

AUGUST 2019

THE STATE OF MONTANA MANUFACTURING

EXECUTIVE SUMMARY

Prepared for the Montana Manufacturing Extension Center
Prepared by Robert Sonora



**BUREAU OF BUSINESS AND
ECONOMIC RESEARCH**
UNIVERSITY OF MONTANA

Contents

Introduction..... 2
World Outlook: Growth is Hampered by Uncertainty 4
Manufacturing Overview..... 5
Manufacturing and the Montana Economy 11
Manufacturing Establishments 18
Employment Size..... 19
Manufacturing Earnings..... 20
Manufacturing Employment 21
Manufacturing Employment by Industry 22
Montana’s Manufacturing Exports 26
Manufacturer’s Outlook 29

Introduction

As of this writing, the United States economy is in its 40th quarter of expansion – the longest in American economic history. Since the end of the recession through 2019, quarterly real GDP has grown an average of 2.3 percent; the headline unemployment rate has fallen about 6.3 percent to 3.7 percent; the core rate of inflation has remained close to or below the Federal Reserve’s preferred rate of 2 percent; and an average of 390 thousand jobs are being created every quarter. In 2018, real GDP grew an average of 2.5 percent. In 2019, it grew 2.6 percent.

Despite the favorable statistics, over the past year there have been some worrying signs coming from the data and policymakers. The Fed is forecasting real GDP growth to be at or below 2 percent for the foreseeable future. And perhaps more importantly to the Fed, inflation is stubbornly staying below 2 percent, despite the low unemployment rate. While the unemployment is at a near all-time low of 3.7 percent, it is worth noting that other labor force data are not as robust. The civilian labor force participation rate and the employment population ratio, which account for “discouraged workers,” are at their lowest levels since the mid-2000s.

A point highlighted by the Federal Open Market Committee (FOMC), the Fed’s monetary policy making group, stated at its July meeting:

“In light of the implications of global developments for the economic outlook as well as muted inflation pressures, the Committee decided to lower the target range for the federal funds rate to 2 to 2-1/4 percent.”¹

Other signs of a potential slowdown are the inversion of the yield curve, as measured by the difference between 10-year and 3-month bond yields. While some view this statistic as losing its predictive power, many recession probability models, including BBER’s, continue to find a strong connection between an inverted yield curve and recession.

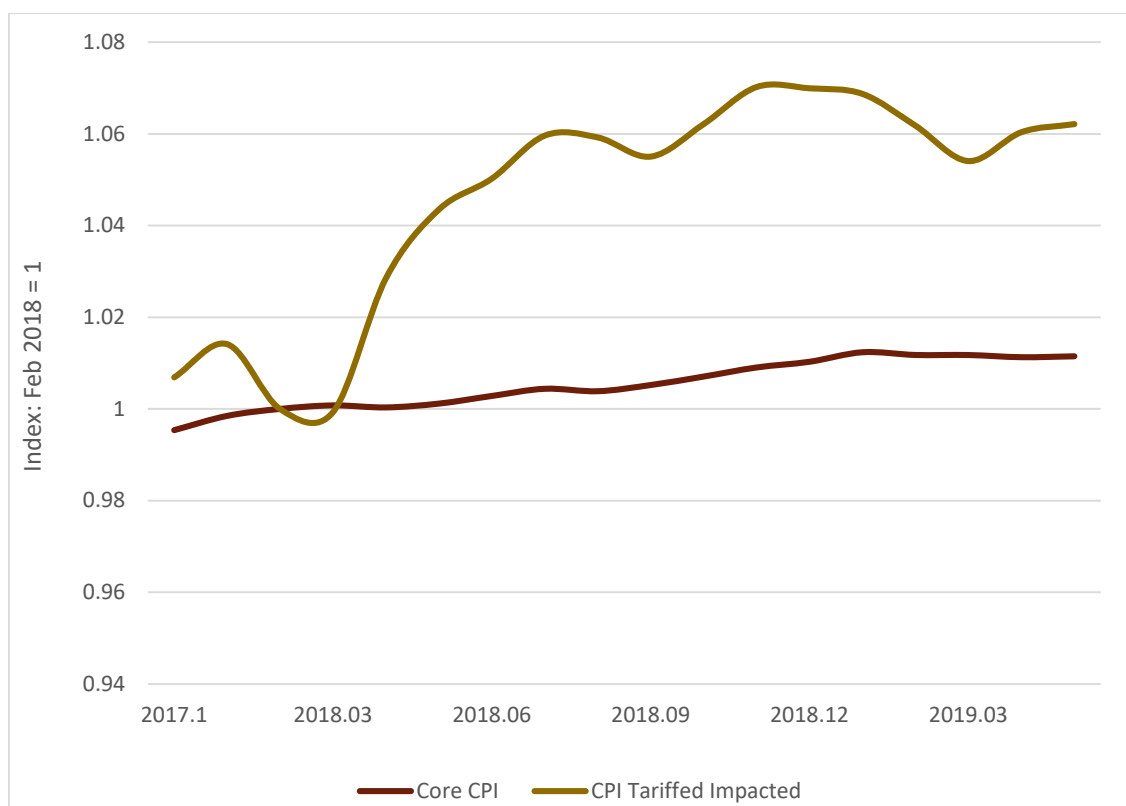
The primary headwinds facing the U.S. economy are twofold: first, the Tax Cuts and Job Act of 2017 was intended to increase disposable income for lower and middle income households. However, this didn’t pan out as expected. Moreover, reducing corporate taxes did not translate into the intended investment boom. Indeed, investment growth is decelerating.

The second headwind is the set of tariffs imposed by the federal government on imported goods, including those imposed on the U.S.’s largest trading partners. The first round began in January 2018, on consumer appliances and was quickly followed by tariffs on imported steel and aluminum. In July, an additional \$50 billion in tariffs were added on Chinese imports beginning in May 2019. The repercussions of these restrictive trade policies resulted in predicted retaliatory tariffs on U.S. exports.

Of more interest to the manufacturing sector, tariffs on imported intermediate goods has undermined many sectors of the economy. According to the Association of Equipment Manufacturers, the tariffs could result in 400,000 jobs lost over the next 10 years.

¹ Federal Open Market Committee, Board of Governors of the Federal Reserve statement, July 31, 2019 (<https://www.federalreserve.gov/newsevents/pressreleases/monetary20190731a.htm>).

Figure 1. Tariff impacted goods vs. core CPI.



Source: BBER calculations using data from the Bureau of Labor Statistics, sectors are appliances, bedding, floor coverings, auto parts, materials.

A recent study by the Peterson Institute for International Economics found that tariffs on steel and aluminum imports are costing the U.S. economy an astounding \$900,000 per job saved.² Similarly, economist from the University of Chicago and the Federal Reserve demonstrated the cost per job saved to be about \$815,000.³ Another study conducted by economists from the New York Fed, Columbia and Yale found that 100 percent of the tariffs are being passed onto consumers in the form of higher final goods prices.⁴

Figure 1 shows the price of the most tariff affected goods compared to core CPI. The shaded area is the period in which tariffs have been in place and were first brought to attention in a report from Goldman-Sachs. Goods on tariffed goods have risen sharply relative to other prices and are about 4 percent higher than core CPI.

² Gary Clyde Hufbauer and Euijin Jung (2019). "Steel Profits Gain, but Steel Users Pay Under Trump's Protectionism," Peterson Institute for International Economics.

³ Aaron Flaen, Ali Hortaçsu, and Felix Tintelnot (2019). "The Production, Relocation and Price Effects of U.S. Trade Policy: The Case of Washing Machines," The University of Chicago, Becker Friedman Institute, WP.

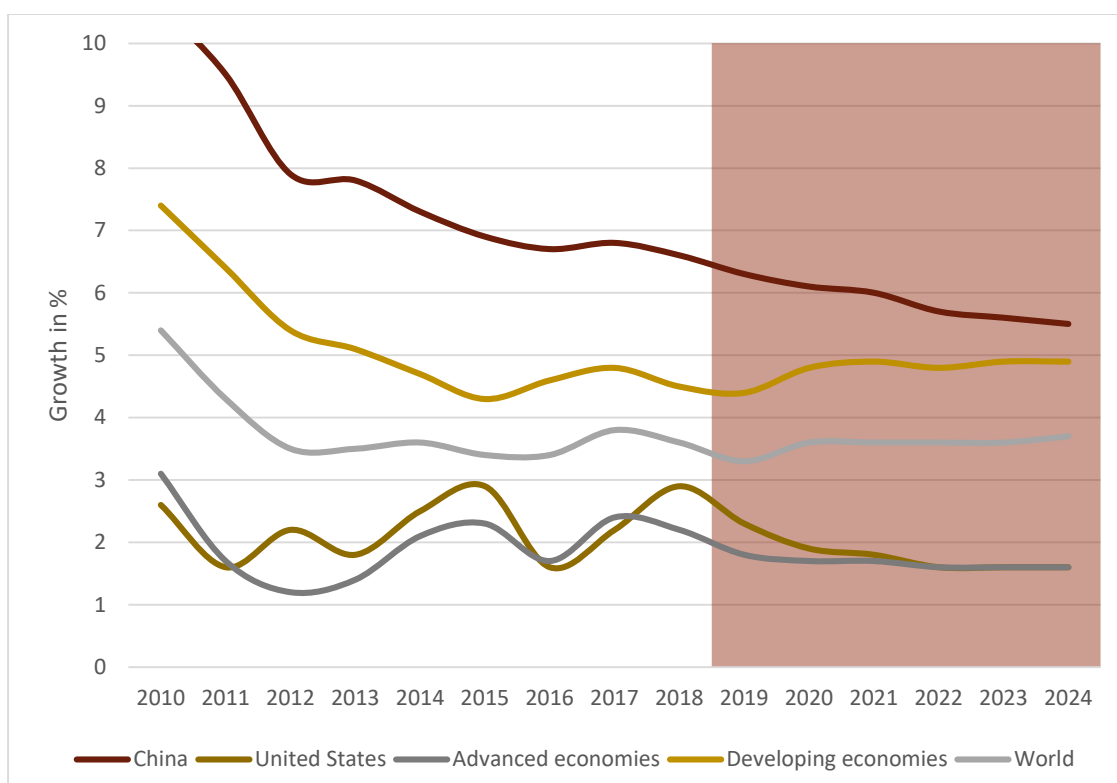
⁴ Mary Amity, Stephen J. Redding, and David E. Weinstein (2019). "The Impact of the 2018 Trade War on U.S. Prices and Welfare," Centre for Economic Policy Research, Discussion Paper DP 13564, London, U.K.

World Outlook: Growth is Hampered by Uncertainty

According to the International Monetary Fund (IMF), global economic growth is forecast to slow over the foreseeable future as seen in Figure 2. They note that a global growth slowdown began in the second half of 2018. Projected growth for 2019 is 3.3 percent down from an initial forecast of 3.6 percent. It then rises back to 3.6 percent in 2020. Across the spectrum of economies, advanced economies growth should remain at or below 2 percent while developing economies can anticipate 5 percent growth through next year.

An OECD report cites slowing trade and global manufacturing in addition to high policy uncertainty and financial risk to the list of global economic risk factors. The OECD is particularly bearish on the Eurozone with projected growth rates of 1 percent and 1.2 percent in 2019 and 2020. Canadian, Mexican and Korean estimates have been revised down to 2 percent, 2.3 percent and 2.6 percent in 2020 respectively.

Figure 2. IMF real GDP forecast (shaded areas represents forecasts).



Source: International Monetary Fund, World Economic Report.

Receiving less attention than tariffs is the steady appreciation of the dollar to other currencies. Since 2018, the U.S. dollar has appreciated from 5 to 10 percent against many of its' largest trading partners, which should lead to a decline in net exports as U.S. goods become more expensive.

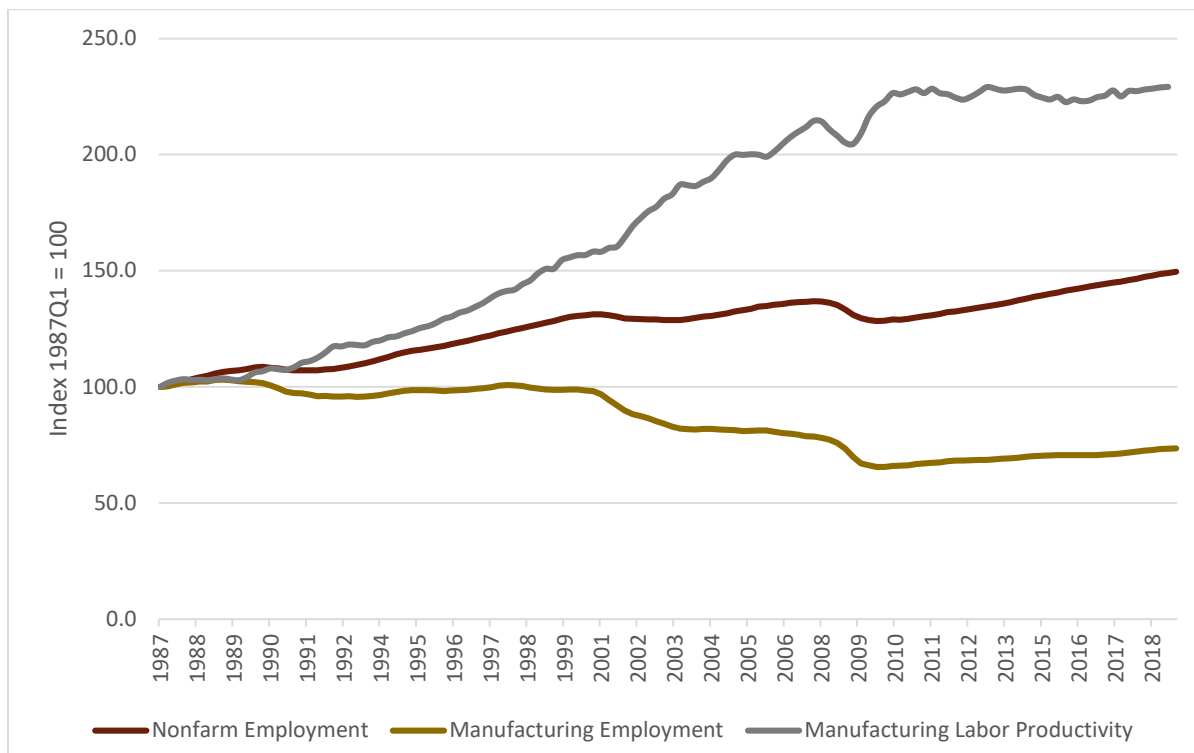
All this has manifested in a fall in world and U.S. business confidence. According to a recent report from Moody's Analytics, business confidence is close to levels not seen since the end of the financial crisis.⁵

⁵ Moody's Analytics, Moody's Analytics Survey of Business Confidence, July 2019.

Manufacturing Overview

We begin our discussion with an overview of manufacturing at the national level. U.S. manufacturing is sometimes pictured as an anachronistic activity in the “new” knowledge-based economy. The true story is subtler and complicated. New investments, often incorporating the latest technology, are particularly important for manufacturers as they constantly improve productivity and efficiency. In most cases, these new investments lead to more output being squeezed from a given amount of inputs or fewer inputs are required to produce a certain output.

Figure 3. Nonfarm and manufacturing employment and manufacturing labor productivity.



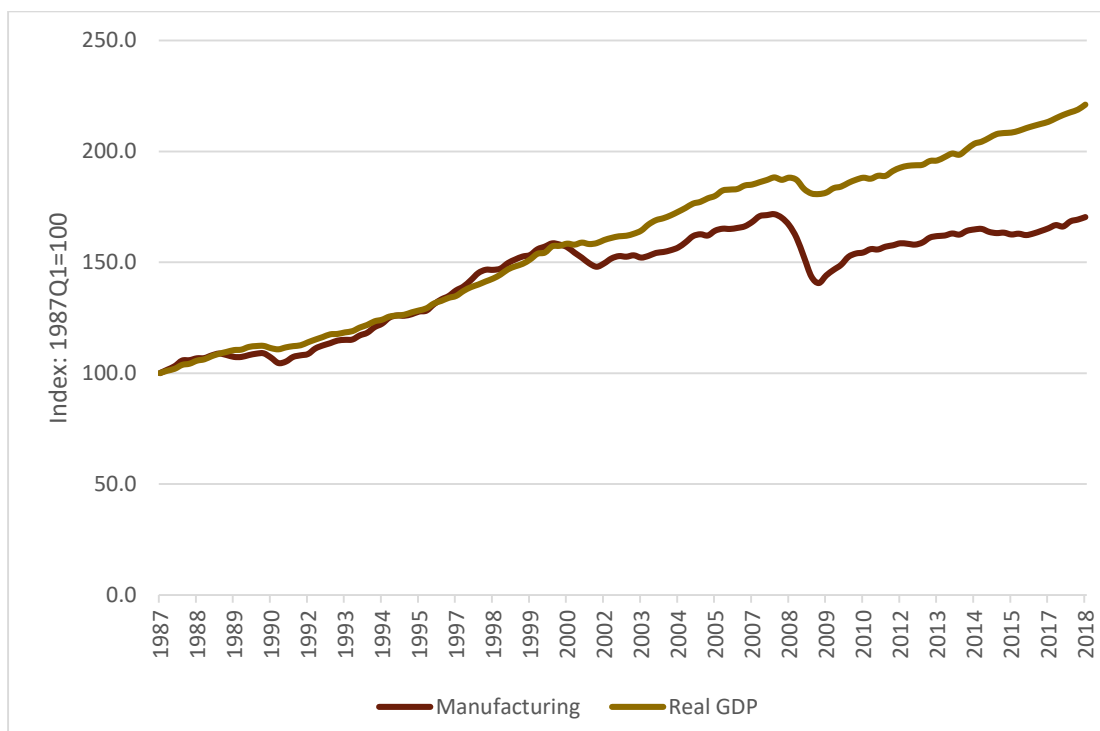
Source: Bureau of Labor Statistics.

Figure 3 presents an index, 1987Q1 = 100, of U.S. manufacturing and overall nonfarm employment, as well as manufacturing labor productivity. We can see that overall nonfarm employment has trended upwards with the declines associated with the recessions of 1990, 2000 and 2007-09. Manufacturing employment on the other hand, remained flat until about 2000 and has been in general decline since. Immediately following the recession in 2009, manufacturing employment was about 34 percent below 1987 levels. By 2019Q1, it had risen to 27 percent below 1987 levels. We will look at post-2010 data in more detail below as our discussion will center on the post-recession recovery.

The long term decline in manufacturing employment is sometimes misinterpreted as an indicator of the poor overall health of the industry. Improvements in productivity and efficiency change the relationships between inputs and outputs. Decreases in employment do not necessarily mean less output is produced or a 10 percent growth in output may not be associated with an equivalent change in some or all of the inputs.

The third line in Figure 3 is an index of worker productivity in the manufacturing sector. This measure has been rising sharply since 1990 and is now about 130 percent above 1987 levels, which explains how few employees are offset by better productivity. The rise in worker productivity is in line with manufacturing capital intensity, a measure of how much capital per worker is used in industry. It is currently about 175 percent above 1987 levels.

Figure 4. Index of manufacturing and real GDP.

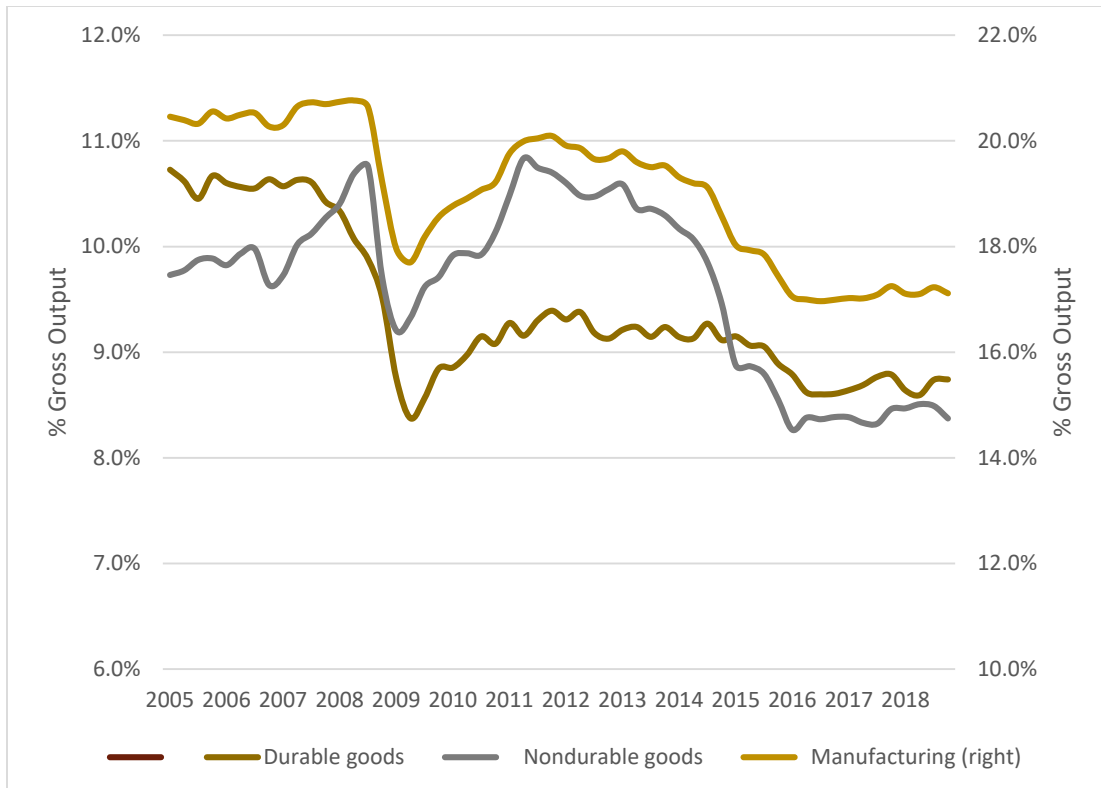


Source: Bureau of Economic Analysis.

Figure 4 presents at the output side of manufacturing and national final output, adjusted for inflation. Output indices, 1987Q1=100, shows real manufacturing output compared to overall real GDP. In a similar story to the discussion above with output, total output and manufacturing output followed a similar trajectory until 2000 when real GDP began to rise relative to manufacturing. We can see a large drop in manufacturing during both the 2000 and 2007-09 recessions. Though manufacturing and GDP have been growing roughly the same rate since 2010, 1.9 percent for manufacturing and 2.0 percent for real GDP, this drop lead to manufacturing lagging national output by about 29 percent.

Turning our attention to differences across durable and nondurable goods between 2005 and 2018, in Figure 5, which shows the share of overall output to overall, durable and nondurable manufacturing. The data shows that durable fell further and recovered slower than nondurable manufacturing, but that nondurables have shrunk considerably since 2015 and now represent a smaller share of output than durable goods – 8.3 percent versus 8.7 percent.

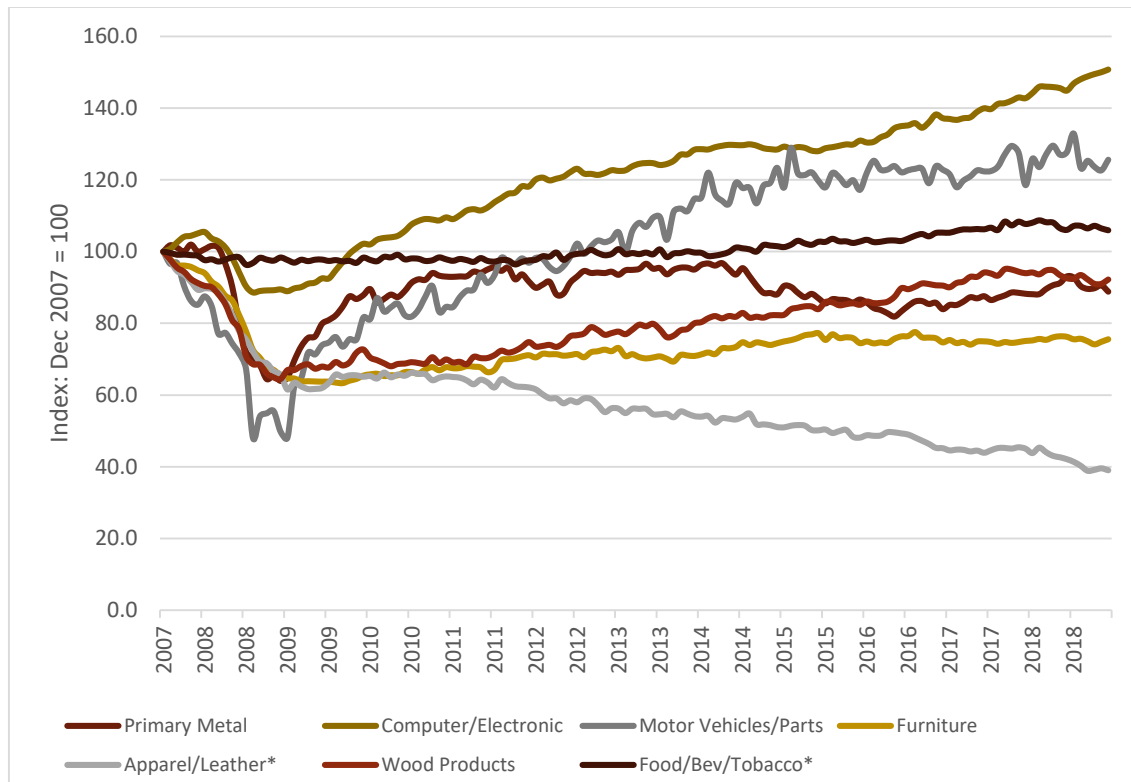
Figure 5. Manufacturing as share of gross output.



Source: BBER calculations using data from the Bureau of Economic Analysis.

Industrial production indexes for seven manufacturing sectors since the start of the 2008-09 recession are illustrated in Figure 6. An asterisk (*) by a sector name denotes nondurable goods. Only computers and electronics, and motor vehicles and parts production are significantly above where they were before the recession. Primary metal, furniture, wood products, and apparel and leather manufacturing have fallen, with apparel and leather about 60 percent below prerecession levels. Food, beverages and tobacco remains more or less unchanged.

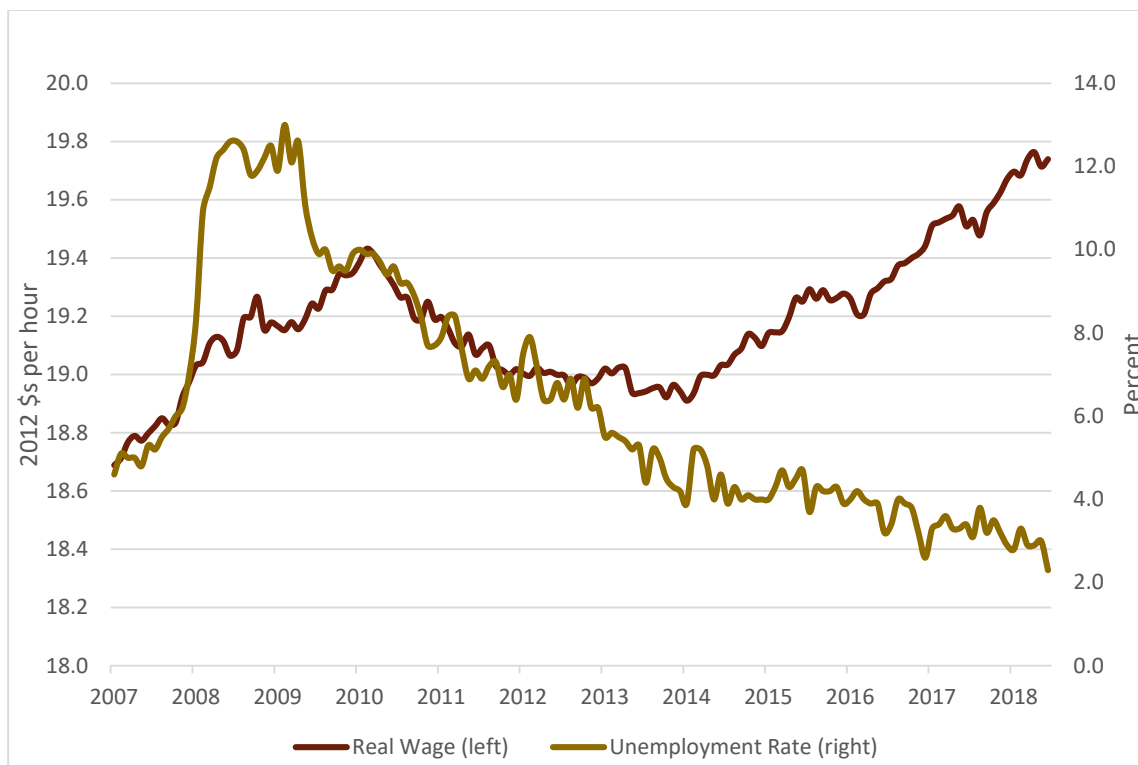
Figure 6. U.S. industrial production by sector: 2007.12=100.



Source: Board of Governors of the Federal Reserve. * denotes nondurable goods.

For those workers who remain in manufacturing there are positive signs. Figure 7 shows the national inflation adjusted average hourly wage for manufacturing workers in 2012 dollars and the manufacturing unemployment rate. Manufacturing wages got a big boost coming out of the recession, then between 2010 and 2014, saw a decline in their spending power. But midway through 2015 real wages began to climb to their current level of about \$19.75 per hour. Manufacturing unemployment has been falling since 2009 and now hovers in the 2.3 percent range – about 1.5 percent below the national average unemployment rate.

Figure 7. Real wage and manufacturing unemployment (right).



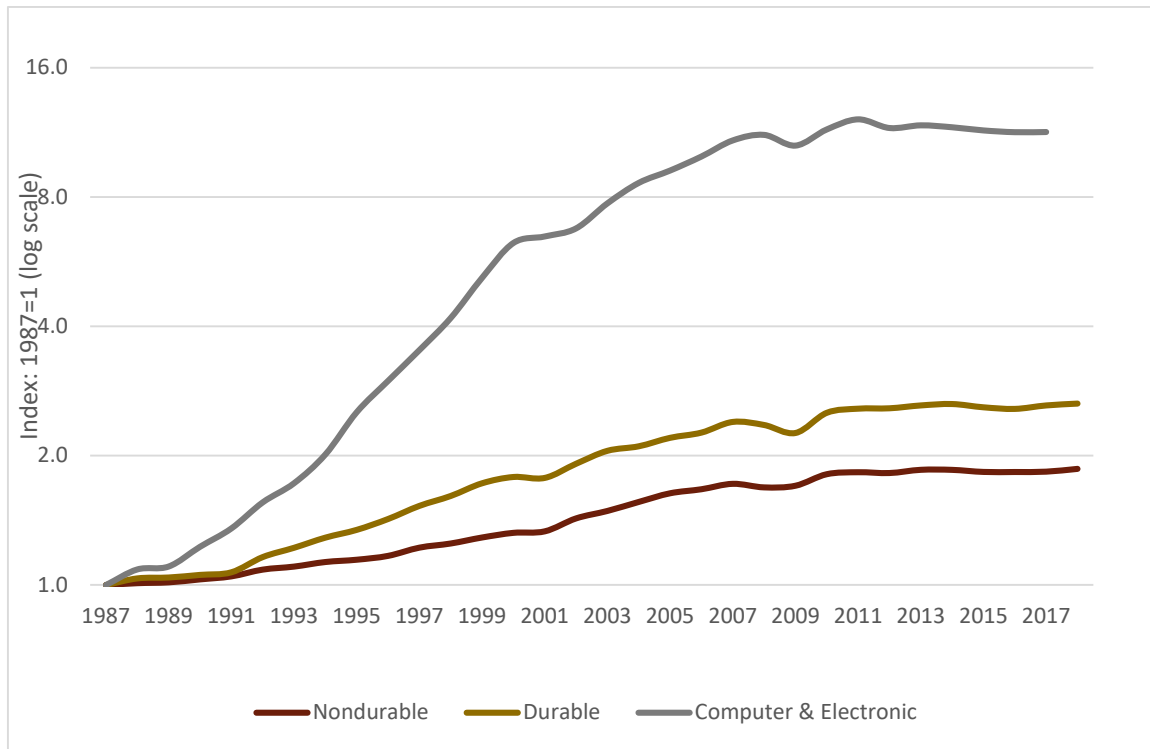
Source: Bureau of Labor Statistics and the Bureau of Economic Analysis.

Summary

Before we move onto Montana, let's consider the causes of the decline in manufacturing. First is the changing structure of the U.S. economy, which has been moving from a manufacturing based economy to a service based one for the past 40 to 50 years. In 1990, the ratio of manufacturing to service employees was about 0.202. By the end of 2018 that ratio was 0.099. As discussed above, much of that has been due to changing production processes in manufacturing – capital intensity in manufacturing is raising worker productivity and reducing the need for as many workers, despite the “de-mechanization” of manufacturing.

An alternative explanation stems from the sectors in manufacturing. In the U.S., most manufacturing gains have been in computer and electronic products (NAICS 334) – labor productivity indices for durable, nondurable, and computer and electronics. Figure 8 illustrates that productivity for nondurable and durable goods have grown significantly slower than in computer and electronics manufacturing. In 2017, labor productivity was about 84 percent and 162 percent above 1987 levels for nondurable and durable manufacturing, respectively. These statistics pale in comparison to the 1,033 percent higher productivity in NAICS sector 334. However, much of growth in computer and electronics occurred prerecession. Since 2008 productivity in computer and electronic production increased by two percent whereas nondurable and durable productivity grew nine and eleven percent, respectively.

Figure 8. Computer, durable and nondurable labor productivity (log scale).



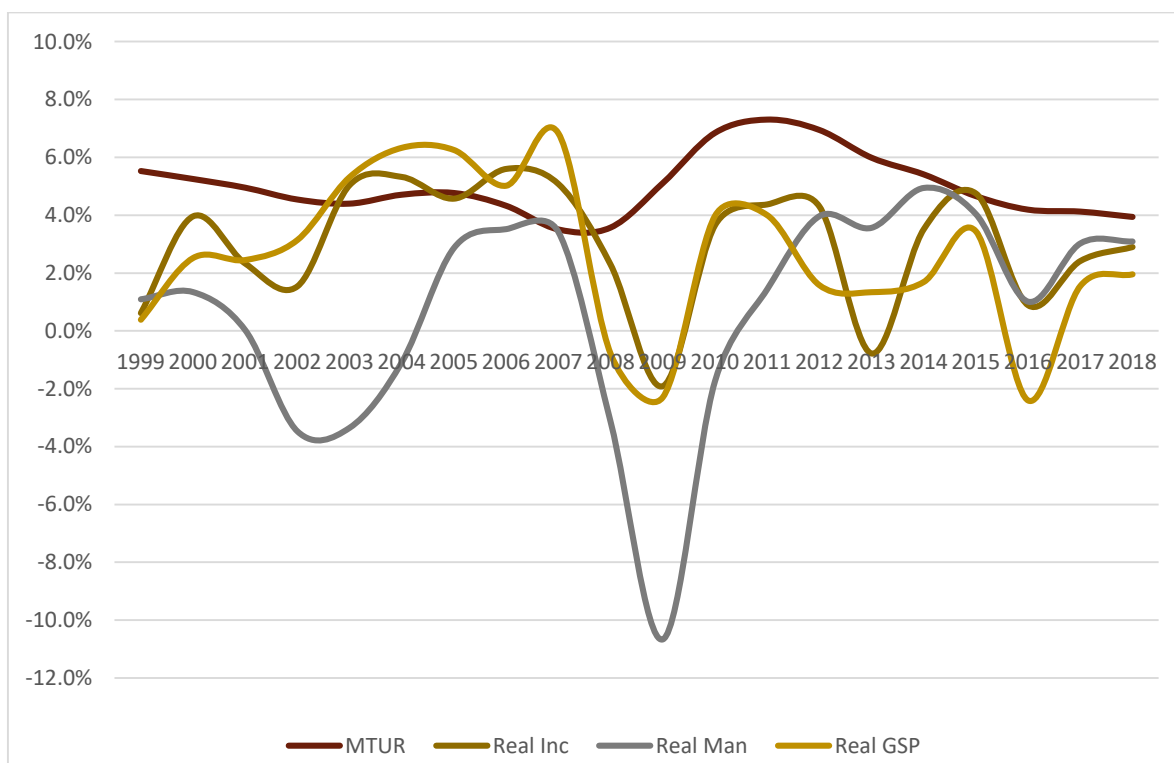
Source: Bureau of Labor Statistics.

Globalization has also played a role. Overall, manufacturing has been shifting to foreign countries as predicted by the product life cycle. Manufacturing in the U.S. has matured and in an increasingly integrated world economy, which accelerated during President Ronald Reagan’s administration, production has shifted abroad. This effect was heightened when China became a member of the World Trade Organization (WTO) in December 2001. We also cannot ignore the recent appreciation of the U.S. dollar in relation to major trading partners. The value of the U.S. dollar is about 35 percent higher today than it was at this time in 2011, making foreign imports cheaper at the expense of U.S. exports.

Manufacturing and the Montana Economy

According to 2018 data, Montana's economy is roughly in the same position as the U.S. as a whole. The 2018 unemployment rate, MTUR, averaged 3.8 percent, and in constant 2012 prices gross state product (GSP) averaged 2 percent growth and mean personal income grew 2.9 percent. Manufacturing income growth average 3.1 percent in 2018. As show in Figure 9, real manufacturing income took a substantial hit during the Great Recession, but has since bounced back. After 2012, manufacturing earnings outpaced both total income and state GSP. Moreover, as shown in Figure 10, the share of total state income has stabilized at about 2.75 percent after falling from 4.5 percent 20 years ago.

Figure 9. Montana macroeconomy.



Source: Bureau of Economic Analysis.

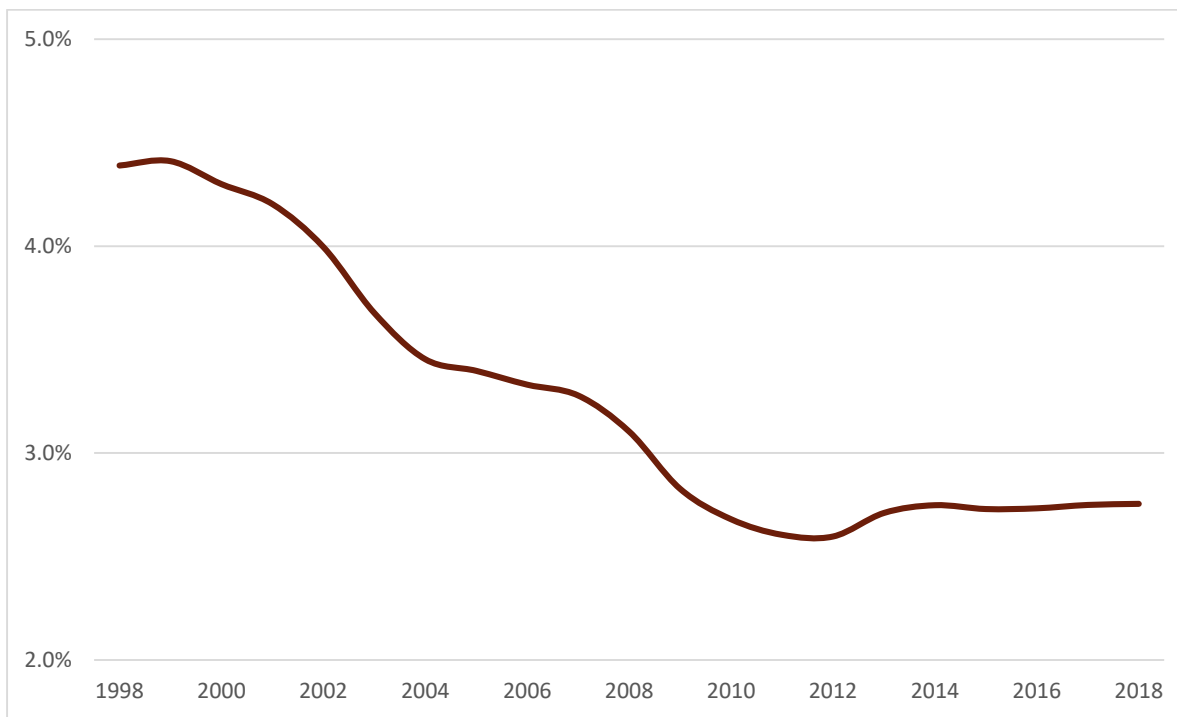
Trends in the Montana economy are primarily determined by the basic industries. Basic industries are those that are located in a state, but sell most of their products elsewhere or are otherwise influenced by factors beyond the state's borders. Basic industries inject new funds into the state economy and are responsible for creating further income and jobs.

Focusing on the relationship between Montana manufacturing and overall nationwide manufacturing – in Figure 11 indexed to 2001, we can see that over Montana has outpaced the nation since 2001. Diving deeper into differences between durable and nondurable production reveals where most of Montana's manufacturing growth originates – nondurable manufacturing, which includes food, beverages, apparel, etc. Manufacturing here began outperforming the country as a whole in the mid-2000s.

By the 2007-09 recession, Montana's output index was almost 10 percent higher than in the U.S. as a whole. But the recession causes the state's manufacturing to fall more precipitously than in the U.S. As we can see, that is

wholly due to the decline in durable manufacturing in Montana. Between 2007 and 2010 nondurable manufacturing grew 8.5 percent during the recession, but the gains were offset by a 25 percent decline in durable output. Since 2013, durable manufacturing has outpaced the national average, while (as of 2017) the index nondurable production is about 50 percent higher in Montana.

Figure 10. *Manufacturing-to-total income.*

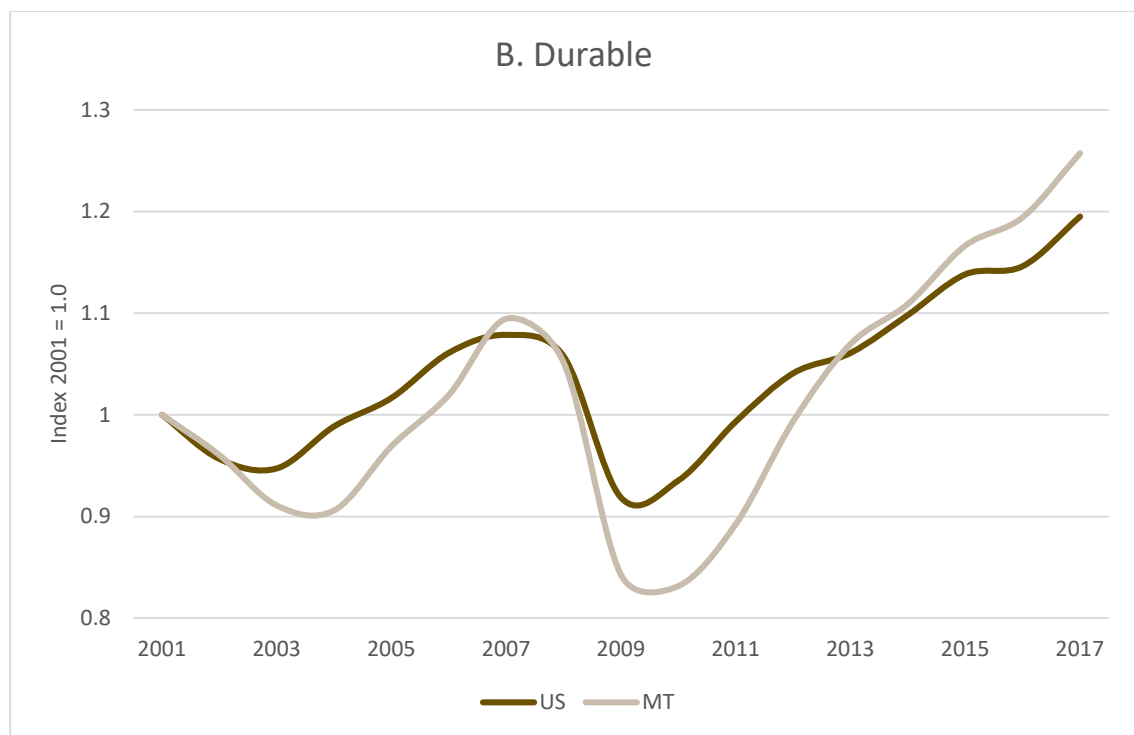
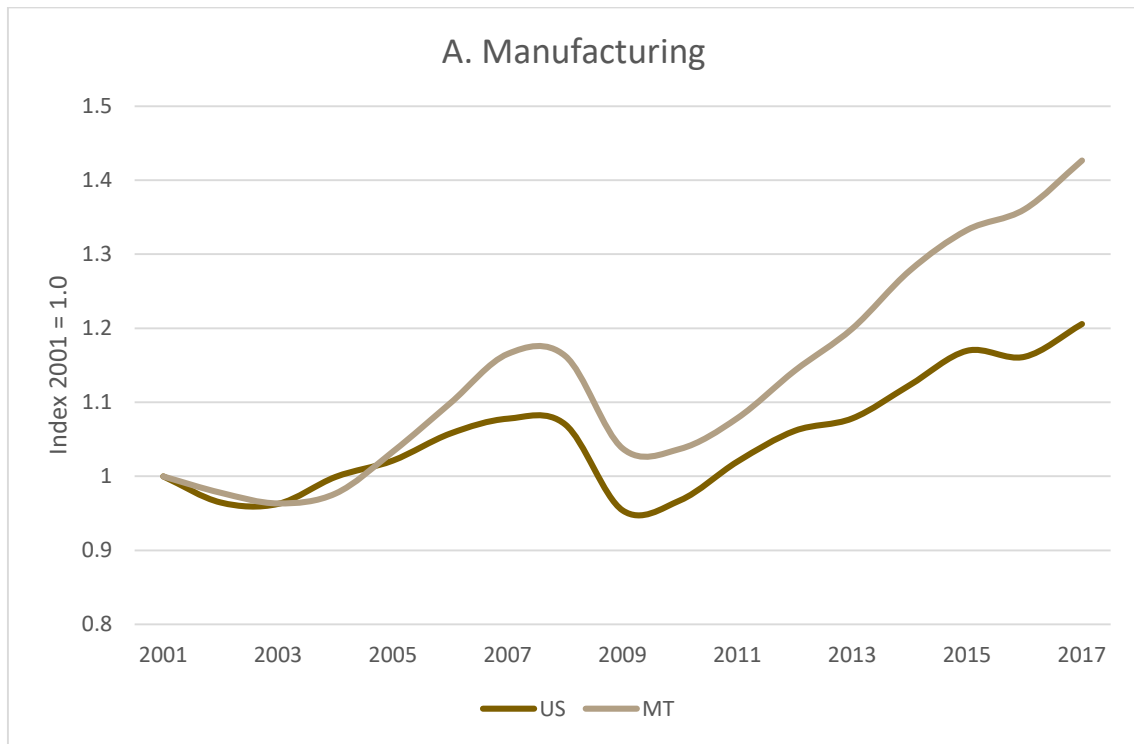


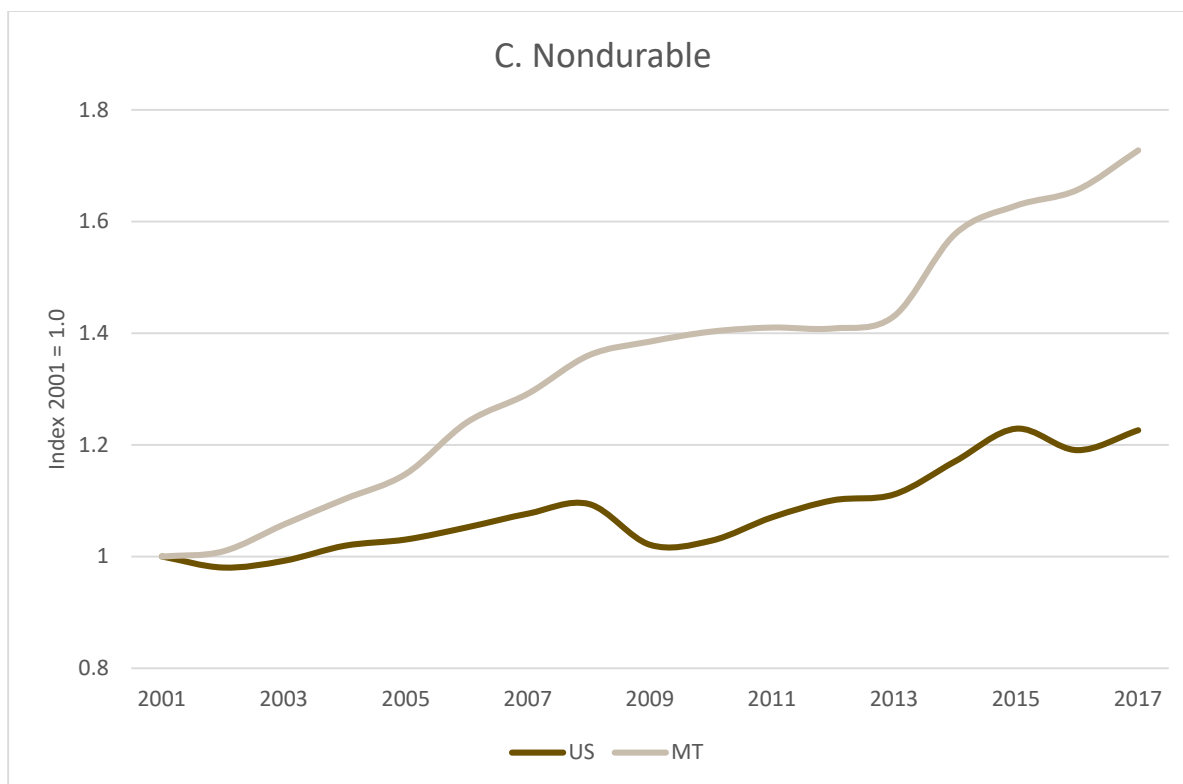
Source: Bureau of Economic Analysis.

Specific industries within manufacturing might be changing due to evolving and improving practices. One example is a greater emphasis on supply chain management. Increased use of supply chain methods suggest that today's production processes may be very different from those used only a few years ago.

The BEA method assigns certain industries to the "basic" sector in each state. In Montana these industries include manufacturing, mining, agriculture, the federal government, tourism and rail/truck transportation. Other industries may also be classified in basic sector in certain cases. For example, financial services in New York, insurance in Connecticut and Indiana, and amusement places, such as casinos in Nevada, all serve nonlocal markets and are part of their state's economic base.

Figure 11. U.S. and Montana manufacturing production, 2001=1.0.





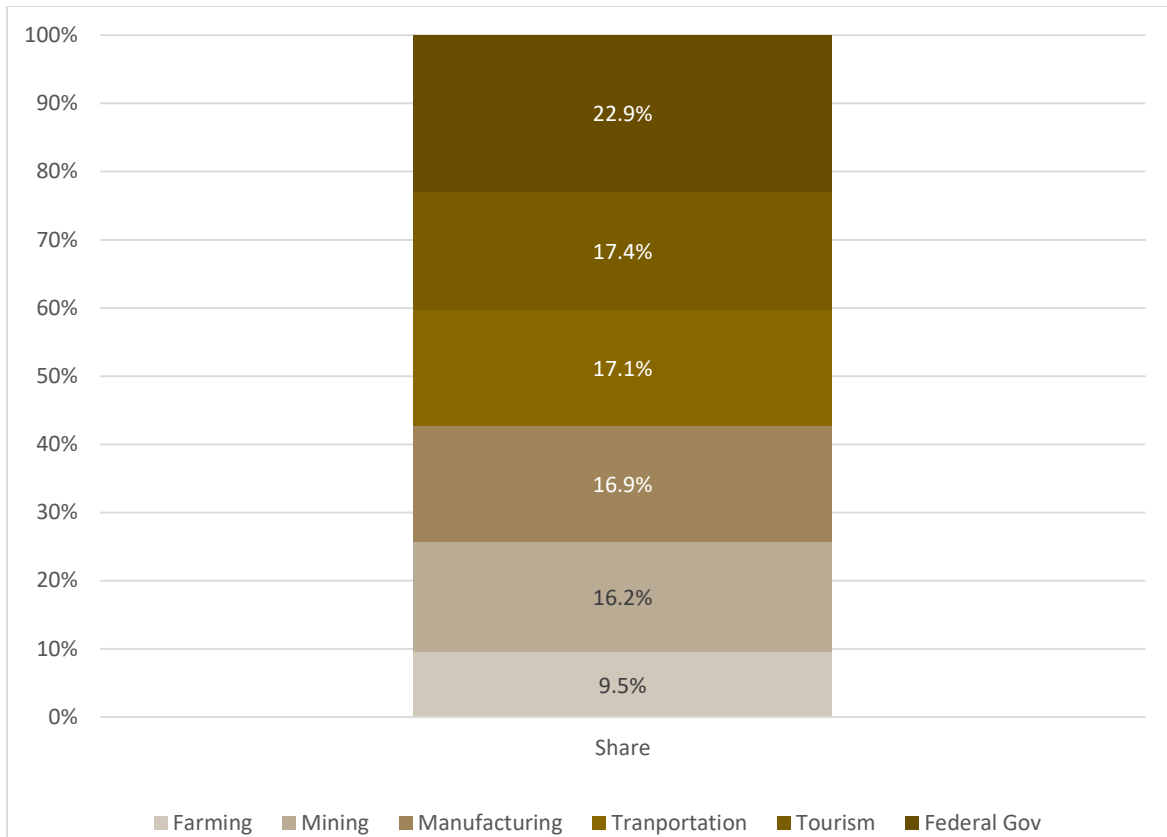
Source: Bureau of Economic Analysis.

To quantify the role base industries play in the Montana economy we consider the earnings for each sector. Gross state product (GSP) data is not well-suited to analyze trends in manufacturing from one year to the next. The disadvantage of GSP data is that it is not available prior to 1997 and the most current figures are several years old or do not provide detail for specific subsectors within manufacturing.

Earnings data is more appropriate for analyzing trends from one year to the next and for periods of a decade or more. But earnings data also has its own characteristics. For example, net farm income of family owned farms and ranches, a major component of farm earnings, is extremely volatile and not a reliable measure of output, revenues or overall economic conditions in the agricultural sector. Consequently, the following sections will analyze nonfarm earnings to identify overall economic trends. Using nonfarm earnings does not imply that agriculture is ignored. Earnings in agricultural services are explicitly included. Excluding farm earnings eliminates a volatile component that could mask important trends elsewhere in the economy.

The share of earnings over the period 2010-18 in each of Montana's basic industries are shown in Figure 12, which shows the share of earning of all basic industries from 2010 to 2018. The share of private earnings in tourism, transportation and manufacturing all hover in the 17 percent range. Manufacturing accounts for about 16.9 percent of total earnings in basic industries and is the fourth largest basic industry. Mining accounts for about 24 percent of basic earnings and ranks just behind manufacturing. Mining includes the oil and gas extraction industry. Farming provided about 10 percent of total basic earnings over 2010-18.

Figure 12. Share of basic earnings, 2010-18.



Source: Bureau of Labor Statistics and the Bureau of Economic Analysis.

Manufacturing contributes to recent economic trends in Montana despite accounting for a relatively modest portion of the economic base. It is worth noting that manufacturing earnings grew each year after the recession trough. This importance is illustrated by the data in Figure 13, which presents the year-to-year changes in nonfarm basic earnings by industry from 2010 to 2018 in inflation adjusted 2012 prices.

Manufacturing is highlighted with the year-on-year change in earnings presented with the four other nonfarm basic industries. Total gains/losses to these industries is represented by the gray line. The value of the change in earnings for manufacturing and all five basic industries are also shown. Overall, we see a “u-shaped” trend for the data presented with the bottom in 2015-16 at --\$281 million – when the state as a whole experienced a minor short-lived recession.

The changes in basic earnings are presented for each nonfarm basic industry below, starting in 2010 and each year thereafter through 2018:

2010-11: Across the industries presented, the overall change in earnings was \$540.6 million. The largest increase was in mining (\$354.5 million), followed by transportation. Changes in manufacturing earnings rose \$23.6 million.

2011-12: Overall earnings change slowed to \$266.9 million. Manufacturing earnings rose \$40.2 million, mining again experienced the largest change in earnings, but now private earnings growth is more balanced. Federal government earnings fell \$29.6 million.

2012-13: Earnings in general increased slightly to \$99.8 million. Government earnings continued in the negative column and mining fell as mineral prices began to stabilize. Transportation saw the largest increase in earnings (\$83.3 million) and manufacturing rose \$35.5 million.

2013-14: Throughout 2014, oil and gas prices fell and the mining earnings declined \$75.6 million. Manufacturing gained momentum adding an addition \$52.4 million in earnings.

2014-15: The continuing slide in energy prices saw mining earnings fall \$360.6 million. Tourism earnings rose \$63.6 million and manufacturing earnings increased \$33.8 million. Overall earnings slumped by \$267.1 million.

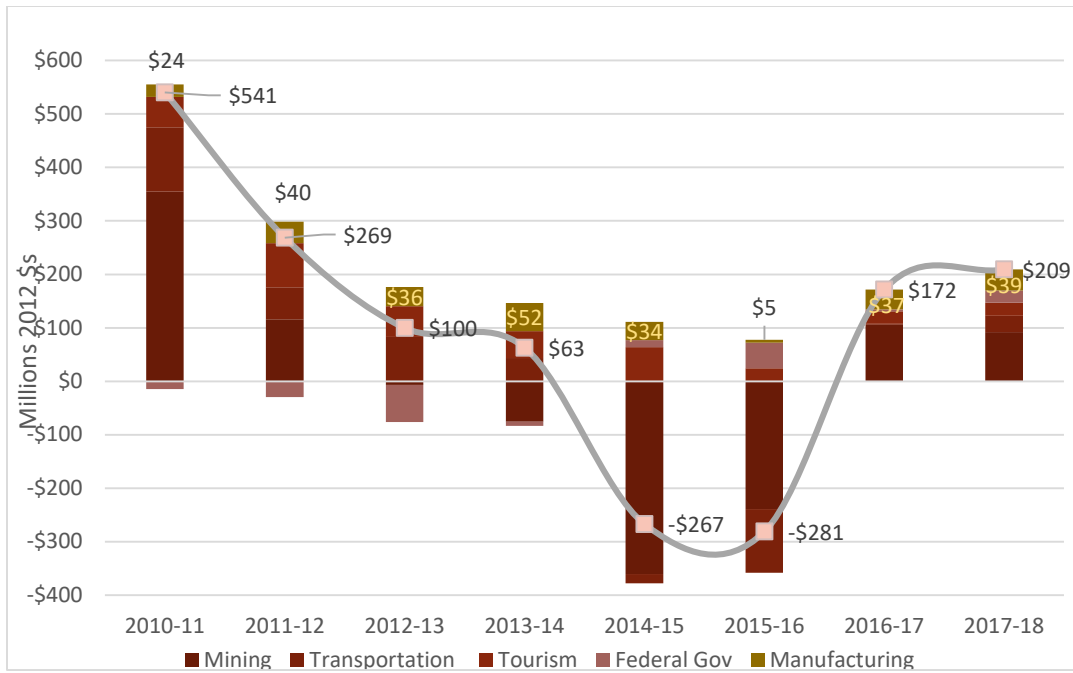
2015-16: Woes continued for mining and transportation in 2015-16, collectively falling \$358 million. Manufacturing rose modestly by \$5 million and government earnings rose by \$47.7 million. Overall, statewide industries earnings fell \$281 million.

2016-17: Agriculture experienced another earnings decline as prices stabilized, while mining's fortunes reversed course rising \$105.9 million. Tourism earnings slowed an additional \$1 million from 2015-16 due to wildfires in the region and manufacturing earnings increased by \$37.3 million. Overall, earning moved to the positive column to \$17.8 million.

2017-18: Over this period, none of the basic sectors were in the red. Manufacturing earnings increased \$39.3 million, tourism added back the \$1 million it lost the year before and overall these five sectors generated an additional \$209.1 million in earnings for the Montana economy.

This discussion illustrates a number of important points about the causes of economic growth in Montana. First, overall growth or decline in basic industries is the net result of events in each of the basic industries. There are always some industries that are growing or declining faster or slower than others. Secondly, there is usually no single cause of growth. None of the nonfarm basic industries were consistently the fastest or slowest growing during this period.

Figure 13. Change in nonfarm basic earnings.



Source: Bureau of Economic Analysis.

Manufacturing Establishments

According to the Bureau of Labor Statistics, there were 1,643 Montana manufacturing establishments in 2018 as shown in Table 1 – ranked from the largest to the smallest. The table also includes average annual growth and total growth from 2008-18. The largest category was fabricated metal (NAICS 332) with 265 establishments. The next largest categories were miscellaneous (NAICS 339) with 184 establishments, food products (NAICS 312) with 174 establishments and wood products (321) with 148 establishments. The smallest sectors are apparel (315), petroleum and coal (324) and paper (322).

Over the past 10 years, the fastest growing NAICS sector has been beverages and tobacco (NAICS 312), which have averaged 11 percent growth per year – though it should be noted there were relatively few firms in 2008 (42). The sector has increased to 132 over the past 10 years. The largest sector overall, fabricated metal, has continued to grow at a decent 3.4 percent annually. Sectors which are losing firms are: wood, paper, petroleum and oil, and primary metal. The electronics and appliance sector has remained the same at 20 firms since 2008.

Table 1. Manufacturing establishments ranked, 2008-2018.

Rank 2018	NAIC	Industry	Growth 2008-18						
			2008	2016	2017	2018	Average	Total	
1	332	Fabricated metal	184	248	264	265	3.4%	44.0%	
2	339	Miscellaneous	160	170	178	184	1.3%	15.0%	
3	311	Food*	173	164	172	174	0.1%	0.6%	
4	321	Wood	185	141	144	148	-2.0%	-20.0%	
5	337	Furniture & related	142	134	143	146	0.3%	2.8%	
6	312	Beverages & Tobacco*	42	103	114	132	11.0%	214.3%	
7	327	Nonmetallic mineral	94	98	102	108	1.3%	14.9%	
8	325	Chemical*	46	56	59	65	3.2%	41.3%	
9	333	Machinery	41	50	59	58	3.2%	41.5%	
10	334	Computer & electronic	40	47	53	55	2.9%	37.5%	
11	336	Transportation equipment	40	39	43	48	1.7%	20.0%	
12	316	Leather & allied*	17	21	25	29	5.0%	70.6%	
13	326	Plastics & rubber*	17	23	22	23	2.8%	35.3%	
14	335	Electrical equipment & appliance	20	20	20	20	0.0%	0.0%	
15	331	Primary metal	22	14	15	15	-3.4%	-31.8%	
16	315	Apparel	6	9	13	12	6.5%	100.0%	
17	324	Petroleum & coal*	11	10	10	10	-0.9%	-9.1%	
18	322	Paper*	4	1	1	1	-11.8%	-75.0%	

Source: Bureau of Labor Statistics, * = nondurables.

Employment Size

Montana manufacturers are mostly small businesses. Because data is not available for 2018, firm size for this year is calculated using current employment levels and the overall number of firms in Montana for all industries, by size. Thus, the first column represents all firms in Montana by size. From this, the share of firms by size were multiplied by the overall number of manufacturing firms in the state to get the number of firms for each size category. As shown in Table 2, there were 713 establishments with one to four workers. They represent 52 percent of the establishments with employees. There were 898 establishments with less than 10 workers or 69.6 percent of the total. There were no Montana manufacturers with 500 employees or more.

Table 2. Manufacturing establishments by number of employees, 2018.

Firm Size	Total Firms		Manufacturing
	2018	Share 2018	Firms 2018*
<5	30,416	65.70%	1,073
5-9	7,338	15.80%	259
10-19	4,704	10.20%	166
20-49	2,778	6.00%	98
50-99	734	1.60%	26
100-249	287	0.60%	10
250-499	68	0.10%	2
\$>\$500	na	na	na
Total	46,325	100%	1,634

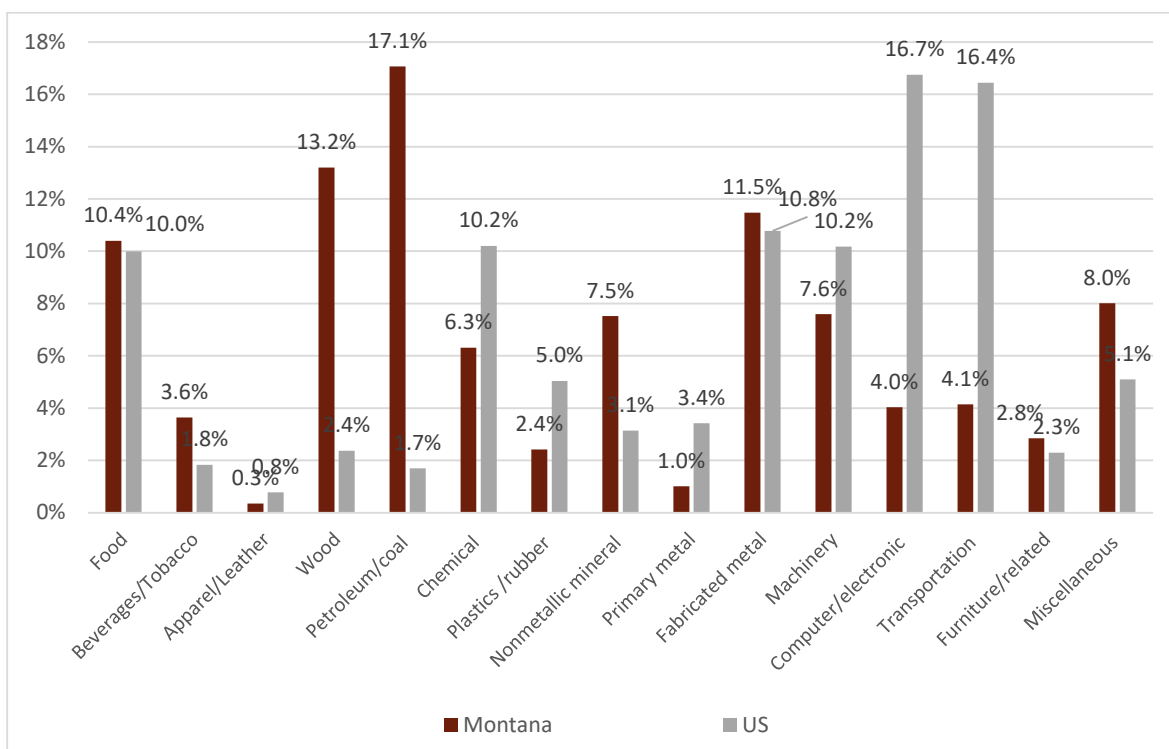
Source: U.S. BLS Data for 2018 is unavailable, based on number of firms in all small industries in 2018. * may not sum to 1,634 due to rounding, na is "not applicable."

Manufacturing Earnings

Montana manufacturing earnings does not have the same composition as it does nationally. Industries that are important in Montana are not necessarily important nationwide and vice versa. Figure 14 presents the composition of manufacturing earnings in Montana and the United States in 2018. The volatility of energy prices has distorted the value of output measures for certain industries, such as petroleum refining. Consequently, worker earnings become the best measure of the composition of manufacturing, because it is the amount earned by manufacturing workers in the state.

The largest component of U.S. manufacturing during 2018 was computers and electronics, which accounted for 16.7 percent of total manufacturing earnings. The next four industries were transportation equipment (16.4 percent), fabricated metals (10.8 percent), and machinery and chemicals (10.2 percent each).

Figure 14. Earnings composition of manufacturing in Montana and the U.S., 2018.



Source: Bureau of Labor Statistics.

The two largest Montana manufacturing industries in 2018 were associated with the processing of crude oil and forest resources. Petroleum and coal products (primarily oil refining) was the largest manufacturing industry accounting for 17.1 percent of total manufacturing earnings in 2018. The next largest industry was wood products and furniture collectively representing 16 percent of earnings. The wood product sector is the largest when measured by employment.

Fabricated metals and food products are the third and fourth largest sectors accounting for 11.5 percent and 10.4 percent respectively – more or less the same as in 2016. Earnings in nonmetallic minerals represented 7.5 percent of the total and machinery, which includes Applied Materials (formerly Semitool) accounting for 7.6 percent.

Manufacturing Employment

Between 2010 and 2017, the number of manufacturing workers in the U.S. increased about 10 percent. As shown in Table 3, durable goods manufacturing grew about 11.8 percent and nondurable goods 7.1 percent. Since 2010, Montana manufacturing employment has experienced a healthy recovery. Manufacturing's share of total employment declined slightly from 7 percent to 6.8 percent during this period.

In Montana, overall manufacturing employment expanded and more than doubled the growth of national employment by increasing over 26%. Durable and nondurable employment grew 31.7 percent and 17.9 percent, respectively. Montana manufacturing employment increased from about 19.9 thousand workers in 2010 to approximately 25.1 thousand workers in 2017 or 26.2 percent more employees. Manufacturing's share of total Montana employment increased from 3.2 percent in 2010 (right after the recession) to 3.7 percent in 2017.

Much of this trend in manufacturing growth employment since 2010 is from the recovery from the Great Recession. Though as we saw above, manufacturing on both the national and state level has been in steady decline since 1980. Referring to Figure 11, we see that nondurable manufacturing weathered the recessionary storm well and continued to grow. Also, as shown in the same figure, durable manufacturing experienced a steep decline during the recession and rebounded strongly post-2011. Some of this is growth associated with the recovery, but Montana manufacturing has also been able to sustain robust growth post-recovery.

Table 3. Full- and part-time employment, total and durable and nondurable manufacturing Montana and the U.S. (in thousands).

	2010	2012	2014	2016	2017	Growth 2010-17
United States						
Total employment	172,902	178,980	186,236	193,369	196,132	13.4%
Manufacturing	12,093	12,596	12,909	13,132	13,305	10.0%
% of Total	7.0%	7.0%	6.9%	6.8%	6.8%	
Durable goods	7,416	7,867	8,080.50	8,194.20	8,293	11.8%
% of Total	4.3%	4.4%	4.3%	4.2%	4.2%	
Nondurable goods	4,677	4,729	4,828.10	4,937.70	5,012	7.1%
% of Total	2.7%	2.6%	2.6%	2.6%	2.6%	
Montana						
Total employment	616.3	633.1	648.8	667.6	675.9	9.7%
Manufacturing	19.9	21.5	22.7	24.3	25.1	26.2%
% of Total	3.2%	3.4%	3.5%	3.6%	3.7%	
Durable goods	11.8	13.2	14	15.1	15.6	31.7%
% of Total	1.9%	2.1%	2.2%	2.3%	2.3%	
Nondurable goods	8	8.3	8.7	9.4	17.9%	
% of Total	1.3%	1.3%	1.3%	1.4%	1.4%	

Source: Bureau of Labor Statistics.

Manufacturing Employment by Industry

Detailed manufacturing employment data from 2007 to 2017 is presented in Table 4. The table is arranged from the fastest growing sectors over the past 10 years to the slowest. The national business cycle trough was in 2009. Here in Montana, the low point for manufacturing was in 2010. This is in line with the Coincident Economic Activity Index, which bottomed out nationally in 2009; whereas Montana did not reach the lowest point until mid-2010. Since then, total manufacturing employment has increased by over 5,000 workers or about 26 percent, as discussed in Table 3. The largest growth in employment occurred in 2013 when there was an increase of more than 1,100 new jobs. The following paragraphs take a closer look at the 2010 to 2017 period. Detailed discussions of events prior to 2010 can be found in earlier editions of this publication.

Before looking at the individual sectors of Montana manufacturing, a major data reclassification needs to be explained because it impacts two large manufacturing industries. REC Silicon, located near Butte, is a Montana high-tech manufacturing firm. The Montana Department of Labor and Industry reclassified it in 2012 from a chemicals industry to the nonmetallic mineral products industry. This reclassification accounts for most of the 498 workers increase in nonmetallic minerals and the modest increase in chemicals between 2010 and 2016. REC Silicon produces raw materials for the international solar and electronic industries. It was formerly named ASiMI.

The largest sector in terms of number of employees is wood products (NAICS 321) – despite losing almost 2,000 jobs since 2007. Second is miscellaneous (339) with 3,181 employees, 31 percent more than in 2010. As the name implies, this category contains a number of firms producing a wide variety of projects. The two most notable subcategories are sporting goods and equipment, and medical equipment and supplies (including dental labs).

Table 4. Manufacturing employment by sector ranked, 2007-17. * = nondurable goods.

Rank 2017	NAICS	Employees by Sector					Growth: 2007-17	
			2007	2010	2015	2017	Average	Total
1	321	Wood	4,955	3,064	3,161	3,193	-3.9%	-35.6%
2	339	Miscellaneous	2,438	2,376	2,799	3,181	2.4%	30.5%
3	311	Food*	2,961	2,779	2,952	3,062	0.3%	3.4%
4	332	Fabricated metal	1,985	1,890	3,002	3,038	3.9%	53.0%
5	327	Nonmetallic mineral	1169	943	1,470	1,507	2.3%	28.9%
6	312	Beverage & tobacco*	772	766	1,099	1,421	5.7%	84.1%
7	333	Machinery	1,607	1,167	1,224	1,401	-1.2%	-12.8%
8	324	Petroleum & coal*	991	1,092	1,261	1,329	2.7%	34.1%
9	323	Printing & related support*	1,338	1,099	1,175	1,229	-0.8%	-8.1%
10	337	Furniture & related	1,237	973	1,095	1,194	-0.3%	-3.5%
11	325	Chemical*	881	991	1026	1060	1.7%	20.3%
12	334	Computer & electronic	578	434	713	801	3.0%	38.6%
13	326	Plastics & rubber*	350	321	454	467	2.7%	33.4%
14	336	Transportation equipment	239	334	395	411	5.1%	72.0%
15	316	Leather & allied *	174	203	269	316	5.6%	81.6%
16	314	Textile product mills*	238	240	244	253	0.6%	6.3%
17	331	Primary metal	483	152	229	250	-5.8%	-48.2%
18	335	Electrical equipment, appliances, components	228	211	207	201	-1.1%	-11.8%
19	313	Textile mills*	41	na	34	33	-2.0%	-19.5%

Source: Bureau of Labor Statistics.

Beverage and tobacco (NAICS 312) experienced the largest employment gain between 2010 and 2017, growing 84 percent to 1,421 employees. Growth has been the most robust in breweries, wineries and spirits, highlighted below. The second largest is in leather and allied products (316), growing about 82 percent or 5.6 percent per year. Fabricated metal (312) was the fourth fastest growing in 2017, just ahead of transportation (336), averaging a respectable 3.9 percent per year. Another notable sector is computer and electronics (334), which was about 39 percent larger in 2017 than in 2010. The hardest hit industries since 2010 are primary metal (331), which has lost almost half its employees since 2007 and was down to 250 employees in 2017, and wood, despite being the largest in absolute terms was down 35.6 percent.

Spotlight on Growing Industries within Manufacturing

Information presented in Table 5 can begin to identify the dynamics of growth in specific manufacturing industries. Specifically, looking at both employment and the number of firms helps to determine if it is more employees at existing firms or is it an increase in the number of firms that lead to overall growth in an industry.

Alcoholic beverage manufacturing has increased significantly since the Great Recession. Breweries are the largest subcategory, with 2018 wage and salary employment of 979 and 87 firms. There are 17 distilleries employing 152 workers and 12 wineries employing 65 workers. Incomes across these three sectors have grown over 200 percent since 2012 – distillery income is up an astounding 650 percent since 2012.

Alcoholic beverages are a good example of important trends that can be hidden in aggregate data. Table 3 shows modest average annual growth in the beverage and tobacco industry, but not the double or triple digit growth in the three detailed industries reported in Table 5.

Table 5. Salary employment, number of firms, and Income, selected manufacturing industries: 2012-2018.

	2012	2014	2016	2018	Growth 2012-18	
					Average	Total
Breweries: 31212						
Employees	309	467	752	979	17.9%	216.8%
Number Firms	28	41	64	87	17.6%	210.7%
Total Income	\$6,307	\$9,578	\$15,812	\$20,815	18.6%	230.0%
Wineries: 31213						
Employees	22	32	44	65	16.7%	195.5%
Number Firms	7	8	9	12	8.0%	71.4%
Total Income	\$274	\$445	\$733	\$1,020	20.7%	272.3%
Distilleries: 31214						
Employees	26	82	154	152	28.7%	484.6%
Number Firms	6	10	14	17	16.0%	183.3%
Total Income	\$453	\$1,642	\$3,098	\$3,409	33.4%	652.5%
Architectural and structural metals: 3323						
Employees	764	877	1016	1,115	5.5%	45.9%
Number Firms	62	71	79	85	4.6%	37.1%
Total Income	\$32,185	\$40,034	\$47,052	\$53,891	7.6%	67.4%
Small arms and ordnance: 332994						
Employees	419	457	450	264	-6.4%	-37.0%
Number Firms	18	19	21	23	3.6%	27.8%
Total Income	\$14,988	\$18,828	\$18,595	\$11,499	-3.7%	-23.3%
Electronic instrument: 33451						
Employees	196	218	302	406	11.0%	107.1%
Number Firms	18	20	20	27	6.0%	50.0%
Total Income	\$10,340	\$11,200	\$16,409	\$24,418	13.1%	136.2%
Aerospace Products and Parts: 3,364						
Employees	177	206	224	251	5.1%	41.8%
Firms	7	9	7	9	3.7%	28.6%
Total Income	\$9,751	\$13,768	\$14,298	\$18,742	9.8%	92.2%

Source: Bureau of Economic Analysis. Total income in thousands.

Table 5 also reports wage and salaries employment and the number of firms for two of the fastest growing subcategories within fabricated metal products. Architectural and structural metal (3323) employment grew about 46 percent between 2012 and 2018 and income rose 67.4 percent. One example is a new firm located just north of Great Falls, which produces prefabricated buildings. An industry which took a hit in 2018 is small arms

manufacturing (NAICS 332994). Employment decreased from 450 workers in 2016 to 264 in 2018, a 37 percent decrease since 2012. This is despite 28 percent more firms. These firms are located throughout the state, but many are in the Flathead and Bitterroot valleys.

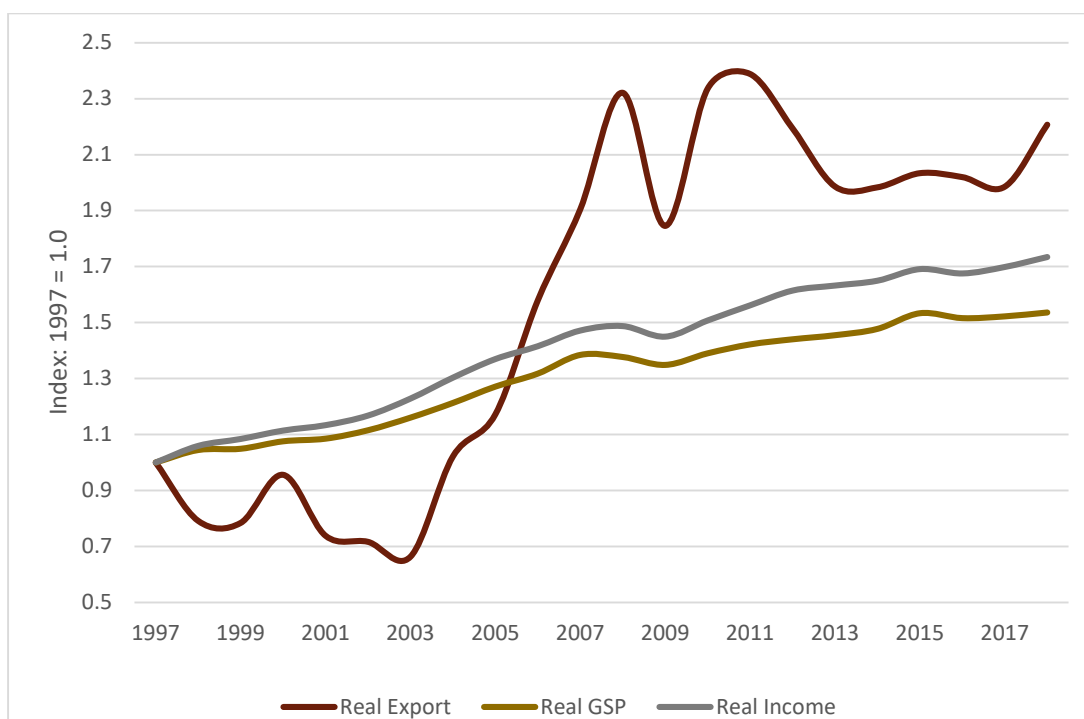
Electronic instrument manufacturing (NAICS 33451) is part of Montana high-tech manufacturing sector. Employment doubled from 196 in 2012 to 406 in 2018. Most of this growth was due to the expansion of existing plants, because the number of firms rose 50 percent over the same period. Investments by Boeing in Helena also produced gains. Aerospace and parts (3364) has 42 percent more employees and a 92 percent higher income in 2018 from 2012.

Montana’s Manufacturing Exports

Montana manufacturers, like all U.S. firms, have lost some competitiveness in international markets because of the appreciation of the dollar over the past two years. After a burst of growth in the mid-2000s, the value of Montana exports has remained relatively stable since the end of the Great Recession. Nevertheless, recent volatility in worldwide economic trends and policies have already had an impact on Montana exports. Since the beginning of 2018, inflation adjusted total exports are down 1 percent, agriculture exports have fallen almost 11 percent and livestock exports have fallen 64 percent. However, the inflation adjusted value of manufacturing exports has not been affected like primary exports – down about 0.2 percent since 2018.

The trend in Montana manufacturing exports adjusted for inflation from 1997 to 2018 is presented in Figure 15. They are compared to real Montana gross state product (GSP) and total income, all in 2012 dollars. In 2018, Montana exports were about 120 percent above their 1997 level and would have likely been more successful -- driven by shrinking primary metal, electrical equipment, publishing and miscellaneous manufacturing -- between 1997 and 2003. The years 2003-07 saw rapid export growth before returning to trend with state real GSP and income. Exports were flat between 2013 and 2017, but grew above 10 percent in 2018. 2019 data will give us more insight into the impacts of tariffs implemented in 2018.

Figure 15. Montana manufacturing exports versus real GSP and real income.



Source: USA Trade, U.S. Census Bureau, via Montana Department of Commerce.

Montana manufacturing exports by industry are reported in Table 6, ranked by export value in constant 2012 dollars. The last two columns are the growth of exports from 2017-18 and the share of total exports in 2018. The detailed data in Table 6 must be interpreted carefully. The value of exports are calculated using the port of exit rather than by state of origin. For example, Montana wheat exported to Asia leaves through Portland, Oregon,

giving Oregon the “credit” for export. However, according to statistics, Oregon exported more wheat than it produced.

Montana's top 10 manufacturing exports expanded 12.6 percent and accounted for over 93 percent of total exports – about \$1.03 billion. The largest export sector was chemicals (NAICS 325), accounting for one-quarter of Montana exports. That was closely followed by beverages and tobacco (312), with an export value of \$270 million. Next was machinery (333) accounting for about 13 percent of total exports. These three sectors combined for about two-thirds of all manufactured exports. Petroleum and coal grew (324) the fastest between 2017 and 2018, almost 62 percent to \$51.5 million. The smallest sectors in 2018 were textiles and printing, but collectively they only account for about \$3 million of Montana exports.

Table 6. Manufacturing exports by sector ranked, 2005-18 (millions of 2012 dollars).

Rank 2018	NAICS	Sector	2005	2015	2017	2018	Growth 2017-18	Share 2018
1	325	Chemicals\dag	\$148	\$311	\$264	\$281	6.7%	25.5%
2	312	Beverages & tobacco\dag	\$0	\$122	\$209	\$270	28.9%	24.4%
3	333	Machinery	\$182	\$148	\$130	\$141	8.5%	12.8%
4	336	Transportation equipment	\$27	\$57	\$57	\$71	24.8%	6.4%
5	327	Nonmetallic mineral	\$36	\$82	\$75	\$65	-13.9%	5.9%
6	324	Petroleum & coal\dag	\$4	\$39	\$32	\$52	60.8%	4.7%
7	331	Primary metal	\$29	\$43	\$34	\$48	40.9%	4.4%
8	334	Computer & electronic	\$26	\$45	\$33	\$41	26.0%	3.7%
9	321	Wood	\$38	\$35	\$37	\$31	-16.2%	2.8%
10	311	Food\dag	\$22	\$49	\$43	\$29	-31.6%	2.6%
11	339	Miscellaneous	\$11	\$34	\$23	\$25	8.2%	2.2%
12	335	Electrical equipment, appliances, & components	\$8	\$16	\$25	\$20	-19.8%	1.8%
13	332	Fabricated metal	\$5	\$19	\$9	\$7	-18.5%	0.7%
14	326	Plastics & rubber\dag	\$5	\$5	\$7	\$6	-14.7%	0.6%
15	316	Leather & allied\dag	\$1	\$4	\$5	\$6	11.5%	0.5%
16	337	Furniture & fixtures	\$0	\$2	\$2	\$2	-6.4%	0.2%
17	313	Textiles & fabrics\dag	\$0	\$1	\$2	\$2	-21.5%	0.2%
18	323	Printing & related activities\dag	\$1	\$2	\$1	\$1	-51.0%	0.1%
19	314	Textiles product mills\dag	\$1	\$1	\$1	\$0	-44.4%	0.0%
		Total top 10	\$512	\$930	\$913	\$1,028	12.6%	93.2%
		Total	\$586	\$1,017	\$993	\$1,103	11.2%	100.0%

Source: USA Trade, U.S. Census Bureau via Montana Department of Commerce, * = nondurable goods.

Table 7 identifies the top 10 destinations for Montana’s manufacturing exports, which account for 81 percent of Montana exports. Canada is consistently the primary export destination with almost 50 percent of Montana exports. After Canada, four of the remaining nine export destinations are in Asia and four in Europe. China now ranks a distant second with an 8.2 percent share. Moreover, exports to China are down 8.1 percent from last year. Nevertheless, the growth of China as a destination for Montana manufacturing exports has been dramatic. During the 15 years from 2002-17, since China joined World Trade Organization, the average increase has been 18.4 percent per year.

Table 7. Montana total manufacturing exports by top 10 destination countries, millions of 2012 dollars.

Rank 2018	Partner Country	2005	2015	2016	2017	2018	Growth	Share
							2017- 18	2018
1	Canada	\$251	\$430	\$499	\$472	\$516	9.5%	46.8%
2	China	\$29	\$102	\$86	\$98	\$90	-8.1%	8.2%
3	Korea, Republic Of	\$28	\$67	\$66	\$71	\$68	-3.6%	6.2%
4	Taiwan	\$37	\$33	\$51	\$35	\$46	31.7%	4.2%
5	Belgium	\$2	\$35	\$26	\$31	\$45	44.2%	4.1%
6	Japan	\$61	\$50	\$44	\$31	\$41	33.2%	3.7%
7	United Kingdom	\$26	\$23	\$17	\$21	\$27	28.2%	2.4%
8	Mexico	\$9	\$33	\$28	\$27	\$26	-3.1%	2.4%
9	Germany	\$56	\$29	\$19	\$25	\$17	-32.5%	1.6%
10	Netherlands	\$18	\$16	\$14	\$15	\$15	2.7%	1.4%
	Total top 10	\$516	\$817	\$850	\$826	\$892	8.1%	80.9%
	Total	\$586	\$1,017	\$1,010	\$993	\$1,103	11.2%	100.0%

Source: USA Trade, U.S. Census Bureau, via Montana Department of Commerce.

Carrying over from last year, Korea and Taiwan continue as the third and fourth largest export markets. Japan is sixth. The largest European destinations are Belgium, the United Kingdom, Germany and the Netherlands. Mexico, the United States' third largest trading partner and fellow member of the North American Free Trade Agreement (NAFTA), is Montana's eighth largest export market with a 2.4 percent share.

Manufacturer's Outlook

2018 in Retrospect

Montana manufacturers are a diverse group of small- to medium-sized firms producing everything from beer to high-tech products. With these differences, it is difficult to summarize the outlook with a simple equation or economic forecasting model. Instead, the Bureau of Business and Economic Research surveys manufacturers each winter and queries them about their outlook for the next year. This section summarizes the responses to the 2018 Manufacturers Survey. The responses are summarized for broad manufacturing categories.

Montana manufacturers were queried about a number of indicators and whether they thought the indicator would increase, decrease or stay the same during 2019. The tables report the percentage of respondents who said the indicator would increase or remain unchanged in 2019. The value for decrease is not reported, but can be calculated. Also reported is the percentage of respondents who expected an increase in response to the same question in the previous year's survey, which provides a measure of change in optimism between 2018 and 2019. More details can be found in the 2019 Montana Manufacturers Survey, also produced by BBER.

Year in Review

Montana manufacturers were asked to report on their plants' performance in 2018. Survey respondents were queried about a number of indicators and whether it increased, decreased or stayed the same during 2018. Tables 8-14 summarize the responses. The tables have the same format. The percentage of respondents who said the indicator was unchanged or increased in 2018 are shown in the table. The figures for decreases are not reported, but can be calculated. Also shown is the percentage of respondents who reported increases for the same question in the previous year's survey, which provides a measure of the trend from 2017 to 2018.

Montana manufacturers reported that 2018 was a moderately positive year. Far more respondents reported unchanged or increased in the economic indicators. The respondents also said that 2018 was about the same or better than 2017. Worker availability was cited as the major issues facing manufacturers in 2018.

Gross Sales

About 51 percent of establishments said their gross sales increased, while 30 percent said they were unchanged in 2018. The sector with the greatest reported increase was machinery/equipment manufacturers with 56 percent reporting increased sales. The year 2018 was quite similar 2017 in terms of the percentage of firms reporting increased gross sales. This was true of each of the manufacturing categories.

Table 8. For calendar year 2018, did your plant's gross sales increase, stay about the same or decrease from 2017?

	Unchanged in 2018	Increased in 2018	Increased in 2017
Total manufacturing	30%	51%	52%
Wood products	45%	45%	38%
Chemical/refining/metallic products	25%	53%	50%
Food and beverage	33%	50%	58%
Machinery/equipment	25%	56%	58%
All other manufacturing	28%	52%	53%

Employment

The U.S. economy is currently experiencing the lowest unemployment rate since the mid-1960s and shortages of workers are reported. It now appears the manufacturing labor market has slackened. The Montana impact of national labor market conditions are summarized in Table 9. About 71 percent of Montana manufacturers said they had a shortage of workers in 2017. That fell sharply to 23 percent in 2018. Sectors which were relatively short-handed were in wood products and all other manufacturing. Sectors reporting the smallest shortages were chemical/refining/metallurgical products and machinery/equipment.

Table 9. Did your plant have a significant shortage of workers at any time during 2018?

	Yes in 2017	Yes in 2018
Total manufacturing	71%	23%
Wood products	81%	26%
Chemical/refining/metallurgical products	67%	14%
Food and beverage	84%	20%
Machinery/equipment	70%	18%
All other manufacturing	63%	27%

Looking Forward

Production

About 61 percent of the manufacturing plants said that their production would increase in 2018 over that of 2017 and an additional 33 percent said they will remain unchanged. The overall optimism of manufacturers about 2019 was approximately the same as last year (62 percent versus 61 percent). Food and beverage producers were the most optimistic about 2019 production and they were also among the most optimistic during the previous year.

Table 10. What do you anticipate will happen to your plant's production in 2019?

	Be about the same as 2018	Increase over 2018	Increase over 2017
Total manufacturing	33%	61%	62%
Wood products	52%	45%	57%
Chemical/refining/metallurgical products	41%	54%	52%
Food and beverage	26%	66%	68%
Machinery/equipment	35%	59%	77%
All other manufacturing	29%	64%	54%

Employment

This year, Montana manufacturers were less optimistic about employment growth. Approximately 59 percent of the respondents said they expected their plant's employment would be unchanged in 2019, while 38 percent said there would be more workers at their plant. The most optimistic about employment growth were the machinery/equipment respondents (53 percent). And while the least optimistic by comparison were those in the wood products industry (29 percent), this level of optimism is almost double that of last year in the same industry.

Overall, there was little change between 2018 and 2019 in the optimism of manufacturers concerning employment growth.

Table 11. What do you anticipate will happen to the number of employees in your plant in 2019?

	Be about the same as 2018	Increase over 2018	Increase over 2017
Total manufacturing	28%	65%	64%
Wood products	45%	45%	57%
Chemical/refining/metallic products	30%	65%	59%
Food and beverage	24%	71%	69%
Machinery/equipment	24%	76%	81%
All other manufacturing	27%	65%	55%

Profits

Montana manufacturers are generally optimistic about profits in 2019. About 61 percent said they expected their plant to have increased profits in 2019. Approximately 30 percent said they expected profits to remain unchanged. The machinery/equipment and food/beverage manufacturers were the most optimistic – about 65 percent in each sector expect higher profits in 2019. The biggest improvement in profit expectations was in the “other” category – the percent of respondents expecting profits to increase rose from 50 percent in 2018 to 63 percent in 2019.

Table 12. What do you anticipate will happen to your plant’s profits in 2019?

	Be about the same as 2018	Increase over 2018	Increase over 2017
Total manufacturing	30%	61%	59%
Wood products	38%	47%	46%
Chemical/refining/metallic products	37%	57%	52%
Food and beverage	25%	65%	59%
Machinery/equipment	35%	65%	84%
All other manufacturing	27%	63%	50%

Employment

Montana manufacturers are less optimistic about employment growth. Approximately 59 percent of the respondents said they expected their plant’s employment would be unchanged in 2019, while 38 percent said there would be more workers at their plant. The most optimistic about employment growth were the machinery/equipment respondents (53 percent). And while the least optimistic by comparison were those in the wood products industry (29 percent), this level of optimism is almost double that of last year in the same industry. Overall, there was little change between 2018 and 2019 in the optimism of manufacturers concerning employment growth.

Table 13. What do you anticipate will happen to the number of employees in your plant in 2019?

	Be about the same as 2018	Increase over 2018	Increase over 2017
Total manufacturing	59%	38%	42%
Wood products	68%	29%	14%
Chemical/refining/metallic products	55%	45%	37%
Food and beverage	64%	32%	42%
Machinery/equipment	41%	53%	69%
All other manufacturing	59%	38%	36%

Overall

Overall, Montana manufacturers were mildly optimistic about 2019. About 58 percent said they expected 2019 to be better with roughly 37 percent saying they expected no change. The most optimistic were the food/beverage manufacturers followed by the “all other” manufacturing firms. There was modest overall reduction in sentiment with the percent of respondents believing their outlook would improve, falling from 65 percent in 2018 to 58 percent in 2019. The greatest reduction in optimistic outlook was in the machinery/equipment products respondents.

Table 14. Considering all factors, how would you rate your overall outlook for your plant in 2019?

	Be about the same as 2018	Increase over 2018	Increase over 2017
Total manufacturing	37%	58%	65%
Wood products	50%	41%	50%
Chemical/refining/metallic products	43%	52%	69%
Food and beverage	32%	65%	63%
Machinery/equipment	53%	47%	84%
All other manufacturing	33%	62%	53%