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The Decline of U.S. Manufacturing Employment - Automation and Trade

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EMPLOYMENT RESEARCH

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Susan N. Houseman

ARTICLE HIGHLIGHTS

- *U.S. manufacturing experienced unprecedented employment declines in the 2000s.*
- *Strong output and productivity growth in manufacturing are often cited as evidence that U.S. manufacturing is doing well and that automation is primarily responsible for the employment declines. A careful look at the evidence does not support this popular view.*

This article is based on "Understanding the Decline in Manufacturing Employment" (Houseman 2018).

ALSO IN THIS ISSUE

The manufacturing sector experienced a precipitous and historically unprecedented decline in employment in the 2000s, which coincided with a surge in imports, weak growth in exports, and a yawning trade deficit. The sharp job losses in manufacturing significantly contributed to the weak employment growth and low labor force participation characterizing the U.S. economy for much of this period.

The plight of U.S. manufacturing featured prominently in the 2016 presidential election, with candidates Donald Trump and Bernie Sanders arguing that globalization had severely damaged U.S. factories and workers. That message resonated in many American communities and helped propel Trump to the presidency. Making good on campaign promises, the president pulled out of the Trans-Pacific Partnership agreement, has proposed renegotiating the North American Free Trade Agreement, and most recently has threatened high tariffs on Chinese imports, raising concerns about a trade war.

An alternative view, which many economists embrace, holds that automation, not globalization, largely explains manufacturing's relative employment declines and, in recent years, steep job losses. As evidence, proponents of this view point to statistics showing robust output growth and much higher productivity growth in manufacturing relative to the aggregate economy. This perspective often is presented as the consensus view among economists and taken as fact in media reports.

The view, however, reflects a misreading of the data. Although automation is occurring in manufacturing, as in other sectors of the economy, neither the descriptive nor the research evidence supports the view that automation was the leading cause of the relative and absolute decline in manufacturing employment in the 2000s.

The Collapse of Manufacturing Employment in the 2000s

Manufacturing employment trended upward in the years following World War II, peaking at over 19 million in 1979. From 1979 to 1989, the year of the next business cycle peak, manufacturing shed 1.4 million jobs, or 7.4 percent of its base, with job losses concentrated in the primary metals and textile and apparel industries. Employment in manufacturing was relatively stable in the 1990s.

Rapid productivity growth in the computer industry—and, by extension, the strong productivity growth in manufacturing—largely reflects improvements in high-tech products, not automation.

Manufacturing employment plunged in the 2000s. Between the business cycle peaks of 2000 and 2007, the sector's employment dropped by 3.4 million, or 20 percent. Although employment in manufacturing, a cyclically sensitive sector, often drops sharply during recessions, the early 2000s marked the first time that employment in the sector did not entirely or largely recover during the expansion. Manufacturing employment was hard-hit again during the Great Recession of 2008–2009, rebounding only slightly during the ensuing recovery. In total, since 2000, manufacturing employment has fallen by nearly 5 million, or over 28 percent. Unlike the declines experienced in the 1980s, the job losses have been broad-based, affecting all industries.

Widespread plant closures accompanied the employment declines. From 2000 to 2014,

the number of manufacturing establishments dropped by more than 78,000, a 22 percent decline.

The Puzzle

Reflecting stable or declining employment in the manufacturing sector, the share of private sector employment in manufacturing has dropped steadily, and relative declines have been particularly prominent since the 1980s. Manufacturing employment as a share of private sector employment peaked at 35 percent in 1953; by 2016, that share had fallen to just under 10 percent. Manufacturing's share of private sector GDP has experienced a parallel decline: manufacturing's contribution to private sector GDP peaked at 33 percent in 1953, and by 2016 its share was just 13 percent.[1] The trends in these shares, depicted in the right scale of Figure 1, suggest that performance in the manufacturing sector has been weak relative to the rest of the economy.

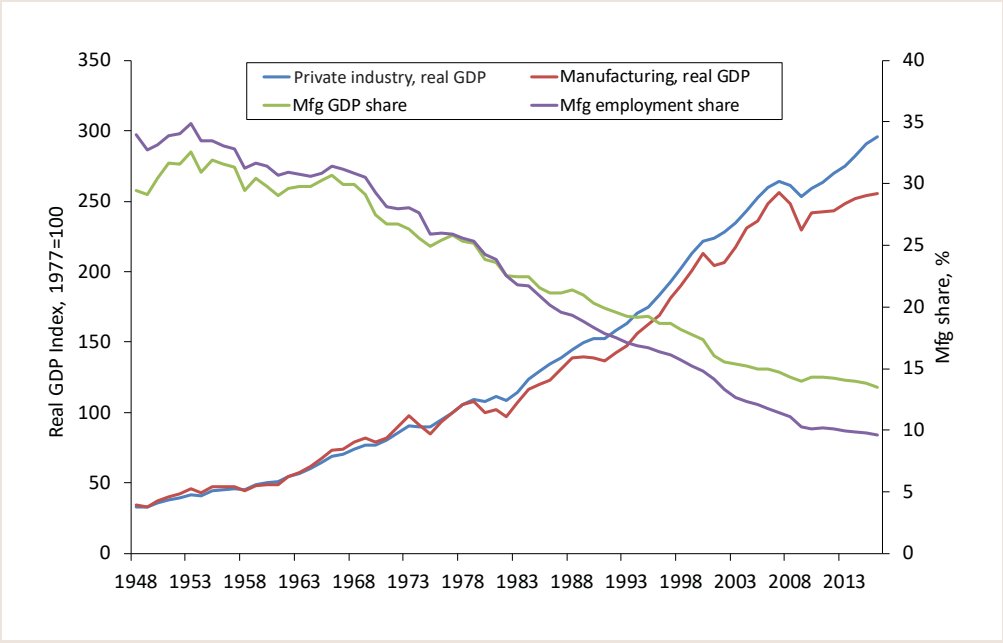
Figure 1 also shows indices for the private sector and manufacturing real (inflation-adjusted) GDP on the left scale. Paradoxically, in view of manufacturing's declining employment and GDP shares, real GDP growth in manufacturing has largely kept pace with that of the private sector overall. Only since the Great Recession has real output growth been noticeably slower in manufacturing than in the aggregate economy.

Reconciling Manufacturing's Declining Shares with Robust Output Growth

How can these apparently contradictory trends be reconciled? If real GDP growth for manufacturing has kept pace with real GDP growth in the aggregate economy yet manufacturing's share of private sector GDP is falling, it must be the case that prices of manufactured goods have grown more slowly than the average growth in prices of goods and services in the economy.

Similarly, manufacturing's declining share of private sector employment results because manufacturing employment is growing more slowly than the average for the private sector.

Figure 1: Manufacturing and Private Industry Real GDP; Manufacturing GDP and Employment Shares



SOURCE: Author's calculations using data from the Bureau of Economic Analysis.

The relationships between labor, GDP, and productivity growth may be expressed as a simple accounting identity, which shows that the difference in the growth rates of labor employed in the aggregate private sector and in manufacturing is equal to the difference in their real GDP growth rates less the difference in their labor productivity growth rates.[2]

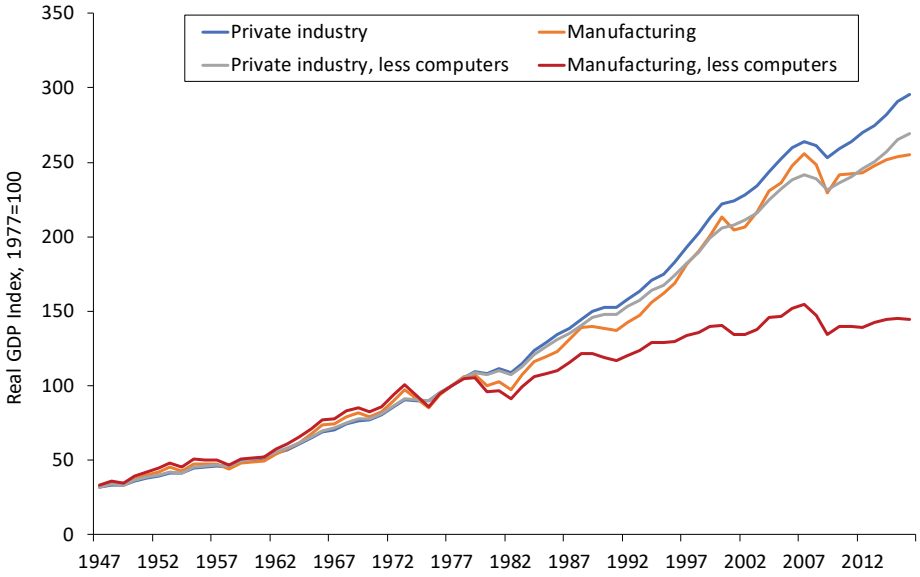
If manufacturing's real GDP growth rate is approximately the same as the average for the private sector, as indicated in Figure 1, then all, or virtually all, of manufacturing's declining employment share is accounted for by higher labor productivity growth. Many economists have taken the patterns shown in Figure 1, and related descriptive evidence, to infer that the higher productivity growth in manufacturing—implicitly or explicitly assumed to reflect automation—has largely caused the relative and absolute declines of manufacturing employment. Even when some role for trade is recognized, it is deemed small, and the decline is taken as inevitable.[3]

Broadly, there are two problems with this conclusion. First, the descriptive evidence is misleading and has been widely misinterpreted. The low growth in prices, strong real output growth, and high productivity growth in manufacturing are largely driven by one industry—computer and electronic products (hereafter computer industry)—and reflect the statistical adjustment of price deflators of computers and semiconductors for improvements in product quality.

Second, as researchers widely recognize, accounting identities and other descriptive evidence per se cannot be used to draw inferences about the causes of the relative and absolute decline in manufacturing employment. Productivity growth does not by itself cause employment reductions and may reflect many forces, including import competition and offshoring.

I discuss each problem in turn.

Figure 2: Real GDP, Private Industry and Manufacturing, with and without Computer Industry



SOURCE: Author's calculations using data from the Bureau of Economic Analysis.

The Outsized Effect of the Computer Industry on Manufacturing Statistics

Many of the products produced in the computer industry have undergone substantial and rapid technical advances. The semiconductors embedded in our electronics, for example, are much more powerful today than they were a decade or even a year ago. Likewise, the computers and related devices that consumers and businesses buy today have much greater functionality than in the past. The statistical agencies account for the rapid improvements in product quality in the industry through adjustments to price deflators; for some products, adjusted prices have declined rapidly over time.

Adjusting product price deflators in the computer industry for improvements in product quality, in turn, has large effects on the industry's measured real GDP and productivity growth. Although the computer industry has always accounted for less than 15 percent of value-added in manufacturing, because of its extraordinary measured real GDP and productivity growth, it has an outsized effect on measured real output and productivity growth in the sector, skewing these statistics and giving a misleading impression of the health of American manufacturing.

Figure 2 displays indices of real GDP in the private sector and manufacturing, as published and omitting the computer industry. The computer industry has had large effects on measured real GDP growth in manufacturing since the 1980s. From 1979 to 2000, measured real GDP growth in manufacturing was 97 percent of the average for the private sector; when the computer industry is dropped from both series, manufacturing's real GDP growth rate is just 45 percent that of the private sector average. Between 2000 and 2016, real GDP growth in manufacturing was 63 percent of the average private sector growth. Omitting the computer industry from each series, manufacturing's measured real output growth is only about 0.2 percent per year and just 12 percent of the average for the private sector in the 2000s. Without the computer industry, measured real output in manufacturing was lower in 2016 than in 2007 at the start of the Great Recession. In addition, without the computer industry, labor productivity growth was no higher or only somewhat higher in manufacturing than in the private sector overall (Houseman 2018).

Once the anomalous effects of the computer industry are excluded, descriptive data no longer provide prima facie evidence that higher rates of automation were primarily responsible for the long-term decline in manufacturing's share of employment. Rather, they suggest that understanding the reasons for the slow output growth in manufacturing output is critical.

It is also important to recognize that the rapid productivity growth accompanying output growth in the computer industry has little to do with automation—production of computers and semiconductors has been automated for many years. Rather, rapid productivity growth in the industry—and, by extension, the strong productivity growth in manufacturing—largely reflects improvements in high-tech products. Nor is the rapid growth in measured computer and semiconductor output a good indicator of the international competitiveness of domestic manufacturing of these products. As detailed in Houseman, Bartik, and Sturgeon (2015), the locus of production of these products has been shifting to Asia, even as the industry was driving the apparent robust growth in the manufacturing sector.

Interpreting productivity growth

Labor productivity is measured as real GDP (the returns to capital and labor) divided by labor input (hours worked or employment). Labor productivity will increase if processes are automated—that is, if businesses invest in capital equipment and that equipment substitutes for workers in the production process. Measured growth in labor productivity, however, captures many factors besides automation. As just discussed,

the strong productivity growth in the manufacturing sector has been driven by productivity growth in the computer industry, which largely stems from product improvements owing to research and development.

In addition, manufacturers have outsourced many activities previously done in-house, either to domestic or foreign suppliers, or have shifted their input sources to lower-cost, often foreign, providers. If the outsourced activities are primarily done by relatively low-paid workers, or if the outsourced labor is cheaper than the in-house labor, measured labor productivity will increase. Shifting to lower-cost input sources will raise measured productivity as well (Houseman et al. 2011).

International competition also may directly impact measured manufacturing productivity by affecting the composition of products produced and processes used in the United States. The industries and plants within industries most affected by increased competition from low-wage countries will likely be the most labor-intensive, raising measured labor productivity. For example, case study research on the impact of the wave of Asian furniture imports in the early 2000s shows that plant closures and employment declines were concentrated in the most labor-intensive furniture industries, and within industries less affected by imports, the most labor-intensive processes were offshored.[4]

Productivity growth surged in some manufacturing industries during the early 2000s, a period marked by a precipitous decline in manufacturing employment and factory closures. A superficial reading of the data might lead one to conclude that productivity in the form of automation caused the relative and absolute declines in manufacturing employment. Yet given the massive structural change occurring at the time, accelerated productivity growth may largely reflect changes in the composition of products produced and processes done in the United States, and may have largely been a consequence of international trade.

Discussion

The aggregate manufacturing output and productivity statistics, dominated by the computer industry, mask considerable weakness in most manufacturing industries, where real output growth has been much slower than in the private sector overall since the 1980s and has been anemic or declining since 2000. Because manufacturing has deep supply chains and accounts for a disproportionate share of R&D in the economy, the health of manufacturing industries has important implications for employment and output growth and innovation in the economy. Understanding the causes of the decline is necessary for developing sensible policy responses.

The prevailing view that automation largely caused the swift relative and absolute declines in U.S. manufacturing employment in the 2000s reflects a misinterpretation of the numbers. Moreover, the automation view is not backed by rigorous research. Studies have failed to find that automation was a significant cause of the precipitous decline in manufacturing employment in the 2000s. And while industrial robots may have the potential to displace many workers in the future, any effects on manufacturing employment to date are small.

A large and growing body of research has also examined the effects of trade on domestic manufacturing in the 2000s. No study captures all aspects of globalization and its effects on manufacturing and aggregate employment, and the limitations of any individual study need to be recognized. Collectively, however, the research points to sizable adverse effects from trade on employment, output, and investment.[5] The denial by many in both the Republican and Democrat parties of globalization's significant role in manufacturing's recent employment declines has inhibited much-needed, informed debate over trade policies.

NOTES

1. GDP, also called value added, reflects the contributions an industry or sector makes to output from its labor and capital.

2. Formally, $\dot{L_T} - \dot{L_M} = (\dot{GDP_T} - \dot{GDP_M}) - (\dot{Prd_T} - \dot{Prd_M})$, where the T and M subscripts indicate the total private and manufacturing sectors, and $\dot{L}$, $\dot{GDP}$, and $\dot{Prd}$ represent the growth rates in labor, GDP, and labor productivity, respectively.

3. See, for example, DeLong, Brad. 2017. "NAFTA and Other Trade Deals Have Not Gutted American Manufacturing—Period." Vox Media. I provide additional citations in Houseman (2018).

4. See Holmes, Thomas J. 2011. "The Case of the Disappearing Large-Employer Manufacturing Plants: Not Much of a Mystery After All." Economic Policy Paper 11-4. Minneapolis, MN: Federal Reserve Bank of Minneapolis.

5. I provide an overview and citations to studies on automation and trade in Houseman (2018).

RELATED ARTICLES

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