QUARTERLY ECONOMICS BRIEFING

The nation's most experienced provider of workers compensation information, tools, and services

March 2017

Review of Current Conditions:

THE ECONOMIC OUTLOOK AND ITS IMPACT ON WORKERS COMPENSATION

The exhibits below are updated to reflect the current economic outlook for factors that typically impact workers compensation. Each exhibit also provides some context for the outlook, relative to the historical data. Forecasts are derived from Moody's Analytics.

EMPLOYMENT GROWTH

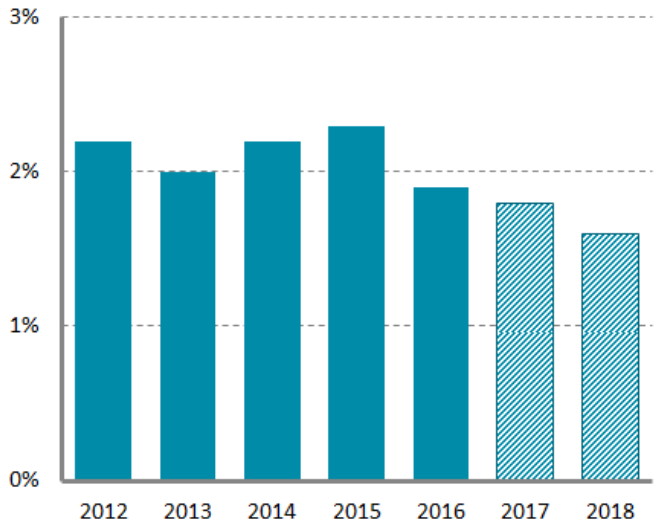
Private employment growth slowed to 1.9% per year in 2016 after increasing to 2.3% per year in 2015, the fastest rate of growth since the recession. Even with slower growth, over 2.2 million workers were added to payrolls throughout 2016.

Education and healthcare, and professional and business services showed the largest employment gains. Trade, transportation, and utilities; and leisure and hospitality also showed strong gains. Natural resources and mining posted the largest decline followed by manufacturing with a small decline. The decline in manufacturing employment is of concern for workers compensation because manufacturing accounts for 15% of premium in NCCI states. See below in **Drilling Down** for a survey of manufacturing presence by state and factors impacting trends in manufacturing output and employment.

Consistent with slowing employment growth, real gross domestic product (GDP) growth also slowed last year. Annual growth in real GDP for 2016 fell to 1.6% from 2.6% in 2015.

Employment: Forecast Is for Growth to Continue to Slow

Growth Rate:
Private Employment



Sources: US Bureau of Labor Statistics; Moody's Analytics

Private employment rose by 227,000 jobs in February 2017 following an increase of 221,000 jobs in January. Despite these robust increases, Moody's forecasts that employment growth will continue to slow to 1.8% this year and 1.6% next year. The forecast for this year is two-tenths of a percentage point higher than in last December's *Quarterly Economics Briefing* (*QEB)*. Moody's has revised its forecast for 2018 from last quarter, when they expected growth to reaccelerate next year.

Growth in employment leads to increased premium, but inexperienced new hires may also put upward pressure on claim frequency. Both impacts are likely to be muted over the next couple of years if employment growth slows.

Analysis and charts prepared in February and March 2017.

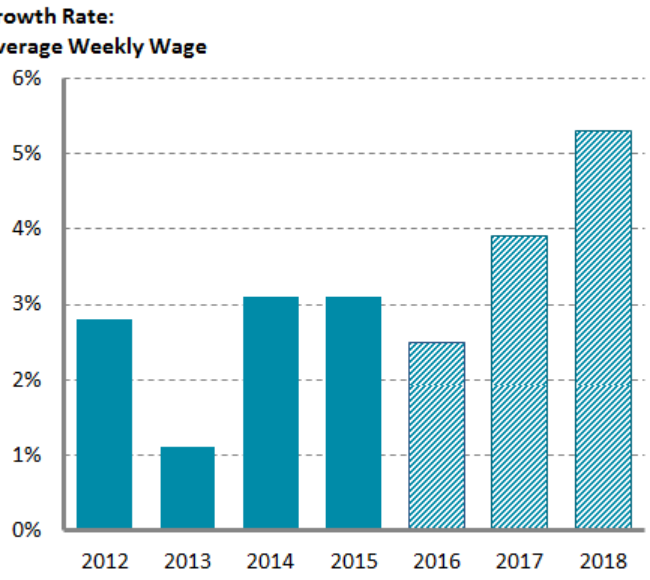
WAGE GROWTH

Wage growth is forecast to have slowed last year to 2.5% after increasing by 3.1% in both 2014 and 2015. This is an upward revision from the last *QEB*, where we estimated average weekly wage growth for 2016 at 2.2%. In addition, wage growth is forecast to accelerate sharply to 3.9% this year and 5.3% next year. The forecast for 2017 is three-tenths of a percentage point below that posted in December.

Wages are forecast to accelerate due to tightening labor market conditions. The unemployment rate averaged 4.9% in 2016—down from 5.3% in 2015—and fell further to 4.7% in February 2017.

The broader measure of unemployment that includes discouraged workers and part-time workers who would prefer a full-time schedule is also declining. It averaged 9.6% in 2016 compared to 10.5% in 2015, and declined to 9.2% in February, the lowest rate of the recovery. While declining, it is still high by historical standards.

Wages: Forecast to Accelerate This Year and Next



Sources: US Bureau of Labor Statistics; Moody's Analytics; NCCI

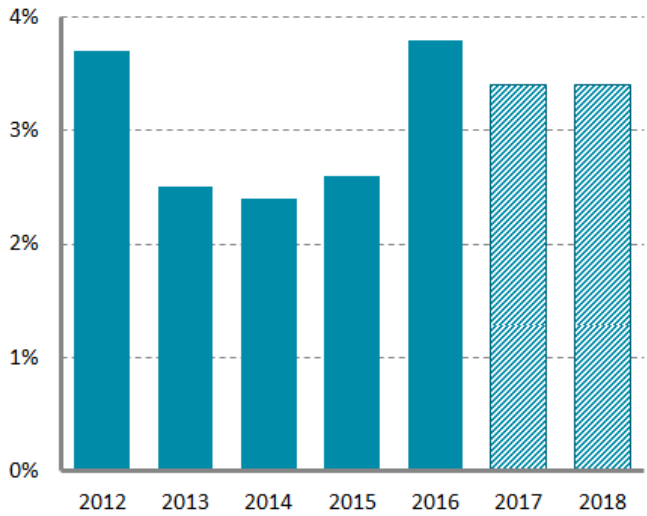
Employers will likely need to offer higher wages to attract workers as the unemployment rate declines. Higher wages will, in turn, lead to both increases in workers compensation premiums and indemnity severity.

MEDICAL INFLATION

Medical inflation accelerated in 2016 to 3.8%, up from 2.6% in 2015. This reflected an increase in price inflation generally from 0.1% in 2015 to 1.3% in 2016. Moody's expects medical inflation to slow slightly this year to 3.4% and continue at that pace in 2018. This is still above the average of 3.0% for the previous five years, and also higher than general inflation in both years. Moody's forecast for general inflation is 2.8% this year and 2.5% next year.

Changes in medical severity are a function of changes in both price and utilization. Higher medical inflation (the price piece of that equation) would imply upward pressure on medical severity. However, in 2015, workers compensation medical severity declined by an estimated 1% for NCCI states[1] although medical inflation increased by 2.6%. A study in the ***2016 Issues Report Fall Edition***

Medical Inflation: Forecast to Decelerate Slightly This Year



Sources: US Bureau of Labor Statistics; Moody's Analytics

[1] States included are AK, AL, AR, AZ, CO, CT, DC, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MD, ME, MO, MS, MT, NC, NE, NH, NM, NV, OK, OR, RI, SC, SD, TN, UT, VA, VT, and WV.

Analysis and charts prepared in February and March 2017.

published on **ncci.com** found that a 3% decline in utilization of physician services was the major driver of the decline in medical severity in 2015.

INTEREST RATES

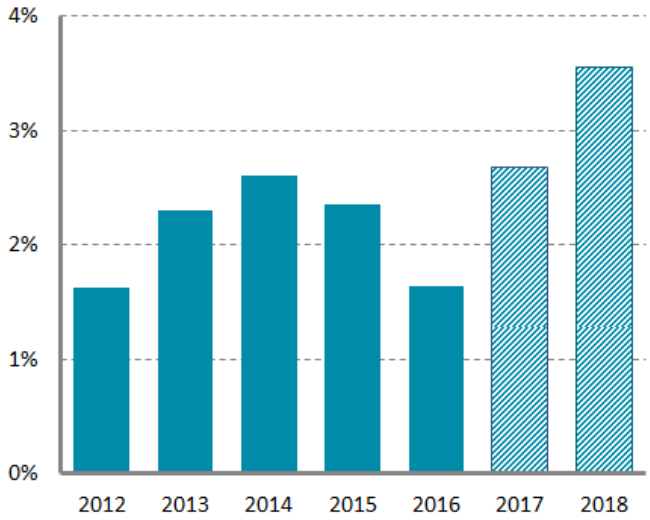
Low interest rates have constrained investment income in the property/casualty (P/C) industry for many years. However, with price inflation returning to more normal levels, interest rates are also expected to rise.

Indeed, the Federal Open Market Committee (FOMC) increased the target range of the federal funds rate by 25 basis points to 0.75%–1.00% at its March meeting after last increasing the target by 25 basis points in December 2016.

The chart on the right shows interest rates for the 10-year Treasury note as of June for 2012–2018. This 10-year rate has been below 3% for the last five years and declined to 1.6% in 2016 due to uncertainty surrounding the British vote to exit the European Union.

Interest Rates: Forecast to Increase Over the Next Two Years

Interest Rate as of June:
10-Year Constant Maturity Securities



Sources: Federal Reserve Board; Moody's Analytics

Moody's expects the interest rate on the 10-year Treasury note to increase to 2.7% in the second quarter of this year and to 3.5% next year. The expectation for 2017 is the same as shown in the December *QEB* and is in line with Moody's expected increase in inflation this year. Their expectation that the FOMC will more aggressively raise short-term interest rates next year underlies their forecast for further acceleration in 2018.

The projected increase in investment yields will increase the potential contribution of investment income to total profitability. However, medical inflation is also forecast to increase as shown in the previous chart, and may offset some of the potential gains from investment income. The overall impact of increases in interest rates and medical inflation is uncertain and will depend on the magnitude of each.

Analysis and charts prepared in February and March 2017.

DRILLING DOWN:

ECONOMIC TRENDS IN MANUFACTURING

In this edition, we focus on manufacturing. First, we show the importance of manufacturing to the workers compensation industry. Next, we present a survey of state manufacturing presence in which we compare relative shares of manufacturing employment across states. Manufacturing encompasses a wide variety of different industries, so we break down total manufacturing into its subsectors focusing on differences in durable and nondurable industries. Analysis in this section focuses on data for 2015 and 2016.

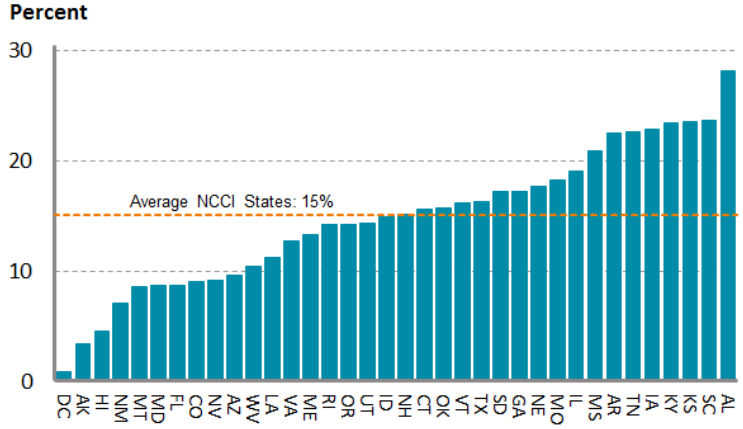
Finally, we look at long-term trends in manufacturing output, employment, and productivity back to 1990, and the rise of automation and supply chain decentralization that has contributed to these trends. The supply chain discussion makes use of the automotive industry as an example.

THE IMPORTANCE OF MANUFACTURING TO WORKERS COMPENSATION

Manufacturing is important to the workers compensation industry because it makes up a disproportionate share of premium relative to exposure. In Policy Year 2016, manufacturing made up just 8% of exposure in terms of payroll, but 15% of total manual premium across NCCI states.

As shown in Figure 1, manufacturing's share of total manual premium ranges from less than 10% for states with low shares of manufacturing employment to more than 20% for those with high or middle-high shares as defined in the next section.

Figure 1–Manufacturing Share of Total Manual Premium, PY2016



Source: NCCI

SURVEY OF STATE MANUFACTURING PRESENCE

In 2016, the US manufacturing sector employed more than 12.3 million workers. The first column in Table 1 shows the number of manufacturing workers employed in each state. The second column shows the share of manufacturing employment calculated by dividing manufacturing employment in a state by that state's total private nonfarm employment. Excluding DC, the average manufacturing employment share across states was 10.3% in 2016. (DC is excluded because it has an immaterial manufacturing presence.)

Analysis and charts prepared in February and March 2017.

States are divided into four categories (high, middle-high, middle-low, and low) based on their manufacturing employment shares. States in the high category have manufacturing employment shares that are greater than one standard deviation above the average share across states, and states in the middle-high category have shares that fall between the average and one standard deviation above the average. Middle-low and low categories are defined similarly. Green indicates states with above-average shares and red indicates states with below-average shares. Darker shades denote states that are more than one standard deviation away from the average share across states; lighter shades indicate states within one standard deviation of the average.

States with high manufacturing shares of total employment are those above 14.5% while those with low shares are below 6%. Note that even though California employs the most manufacturing *workers* in the country, its manufacturing employment *share* is below average at 9.4%. On the other hand, smaller states such as Arkansas and Mississippi employ fewer manufacturing workers but have high manufacturing employment shares of 15.3% and 15.9%, respectively.

The map in Figure 2 shows the geographical distribution of manufacturing shares using the same categories and colors as in Table 1. It indicates that states with high manufacturing employment shares (dark green) are primarily located in the Midwest and central South. Many states with high manufacturing employment shares tend to have high exposure to durable goods manufacturing, as we will see next. States with low manufacturing employment shares (dark red) are distributed in both the West and East. In general, the economies in these states depend more on services than manufacturing.

Table 1–Manufacturing Employment and Share of Private Industry Employment, 2016

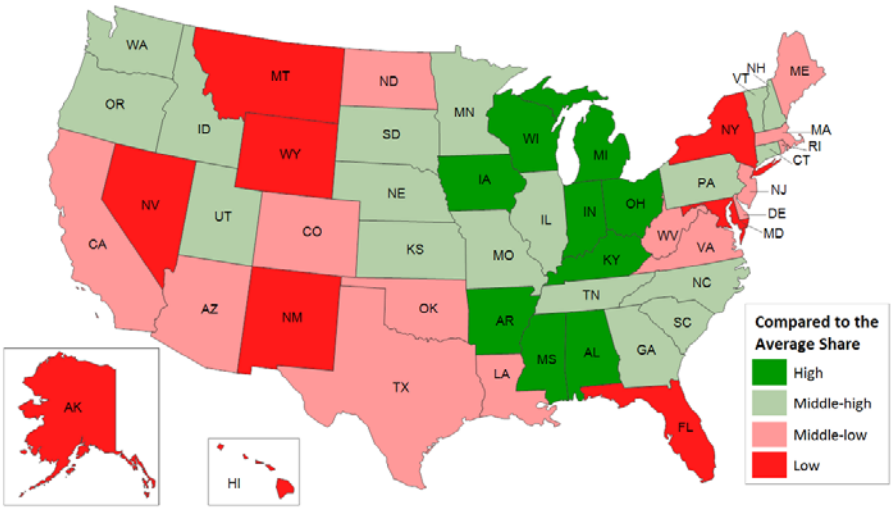
Average Share = 10.3%

State	Workers, (000s)	Share, %	State	Workers, (000s)	Share, %
Indiana	523	19.7	Utah	126	10.6
Wisconsin	465	18.5	Georgia	388	10.5
Alabama	261	16.3	Oklahoma	129	9.9
Iowa	213	16.3	Maine	51	9.8
Michigan	600	16.1	Rhode Island	40	9.4
Mississippi	143	15.9	California	1,306	9.4
Kentucky	249	15.6	Texas	847	8.4
Arkansas	155	15.3	Louisiana	136	8.2
Ohio	686	14.6	Massachusetts	246	7.9
South Carolina	238	14.1	West Virginia	47	7.9
Kansas	160	13.9	Virginia	233	7.3
Tennessee	343	13.5	North Dakota	25	7.0
North Carolina	465	12.9	New Jersey	242	7.0
Minnesota	318	12.9	Arizona	160	7.0
Oregon	188	12.3	Delaware	26	6.6
South Dakota	42	11.9	Colorado	142	6.5
New Hampshire	68	11.8	New York	451	5.7
Vermont	30	11.6	Alaska	13	5.3
Nebraska	97	11.5	Montana	19	5.2
Idaho	65	11.3	Florida	355	4.9
Illinois	574	11.1	Maryland	104	4.7
Missouri	263	10.9	Wyoming	9	4.4
Washington	290	10.9	New Mexico	27	4.2
Connecticut	156	10.8	Nevada	44	3.8
Pennsylvania	558	10.8	Hawaii	14	2.7

District of Columbia not included.

Sources: US Bureau of Labor Statistics (BLS); NCCI

Figure 2–Manufacturing as a Share of Private Industry Employment, 2016



Sources: US Bureau of Labor Statistics (BLS); NCCI

Manufacturing consists of many different industries that can be broadly grouped into durable goods and nondurable goods. Durable goods are defined as those that do not wear out quickly and are used for an extended period of time, usually three or more years. Examples include furniture, appliances, and cars. Nondurable goods are ones that are either consumed in a single use or have a life span of fewer than three years, such as food, apparel, and paper products.

The key functional distinction between the two categories is that demand for durable goods is more of an investment decision, and demand

Analysis and charts prepared in February and March 2017.

for nondurable goods is more of a consumption decision. Purchases of durable goods can be timed or postponed more than purchases of nondurable goods in response to current economic conditions or future expectations. Therefore, demand for durables can be expected to exhibit greater cyclical volatility than nondurables.

Because of this distinction, economic conditions will not affect all states with high manufacturing employment shares in the same way. States with higher concentrations in durable goods industries can be harder hit by economic slowdowns. And workers compensation premiums, frequency, and severity in those states could also be impacted more than states with high concentrations in nondurable goods. For example, states with high concentrations in auto manufacturing may be harder hit during a recession than states with high concentrations in food manufacturing.

The following tables are similar to Table 1 above showing employment shares, but break out the data for durable and nondurable manufacturing for 2016. Table 2 is for the durable manufacturing sector while Table 3 is for nondurable. Again, categories and colors are assigned based on the average share in each table and the standard deviation. The average employment share across states is 6.4% for durable manufacturing and 4.0% for nondurable manufacturing.

Table 2–Durable Goods Manufacturing Share of Private Industry Employment, 2016
Average Share = 6.3%

State	Share, %		Share, %
Indiana	14.1	Pennsylvania	6.5
Michigan	12.1	Rhode Island	5.9
Wisconsin	11.2	California	5.9
Alabama	10.6	Maine	5.5
Mississippi	10.5	Texas	5.4
Kentucky	10.1	Arizona	5.3
Ohio	9.8	Nebraska	5.2
Iowa	9.5	Georgia	5.1
New Hampshire	8.8	Massachusetts	5.1
Tennessee	8.6	West Virginia	4.7
Oregon	8.6	North Dakota	4.6
Connecticut	8.5	Virginia	4.2
Kansas	8.3	Colorado	4.1
South Carolina	8.3	Louisiana	3.9
Minnesota	8.2	Florida	3.3
Washington	7.8	New York	3.3
South Dakota	7.8	New Jersey	3.2
Arkansas	7.3	Montana	3.1
Vermont	7.3	Maryland	2.5
North Carolina	7.0	New Mexico	2.4
Utah	6.9	Delaware	2.4
Oklahoma	6.8	Nevada	2.4
Missouri	6.6	Wyoming	2.0
Idaho	6.5	Alaska	0.8
Illinois	6.5	Hawaii	0.7

District of Columbia not included.
Sources: US Bureau of Labor Statistics (BLS); NCCI

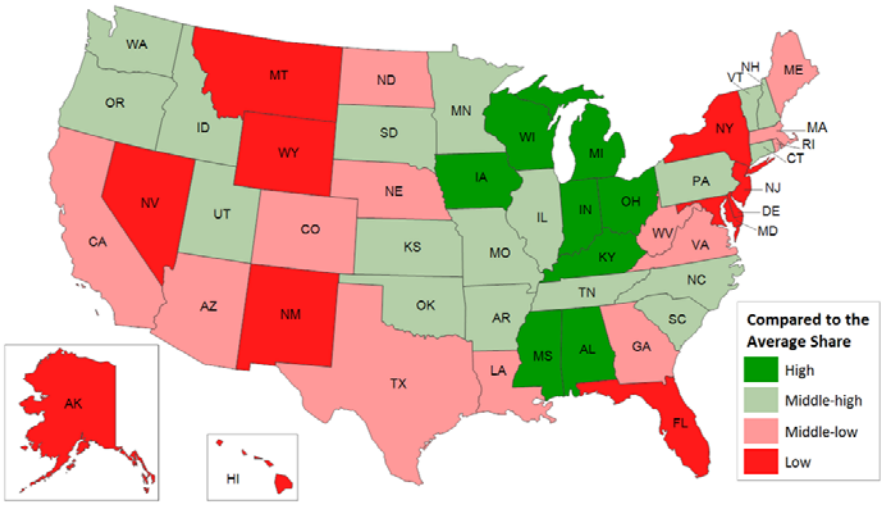
Table 3–Nondurable Goods Manufacturing Share of Private Industry Employment, 2016
Average Share = 4.0%

State	Share, %		Share, %
Arkansas	7.9	Michigan	4.0
Wisconsin	7.4	New Jersey	3.8
Iowa	6.8	Oregon	3.7
Nebraska	6.3	Utah	3.7
North Carolina	5.9	Rhode Island	3.5
South Carolina	5.8	California	3.5
Alabama	5.7	West Virginia	3.2
Kansas	5.6	Oklahoma	3.2
Indiana	5.6	Washington	3.1
Kentucky	5.4	Virginia	3.0
Georgia	5.4	Texas	3.0
Mississippi	5.4	New Hampshire	3.0
Tennessee	4.9	Massachusetts	2.8
Idaho	4.7	Wyoming	2.4
Ohio	4.7	Colorado	2.4
Minnesota	4.7	North Dakota	2.4
Illinois	4.6	New York	2.4
Alaska	4.5	Connecticut	2.3
Vermont	4.3	Maryland	2.2
Missouri	4.3	Montana	2.0
Louisiana	4.3	Hawaii	2.0
Pennsylvania	4.3	New Mexico	1.8
Maine	4.3	Arizona	1.7
Delaware	4.2	Florida	1.6
South Dakota	4.1	Nevada	1.5

District of Columbia not included.
Sources: US Bureau of Labor Statistics (BLS); NCCI

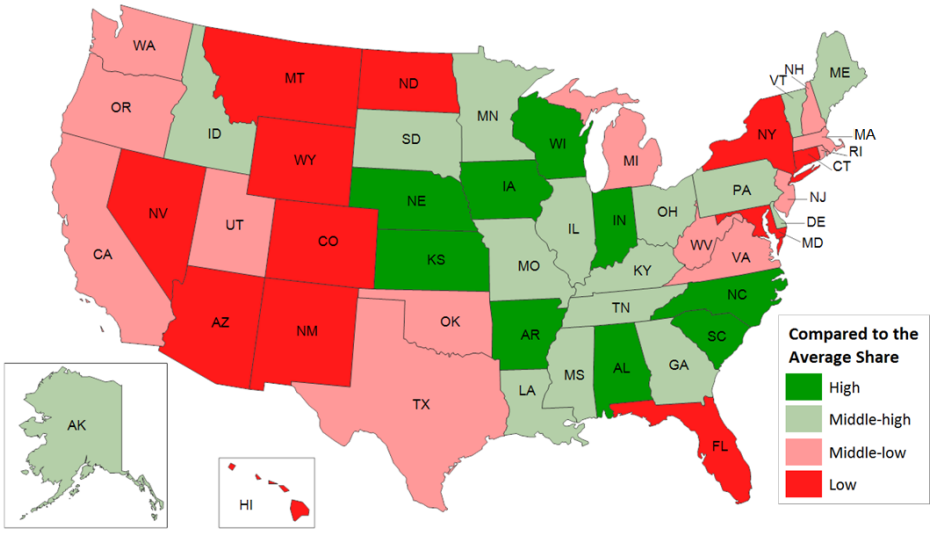
Analysis and charts prepared in February and March 2017.

Figure 3–Durable Goods Manufacturing as a Share of Private Industry Employment, 2016



Sources: US Bureau of Labor Statistics (BLS); NCCI

Figure 4–Nondurable Goods Manufacturing as a Share of Private Industry Employment, 2016



Sources: US Bureau of Labor Statistics (BLS); NCCI

Maps for employment shares of durable and nondurable manufacturing are shown in Figures 3 and 4. Arkansas, South Carolina, Kansas, North Carolina, and Nebraska are more important producers of nondurable goods than durable goods. Therefore, the manufacturing sectors in these states should exhibit less cyclical sensitivity than Michigan, Mississippi, Kentucky, and Ohio, which are more dependent on durable goods and less dependent on nondurables.

Table 4 drills down further to the three-digit North American Industry Classification System (NAICS) codes within durable and nondurable goods. Data for this level of detail is from a different data source (the Quarterly Census of Employment and Wages), for which 2015 is the latest year currently available. Employment shares are displayed for each manufacturing subsector for the 13 states with high shares of durable and nondurable manufacturing employment from Figures 3 and 4. Four of the 13 states have both high durable and nondurable shares.

Analysis and charts prepared in February and March 2017.

Colors are assigned based on a comparison of each state's share to the US average for each three-digit NAICS code. Cells shaded darker green indicate the manufacturing sectors which are most concentrated in each state. For example, transportation equipment manufacturing in Michigan is dark green indicating it has a much higher share than the nation as a whole. Kentucky, Indiana, and Alabama also have significantly higher shares in transportation equipment manufacturing.

Other industries with high shares relative to the nation for the eight states with high durable manufacturing shares include:

- Wood product manufacturing—Mississippi and Alabama
- Primary metal manufacturing—Indiana and Alabama
- Machinery manufacturing—Michigan, Wisconsin, and Iowa
- Electrical equipment and appliance manufacturing—Wisconsin
- Furniture and related product manufacturing—Mississippi

For the nine states with high shares in nondurable manufacturing, dominant industries include:

- Food manufacturing—Wisconsin, Iowa, Arkansas, Kansas, and Nebraska
- Textile mills—Alabama, South Carolina, and North Carolina
- Paper manufacturing—Wisconsin and Arkansas
- Printing—Wisconsin
- Plastics and rubber products manufacturing—Indiana, Wisconsin, Arkansas, and South Carolina

Table 4–Manufacturing Share of State Private Industry Employment by Three-Digit NAICS Code, 2015
Color based on comparison to US average for each industry code

			High Durable Share			High Durable and Nondurable Share				High Nondurable Share				
		US	MI	MS	KY	OH	IN	WI	IA	AL	AR	SC	KS	NC	NE
Durable Goods	NAICS 321 Wood product manufacturing	0.3	0.3	1.0	0.7	0.3	0.5	0.7	0.7	1.0	1.0	0.5	0.1	0.5	0.2
	NAICS 327 Nonmetallic mineral product manufacturing	0.3	0.3	0.4	0.5	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
	NAICS 331 Primary metal manufacturing	0.3	0.6	0.4	0.8	0.8	1.7	0.7	0.6	1.2	0.9	0.4	0.2	0.2	0.2
	NAICS 332 Fabricated metal product manufacturing	1.2	2.3	1.1	1.4	2.3	2.3	3.1	1.6	1.7	1.5	1.8	1.4	1.1	1.1
	NAICS 333 Machinery manufacturing	0.9	2.0	1.4	1.4	1.7	1.7	2.8	3.1	0.7	1.2	1.3	1.7	0.9	1.2
	NAICS 334 Computer and electronic product manufacturing	0.9	0.5	0.3	0.3	0.5	0.6	0.8	1.0	0.6	0.3	0.4	0.5	0.9	0.6
	NAICS 335 Electrical equipment and appliance mfg.	0.3	0.4	0.7	0.7	0.6	0.3	1.0	0.5	0.3	0.5	0.8	0.3	0.6	0.2
	NAICS 336 Transportation equipment manufacturing	1.4	4.8	3.1	3.9	2.7	4.8	1.1	1.3	4.1	1.4	2.4	3.4	1.0	1.1
	NAICS 337 Furniture and related product manufacturing	0.3	0.6	2.2	0.2	0.3	0.9	0.6	0.5	0.6	0.3	0.2	0.3	1.0	0.2
	NAICS 339 Miscellaneous manufacturing	0.5	0.6	0.3	0.3	0.5	1.1	0.6	0.3	0.4	0.3	0.4	0.4	0.4	0.6
Nondurable Goods	NAICS 311 Food manufacturing	1.3	1.0	2.6	1.8	1.3	1.5	2.7	4.0	2.0	4.4	1.2	2.8	1.5	4.3
	NAICS 312 Beverage and tobacco product manufacturing	0.2	0.2	NA	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.3	0.1
	NAICS 313 Textile mills	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.4	0.0	0.9	0.0	0.8	0.0
	NAICS 314 Textile product mills	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.1	0.2	0.1	0.2	0.0
	NAICS 315 Apparel manufacturing	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.2	0.0
	NAICS 316 Leather and allied product manufacturing	0.0	0.0	NA	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
	NAICS 322 Paper manufacturing	0.3	0.3	0.4	0.6	0.4	0.4	1.3	0.3	0.7	1.0	0.8	0.2	0.5	0.2
	NAICS 323 Printing and related support activities	0.4	0.4	0.2	0.6	0.5	0.6	1.2	0.5	0.2	0.4	0.3	0.7	0.3	0.4
	NAICS 324 Petroleum and coal products manufacturing	0.1	0.0	0.3	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.2	0.0	0.0
	NAICS 325 Chemical manufacturing	0.7	0.8	0.7	0.8	1.0	1.2	0.7	0.9	0.7	0.5	1.2	0.6	1.2	0.7
	NAICS 326 Plastics and rubber products manufacturing	0.6	1.1	0.7	1.1	1.2	1.5	1.3	0.8	1.0	1.2	1.3	0.9	1.0	0.6

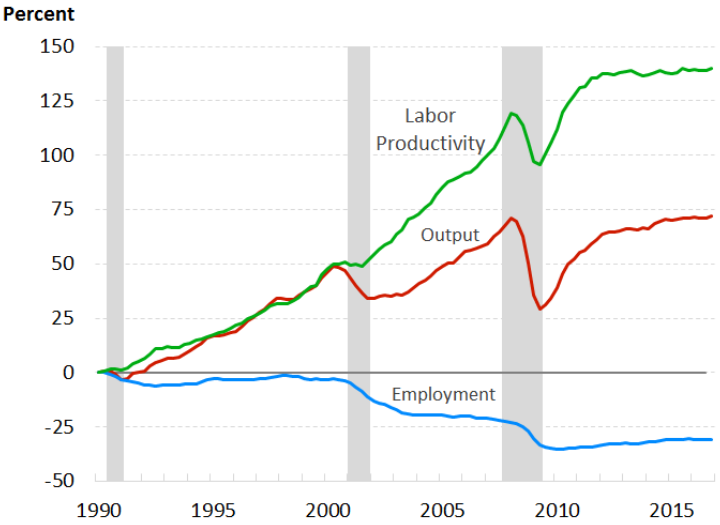
Sources: US Bureau of Labor Statistics (BLS); Quarterly Census of Employment and Wages (QCEW)

Analysis and charts prepared in February and March 2017.

TRENDS IN MANUFACTURING OUTPUT, EMPLOYMENT, AND PRODUCTIVITY

This section examines longer-term trends in US manufacturing output, employment, and labor productivity. Figure 5 contains cumulative changes since 1990 in US manufacturing output and employment. For decades, US manufacturing output has grown while manufacturing employment has declined. In 2016, manufacturing output reached a record high. Since 1990, manufacturing output *grew* 71.8% while manufacturing employment *fell* 30.7%. This means that in 2016 the United States produced almost 72% more goods than in 1990, but with only about 70% of the workers. A similar trend is seen since 2000 when output grew by 17.4% and employment fell by 28.3%. In the post-recessionary period since 2010, manufacturing output grew 23.5% while employment also grew but by only 7.0%.

Figure 5–US Manufacturing: Cumulative Changes in Employment, Output, and Labor Productivity Since 1990



Shaded areas indicate US recessions
Source: US Bureau of Labor Statistics (BLS)

AUTOMATION

Part of the divergence between output and employment trends is due to increases in labor productivity resulting mainly from capital investment to automate production. Automation can include computerized machines, streamlined processes, and robots.[2] In 2014, there were 1.5 million robots in factories and warehouses worldwide, with the number expected to rise to 1.9 million this year. Japan has the most industrial robots at 306,000 followed by 237,000 in North America.[3]

The long-standing trend that automation has decreased manufacturing costs over time has made US manufacturers less expensive and more competitive, reducing the labor required to produce output. Figure 5 contains a line showing cumulative changes since 1990 in US manufacturing labor productivity, or output per hour. Labor productivity has grown 140.1% since 1990, 62.5% since 2000, and 13.2% since 2010.

There are many reasons companies cite for automating manufacturing processes, with increasing labor productivity being just one of them. Other cited reasons include reducing labor costs, lessening the impact of labor shortages, cutting out routine manual tasks, improving worker safety, improving product quality, reducing lead time, and achieving competitive advantage.[4] An article by *BCG Perspectives* states that in 2015 only about 10% of manufacturing tasks globally were performed by robots, but that is expected to rise to 25% by 2025 as robots become less expensive and easier to program, making them more accessible, particularly to small factories. Four manufacturing sectors are expected to account for 75% of the expansion, including computers and electronic products; electrical equipment, appliances, and components; transportation equipment; and machinery.[5] In fact, automation is starting to take hold in other economic sectors beyond manufacturing, including kiosks and tablets to place orders and pay in restaurants, robots to process packages in warehouses, and self-driving trucks in transportation.[6]

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[2] Newman, Rick, "How Robots Paved the Way for Donald Trump," Yahoo Finance, July 14, 2016.
[3] West, Darrell M., "How Technology is Changing Manufacturing," Brookings, June 2, 2016.
[4] Csanyi, Edvard, "9 Reasons for Automation of Manufacturing Processes," Electrical Engineering Portal, January 11, 2016.
[5] Sirkin, Harold; Zinser, Michael; and Rose, Justin; "The Robotics Revolution: The Next Great Leap in Manufacturing," *BCG Perspectives*, September 23, 2015.
[6] Newman, Rick, "How Robots Paved the Way for Donald Trump," Yahoo Finance, July 14, 2016.

Analysis and charts prepared in February and March 2017.

Automation has reduced the cost of US manufactured goods, making manufacturers more competitive, but it is also the main driver of decreased employment in manufacturing. A Ball State University study found that 87% of the job losses in manufacturing from 2000 to 2010 are due to automation that led to productivity growth, and 13% are due to globalization and trade.[7] Increased automation also means that today's manufacturing jobs require skills that go beyond the old-time blue collar jobs of the 1970s. More than half of manufacturing workers now have some education past high school versus only a quarter in 1979.[8]

DECENTRALIZED SUPPLY CHAINS

Besides automation, a second trend has been the development of decentralized supply chains. Manufacturers today achieve lower costs by producing and assembling different components in different locations, but this trend has also contributed to a decline in US manufacturing employment to the extent that production is located outside the United States. The North American Free Trade Agreement (NAFTA), effective since 1994, has allowed domestic auto manufacturers to reduce costs by producing in neighboring countries rather than overseas, leading to a supply chain that spans the United States, Canada, and Mexico. The US automotive industry provides an example of decentralization in the modern manufacturing supply chain.

According to a January 2017 report by the Center for Automotive Research (CAR),[9] the US automotive industry imported $44.3 billion of auto parts produced in Mexico and $14.9 billion of auto parts produced in Canada during 2015, the latest year for which data are available. The table below shows the percentage of parts coming from Mexico and Canada as a proportion of all imports for different categories of auto parts.

Type of Auto Part	Share of Imports From Mexico and Canada
Engine and engine parts	59.8%
Transmission and powertrain parts	47.0%
Electrical and electronic equipment	60.7%
Steering and suspension parts	52.8%
Seating and interior trim	76.0%
Brake systems	36.9%
Automotive lighting equipment	37.8%
Motor vehicle parts not elsewhere specified	55.9%

Auto parts may cross borders as many as eight times before being installed in a final assembly plant in one of the three countries. In fact, US content makes up 40% of the value of light vehicle and parts imports from Mexico and 25% of the value from Canada. Overall, 51% of the value of US auto parts imports is from Canada and Mexico, with three-quarters coming from Mexico and one-quarter coming from Canada. These statistics indicate that parts sourced from Mexico and Canada are integral to the US auto industry.

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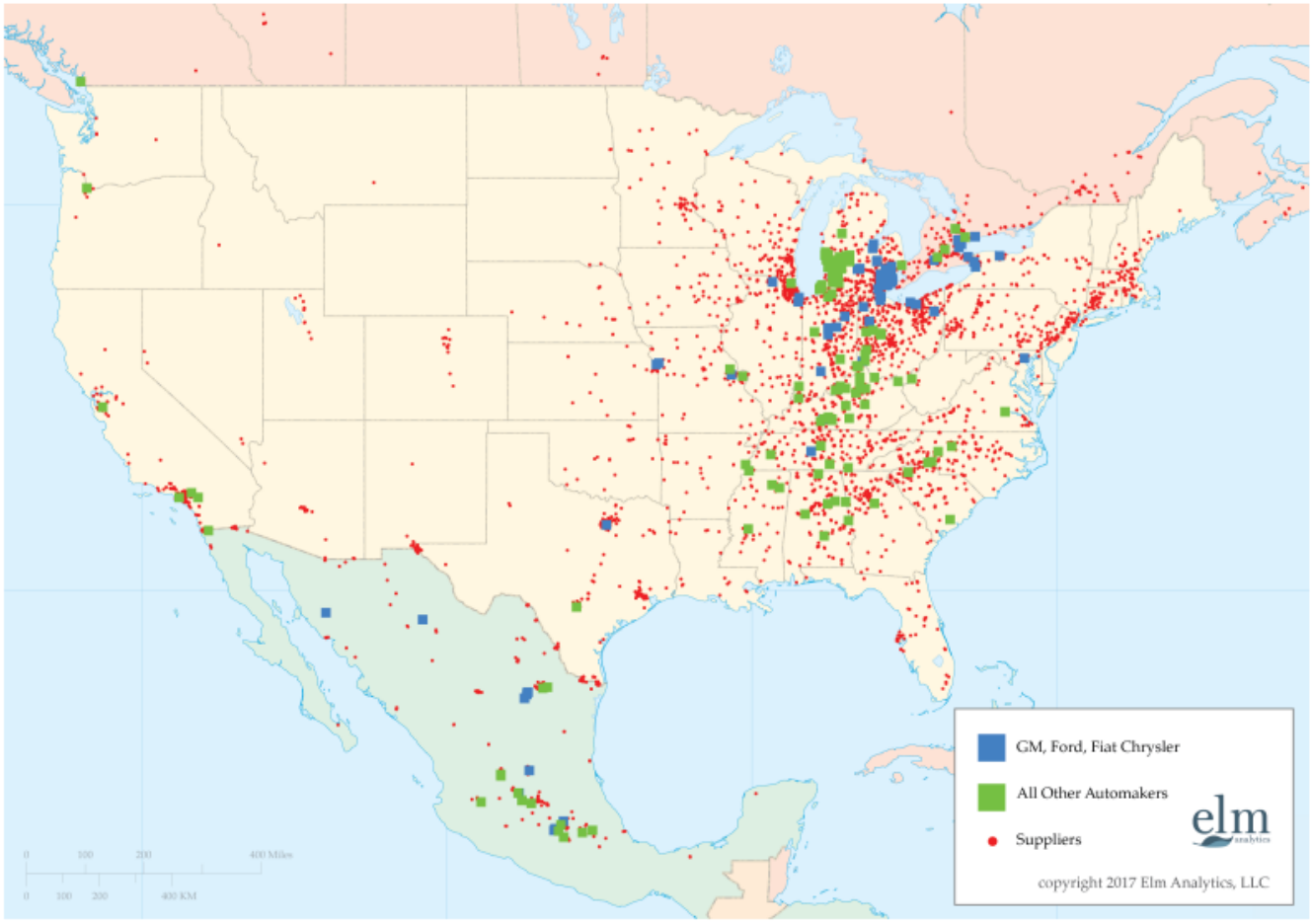
[7] Hicks, Michael J. and Devaraj, Srikant, "The Myth and the Reality of Manufacturing in America," Ball State University, June 2015, p. 6.
[8] McGill, Andrew, "The Impossibility of Reviving American Manufacturing," *The Atlantic*, April 28, 2016.
[9] "NAFTA Briefing: Trade Benefits to the Automotive Industry and Potential Consequences of Withdrawal from the Agreement," Center for Automotive Research (CAR), January 2017, www.cargroup.org/?module=Publications&event=View&pubID=148.

Analysis and charts prepared in February and March 2017.

The map in Figure 6 shows the interconnection of automotive supply chains. There are approximately 6,500 original equipment manufacturer and supplier locations across the United States, Mexico, and Canada. The squares are original equipment manufacturers (OEM) and can be both automaker assembly plants and automaker parts plants. Blue indicates the plant is one of the former three Detroit automakers (Ford, GM, or Chrysler [now Fiat Chrysler]) and green indicates all other automakers. The red circles indicate automotive suppliers.

The map illustrates that automotive parts and components are produced in all three countries. These decentralized supply chains have allowed automotive manufacturers to locate assembly and parts plants in the location with the lowest costs, increasing their competitiveness, but also contributing to the decline in employment shown in Figure 5. Because of NAFTA, US automakers have structured their US operations interdependently with Canadian and Mexican suppliers, some of whom are OEMs themselves.

Figure 6-North American Automotive Original Equipment Manufacturer and Supplier Facilities, March 2017



Source: Elm Analytics

Analysis and charts prepared in February and March 2017.

KEY TAKEAWAYS

In this report, we have focused on the manufacturing sector. Key takeaways include:

- Manufacturing is important to the workers compensation industry because it makes up a disproportionate share of premium (15%) relative to exposure (8%).
- States with high manufacturing employment shares are primarily located in the Midwest and central South. States in the East and West tend to be more service-oriented, with lower shares of manufacturing employment.
- Durable manufacturing is more cyclical than nondurable manufacturing. Therefore, states with higher concentrations in durable goods industries can be harder hit by economic slowdowns.
- For several decades, US manufacturing real output has increased while employment has declined. In 2016 the US produced almost 72% more goods than in 1990, but with only about 70% of the workers.
- Increases in automation have reduced manufacturing costs, making US manufacturers less expensive and more competitive, and reducing employment required to produce output.
- Decentralized supply chains allow manufacturers to achieve lower costs, but also contribute to a decline in US manufacturing employment to the extent that production is located outside the United States.

Analysis and charts prepared in February and March 2017.