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The Role of Manufacturing in a Jobs Recovery

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The Role of Manufacturing in a Jobs Recovery

By Susan N. Houseman

Problems in the U.S. labor market were evident well before the start of the recession in 2008. The U.S. economy was dubbed the American jobs machine in the 1990s, but employment growth abruptly slowed after 2000, leading to a sizable decline between 2000 and 2007 in the employment rate among working-age adults.

The precipitous loss of jobs in the U.S. manufacturing sector has been a major force behind the sluggish job growth and declining employment rates that the U.S. economy has experienced since 2000.[1] Although the share of workers employed in manufacturing has been declining for decades, the number of manufacturing jobs was relatively stable between 1970 and 2000. In the seven years leading up to the Great Recession, manufacturing employment dropped by 3.4 million, or 20 percent. Manufacturing lost an additional 2.3 million jobs during the recession and has regained only a half million of those jobs during the last three years of recovery. Today, employment in U.S. manufacturing is 30 percent less than in 2000.

While most acknowledge that the deep cuts in manufacturing employment have significantly contributed to the jobs problem currently facing the U.S. economy, there is little consensus that a resurgence in U.S. manufacturing can be part of the solution. The reason is that official output statistics point to a sector that is already healthy. Except during recessions, U.S. growth in real (price-adjusted) value-added has outpaced that of aggregate gross domestic product.[2] Large employment declines accompanied by above-average output and productivity growth have led many to conclude that the sector's job losses are largely the result of labor-saving technology.

Nobel laureate Gary Becker and other prominent economists have likened manufacturing to agriculture.[3] Even though the U.S. agricultural sector produces an abundance of food and exports the surplus, farms employ few Americans today because of automation. If the sharp job losses in manufacturing since 2000 are the inevitable result of technological progress, then output growth will generate few employment gains. Manufacturing, the argument goes, is unlikely to play an important role in any future jobs recovery.

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[1] Daron Acemouglu et al. ("Import Competition and the Great U.S. Employment Sage of the 2000s," Massachusetts Institute of Technology, Working Paper, 2013) provide a formal analysis of the effect of job losses in manufacturing on aggregate job growth and employment rates in the U.S. economy since 2000.

[2] An industry's contribution to the value of the product, adjusted for changes in prices, is its real value-added or real GDP.

[3] Gary Becker, "Concern About the Decline of Manufacturing in the United States?" *The Becker-Posner Blog,* 2012, http://www.becker-posner-blog.com/2012/04/concern-about-the-decline-in-manufacturing-in-the-united-states-becker.html.

Former Labor Secretary Robert Reich succinctly expressed the views of many economists when he wrote, "Manufacturing jobs are never coming back."[4]

This view reflects a fundamental misunderstanding about what manufacturing statistics measure and what they mean. Output growth in most manufacturing industries — those that account for the large majority of the sector's value-added and employment — has been weak or negative. Although automation undoubtedly has displaced some workers in manufacturing, a growing body of research suggests that trade and the decline of the United States as a location for production have accounted for much of the sector's job loss. In addition, the employment effects of manufacturing production extend well beyond that sector. The breakup of vertically integrated firms and the growth of complex supply chains mean that a large share of the workers needed to produce manufactured goods — currently about half — is employed outside the manufacturing sector. A strong domestic manufacturing presence also is critical to innovation and the growth of high-skilled jobs.

Returning the country to full employment is the highest domestic priority for the Obama Administration. Not only can a resurgence in U.S. manufacturing be an important component of a jobs recovery, but a vibrant domestic manufacturing sector is essential for the global competitiveness of American workers.

Misperception No. 1: Manufacturing Output Growth Is Strong

A cursory look at official statistics would suggest that American manufacturing is strong. Between the business-cycle peaks of 2000 and 2007, the amount produced in U.S. factories grew at an annual rate of 2.7 percent, outpacing the annual growth rate of 2.4 percent for the U.S. economy overall. Manufacturing was especially hard-hit by the recession, and output declined by 11.5 percent between 2007 and 2009, compared to a 3.1 percent decline for the economy overall. Since 2009, output has expanded considerably faster at U.S. factories than in the economy overall. Over the last 15 years, the growth in production at U.S. factories has roughly equaled that of gross domestic product (GDP). Reflecting the view of many economists, Robert Lawrence and Lawrence Edwards recently asserted, "The concerns about U.S. manufacturing are not about output or growth…"[5]

Yet, the apparently robust output growth in manufacturing in recent years is driven by one small industry segment: computer and electronic products manufacturing. Figure 1 depicts an index of real GDP for the aggregate economy, manufacturing, and manufacturing less computer and electronic products between 1997 and 2012.[6] Over this 15-year period, output in computer-related industries grew at an average annual rate of 14.1 percent, five times faster than the next fastest-growing industry, motor vehicles. Omitting computer-related industries has a large impact on manufacturing output growth. The quantity produced in U.S. factories was 21 percent higher in 2007 compared to that in the previous business cycle peak of 2000, but without this industry the increase is almost halved. Over the 15-year period, the quantity produced at U.S. factories increased by 38 percent in official statistics; without computer and electronic products manufacturing, output increased by a mere 7 percent.

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[4] Robert Reich, "Made in America: Manufacturing Jobs Are Never Coming Back," 2009, http://www.forbes.com/2009/05/28/robert-reich-manufacturing-business-economy.html.

[5] Robert Z. Lawrence and Lawrence Edwards, "U.S. Employment Deindustrialization: Lessons From History and the International Experience," Peterson Institute for International Economics, 2013.

[6] Because of changes in industry classification, 1997 is the first year for which industry data on a consistent basis are available.

One might be surprised to learn that, in spite of its extraordinary growth in real value-added, computer and electronic products manufacturing has accounted for a relatively small and declining share of the dollar (nominal) value-added in U.S. manufacturing: 15 percent in 1997, falling to 12 percent by 2012. The rapid real output growth measured in official statistics instead reflects the prices of a relatively small number of products within this industry group (in particular the prices for computers and semiconductors) that, when adjusted for improvements in these products, are falling rapidly.

Calculating price deflators for computers and semiconductors is tricky because rapid technological advances mean that these products are becoming ever more powerful. Government statisticians take these quality improvements into account when calculating price changes. While product prices generally rise over time, between 1997 and 2011 the prices used to deflate microprocessors, portable computers, and desktop personal computers and workstations made in the United States fell at a compound annual rate of 52 percent, 36 percent, and 28 percent, respectively. Measures showing rapid growth in the quantity of computers and semiconductors do not mean that the number manufactured domestically is growing so fast — it could even be falling; rather, these measures largely capture improvements in the quality of what is produced. One personal computer assembled in the United States today, for example, is in some statistical sense the equivalent of many computers assembled a decade ago.

It is important to emphasize that adjusting price deflators to account for changes in product quality is justified, though some have questioned whether price adjustments for these products overstate the true value of product improvements to consumers.[7] It is equally important to emphasize that the price deflators for a small segment of manufacturing skew key statistics and make them hard to interpret. Computers and semiconductors account for less than 5 percent of the (nominal) dollar value of U.S. manufacturing shipments. As a result, the widely cited output growth rates in manufacturing do not represent what is happening in most of manufacturing — a fact that few economists and policy analysts understand.

Ironically, the outstanding real output growth registered in the computer and semiconductor industry segments does not signal that the United States is competitive as a location for the manufacture of these products. Few personal computers and servers are assembled in the United States anymore. And although the United States retains a sizable manufacturing presence for semiconductors, the U.S. share of global semiconductor capacity declined from 19 to 13 percent between 2000 and 2013, reflecting rapid expansion in Asia.[8]

In addition, since the 1990s, U.S. manufacturers have greatly increased their use of imported intermediate inputs, predominantly from low-cost suppliers in emerging economies. Such offshoring activities likely have imparted a sizable bias to published real value-added statistics for all manufacturing industries. To illustrate why, suppose a U.S. auto assembly plant shifts its sourcing of tires from a domestic supplier to a Mexican supplier that offers the same quality of tire for half the price. If the price decline for tires is not measured, it will appear in the data as if the U.S. auto company can produce a car with two tires. In practice, of course, statistical agencies do not track the number of tires or other parts used in such assembly plants. Instead, agencies measure the dollar value of car shipments from assembly plants and the dollar value of the inputs purchased by those plants over time and adjust the value of cars, car parts, and other inputs for price changes. In this tire example, when the plant shifts to the Mexican supplier, the auto assembly plant appears to be able to produce the same car with fewer inputs because the true quantity of

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[7] Susan Houseman, Timothy Bartik, and Timothy Sturgeon, "Measuring Manufacturing: How the Computer and Semiconductor Industries Affect the Numbers and Perceptions," Upjohn Institute, Working Paper 14-209, 2014, http://research.upjohn.org/cgi/viewcontent.cgi?article=1226&context=up_workingpapers.

[8] Houseman, Bartik, and Sturgeon.

imported inputs is understated. As a result, the real value-added and productivity in the domestic assembly plant are overstated.

Accounting for such biases, the average annual growth rate in real value-added between 1997 and 2007 may be overstated by as much as a fifth for all manufacturing and by as much as half for manufacturing excluding computer-related industries.[9] Additional factors may have resulted in further understatement in real import growth and therefore an overstatement of real value-added growth in manufacturing and in the aggregate economy.[10] Consequently, the numbers plotted in Figure 1, which are based on published statistics, in all likelihood substantially exaggerate the true growth in real value-added for manufacturing.

Misperception No. 2: Productivity Growth in Manufacturing Is Due to Automation or Labor-Saving Technology

The coincidence of rapid output growth and large employment declines implies strong labor productivity growth, leading many to conclude that productivity caused the employment losses. Such thinking is illustrated in a report on manufacturing issued by the Obama Administration, which states, "Manufacturing workers have paradoxically often been the victims of their sector's own success, as rapid productivity growth has meant that goods can be produced with fewer workers."[11] Analysts typically assume that productivity growth arises from labor-saving technology, and analogies between agriculture and manufacturing implicitly assume that productivity growth in manufacturing results from automation.

Yet, a variety of other factors may increase measured labor productivity. U.S. manufacturers have outsourced to both domestic and foreign suppliers many of the tasks previously performed in-house.[12] Often manufacturers outsource low-skill, labor-intensive tasks, or they may concentrate production in capital-intensive product segments in response to competition from low-wage countries. The result is a boost to measured productivity in what remains in the domestic manufacturing sector.[13] Even if the labor productivity of the outsourced or offshored tasks is not lower, however, the methodology used by the Bureau of Labor Statistics to compute labor productivity statistics will result in a mechanical increase in measured labor productivity, all else the same, and the increase can be substantial.[14]

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[9] Susan Houseman et al., "Offshoring Bias in U.S. Manufacturing," *Journal of Economic Perspectives* 25(2): 111–32, 2011.

[10] Feenstra et al. ("Effects of Terms of Trade Gains and Tariff Changes on the Measurement of U.S. Productivity Growth," *American Economic Journal: Economic Policy* 5(1): 59-93, 2013) discuss biases to the measurement of real import growth from tariff reductions and from an increase in the variety of imported products.

[11] Executive Office of the President, "A Framework for Revitalizing American Manufacturing (Washington DC: U.S. Government Printing Office, 2009).

[12] See Robert E. Yuskavage, Erich H. Strassner, and Gabriel W. Mederios, "Outsourcing and Imported Services in BEA's Industry Accounts," in Marshall Reinsdorf and Matthew Slaughter, eds., *International Flows of Invisibles: Trade in Services and Intangibles in the Era of Globalization* (Chicago: University of Chicago Press, 2008), pp. 247–88, and Houseman et al. for discussions of the growth of domestic outsourcing and imported intermediates by U.S. manufacturers.

[13] Andrew B. Bernard, J. Bradford Jensen, and Peter K. Schott, "Survival of the Best Fit: Exposure to Low-Wage Countries and the (Uneven) Growth of U.S. Manufacturing Plants," *Journal of International Economics* 68(1): 219–37, 2003.

[14] The issue arises from the output measure BLS uses to compute manufacturing labor productivity, which does not net out inputs purchased from outside the manufacturing sector or from overseas. Matthew Dey, Susan Houseman, and Anne E. Polivka ("Manufacturers' Outsourcing to Staffing Services," *ILR Review* 64(3): 533–59, 2012) show that manufacturing labor productivity growth has been significantly inflated in the past owing to manufacturers' use of staffing services.

Productivity growth also may reflect improvements to product design that result from research and development activities. In fact, research and development, not automation, largely underlies the declines in price deflators and, correspondingly, the rapid increases in measured real value-added and productivity for computers and semiconductors. Computers today may be far more powerful than previous models, but this fact, by itself, does not mean that it takes fewer workers to assemble a computer today than in the past. Within manufacturing, the computer and electronic products industry has sustained above-average employment losses since 2000, yet a recent report concluded that these losses are entirely attributable to the shift in production to Asia.[15] The reason employment in electronic computer manufacturing has declined by 41 percent since 2000, for example, is not because the assembly process has been automated but because most computer assembly has moved to Asia.

As an outlier with its extraordinary measured real output growth and large employment declines, the computer and electronic products industry not only makes published statistics difficult to interpret but also can be the source of perverse research findings. Using state manufacturing data from 1997 to 2007, Timothy Bartik, Timothy Sturgeon, and I illustrate how the computer and electronic products industry breaks the expected empirical relationship between manufacturing output and employment growth. Higher state manufacturing output arising from increased demand should increase manufacturing employment, all else the same. Yet the study finds no effect; states with higher output growth from increased demand for their products experience no higher growth in manufacturing employment. This finding makes no sense, although the naïve analyst might conclude that policies to increase employment by stimulating growth in the manufacturing sector, such as through export promotion, will be futile.

When computer and electronic products are excluded from the measures, however, the expected relationship between output and employment appears: an increase in demand that results in a 10 percent increase in a state's real manufacturing value-added results in a 7 to 10 percent increase in its manufacturing employment.[16] Our findings suggest that had annual real value-added growth in the balance of manufacturing been at the level published for all of manufacturing during the period (3.6 percent), manufacturing employment in the decade leading up to the Great Recession would have dropped little, if at all, and the adverse spillover effects on employment in other sectors would have been avoided.

The Causes of the Decline in Manufacturing Employment and the Competitiveness of American Workers

Although this analysis does not attempt to explain the reasons behind the sharp decline in U.S. manufacturing employment since 2000, it does underscore the point that the strong output and productivity growth in the aggregate manufacturing statistics is not evidence by itself that automation caused the decline. Economists generally understand that one cannot draw causal inferences from descriptive data. In the absence of solid research, however, the analogy to agriculture has provided a simple and, on the surface, compelling explanation for the decline in manufacturing employment. According to Gary Becker, as in agriculture:

> Big productivity gains in manufacturing are also a major cause behind the decrease in manufacturing employment in the United States. Higher productivity lowered prices of manufactured goods relative to prices of services. Yet employment in manufacturing fell because the lower manufacturing prices did not stimulate a large enough increase in the

[15] Charles Roxburgh et al., "Trading Myths: Addressing Misconceptions About Trade, Jobs, and Competitiveness," McKinsey Global Institute, 2012.

[16] See the appendix for further discussion.

demand for manufactured goods to offset the productivity increases of the manufacturing workforce.[17]

As emphasized above, however, labor productivity growth in not synonymous with automation. Rapidly falling prices for computers and semiconductors, the result of quality adjustment for technological improvements in these products, played a large role in the lower price growth of manufactured goods relative to services as measured in official statistics, as did the growth of low-cost imported intermediates from emerging economies. In addition, Becker's assertion that the increase in demand for manufactured goods has been insufficient to offset productivity increases seems at odds with the sharply higher trade deficit in manufactured goods that the United States has run since 2000, coincident with the decline in manufacturing employment. And world demand for manufactured products has soared since the 1990s with the explosive development in emerging economies.

Establishing the causes of the sharp decline in U.S. manufacturing employment since 2000 is difficult. During the period, trade has expanded and significant technological advances have been made, but it is hard to empirically parse out the relative contributions of trade, technology, or other macroeconomic factors that have influenced manufacturing employment; no credible research provides a precise accounting. Yet, the most rigorous research to date, which has focused on the effects of Chinese imports, clearly points to trade as a large and likely the most important factor. A study using industry and regional data finds that increased exposure to Chinese imports can explain 26 to 55 percent of the decline in manufacturing employment between 2000 and 2007 and also had sizable adverse impacts on employment rates and wages in local economies.[18] Drawing on plant-level data, another study finds that normalization of U.S. trade relations with China in 2000 led to large net job losses in manufacturing in the ensuing years both because job destruction accelerated and because job creation slowed at U.S. factories. In the absence of this policy change, employment in manufacturing, which fell by 15 percent between 2001 and 2007, would instead have expanded by 10 percent, according to the study's estimates.[19]

Related to this last finding, U.S. multinational enterprises have expanded employment primarily in their foreign operations, according to data from the Bureau of Economic Analysis. The propensity of U.S. multinational companies to move production to foreign affiliates rather than to export from the United States has been tied to weak export growth, expansion of the trade deficit, and anemic hiring in domestic manufacturing.[20]

This collection of evidence is consistent with new data showing that the U.S. share of labor employed to meet world demand for manufactured goods has steadily declined from 4.4 percent in 1995 to 2.8 percent in 2009. The U.S. experience is similar in some respects to that of other advanced economies. While the number of workers employed directly or indirectly in the production of manufactured products has declined in the United States and most other advanced economies, the number has significantly expanded in emerging economies, including China, India, Mexico, and Brazil. The United States experienced the

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[17] Becker.

[18] David H. Autor, David Dorn, and Gordon H. Hanson, "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review* 103(6): 2121–68, 2012.

[19] Justin R. Pierce and Peter K. Schott, "The Surprisingly Swift Decline of U.S. Manufacturing Employment," National Bureau of Economic Research, Working Paper 18655, 2012.

[20] Barry Bosworth and Susan M. Collins, "Rebalancing the U.S. Economy in a Post-Crisis World," Brookings Institution, Working Paper, 2011.

greatest percentage decline in manufacturing-related employment, and a much larger decline than did Europe.[21]

Moreover, whereas the number of college-educated workers increased in all other advanced countries, mitigating overall declines in the size of the workforce, the number of highly educated workers involved in manufacturing in the United States has fallen. From 1995 to 2008, the number of workers with at least a four-year college degree in manufacturing-related employment fell by about 200,000 in the United States while it rose by about 360,000 in Japan, 610,000 in Germany, and 570,000 in France.[22] In 1995 the United States accounted for an estimated 17.4 percent of college-educated workers used directly or indirectly to meet world demand for manufacturing products; by 2008 that share was 9.8 percent. Given that the United States is presumed to have a comparative advantage in high-skilled labor, this finding is surprising and suggests that even U.S. college-educated workers have fared relatively poorly in the global economy.

The Importance of Manufacturing in Jobs Creation

The decline of manufacturing employment in the 2000s put a drag on employment growth in the U.S. economy both because of the magnitude of the jobs lost in that sector and because of the large spillover effects manufacturing has on employment in other sectors. Just as the decline in manufacturing employment was, to a large degree, responsible for the weakening U.S. labor market in the years leading up to the Great Recession, some restoration of manufacturing jobs arguably is needed to help restore the labor market's health.

In assessing the potential employment impacts of policies that promote manufacturing, it is important to recognize that much of the job growth will occur *outside* the manufacturing sector. In the United States, as in other countries, a growing share of workers directly and indirectly needed to produce manufactured products is employed in services and other non-manufacturing sectors.[23] This trend, in part, reflects the fact that domestic contracting out has increased as companies have become less vertically integrated. As a result, labor that used to be counted in manufacturing is embedded in purchased services. Even many workers in core production jobs are employed through staffing services.[24]

Today, roughly half of the workers needed to produce U.S. manufactured goods are employed outside the manufacturing sector. Back-of-the-envelope calculations suggest, therefore, that the Obama Administration's modest goal of adding 1 million manufacturing jobs to the economy during his second term would result in the employment of an additional million workers in other sectors. Arguably a much larger number of manufacturing jobs potentially could be added to the economy: most manufacturing jobs lost during a recession typically are restored during the initial recovery period,[25] and a sizable share, if not all, of manufacturing's job losses between 2000 and 2007 have been linked to trade and globalization. Should the economy recover half of the 5.3 million manufacturing jobs lost since 2000, more than 5 million jobs would be generated to support the increased domestic production. In view of the low

[21] These tabulations are based on the World Input–Output Database, described in Marcel P. Timmer, Bart Los, and Gaaitzen J. de Vries, "Incomes and Jobs in the Global Production of Manufacturers: New Measures of Competitiveness Based on the World Input–Output Database," paper presented at the conference "Measuring the Effects of Globalization," Washington DC, February 28–March 1, 2013.

[22] Timmer, Los, and de Vries.

[23] Timmer, Los, and de Vries.

[24] Dey, Houseman, and Polivka.

[25] The one exception was the recovery following the 2001 recession, which coincided with China's accession to the World Trade Organization and a surge of imports from that country.

employment rates prevailing in the U.S. economy, the income generated by these additional jobs should raise aggregate demand, further increasing employment.

Besides the immediate employment benefits from a resurgent manufacturing sector, a strong manufacturing sector is integral to innovation and thereby to a dynamic economy. This assertion may seem at odds with recent economic history. In the last few decades, some of the most successful American companies, such as Apple, Cisco, and Qualcomm, outsourced the manufacturing of the products they design, for the most part to producers overseas.[26] With improved communications and the growth of global supply chains, the United States, it might have seemed, could keep the high-skilled, high-value-added jobs in innovation, even if it lost the factory jobs.

Yet, the recent MIT initiative on "Production in the Innovation Economy" and other research challenge the notion that this business model is broadly applicable or sustainable. The process of innovating, testing prototypes, and scaling them up for market depends on a deep set of skills and know-how, often geographically based, within and across firms and universities, forming what has been termed an "industrial commons."[27] An MIT solar lab, for example, relies on skilled machinists in local companies to fashion instruments, and these companies, in turn, depend on the labs to test and develop tools that they will market to solar companies.[28] The refinement of product design is an iterative process with manufacturing: often a large part of developing a new product design involves innovations in production, and insights from the production process generate ideas for new product designs.

As a result, the trend by U.S. companies to offshore production could significantly undermine future innovation in the United States. Indeed, some evidence suggests that research and development jobs are already following manufacturing. Virtually all U.S.-branded laptops and cell phones, for instance, are both manufactured and designed in Asia.[29]

Implications for Policy

Framing the debate: implications for statistical agencies

The widespread perception that American manufacturing is strong has shaped the policy response — or lack thereof — to the steep decline in manufacturing jobs since 2000. Yet, few who point to manufacturing's apparently robust output growth to argue that these employment declines are inevitable understand that one small industry segment largely accounts for the sector's growth, that the output and productivity growth in computer-related industries primarily derives from product innovation, or that even in these industries the U.S. manufacturing presence appears to be declining. The health of American manufacturing also has been exaggerated because of biases in the numbers related to the growth of low-cost imports. Economic statistics should help inform policymakers and guide responses, but at times the statistics have muddled the important policy debate over manufacturing in this country.

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[26] William Lazonick, in *Sustainable Prosperity in the New Economy? Business Organization and High-Tech Employment in the United States* (Kalamazoo, MI: Upjohn Press, 2009), provides a discussion of the evolution of what he calls the new economy business model.

[27] Gary P. Pisano and Willy C. Shih, "Restoring American Competitiveness," *Harvard Business Review,* July-August 2009, pp. 114–25.

[28] Suzanne Berger, *Making in America: From Innovation to Market* (Cambridge, MA: MIT Press, 2013), p. 5.

[29] Pisano and Shih.

In the short term, statistical agencies could easily clear up much of the confusion over the numbers by making the influence of computer-related industries on the aggregate statistics transparent. Specifically, agencies should publish separate tabulations on real output and productivity measures for manufacturing excluding computer-related industries. Because the calculations are involved and the requisite industry detail is not published or published with considerable lag, it is not feasible for data users to do them. Over the longer term, agencies need to address biases in the data that have been magnified by the growth of trade.

Policies to promote manufacturing

Recognizing that the United States has lost competitiveness as a location for production and that globalization and international trade are, to a large degree, responsible for the steep loss of U.S. manufacturing jobs is an essential first step for fashioning appropriate policy responses. The decline in the competitiveness of the United States as a location for factories does not mean that companies headquartered in the United States are faring poorly in the global economy. U.S. multinational companies have enjoyed record profits and stock prices in recent years. The problem is that their success has translated into little domestic job growth, as these companies have focused on expanding overseas operations.

While job losses in manufacturing are not, as many have argued, inevitable, reversing the sharp decline of U.S. manufacturing employment since 2000 will not be easy. An effective strategy will likely involve an array of trade, exchange rate, tax, investment, and labor-market policies. Notably, implementing several of these policies will require little in the way of expenditures.

Many economists see exchange rates as the key determinant of the U.S. trade deficit, and some depreciation of the dollar against foreign currencies is critical to restoring balance.[30] However, because some have seen the sharp decline in U.S. manufacturing employment as largely a consequence of automation, they have discounted the adverse consequences of the ballooning trade deficit on employment in the economy. U.S. pressure has led to a 26 percent depreciation of the dollar against the Chinese renminbi since 2006, but the dollar nevertheless remains substantially overvalued relative to the renminbi as well as to the currencies of other major trading partners.[31] The strong dollar reflects currency manipulation as well as the fact that the U.S. economy has served as a safe haven for foreign investors during this current uncertain economic period. While the role that the dollar plays as the world's reserve currency confers some benefits to the U.S. economy, it is time to fully recognize the short- and long-term deleterious effects of a large trade deficit on jobs and the competitiveness of American industry, labor, and innovation.

High U.S. statutory corporate income tax rates, which in the top bracket are 39 percent when federal and state taxes are combined,[32] also have dampened job growth in the United States. While the income tax rates companies actually pay can be considerably lower, among manufacturing firms in recent years the average effective tax rate for those headquartered in the United States was 26 percent, one of the highest in the world and 11 percentage points higher than the average effective rate for manufacturers

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[30] C. Fred Bergsten, "Addressing Currency Manipulation Through Trade Agreements," Peterson Institute for International Economics, Policy Brief 14-2, 2014; Bosworth and Collins; and Dean Baker, "The Trade Deficit: The Biggest Obstacle to Full Employment," Center for Economic and Policy Research and Center on Budget and Policy Priorities, 2014.

[31] Bergsten.

[32] OECD, "Corporate and Capital Income Taxes, http://www.oecd.org/tax/tax-policy/tax-database.htm - C_CorporateCaptial.

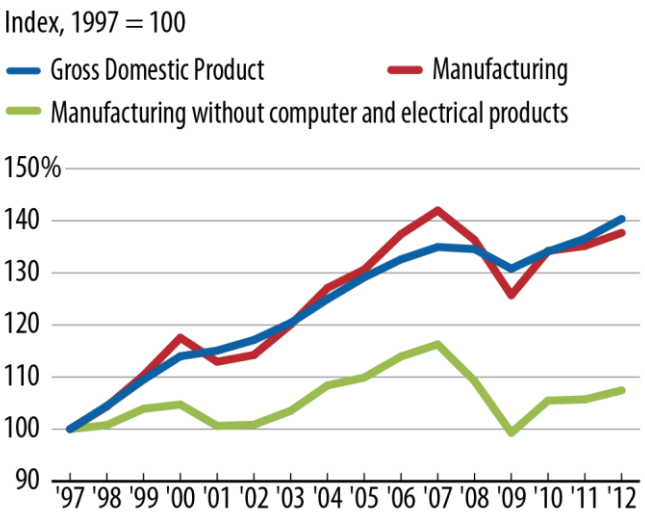
headquartered in tax havens.[33] In response to such differences, some American companies have moved their corporate headquarters overseas. Moreover, relatively high marginal U.S. corporate tax rates give multinational companies a strong incentive to hold or reinvest their foreign earnings overseas. Significantly lowering corporate income taxes in a revenue-neutral way by eliminating deductions and simplifying the tax code enjoys broad bipartisan support. While such reform is not specific to manufacturing, it is important to revitalizing the sector.

Other potentially important policies would specifically target manufacturing. Improving access for U.S. producers to foreign markets is a high priority. The Obama Administration's new initiative to create Institutes for Manufacturing Innovation is intended to generate regional public-private partnerships among universities, companies, and governments in specific areas of advanced manufacturing. These collaborative efforts, which involve innovation and scaling up for production, are modeled on successful programs in Germany and should help reestablish the "industrial commons" that has eroded in many parts of the country in recent years.

Expansion of manufacturing employment also requires an appropriately skilled workforce. Widespread media reports suggest that hiring in manufacturing has stalled because employers cannot find workers with the right qualifications in spite of high unemployment rates. A recent survey shows that, while such a skills gap is not the norm, it is a problem for a significant minority of manufacturers.[34] The perception that technology was causing manufacturing jobs to quickly disappear was an important factor spurring major changes in education curricula across the country. Unfortunately, vocational and technical education was often a casualty of these reforms. Revitalizing American manufacturing is a key component of a broader strategy to restore full employment, and rigorous vocational and technical education programs in high schools and community colleges, apprenticeships, and training assistance for employers will help prepare workers for these jobs.

Figure 1

Real GDP and Value-Added in Manufacturing, 1997-2012



Source: Author's calculations based on BEA data.

[33] Kevin S. Markle and Douglas A. Shackelford, "Cross-Country Comparisons of Corporate Income Taxes," National Bureau of Economic Research, Working Paper No. 16839, 2011.

[34] Paul Osterman and Andrew Weaver, "Skills and Skills Gaps in Manufacturing," in Richard M. Locke and Rachel L. Wellhaussen, eds., *Production in the Innovation Economy* (Cambridge, MA: MIT Press, 2004), pp. 17-50.

Appendix:
The Relationship Between Manufacturing Output and Employment Growth

The computer and electronic products industry has a large effect on manufacturing real value-added growth not only at the national level, but also in most states. Over the decade from 1997 to 2007, measured growth in manufacturing real value-added falls by more than half in 28 states and by more than a quarter in all but 10 states when that the computer and electronic products industry is excluded.[35]

A state that experiences relatively higher growth in demand for its manufactured products also should experience greater manufacturing employment growth, all else the same. In Houseman, Bartik, and Sturgeon, however, my coauthors and I show that the outsized effect of computer-related industries on the sector's real output growth disrupts this expected economic relationship. Specifically, we estimate the log change in a state's manufacturing employment between 1997 and 2007 on the state's log change in manufacturing real value-added:

$$\ln(E_{s,07} / E_{s,97}) = \alpha + \beta \ln(Q_{s,07} / Q_{s,97}) + \varepsilon_s$$

Simple ordinary least squares regressions do not have a causal interpretation. While a state's manufacturing output growth should be associated with manufacturing employment growth, causality could run in the opposite direction; for example, an increase in a state's population may increase the supply of manufacturing workers and lead to higher state manufacturing output. To isolate the effect of demand changes on employment growth, we instrument state manufacturing real value-added with a weighted average of industry real value-added growth at the national level, where the weights represent the industries' shares of manufacturing value-added in the state.

Appendix Table 1 displays estimates of β, which captures the elasticity of manufacturing employment with respect to real value-added, from two-stage least squares regressions. Manufacturing real value-added is measured three ways: 1) as published, 2) omitting the computer and electronic products industry from the sector, and 3) omitting the computer and electronic products industry and adjusting for biases from offshoring in the published output growth measures.

Column 1 reports the results of regressions that use observations from all 50 states. The estimated elasticity based on published manufacturing statistics (top panel) is near zero and insignificant, implying that higher demand for a state's manufacturing products will have no effect on its manufacturing employment. When the computer and electronic products industry is omitted from the sector (middle panel), however, the elasticity jumps to about 1, although it is imprecisely estimated. Also adjusting the real value-added growth measure for biases from offshoring (bottom panel) yields a similar coefficient estimate but improves its precision. The elasticity estimate in the bottom panel of 1.1 is moderately significant (p-value is 0.07) and implies that a 10 percent demand-driven increase in manufacturing real value-added will generate a similar percentage increase in the state's manufacturing employment.

Column 2 omits Alaska and Hawaii, the states with the smallest manufacturing sectors, from the analysis. The pattern of coefficient estimates in column 2 is similar to that of column 1, but the precision of estimates is improved. The elasticity estimate using the published manufacturing growth rates is again near zero and insignificant. In the middle and bottom panels, the elasticity estimates of about 0.7 are somewhat smaller than those in column 1, (though insignificantly different from 1), but are significantly different from zero at conventional levels (p-values are 0.05 and 0.02). Further discussion and a complete set of results are available in Houseman, Bartik and Sturgeon.

[35] Houseman, Bartik, and Sturgeon.

Table 1

The Effect of Manufacturing Output Growth on Employment Growth, 1997–2007

	All 50 States	48 Continental States
Growth manufacturing real value added	0.073 (0.08)	0.084 (0.08)
Growth manufacturing real value added without computer and electrical product manufacturing	1.14 (0.70)	0.69** (0.34)
Growth manufacturing real value added without computer and electrical product manufacturing and adjusted for offshoring bias	1.10* (0.59)	0.70** (0.30)
N	50	48

Notes: Each panel represents the regression of state employment growth on output growth for the period 1997-2007.
A weighted average of national-level industry real value-added growth is used as an instrument for state growth measures. The reported coefficient estimate represents the estimated elasticity of manufacturing employment with respect to real value-added. Standard errors of the coefficient estimates are reported in parentheses.

*Denotes significance at the 0.1 level.

**Denotes significance at the 0.05 level.