertrain (engine and transmission), chassis, and vehicle interior. Reliable estimates for the share of safety systems and other miscellaneous electronics were not available to the study. A number of the constituent components for these two last systems, therefore, were included in the content of the other three systems. For example, powertrain systems are assumed to comprise 35 percent of total vehicle parts cost. Powertrain systems now include such miscellaneous components as alternators and voltage regulators.

Table 9
The Share of Electronics in Vehicle Parts Cost

	System Share of Vehicle Parts Cost	Electronics Share of Systems Cost	Electronics Share of Total Vehicle Parts Cost	Share of System Electronics Produced in Auto Industry	Electronics Share of Total Vehicle Parts Cost Produced in Auto Industry
Powertrain	34.9%	9.8%	3.4%	77.1%	2.6%
Chassis	20.8%	6.2%	1.3%	91.2%	1.2%
Interior	17.9%	16.3%	2.9%	91.2%	2.7%
			7.6%		6.5%

Column 2 contains the company's estimates of the proportion of systems group cost that can be attributed to electronics. The company answers were weighted by company sales in each segment in 1999. For example, about 9.8 percent of powertrain-systems costs are attributed to electronics. The fraction in column 2 is multiplied by the vehicle-parts share shown in column 1, in the same row, to estimate system electronic contribution to total vehicle-parts cost. This product is shown in column 3. For example, we estimate that 3.4 percent of total vehicle-parts cost can be attributed to powertrain electronics. The sum of the three systems in column 3 yields a total contribution of electronics to vehicle-parts cost. We estimate that 7.60 percent of total vehicle-parts cost is composed of electronics parts cost.

Column 4 contains the companies' estimates of the automotive share of electronics cost percentages shown in column 3. This allows the computation of the percentages shown in column 5, or the share of vehicle-parts cost comprised by electronics produced within the auto industry. The sum across the system percentages for this last value was 6.45 percent. In other words, almost 6.5 percent of total vehicle-parts and components costs are made up by the value of electronics produced within the auto industry.

How large are the markets for in-vehicle electronics in the United States and world motor-vehicle industries? Table 10 contains summary information that can be combined with the results shown in table 9 to provide a partial answer to these questions. The USBOC 1997 Census of

[32] Systems group share of vehicle parts cost was generated with the use of stylized vehicle component cost figures computed in the Michigan Department of Commerce, Auto-in-Michigan project: Andrea, David J., Mark Everett, and Daniel Luria, "Automobile Company Parts Sourcing: Implications for Michigan Suppliers," Auto-In-Michigan Project Newsletter, Office for the Study of Automotive Transportation, University of Michigan Transportation Institute, Ann Arbor, MI, May 1988; and Luria, Daniel, Calculating Big Three Vertical Integration, Industrial Technology Institute, Ann Arbor, MI, August 1990.

Manufactures[33] estimates that U.S. light-vehicle assembly facilities purchased $137.47 billion in materials in 1997. This would imply a $10.45 billion U.S. automotive electronics market in 1997 on the basis of our estimated share of 7.60 percent for vehicle electronics. About $8.87 billion of this market (85 percent) is composed of components produced within the auto industry itself. U.S. production of light vehicles amounted to 22.7 percent of world vehicle production in 1997. The world market for automotive electronics could amount to $46.09 billion if in-vehicle electronics make the same share of vehicle-parts costs in the world auto industry as is the case in the U.S. industry (higher content in Japan, lower content in emerging markets). About $39.13 billion of the worldwide automotive-electronics-market products would be produced within the auto industry itself.

Table 10
The Size of the Automotive Electronics Market

1997 Auto. & Light Truck Cost of Materials[1] $137,473,493,000
Auto. & Light Truck Cost of Electronic Materials $10,447,320,000
Auto. & Light Truck Cost of Electronic Materials produced by auto industry $8,869,264,000
1997 U.S. Vehicle Production[2] 12,119,000
1997 World Vehicle Production[2] 53,463,000
1997 U.S. Production Share 22.7%
Adjusted World 1997 Light Vehicle Cost of Electronic Materials $46,088,407
Adjusted World 1997 Light Vehicle Electronic Materials Produced by Auto Industry $39,126,803
Sources: 1: 1997 Economic Census, U.S. Census Bureau, U.S. Department of Commerce 2: Motor Vehicle Facts & Figures 1998, American Automobile Manufacturers Association

[33] U.S. Census Bureau, U.S. Department of Commerce, Economics and Statistics Administration, Automobile Manufacturing, 1997 Economic Census, Manufacturing, Industry Series, Washington D.C., October 12, 1999, p. 7; and, Light Truck and Utility Vehicle Manufacturing, 1997 Economic Census, Manufacturing, Industries Series, Washington D.C., October 12, 1999, p.7. Unfortunately, direct accounting of the use of electronics components in automotive manufacturing is not available through these Census publications in the "materials consumed by kind" data because of restrictions on disclosure. An exception is the purchase of semiconductors and related devices by U.S. passenger car manufacturing facilities in 1997. The Census figure for these materials was $963.3 billion.

Reference List

American Petroleum Institute Industry Statistics, http://api-ec.api.org/industry/, Accessed 4/20/04

California Board of Equalization, http://www.boe.ca.gov/sptaxprog/spfuel.htm, Accessed 5/04/04

California Department of Motor Vehicles.

[1] McAlinden, S.P., et. al., Michigan: The High Technology Automotive State, Office for the Study of Automotive Transportation, University of Michigan Transportation Research Institute, April 2000. UMTRI Report No. 2000-24-2.

The McGraw Hill companies and the U.S. Department of Commerce/International Trade Administration, U.S. Industry & Trade Outlook 2000. McGraw Hill, New York, N.Y., 2000.

Statistical Abstract of the United States, U.S. Census Bureau, http://www.census.gov/prod/www/statistical-abstract-02.html, Accessed 5/11/04

Ward's Automotive Yearbook 2003, U.S. Total Vehicle Registrations by Type by State, 2001, p. 259

Ward's Motor Vehicle Data 2003, Total Vehicle Sales by Company by Country, p. 226

Ward's Motor Vehicle Data 2003, Vehicles in Operation by Country, p. 232

Ward's Motor Vehicle Facts & Figures 2002, New Passenger Car and Truck Registrations by State, p. 31

Country Business Patterns 2001, U.S. Census Bureau http://www.census.gov/epcd/cbp/view/cbpview.html, Accessed 4/19/04