

**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
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**Prepared by
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**and
Economics and Business Group
Center for Automotive Research**

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

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EXECUTIVE SUMMARY

- The purpose of this study is to update our previous study to estimate the contribution of the U.S. motor vehicle industry in 2003 to the economies of the United States, California, New York, and New Jersey.
- The estimates are generated using a state-of-the-art economic model in conjunction with survey data from twenty-one automotive firms in the United States and from the National Automobile Dealers Association. The results include the effects of new motor vehicle retail activities and industry spin-off activities.
- The employment contribution associated with automotive manufacturing activity in the United States is estimated to be about 5.2 million jobs in the private sector, and the compensation contribution is estimated to be almost \$250 billion, measured in 2003 dollars. The comparable employment and compensation contributions for California are 321,000 jobs and over \$17 billion in compensation; for New Jersey, 111,100 jobs and \$6.5 billion; and for New York, 194,200 jobs and \$11.7 billion.
- The employment contribution associated with new-vehicle-related sales and service activity in the United States is estimated to be about 1.9 million jobs in the private sector, and the compensation contribution is estimated to be over \$86 billion, measured in 2003 dollars. The comparable employment and compensation contributions for California are 235,400 jobs and \$12.3 billion in compensation; for New Jersey, 58,600 jobs and \$3.3 billion; and for New York, 94,900 jobs and \$5.5 billion.
- The employment contribution associated with the total automotive industry, combining new vehicle production, sales, and service is estimated to be 7,057,300 jobs in the private sector of the U.S. economy, and the compensation contribution is estimated to be almost \$335 billion, measured in 2003 dollars. The comparable employment and compensation contributions for California are 556,500 jobs and \$29.5 billion in compensation; for New Jersey, 169,700 jobs and \$9.8 billion; and for New York, 289,100 jobs and \$17.2 billion.
- There are yet more potential benefits that cannot be quantified, such as the intangible advantages of technological transfers associated with the U.S. motor vehicle industry. Nevertheless, the results of the study do confirm that the health of the automotive industry is very important to the overall health of the United States economy.

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—The Authors

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INTRODUCTION

The motor vehicle industry continues to be one of the most important sectors of the U.S. economy. It is sufficiently prominent to influence the movements of Gross Domestic Product, and it employs hundreds of thousands of workers in well-paying jobs across the country. Significant as the industry statistics are, however, they still understate the contribution of the industry to the national and regional economies. They refer only tangentially to new motor vehicle dealer retail activities, and they focus on direct activity in manufacturing, ignoring spin-off activities related to automotive production. Spin-off activities come from two sources: indirect effects, or purchases from local suppliers (for example, steel); and expenditure-induced effects, or spending by people who receive income attributable to automotive industry activity (for example, spending by realtors of income received from selling homes to autoworkers). It is the sum of these direct and spin-off activities from the making, selling, and servicing of new vehicles that determines the total contribution of the automotive industry to the national and regional economies. For regions with little if any direct automotive manufacturing activity, the industry can still contribute to their economies because spin-off employment is generated by the feedback effects of direct automotive employment in other regions. For instance, when autoworkers in Michigan go to movies, California's entertainment industry benefits—an effect that our model is sufficiently sophisticated to capture.

To fill the information void, we published a study three years ago that provided estimates for all fifty states of the economic contribution associated with the automotive industry in 1998, including the effects of new motor vehicle retail activities and industry spin-off activities (Institute of Labor and Industrial Relations, University of Michigan et al. 2001). The purpose of this report is to update the results of the previous study to 2003, for the country as a whole and for three states selected by the sponsor: California, New Jersey, and New York. As in the previous research project, the estimates are generated from simulations using a state-of-the-art economic model in conjunction with input data provided by the motor vehicle firms in the United States and by the National Automobile Dealers Association. Compared with the study of three years ago, the study update is enhanced by an improved economic modeling technology, an enriched methodology, and a fully updated survey of activities for twenty-one automotive firms in the United States.¹ The changes in the industry over the past five years are captured in the new results. The results remain based on the industry classification scheme used in the previous study (Standard Industrial Classification codes), rather than on the system recently released by the federal government (North American Industrial Classification System), which will be used in future studies.

The following sections of the report summarize our estimates of the contribution of the U.S. motor vehicle industry, measured in jobs and personal income, to the economies of the country and the three selected states. The industry results are divided into three

¹ We define the automotive industry to include the value of the production or sale of light vehicles by the following vehicle manufacturers: Audi, BMW, DaimlerChrysler, Ford, General Motors, Honda, Hyundai, Isuzu, Jaguar, Kia, Mazda, Mercedes, Mitsubishi, Nissan, Porsche, Saab, Subaru, Suzuki, Toyota, Volkswagen, and Volvo. We also include in our industry definition the sales and service activities connected to new vehicle sales located at new light-vehicle dealerships.

parts: automotive manufacturing, new vehicle dealers, and the total automotive industry. More details on the methods of the study, including information on the economic/demographic model, input data, and research procedures, are presented in the final section.

CONTRIBUTION OF AUTOMOTIVE MANUFACTURING

The tables in this section show our estimates of the employment and income contributions of automotive manufacturing to the private sector of the U.S. economy for 2003. Estimates are also presented for the states of California, New Jersey, New York, and for the balance of the country. The estimates include both direct employment and payroll, and the spin-off jobs and compensation that result from automotive manufacturing's direct activity. Data on direct employment and compensation for automotive manufacturing are from the survey of the twenty-one participating firms enumerated in the introductory section (footnote 1).

Summary estimates of the employment and income contributions are shown in table 1.² Both blue-collar and white-collar workers employed by the manufacturing firms are included in the direct effect. According to the data compiled from the survey of motor vehicle firms, 498,200 workers were employed in automotive manufacturing nationwide in 2003. (All of the employment estimates reported in this study are rounded to the nearest hundred workers). This is shown as direct employment in table 1. In contrast to our previous study for 1998, the auto parts companies Visteon and Delphi are no

² In the tables, employment represents the total number of private sector jobs, including the self-employed; compensation in the private sector consists of wage and salary disbursements, fringe benefits, and net incomes of owners of unincorporated businesses.

Table 1
Contribution of the Automotive Manufacturing Industry to the Private Sector
in the United States, California, New Jersey, and New York
2003

	U.S.	California	New Jersey	New York	Balance of U.S.
Employment*					
Direct	498,200	25,000	9,000	10,200	454,000
Spin-off	4,676,200	296,100	102,100	184,000	4,094,000
Total (direct plus spin-off)	5,174,400	321,100	111,100	194,200	4,548,000
Multiplier**	10.4	n.a.	n.a.	n.a.	n.a.
Compensation (billions of \$)	248.70	17.12	6.53	11.65	213.39
Plus: transfer payments	-18.58	-1.45	-0.49	-0.99	-15.65
Less: social insurance contributions	16.17	1.05	0.43	0.74	13.96
Less: personal income taxes	31.15	2.43	1.00	1.71	26.01
= private disposable personal income	182.80	12.20	4.62	8.22	157.77
Contribution as % of total private economy					
Employment	3.8	1.9	2.8	2.2	4.2
Compensation	4.6	2.3	3.3	2.6	5.4

*Values for employment are rounded to the nearest hundred workers.

**The multiplier is not applicable as a measure of job leverage for direct employment in subnational regions, where much of the job gain is due to feedback effects from auto industry activity in other regions.

longer included in direct employment because they have since become independent organizations, although they are still included in total employment. Also, the direct effect is not made up solely of workers assigned to the motor vehicle industry classification. Some direct employees are classified in credit and finance and in wholesale trade and port service activities.

Spin-off employment for the United States (including indirect plus expenditure-induced effects) from these automotive manufacturing activities is estimated to be 4,676,200 jobs. The sum of direct and spin-off jobs equals 5,174,400. The resulting number of jobs created (direct plus spin-off) for every direct job introduced constitutes the "employment multiplier." In this case, the employment multiplier is 10.4. The

employment multiplier can be interpreted in two ways: (1) there are 10.4 times as many private sector jobs generated as there are direct automotive manufacturing jobs ($5,174,400 \div 498,200$), or (2) there are 9.4 spin-off jobs generated for every direct job (1 direct job + 9.4 spin-off jobs = 10.4 jobs).

The contribution of automotive manufacturing to compensation in the private sector (calculated as the direct plus spin-off effects) is estimated to be almost \$250 billion, measured in 2003 dollars. This estimate of compensation is prior to deductions for personal income taxes and contributions to social insurance programs, and does not include transfer payments. As shown in table 1, there is a reduction in transfer payments of \$18.6 billion associated with U.S. automotive manufacturing activity in 2003, and personal income tax revenues are increased by over \$31 billion. The implication for disposable personal income, or personal income after taxes and including transfers, is an increase of about \$183 billion in the domestic economy for 2003.

To put the employment and compensation contributions in some context, these contributions are represented in table 1 as a share of the total private sector economy for each region. For the U.S. economy, the economic contribution of direct and spin-off automotive manufacturing activities in 2003 represents 3.8 percent of total private sector jobs and 4.6 percent of private sector compensation. The compensation share is greater than the employment share because compensation in the auto industry is higher on average than in other industries.

Compared with the previous results published for 1998, there are fewer direct automotive manufacturing jobs reported by the companies for 2003, but more jobs in total attributable to the industry. Consequently, the employment multiplier is now larger, 10.4 versus the previously estimated 7.6. In part, this reflects the transfer of workers at Visteon and Delphi from the auto companies to their own independent organizations, thus removing them from direct employment while still including them in total employment. The greater job leverage for automotive manufacturing also reflects the tremendous productivity gains realized by the industry in the past five years. Greater production per autoworker generates more employment per autoworker in the rest of the economy.

Summary estimates of the employment and income contributions of automotive manufacturing in California, New Jersey, New York, and the balance of the United States are shown in the remaining columns of table 1. All of the results were generated to be consistent with those for the nation. According to the data compiled from the survey of motor vehicle firms, 25,000 workers were employed in automotive manufacturing in California in 2003, 9,000 in New Jersey, and 10,200 in New York. This leaves 454,000 direct employees in the rest of the country. Spin-off employment in California is estimated to be 296,100 jobs, resulting in 321,000 private sector workers associated with automotive manufacturing activity in the state ($25,000 + 296,100 = 321,100$). The industry contributes 111,100 total private sector jobs in New Jersey, 194,200 in New York, and 4,548,000 in the remaining forty-seven states. Thus, automotive manufacturing contributes a significant number of jobs in total to these regional economies, even though some do not have many direct industry workers.

Unlike the results for the nation as a whole, for the regions the number of total jobs contributed relative to direct industry jobs should not be interpreted as a measure of job leverage for direct jobs. For instance, in California, the addition of another direct worker in automotive manufacturing does not imply from the results in table 1 that another 12.8 jobs in total will accrue to the state economy ($321,100 \div 25,000 = 12.8$). This is because much of the job gain in California is due to feedback effects from auto industry activity in other regions. In the real economy, spin-off activity is not generated solely by direct activity within a state or region, but also by activity in other regions. For example, an increase in vehicle production in Michigan could in turn boost purchases from auto suppliers in California. Since job multipliers are usually interpreted as measures of job leverage, we do not report them in table 1 for the subnational regions.

The contribution of automotive manufacturing to compensation in the private sector is estimated to be over \$17 billion for California, \$6.5 billion for New Jersey, and \$11.7 billion for New York; the contribution for the rest of the country totals over \$213 billion. For the three states, there is a reduction in transfer payments ranging from \$0.5 billion to \$1.5 billion associated with automotive manufacturing activity in 2003, as well as increases in personal income tax revenues between \$1 billion and \$2.4 billion. The regional employment and compensation contributions are represented at the bottom of table 1 as a share of the total private sector economy for each region. The employment contribution of direct and spin-off automotive manufacturing activity in 2003 represents 1.9 percent of the private sector jobs in California, 2.8 percent in New Jersey, 2.2 percent in New York, and 4.2 percent in the rest of the country. Corresponding estimates for the compensation contribution are 2.3 percent in California, 3.3 percent in

New Jersey, 2.6 percent in New York, and 5.4 percent in the rest of the country. Similar to the nation, the regions' compensation share is greater than the employment share because compensation in the auto industry is higher on average than in other industries. The gap between the compensation and employment shares is larger for the balance of the country than for the three states because its share of manufacturing activity is greater, and manufacturing is more highly compensated on average than other industries.

The automotive manufacturing contribution to employment for the United States and the selected regions is distributed across major industry divisions in table 2. The estimates represent direct and spin-off employment, and the totals for each economy match the total employment effect reported in table 1. As might be expected, in each region many of the supplier jobs are in the manufacturing sector. Within durable manufacturing, major auto suppliers are: fabricated metals (e.g., automotive stampings), machinery and computers (e.g., investment in machinery and equipment), electrical equipment (e.g., semiconductors, batteries, equipment for internal combustion engines), and primary metals (e.g., steel mills, foundries). Within nondurable manufacturing, key suppliers are: plastics products (e.g., exterior and interior trim) and apparel (e.g., automotive fabric). Each region has varying shares of these industry activities; detail is provided in table 2. Manufacturing accounts for about 29 percent of the employment gains in each of the states identified in this study, but that sector accounts for almost 36 percent of the job gains in the rest of the country collectively, which is much more concentrated in manufacturing activity in general.

There is also a high level of supplier employment in private nonmanufacturing. Activities such as business and professional services, wholesale trade, trucking, and credit and finance are more linked to the supplier network for automotive manufacturing than is often recognized. Most of the expenditure-induced activity is in the private nonmanufacturing sector, particularly in industries such as services and retail trade, and is associated with household purchasing activity. Each region has varying shares of activity among the industries within the nonmanufacturing sector, as shown in table 2.

Table 2
Contribution of Automotive Manufacturing to Private Sector Employment by Industry
in the United States, California, New Jersey, and New York
2003

Industry division (SIC code)	U.S.	California	New Jersey	New York	Balance of U.S.
Manufacturing	1,805,300	94,800	31,800	55,200	1,623,500
Durable goods	1,332,900	63,900	19,400	36,800	1,212,800
Primary metals (33)	87,300	2,100	1,200	2,300	81,700
Fabricated metals (34)	220,400	8,500	3,300	6,100	202,500
Machinery and computers (35)	88,600	5,000	1,300	3,400	78,900
Electrical equipment (36)	119,500	12,800	1,900	5,500	99,300
Motor vehicles (371)	642,100	22,400	8,700	12,000	599,000
Other durable goods	175,000	13,100	3,000	7,500	151,400
Nondurable goods	472,400	30,900	12,400	18,400	410,700
Apparel (23)	94,600	15,500	2,200	6,400	70,500
Printing and publishing (27)	64,300	3,000	1,900	3,400	56,000
Plastics products (30)	130,900	3,800	2,200	2,800	122,100
Other nondurable goods	182,600	8,600	6,100	5,800	162,100
Private nonmanufacturing	3,369,100	226,300	79,300	139,000	2,924,500
Construction (15–17)	109,800	5,400	1,700	2,700	100,000
Trucking (42)	125,800	6,600	3,300	3,600	112,300
Credit and finance (61, 62, 67)	118,100	10,000	4,000	8,100	96,000
Wholesale trade (50–51)	349,400	19,500	10,300	14,100	305,500
Retail trade (52–59)	741,300	39,300	13,800	21,200	667,000
Services (70–89)	1,427,100	111,500	34,300	67,200	1,214,100
Business services (73)	393,600	35,000	10,200	15,600	332,800
Professional services (81, 87, 89)	250,900	22,000	7,900	11,100	209,900
Nonprofit services (83, 84, 86)	173,900	8,300	3,200	9,700	152,700
Other services	608,700	46,200	13,000	30,800	518,700
Other private nonmanufacturing	497,600	34,000	11,900	22,100	429,600
Total private nonfarm	5,174,400	321,100	111,100	194,200	4,548,000

NOTE: Values for employment are rounded to the nearest hundred workers.

CONTRIBUTION OF NEW VEHICLE DEALERS

Until our previous study, little analysis existed on the economic contribution of dealer activity. In this study, we update the new vehicle dealer results to 2003. The general explanations given in the previous section pertain to this section as well, and will not be repeated in the same detail.

Summary estimates of the employment and income contributions of new vehicle dealers to the U.S. private sector economy for 2003 are shown in table 3. Estimates are also presented for the states of California, New Jersey, and New York, and for the balance of the country, including both direct dealer activity associated with the sales and servicing (under warranty) of new passenger cars and light-duty trucks, and the resulting spin-off

Table 3
Contribution of New Vehicle Dealers (Retail) to the Private Sector
in the United States, California, New Jersey, and New York
2003

	U.S.	California	New Jersey	New York	Balance of U.S.
Employment*					
Direct	705,700	84,100	22,600	33,400	565,600
Spin-off	1,177,200	151,300	36,000	61,500	928,400
Total (direct plus spin-off)	1,882,900	235,400	58,600	94,900	1,494,000
Multiplier**	2.7	n.a.	n.a.	n.a.	n.a.
Compensation (billions of \$)	86.21	12.34	3.29	5.51	65.08
Plus: transfer payments	-6.81	-0.89	-0.23	-0.44	-5.26
Less: social insurance contributions	5.68	0.78	0.22	0.36	4.33
Less: personal income taxes	11.02	1.79	0.49	0.82	7.92
= private disposable personal income	62.70	8.88	2.35	3.90	47.58
Contribution as % of total private economy					
Employment	1.4	1.4	1.5	1.1	1.4
Compensation	1.6	1.6	1.7	1.2	1.6

*Values for employment are rounded to the nearest hundred workers.

**The multiplier is not applicable as a measure of job leverage for direct employment in subnational regions, where much of the job gain is due to feedback effects from auto industry activity in other regions.

activity. Data on direct dealer activity were obtained from the National Automobile Dealers Association, and the new vehicle share of sales, parts, and service was isolated by the authors of this study. That percentage was then used to calculate employment and payroll for new-vehicle-related sales, parts, and service (see the section on methods for more detail). Thus, activity associated with the sale of previously owned vehicles and repair work on non-new vehicles was excluded from our estimates of the direct dealer effect.

Our estimate of direct employment nationwide in new-vehicle-related sales and service activity is 705,700 jobs in 2003. Spin-off employment from this activity is estimated to be 1,177,200 jobs. Thus, the employment contribution associated with new-vehicle-related sales and service activity in the United States is estimated to be about 1.9 million jobs in the private sector. The resulting employment multiplier is 2.7, the same value as estimated in our earlier study; that is, there are 2.7 times as many jobs generated as there are direct jobs ($1,882,900 \div 705,700 = 2.7$). The employment multiplier for dealer activity is considerably lower than the multiplier for manufacturing activity because the supplier chain is not as extensive for dealers, and employee compensation for expenditures is not as high on average.

The contribution of dealer activity to compensation in the private sector (calculated as the direct plus spin-off effects) is estimated to be over \$86 billion, measured in 2003 dollars. The estimate of compensation is prior to deductions for personal income taxes and contributions to social insurance programs, and does not include transfer payments. As shown in table 3, there is a reduction in transfer payments of \$6.8 billion associated with U.S. dealer activity in 2003, and personal income tax revenues are

increased by \$11 billion. The implication for disposable personal income, or personal income after taxes and including transfers, is an increase of \$62.7 billion in the domestic economy for 2003. For the U.S. economy, the economic contribution of direct and spin-off dealer activity in 2003 represents 1.4 percent of total private sector jobs and 1.6 percent of private sector compensation.

Summary estimates of the employment and income contributions of new-vehicle-related sales and service activity in California, New Jersey, New York, and the balance of the United States are shown in the remaining columns of table 3. According to our estimates, 84,100 workers were employed in such activity in California in 2003, 22,600 in New Jersey, 33,400 in New York, and 565,600 in the remaining forty-seven states. Spin-off employment in California is estimated to be 151,300 jobs, resulting in 235,400 private sector workers associated with new-vehicle-related sales and service activity in the state ($84,100 + 151,300 = 235,400$). This activity contributes 58,600 private sector jobs in New Jersey, 94,900 in New York, and 1,494,000 in the rest of the country. For the same reasons discussed in the previous section, the employment multiplier is not applicable to the results presented here for the subnational economies.

The contribution of new-vehicle-related sales and service activity to compensation in the private sector is estimated to be \$12.3 billion for California, \$3.3 billion for New Jersey, and \$5.5 billion for New York; the contribution for the rest of the country totals \$65 billion. For the three states, there is a reduction in transfer payments ranging from \$230 million to \$890 million associated with this activity in 2003, as well as increases in personal income tax revenues between \$490 million and \$1.8 billion. The regional employment and compensation contributions are represented at the bottom of table 3

as a share of the total private sector economy for each region. The employment contribution of direct and spin-off new-vehicle-related sales and service activity in 2003 represents 1.4 percent of the private sector jobs in California, 1.5 percent in New Jersey, 1.1 percent in New York, and 1.4 percent in the balance of the country. Corresponding estimates for the compensation contribution are 1.6 percent in California, 1.7 percent in New Jersey, 1.2 percent in New York, and 1.6 percent in the rest of the country.

The contribution to employment for the nation and the selected regions is distributed across major industry divisions in table 4. The estimates represent direct and spin-off

Table 4
Contribution of New Vehicle Dealers (Retail) to Private Sector Employment by Industry
in the United States, California, New Jersey, and New York

2003

Industry division (SIC code)	U.S.	California	New Jersey	New York	Balance of U.S.
Manufacturing	180,200	20,000	4,200	8,100	147,900
Durable goods	100,600	10,800	1,700	4,100	84,000
Nondurable goods	79,600	9,200	2,500	4,000	63,900
Private nonmanufacturing	1,702,700	215,400	54,400	86,800	1,346,100
Construction (15–17)	35,600	4,100	800	1,300	29,400
Trucking (42)	23,300	2,400	700	800	19,400
Credit and finance (61, 62, 67)	32,000	4,600	1,300	3,500	22,600
Wholesale trade (50–51)	59,400	7,600	2,400	3,200	46,200
Retail trade (52–59)	947,200	113,600	29,900	42,100	761,600
Eating and drinking establishments (58)	88,100	11,500	2,100	3,500	71,000
Other retail trade (52–57, 59)	859,100	102,100	27,800	38,600	690,600
Services (70–89)	446,000	63,200	14,400	27,300	341,100
Business services (73)	119,600	18,100	4,100	6,300	91,100
Professional services (81, 87, 89)	69,500	10,700	2,500	4,600	51,700
Nonprofit services (83, 84, 86)	57,300	6,000	1,500	4,300	45,500
Other services	199,600	28,400	6,300	12,100	152,800
Other private nonmanufacturing	159,200	19,900	4,900	8,600	125,800
Total private nonfarm	1,882,900	235,400	58,600	94,900	1,494,000

NOTE: Values for employment are rounded to the nearest hundred workers.

employment, and the totals for each economy duplicate the total employment effect reported in table 3. Most of the jobs that new-vehicle-related sales and service activity contributes to the economy in each region are in the private nonmanufacturing sector; in fact, about nine jobs in ten in each region are found in that sector, whereas only one job in ten is in manufacturing. When direct dealership employment is included, about half of the jobs are in retail trade in every region except New York, where retail's share is somewhat lower. Much of the spin-off employment contribution is from expenditure-induced activity due to household purchasing, and this activity is heavily concentrated in the private nonmanufacturing sector. Detail on the industry distribution for individual regions is provided in table 4.

CONTRIBUTION OF THE TOTAL AUTOMOTIVE INDUSTRY

Combining the estimates for automotive manufacturing and new vehicle dealers in the previous two sections yields the bottom line for the automotive industry as a whole, including new vehicle production, sales, and service nationwide and for the states of California, New Jersey, New York, and the rest of the states collectively. These bottom-line estimates for 2003 are shown in table 5. Direct employment of 1,203,900 (498,200 automotive manufacturing jobs from table 1 + 705,700 new vehicle dealer jobs from table 3) combined with spin-off employment of 5,853,400 sums to a contribution to private sector employment of 7,057,300 in the U.S. economy. The corresponding employment multiplier is 5.9 ($7,057,300 \div 1,203,900$); that is, there are 5.9 times as many jobs generated as there are direct jobs.

Table 5
Contribution of the Automotive Industry (New Vehicle Production, Sales, and Service)
to the Private Sector in the United States, California, New Jersey, and New York
2003

	U.S.	California	New Jersey	New York	Balance of U.S.
Employment*					
Direct	1,203,900	109,100	31,600	43,600	1,019,600
Spin-off	5,853,400	447,400	138,100	245,500	5,022,400
Total (direct plus spin-off)	7,057,300	556,500	169,700	289,100	6,042,000
Multiplier**	5.9	n.a.	n.a.	n.a.	n.a.
Compensation (billions of \$)	334.91	29.46	9.83	17.16	278.46
Plus: transfer payments	-25.39	-2.34	-0.72	-1.43	-20.91
Less: social insurance contributions	21.85	1.83	0.65	1.09	18.29
Less: personal income taxes	42.17	4.23	1.49	2.53	33.93
= private disposable personal income	245.50	21.07	6.97	12.12	205.34
Contribution as % of total private economy					
Employment	5.1	3.3	4.2	3.3	5.6
Compensation	6.2	3.9	4.9	3.8	7.0

*Values for employment are rounded to the nearest hundred workers.

**The multiplier is not applicable as a measure of job leverage for direct employment in subnational regions, where much of the job gain is due to feedback effects from auto industry activity in other regions.

The compensation contribution nationwide (calculated as the direct plus spin-off effects) is estimated to be almost \$335 billion, measured in 2003 dollars. The estimate of compensation is prior to deductions for personal income taxes and contributions to social insurance programs, and does not include transfer payments. As shown in table 5, there is a reduction in transfer payments of \$25.4 billion associated with the total U.S. automotive industry in 2003, and personal income tax revenues are increased by \$42.2 billion. The implication for disposable income, or personal income after taxes and including transfers, is an increase of \$245.5 billion in the domestic economy for 2003. The economic contribution of direct and spin-off activity from new vehicle production, sales, and service in 2003 represents 5.1 percent of the private sector jobs and 6.2 percent of the private sector compensation in the U.S. economy.

Comparable summary estimates of the employment and income contributions of total automotive industry activity in California, New Jersey, New York, and the balance of the United States are shown in the remaining columns of table 5. Direct industry employment in 2003 was 109,100 in California, 31,600 in New Jersey, 43,600 in New York, and 1,019,600 in the remaining states. Spin-off employment in California is estimated to be 447,400 jobs, resulting in 556,500 private sector workers associated with new vehicle production, sales, and service in the state (109,100 + 447,400). Comparable contributions for the other regions are 169,700 private sector jobs in New Jersey, 289,100 in New York, and 6,042,000 in the remaining forty-seven states.

The contribution of the automotive industry in total to compensation in the private sector is estimated to be \$29.5 billion for California, \$9.8 billion for New Jersey, and \$17.2 billion for New York; the contribution for the rest of the country totals \$278.5 billion. For the three states, there is a reduction in transfer payments ranging from \$0.7 billion to \$2.3 billion associated with total automotive activity in 2003, as well as increases in personal income tax revenues between \$1.5 billion and \$4.2 billion. The employment contribution of direct and spin-off activity from new vehicle production, sales, and service in 2003 represents 3.3 percent of the private sector jobs in California, 4.2 percent in New Jersey, 3.3 percent in New York, and 5.6 percent in the rest of the country. Corresponding estimates for the compensation contribution are 3.9 percent in California, 4.9 percent in New Jersey, 3.8 percent in New York, and 7 percent in the rest of the country. The compensation share is greater than the employment share because compensation in the auto industry is higher on average than in other industries. The gap between the compensation and employment shares is larger for the balance of the

country than for the three states because its share of manufacturing activity is greater, and manufacturing is more highly compensated on average than other industries.

The total automotive industry contribution to employment for the United States and the selected regions is distributed across major industry divisions in table 6. The estimates represent direct and spin-off employment, and the totals for each economy match the total employment effect reported in table 5. Most of the direct jobs are in durable goods and retail trade, but some are in credit and finance and in wholesale trade. More than one in four jobs contributed by the automotive industry are in manufacturing nationally, but for the three selected states, which are less concentrated in manufacturing activity overall, the proportion is one job in five. Many of the supplier jobs are in manufacturing,

Table 6
Contribution of the Automotive Industry (New Vehicle Production, Sales, and Service)
to Private Sector Employment by Industry
in the United States, California, New Jersey, and New York
2003

Industry division (SIC code)	U.S.	California	New Jersey	New York	Balance of U.S.
Manufacturing	1,985,500	114,800	36,000	63,300	1,771,400
Durable goods	1,433,500	74,700	21,100	40,900	1,296,800
Nondurable goods	552,000	40,100	14,900	22,400	474,600
Private nonmanufacturing	5,071,800	441,700	133,700	225,800	4,270,600
Construction (15–17)	145,400	9,500	2,500	4,000	129,400
Trucking (42)	149,100	9,000	4,000	4,400	131,700
Credit and finance (61, 62, 67)	150,100	14,600	5,300	11,600	118,600
Wholesale trade (50–51)	408,800	27,100	12,700	17,300	351,700
Retail trade (52–59)	1,688,500	152,900	43,700	63,300	1,428,600
Services (70–89)	1,873,100	174,700	48,700	94,500	1,555,200
Business services (73)	513,200	53,100	14,300	21,900	423,900
Professional services (81, 87, 89)	320,400	32,700	10,400	15,700	261,600
Nonprofit services (83, 84, 86)	231,200	14,300	4,700	14,000	198,200
Other services	808,300	74,600	19,300	42,900	671,500
Other private nonmanufacturing	656,800	53,900	16,800	30,700	555,400
Total private nonfarm	7,057,300	556,500	169,700	289,100	6,042,000

NOTE: Values for employment are rounded to the nearest hundred workers.

but many are also in private nonmanufacturing, including business and professional services, wholesale trade, trucking, and credit and finance. In all of the regions, most of the expenditure-induced spin-off jobs are in private nonmanufacturing, especially in retail trade and services, reflecting household purchasing activity. In fact, all three of the selected states find the majority of their total employment contributions in these two industries. There is more detail on the industry distribution of the employment contributions for each region in table 6.

There are yet more potential benefits that cannot be quantified. For instance, our estimates do not include the qualitative effects that would produce additional benefits for the national and regional economies, such as the intangible advantages of technological transfers associated with the automotive industry in the United States. The results of the study do confirm, though, that the health of the automotive industry is very important to the overall health of the United States economy.

METHODS

The general approach is to use a state-of-the-art economic model, in conjunction with primary data from a survey of twenty-one automotive firms and from the National Automobile Dealers Association (NADA), and a research design enhanced from our previous study, to generate estimates of the contribution associated with the automotive industry in the U.S. economy. A summary of the model, data, and procedures follows.

Macroeconomic Model

To estimate the contribution of the U.S. automotive industry, we use an economic/demographic model constructed by Regional Economic Models, Inc. (REMI)

of Amherst, Massachusetts, and adapted by our research team for the purposes of this study. The REMI model has been fully documented and peer-reviewed in the professional literature (Treyz 1993, Treyz et al. 1992). The REMI model has been designed particularly for carrying out simulations of the type generated for this study, and has been used extensively for such studies over the past two decades.

The version of the U.S. model system used for this study includes models of the California, New Jersey, and New York economies, and a model of the rest of the United States. This design allows us to simulate the interaction among each of the three state economies and the rest of the nation, so that interregional migration and trade flows are identified, including feedback effects among regions. In the real economy, spin-off activity is generated not only by changes in direct activity within the same region, but also by changes in activity in other regions. Because of its design, the REMI model is able to provide estimates of the effects of these interregional trade flows, resulting in much more accurate estimates of the regional contribution of automotive industry activity. The model also captures the buying and selling relationships among a fairly detailed breakout of industries, again increasing the accuracy of the results.

Data

This study and its predecessor had access to the richest data set ever assembled on domestic auto industry employment and compensation. For the part of the study on automotive manufacturing, employment and payroll data for California, New Jersey, New York, and the country as a whole were collected from twenty-one automotive firms that sell new light vehicles in the United States (identified in footnote 1). Salaried and

hourly employees were broken out into eight different categories, enabling us both to control for double-counting jobs and to assign the workers in the model to their correct functional activities and compensation (an example is given in the following section, on procedures). The survey data were collected for the most recent complete year, 2003.

For the part of the study on new vehicle dealers, survey data on dealerships were provided by NADA. The proportion of dealer activity associated with the sale and servicing of light vehicles was estimated by the authors of this study from the background information provided. We used data on gross revenue (sales minus the cost of vehicles and parts) plus advertising and rent to isolate the share of activity at new car dealers associated with the sales and service of new vehicles. New vehicles were defined as those still under warranty. The data do not directly identify how much of the service and parts activity is attributable to new vehicles, so we analyzed the subcategories of service and parts activity and estimated the share of each subcategory attributable to new vehicles. Then we combined the shares of the subcategories to arrive at an overall estimate of the service and parts activity share attributable to new vehicles, so as to include all warranty-related work and all other service work on vehicles that are still under warranty. When combined with the data for new vehicle sales, we estimate that 62.5 percent of dealer activity in the United States is attributable to new vehicles; the values vary by state.

Procedures

The general procedure in estimating the economic contribution of the automotive industry is to adjust the model so as to remove the industry from each of the state and

regional economies and then to have the model generate the economywide impact, including the spin-off effects. We begin by generating a baseline simulation for the economies of California, New Jersey, New York, and the balance of the country, before any changes are made. We then generate an alternative simulation in which we remove the industry from the baseline simulation, to determine hypothetically how different the economies would be. The decrease in activity associated with the removal of automotive activity constitutes our estimate of the contribution of the industry to the state and regional economies. The contribution to the entire national economy is calculated by summing the regional contributions.

The 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 catastrophic scenario would be mitigated over time by significant compensating adjustments, which are inappropriate to include in an analysis whose purpose is to dissect the industry's current presence in the domestic economy.

The general approach here is straightforward, but its actual application is much more complex, for several reasons. First, for the model to be able to distinguish between a catastrophic impact scenario and a contribution scenario, we had to neutralize several compensating adjustments in the model that would otherwise respond to the complete loss of the industry. Second, since the survey data from the auto firms were collected by type of activity and the model requires these activities to be sorted by Standard Industrial Classification (SIC) code, we made the necessary assignments based on function of activity. For example, our analysis suggests that many white-collar workers in the automotive industry are functionally most like workers in professional services.

Consequently, we input headquarters workers and engineering and design workers in their functional category (with the correct assignment of wages), for the purpose of having the model generate more accurate numbers of spin-off jobs. In our final accounting, these direct jobs are reassigned to the motor vehicle industry. Also, within manufacturing, we were careful to distinguish between vehicle assembly and parts workers. Third, adjustments were made to avoid double-counting jobs. Also, the model was adjusted so that the correct payroll values were used for all of the direct employees. Several adjustments were also made to generate accurate estimates of dealer contributions. The most significant of these adjustments was the isolation of the new vehicle share of dealership activity across sales, parts, and service, in order to compute new-vehicle-related employment. The model was also adjusted so that dealer wages were consistent with the NADA data.

Along with its predecessor, this is one of the two most comprehensive studies in the literature on the contribution of the U.S. motor vehicle industry to the U.S. economy. The current study is smaller in scope than the previous study, focusing on four regions of the country rather than fifty-one, but it benefits from the evolutionary effects of ongoing research: the models, data, and methods have all improved, leading to increasingly accurate results. Another significant improvement is close to operational, that being the incorporation into our economic model of the new industry classification scheme recently released by the federal government (the North American Industrial Classification System, or NAICS). The new classifications are based on the service or product provided by each facility rather than on the output of the parent establishment. NAICS also reflects the changes in technology and the diversification of services that

have occurred in recent decades. This new data system will further enhance our ability to represent the industry in our inputs to the model, and improve the capability of the model so that it will produce even more finely tuned results. Future studies will be able to take advantage of these enhancements.

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