

Manufacturing & Logistics:

A Generation of Volatility & Growth

Michael J. Hicks, PhD and Srikant Devaraj, PhD

Ball State University Center for Business and Economic Research

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Background

Over the past generation, from the peak of the late 1990s through today, the manufacturing and logistics industries experienced dramatic volatility and growth. This period was further marked by the Dot.com Boom and Bust, the Great Recession, and the expansion of trade and automation. Over this time, industrial production rose by more than 10 percent in constant dollar terms.

This brief review, written in the 10th year of the Conexus Indiana Manufacturing and Logistics Report, describes these trends, focusing on GDP, value-added growth, productivity and employment changes in both industries. [1] We begin with manufacturing and logistics GDP.

Industry Health

The total value of manufactured goods produced in the United States peaked (in inflation-adjusted dollars) in 2014, and again in 2015. This fact stands in stark contrast to the frequently stated belief that US manufacturing is in decline. See *Figures 1 and 2* for the long and most recent views of manufacturing.

The very deep effects of the business cycle in 2001 and the Great Recession of 2007-2009 are clear in these data. Because business cycles predominately affect purchases of business capital investment and consumer durables, manufacturing production saw significant declines through 2000 and 2008 and 2009. Dips in manufacturing GDP of 8-12 percent occurred over both business recessions, concentrated in durable goods sectors and geographically across the county.

In contrast, the logistics industry (predominantly transportation and warehousing) is less cyclically sensitive. Growth in trade, along with continued movement of non-durable goods and household travel mitigated the effect of reduced demand for manufactured goods on the logistics sector. Total GDP for transportation and warehousing saw only about half the proportional decline than did manufacturing over the Great Recession. *Figure 3* uses data that are available only from 2005 to the present, but this graph illustrates the smaller dip in real GDP in these industries.

[1] For earlier studies, see Hicks and Devaraj (2016, 2015, 2014), Hicks, 2013, and Hicks and Kuhlman, 2011.

Figure 1. US Industrial Production Index, 1919-2016

Source: Federal Reserve and BEA

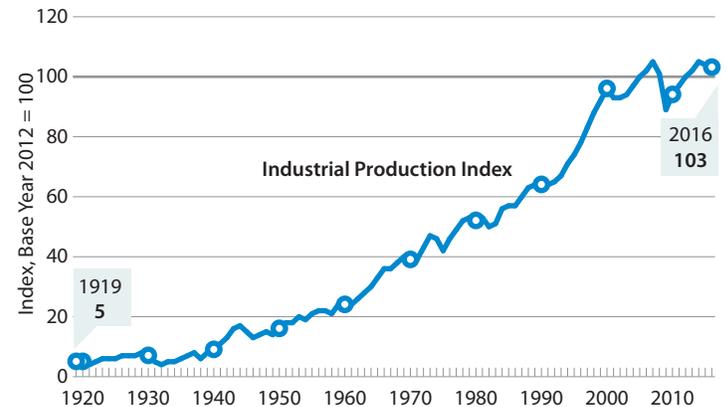


Figure 2. Manufacturing Real GDP (in 2017 dollars)

Source: BEA, adjusted for inflation with the GDP Deflator

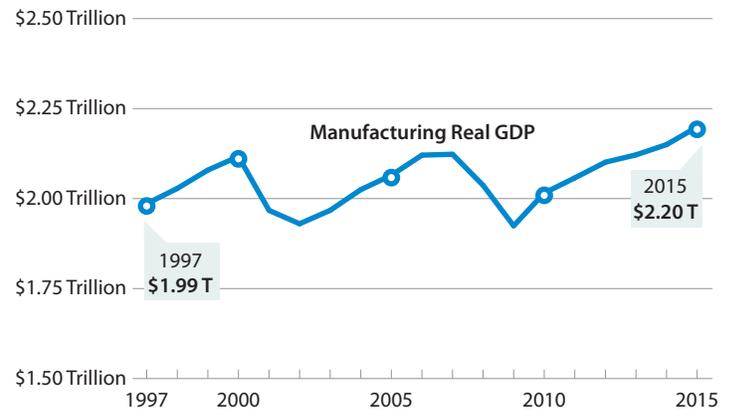


Figure 3. Logistics Real GDP (in 2017 dollars)

Source: BEA, adjusted for inflation with the GDP Deflator

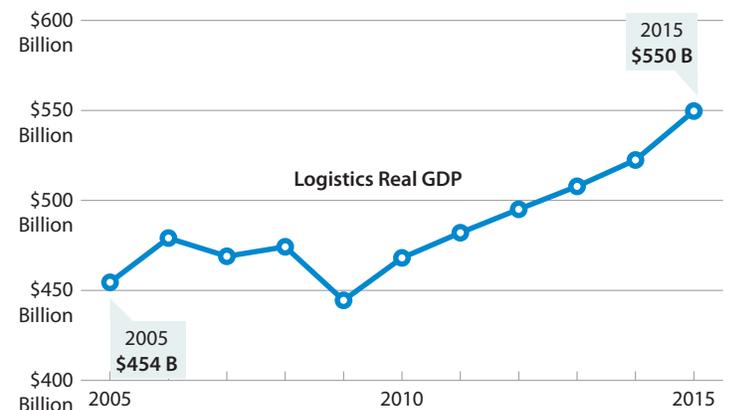
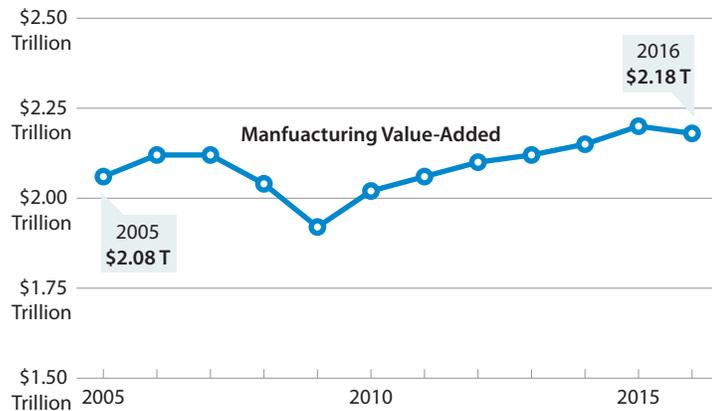


Figure 4. US Manufacturing Value-Added, 2005-2016

Source: BEA, deflated with GDP Deflator, base 2017



In 2001, China was granted Permanent Normal Trade Relations (PNTR), and overall trade as a share of manufacturing GDP grew substantially. Pierce and Schott (2016) provide a very detailed account of job losses associated with this policy change. These authors link the significant declines in manufacturing employment to import substitution, reporting a contribution of roughly 1.3 percent of percent of total employment declines during the 2000-2007 period to import substitution. Other researchers conclude that statistical measurement of the value of intermediate goods is biased towards import substitutes. Thus, the official statistical data overstates worker productivity growth in the United States and understates import substitution (Housemann, et al., 2011). Other researchers conclude that productivity gains played a larger role in the changing pattern of manufacturing production and employment in recent years (see Autor, Dorn, and Hanson, 2016; Hicks and Devaraj, 2015).

Most recent analysis of manufacturing value-added subtracts imported parts from domestic manufacturing, so offers a clear picture of the role of import substitution. Figure 4 illustrates real value-added manufacturing in the US from 2005 to the present.

These data suggest that despite growth in import substitution, US manufacturing production continued to rise through the most recent period, setting constant-dollar records in 2014 and 2015, but suffering a small decline in 2016.

The industrial composition of GDP growth has been very uneven within manufacturing. Using the most recent comparable data [2] (NAICS, 1997-2014), we find that durable goods manufacturing grew by an average of 0.4 percent per year (in inflation-adjusted terms), while nondurable goods grew by 2.2 percent, on average. This resulted in an increase of \$67 billion in durable goods and more than \$248 billion in non-durable goods. See Table 1.

Among durable goods, transportation equipment saw the fastest growth rate, followed by machinery, miscellaneous goods, and computer and electronic parts manufacturing. Among nondurable goods, petroleum and chemical saw the largest growth in total value, while

Table 1. US Manufacturing Real GDP Growth, 1997 & 2014

Source: NAICS • Note: GDP adjusted to 2014 dollars

Industry	1997 GDP (\$Billion)	2014 GDP (\$Billion)	Change (\$Billion)	Avg Annual Growth
<i>Durable goods manufacturing</i>	\$1,060.57	\$1,129.19	\$68.62	0.40%
Wood products	\$34.44	\$29.10	-\$5.34	-1.00%
Nonmetallic mineral products	\$51.22	\$45.89	-\$5.33	-0.60%
Primary metals	\$61.74	\$58.62	-\$3.12	-0.30%
Fabricated metal products	\$141.67	\$146.22	\$4.55	0.20%
Machinery	\$131.46	\$152.18	\$20.71	1.00%
Computer and electronic products	\$251.66	\$266.30	\$14.63	0.40%
Electrical equipment, appliance, and components	\$60.37	\$55.44	-\$4.94	-0.50%
Motor vehicles, bodies and trailers, and parts	\$144.39	\$144.15	-\$0.24	0.00%
Other transportation equipment	\$80.38	\$125.97	\$45.59	3.50%
Furniture and related products	\$35.92	\$26.12	-\$9.80	-1.70%
Miscellaneous	\$67.31	\$79.21	\$11.90	1.10%
<i>Nondurable goods manufacturing</i>	\$721.39	\$970.24	\$248.85	2.20%
Food and beverage and tobacco products	\$174.48	\$246.31	\$71.83	2.60%
Textile mills and textile product mills	\$35.18	\$17.96	-\$17.22	-3.10%
Apparel and leather and allied products	\$32.35	\$10.11	-\$22.24	-4.30%
Paper products	\$71.26	\$56.61	-\$14.66	-1.30%
Printing and related support activities	\$48.04	\$37.49	-\$10.54	-1.40%
Petroleum and coal products	\$61.50	\$170.62	\$109.12	11.10%
Chemical products	\$224.22	\$364.59	\$140.37	3.90%
Plastics and rubber products	\$74.36	\$66.55	-\$7.81	-0.70%

food and beverage manufacturing also grew. Most other sectors within non-durable manufacturing experienced much slower growth, while textile and apparel manufacturing saw significant production declines.

Growth in the logistics industry was both larger and more uniform than in manufacturing over the same period. All logistics sectors grew, with the industry total experiencing a very robust 3.3 percent annualized growth rate from 1997 through 2014. Individual subsector growth ranged from 1.6 percent for air transportation, to 7.1 percent for water transport, to 10.7 percent increase

[2] The North American Standard Industrial Classification was adopted between 1999 and 2000, and backdated to allow for comparison of Standard Industrial Classification (SIC) of industries. Disaggregated data on industry GDP is usually available two full years after the end of a calendar year.

Table 2. US Logistics Real GDP Growth, 1997 & 2014

Source: NAICS • Note: GDP adjusted to 2014 dollars

Industry	1997 GDP (\$Billion)	2014 GDP (\$Billion)	Change (\$Billion)	Avg Annual Growth
<i>Transportation and warehousing</i>	\$328.24	\$510.19	\$181.95	3.30%
Air transportation	\$68.12	\$86.14	\$18.01	1.60%
Rail transportation	\$25.68	\$46.82	\$21.14	4.80%
Water transportation	\$8.48	\$18.69	\$10.21	7.10%
Truck transportation	\$99.23	\$139.14	\$39.91	2.40%
Transit and ground passenger transportation	\$19.30	\$32.77	\$13.46	4.10%
Pipeline transportation	\$8.88	\$25.10	\$16.22	10.70%
Other transportation and support activities	\$71.62	\$110.40	\$38.78	3.20%
Warehousing and storage	\$26.92	\$51.13	\$24.21	5.30%

for pipeline services. While these data do not include all tangential industries, e.g. business services related to warehousing and transport, the overall growth in those sectors likely mirror the overall transportation and logistics share of the economy. See *Table 2*.

Regional Changes

The industrial variation in performance was also mimicked by differences within regions. Though some of the differences in regional performance could be attributed to differences in the composition of industry, there are also regional differences in costs, which could contribute to differential growth levels. To observe the large differences, we examine an index of manufacturing production in the nation's seven census regions from 1998 through 2015. From *Figure 5*, it is clear that the Far West is a standout in growth, while the Rockies, New England, and the Southwest have also experienced significant growth.

Indiana

To clarify the region, we examine Indiana, and comparable manufacturing states of Wisconsin, Michigan, Ohio and Illinois, along with the index of the nation as a whole. As is clear from *Figure 6*, Indiana has enjoyed significant expansion of manufacturing, especially pronounced following the end of the Great Recession. In contrast, Michigan, Ohio and Illinois have returned to their pre-2000 manufacturing production levels following the Great Recession.

Manufacturing and logistics have been an especially critical part of Indiana's economy over the past generation. Indiana's total economy grew 29 percent over the period 1997 to 2015. Logistics growth has kept pace, with total growth of 27 percent over the same period. However, manufacturing GDP was a standout, rising by 50 percent in inflation-adjusted terms. See *Figure 7*.

Figure 5. Regional Manufacturing Production Index, 1998-2015

Source: Federal Reserve and BEA • Note: Using BEA regions

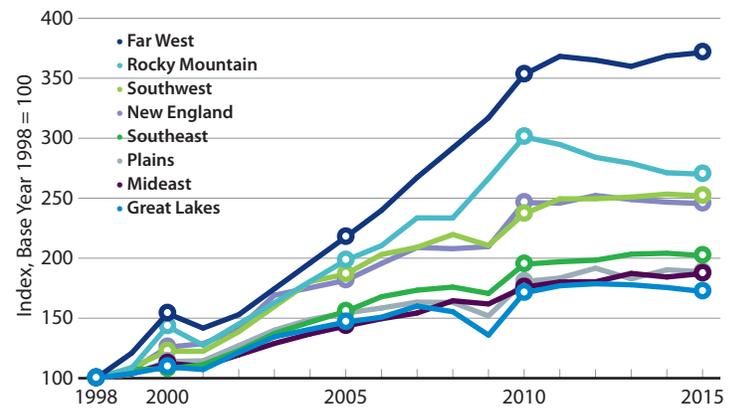


Figure 6. Indiana and Great Lakes States Manufacturing Production Index, 1997-2015

Source: Federal Reserve and BEA

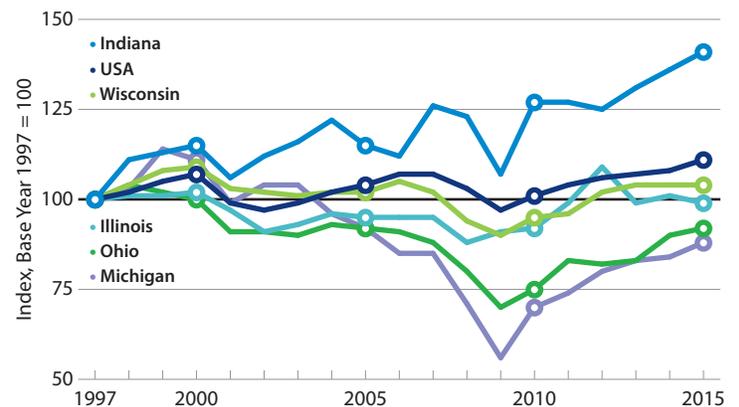
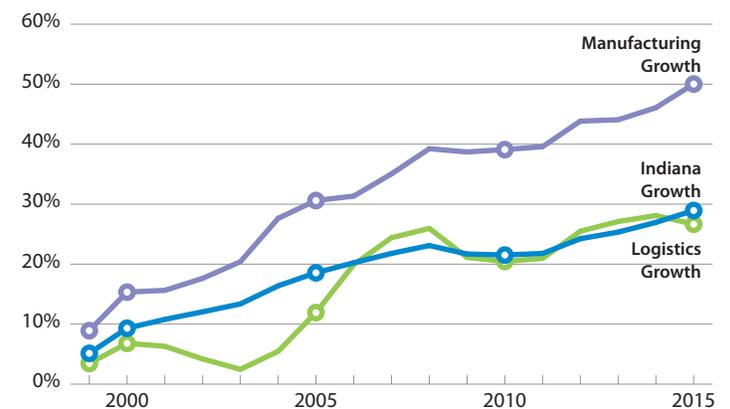


Figure 7. Indiana Cumulative GDP Growth, 1997-2014 (in 2014 dollars)

Source: BEA



Manufacturing and logistics have been an especially critical part of Indiana's economy over the past generation."

Manufacturing Report Card

Importantly, manufacturing and logistics growth comprised 45 percent of Indiana's GDP growth since 1997, and 52.5 percent since the end of the Great Recession. More plainly, more than half of the Indiana economic expansion since the end of the Great Recession has come in the form of producing and moving goods.

The robust economic performance of Indiana's manufacturing and logistics sectors is reflected in the annual Manufacturing and Logistics Report produced by the Ball State University Center for Business and Economic Research. The first scorecard was released in 2008, and the first fully graded scorecard using familiar categories was released in 2009. In comparing the 2009 scorecard to the most recent iteration, we see manufacturing health remaining robust, with Indiana continuing to score in the top five states. Logistics health has also improved from a B- to an A, reflecting the growth of this sector as well. Both productivity and worker benefit costs grades have improved from a national average to a B ranking (among the top 16 nationally).

Indiana has also done well in innovation, and remains in the national averages with its sector diversification. Fiscally, Indiana remains among the top states in which to live and do business, and enjoys strong pension funding and tax climate.

Summary

This year marks the 10th year of the Manufacturing and Logistics Report, a partnership between Conexus Indiana and Ball State University. This has been an especially turbulent time for the economy in general, and for manufacturing and logistics in particular. As we grade Indiana and other states, we are mindful of public policy efforts to preserve fiscal strength and to increase the quality of human capital as an input to successful firms. The outsized contribution of manufacturing and logistics to Indiana's economy attests to the importance of these sectors to the continued health of Indiana's economy.

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Table 3. Changes in Indiana's Performance, Manufacturing and Logistics Report, 2009 & 2017

Source: Conexus Indiana Manufacturing and Logistics Report, available online: <http://conexus.cberdata.org>

Category	2017	2009
Manufacturing Industry Health	A	A
Logistics Industry Health	A	B-
Human Capital	C	D+
Worker Benefit Costs	B	C
Tax Climate	A	A
Expected Liability Gap	B-	n/a
Global Reach	A	A
Sector Diversification	C	n/a
Productivity and Innovation	B	C

Table 3 Notes:

- Logistics Industry Health improved from "B-" to "A" primarily due to improvements in per-capita commodity flows through road.
- Human Capital improved from "D+" to "C" due to increase in first year retention rates at community and technical colleges and also due to adding three new factors in scorecards since 2010: workers with associates degree, 8th graders math scores, and high school graduation rates.
- Workers Benefit Costs improved from "C" to "B" due to lower long-term health care costs relative to other states and adding a new factor – federal total expenditures per capita in scorecards since 2010.
- Productivity and Innovation improved from "C" to "B" due to adding manufacturing productivity as a new factor in scorecards since 2010.



More Online

Visit the Manufacturing & Logistics Report Card website to view the performance history for each state and category since 2009, a custom profile for Indiana, and an archive of past reports, including companion pieces with insight into the manufacturing industry:

<http://conexus.cberdata.org>

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CONEXUS INDIANA
111 Monument Circle, Suite 1800
Indianapolis, IN 46204
317-638-2107
www.conexusindiana.com



CENTER FOR BUSINESS AND ECONOMIC RESEARCH
2000 W. University Ave. (WB 149)
Muncie, IN 47306
765-285-5926
www.bsu.edu/cber • www.cberdata.org