Contribution of General Motors to the Economies of Nine States and the United States in 2019

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CAR's mission is to conduct independent research and analysis to educate, inform and advise stakeholders, policymakers, and the general public on critical issues facing the automotive industry, and the industry's impact on the U.S. economy and society.

Executive Summary

This study estimates the employment and economic contribution of General Motors' United States operations to the United States economy and the economies of the nine states in which GM has significant manufacturing operations in 2019.

The Center for Automotive Research (CAR) used a regional input-output model of the U.S. and state economies to estimate that GM's 83,860 direct U.S. employees generate an additional 207,420 jobs at companies that supply General Motors (intermediate impacts) and 291,280 jobs that are supported in the U.S. economy by GM direct and indirect employees spend their earnings (spin-off or expenditure-induced impacts. The total employment contribution of GM's 83,860 jobs is 681,000 jobs in the U.S. economy, including the people who work for General Motors. The employment multiplier for GM's U.S. manufacturing and related jobs is 8.1, which means that for every one GM job, 7.1 other jobs are supported in the U.S. economy.

GM's U.S. employment also supports $51.6 billion in private non-farm earnings and $13.7 billion in government receipts from personal income taxes and contributions for government social insurance and transfer payments. GM's estimated employment contribution is equivalent to 0.39 percent of total U.S. private sector employment and 0.46 percent of total U.S. private compensation. The fact that the compensation share is larger than the employment share implies that GM employees earn higher compensation on average than do U.S. workers on average.

CAR's estimates demonstrate that General Motors—the largest automaker by U.S. market share and second-largest automaker by U.S. light vehicle production volume—is a significant contributor to the U.S. economy and the economies of the nine states in which GM has manufacturing facilities. Close to 90 percent of the light vehicles GM builds in the United States are also sold in the country. GM is also among the largest investors in the U.S. automotive industry, with a total of $44.3 billion in announced investments in the country since 2000. Over the past 19 years, nearly four out of every five dollars General Motors has announced it would invest in North America have been spent on U.S. facilities.

This report is presented in two major sections: a brief history of GM in the United States, which includes GM's sales, market share, production, and investments, and the economic contribution of General Motors in the United States and the nine states in which GM has manufacturing operations. Two appendices cover the modeling methods and provide detailed employment contribution results by U.S. industrial sectors.

A Brief History of General Motors in the United States

General Motors Overview

General Motors (GM), founded in 1908, has operated in one form or another in the United States for the past 111 years.[1] With the purchase of Vauxhall in 1925 and the acquisition of Opel in 1929, GM became an established, global company within twenty years of its founding (The Associated Press, 2009) (CNN Library, 2009). GM has produced vehicles, components, and parts in Canada and Mexico nearly since its founding. GM's Buick Division supplied engines to the McLaughlin Motor Car Company, which was later purchased by General Motors, forming General Motors Canada in 1918 (General Motors Canada, n.d.). Mexican operations were established 17 years later, with GM's first Mexican factory opening in 1935 (Dillon, 1998). According to the company's 2018 annual report, GM employed 173,000 people globally as of 31 December 2018(General Motors Company, 2019a).

General Motors U.S. Sales, Market Share, Production, & Investments

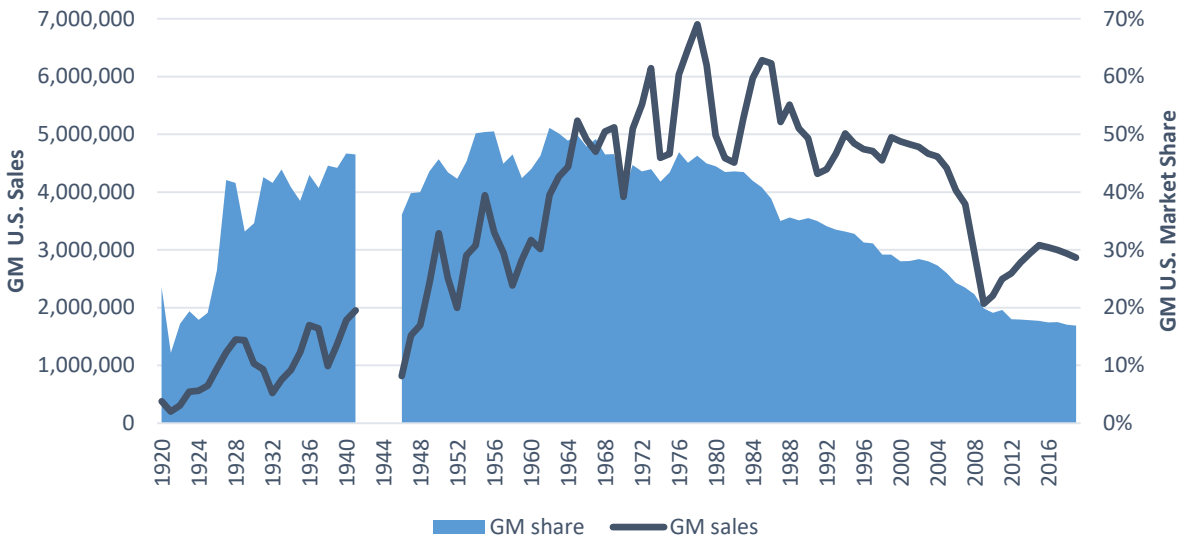
> *"I thought what was good for our country was good for General Motors, and vice versa. The difference did not exist. Our company is too big. It goes with the welfare of the country. Our contribution to the Nation is quite considerable."*
> –Charles E. Wilson, former GM President and U.S. Secretary of Defense

General Motors U.S. Sales & Market Share

GM is the top automaker in terms of U.S. sales and the company has held the coveted top spot since 1931 (Automotive News, 2009). At the time the often-misquoted Charles Wilson line entered the U.S. cultural memory in 1953 (Terrell, 2016), sales of General Motors vehicles constituted 42.3 percent of the U.S. new vehicle market—with nearly 2 million units sold (Automotive News, 2019). Two years later, GM's market share reached 50 percent for the first time. By volume, GM U.S. sales peaked in 1978, with more than 6.9 million units sold—a 47.6 percent share of the U.S. market. From 1954 through 1978, the company's U.S. market share averaged 46.4 percent but has since steadily eroded due to increasing international automaker competition in the U.S. market, reaching 16.8 percent in November 2019. Throughout the 1970s and 1980s, GM sold, on average, 5.4 million vehicles each year. From 1990 through 2007, annual sales averaged 4.6 million. Since 2008, annual U.S. sales have averaged 2.7 million units (Automotive News, 2019) (Automotive News) (Wards Intelligence). In 2019, GM offered 43 different nameplates for sale in the U.S. market, ranking second behind Volkswagen Group with 46. Figure 1 charts the history of GM's U.S. vehicle sales, and the company's share of the U.S. light vehicle market.

[1] General Motors Corporation filed for Chapter 11 bankruptcy reorganization on 1 June 2009, and the General Motors Company purchased the company's ongoing operations on 10 July 2009.

Figure 1: General Motors U.S. Sales and Market Share, 1920 through September 2019

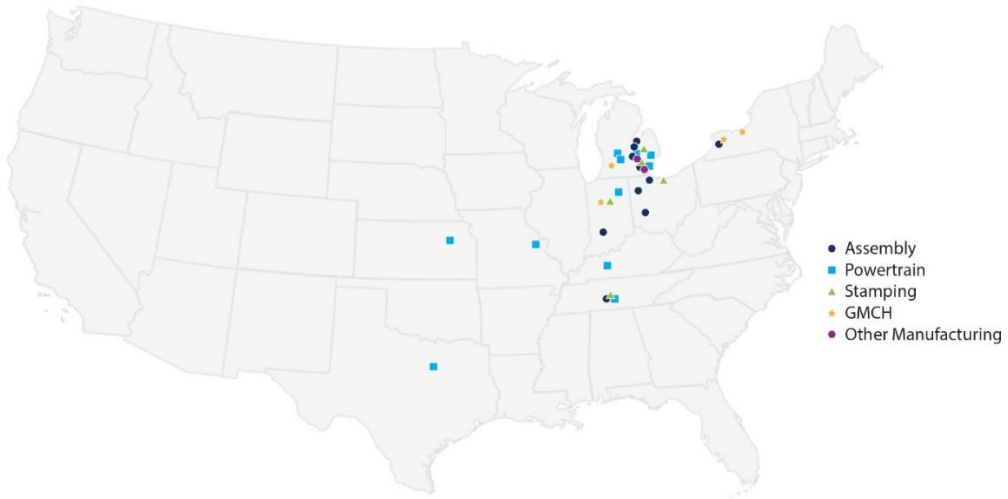


Source: Automotive News and WardsAuto; 1941-1945 data is unavailable

General Motors U.S. Manufacturing Footprint

As of November 2019, General Motors operated 32 manufacturing facilities in the United States—more than any other automaker. GM's U.S. plants include 11 vehicle assembly plants—located in Kansas, Kentucky, Indiana, Michigan, Missouri, Tennessee, and Texas and 10 powertrain plants—located in Indiana, Michigan, New York, Ohio, and Tennessee. General Motors has an additional 11 manufacturing facilities in the United States: 5 metal centers—located in Indiana, Michigan, and Ohio; 4 components operations—located in Indiana, Michigan, and New York; 1 tool and die facility in Michigan, and 1 battery assembly plant in Michigan. GM also operates parts distribution centers in California, Colorado, Illinois, Michigan, Mississippi, Nevada, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, West Virginia, and Wisconsin.

Figure 2: General Motors U.S. Manufacturing Facilities



Source: General Motors

Table 1 summarizes General Motors' U.S. manufacturing operations with information compiled from corporate plant fact sheets, which were last updated on 14 September 2019.

Table 1: General Motors U.S. Manufacturing Facilities[2]

Facility	Opened	Employees	Products
Vehicle Assembly Plants			
Arlington	1954	5,442	GMC Yukon; Chevrolet Suburban, Tahoe; Cadillac Escalade
Bowling Green	1981	1,052	Corvette Stingray
Detroit-Hamtramck	1985		Production ceased June 1, 2019; new product in 2022
Fairfax	1987	2,241	Cadillac XT4; Chevrolet Malibu
Flint	1947	5,119	Chevrolet Silverado HD; GMC Sierra HD
Fort Wayne	1986	4,545	GMC Sierra; Chevrolet Silverado
Lansing Delta Township	2006	2,564	Buick Enclave; Chevrolet Traverse
Lansing Grand River	1999	1,463	Cadillac CT4, CT5; Chevrolet Camaro
Orion	1983	1,032	Chevrolet Sonic, Bolt EV; Cruise AV test vehicles
Spring Hill Manufacturing	1990	3,700 across Spring Hill	Cadillac XT5, XT6; GMC Acadia
Wentzville	1983	4,320	Chevrolet Colorado, Express; GMC Canyon, Savana
Vehicle Propulsion Systems			
Bay City	1892	483	Engine and transmission components
Bedford Casting Operations	1942	933	Engine and transmission components
Defiance	1948	617	Engine components
DMAX	1999	796	V8 engines
Flint Engine Operations	2002	525	I4 and I6 engines
Romulus	1976	1,446	V6 engines and 10-speed transmissions
Saginaw	1919	476	Engine components
Spring Hill Engine	1990	3,700 across Spring Hill	I4 and V8 engines
Toledo Transmission	1916	1,737	Transmissions: RWD 6-, 8-, and 10-speed; FWD 9-speed
Tonawanda	1938	1,540	V6 and V8 engines
Metal Centers			
Flint Metal Center	1954	713	Stampings
Marion Metal Center	1956	979	Stampings
Parma Metal Center	1948	1,101	Stampings
Pontiac Metal Center	1926	380	Stampings
Spring Hill Stamping	1990	3,700 across Spring Hill	Stampings
Components Holdings			
Grand Rapids Operations	1943	1,006	Components
Kokomo Operations	1936	420	Components
Lockport Components	1939	1,493	Components
Rochester Operations	1939	1,044	Components
Tooling			
Flint Tool & Die	1967	352	Construction of tools and dies
Battery Assembly			
Brownstown Battery	2009	47	Battery packs and autonomous vehicle components

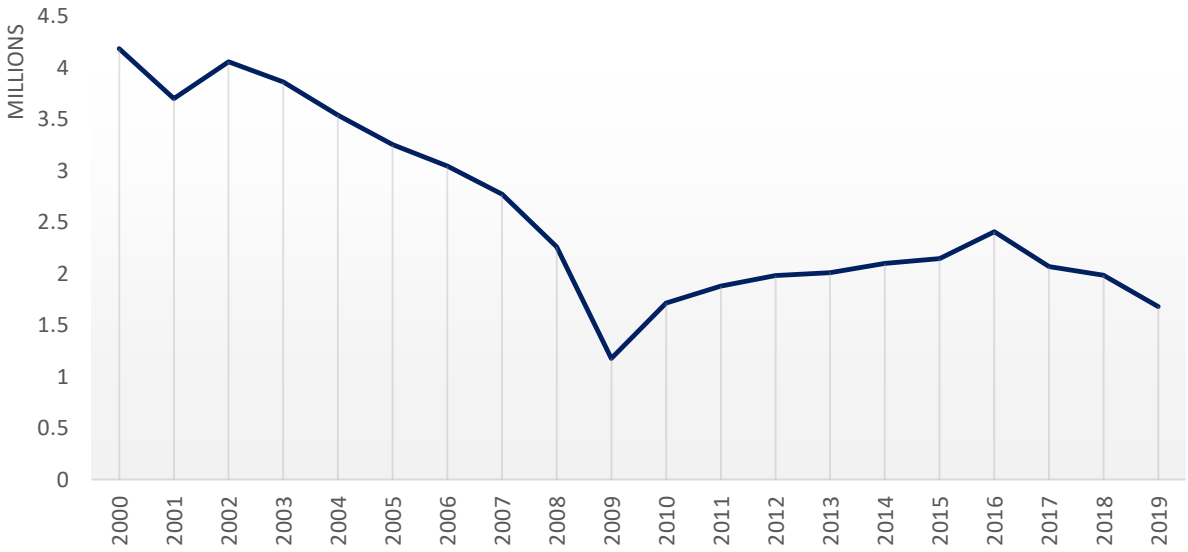
Source: General Motors

[2] This list does not include the Lordstown Assembly plant, or the Baltimore or Warren Transmission plants which were closed in the 2019 UAW-GM National Agreement. GM's published employment totals for each plant may differ from the numbers GM provided to CAR for use in this economic contribution analysis.

General Motors U.S. Production

GM currently ranks as the second-largest vehicle producer in the United States, manufacturing 1.7 million light vehicles in 2019 (Ford ranks first with 2.2 million U.S. light vehicle production). GM's light vehicle production made it the top U.S. light vehicle producer every year from the 1930s until 2009; the company has ranked second every year since the great recession.

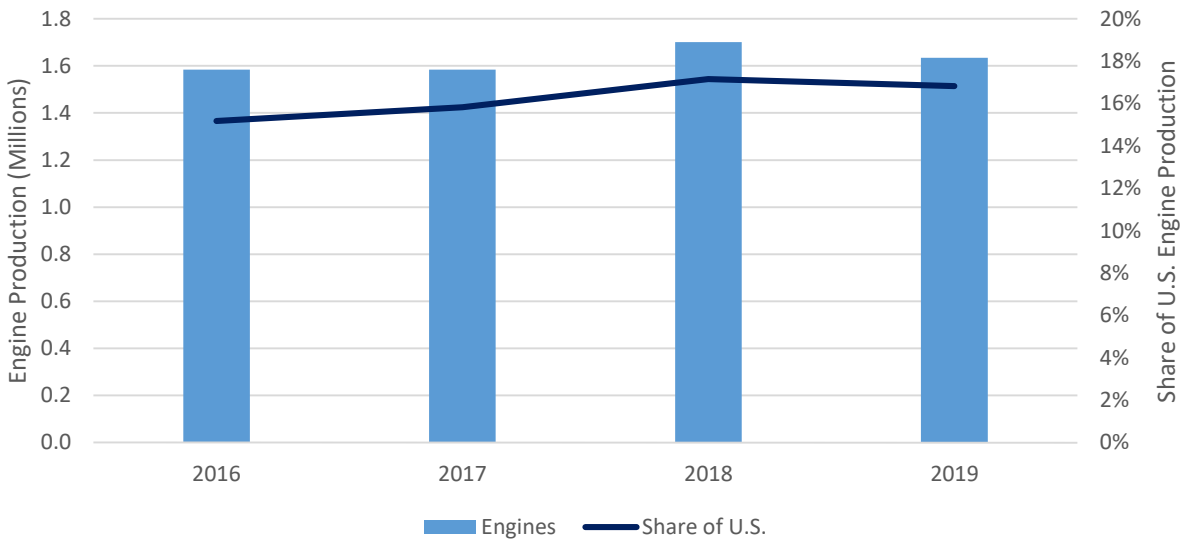
Figure 3: General Motors U.S. Light Vehicle Production, 2000-2019



Source: IHS | Markit and LMC Automotive

General Motors ranks as the third-largest U.S. engine producer in 2019, behind Toyota (first) and Ford (second). In 2019, the company is planning to build 1.6 million engines in the United States—or 17 percent of all U.S. light vehicle engines produced. GM's engine production share has held steady between 15 and 17 percent since 2016.

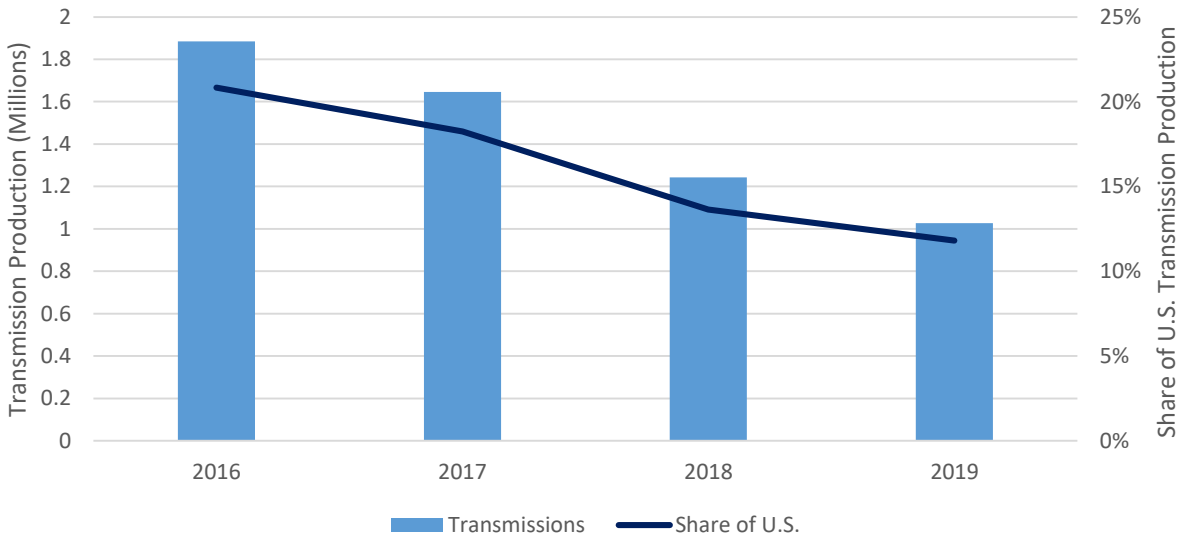
Figure 4: General Motors U.S. Engine Production, 2016-2019



Source: LMC Automotive

General Motors ranks fourth in terms of U.S. transmission production, behind Ford (first), FCA (second), and Honda (third). In 2019, the company is on pace to build 1.0 million transmissions in the United States—or 12 percent of all U.S. light vehicle transmissions produced. GM's transmission production share has fallen steadily from 21 percent in 2016.

Figure 5: General Motors U.S. Transmission Production, 2016-2019

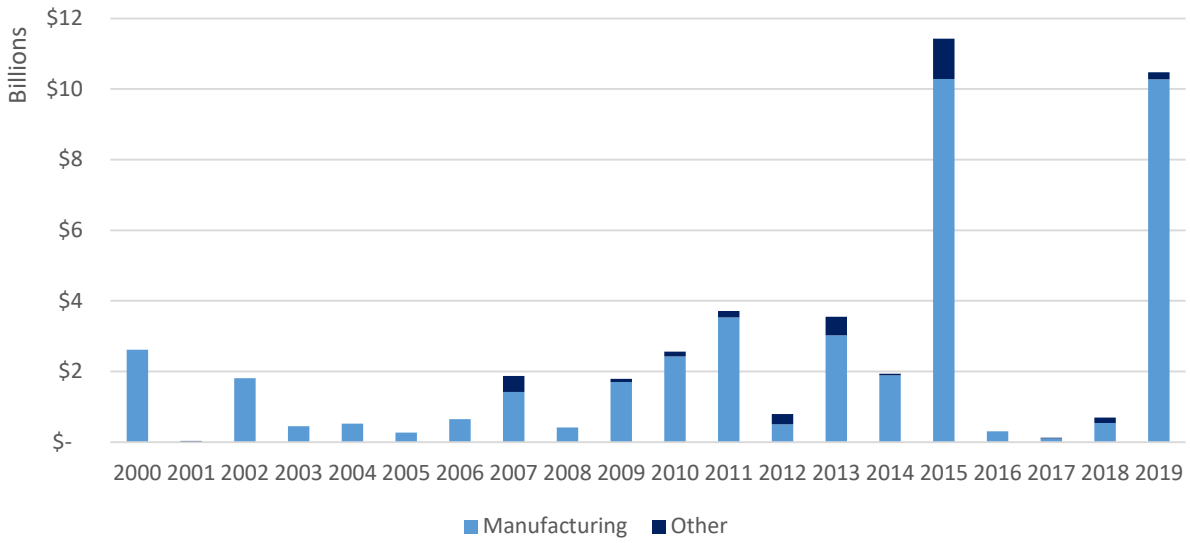


Source: LMC Automotive

General Motors U.S. Investments

General Motors is among the largest investors in the U.S. automotive industry, with a total of $44.3 billion in announced investments in the country since 2000. Figure 6 shows the amount of GM's overall investment in manufacturing and non-manufacturing facilities in the United States over the past two decades.

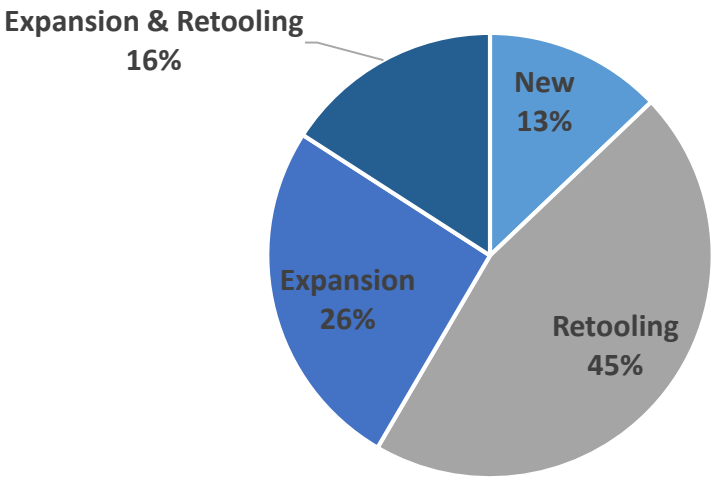
Figure 6: General Motors Announced U.S. Total Investments by Year, 2000-2019



Source: Center for Automotive Research, Book of Deals

Figure 7 details the distribution of GM's announced investment by type over the past two decades, and shows that expansion and retooling investments make up 87 percent of the company's total dollars invested in the United States.

Figure 7: General Motors Announced U.S. Manufacturing Investments by Type, 2000-2019



Source: Center for Automotive Research, Book of Deals

Economic Contribution of General Motors in the United States

CAR researchers estimated General Motors' economic contribution by using proprietary employment data provided by the company and a commercially-available and peer-reviewed dynamic input-output general equilibrium model of the U.S. economy know produced by Regional Economic Models, Inc. (REMI). Appendix I contains a detailed explanation of the methods used to employ the REMI model with GM's data. The first half of CAR's analysis focuses on General Motors' economic contribution to the U.S. economy and the second part of the analysis provides details of the company's economic activity in nine states in which it manufacturers vehicles, parts, and components: Indiana, Kansas, Kentucky, Michigan, Missouri, New York, Ohio, Tennessee, Texas, and the remainder of the United States.

The REMI model produces estimates based on model inputs of General Motors' direct employment, income, and compensation data. Direct employment is all General Motors hourly and salaried workers in the United States. The model estimates intermediate employment or the number of supplier jobs directly related to General Motors across all sectors of the U.S. economy—in other words, these are the jobs supported by everything GM buys in the United States. The model also estimates spin-off or expenditure-induced employment—the jobs direct and indirect workers spending their earnings in the economy support. Additionally, the model generates estimates of the amount of U.S. personal income and tax revenues generated by General Motors' manufacturing activities in the United States.

General Motors Total Economic Contribution to the U.S. Economy

General Motors directly employs over 83,850 hourly and salaried workers in the United States. As shown in Table 2, these 83,850 jobs support over 207,400 indirect jobs at GM suppliers. These suppliers fall into a broad array of industries—everything from providing raw materials, parts, and components to the company's manufacturing operations to transportation and logistics services to get vehicles to market or food services for GM's plant cafeterias. Together, GM's direct and indirect jobs support more than 389,760 additional spin-off jobs in the U.S. economy. All totaled, GM's 83,850 hourly and salaried manufacturing jobs support more than 681,000 U.S. jobs—or 0.39 percent of all U.S. private-sector employment. Comparing the total employment figure to GM's direct employment yields an overall employment multiplier of 8.1—meaning there are 7.1 additional jobs in the U.S. economy for every one GM hourly or salary manufacturing job.

The total earnings for all 681,000 U.S. jobs that GM's hourly and salaried employment supports are $51.6 billion, which represents 0.46 percent of all U.S. private-sector compensation. CAR estimates that the earnings that GM manufacturing supports generate more than $7.2 billion in personal income tax revenues and $6.5 billion in social insurance tax revenues and transfer payments (e.g., Social Security or unemployment insurance tax revenues). CAR estimates that GM supports $37.9 billion in private disposable personal income in the United States in 2019.

Table 2: Contribution of General Motors Operations to the United States Economy in 2019

Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	83,857
Intermediate	207,419
Total (Direct + Intermediate)	291,276
Spin-Off (Expenditure Induced)	389,768
Total (Direct + Intermediate + Spin-Off)	681,044
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	8.1
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$51.6
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$6.5
Less: Personal Income Taxes ($ Billions, Nominal)	$7.2
Equals Private Disposable Personal Income ($ Billions, Nominal)	$37.9
Contribution as Percent of U.S. Total Private Economy	
Employment	0.39%
Compensation	0.46%

*CAR adjusted the model to avoid double-counting in the motor vehicle and parts industries.
Source: Center for Automotive Research analysis

General Motors' total U.S. Operations contribution supports jobs in nearly every sector of the U.S. economy. Table 3 shows that the top five industries that GM U.S. Operations support comprise almost 58 percent of the total employment contribution. The top five industries include manufacturing—with more than 20.1 percent of the employment impact, professional and technical services—with 12.5 percent of the impact, construction—with 12.2 percent of the impact, retail trade—with 6.7 percent of the impact, and wholesale trade—with 6.1 percent of the impact. Appendix II contains detailed GM U.S. Operations contributions by industry sector for all impacted sectors.

Table 3: Top Five Industry Sectors supported by General Motors U.S. Operations, 2019

Industries (Sub-industries are indented and listed below the main industry category)	Employment Contribution
Manufacturing	134,186
Motor vehicles, bodies & trailers, & motor vehicle parts manufacturing	65,732
Professional & Technical Services	83,549
Construction	81,643
Retail Trade	44,680
Wholesale Trade	40,653

Source: Center for Automotive Research analysis

General Motors Economic Contribution for Nine U.S. States and the Rest of the United States

Indiana

GM operates four manufacturing facilities in Indiana. Fort Wayne Assembly opened in 1986 and now employs over 4,500 hourly and salaried workers making the Chevrolet Silverado and GMC Sierra pickup trucks. Bedford Castings in Bedford, Indiana (75 miles southwest of Indianapolis), first opened in 1942, employs over 900 employees making engine and transmission components. GM's Marion Metal Center, located between Fort Wayne and Indianapolis, employs nearly 1,000 workers who produce metal stamped parts in a plant that opened in 1954. Finally, GM Component Holdings, a subsidiary of General Motors, operates a parts and components plant in Kokomo, about an hour north of Indianapolis. The plant opened in 1936 and now employs more than 400 workers. GM has announced investments totaling nearly $3 billion in its Indiana facilities since 2000.

Direct GM employment in Indiana totals over 6,800 hourly and salaried workers. Those direct jobs in Indiana support another 38,000 jobs in the Indiana economy and produce a 6.6 employment multiplier— which means there are 5.6 other jobs in the Indiana economy for every direct GM hourly and salaried job in the state. These 5.6 jobs support not only GM's Indiana manufacturing facilities but also GM operations in the rest of the United States. GM's manufacturing activities in Indiana produced an estimated $3.2 billion in earnings and $800 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 4: Contribution of General Motors Operations to the Indiana Economy in 2019

Indiana Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	6,819
Intermediate	13,677
Spin-Off (Expenditure Induced)	24,241
Total (Direct + Intermediate + Spin-Off)	44,736
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	6.6
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$3.2
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.4
Less: Personal Income Taxes ($Billions, Nominal)	$0.4
Equals Private Disposable Personal Income ($ Billions, Nominal)	$2.4

Source: Center for Automotive Research analysis

Kansas

GM has just one manufacturing facility in Kansas—the company's Fairfax Assembly plant. Fairfax Assembly opened in 1987 and now employs over 2,400 hourly and salaried workers making the Cadillac XT4 and the Chevrolet Malibu. Fairfax also has contiguous stamping operations. GM has announced investments totaling $1.2 billion in its Fairfax Assembly plant since 2000.

Direct GM employment in Kansas supports another 8,200 jobs in the Kansas economy and produces a 4.4 employment multiplier—which means there are 3.4 other jobs in the Kansas economy for every

direct GM hourly and salaried job in the state. These 3.4 jobs support not only GM's Kansas manufacturing facility but also GM operations in the rest of the United States. GM's manufacturing operations in Kansas produced an estimated $800 million in earnings and $200 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 5: Contribution of General Motors Operations to the Kansas Economy in 2019

Kansas Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	2,430
Intermediate	2,916
Spin-Off (Expenditure Induced)	5,332
Total (Direct + Intermediate + Spin-Off)	10,678
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	4.4
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$0.8
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.1
Less: Personal Income Taxes ($Billions, Nominal)	$0.1
Equals Private Disposable Personal Income ($ Billions, Nominal)	$0.6

Source: Center for Automotive Research analysis

Kentucky

GM has just one manufacturing facility in Kentucky—the company's Bowling Green Assembly plant. Bowling Green opened in 1981 and now employs over 1,000 hourly and salaried workers making the Corvette. GM has announced investments totaling $908 million in the Bowling Green Assembly plant since 2000.

Direct GM employment in Kentucky supports another 11,300 jobs in the Kentucky economy and produces an 11.5 employment multiplier—which means there are 10.5 other jobs in the Kentucky economy for every direct GM hourly and salaried job in the state. These 10.5 jobs support not only GM's Kentucky manufacturing facility but also GM operations in the rest of the United States. GM's manufacturing operations in Kentucky produced an estimated $800 million in earnings and $200 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 6: Contribution of General Motors Operations to the Kentucky Economy in 2019

Kentucky Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	1,074
Intermediate	2,826
Spin-Off (Expenditure Induced)	8,500
Total (Direct + Intermediate + Spin-Off)	12,400
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	11.5
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$0.8
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.1
Less: Personal Income Taxes ($Billions, Nominal)	$0.1
Equals Private Disposable Personal Income ($ Billions, Nominal)	$0.6

Source: Center for Automotive Research analysis

Michigan

GM operates 15 manufacturing facilities in Michigan—the largest concentration of GM manufacturing in North America.

There are five GM assembly plants in Michigan. GM's Detroit-Hamtramck Assembly plant first opened in 1985, and is currently idle as GM recently announced it would invest $3 billion in and around this assembly plant for the production of future electrified vehicles. GM's Flint Assembly operations employ over 5,000 hourly and salaried workers who make the Chevrolet Silverado HD and the GMC Sierra HD pickup trucks. Flint Assembly first opened in 1947. Lansing has two GM assembly plants—the Lansing Delta Township plant opened in 2006 and employs over 2,500 workers who make the Buick Enclave and Chevrolet Traverse, and the Lansing Grand River Assembly plant that began production in 1999 and currently employs nearly 1,500 workers who make the Cadillac CT4, Cadillac CT5, and Chevrolet Camaro. Both Lansing plants have contiguous stamping operations. Lastly, GM's Orion Assembly plant that opened in 1983 now employs over 1,000 workers who build the Chevrolet Sonic, Bolt EV, and Cruise AV test vehicles.

There are four GM powertrain facilities in Michigan. Bay City Powertrain first opened in 1892 as National Cycle Manufacturing and is the oldest GM U.S. manufacturing facility still in operation. Currently, Bay City employs nearly 500 workers who make engine and transmission components. GM's Flint Engine operations employ just over 500 workers who make I4 and V6 engines for many of GM's most popular vehicles. Flint Engine operations began in 2002. GM's Romulus Powertrain employs nearly 1,500 workers who make V6 engines and 10-speed transmissions. Romulus launched production in 1976. Saginaw Metal Castings Operations began production in 1919—making it GM's third oldest plant in the United States. Saginaw Metal Castings currently employs nearly 500 workers who make engine components.

There are two GM metal stamping operations in Michigan. Flint Metal Center began operations in 1954 and now employs over 700 workers. Pontiac Metal Center started operations in 1926 and currently employs nearly 400 workers.

In addition to the assembly, powertrain, and stamping plants in Michigan, GM also has a General Motors Components Holdings plant in Grand Rapids that opened in 1943 and currently employs over 1,000 workers. GM's Flint Tool & Die opened in 1967 and now has 350 employees, and the Brownstown Battery plant opened in 2009 and employs roughly 50 workers who make batteries and autonomous vehicle components. Michigan is also home to GM's global headquarters at the Renaissance Center in downtown Detroit and GM's Technical Center in Warren. GM employs more than 28,000 salaried workers in these two locations and in other non-manufacturing operations in Michigan. In addition, GM operations numerous Customer Care and Aftersales facilities in Michigan that are involved in parts distribution activities.

GM has announced investments totaling over $16 billion in its Michigan manufacturing operations since 2000.

Direct GM employment of 46,800 hourly and salaried workers in Michigan supports another 153,600 jobs in the Michigan economy and produces a 4.3 employment multiplier—which means there are 3.3 other jobs in the Michigan economy for every direct GM hourly and salaried job in the state. These 3.3 jobs support not only GM's Michigan manufacturing facilities but also GM operations in the rest of the

United States. GM's manufacturing operations in Michigan produced an estimated $14.5 billion in earnings and $4 billion in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 7: Contribution of General Motors Operations to the Michigan Economy in 2019

Michigan Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	46,817
Intermediate	59,888
Spin-Off (Expenditure Induced)	93,732
Total (Direct + Intermediate + Spin-Off)	200,436
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	4.3
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$14.5
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$1.9
Less: Personal Income Taxes ($Billions, Nominal)	$2.1
Equals Private Disposable Personal Income ($ Billions, Nominal)	$10.5

Source: Center for Automotive Research analysis

Missouri

GM has just one manufacturing facility in Missouri—the company's Wentzville Assembly plant. Wentzville opened in 1983 and now employs over 4,300 hourly and salaried workers making the Chevrolet Colorado and GMC Canyon mid-size pickup trucks and Chevrolet Express and GMC Savana vans. Wentzville also has contiguous stamping operations. GM has announced investments totaling more than $2 billion in the Wentzville Assembly plant since 2000.

Direct GM employment in Missouri supports another 18,200 jobs in the Missouri economy and produces a 5.4 employment multiplier—which means there are 4.4 other jobs in the Missouri economy for every direct GM hourly and salaried job in the state. These 4.4 jobs support not only GM's Missouri manufacturing facility but also GM operations in the rest of the United States. GM's manufacturing operations in Missouri produced an estimated $1.6 billion in earnings and $400 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 8: Contribution of General Motors Operations to the Missouri Economy in 2019

Missouri Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	4,155
Intermediate	6,481
Spin-Off (Expenditure Induced)	11,730
Total (Direct + Intermediate + Spin-Off)	22,365
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	5.4
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$1.6
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.2
Less: Personal Income Taxes ($Billions, Nominal)	$0.2
Equals Private Disposable Personal Income ($ Billions, Nominal)	$1.2

Source: Center for Automotive Research analysis

New York

GM operates three manufacturing facilities in New York—one powertrain plant and two General Motors Components Holdings subsidiary locations. The company's Tonawanda Engine plant (located just north of Buffalo) opened in 1938 and currently employs over 1,500 workers making V6 and V8 engines. The GMCH operations in Lockport (located just northwest of Buffalo) employ 1,500 workers, and GMCH-Rochester employs just over 1,000 workers—both produce parts and components. GM has announced investments totaling $2.2 billion in its New York manufacturing operations since 2000—with 90 percent of the investment going to the Tonawanda Engine plant.

Direct GM employment in New York supports another 26,250 jobs in the New York economy and produces a 7.5 employment multiplier—which means there are 6.5 other jobs in the New York economy for every direct GM hourly and salaried job in the state. These 6.5 jobs support not only GM's New York manufacturing facilities but also GM operations in the rest of the United States. GM's manufacturing operations in New York produced an estimated $2.9 billion in earnings and $800 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 9: Contribution of General Motors Operations to the New York Economy in 2019

New York Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	4,043
Intermediate	6,362
Spin-Off (Expenditure Induced)	19,890
Total (Direct + Intermediate + Spin-Off)	30,295
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	7.5
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$2.9
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.3
Less: Personal Income Taxes ($Billions, Nominal)	$0.5
Equals Private Disposable Personal Income ($ Billions, Nominal)	$2.1

Source: Center for Automotive Research analysis

Ohio

GM operates three powertrain manufacturing facilities and one metal stamping plant in Ohio. The company's Defiance Casting Operations (located half-way between Toledo, Ohio and Fort Wayne, Indiana) began production in 1948. The plant currently employs over 600 workers who make cast powertrain parts. GM's DMAX facility in Moraine, Ohio (located just south of Dayton) opened in 1999 and is jointly owned by GM (60 percent) and Isuzu Diesel Services of America, Inc. (40 percent). DMAX employs nearly 800 workers producing diesel V-8 engines used in GM's Silverado HD and Sierra HD pickup trucks. GM's Toledo Transmission plant first opened in 1916 and is the second oldest plant in the GM U.S. manufacturing system. Toledo transmission produces 6-, 8-, and 10-speed RWD transmissions and 9-speed FWD transmissions with nearly 1,800 workers. GM's Parma Metal Center (located southwest of Cleveland) opened in 1948 and currently employs over 1,100 workers making metal stampings. GM has announced investments totaling $6.5 billion in its Ohio manufacturing operations since 2000.

Direct GM employment in Ohio also includes GM Customer Care and Aftersales operations. GM's direct employment supports another 43,000 jobs in the Ohio economy and produces a 12.4 employment multiplier—which means there are 11.4 other jobs in the Ohio economy for every direct GM hourly and salaried job in the state. These 11.4 jobs support not only GM's Ohio manufacturing facilities but also GM operations in the rest of the United States. GM's manufacturing operations in Ohio produced an estimated $3.3 billion in earnings and $800 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 10: Contribution of General Motors Operations to the Ohio Economy in 2019

Ohio Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	3,768
Intermediate	10,437
Spin-Off (Expenditure Induced)	32,560
Total (Direct + Intermediate + Spin-Off)	46,766
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	12.4
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$3.3
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.4
Less: Personal Income Taxes ($Billions, Nominal)	$0.4
Equals Private Disposable Personal Income ($ Billions, Nominal)	$2.5

Source: Center for Automotive Research analysis

Tennessee

GM's Tennessee operations are an assembly plant, engine plant, and stamping facility all located in Spring Hill (southwest of Nashville). Spring Hill Manufacturing opened in 1990. The complex currently employs 3,700 workers across all three plants. Spring Hill produces the Cadillac XT5, Cadillac XT6, and the GMC Acadia, and the engine plant makes both I4 and V8 engines. GM has announced investments totaling $3.2 billion in its Tennessee manufacturing operations since 2000.

Direct GM employment in Tennessee also includes GM Customer Care and Aftersales operations. GM's direct employment supports another 23,000 jobs in the Tennessee economy and produces a 6.8

employment multiplier—which means there are 5.8 other jobs in the Tennessee economy for every direct GM hourly and salaried job in the state. These 5.8 jobs support not only GM's Tennessee manufacturing facilities but also GM operations in the rest of the United States. GM's manufacturing operations in Tennessee produced an estimated $1.9 billion in earnings and $500 million in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 11: Contribution of General Motors Operations to the Tennessee Economy in 2019

Tennessee Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	3,953
Intermediate	8,977
Spin-Off (Expenditure Induced)	14,138
Total (Direct + Intermediate + Spin-Off)	27,069
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	6.8
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$1.9
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.3
Less: Personal Income Taxes ($Billions, Nominal)	$0.2
Equals Private Disposable Personal Income ($ Billions, Nominal)	$1.4

Source: Center for Automotive Research analysis

Texas

GM operates one assembly plant in Arlington, Texas (located between Dallas and Fort Worth). Arlington Assembly produces GM's full-size SUVs—the Cadillac Escalade, Chevrolet Suburban and Tahoe, and the GMC Yukon. The plant also has contiguous stamping operations. GM has announced investments totaling $2.0 billion in its Texas manufacturing operations since 2000. Texas is also home to GM Financial, a wholly-owned subsidiary of GM that employs more than 2,800 GM salaried workers.

Direct GM employment in Texas also includes GM Customer Care and Aftersales operations. GM's direct employment supports another 58,300 jobs in the Texas economy and produces a 9.8 employment multiplier—which means there are 8.8 other jobs in the Texas economy for every direct GM hourly and salaried job in the state. These 8.8 jobs support not only GM's Texas manufacturing facility but also GM operations in the rest of the United States. GM's manufacturing operations in Texas produced an estimated $4.7 billion in earnings and $1.1 billion in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 12: Contribution of General Motors Operations to the Texas Economy in 2019

Texas Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	6,637
Intermediate	24,693
Spin-Off (Expenditure Induced)	33,580
Total (Direct + Intermediate + Spin-Off)	64,909
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	9.8
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$4.7
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$0.6
Less: Personal Income Taxes ($Billions, Nominal)	$0.5
Equals Private Disposable Personal Income ($ Billions, Nominal)	$3.6

Source: Center for Automotive Research analysis

Rest of the United States

GM operates numerous Customer Care and Aftersales and other operations in the remaining 41 U.S. states. Direct GM employment in the 41 state region totaled nearly 4,200 workers in 2019, including approximately 1,000 salaried jobs at GM's IT Innovation Center in Atlanta, Georgia. GM's direct employment in this 41-state region, along with GM operations in the nine other states support another 217,200 jobs in the 41-state region. CAR cannot estimate an employment multiplier on this region because there is no applicable connection between direct, indirect, and spin-off employment in this multi-state region. GM's operations in the remaining 41 states produced an estimated $17.9 billion in earnings and $4.7 billion in personal income taxes and government social insurance and transfer payment receipts in 2019.

Table 13: Contribution of General Motors Operations to the Remaining 41-State Region's Economy in 2019

Rest of U.S. Economic Impact	GM U.S. Manufacturing-Related
Employment	
Direct (Hourly + Salaried)	4,161
Intermediate	71,162
Spin-Off (Expenditure Induced)	146,064
Total (Direct + Intermediate + Spin-Off)	221,388
Multiplier: (Direct + Intermediate + Spin-Off)/Direct	N/A
Total Earnings by Place of Work, Private Non-Farm ($ Billions, Nominal)	$17.9
Less: Contributions for Government Social Insurance and Personal Current Transfer Receipts ($ Billions, Nominal)	$2.2
Less: Personal Income Taxes ($Billions, Nominal)	$2.5
Equals Private Disposable Personal Income ($ Billions, Nominal)	$13.1

Source: Center for Automotive Research analysis

Appendix I: Methods

CAR researchers produced the estimates presented in this study using a specially constructed, inter-industry dynamic economic model developed by Regional Economic Models, Inc. (REMI). The REMI model is designed to simulate dynamic year-over-year regional economic effects of policies or actions, including General Motors' investment, employment, and wage rates. Government agencies, consulting firms, and universities have long relied on the highly-regarded REMI model for analyzing economic policy impacts and industry contributions. CAR has used REMI for multiple economic impact studies in the past.[3]

CAR researchers used a 10-region, 160-sector REMI model to estimate the economic contribution of General Motors' operations in the United States—including vehicle assembly, engine and transmission manufacturing, parts and component manufacturing, metalworking, stamping, Customer Care and Aftersales operations (CCAs), Logistics Optimization Centers (LOCs), engineering, research and development, and headquarters locations. The approach permitted simulation of the interactions among the economies of the nine selected states and the rest of the United States. The simulation inputs include, but are not limited to: the proprietary production and skilled trade worker headcounts,

[3] **Contribution of Toyota Motor North America to the Economies of Nineteen State and the United States in 2016.** Kristin Dziczek, Yen Chen, Bernard Swiecki, Michael Schultz, Deb Maranger Menk, and Juliana Peterson, Center for Automotive Research, Ann Arbor, MI Septemer 2016; **Contribution of General Motors' Manufacturing Plants to the Economies of Ten States and the United States in 2013 and 2014.** Kristin Dziczek, Debbie Maranger Menk and Yen Chen, Center for Automotive Research, Ann Arbor, MI, April 2015; **Economic Contribution of the Ford Motor Company Michigan Assembly Plant to the Michigan Economy.** Kim Hill, Bernard Swiecki, Debbie Maranger Menk, Joshua Cregger, Michael Schultz, Center for Automotive Research, Ann Arbor, MI, March 2013. **Economic Impact of Hyundai in the United States.** Kim Hill, Debbie Maranger Menk and Joshua Cregger, Center for Automotive Research, Ann Arbor, MI, November 2011.; **Contribution of Toyota Motor North America to the Economies of Sixteen States and the United States in 2010**. 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Note: The research staff of the Center for Automotive Research performed a number of these studies while located at the University of Michigan's Office for the Study of Automotive Transportation.

salaried employment headcounts, aggregated GM manufacturing payroll and wage rates, direct and indirect investment totals, and publicly available financial data from the company's annual reports.

Researchers paid particular attention to capture the economic contribution of GM's production operations and non-production-related services in estimating the total economic contribution of GM's U.S. operations. Non-production services and functions include engineering, legal, accounting, business services, management, finance, insurance, communication, research and development, and advertising. CAR researchers addressed the issue of the potential double-counting activities between suppliers and the various GM subsidiaries by nullifying the corresponding intermediate demand in the model to reflect the actual GM manufacturing supply chain.

The CAR research team further customized the model and simulation runs by addressing the differences between REMI's underlying parameters and the actual data—including wage rates, labor productivity rates, and direct investment. The general analytical methodology is to simultaneously run the regional economic simulation using the assumptions mentioned above as the economic shocks, then compare the simulation results with the baseline. The differences represent the economic contribution in each state in which GM directly conducts business operations as well as in the U.S. economy as a whole. The individual states in the study are Indiana, Kansas, Kentucky, Michigan, Missouri, New York, Ohio, Tennessee, and Texas. CAR used August 2019 data to estimate impacts for calendar 2019.

Appendix II: Intermediate & Spin-Off Employment Contribution of General Motors' Operations in the United States, 2019

Industries (Sub-industries are indented and listed below the main industry category)	Employment Contribution
Forestry, fishing, & other related activities	1,286
Mining	6,393
Utilities	1,668
Construction	81,643
Manufacturing	134,186
Wood product	2,756
Nonmetallic mineral product	3,878
Primary metal	4,608
Fabricated metal product	14,473
Machinery	12,710
Computer & electronic product	4,945
Electrical equipment & appliance	1,554
Motor vehicles, bodies & trailers, & parts	65,732
Other transportation equipment	1,478
Furniture & related product	1,659
Miscellaneous	1,925
Food	1,839
Beverage & tobacco	384
Textile mills; textile product mills	428
Apparel; Leather & allied product	-285
Pulp, paper, & paperboard	1,711
Printing & related support activities	1,410
Petroleum & coal products	225
Chemical	3,162
Plastics & rubber product	9,594
Wholesale trade	40,653
Retail trade	44,680
Transportation & warehousing	30,407
Information	10,479
Finance & insurance	28,204
Real Estate	15,696
Rental & leasing (Auto, consumer goods, & commercial/industrial goods)	2,796
Professional & technical services	83,549
Management of Companies & Enterprises	25,734
Administrative & Waste Services	47,615
Educational Services	10,990
Health Care & Social Assistance	41,800
Arts, Entertainment, & Recreation	14,662
Accommodation & Food Services	25,145
Other Services, including Public Administration	18,362
GRAND TOTAL	665,948

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