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IS AMERICAN MANUFACTURING IN DECLINE?

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Johns Hopkins Institute for Applied Economics,
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Enterprise

Is American Manufacturing in Decline?

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About the Series

The *American Capitalism* series in under the general direction of Professor Steve H. Hanke, Co-Director of the Johns Hopkins Institute for Applied Economics, Global Health, and the Study of Business Enterprise (hanke@jhu.edu).

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Abstract

There is a widespread popular view that American manufacturing is in decline. This declinist view reflects many factors. First, real GDP growth during the current business expansion has been the weakest in the post-WWII period. Second, over the decade from 2000 to 2010, manufacturing employment has declined by about 6 million. Third, persistent manufacturing trade deficits have led many observers to conclude U.S. competitiveness has eroded. This paper discusses these arguments and suggests a competing view that, instead, U.S. manufacturing is a leading growth sector and has remained strongly competitive internationally. On balance, we show that traditional domestic economic forces adequately explain recent trends in U.S. manufacturing output and employment growth. Finally, we argue that the recent reduction in the corporate income tax rate may further boost the fortunes of the U.S. manufacturing sector, although this favorable development could be offset by a more restrictive international trade regime.

The following paper won the National Association for Business Economics' first Daniel Meckstroth Award for Excellence in Manufacturing Research, 2018. It is forthcoming in the July Business Economics.

Is American Manufacturing in Decline?

Kevin L. Kliesen and John A. Tatom*

INTRODUCTION

According to a recent Gallup poll, Americans believe that a vibrant manufacturing sector is "key" to boosting job growth.[1] At the same time, many may also appear to believe that American manufacturing is in an irreversible decline because of declining competitiveness with manufacturers in other countries—particularly those in Asia. The declinist view seemed to increase in popularity following the Great Recession and financial crisis. Between December 2007 (previous business cycle peak) and March 2010, the number of employees in the manufacturing sector declined from almost 13.75 million to about 11.5 million employees—the lowest level since March 1941. However, the recent plunge in manufacturing employment is not a new development. In fact, manufacturing employment has been on a secular decline since the late 1970s. From its peak in June 1979 to its recent trough in March 2010, manufacturing employment has declined by about 8.1 million.

Although the Great Recession was a severe shock to manufacturing, the longer secular decline in manufacturing employment has reflected other factors. One potential factor has been the persistence of manufacturing (goods) trade deficits. In the declinist view, growing imports have displaced domestic production, thereby triggering a wave of plant closures and lost jobs. Of course, growing trade deficits ultimately stem from the nation's fundamentals—in this case, lower domestic saving rates. A second potential factor has centered on China and the potential adverse effects of its entry into the World Trade Association at the end of 2001.

This paper discusses these arguments and presents a competing narrative. We argue instead that the U.S. manufacturing sector is fundamentally strong. Why? Because it has historically experienced rapidly rising productivity and output that, despite falling employment, has maintained a roughly constant share of domestic output (GDP). This was evident historically in a falling relative price of manufacturing output. While beneficial to manufacturing and to other sectors, rising levels of manufacturing productivity naturally lead to declining employment in manufacturing —much as the agricultural sector experience declining employment and rising output in the 20th century.

That said, we are cognizant of the fact that, along with the aggregate economy, manufacturing output and productivity growth have been unusually slow, and employment declined sharply for 10 years since the turn of the century.[2] But since the

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[1] See http://news.gallup.com/poll/211010/americans-manufacturing-key-job-creation.aspx.

[2] See Fernald et al (2017) for a useful review of most of these issues from a more aggregate approach that focuses especially on the weakness of the recent recovery.

manufacturing sector is highly cyclical, weaker manufacturing output growth reflects fundamentals in the aggregate economy. In that vein, the slowing growth of population and the labor force, dramatically slower capital formation and consequent weaker aggregate labor productivity growth, have helped to slow the economy's potential GDP growth and its actual growth rate. Thus, if the declinist view has any credence, it mostly stems from the nation's slower economic growth process and very weak economic recovery. Should aggregate productivity rebound, this will be reflected in a tremendous boost to the manufacturing sector.

The outline of the paper is as follows. In section 1 we show that there are some key recent qualifications to the pattern of U.S. manufacturing trends that prevailed over the post-World War II period. Despite the influence of slowing population and labor force growth, and its related effects on investment, capital formation, and productivity, U.S manufacturing output and, less so, employment growth remains healthy. In fact, relatively faster productivity growth, reflecting innovation and the substitution of labor for capital, continues to shift employment shares away from manufacturing to other sectors, especially services.

In Section 2, we examine the role of domestic factors—demographics and structural labor productivity growth—in explaining the slowdown in manufacturing employment and a lower manufacturing output share. In Section 3, we turn to the role of foreign factors, such as growing imports from abroad, especially from China and other emerging market countries in Asia. This conjecture is termed the Chinese import hypothesis. Our analysis shows, instead, that that there is a strong *positive* relationship between U.S. manufacturing output growth and growth of goods imports. This occurs because of the key role that imported materials and capital goods play in boosting U.S. manufacturing competitiveness. Although we find some evidence that the time period surrounding China's entry into the WTO in December 2001 was associated with declines in U.S. manufacturing employment, consistent with the findings of other researchers, we also find that the surge in Chinese imports does not appear to be the dominant explanation for trends in U.S. manufacturing employment since the early 2000s.

Section 4 concludes with a brief discussion of the outlook for U.S. manufacturing given recent legislation to reduce the federal corporate tax rate from 35 percent to 21 percent and introduce immediate expensing of capital formation. We also briefly discuss the Trump Administration's belief that unilateral and bilateral trade policies, including tariffs or quotas, will lower U.S. imports and the trade deficit. We argue that the latter effect is likely to adversely affect the U.S. manufacturing sector. We undertake no formal modeling exercise to examine whether the net effect of these two developments will be positive or negative for the U.S. manufacturing sector. Our evidence of a positive link between imports and manufacturing suggests that trade policy efforts to restrain imports, if successful, will reduce the efficiency and productivity growth in manufacturing that is expected to result from beneficial new regulatory and tax policy initiatives.

1. Changing Patterns of Manufacturing Performance

Popular discussions of the death of U.S. manufacturing date back at least to the 1970s, when many analysts argued that manufacturing had lost its competitiveness. Proponents of this view argued that output and employment was declining because manufacturers were closing domestic operations and opening facilities overseas. This phenomenon came to called the "deindustrialization" hypothesis: Basic manufacturing operations were moving overseas, leaving only headquarter shell operations and "hollowing out" their operations in the United States. In part, these arguments were buttressed by the large energy price shocks in 1973-74 that lowered productivity in the early 1980s and helped trigger relatively deep and long recessions and double-digit inflation (stagflation). Another factor was the rise of Japan, Inc., which led to protectionist trade measures against Japanese automotive manufacturers, among others. Japan's ascent from the ashes of World War II to the purported world leader in manufacturing echoes today with China's rise as a global economic power over the past 30 years of so.[3] In hindsight, the claims of the demise of the U.S. manufacturing sector made during the 1970s, 1980s and 1990s seem overwrought, at best.

Figure 1
Divergent Trends in Manufacturing Performance

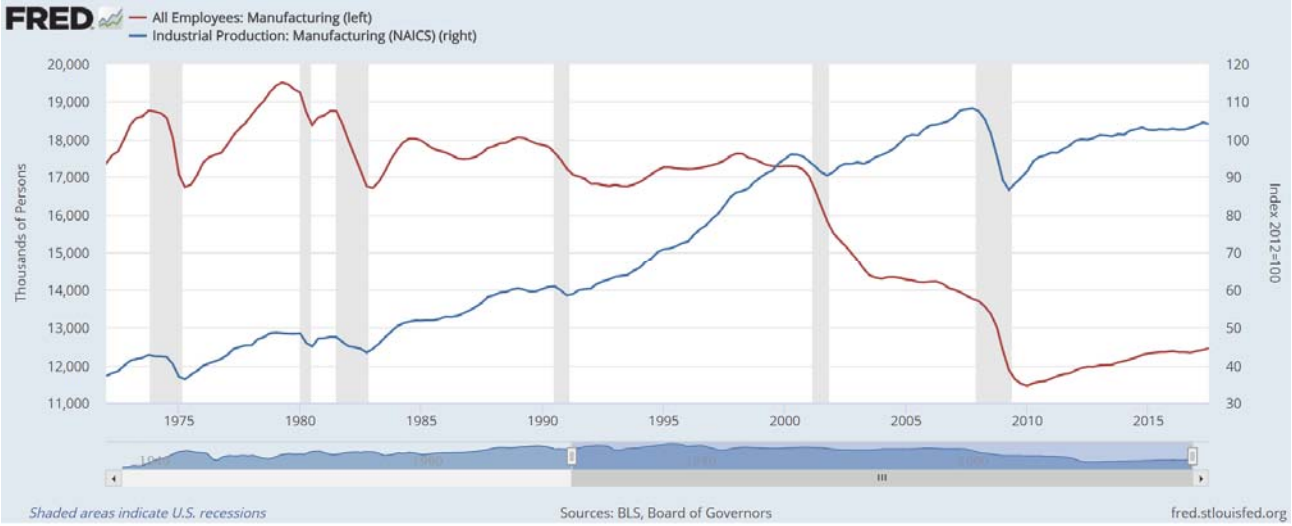


Figure 1 plots domestic manufacturing output and employment over the past 45 years. We begin the data in 1972 because of a revision in how manufacturing firms and their output are classified and measured.[4] As the recession-shaded areas suggest, manufacturing output and employment are very sensitive to the state of the economy.[5] Indeed, the National Bureau of Economic Research Business Cycle Dating Committee uses industrial production as a key metric when dating business cycle peaks and troughs.

[3] See Thurow (1992).
[4] This was due to the shift from the Standard Industrial Classification code (SIC) to the North American Industry Classification System (NAICS) in 1997. The data on the new basis began to appear in the early 1990s and was officially developed with the cooperation of the United States, Canada and Mexico. The data here are based on NAICS and on this basis date from 1972.
[5] From the first quarter of 1973 to the third quarter of 2017, the correlation coefficient between four-quarter growth rates in manufacturing output and real GDP was 0.87; it was 0.89 between manufacturing employment and civilian employment.

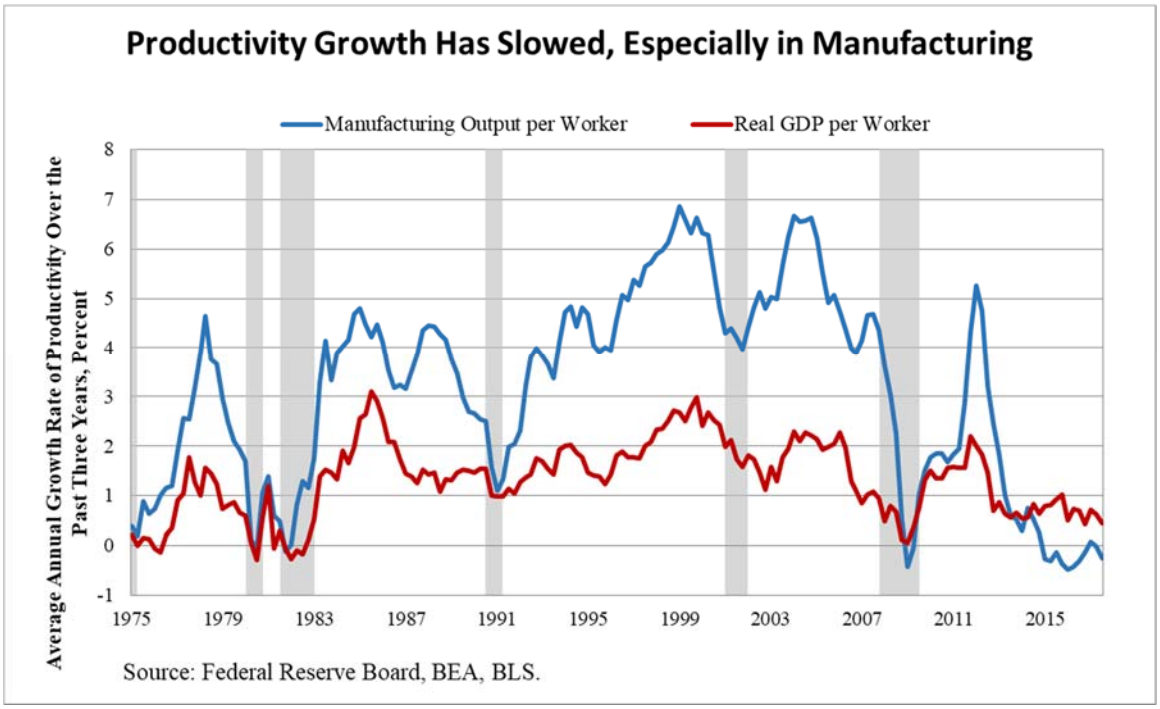
As Figure 1 shows, manufacturing output and employment fell sharply during the Great Recession and financial crisis. From the fourth quarter of 2007 to the second quarter of 2009, output fell by 20 percent, the largest recession-induced decline since the 1930s. In percentage terms, manufacturing employment fell by 13.7 percent, about 1.9 million jobs. However, as Figure 1 also shows, manufacturing employment was falling both before the start of the recession and continued to decline slightly for the first three quarters after the recession.

Although manufacturing output has increased since the trough of the Great Recession, its growth, like the overall economy, has been unusually weak.[6] From the second quarter of 2009 to the third quarter of 2017, manufacturing output has increased at a 2.2 percent annual rate, slower than the 3 percent annual rate in the six-year expansion from the 2001 recession. Both were well below the 5 percent average rate of the first six years of recovery and expansion in the prior two expansions (since 1982). Figure 1 also shows that manufacturing output, unlike previous expansions, currently remains below its previous-expansion peak. Although output has increased at a 2.2 percent rate since the business cycle trough, manufacturing employment has only increased half as fast (1.1 percent rate) since early 2010.

There are other ways to measure changes in manufacturing performance. One key measure is labor productivity. Figure 2 shows (i) the annual growth rate over the three previous years of indices of output per worker for the overall economy, measured as real GDP per civilian worker,[7] and (ii) the annual growth rate over the most recent three years for manufacturing output per manufacturing worker. The figure shows that manufacturing productivity has historically grown much faster than that for the overall economy. This has made possible falling prices of manufacturing output relative to the price of overall output. Both measures began to slow after the turn of the century. However, manufacturing productivity growth slowed more sharply after the business cycle peak at the end of 2007—both absolutely and relative to aggregate U.S. productivity growth, as noted above. It even began to fall in 2014. From the last business cycle peak at the end of 2007 to the third quarter of 2017, manufacturing output per worker has risen at only a 0.6 percent rate, slower than the real GDP per worker growth rate of 0.9 percent.

Figure 2
Manufacturing Productivity Growth Has Declined Relatively and Absolutely

[6] Bordo and Haubrich (2012) have pointed to the unusually weak recovery from the Financial Crisis.
[7] Real GDP per worker is a broad indicator of labor productivity for the whole economy. Productivity analysts often use measured output per hour instead of per worker. Our measure of aggregate productivity is closely related to, and the dominant determinant of real GDP per person, a common measure of living standards. It is also closely related to movements in output per hour in the business sector. Declining hours per worker make it grow slightly slower than output per hour in the business sector.



Another metric of manufacturing performance is its output growth relative to the growth of the overall economy (real GDP). If manufacturing is a declining industry, then its output share should be declining relative to non-manufacturing industries. Figure 3 shows manufacturing output and employment as shares of real GDP and civilian employment, respectively; the figure also plots manufacturing productivity relative to that for the overall economy. The output share is consistent with the pattern noted above—that is, a relatively constant share of manufacturing output to real GDP until the beginning of the Great Recession. From the first quarter of 1972 to the first quarter of 2008, the output share averaged 21.7 percent. Indeed, the output shares would remain relatively constant if we had extended the sample period before 1972.[8]

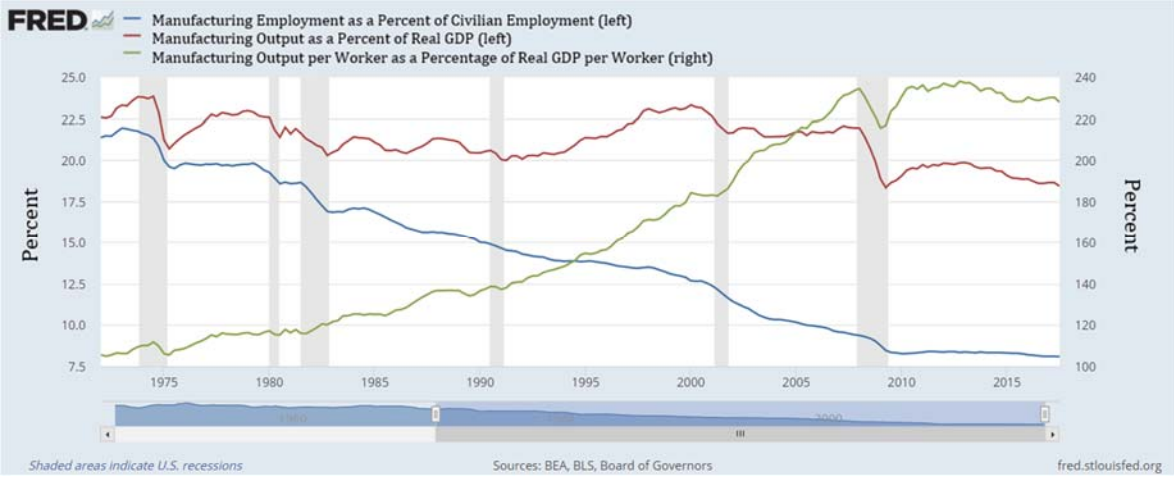
Figure 3 also shows that the manufacturing output share has declined in the aftermath of the Great Recession, reflecting the relatively faster growth of non-manufacturing output relative to manufacturing output. The manufacturing output share is currently about 18.4 percent, more than 3 percentage points below its long-run average, and the same as it was at the lowest point in the Great Recession. Some of the recent decline in the manufacturing share probably reflects a sharp decline in the production of equipment and structures used in mining and exploration after the collapse in crude oil prices in June 2014. Another factor is the sharp decline in coal production, as aging units were closed or many existing plants switched from coal-fired to natural gas-fired units.[9] Regardless of

[8] See Kliesen and Tatom (2013) or Tatom (1986), which shows the relatively constant share of manufacturing in real GDP extends, using SIC code data for the manufacturing sector holds up from 1948 to 1985.

[9] From December 2014 to March 2016, energy production in the industrial sector declined by 11.5 percent.

the reason, there appears to be no apparent tendency yet for the manufacturing output share to return to its earlier mean.[10]

Figure 3
Manufacturing Output, Employment and Productivity and The Total Economy



A fourth, and final, method of analyzing the performance of the U.S. manufacturing sector is by comparing it to other advance countries. If foreign countries are experiencing faster growth in manufacturing output compared with the United States, then that would be some evidence of a decline in U.S. performance.

International Comparisons
Probably the best data for assessing the performance of U.S. manufacturing performance relative to other countries is collected and published by the Organization for Economic Cooperation and Development (OECD). The OECD has data on manufacturing output (value-added) measured in constant 2010 U.S. dollar prices for 32 of the 35 OECD member countries for the period 1997-2016.[11] Table 1 details manufacturing output for the United States and seven other developed countries with important trade ties to the United States: France, Germany, the United Kingdom, Italy, Japan, Mexico, and South Korea. In 1997, real manufacturing output in these eight countries totaled $3.97 trillion. Output totaled about $880 billion for all other countries. Thus, these eight countries comprise the bulk of OECD manufacturing activity, roughly 82 percent. United States manufacturing output accounted for a little more than a third of the eight-country output in 1997, with Japan accounting for a little more than a quarter of the output. Germany's manufacturing output, at 14 percent, was the third largest, followed by Italy at about 7.75 percent. The other countries were a less than 6 percent each.

[10] This may reflect an unusual temporary feature of the recent growth slowdown and could reverse if overall and manufacturing productivity growth return to a more normal pace.
[11] These countries were originally, and often today, thought of as the major developed or industrial countries. Data for Canada are only available from 2007 to 2016 and so is omitted here, along with Israel for which the OECD shows no data and Ireland, where data appear for 1997 to 2013. For 2016, data are not available for the United States.

Table 1

Manufacturing Output and Output Shares for Selected Countries: 1997 vs. 2015

Billions of 2010$ and Percent

	1997	1997 Shares (%)	2015	2015 Shares (%)	Percent Change in Output, 1997-2015	Annualized Percent Change
Germany	555.9	14.0	774.9	14.6	39.4	1.9
France	222.1	5.6	284.8	5.4	28.2	1.4
United Kingdom	229.1	5.8	223.5	4.2	-2.5	-0.1
Italy	309.6	7.8	301.8	5.7	-2.5	-0.1
Japan	1,037.6	26.1	1,240.9	23.4	19.6	1.0
Korea, Rep.	123.8	3.1	362.2	6.8	192.7	6.1
Mexico	142.6	3.6	204.9	3.9	43.7	2.0
United States	1,350.0	34.0	1,902.9	35.9	41.0	1.9
TOTAL	3,970.8	100.0	5,295.9	100.0		1.6

SOURCE: OECD

By 2015, manufacturing output in these eight countries had increased by 41 percent, or 1.6 percent per year on average, to nearly $5.3 trillion. In 2015, the share of manufacturing output in these eight countries as a share of total OECD manufacturing output had declined slightly to about 79 percent, down from 81.8 percent in 1997.[12] Table 1 shows that by 2015 the U.S. share of the eight-country manufacturing output had increased slightly, to about 36 percent. It also rose for the 32-country total, rising from 27.9 percent in 1997 to 28.5 percent in 2015. Germany's share was nearly unchanged, but the output share of Mexico and South Korea rose from 5.5 percent to 7 percent over the 18-year period. All other countries saw their share of manufacturing output decline, paced by Japan's nearly 3 percentage point drop. By this standard, the U.S. manufacturing sector compares very favorably to other large manufacturing countries.

What About China?

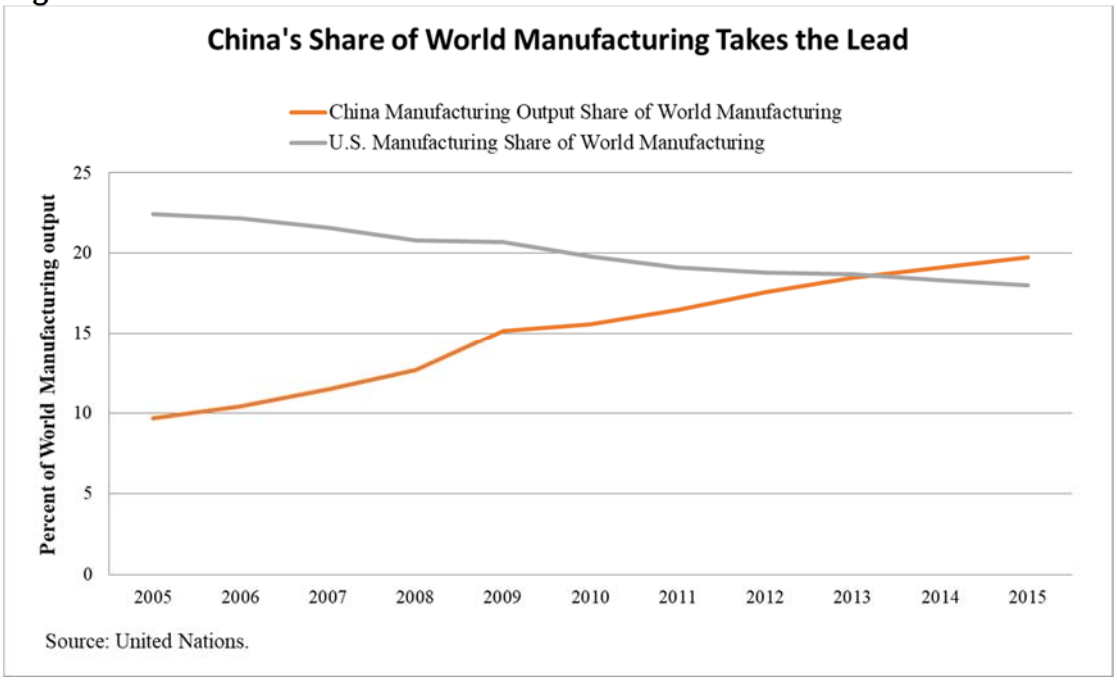
According to United Nations' statistics, China surpassed the United States in 2014 as the world's largest manufacturing country in value-added terms. China's manufacturing output totaled $1.89 trillion in 2014, slightly more than U.S. output's $1.81 trillion (both in 2005 dollars, Figure 4). China is not a member of the OECD, so the OECD has no comparable data on its spectacular growth. There is comparable data available for China since 2005 in the United Nation's manufacturing data base. In 2015, Chinese manufacturing output comprised 19.8 percent of world manufacturing output and it was nearly 10 percent larger than U.S. manufacturing output.[13] It was more than double its world share in 2005, when it was only 43 percent of U.S. manufacturing output. Although U.S output is also larger than 10 years earlier, its share of world output has nonetheless declined by about 4.4 percentage points to 18 percent of world output. By contrast, China's world output share rose by 10.1 percentage points, while the rest-of-the-world's manufacturing output share by fell by 5.7 percentage points of world output. Thus,

[12] This decline is due to slower growth, or declines in Japan, the United Kingdom, France and Italy.

[13] One should handle Chinese data carefully. See Owyang and Shell (2017) and the references therein.

China's gain in the share of world output has come more at the expense of the rest of the world than from the United States. This hypothesis is discussed more systematically below.

Figure 4



To sum up, there are several well-established long-run patterns of manufacturing performance that are apparent in Figures 1-4. First, manufacturing productivity, or output per worker or per hour, typically grows faster than that of the overall economy, but not in recent years. Second, manufacturing output has historically tended to grow at roughly the same pace as real GDP—at least until the Great Recession. The second development implies that the share of real manufacturing output in real GDP is roughly constant—although it varies over the business cycle and, as noted above, has declined since beginning of the Great Recession. Third, with manufacturing productivity growth typically outpacing productivity for the rest of the economy, manufacturing employment tends to decline as a share of overall employment or even absolutely.[14] Finally, the U.S. manufacturing sector remains the largest of all OECD countries and has even increased its share of OECD output since 1997. However, there is some evidence that the size of China's manufacturing output recently surpassed U.S. output, making it the world's largest in terms of value added.

II. Causes of Slowing Growth: Domestic Factors

The previous section documented that, while the U.S. manufacturing sector is growing and has a large global share, it has nonetheless declined relative to its earlier

[14] See Tatom (1986) for the development of these manufacturing characteristics, for example.

performance—especially its productivity and output growth. Why did this happen? This section examines competing explanations for the slowing manufacturing growth.

The reasons for the changing patterns of manufacturing output and employment are, at least in part, implicit in the discussion of the changes above. The Great Recession played a role in the United States, but also abroad. The demands for manufacturing output and the labor to produce it are very sensitive to the business cycle. Demographics—slowing growth of the population and the labor force—have slowed long-term economic growth and employment. They also reduce the demand for capital goods and indirectly slow the pace of innovation, further reducing the pace of potential output growth. Heightened regulatory rules can reduce productivity as well. Slower long-term economic growth reduces the growth of demand for output generally and especially manufacturing output and employment. Other analysts and commentators have attributed weaker growth in U.S. manufacturing employment to two factors associated with globalization: The shift of manufacturing facilities abroad, and a rise in U.S. imports. The latter (rising imports) is examined in Kliesen and Tatom (2013). More recently, some researchers have focused more narrowly on the rise of Chinese imports in displacing U.S. manufacturing production and jobs.[15] This section examines evidence for these competing hypotheses.

Structural Dynamics

The conventional explanation of a decline in the manufacturing output growth focuses on business cycle effects, since the demand for durable goods is very sensitive to short-term fluctuations in income. Transitory cyclical losses in income show up in reduced demand for durable goods, both consumer and producer durables, whose replacement can be more easily postponed. In unsustainable booms in demand, employment and income, consumers and producers tend to "save" transitory income, including by acquiring durable manufactured goods largely for future production or consumption. Cyclical fluctuations in real GDP and employment are accompanied by relatively larger fluctuations in manufacturing.

As noted above, the United States has had two recessions since the beginning of the century—in 2001 and from December 2007 to June 2009. Importantly, the manufacturing output share has declined since the Great Recession and manufacturing output growth has slowed. But manufacturing productivity growth has slowed since 2000 (Figures 2), and overall aggregate productivity has slowed since around 2005, so this is likely not a dominant factor in explaining the lower output share.[16] Some observers have instead argued that "secular stagnation" has set in. Perhaps the most popular view of the latter is that aggregate demand has been weakened by a net decline in government expenditures since mid-2009. Proponents of this view believe that increases in government spending are needed to escape the secular stagnation trap. This view is usually associated with former Treasury Secretary Larry Summers, but the thesis originated with Alvin Hansen (1938).

[15] See Pierce and Schott (2016), Autor, Dorn and Hanson (2013) and Feenstra (2010) for the elaboration of the hypothesis that off-shoring, and especially developments in U.S. trade policy toward China , have caused the unusual decline in U.S. manufacturing employment since 2000.

[16] See Fernald, *et al.* (2017).

Demographics

Another possible explanation centers around demographic shifts. Following the past two recessions, the economy returned to a regime characterized by low unemployment rates and high-employment growth. In October 2006 the civilian unemployment rate was 4.4 percent and remained below 5 percent until November 2007. Similarly, in the current business expansion, the unemployment rate has fallen to 4.1 percent in November 2017. Moreover, the December Summary of Economic Projections released by the Federal Open Market Committee suggests that the median FOMC member expects the unemployment rate to average 3.9 percent in the fourth quarter of 2018 and in the fourth quarter of 2019. Thus, slow output growth does not necessarily imply unusually high unemployment when long-term forces determining economic capacity, or potential GDP, slow.

From a growth accounting perspective, real potential GDP growth is influenced by the growth of labor input. Projections of labor force growth by the Office of the Actuary and Trustees of the Social Security and Medicare Trust Funds (2017) show labor force growth accelerating slightly to 0.8 percent for the 10 years 2016 to 2026, from 0.4 percent over the past decade, but then falling back to about 0.5 percent per year for the next 70 years.[17] Either figure continues historically slow growth of the labor force and the continuation of slow growth. In the 2016-2026 period, the Trustee's intermediate projection, or base case, is average annual growth real GDP growth of 2.6 percent, the tipping point below which Gramm and Solon (2017) would characterize performance as secular stagnation, such as in 1973-83 and during every 10-year period since the end of 2008. But even this may be optimistic according to some.[18] Relatively slow labor force growth is itself an indicator of the slowing dynamism in the labor market and other markets. Thus, when viewed from a growth accounting perspective, where real potential GDP growth is determined by underlying growth in productivity and labor input, that demographic factors—the aging of the population and the slowing of growth of the labor force—are helping to slow the growth of aggregate and manufacturing output.

Capital Formation and Technological Progress

The slowing in labor force growth reduces the demand for capital in the neoclassical model of growth as it lowers the return to capital and the initial capital growth rate exceeds that desired to keep pace with the slower labor force growth. This also lowers the growth rate of potential output. Slower capital formation is also expected to slow the growth in technological change or total factor productivity to the extent that net capital formation also comes with better technology.

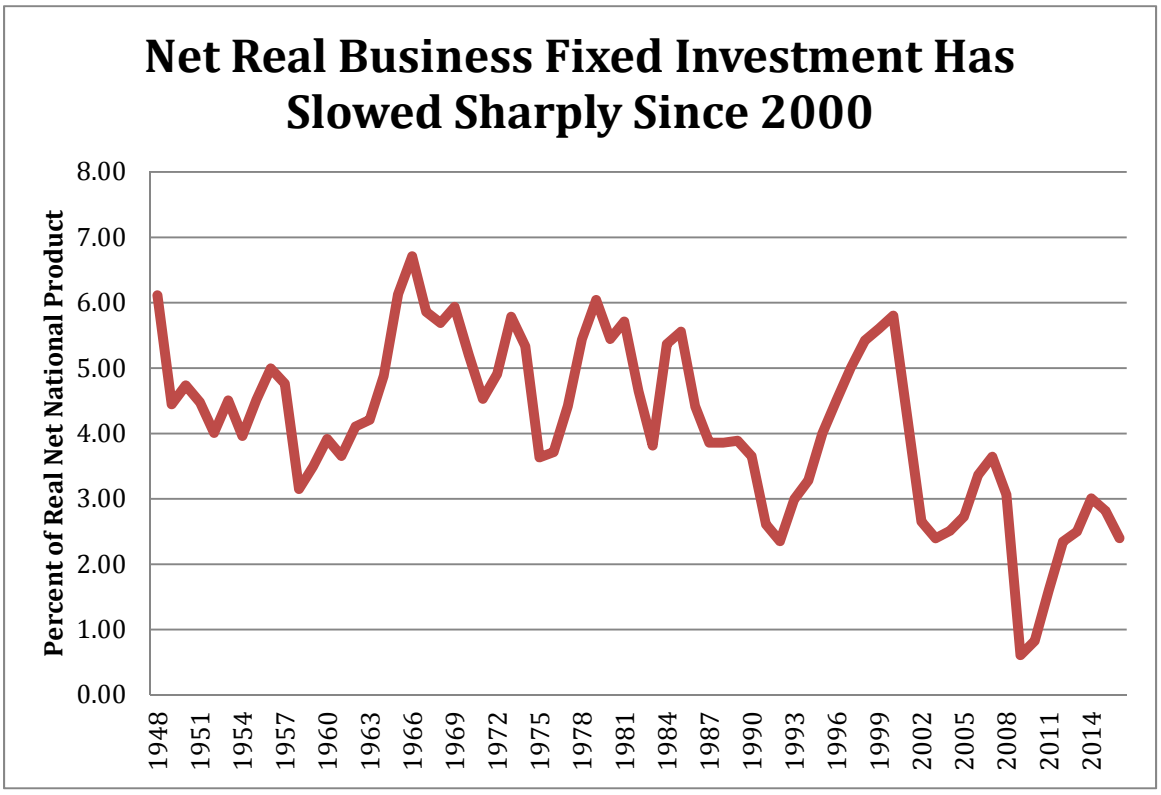
Figure 5 shows net nonresidential fixed capital investment as a percentage of real GDP. Since a peak of 5 percent in 2000—likely associated with the effects of the Clinton Administration's cut in the capital gains rate in 1997—real business capital formation, which is the annual difference in the private net fixed nonresidential capital stock as a

[17] Similarly, according to the Congressional Budget Office's (2017) latest long-term projections, potential labor force growth will average 0.5 percent per year from 2017 to 2027.

[18] See Fernald, et. al (2017).

percent of real Net National Product has plummeted to new lows. Since 2000, each successive peak is lower than the previous peak. In fact, this percentage reached its lowest level in 2009 at 0.6 percent. Although this share subsequently rebounded slightly, in 2016, it fell back to its level in 1993 and 2003, the record lowest levels before 2009. This evidence is startling and supports the equally disappointing evidence of slow productivity growth overall and declining manufacturing productivity.

Figure 5
Capital Formation has slowed dramatically



The pace of technological change embodied in total factor productivity has also been dismal because of weak capital formation. Moreover, the pace of innovation has slowed. Decker *et al* (2014) shows that entrepreneurship and employment dynamism, including for example, the share of new firms and start-ups, have declined for the past 30 years, and this decline accelerated after 2000. Phelps (2013) argues that innovation creates economic dynamism, which in his view is a prerequisite for high growth, but it has been in decline for a long time. In his view, innovation is created in the private sector, but public efforts to improve institutions and values can create a more supportive base for it. Weissman (2012) claims the decline in U.S. entrepreneurship has accelerated since the 2008-09 recession. Since 2009, the average number of start-ups per 1000 Americans has been 7.8, compared with 10.8 during the George W. Bush years and 11.2 per 1000 during the Clinton years. The growth rate for the number of U.S. patent grants slowed from 12.8 percent in 2012 to 9.7 percent in 2013 and to 8.2 percent in 2014, according to patent data. Although several forces are at work, a common element in these studies is that high taxes, regulations, and less competitive markets have slowed the pace of innovation. Rising numbers and costs of patent infringement cases have likely exacerbated these frictions.

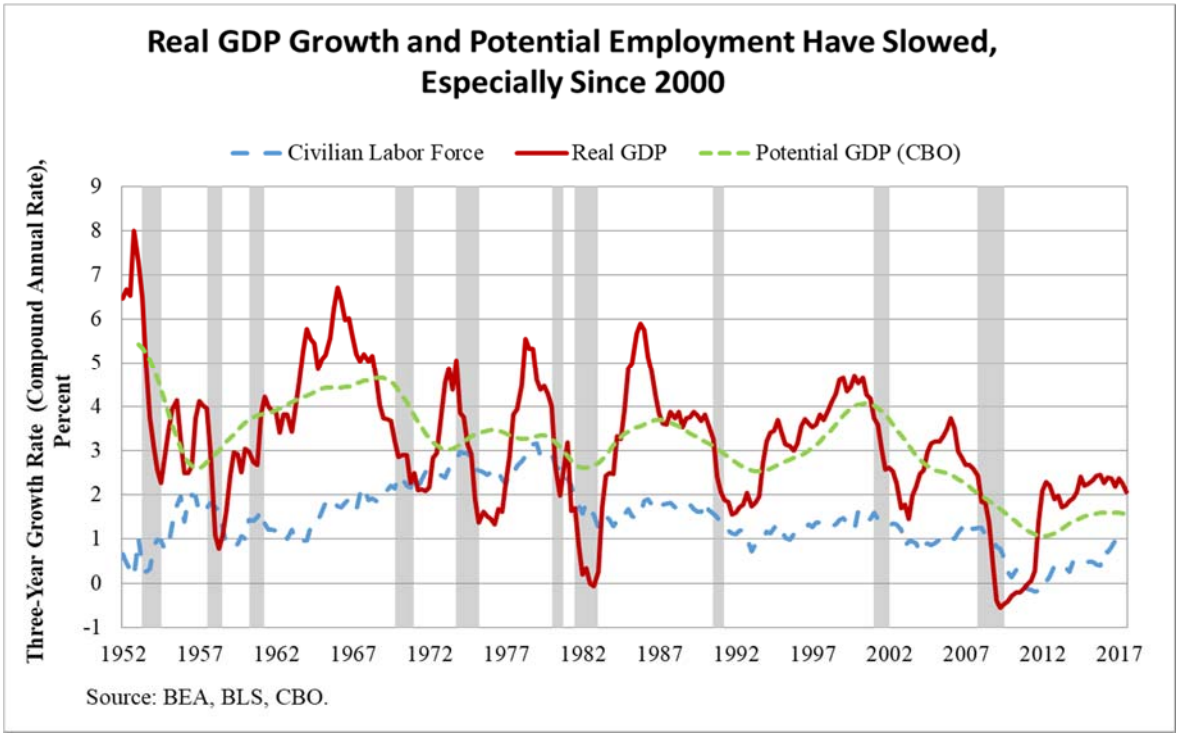
Figure 6 measures the growth rates of real GDP, potential output and the civilian labor force for the past three years since 1952. These three-year periods are used to smooth out the series. Note that in the Great Moderation period (post-1984), real GDP growth peaked

at its 1982-85 average growth rate and has varied cyclically. The peak of real GDP growth during the 1991-2001 expansion was also strong, but less than at the previous business expansion peaks. Growth in the current and previous expansions has been slower yet. The slowing in civilian labor growth from near 3 percent in the mid-1970s to near zero in 2008, has been mirrored in slowing potential output growth. The narrowing gap between the labor force growth and potential output growth since the end of the 1990s reflects slowing growth in total factor productivity or the pace of technological progress and innovation, due to reduced capital formation, innovation and start-ups.

The Congressional Budget Office measure of potential output growth was able to temporarily accelerate in the first half of the 1980s, and then fell back to a 1970s pace, before accelerating again in the 1990s. It subsequently began a long decline from about a four percent pace in 2000 to about a one percent annual rate in 2009. One of the key factors reducing potential output growth has been the slowing in the growth rate of the labor force because of slowing population growth. CBO long-term projections since 2001 suggest little change in the growth of total factor productivity—until the past two years, when they have been reduced by about 0.25 percentage points to 1.1 percent. Although labor force and potential output growth have both accelerated slightly since 2009, this is expected to be temporary—absent a further pick-up in structural productivity growth—as the baby boom retirement process picks up steam and population growth continues to slow.[19]

[19] Some economists point to several factors, such as advances in robotics and health care diagnosis and delivery systems, as having the potential to boost productivity growth. See Sichel and Branstetter (2017).

Figure 6



Overall, then, slower growth in real GDP, related to unfavorable demographic factors, slowing capital formation and innovation, and mounting regulation costs have severely affected the growth rate of manufacturing productivity, output and employment over the past 17 years or so. Increasingly, however, foreign influences and globalization, especially rising manufactured goods imports, have been suggested as the principal factor explaining the poor performance of domestic manufacturing. A related argument that it is especially the rise of the Chinese manufacturing juggernaut and imports from China that have adversely affected the growth of U.S. manufacturing output and employment. The role of imports, including from China, in displacing domestic manufacturing output and employment is examined next.

III. Causes of Slowing Growth: Foreign Factors

Section 2 briefly discussed the rise in the Chinese manufacturing sector in comparison with the United States and other large manufacturing-producing countries in the OECD. Given the upsurge in globalization over the past several decades, it is easy to believe that foreign developments have affected—for better or worse—the U.S. manufacturing sector. For example, in an earlier paper, we discuss several factors that are often discussed as likely to affect manufacturing output.[20] Our analysis was an attempt to provide a useful framework in which to test whether foreign trade, exports and/or imports have affected U.S. manufacturing output. Other factors include changes in domestic real GDP growth, foreign real GDP growth, the unemployment rate, the real value of the dollar in international exchange, real energy prices, and real exports and imports. Specifically, our

[20] See Kliesen and Tatom (2013).

earlier results for the period 1973:Q2 to 2011:Q4 showed that real exports, the real exchange value of the dollar, and real energy prices have no statistically significant effects on manufacturing. The only statistically significant factors affecting manufacturing are real GDP, foreign real GDP, the unemployment rate, a lagged dependent variable, and real goods imports.

Gauging the Effects on Manufacturing Output

Perhaps most surprisingly, we find that the effect of real imports on U.S. manufacturing output is positive. Increased real imports are associated with statistically significant increases in manufacturing output. Most analysts and popular critics of globalization suggest that higher imports displace domestic manufacturing, but the evidence rejects this conclusion and finds instead that imports have a positive relationship with domestic output. This finding is consistent with an earlier analysis by Eldridge and Harper (2010), who argued that many imports are raw and/or intermediate materials that boost domestic output. The most significant variables, besides real imports, are domestic real GDP growth and the change in the unemployment rate, the factors stressed above.

Table 2 provides an update to our earlier analysis. Using data through 2017:Q3, we regress U.S. manufacturing output on several variables. Column 1 presents our base specification and the second column is a re-estimate containing only significant variables.

Table 2
Factors Affecting Manufacturing Output

Periods/Coefficients	**III/1973 – III/2017**	**II/1973 – III/2017**
Constant	–0.848	–0.526
	(-1.72)	(-1.25)
Lagged dependent variable	-0.016	
	(-0.36)	
U.S. real GDP	0.632**	0.645**
	(7.21)	(7.69)
Foreign real GDP	0.173	
	(1.51)	
Unemployment rate (%)	–2.198**	–2.269**
	(-7.97)	(-9.71)
Real value of the dollar	0.001	
	(0.05)	
Real energy prices	0.022*	0.024**
	(2.40)	(2.63)
Real imports	0.137**	0.140**
	(5.66)	(6.00)
Real exports	0.005	
	(0.23)	
Autoregressive error term	0.238*	0.252**
	(2.48)	(3.35)
Adjusted R^2	0.82	0.82
Durbin-Watson	2.02	2.04
Standard error of regression	2.948	2.923

NOTE: Independent variables are annualized first differences in logs, except for the unemployment rate, which is an annualized first difference; t-statistics are shown in parentheses; * and ** indicate significance at the 5 percent and 1 percent levels, respectively.

Consistent with our earlier analysis, we find that the growth of manufacturing output is strongly influenced by the two cyclical factors: Real GDP growth and the unemployment rate. The coefficients are of the expected sign and are highly significant. However, the lagged dependent variable is not as significant as before. We also find that increases in real energy prices are positively, and statistically significantly, related to increases in manufacturing output growth. This is consistent with the earlier discussion of the upsurge in domestic crude oil production stemming from the shale oil revolution. As before, real import growth has a statistically significant positive relationship to real manufacturing output growth, but the value of the dollar and exports do not. The two estimates include a first-order autocorrelation adjustment that is statistically significant in each case, though it was not for the shorter periods used in Kliesen and Tatom (2013) that ended in IV/2011.

Gauging the Effects on Manufacturing Employment

An instructive assessment of the causes of the decline in manufacturing employment is to examine the extent to which the same factors can account for the weakness in manufacturing employment. Recall from Figure 1 that manufacturing employment has declined since 1979. Moreover, manufacturing employment appears to exhibit even larger declines after 2000. This analysis is presented in Table 3.

Table 3 provides a similar analysis for the growth rate of manufacturing employment as Table 2 provides for manufacturing output growth. The first column provides the estimate with only the statistically significant factors. The only statistically significant economic influences here are the lagged dependent variable, unemployment rate, real energy prices and real imports, each with the expected sign. Real GDP, foreign real GDP, the real value of the dollar and real exports are not and are omitted. Specification (1) in Table 3 is our baseline. As in Table 2 for output, we find that the change in real goods imports has a positive and statistically significant effect on employment. This finding suggests, again, that policies designed to restrict the flow of goods imports would have adverse effects for the U.S. manufacturing sector, and thus the U.S. economy. Specifications 2-4 relate to the China uncertainty hypothesis that argues a reduction in uncertainty about U.S. trade policy toward China led to a surge in Chinese imports that depressed manufacturing output and employment in the early part of the century.

Table 3
Foreign Influences on Manufacturing Employment

	Dependent variable: Log change of U.S. manufacturing employment			
	Model specification			
Independent variables	**(1)**	**(2)**	**(3)**	**(4)**
Constant	-0.82** (0.000)	-0.87** (0.000)	-0.86** (0.000)	-0.77** (0.000)
Lagged dependent variable	0.39** (0.000)	0.38** (0.000)	0.38** (0.000)	0.36** (0.000)
Unemployment rate (%)	-1.75** (0.000)	-1.77** (0.000)	-1.76** (0.000)	-1.81** (0.000)
Real energy prices	0.01* (0.019)	0.01* (0.049)	0.01* (0.050)	0.01* (0.008)
Real imports, total	0.04** (0.000)	0.04** (0.000)	-	0.04** (0.000)
Real Chinese imports	-	0.00 (0.880)	0.00 (0.811)	-
Real imports, less Chinese imports	-	-	0.05** (0.000)	-
WTO dummy (2002:Q3 - 2003:Q4)	-	-	-	-2.34** (0.000)
Adjusted R-squared	0.88	0.88	0.88	0.89
Durbin-Watson	1.77	1.76	1.78	1.88
Standard error of regression	1.53	1.52	1.52	1.48

NOTE: *p*-Values are listed in parentheses. The sample period is 1973:Q3 to 2017:Q3. * and ** indicate significance at the 5 percent and 1 percent levels, respectively.

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China's admission to the World Trade Organization, Chinese Imports and U.S. Manufacturing Employment

Several researchers have developed a hypothesis that it is a sharp rise in U.S. imports from China that explains the decline in manufacturing employment. The argument is that China's accession to the World Trade Organization, approved in October 2000 and implemented in December 2001, established permanent normal trade relations (PNTR) for China, which exempted China from much higher Smoot-Hawley tariffs. This made permanent the exemptions that had been granted in U.S. annual reviews of normal trade relations, or Most Favored Nation status, since 1980. The benefit to China, its investors and exporters was the removal of uncertainty about NTR that had plagued earlier relationships. The reduction in the uncertainty boosted trade with, and investment in, China. See Pierce and Schott (2016), Autor, Dorn and Hanson (2013) and earlier work by Feenstra (2010) for the development of and evidence supporting this hypothesis.

The second specification in Table 3 tests whether real Chinese imports have affected U.S. manufacturing employment. They do not, as indicated by a zero, non-statistically significant coefficient. In the third specification, we parse total goods imports into those from China and those from all other countries. Non-Chinese import growth is highly correlated with Total imports (0.99), so this estimate does not imply that Chinese imports do not matter, just that their influence comes through the total imports.

Nonetheless, there is some evidence from closer analysis of the first specification in Table 3 that is consistent with the China hypothesis. A dummy variable that equals one from 2002:Q3 to 2003:Q4 is added to specification 1; this addition appears as specification 4 in Table 3.[21] It is statistically significant. It implies that by the end of the six quarters, China's entry into the WTO may have systematically reduced manufacturing employment by 3.5 percent (six quarters with an annual effect of -2.34 at an annual rate).

There is another reason to doubt the China uncertainty hypothesis. Figure 7 shows total U.S. real imports of goods and broken down by whether they are sourced from China or from the rest of the world ("other"). Total U.S. imports grew very rapidly from 1990 to late-2000. But as after China's application for WTO membership was approved, the growth of U.S. imports from China slowed. The period of rapid growth in imports from China, according to the China hypothesis, is not supported by the data here and came just as the China import growth and total import growth slowed. Since III/2000, U.S. imports slowed especially from other countries than China. Like the evidence for the rise in China's share of world manufacturing output since the late 1990s, the rise in Chinese imports since 2000 came largely at the expense of manufacturing imports from elsewhere.

[21] This choice of the period of effect is based on an out-of-sample estimate of the best specification of the equation with the in-sample period ending in 2000:Q2, the previous peak of manufacturing employment. It showed persistent large negative errors (more than twice the standard error of the estimate for all six of the errors) from 2002:Q3 to 2003:Q4.

Figure 7
U.S. Imports of Goods Have Risen. Especially from 1990 to 2000

Figure 7 shows that China's success in expanding their market in the United States was very impressive, but came largely at the expense of China's non-U.S. competitors. Total real imports actually slowed at almost exactly the point when proponents of the China hypothesis suggested the beginning of China's huge effect on total real imports and displacement of U.S. manufacturing.

Table 4
Imports from China and Elsewhere slowed after Its WTO Entry

Period/Average annual rate	Imports from China	Non-China Imports	Total U.S. Imports
III/1991-IV/2000	23.6%	10.7	11.9%
IV/2000-IV/2006	20.0	2.6	4.4
IV/2006-III/2017	4.5	0.9	1.6

U.S. imports from China actually grew faster in the 1990s, when the United States also had a faster growth rate of total goods imports. Beginning in 2000:Q4, when United States agreement to China entering the WTO was announced, until the end of 2006, China continued to have a rapid pace of growth, but it was actually slower than in the 1990s and 2000, and more importantly, overall U.S. goods imports growth slowed. The major effects of China's WTO entry seem doubtful since Chinese imports grew faster earlier and because overall import growth, the channel of influence of China's exports, actually slowed sharply. However, the experiments above that show relatively large

errors in explaining manufacturing employment from 2001:Q1 to 2003:Q1 do suggest that there could have been an effect from the announcement of U.S. approval of China's WTO entry at the end of 2000 and its effective date at the end of 2001.

Another possible development favorable to the China uncertainty hypothesis is that there would be, if correct, a surge in U.S. and other countries investment in China because of its improved access to the U.S. market. As seen in Figure 8, there is the sharp increase in U.S. direct investment in China in 2003. The evidence in Table 3, specification 4, and here for U.S. investment in China, are favorable to the China hypothesis. China's entry into the WTO appears to have some measurable and statistically significant effect reducing manufacturing employment by an estimated cumulative 5 percent, but other factors are more important.

Figure 8
U.S. Investment in China Surged from 2003 to 2008

Further Evidence on Foreign Influences on Domestic Manufacturing Output
There has long been a fear that globalization or lost competitiveness has adversely affected the U.S. manufacturing sector. It could be the case, though, that the results in tables 2 and 3 are masking a statistically significant bi-directional causation. In our earlier paper, we employed Granger Causality analysis to test this hypothesis and, in particular, a negative relationship between (i) real imports and manufacturing output and (ii) real exports and manufacturing output. Our analysis, using data from 1973:Q2 to 2011:Q4, indicated that we can reject the negative relationship between real imports and manufacturing output—consistent with the results in Table 2.

Kliesen and Tatom (2013) examine Granger causality of relationships between imports and real GDP and, more importantly, whether there is a statistically significant long-run negative relationship between manufacturing output and real imports. In Kliesen and Tatom (2013) such a cointegration test is described and finds that there is a significant long-term *positive* relationship between manufacturing output and real imports. A one percent rise in imports causes a 0.4 percent rise in manufacturing output through the vector error correction term in a vector error correction model (VECM). When we extend the sample through the third quarter of 2017, we again cannot reject that such a long-run relationship exists using a Trace test and Maximum Eigenvalue test. The coefficient in the cointegration vector indicates that a one percent rise the imports causes a 0.39 percent rise in manufacturing output and again that this causality is significant in the VECM (t = 2.19).[22]

We concluded earlier and here that real imports do not have a significant negative effect on domestic manufacturing output, or here, employment. Indeed, the evidence shows that imports improve both manufacturing output and employment growth. The evidence here also shows that manufacturing output and employment are strongly influenced by the business cycle and that has presented strong challenges since mid-2000. Nonetheless, the evidence does not suggest a breakdown in the influence of other factors that influence manufacturing performance.

IV. Policies to Improve Manufacturing Performance

Whether the slowdown in productivity and output growth is permanent or temporary is a matter of important debate. Gordon (2016) argues that the slowing is permanent, while Mokyr (2002), Branstetter and Sichel (2017) and others argue that it is transitory. In either case, however, there are important policy initiatives that could improve economic growth and thereby boost the health of manufacturing output and employment.

Some causes of slow growth and productivity have to do with regulatory and tax policies adopted since the 1990s, but especially since 2008, and the reversal of these is likely to reverse the slowing and provide new impetus to expansion. In 2017, the Trump Administration quickly implemented policies to reverse regulation that likely damaged productivity in the energy, chemical, and communications sectors, and other highly regulated industries.

Tax Reform

Perhaps the most important step is tax reform and tax rate reductions adopted in late-2017 in. The centerpiece of the Tax Reform and Jobs Act of 2017 is to lower the corporate tax rate to 21 percent, adopt immediate expensing to replace slower depreciation schedules and to provide incentives to bring a large part past foreign profits onshore for reinvestment.

Although the empirical evidence varies, depending on the period studied, the type of tax enacted, and the models used to assess the economic effects, mainstream economic

[22]Granger causality and cointegration results are available by request.

theory and past experience suggest the effects could be quite positive in boosting investment, productivity and economic growth, particularly for manufacturing. For example, Barro, et. al. (2017) find that real GDP growth over the next 10 years could be boosted by 0.4 percentage points per year assuming full expensing and 0.3 percentage points per year assuming temporary full-expensing.[23] Still, others are less optimistic while others are more optimistic. [24] For their part, a December 2017 survey of Blue Chip forecasters found that 41 percent expect the tax reform legislation to have a "medium impact" on GDP growth over the next five years, while 6 percent expect a "large impact." However, 53 percent expect the tax cuts to have "little impact."

However, Figure 6 above shows some evidence of the effects of tax policy on investment, productivity and growth. Note the acceleration in potential output growth rate shown from 1982:Q3 to 1986:Q3. This corresponds to the beginning of the 1981 tax cuts and accelerated depreciation for business taxation, which lowered business taxes and stimulated investment and potential output growth. Potential output accelerated from 2.6 percent per year to a 3.6 percent rate of growth, according to the CBO. As these effects diminished, the 1986 tax reform act was passed—but that lowered the rapid depreciation allowances on capital and raised the capital gains tax. Compounded by the Bush tax hikes in 1990, potential output growth slowed to 2.5 percent in 1993:Q2. Potential output growth rebounded during the 1990s with the so-called New Economy innovations tied to the rapid use of new technologies embedded in information and communication equipment and the sharp declines in semi-conductor prices. In response, potential output growth rose to 3.1 percent in 1997:Q1. The Clinton capital gains tax cut from 28 percent to 20 percent was probably also a factor in helping to boost fixed investment, productivity and potential output growth, which reached a peak of 4.1 percent (2000:Q2). After 2000, though, potential output growth began its sharp slowing, reaching a record low 1.1 percent one rate in 2012:Q2. This is nearly exactly the same period in which the economy lost 5.8 million manufacturing workers (2000:Q2-2010:Q1).

Part of the reconciliation in the debate over the tax cut is that its opponents argue that its effects will be small, at best. Even proponents predict the business tax cuts will boost productivity about 3-5 percent, over several years. Spread over a 10 ten-year period, this is only 0.3 to 0.5 percent per year, a small number. Nonetheless, a step that could boost real GDP, productivity and real wages by 3-5 percent within a few years is a large payoff, judged relative to recent performance.

Trade Policy and Processes Put Gains from Regulatory and Tax Reform at Risk
The Trump administration has vowed to enact policies designed to reduce or eliminate chronic trade deficits. As one example, new tariffs on Canadian soft lumber take effect on January 1, 2018.[25] Other proposed policies, such as subjecting imports from a country to

[23] The mechanism for such a change is that tax policy will lower the corporate cost of capital by about 15 percent, raising capital formation by a like amount. The gain in business capital formation will boost labor productivity, real wages and output.
[24] For analysis suggesting more modest results, see the recent edited volume by Auerbach and Smetters (2017). For analysis suggesting much stronger effects, see Benzell, Kotlikoff, and Lagarda (2017).
[25] See Wall Street Journal (2017) for another example.

35 to 45 percent tariffs if the value of their goods exported to the United States exceeds the value of U.S. exports to the country. Some Administration officials have also discussed penalizing U.S. firms that move headquarters or production facilities overseas. Increasingly, though, protectionist sentiments cut across political party lines. Regrettably, the President, Congress, and many others seem unaware of the consequences of past protectionist regimes, such as the huge Smoot-Hawley tariffs adopted in 1930.[26]

Economists are nearly unanimous in their belief that highly restrictive trading regimes—whether through punitive tariffs and/or non-tariff barriers, is a supply shock that reduces long-term growth through reduced productivity.[27] Productivity gains are critical for improving the standard of living. Certainly, slower productivity growth will not eliminate America's trade deficits, nor will faster productivity growth eliminate America's trade deficits. United States trade deficits increased during periods of booming productivity such as the 1980s, the second half of the 1990s, or even in the early 2000's. During these periods, net foreign investment in the United States surges, largely by U.S. investors shifting investment from abroad back to the United States, and the value of the dollar increases.[28]

In short, as the evidence presented in this paper shows, import are beneficial to the nation's producers and their customers. Restriction of imports would seriously damage U.S. production and productivity. Higher tariffs on imports would constrain the U.S. ability to produce goods and services, lowering productivity and the standard of living. Robert Zoellick (2016), former President of the World Bank and former U.S. Trade Representative, has pointed out that lower U.S. import tariffs have lowered the costs of goods and services for US consumers, channeled resources to higher-valued uses, and increased the foreign demand for U.S. exports and assets, further boosting U.S. employment, income and wealth.

In sum, it remains an open question whether the unfavorable trade policies—if enacted into law—will more than offset the favorable tax policies that have already been enacted into law.

IV. Conclusion

Conclusion

The evidence here indicates that American manufacturing is not in decline. Output has been growing since the end of the Great Recession, admittedly at a slow 2.2 percent annual rate. Similarly, manufacturing employment has been rising since early 2010, but at only half the rate (1.1 percent annual rate). These slow gains come on the heels of two recessions and another meager recovery over the 10 years from 2000:Q2 to 2010:Q1.

[26] The historical difficulties of bilateral tariffs and quotas are traced in Irwin (2017). For other assessments of the role of Smoot-Hawley and other federal policies in the Great Depression, see Bordo, Goldin and White (1998). See Rappeport and Huetteman (2017) for a summary of recent remarks by Secretary of Commerce Wilbur Ross .

[27] See Bhagwati, (2002) and Irwin (2017), for examples.

[28] See Tatom (1988).

The poor performance of manufacturing is largely due to the poor performance of the overall economy as manufacturing is much more cyclical that overall output. Evidence is provided that there been a substantial slowing in labor force growth, capital formation, technological advance and innovation and the nation's potential output growth rate, all of which have fallen, as is typically the case, especially hard on the manufacturing sector. The central role of manufacturing historically has been its outsized long-term growth of productivity. Productivity has slowed substantially since the 1990s and in the past few years it has been slower than for the overall economy. Since 2011-2014, it has been falling. This is a major departure from previous trends. Rapid productivity growth in the past led prices of manufactured goods to fall, the share of manufacturing output in real GDP to be relatively constant and for manufacturing employment to decline slightly on a trend basis. The slowing in productivity even led to a noticeable decline in the share of manufacturing during the Great Recession and was accompanied by a large decline in manufacturing employment. Most of these developments can be accounted for by the unusually long and deep cyclical declines, at least as judged by movements in the civilian unemployment rate, that fell, quite normally, on manufacturing.

We also examine whether growing U.S. imports have crowded out manufacturing output and employment. We provide evidence that, contrary to popular opinion, imports do not crowd out domestic production. Instead, there is strong positive relationship between imports and manufacturing output and employment. This is supported by empirical evidence provided here and evidence of a long-term relationship that ties the level of imports to the level of output. The reason is that a large share of imports is materials and capital goods essential to domestic production. Whether this relationship could be cut is doubtful, but efforts to do so by raising tariffs or quotas on imports would seriously affect manufacturing and employment by depressing productivity, to the extent they are effective.

We also question the hypothesis that Chinese accession to membership in the World Trade Organization in December, 2001 reduced uncertainty about U.S. trade barriers to Chinese imports, or perhaps even earlier when the United States endorsed China's WTO application in December 2000. That hypothesis is rejected in direct statistical tests here, but we do provide some evidence that our estimates have relatively large errors after China's accession. The cumulative effect based on such a search for potential large effects finds that from mid-2003 to the end of 2003 there was a 3.5 percent loss in manufacturing employment. There is also some evidence of a surge in U.S. investment in China in 2003 is consistent with the WTO accession effect.

Finally we conclude with a discussion of public policies that could reverse some of these past trends. New regulatory reform policies recently adopted and proposed could boost productivity, just as tightening regulations impaired productivity in the past decade or regulatory reform in the late-1970s and early 1980s appeared to boost productivity. New tax policies, especially lowering the corporate income tax rate to 21 percent and immediate expensing can be expected to boost investment, productivity and output. Earlier experience with similar tax policies, and sometimes their reversal, or capital gains tax rate cuts (increases) that lowered (raised) the return to investment have the expected

visible effects on investment, productivity, output and real wages and lead to expected movements in potential output. A review of the risks of trade intervention also suggests that this is the major risk threatening success of the new tax policy. Policies that increase the expected return to business investment in the past have attracted large capital flows to the United States and boosted the value of the dollar. These changes have also led to larger trade deficits, which could trigger self-defeating deterioration in economic performance.

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