Worse Than the Great Depression: What Experts Are Missing About American Manufacturing Decline

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INTRODUCTION

In the 2000s, U.S. manufacturing suffered its worst performance in American history in terms of jobs. Not only did America lose 5.7 million manufacturing jobs, but the decline as a share of total manufacturing jobs (33 percent) exceeded the rate of loss in the Great Depression.[1] Despite this unprecedented negative performance, most economists, pundits and elected officials are remarkably blasé about what has transpired. Manufacturing, they argue, has simply become incredibly productive. While tough on workers who are laid off, job losses indicate superior performance. All that is needed, if anything, are better programs to help laid-off workers.

The conventional wisdom that U.S. manufacturing job loss is simply a result of productivity-driven restructuring (akin to how U.S. agriculture lost jobs but is still healthy) is fundamentally flawed.

This report argues that this dominant view on the loss of manufacturing jobs is fundamentally mistaken. Manufacturing lost jobs because manufacturing lost output, and it lost output because its ability to compete in global markets—some manipulated by egregious foreign mercantilist policies, others supported by better national competiveness policies, like lower corporate tax rates—declined significantly. In 2010, 13 of the 19 U.S. manufacturing sectors (employing 55 percent of manufacturing workers) were producing less than they there were in 2000 in terms of inflation-adjusted output.[2] Moreover, we assert that the government's official calculation of manufacturing output growth, and by definition productivity, is significantly overstated. Overall, U.S. manufacturing output actually fell by 11 percent during a period when GDP increased by 17 percent.[3]

The alarm bells are largely silent for two reasons: government statistics significantly overstate the change in U.S. manufacturing output, and most economists and pundits do not extend their analysis beyond one macro-level number (change in real manufacturing value added relative to GDP). But the conventional wisdom that U.S. manufacturing job loss is simply a result of productivity-driven restructuring (akin to how U.S. agriculture lost jobs but is still healthy) is wrong, or at least not the whole story. This report contends that the loss of U.S. manufacturing jobs is a function of slow growth in output (and, in most sectors, actual loss of output) caused by a steep increase in the manufactured goods trade deficit.

Even if economic policy experts acknowledge that manufacturing's share of output has declined, many comfort themselves with a narrative that such decline comes as the inevitable result of market forces. "Manufacturing is in decline everywhere, even in China," they argue. They would be wise to consult actual data, for they would find that while manufacturing has declined as a share of GDP in some nations (notably Canada, Italy, Spain, the United Kingdom, and the United States), it is stable or even growing in many others (including Austria, China, Finland, Germany, Japan, Korea, the Netherlands, and Switzerland). The loss of U.S. manufacturing is due to the failure of U.S. policies (for

example, underinvestment in manufacturing technology support policies and a corporate tax rate that is increasingly uncompetitive, among others) and the expansion of other nations' mercantilist policies; it is not the work of the invisible hand.

Some go so far as to assert that manufacturing industries are "old economy" and that it is a reflection of failure, not success, if a country has a manufacturing sector that is either stable or growing. Perhaps they are thinking of the kind of factory represented in old movies, television shows, or news clips: dirty, clunky, mechanical havens filled with low- and moderate-skilled workers producing commodity products. They would be well-advised to visit the clean, streamlined, IT-driven manufacturing facilities operating in the United States today. The new facilities use advanced technologies and employ moderate- and high-skilled workers to turn out advanced products, from jet aircraft, computers, advanced instruments and vehicles, to sophisticated chemical and biological compounds.

Even in these sophisticated areas, U.S. manufacturing leadership is in peril. Correcting for biases in the official data, ITIF finds that from 2000 to 2010, U.S. manufacturing labor productivity growth was overstated by a remarkable 122 percent. Moreover, manufacturing output, instead of increasing at the reported 16 percent rate, in fact *fell* by 11 percent over the period. Thus, while productivity increases have played some role in declining manufacturing employment, the overriding factor is output decline, highlighted by a striking result: if from 2000 to 2010 manufacturing output had grown at the same rate as that of the rest of the business sector, the United States would currently have some 13.8 million more jobs. Indeed, there is a strong relationship between manufacturing job loss and overall employment performance. In a comparison of 10 nations, there is a strong (0.57) correlation between change in manufacturing employment between 1987 and 2005 and employment growth from 2005 to 2010.[4]

MANUFACTURING JOB LOSS

The most obvious sign of U.S. manufacturing decline has been the loss of jobs. Job loss does not necessarily mean output loss and competitiveness decline, however. This section examines manufacturing job loss in depth, while the next section examines and rebuts the claim that it is a result of superior productivity growth.

To be sure, manufacturing job loss is not new. Some who deny the problem of U.S. manufacturing decline point to the fact that manufacturing's share of total U.S. employment has been falling since the 1950s and that the absolute number of manufacturing jobs peaked in 1979.[5] They argue that this loss of jobs reflects an inexorable and fundamentally positive trend away from manufacturing to services. We have become, the thinking goes, a "post-industrial economy." Our world-leading job losses can be seen as a sign that we are the most advanced economy in the world, moving beyond all that commodity-based activity of actually making things. The American Enterprise Institute's Kevin Hassett states, "Any economist can tell you that this decline (in manufacturing) is not necessarily a cause for concern…We have become an ideas economy."[6] Larry Summers, former director of the National Economic Council under President Obama, agrees, stating, "America's role is to feed a global economy that's increasingly based on knowledge and services rather than on making stuff."[7]

Yet manufacturing job loss was relatively slow and modest until just the last decade. From 1980 to 1999, manufacturing jobs declined by an average of 0.5 percent per year. But from 2000 to 2011 the rate of loss dramatically accelerated, with manufacturing jobs shrinking at a rate nearly six times faster (3.1 percent per year) than the rate in the prior two decades. Manufacturing lost 5.4 million jobs for a decline of 31.4 percent. (Figures 1 and 2) The economy lost 13 times as many manufacturing jobs between 2000 and 2010 than between 1990 and 2000. On average, 1,276 manufacturing jobs were lost every day for the past 12 years.[8] A net of 66,486 manufacturing establishments closed, from 404,758 in 2000 down to 338,273 in 2011. In other words, on each day since the year 2000, America had, on average, 17 fewer manufacturing establishments than it had the previous day.[9]

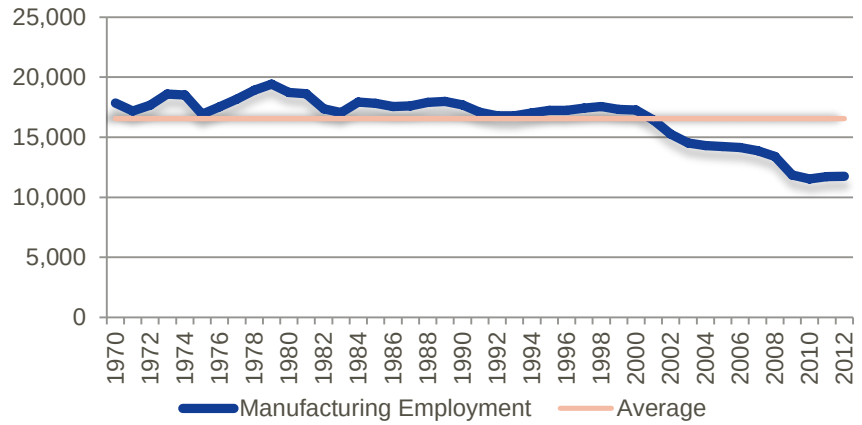

Figure 1: U.S. Manufacturing Employment (thousands), 1949-2011[10]

The overall economy's anemic employment record of the 2000s is due in large part to the loss of manufacturing jobs. As Figure 2 shows, total job growth was robust in the 1980s and 1990s while manufacturing jobs declined only modestly. But there was no net job growth in the 2000s, principally because manufacturing jobs fell so sharply. When an economy loses 1,276 manufacturing jobs a day, and then another approximately 2400 jobs because of the multiplier effect (for a total loss of approximately 3,676 a day), it generates a stiff headwind for the American jobs machine to overcome.

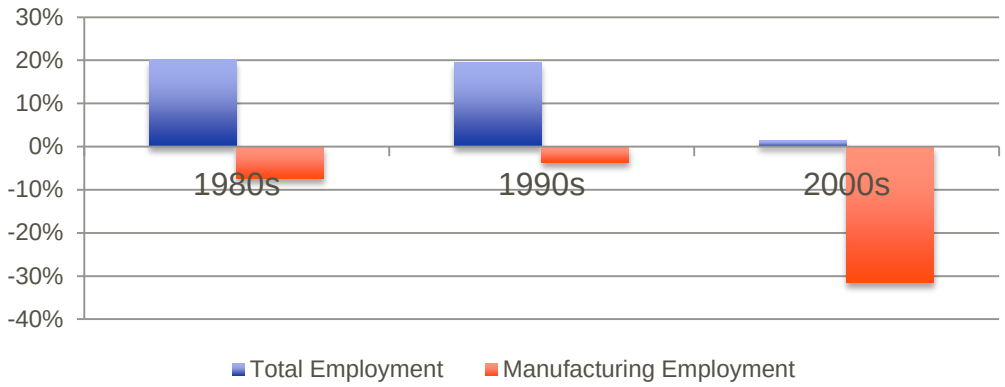

Figure 2: Total Net Job Percent Change and Manufacturing Job Percent Change[11]

In fact, in January 2012 there were more unemployed Americans (12.8 million) than there were Americans who worked in manufacturing (just under 12 million).[12] Indeed, as Figure 3 shows, this has been the case since 2009. The last time fewer Americans worked in manufacturing was before World War II.[13]

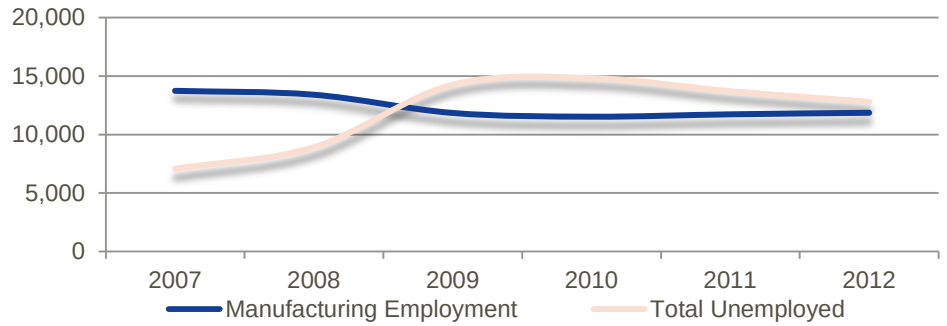

Figure 3: Manufacturing Employment Versus Total Unemployment (thousands), 2007-2011[14]

The U.S. economy lost a greater percentage of manufacturing jobs in the 2000s than it did in the Great Depression

From an historical perspective these job losses are unprecedented. The U.S. economy lost a greater percentage of manufacturing jobs in the 2000s than it did during the Great Depression (from the peak before the Depression to the employment trough of it—see Figure 4). Moreover, while manufacturing accounted for 43 percent of the jobs lost in the Great Depression, it accounted for 34 percent of all jobs at the time. In the last decade, manufacturing accounted for nearly one-third of the job loss even though it represented just one-tenth of the jobs.[15] In other words, in the Great Depression jobs losses were 26 percent more concentrated in manufacturing compared to the entire economy, while in the last decade they were three times more concentrated in manufacturing.[16]

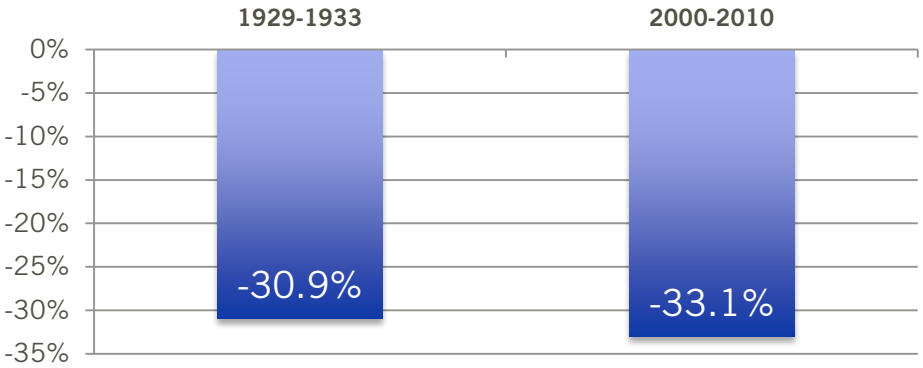

Figure 4: Percent Change in Manufacturing Employment During the Great Depression and the 2000s[17]

While all manufacturing industries saw job losses between 2000 and 2010, this change was not distributed evenly across all industries. Low-value-added industries most affected by globalization have seen the steepest job losses, with almost seven in 10 jobs in apparel disappearing, six in 10 in textiles, and almost five in 10 in furniture. (See Figure 5) Two industries least impacted by globalization—food products and petroleum refining—experienced the lowest job loss: less than 10 percent each. This disparity is evidence that the job loss over the last decade was *not* predominantly driven by productivity growth. There is no reason why an industry like apparel should be able to attain productivity

growth rates eight times higher than the food processing industry. In fact, one study found that between 1972 and 2001, industries that faced the most import competition from low-wage countries saw a decade-long decline in employment of 12.8 percent, on average, while industries that faced little competition saw a 2.3 percent increase in employment, on average.[18]

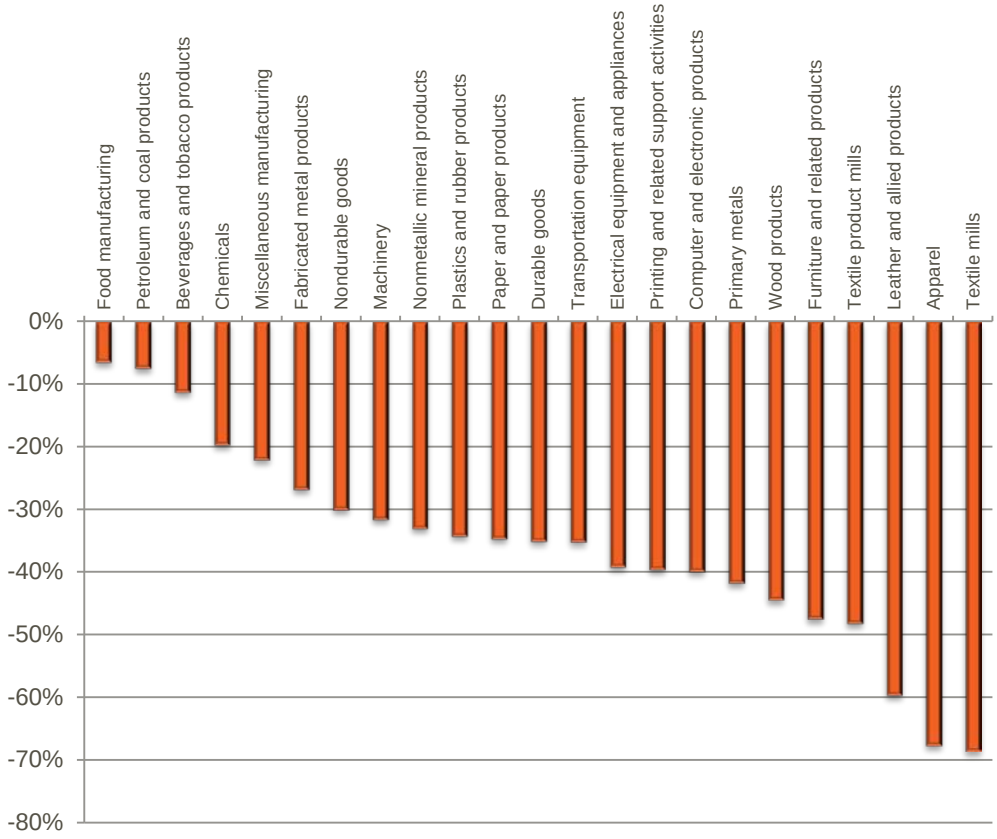

Figure 5: Percent Change in Employment by Industry, 2000-2010[19]

Manufacturing Job Losses in Recessions

Historically manufacturing has lost jobs at a higher rate than other industries in economic downturns because purchases of manufacturing goods, especially durable goods, are more cyclical than other goods and services (such as health care or banking services). But after a recession, manufacturing usually grows faster than the rest of the economy, leading to a full, or near full, recovery of jobs. This trend was observed in the majority of recessions between World War II and the year 2000. While manufacturing lost on average 6.7 percent of its jobs from the 12 months preceding a recession to the end of a recession, it regained or nearly regained (6.4 percent) those jobs in the subsequent 30 months. (See Table 1)

Recession Years	Percent Jobs Lost from 12 months Prior to the Recession to the End of Recession	Percent Jobs Regained from the End of the Recession to 30 Months After the Recession[20]
1949-50	-10.6%	15.0%
1953-54	1.8%	5.9%
1957-58	-8.7%	4.8%
1960-61	-3.8%	5.4%
1969-70	-7.5%	8.3%
1973-75	-6.4%	8.1%
1980-82[21]	-13.8%	6.3%
1990-91	-4.7%	-2.2%
2000-01	-8.5%	-10.3%
2007-09	-16.3%	0.7%
Average Prior to 2000	-6.7%	6.4%
Average After 2000	-12.4%	-4.8%
Average 1949-2011	-7.8%	4.2%

Table 1: Manufacturing Job Losses and Gains During Recessions and Subsequent Months[22]

However, as Figures 6 and 7 show, during the 2001 recession, manufacturing lost 7.1 percent of its jobs, but then lost another 9.4 percent in the 30 months after the recession. Likewise, 14.8 percent of manufacturing jobs were lost in the Great Recession, but only 0.7 percent was regained in the subsequent 30 months. It appears that U.S. manufacturing now experiences what can be called a one-way job loss ratchet, with significant job losses in economic downturns but then very shallow job gains, if any, in the recovery period.

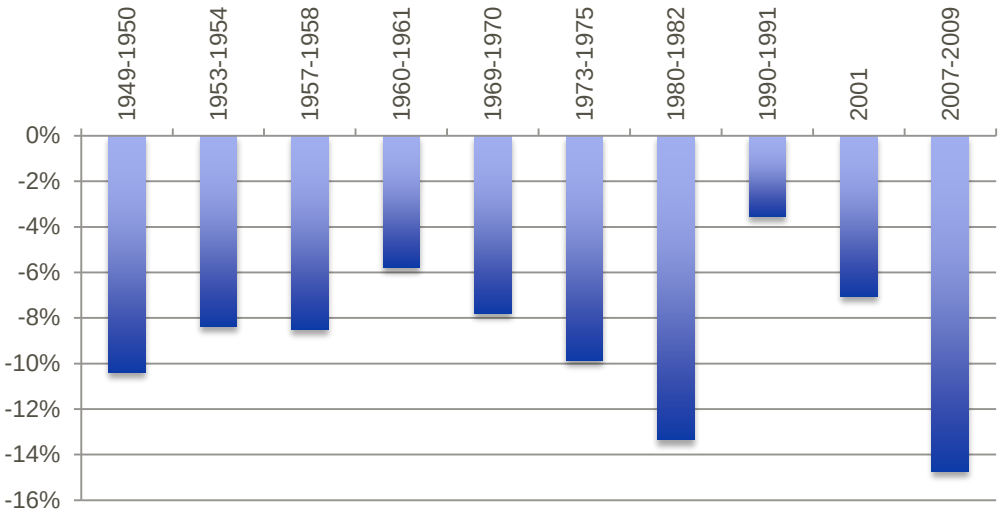

Figure 6: Percent Change in Manufacturing Jobs During Recessions[23]

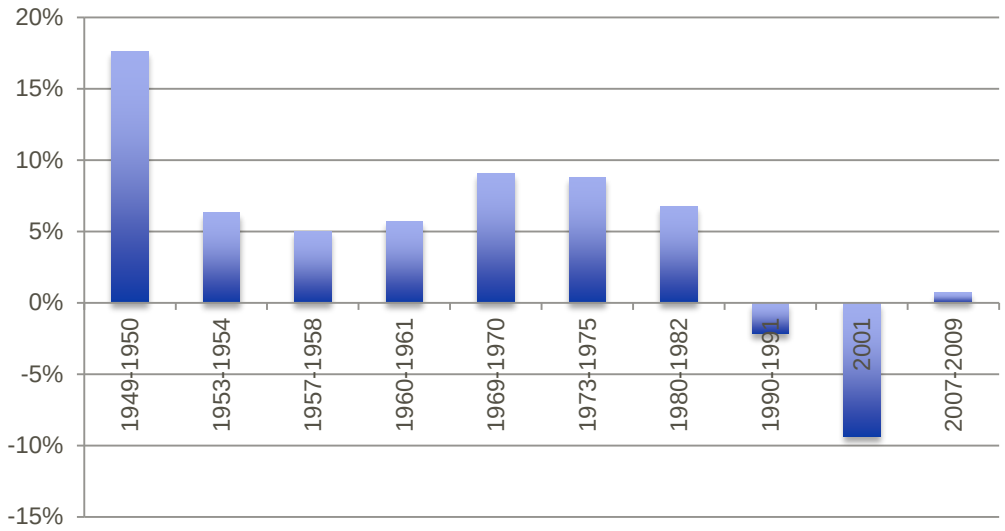

Figure 7: Percent Change in Manufacturing Jobs 30 Months After the End of Recession[24]

With the exception of the 1960-1961 recession, before 2001, manufacturing added jobs in the three years prior to the beginning of a recession. (See Figure 8) But in the three years before both the 2001 and 2008 recessions, manufacturing lost around four percent of its jobs. The twin recessions of the early 1980s were in large part manufacturing recessions; a large amount of "rust belt" jobs were lost, accounting for 13.4 percent of all manufacturing jobs.

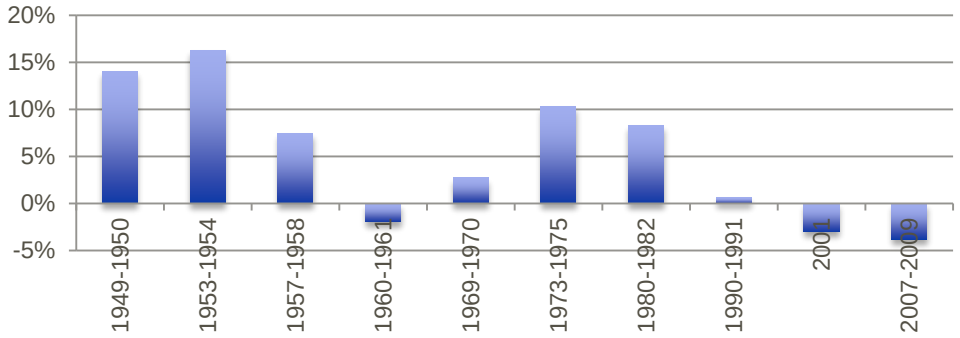

Figure 8: Percent Change in Manufacturing Jobs From the 3 Years Preceding Onset of Recession to the Start of the Recession[25]

The loss during the Great Recession was the largest since the Great Depression. In the Great Recession, 14.8 percent of all manufacturing jobs were lost. Measuring two years before the beginning of a recession to 30 months after the month it ended, it is clear that the last two recessions were exceptional. Manufacturing jobs grew during these periods in the 1960s and 1970s recessions. (See Figure 9) They shrunk in the late 1950s, 1980s and 1990s recessions, but by less than 6 percent. In the last two recessions, they were still down by more than 16 percent.[26]

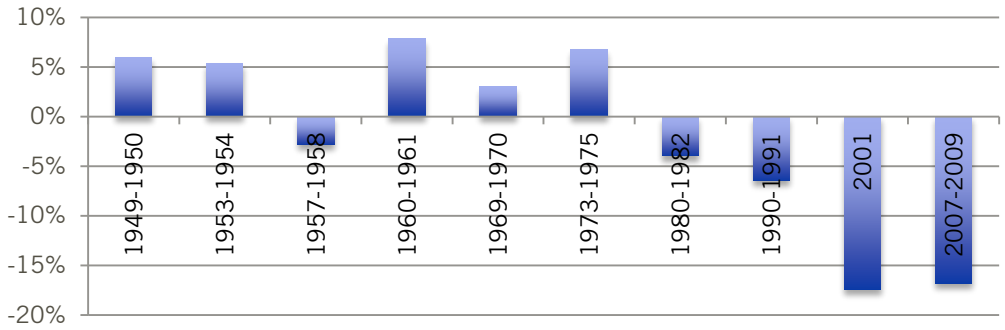

Figure 9: Percent Change in Manufacturing Jobs From 2 Years Before Recession to 30 Months After End[27]

The data on gross job losses and gains reveal the same pattern as the above data on net job losses and gains. The gross data measure total job losses from closing and contracting manufacturing establishments and total job gains from opening and expanding manufacturing establishments. In the 1990s losses from closing and contracting plants were more or less offset by gains from new and expanding plants. (See Figure 10)[28] But in the 2000s gains declined dramatically, on average about 10,000 less per year than in the 1990s. Losses also declined in the middle of the 2000s, but spiked to very high levels in the 2001 and 2008 recessions.

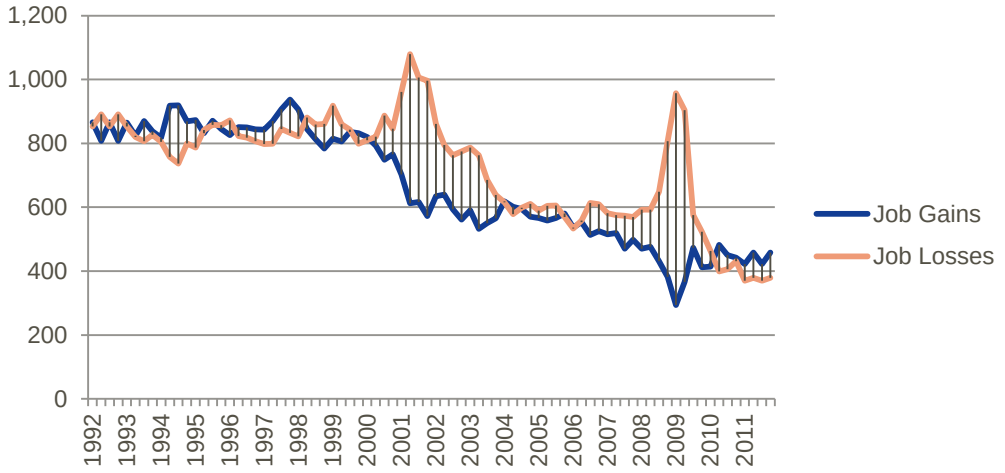

Figure 10: Gross Job Gains and Losses (millions), 1992-2012[29]

The manufacturing base was significantly smaller after 2001; losses in 2008 and 2009 might have been even higher had the base been larger. As Figures 10 and 11 show, there are substantial losses in manufacturing jobs during recessionary periods (immediately before the economy goes into recession and continuing at least a year after the formal National Bureau of Economic Research end of the recession). Gains did not exceed losses for a single period between 2000 and 2010; thus, the new one-way ratchet.

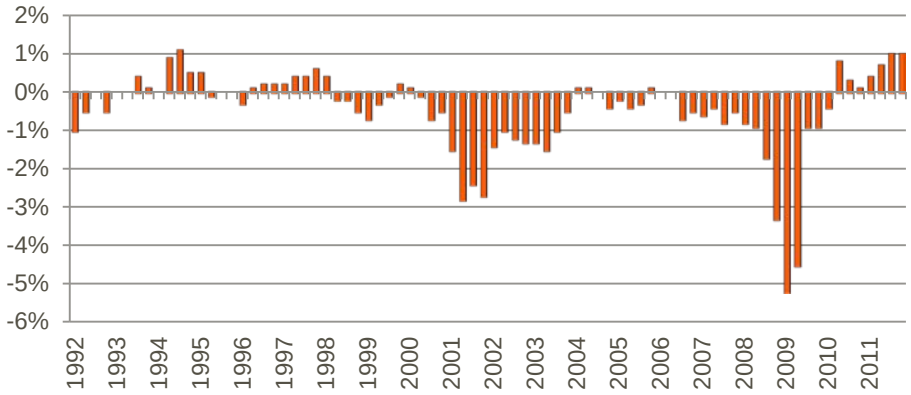

Figure 11: Net Percent Change in the Number of Manufacturing Jobs Percentage Change in Manufacturing Jobs by Quarter, 1992-2012[30]

We see the same dynamic in the number of manufacturing establishments losing and gaining jobs. There were a significant number of manufacturing establishments losing jobs during the 2001 recession, but in only five quarters after that, and prior to the Great Recession, did more establishments gain jobs than lose them, and the share of gainers over losers was quite small (See Figure 12). Prior to and during the Great Recession there were 15 quarters when the losers outnumbered the gainers, and the number of losers was much greater than the number of gainers. So far, there have been five quarters since the Great Recession in which gainers moderately outnumbered losers.

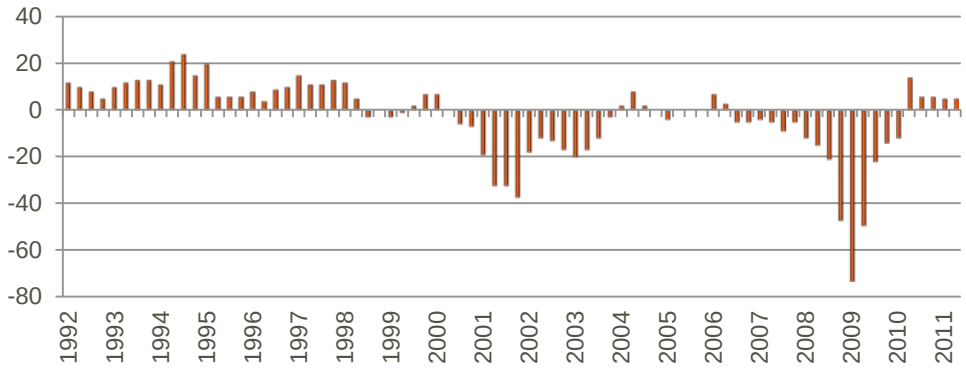

Figure 12: Net Number of Manufacturing Establishments Gaining Jobs Versus Losing Jobs per Quarter (thousands), 1992-2011[31]

In a healthy industry, steady growth in employment often masks the constant churning of firm creation and destruction. As less innovative and efficient companies go out of business and more innovative and competitive firms take their place, there is an increase in net new jobs. This has been termed "creative destruction". There is some decline and some growth, but the net result is growth. The highly competitive nature of most industries produces this process of dynamic equilibrium. But the dynamic in the U.S. manufacturing sector has been quite different, at least in the last decade. As Figure 13 indicates, in no year since 2001 have there been more manufacturing establishment openings than closings. While creative destruction represents an ever-innovating economy, the steady loss of manufacturing establishments indicates net destruction.

As we will discuss below, these dynamics provide one more piece of evidence to suggest that the job losses over the last decade were not solely or even principally related to superior productivity performance within manufacturing. If they were, the losses would be more evenly distributed and there would be greater pick up during the recovery periods. They were instead related to structural weaknesses in U.S. manufacturing competitiveness, akin to having a weakened immune system: a bad flu (recession) hits and a recovery follows, but some patients are never able to regain their health.

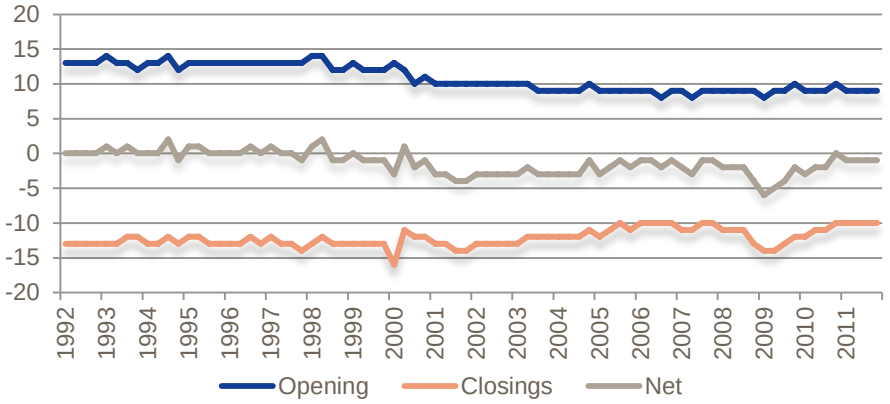

Figure 13: Manufacturing Establishment Openings and Closings (thousands), 1992-2011[32]

False Optimism?

Despite the unprecedented losses in manufacturing employment over the last decade, there is actually growing optimism about U.S. manufacturing due to the fact that manufacturing jobs have grown, albeit modestly, since the end of the Great Recession. In May 2011, Paul Krugman touted a recent Boston Consulting Group study and some very mild manufacturing employment growth, claiming manufacturing is "one of the bright spots of a generally disappointing recovery."[33] Floyd Norris of the *New York Times* wrote, "When the Labor Department employment numbers are released on Friday, it is expected that manufacturing companies will have added jobs in two consecutive years. Until last year, there has not been a single year when manufacturing employment rose since 1997."[34] The jobs data seem to back up Norris's claim. According to the U.S. Bureau of Labor Statistics, from January 2010 to January 2012, 402,000 manufacturing jobs were added, contributing to 13 percent of total job gains, even though manufacturing accounts for less than 10 percent of U.S. jobs.[35]

Economic analysts and journalists often turn to monthly labor reports for information on trends rather than data points. "Two straight years of growth" may then be interpreted as a manufacturing panacea, where not-so-past worries are firmly dispelled. When measured in terms of job growth since the end of the recession, it is true that manufacturing has added jobs. But as noted above, this performance is weaker than most post-war recoveries. Manufacturing jobs were up just 0.7 percent in the 30 months since the end of the recession, and only 1.4 percent by February 2012. By contrast, manufacturing added between 6.8 and 9.0 percent in the 30 months succeeding the recessions in 1969, 1974, and the early 1980s. Norris and others overlook the fact that, at 14.7 percent, the loss of manufacturing jobs in this recession was the largest ever. Compare this to the 1990-1991

recession, when manufacturing lost only 3.2 percent of its jobs. For every 12 manufacturing jobs lost during the Great Recession, only one had returned by February of 2012.[36]

At the rate of growth in manufacturing jobs in 2011, it would take almost 11 years to return to where the economy was in terms of manufacturing jobs at the end of 2007.

In short, the United States lost two million manufacturing jobs during the Great Recession, and after the recession just 166,000, or 8.2 percent, returned. That leaves 91.8 percent of jobs to be recovered. At the rate of growth in manufacturing jobs in 2011, it would take until at least 2020 for employment to return to where the economy was in terms of manufacturing jobs at the end of 2007.[37] In reality, and as the rest of this report will show, U.S. manufacturing has been in a state of structural decline due to loss of U.S. competitiveness, not temporary decline based on the business cycle.

The optimism stemming from the restoration of 8.2 percent of lost manufacturing jobs is bolstered by reports like the one from Boston Consulting Group (BCG) that claimed that, "within the next five years, the United States is expected to experience a manufacturing renaissance as the wage gap with China shrinks and certain U.S. states become some of the cheapest locations for manufacturing in the developed world."[38] In other words, America has turned the corner and is now back in the game. Never mind that BCG came to the exact opposite conclusion a few years earlier, stating, "We maintain, in contrast, that the cost gap [between China and the United States] not only is unlikely to close within the next 20 years, but in some cases may actually increase."[39] The fact is that the cost differential is still quite high (see Figure 14). Moreover, as China opens up its interior regions to development, it is tapping into new, large pools of low-wage labor. Thus, the rate at which the wage differential is closing is still very slow, as Figure 15 shows. In any case, is it really wise to suggest that America not bother to act to revitalize manufacturing because it *might* come back on its own?

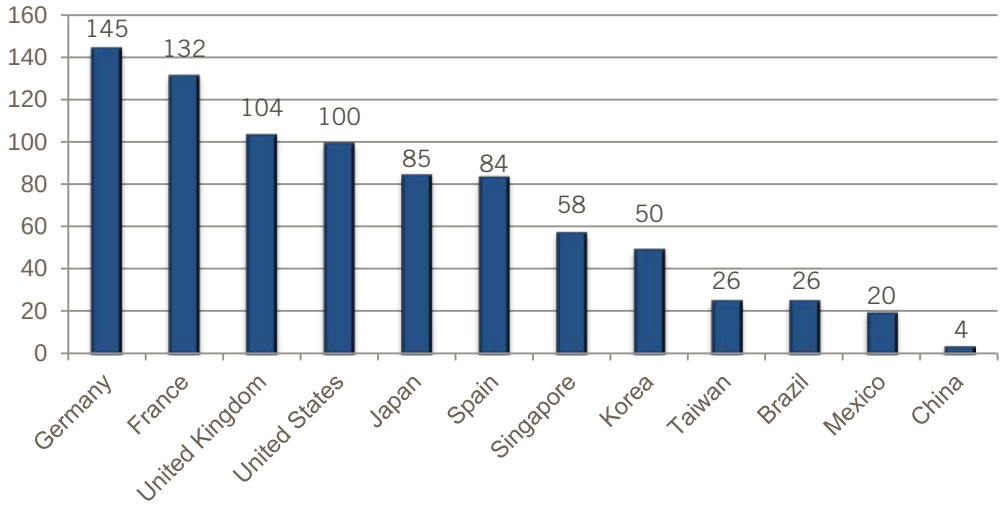

Figure 14: Hourly Manufacturing Compensation Costs (United States = 100), 2008[40]

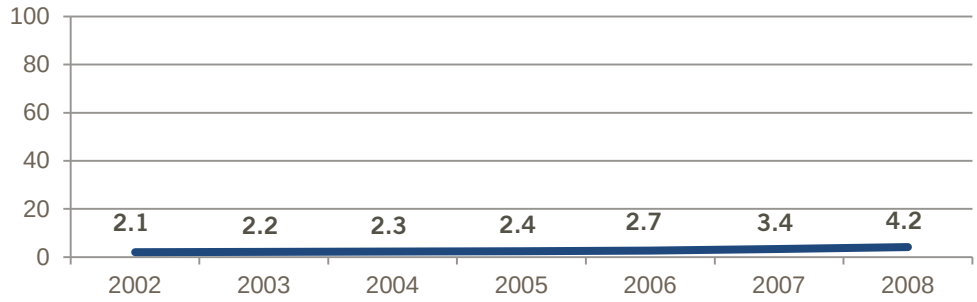

Figure 15: Chinese Hourly Manufacturing Compensation Costs (United States = 100), 2002-2008[41]

International Comparisons

It is clear that manufacturing employment has declined precipitously in the United States in the last decade. But this decline is often cited by defenders as "normal" and in line with what is happening in other countries. In this "post-industrial" view, advanced nations are transitioning from factories to services; the greater and faster the loss of manufacturing, the more successful nations are in mastering the transition. *The Economist* writes,

> Deindustrialization—the shrinkage of industrial jobs—is wrongly perceived as a symptom of economic decline, when it is really a stage of economic development, because as a country gets richer, it is inevitable that a smaller proportion of workers will be needed in manufacturing.[42]

This was also the thinking behind Lawrence Summers's statement in December 2010 that,

> We are moving towards a knowledge and service economy. You don't succeed by producing exactly the same thing that other people are producing in the same way just at a lower cost…There is no going back to the past. Technology is accelerating productivity in mass production to the point where even China has seen manufacturing employment decline by more than ten million jobs over the most recent decade for which data is available.[43]

As Senator Pat Moynihan used to be fond of saying, "you are welcome to your own opinions but not your own facts," and Summers's facts are flat out wrong. He presumably based his remarks on a report by the Conference Board and the National Bureau of Statistics of China, which showed that China lost 10.3 million manufacturing jobs from 1987 to 2002.[44] However, there are several problems with that data. First, the report only looked at China's largest manufacturers and missed the rapid increase of small manufacturers. Second, as several economists have noted, it is notoriously difficult to get accurate time trend data on the manufacturing sector in China. The Bureau of Labor Statistics (BLS) note within their own report, "China's public statistics on employment and wages in manufacturing do not meet international standards. No source of frequency published, official data provides nationwide employment and labor compensation statistics on Chinese manufacturing."[45] Third, during the 1990s China shut down many inefficient state-owned manufacturers, which actually made their manufacturing sector more

competitive. According to China's own statistics, in 1995 (at the height of state-owned enterprises [SOEs] closures) roughly half of all SOEs were unprofitable.[46]

That Summers could give a speech defending the loss of U.S. manufacturing as normal, citing significantly outdated Chinese data to buttress his point, is troubling. In fact, manufacturing employment in China has been increasing rapidly since 2002. Between 2002 and 2006, while the United States was losing manufacturing jobs at an unprecedented rate, China's manufacturing employment rose by an astounding 11 million workers. In four short years China created as many manufacturing jobs as exist in the United States today.[47]

Still, some argue that China's manufacturing economy has peaked or has begun to decline, citing official Chinese statistics of a decline in manufacturing employment between 2006 and 2007. However, this "loss" is due to Chinese statistics no longer counting self-employed manufacturers. In other words, the one-year decline is an accounting issue and not a true reflection of manufacturing employment in China. As the BLS notes, "Despite the statistical break, it is still clear that the actual trend for the whole decade from 1999 to 2008 is that manufacturing employment increased every year from 1998 to 2006 and that the rising trend continued from yearend 2007 to yearend 2008."[48] Between 2007 and 2008 employment increased by 1.1 million.[49] So the story that even China is losing manufacturing jobs is simply incorrect.

The story that even China is losing manufacturing jobs is simply wrong.

There is, however, some truth to the post-industrialists' view. Advanced economies naturally see manufacturing jobs contribute to a smaller share of total employment, since manufacturing productivity is typically higher than non-manufacturing productivity. But normally the loss is modest and gradual, in contrast to the United States where in the last decade it was sudden and steep. Moreover, advanced nations do lose some lower-value-added, lower-skill, commodity-based manufacturing to lower-wage nations. But, what the post-industrialists miss is that, as these lower-wage developing nations grow, they also increase their demand for the higher-value-added products that developed nations should naturally produce. In other words, the process of global integration does not and should not naturally lead to the deindustrialization of developed economies, but rather to the transformation of their industrial bases toward more complex, higher-value-added production. Indeed, this is how nations maintain their manufacturing competitiveness. For example, while Germany and Japan have lost low-skilled manufacturing jobs, a recent OECD report finds that they have seen an increase in high-skilled manufacturing.[50] This is why nations like Germany and Japan have a significantly higher share of their manufacturing output in high-tech and medium-high-tech industries than the United States; they have been able to transform their manufacturing industries. (See Figure 16)

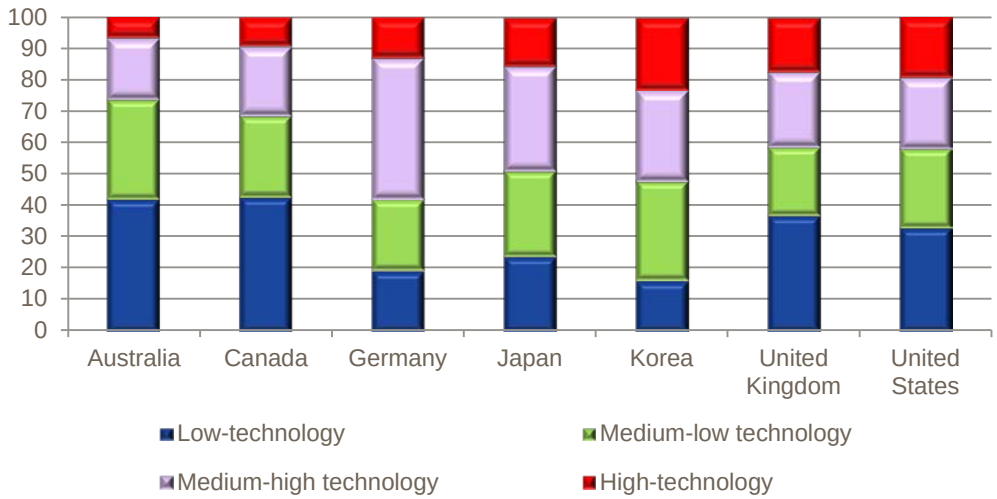

Figure 16: Composition of Manufacturing Sector by Technology Intensity[51]

There is a major difference between restructuring and decline in a nation's manufacturing sector. Manufacturing restructuring is required (higher productivity and a shift from lower-value-added sectors to higher-value-added ones) for economic success. But decline is just decline.

This is also why the manufacturing job performance in these nations is significantly better than in the United States. Of 10 nations examined by the BLS, only the United Kingdom experienced a magnitude of manufacturing job loss comparable to the United States from 2000 to 2009 (when adjusted for growth in working age population). (See Figure 17) The reality is that, over the last decade, many other nations have kept job loss to a minimum by increasing manufacturing output. Only the United Kingdom—long in economic trouble because of its hollowed out manufacturing sector—suffered a larger share of manufacturing job loss than the United States.

That these nations lost a smaller share of their manufacturing employment (despite ups and downs) over this period, avoiding the precipitous decline the United States has experienced, shows that U.S. manufacturing decline was not inevitable. Deindustrialization of high-wage economies is not pre-ordained. The United States' steep loss of manufacturing jobs is not "normal" and is certainly not progressive. As such there is a major difference between the restructuring and the decline of a nation's manufacturing sector. Restructuring (higher productivity and a shift from lower-value-added sectors to higher valued-added ones) is required for economic success. But decline is just decline. Germany restructured, shedding jobs in lower-wage manufacturing sectors and lower-skill jobs in all manufacturing sectors. But Germany made up for most of those losses with gains in higher-value-added sectors and jobs. By contrast, the United States restructured and declined.

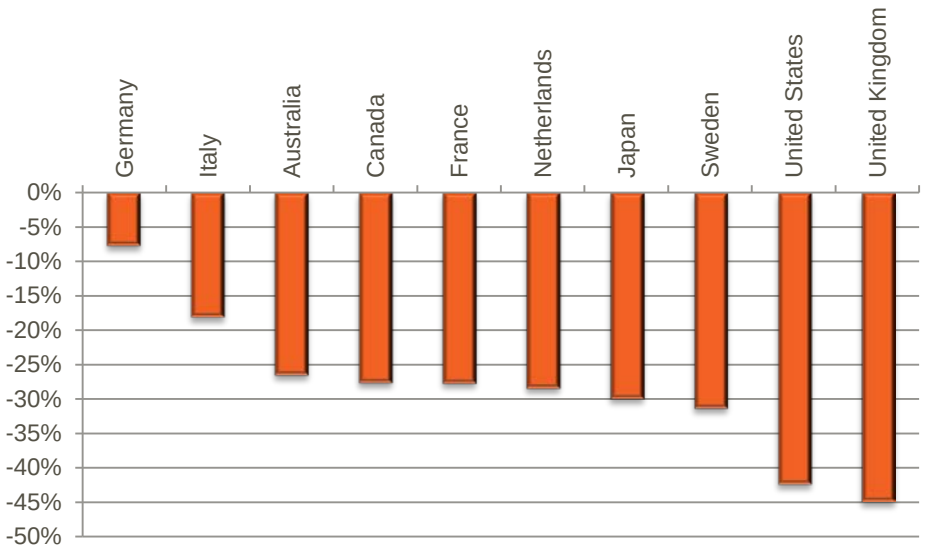

Figure 17: Percent Change in Manufacturing Jobs in Select Countries, Adjusted for Population Growth, 1997-2010[52]

Manufacturing Job Losses Within the United States

One reason some observers have argued that all is well with U.S. manufacturing is that they persist in viewing manufacturing as a "rust belt" industry where the losses are largely confined to a few states whose economies are concentrated in what are essentially "buggy whip" industries. To be sure, the "rust belt" states saw significant losses in the last decade. The deterioration of the automobile industry led to a loss of close to half of Michigan's manufacturing jobs—Detroit alone lost 150,000 auto industry jobs between 2000 and 2008.[53] But manufacturing loss has been a significant feature of almost every state. North Carolina, often referred to as the "new South" due to the presence of many federal labs and IT and pharmaceutical firms, ranks second in the loss of manufacturing jobs between 2000 and 2010.

In fact, only two states—Alaska and North Dakota—saw less than double-digit declines in manufacturing employment (with only Alaska actually creating jobs), and in neither state is manufacturing a substantial part of the economy. Manufacturing in Alaska and North Dakota represents 1.7 and 2 percent of gross state product, respectively. The two states employ less than 20,000 workers combined.[54] Even the third-best state in terms of manufacturing employment performance, Nevada, saw a loss of 11 percent of manufacturing jobs. (See Figure 18, Tables 2 and 3)

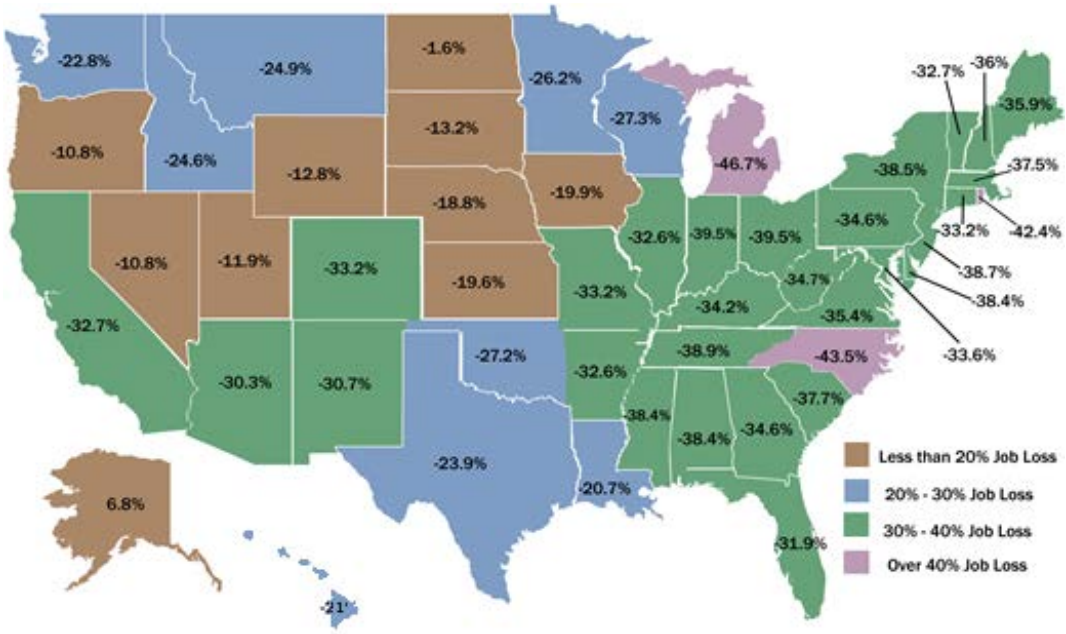

Figure 18: Percentage Loss in Manufacturing Jobs, 2000-2010[55]

Rank	State	Change
1	Michigan	-46.7%
2	North Carolina	-43.5%
3	Rhode Island	-42.4%
4	Ohio	-39.5%
5	Tennessee	-38.9%
6	New Jersey	-38.7%
7	New York	-38.5%
8	Delaware	-38.4%
9	Mississippi	-38.4%
10	South Carolina	-37.7%

Table 2: Top Ten States With the Largest Share of Manufacturing Job Loss, 2000-2010[56]

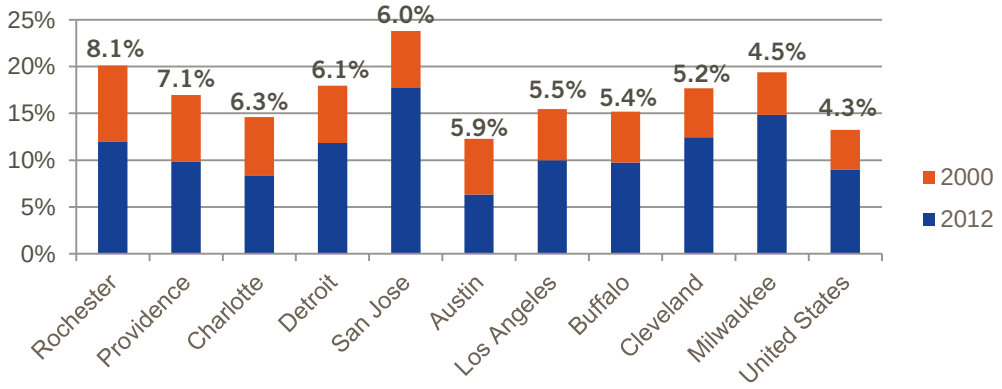

Figure 19: Selected Metropolitan Areas Percent of Workforce in Manufacturing and Percentage Point Declines, January 2000-January 2012[57]

Rank	State	Change
1	Alaska	6.8%
2	North Dakota	-1.6%
3	Nevada	-10.8%
4	Utah	-11.9%
5	Wyoming	-12.8%
6	South Dakota	-13.2%
7	Nebraska	-18.8%
8	Kansas	-19.6%
9	Iowa	-19.9%
10	Louisiana	-20.7%

Table 3: Top Ten States With Manufacturing Job Gain or Least Job Loss, 2000-2010[58]

We see the same dynamic at the metropolitan level. It is not surprising that "rust belt" metros such as Buffalo, Cleveland, and Detroit have lost manufacturing jobs (so much so that fewer than 12 percent of workers are employed in manufacturing in those areas), but so have so-called "new economy" metros such as Austin, Texas, Los Angeles, and San Jose. (See Figure 19)

Does Manufacturing Matter?

Do manufacturing jobs matter? For the neoclassical economists who largely preside over economic discourse in Washington, the answer is a resounding "No!" – or at least: "they matter no more than jobs in any other industry." Michael Boskin, former economic advisor for President George W. Bush, reportedly stated: "computer chips, potato chips, what's the difference?"[59] More recently, Christina Romer, former head of the Council of Economic Advisors in the Obama administration, wrote in *The New York Times* that manufacturing doesn't matter.[60]

For Romer, as for most neoclassical economists, the decline in manufacturing jobs implies a transition from employment in one type of industry to another. In an efficient global marketplace, a competitive economy will shed jobs in one industry because the relative value of labor is higher in other industries. Efficient labor markets will always allocate labor to its most effective end, and therefore such transitions are good for the economy. If in 1980 the U.S. economy had more manufacturing workers than retail workers, but in 2011 it had more retail workers than manufacturers, the market must then prefer retailing to manufacturing, and thus the employment shift is the optimal outcome. Any attempt to favor a particular sector, such as manufacturing, can only retard this growth-enhancing reallocation of societal resources. However, there are a number of actual flaws in this logic.

First, the argument at its core is a tautology: the market allocates employment efficiently; therefore, employment is efficient if it is allocated by the market. Second, with unemployment at 8.3 percent, it is clear that even if manufacturing job losses were the outcome of a well-oiled economy, all those jobs have not been recreated in other industries. At a minimum, the "don't worry, jobs will be replaced elsewhere" thesis is risky—manufacturing still contributes $1.7 trillion to GDP and employs 12 million workers.[61] Allowing this sector to decline further requires strong guarantees that other jobs will appear to replace those lost in manufacturing.[62] Third, it was not the market that led to U.S.

losses; it was other nations' competitiveness policies focused on manufacturing. Neoclassical economists may not like these policies, but their liking them or not liking them is irrelevant to their existence and effect.

More importantly, the central thesis of the argument is flawed because manufacturing jobs are not the same as all other jobs in the economy. Supporters of manufacturing offer many valid arguments for why manufacturing jobs are different and more critical than jobs in other sectors. These include: manufacturing jobs pay more;[63] manufacturing is a source of good jobs for non-college-educated workers;[64] and manufacturing is the key driver of innovation—without manufacturing, non-manufacturing innovation jobs (for example, research and design) will not thrive.

The first two rationales are grounded in social policy concerns. A strong manufacturing sector is important because it allows the nation to achieve social goals. Neoclassical economists, to the extent that they care about social goals, will argue that there are other, more efficient ways of addressing these concerns such as increasing the earned income tax credit or boosting support for education. The third rationale is more-closely related to economic growth. It is partly an empirical question (there is considerable evidence that manufacturing and innovation are inextricably linked), but, for neoclassical economists, neither manufacturing nor non-manufacturing innovation jobs are any more important than other jobs.

The anemic overall job performance in the last decade was directly related to the loss of 32 percent of manufacturing jobs.

But the central reason why manufacturing matters is that it is a key enabler of traded sector strength. And, in a global economy, it is impossible to have a vibrant national economy without a globally competitive traded sector.[65] Manufacturing is still the largest traded sector of the United States economy, and it will be for some time. While some argue that the United States can close its trade deficit by boosting exports of services or non-manufactured goods (principally agricultural products or energy exports such as natural gas), the facts suggest otherwise.[66]

Traded sector jobs are important, in part, because they have high employment multipliers. This is the primary reason why all 50 states focus their economic development efforts on traded industries like manufacturing and software, and not on the barbershop industry. If a barbershop closes, then another will take its place to serve local demand. But if a manufacturer closes, then another one may take its place, but perhaps not in the same state. This is true not just at the state level, but the national level as well. Every lost manufacturing job means the loss of around 2.3 other jobs in the economy.[67] As such, the anemic overall job performance in the last decade was directly related to the 32 percent loss of manufacturing jobs. The erosion of the manufacturing base turned the U.S. economy into a leaky boat with worn sails. Meanwhile, the headwinds became gale force. For most of the 2000s, manufacturing's decline bestowed slow economic growth. Late in the decade, it helped turn a recession into "The Great Recession."

There is another, more subtle, but ultimately more significant impact of the decline of manufacturing on the U.S. economy: it erodes the confidence of businesses, workers and consumers. Ultimately, a strong and brisk recovery will depend on the faith that America will once again lead in the global economy. If that faith is absent or, worse, if there is a

sense of economic foreboding and decline, then the United States will lack the rational exuberance needed to power investment and spending, and the recovery will continue to drag.

As Keynes noted, "Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as the result of animal spirits—a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities."[68] Had U.S. manufacturing expanded real output by 20 percent in the last decade and eliminated the trade deficit (instead of contracting by 11 percent with a trade deficit of around $600 billion), not only would America's economy be much healthier, but so too would be its "animal spirits."

Non-Productivity Arguments Why Manufacturing Job Losses Should Not be a Concern

In the face of these unprecedented declines, there are a number of arguments to rebut any claim that these losses stem from a loss of U.S. manufacturing competitiveness. The next section will address the familiar rationalization that job losses are the result of superior manufacturing productivity growth. The remainder of this section examines the arguments related to job definitions within manufacturing.

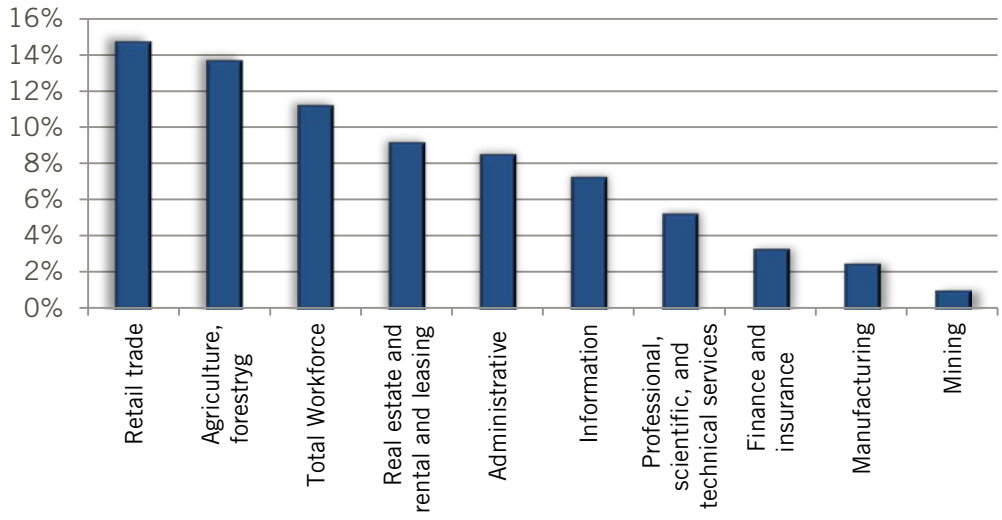

Figure 20: Percent of Workforce That is Long-Term Part-Time, 2010[69]

While the data paint a clear picture of the decline in manufacturing, some believe the jobs data to be flawed. One argument is that full-time manufacturing job losses do not reflect an underlying problem in the U.S. manufacturing sector; instead, many of these workers have become part-time employees, due in part to increased productivity in the sector, greater employment flexibility, and temporary economic conditions. Involuntary part-time employment certainly increases during recessions.[70] Yet this is a long way from explaining the massive loss in manufacturing employment. Rather, the transition from full employment to involuntary part-time is a function of the economy at large, not a particular sector, and especially not of the manufacturing sector.

According to the Bureau of Labor Statistics, 36.2 percent of the rise in involuntary part-time employment was in the construction sector between 2006 and 2009, with another 24.3 percent increase among workers in the professional and business services industry.[71] As Figure 19 shows, only one in 50 manufacturing workers is long-term part time, compared to one in seven in the retail and agriculture industries, and one in nine in the total workforce. Similarly, Figure 20 shows the percentage change in part-time employees by sector over the last decade; the number of part-time workers in the manufacturing sector increased by just 0.05 percent, compared to 0.08 percent in the overall workforce and 1.6 and 2.3 percent in the administration and agriculture sectors, respectively. Finally, the data on total hours worked in manufacturing are clear. From 2000 to 2010, the total number of hours worked by full- and part-time manufacturing workers declined by 12.5 billion hours, or 33 percent—almost exactly the same rate of decline for overall manufacturing employment.[72] (See Figure 22)

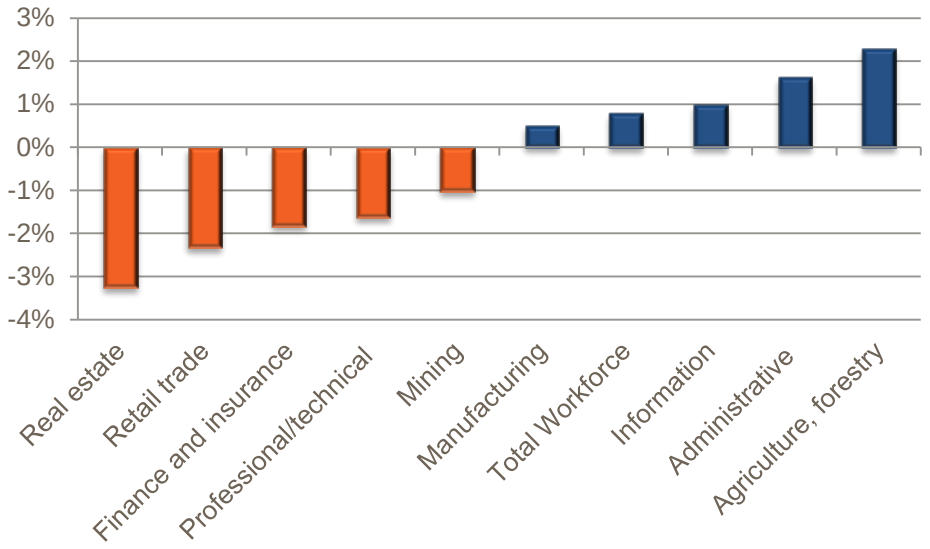

Figure 21: Percentage Change in the Number of Part Time Employees, 1998-2010[73]

Those who question the decline in manufacturing are actually partially correct. While they are wrong that full-time employment loss can be explained by part-time employment gains, they are correct in that the manufacturing sector has indeed lost a higher share of full-time equivalent employees than other sectors. As Figure 23 highlights, the manufacturing sector has lost 34 percent of its full-time employees since 2000.[74] The construction industry had the second-most full-time equivalent losses. Often lauded as the biggest loser of the recent recession and the industry most in need of recovery funds, construction lost two-thirds as many full-time equivalent employees as the manufacturing sector.

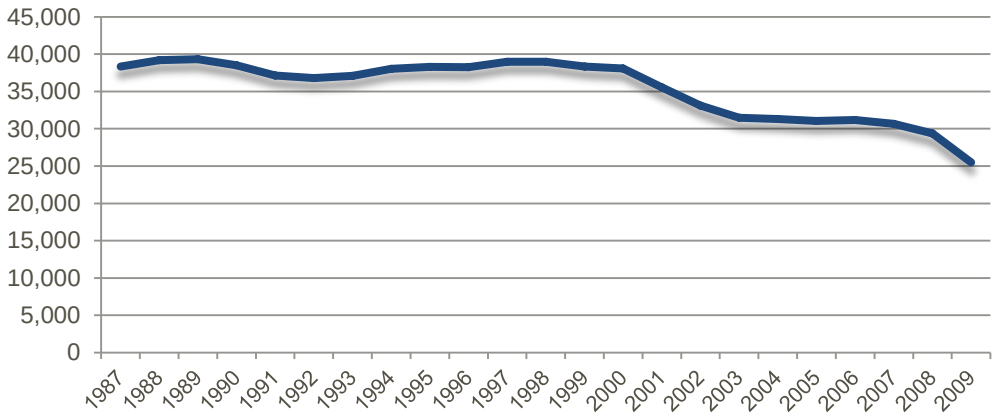

Figure 22: Total Hours Worked in Manufacturing (millions), 1987-2009[75]

Skeptics also argue that the decline in manufacturing jobs is really a function of the reclassification of jobs from manufacturing to services, as more manufacturing firms delegate work out to specialized contractors. For example, a manufacturing company that once employed its own security guards may now contract out that work to a firm that provides security services, and now the job is counted in NAICS code 561612—Security Guards or Patrol Services—instead of in the manufacturing sector. Or, a firm that once employed its own accountants for payroll services may now contract a firm like Automatic Data Processing (ADP). These manufacturing jobs losses would then be an artifact of statistics, and would not signify any real manufacturing decline.

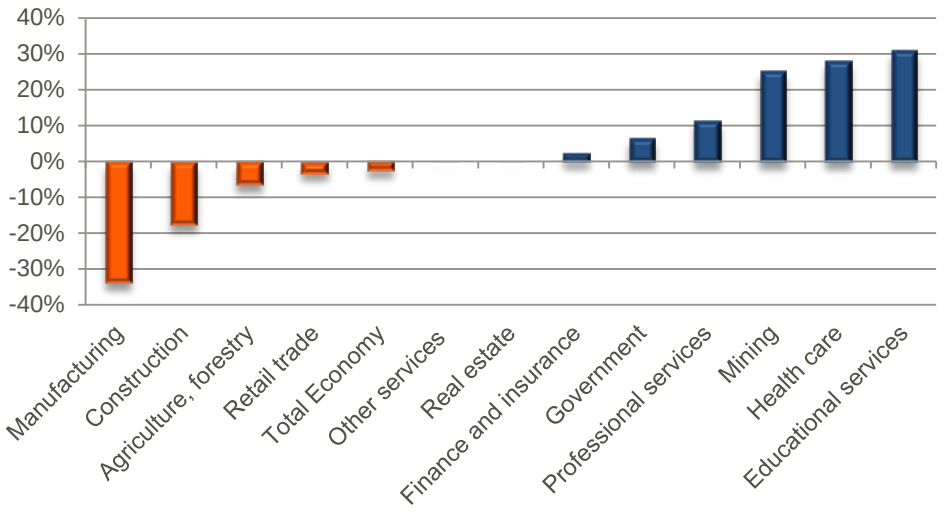

Figure 23: Percentage Change in Full-Time Equivalent Employees by Industry, 2000-2010[76]

The evidence suggests that, while reclassification of workers has indeed played a role in the decline of manufacturing employment, it does not nearly account for the full magnitude of the job losses over the past decade. Economist Susan Houseman finds that, even with the increase in contract work, non-contract manufacturing employment still declined significantly from 2000 to 2004. In fact, in 2004, counting employment service workers as manufacturing workers would have added just 8.7 percent to manufacturing jobs, up from

2.3 percent in 1989.[77] However, to the extent that the reclassification argument is correct, it actually undermines the argument that manufacturing job losses are due to productivity gains. Dey, Houseman and Polivka estimate that reclassification due to increased contracting caused the annual growth rate of manufacturing labor productivity to be overstated by 0.5 percentages points (or about 14 percent) between 1989 and 2000, with similar results holding for the years 2000 through 2004.[78] This means that, because actual productivity growth was lower than the officially reported productivity growth figures, the number of manufacturing jobs lost due to productivity growth is also fewer due to the reclassification phenomenon.

PRODUCTIVITY GROWTH DOES *NOT* EXPLAIN U.S. MANUFACTURING JOB LOSS

At a November 2011 manufacturing automation conference in Chicago, William Strauss, a senior economist at the Federal Reserve Bank of Chicago, gave a keynote presentation on the state of American manufacturing. He stated, "On average, manufacturing output has been growing 3.1 percent annually over the past 63 years. Automation has enabled U.S. manufacturers to produce significantly more with fewer workers than they did in previous decades. Today, 177 workers can generate as much output as 1,000 plant employees could produce in 1950."[79] In this narrative, all is well. Rapid productivity growth, not output loss, is driving manufacturing job losses. Far from a cause for concern, the dramatic loss in manufacturing jobs should be seen as a key metric of success.[80] Firms are becoming highly productive and, in the process, are shedding workers they no longer need. While this may pose a problem for workers, the job losses benefit consumers and the American economy.

It has long been the Washington consensus that steep declines in manufacturing employment, along with apparently rising output, are symptoms of our industrial salubrity.

Strauss is not alone in his rosy diagnosis. Indeed, it has long been the Washington consensus that steep declines in employment, along with apparently rising output, are symptoms of our industrial salubrity. A sampling of these statements includes:

- "The long-term trends that we have recently seen in manufacturing mirror what we saw in agriculture a couple of generations ago." N. Gregory Mankiw, Chairman of the Council of Economic Advisers (CEA) under President Bush, 2003.[81]
- "Employment in the [manufacturing] sector … [gets] smaller and smaller almost as proof of how productive it has become. It is exactly the same process that agriculture went through." Austan Goolsbee, University of Chicago, 2006.[82]
- "Manufacturing employment has fallen [since 2000] because of productivity growth, not a decline in output." The Congressional Research Service,2008.[83]
- "The majority of manufacturing job losses is due to productivity increases." Robert Reich, University of California, Berkeley, 2012.[84]
- "Manufacturing is doing 'amazingly well." Mark Perry, American Enterprise Institute, 2012.[85]
- "For all the bellyaching about the 'decline of American manufacturing' and the shifting of production en masse to China, real output has been growing at an

annual pace of almost 4 percent since 1991 [to 2005], faster than overall GDP growth." *The Economist*, 2005.[86]

- "Since, contrary to conventional wisdom, manufacturing output has been growing strongly, not declining, the fall in [manufacturing] employment in America and elsewhere should be seen as a good thing." Kevin Williamson, *National Review*, 2010.[87]
- "This trend of a reduction in employment and an increase in manufacturing productivity is similar to the trend observed in agriculture in the early part of the 20th century." Paul Weener, IntelliQ Research, 2012.[88]
- "American manufacturing remains robust, but only because it has responded to global competitive forces by becoming much more productive—by learning how to add more value with fewer workers." William Galston, The Brookings Institution, 2012.[89]
- "[Agricultural jobs fell dramatically and now] the same thing is now happening in manufacturing. Through automation, through improved productivity, we're driving the number of jobs." Dan Miklovic, Gartner Inc., 2003.[90]
- "Strong growth in productivity and a slower rate of growth in the demand for manufactured goods have necessarily entailed a decline in manufacturing's share of total employment." Congressional Budget Office, 2004.[91]
- "Productivity enhancements reduced manufacturing employment." John Tamny, RealClearMarkets, 2011.[92]
- "Computers have made manufacturers more productive by automating many routine tasks. American manufacturers now employ fewer workers to produce more goods." James Sherk, Heritage Foundation, 2010.[93]
- "The decline in U.S. manufacturing employment is explained by rapid growth in manufacturing productivity." R. Glen Hubbard, Columbia University, 2004.[94]
- "While the demand for the output of the manufacturing sector has grown about as rapidly as GDP, it has not grown fast enough to offset the relatively rapid productivity growth in the sector." Martin Neil Baily, Brookings Institution and Robert Z. Lawrence, Harvard University, 2004.[95]
- "Manufacturing mirrors farming: just a tiny sliver of the work force can now feed the entire country." Richard Katz, *Oriental Economist Alert*, 2012.[96]
- "America's manufacturing prowess never went away. What did change was that the number of workers required to manufacture the same amount of products fell sharply." Jay Pelosky, J2Z Advisory, 2012.[97]

Virtually everyone makes the argument that massive manufacturing job decline is a sign of success: manufacturers are using technology to automate work and to become more efficient. "Manufacturing is like agriculture" has been the dominant story. The United

States produces more food than ever, but because farming has become so efficient, it requires a very small share of U.S. workers to grow and harvest the food. So while manufacturing productivity growth may be tough on workers, job loss is seen as a sign of strength, not weakness. According to this narrative, U.S. manufacturing is quite healthy, apart from the recession. U.S. manufacturing output is still the highest in the world—the story goes—and what's more, it has expanded faster than the manufacturing output of other nations in the past year.[98] All that is necessary are a few limited policy interventions to smooth the transition and help laid-off workers gain the skills needed to thrive in the expanding service sector.[99]

Lamentably, the state of American manufacturing—and by extension the American economy—has been seriously misdiagnosed. In fact, the idea that "all is well" is faulty on two counts. First, even when relying on official U.S. government data, it is clear that manufacturing output growth has lagged this decade, particularly in a number of key sectors. Second, and more importantly, it is increasingly clear that there are substantial upward biases in the U.S. government's official statistics and that real manufacturing output and productivity growth is significantly overstated. The most serious bias relates to the computers and electronics industry (NAICS 334)—its output is vastly overstated. Correcting for these statistical biases, we see that the base of U.S. manufacturing has eroded faster over the past decade than at any time since WWII, when the United States began compiling the statistics. In other words, the massive loss of jobs is not due to productivity alone. It is also caused by loss of output, which stems from a loss of international competitiveness among U.S. manufacturing establishments. (Establishments are the factories, offices, and laboratories of companies. Virtually all large companies are multi-establishment companies while some are small companies and single establishment companies.) The American economy has been in a slow-motion structural free fall for the last decade, dragged down by the weight of a manufacturing sector that has lost its international competitiveness.

Adjusting for the various statistical biases, ITIF finds that labor productivity increased by only 32 percent during the period, implying that the official figure of 72 percent was a 122 percent overstatement.

The Official Statistics Do *Not* Paint a Completely Rosy Picture

Any analysis of the health of manufacturing needs to be grounded in an analysis of changes in real, inflation-adjusted output as a share of the economy. Despite this caution, many who claim that manufacturing is declining point to the rapid decline in manufacturing output as a share of GDP. Others use this data to argue that because manufacturing is declining, both in the United States and elsewhere; it has become a much less important part of the economy and can be largely ignored.

Indeed, from 1970 to 2010, manufacturing's share of GDP fell from 22.7 percent to 11.7 percent. But this tells us little since the nominal dollars have not been adjusted for price changes. Because measured manufacturing productivity has grown faster than overall productivity, manufacturing output in nominal terms might be expected to decline. An item that cost $500 to produce in 1980 might cost $400 to produce in 2010, but during the same period inflation in the total economy grew by 165 percent.[100] Using nominal output figures would suggest that the output of this item has declined, but it is possible only its price declined. In this way, using nominal dollars overstates the decline of manufacturing.

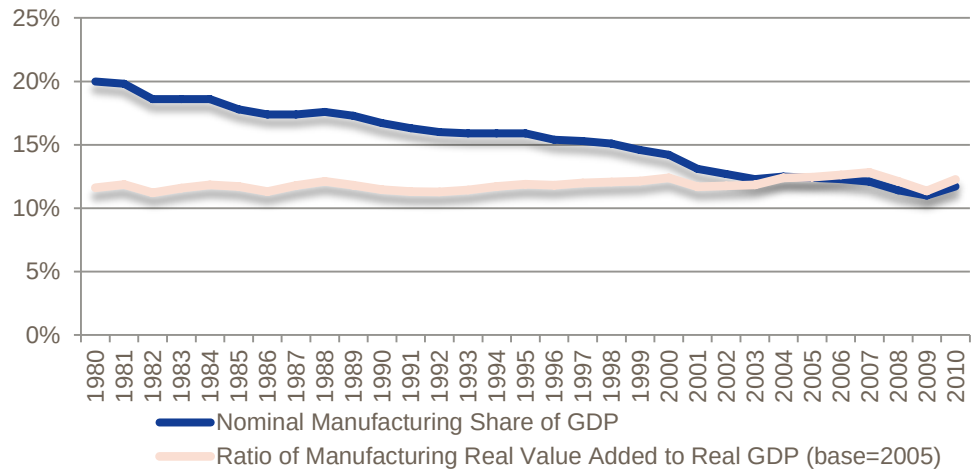

Figure 24: Manufacturing Value Added Relative to GDP, 1980-2010[101]

The most meaningful statistics on the health of manufacturing focus on the change in "real" manufacturing output relative to GDP. Previously, it would have been possible to approximate manufacturing's real "share" of GDP using "constant" dollars. However, in 1996 the Bureau of Economic Analysis (BEA) switched from using constant dollars as their inflation adjustment method to using "chained" dollars. Due to this change, it is not possible to obtain a precise inflation-adjusted share of GDP for manufacturing, at least not over extended periods of time.[102] Nevertheless, using the BEA's chained dollar figures still provides a more accurate picture than using nominal dollars.

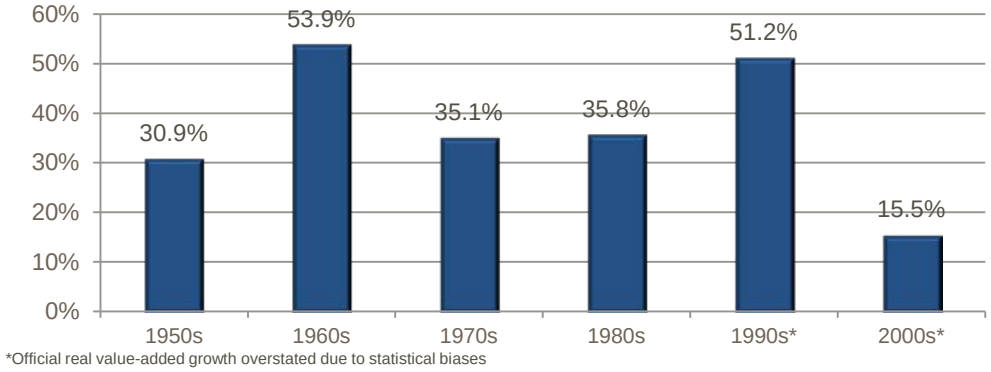

Figure 25: Manufacturing Real Value Added Change by Decade[103]

On the face of it, this price-adjusted picture looks much better for those who deny the problem of U.S. manufacturing job loss. As Figure 24 shows, the ratio of chained ("real") manufacturing output to real GDP output fell only slightly, while manufacturing grew slightly slower (15.5 percent) than non-manufacturing output (16.9 percent) from 2000 to 2010.[104] More than any other, this is this figure that leads many economists to argue that there is nothing wrong with U.S. manufacturing. If manufacturing is still the same share of GDP as it was a decade ago but it employs 5.5 million fewer workers, it can only be due to superior productivity performance. If an industry increases its productivity faster than the average rate of productivity growth in an economy, then it may experience slower job

growth than other industries since it needs fewer workers to produce the same number of products.

When government measurement errors are corrected, it appears that real U.S. manufacturing output declined by 11 percent from 2000 to 2010, likely the only decade in American history (other than perhaps the Great Depression) where manufacturing output fell.

But it is also true that relatively higher productivity in an industry leads to lower costs, which in turn can spur higher demand for the good or services. William Nordhaus found that within each manufacturing industry, increases in the rate of productivity growth were associated with increases in the rate of job growth during the period from 1948-2003.[105] So the loss of so many manufacturing jobs in the last decade cannot automatically be attributed to superior productivity. Figure 25 shows that, relative to decades past, manufacturing output has underperformed. For example, real manufacturing output grew at about 35 percent per decade in the 1970s and 1980s, but in the 2000s it grew at just 15 percent.[106] Some will argue that even if manufacturing growth was slower in the 2000s than in any decade since World War II, it more or less matched the growth of GDP. This is true, but an equally compelling explanation is that the dramatic falloff in the growth of manufacturing contributed to the significantly slower growth of GDP.

Even leaving aside this issue, a detailed examination of output change by sector reveals a more complicated result. While, according to official reports, overall manufacturing output grew just slightly slower than GDP, in fact 13 of 19 manufacturing sectors have seen absolute declines in real output over the past decade. At the end of 2010, wood products had 10 percent less output than it had in 2000, the electrical equipment industry 12 percent less, printing and plastics 14 percent less, fabricated metals 20 percent less, furniture 26 percent less, paper 27 percent less, nonmetallic minerals 30 percent less, primary metals by 36 percent less, apparel 40 percent less, motor vehicles 45 percent less, and textiles 47 percent less. In other words, 13 manufacturing sectors that employed 55 percent of manufacturing workers all produced less in 2010 than in 2000, at a time when the overall economy grew 17 percent. And three of the remaining six grew slower than the rate of GDP growth. (See Figure 26) Importantly, the measured output in one industry, computer and electronic products, grew enormously, dwarfing the output growth of the other industries. In fact, this one industry, accounting for fewer than 11 percent of manufacturing jobs in 2000, accounted for all the output growth and more of the U.S. manufacturing sector. Collectively the other 18 sectors saw declines in output.[107] As the report discusses in the next section, the official output figures for the computer industry are vastly overstated.

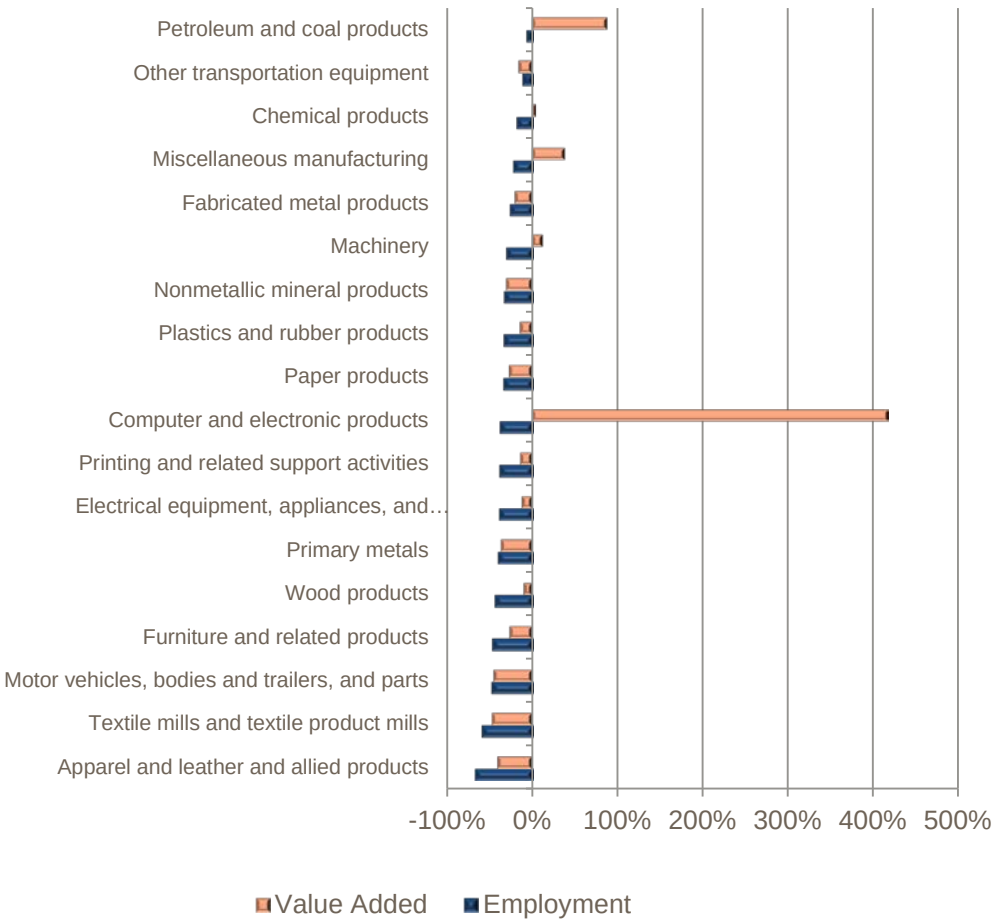

Figure 26: Change in Employment and Real Value Added, 2000-2010[108]

Moreover, it is not clear how productivity could be the culprit behind the large share of job loss in the 2000s when manufacturing labor productivity (as measured by the official value added data) was not substantially different in the 1990s than it was in the 2000s. During the 1990s, manufacturing jobs fell by one percent, while labor productivity increased by 53 percent. In the 2000s, manufacturing jobs fell by 33 percent while productivity increased by 66 percent.[109] (See Figure 27) This is indeed a larger amount, but it is not great enough to account for the significant loss of jobs.[110] Moreover, as described below, the 2000s productivity number is actually significantly overstated, even more so than the 1990s figure. Adjusting for bias in the data, the actual productivity growth in the 2000s was just 32 percent.

Some will rightly point out that it is the relative rate, not the absolute rate of productivity growth that matters. Again, the evidence supports the view that productivity was not the major cause of the 2000s manufacturing job debacle. Business sector productivity grew by 24 percent in the 1990s and by 28 percent in the 2000s.[111] In other words, the ratio of manufacturing productivity to overall business productivity was approximately the same in the both decades. Yet in the 1990s manufacturing jobs were essentially unchanged. Something other than productivity was at work in driving the loss of one-third of manufacturing jobs.

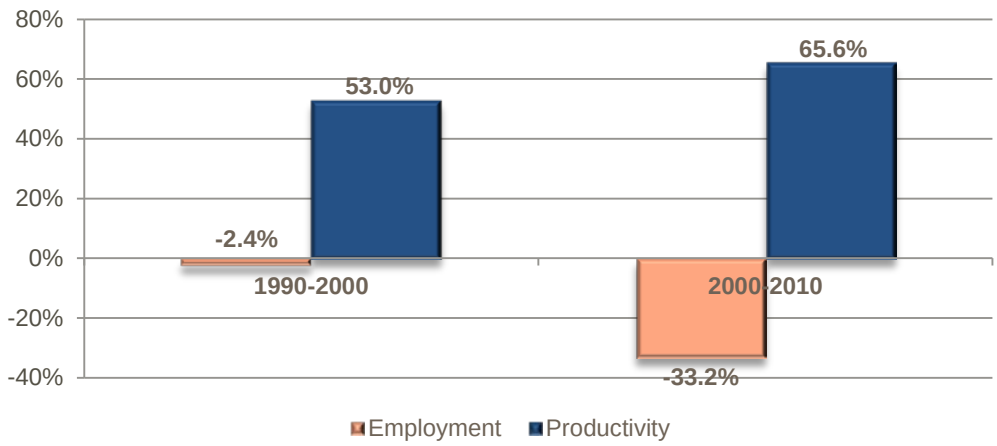

Figure 27: Manufacturing Employment and Manufacturing Productivity Growth[112]

Finally, it is important to note that some of the growth in manufacturing over the past decade came as a result of increases in defense contracts. After 9-11, and with the wars in Iraq and Afghanistan, defense procurement budgets increased from $52 billion in 2000 to $134 billion in 2010.[113] This is equivalent to a rise from four percent of manufacturing output in 2000 to eight percent in 2010.[114] This is not to say that the output growth was not real, but rather that this component of growth does not reflect a change in U.S. manufacturing competitiveness, since most defense goods are procured within the United States. With the ending of the wars and the impending defense budget cuts, the defense "stimulus" enjoyed by manufacturing over the past decade will end as well.

Official Government Statistics Significantly Overstate Output and Productivity Growth

While the official numbers do not paint a completely rosy picture, they can certainly be interpreted to mean that manufacturing is on solid ground, although not growing quite as fast as the overall economy. However, there are serious problems with how the U.S. government measures manufacturing output that cause it to significantly overstate output and, by extension, productivity. When government measurement errors are corrected, it appears that real U.S. manufacturing output declined by 11 percent from 2000 to 2010, likely the only decade in American history (other than the Great Depression) where manufacturing output fell.

In order to see how productivity and output are overstated, it is necessary to understand both concepts. (See Box 1) Labor productivity is a ratio of an industry's output to hours worked. Output needs to be stated in inflation-adjusted terms rather than as a nominal value, otherwise price changes will skew the productivity numbers higher or lower and lead to relatively meaningless results. Unfortunately, measuring output is rarely as simple as counting the number (and assessing the quality) of units shipped by a specific industry, as that sort of information is difficult to measure. Instead, the statistical agencies of the U.S. government usually estimate output quantities by first estimating the change in a product's price and then removing this price change from the change in the product's market value. The agencies then adjust this output quantity to include changes in quality (or technological improvement) such that both increases in the number of units shipped and

BOX 1: Output and Productivity: Terms and Definitions

Any analysis of U.S. manufacturing must deal with a confusing array of different measurements, from output to productivity. This box defines these terms.

Productivity: a ratio of a measure of output quantity to a measure of input use quantity. The two most common measures of productivity are labor productivity and multifactor productivity.

Labor Productivity: a ratio of a measure of output quantity to a measure of labor input quantity. Typically, the output measure is either "value added" or "gross output," and the labor input quantity is either hours worked or a related measure of employment. In this report, ITIF employs value added as the output measure and hours worked as the input measure, unless otherwise stated.

Output: a loosely defined term. In typical usage, output can refer to either "gross output" or "value added" (also known as "net output"). In this report, "output" refers to value added.

Gross Output (GO): consists primarily of gross sales or receipts, or other operating income. Gross output is basically equivalent to gross revenue, although, when viewing it at the sector level, it suffers from a problem whereby transactions between firms within the same sector are double counted.

Intermediate Inputs (II): goods and services that are used in the production of other goods and services—in other words, the value of the goods and services used up in production.

Value added (VA): also known as "net output." Equals gross output minus intermediate inputs. In other words, value added represents the gross revenue from production less the value of goods and services used up in that production. Value added is used in aggregate to compute GDP. It does not suffer from the "double counting" problem like gross output.

Quantity: also known as "volume." This is an idealized figure that can represent one of the three measures listed above (GO, II, and VA) and that has been adjusted to exclude price changes and include quality changes over time. Quantities are usually not directly measurable, but rather estimated by observing price changes and then compiled as index of quantity change over time.

Nominal Value: also known as "current value." This is the raw figure representing the value of one of three measures listed above (GO, II, and VA) and that has not been adjusted for changes in product prices or product quality over time.

Real Value: similar and often interchangeable with "quantity"—thus one may read and interpret it as the quantity of one of the three measures listed above—that is, GO, II, or VA adjusted for price and quality changes over time. Sometimes it refers to values written as "real dollars" or "real currency," whereby the quantity index has been multiplied by some base year's nominal values, and thus the real dollar figures can be interpreted in the base year's prices.

improvements in product quality cause output quantities to rise. With labor productivity, estimating the input measure—hours worked—is relatively easy; estimating the output measure through price changes is relatively hard, and this is where the problems begin. Due to these difficulties, there are at least three problems that lead to overstating growth in U.S. manufacturing output.

Problem #1: Understating the Value of Intermediate Goods Imports

The offshoring of global supply chains can lead to the appearance of productivity growth, even though a domestic manufacturer's productivity may not have improved. This phenomenon is known as "import substitution bias". Although the Bureau of Labor Statistics does attempt to control for the effect of increased imports, these attempts fall short due to underfunding and data collection problems (offshore suppliers are difficult for the agency to survey).[115] According to the Department of Commerce, "improvement in productivity may be slightly overstated due to the fact that low-cost foreign inputs are not adequately captured in existing price indices."[116] This admission is an understatement in itself, as recent research suggests that productivity is in fact significantly overstated.

It is increasingly clear that there are substantial upward biases in the U.S. government's official statistics and that real manufacturing output and productivity growth is significantly overstated.

The primary problem is that when an American manufacturer switches from a domestic supplier to a lower-cost foreign supplier, the resulting drop in price of the input is not always correctly picked up in the price index data.[117] The way this impacts output is technical and will not be discussed in depth in this report.[118] However, the crux of the problem lies in the most common measure of output, "value added," which is equal to the "gross output" of an industry (approximately, the market value of its sales) minus the value of its "intermediate inputs" (the parts and supplies that go into producing that output). When the Bureau of Economic Analysis wants to convert value added from a nominal value into a quantity measure, it must use Bureau of Labor Statistics data to estimate the price changes and, in turn, estimate the quantities of both the industry's gross output and its intermediate inputs.

For example, when a U.S. manufacturing facility switches to an offshore supplier for a widget and the price of the widget declines from $1 to 75 cents, the correct way to measure this change is to reduce the intermediate input price index by 25 cents. If the change is not measured correctly, then the U.S. facility will look as though it is generating more value added than it actually is in reality. More precisely, the failure to pick up price decreases due to offshoring causes the price indexes for domestic manufacturers' intermediate inputs (which include the import price indexes) to increase more rapidly than they should, causing the quantity change of intermediate inputs to grow slower than it should. This, in turn, increases the calculated change in the quantity of value added. Thus, the output growth of an industry relying more on imported intermediate goods will be overstated.[119] This problem is compounded when a product that is already offshored is switched to an even lower cost foreign supplier.[120]

So how prevalent is import substitution bias in U.S. manufacturing output statistics? According to recent research by Houseman et al., the answer is "very." From 1997 to 2007 imports of manufactured goods rose by more than 100 percent. In addition the share of manufacturer's intermediate inputs that were imported increased more rapidly than in the

previous decade, from 17 percent to 25 percent.[121] This surge in imported intermediate goods has meant that in the 2000s, import substitution bias skewed the output (and thus the productivity) numbers of official U.S. statistics ever more greatly upwards. Houseman et al. find that from 1997 to 2007, the average annual growth in manufacturing value added was overstated by as much as 22 percent. Excluding computers and electronic products, the maximum potential overstatement is 95 percent. Likewise, the average annual growth in multifactor productivity was overstated by as much as 17 percent.[122] ITIF employed the results of Houseman et al. to correct for import substitution bias in our adjusted output and productivity figures. We extrapolated the study's results from the 1997-2007 period by applying the percent of the value-added average annual percentage change attributable to import substitution bias to the official value-added growth rate over the 2000-2010 period.[123]

Once the official output figures are adjusted and aggregated, the recent performance of U.S. manufacturing looks very different from the official figures.

Problem #2: Computers and Rapid Technological Change

The second problem stems from the way in which output is measured and its impact on the statistics for the computer and electronic products industry (NAICS 334). According to official data, real output in NAICS 334 was an incredible 27,861 percent higher in 2010 than it was in 1980, implying a growth rate of over 21 percent each year. From 2000 to 2010, the computer and electronics sector in the United States increased its real output over 5.17 times, or 417 percent. (See Figure 28) Compare this with electrical equipment, which saw a decline of 12 percent, or chemical products, which increased by four percent, or machinery, which increased 12 percent.[124] To put it in perspective, close to 15 percent of total U.S. GDP growth in the 2000s came from this one sector, which accounted for less than two percent of GDP in 2000.[125] It is simply hard to believe that the U.S. computer and electronics sector is producing over five times more in the United States than it was a decade ago, given the fact that employment in the sector declined by 43 percent from 2000 to 2010 as a not insignificant share of U.S. computer production moved offshore.[126] This implies that, from 2000 to 2010, the average worker in NAICS 334 was producing nine times more output than she was in 2000. And yet, the nominal value of U.S. shipments in the industry declined by 25 percent from 2000 to 2010, according to the Census Bureau.[127] Clearly this real growth of output was not possible. It is not as if companies in the industry are producing five times the number of computers and electronics within the United States. So what is going on? There are several factors at work, one of which is discussed below, and the rest of which are discussed in Appendix A.

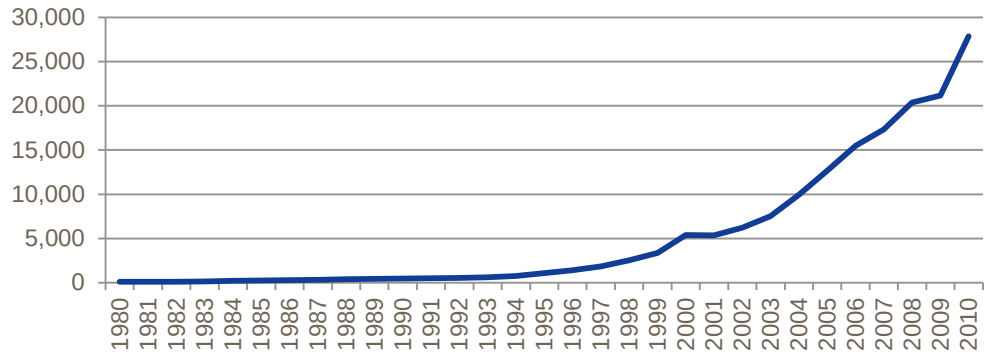

Figure 28: Computer and Electronics Industry Real Value-Added Growth (1980=100), 1980-2010[128]

One factor is that much of the output growth in computer and electronic products is explained primarily by quality improvements, not by an actual increase in the number of units shipped by computer manufacturers. From 1990 to 2010, the real gross output for computers and electronic products grew at a rate (10.0 percent) that was 20 times higher than the growth rate for all of manufacturing minus computers and electronics (0.5 percent).[129] By contrast, nominal industry shipment values of computer and electronic products made in America barely grew at all: only 24 percent between 1992 and 2011.[130] (See Figure 29) The unit quantity numbers in the Census Bureau's *Current Industrial Report* reveal similar information. For example, the number of units of consumer electronic products shipped from U.S. factories fell between 69 and 75 percent between 2000 and 2010. Likewise, while shipment unit quantities are not available for computer and peripheral products, export unit quantities are. These quantities show that the number of units exported by U.S. factories was essentially flat over the period (a 0.3 percent drop).[131]

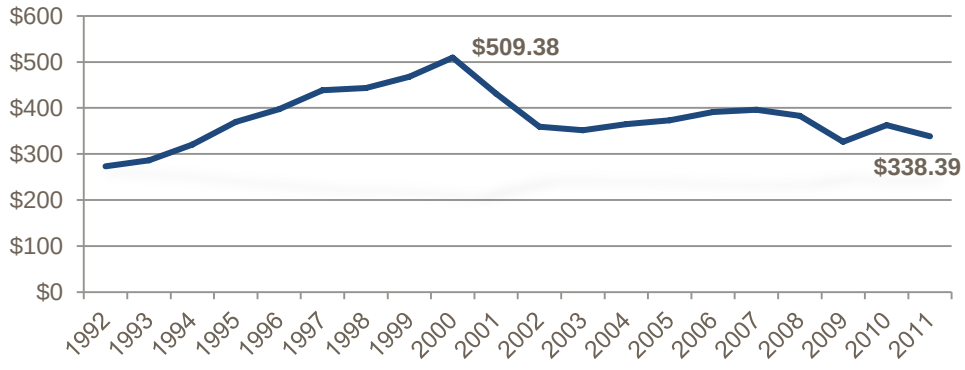

Figure 29: Nominal Value of Computer and Electronic Product Shipments ($ billions), 1992-2011[132]

Rapid technological improvement inherent to the computer and electronics industry cause the discrepancy between the gross output numbers. In a sense, Moore's law (the prediction that computing price falls by half and doubles in power every 24 months) makes it seem as if the industry is producing much more output than it really is. This poses a problem for output and productivity statistics because, although the rapid quality improvement may indeed accurately represent the increased computing value experienced by consumers, from

an industry perspective it falsely implies rapid expansion. Because the industry has rapid quality improvement, its measured gross-output growth, and, by extension, its value-added growth, are highly inflated, which in turn has an inordinate impact on overall manufacturing output and productivity figures. As a result, the growth of output in 334 accounted for 113 percent of the growth of U.S. manufacturing value added from 2000 to 2010.[133] In other words, while the rest of U.S. inflation-adjusted manufacturing value added (minus NAICS 334) fell by 5.6 percent during this period, NAICS 334 output increased by 417 percent.[134] As described in Appendix A, we believe that a more accurate (and perhaps still overstated) number for NAICS 334's real output growth from 2000 to 2010 is 28 percent.

To see how this problem impacts the top-line manufacturing output numbers, consider that the federal government classifies manufacturing into two major groups: durable goods (industries like automobiles, machines, and computers) and nondurables (industries like food, chemicals, apparel, and petroleum products). From 1987 to 2010, increases in the output of nondurables added just 1.96 percent to overall GDP growth. This is just over half of the approximately 3.73 percent they should have added to GDP had they contributed their "fair share" (that is, if they had grown at the same rate as the overall economy). Durables, in contrast, added 81 percent more than their fair share. But a closer look reveals that every durable goods industry grew more slowly in output than GDP except two: computer and electronic products, and petroleum and coal products, with the former growing a whopping 720 percent faster than GDP. In fact, close to eight percent of total U.S. GDP growth came from this one sector, which accounted for less than 1.6 percent of GDP.[135] Does anyone really believe that the computers and electronics industry in America is actually 5,734 percent larger than it was in 1990?

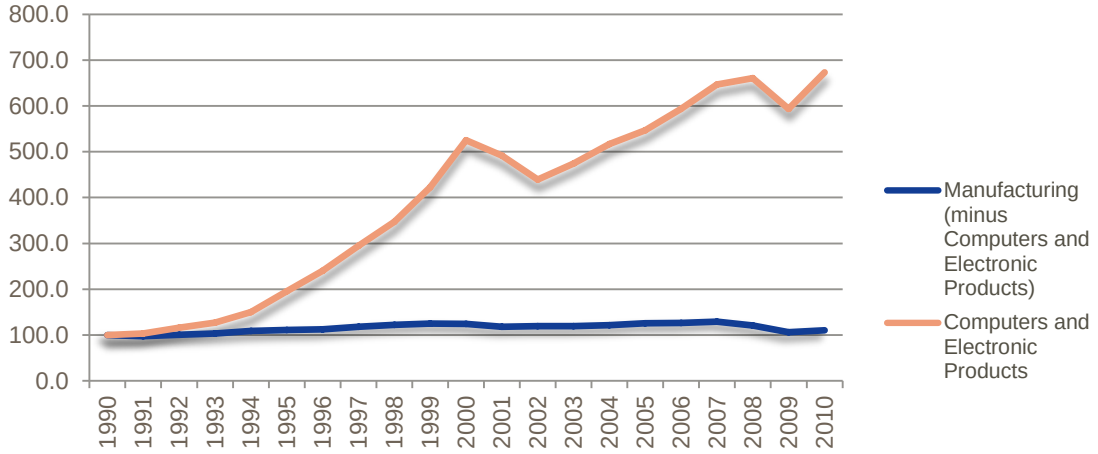

Figure 30: Real Gross Output Growth (1990=100), 1990-2010[136]

One can see these trends in Figure 31. The top dark blue line represents an approximation of the ratio of real manufacturing value added to real GDP. It has been relatively steady, falling in the Great Recession, but recovering somewhat.[137] The orange dashed line, non-durables (industries like chemicals, apparel, paper), fell slowly from 1987 to 1994 and has steadily declined since then. By contrast, durables (the light dotted line comprising

industries like computers, automobiles, steel), has steadily increased from 1992. As such, the two major sections appear to net each other out. So while America has lost non-durables, it has gained durables. However, when the computer and electronics industry (the bottom dark line) is separated out, it clearly shows that durables (with the light dotted line line) follow the same trend downward as non-durables from 1999, and overall manufacturing output (the blue dotted line) falls.

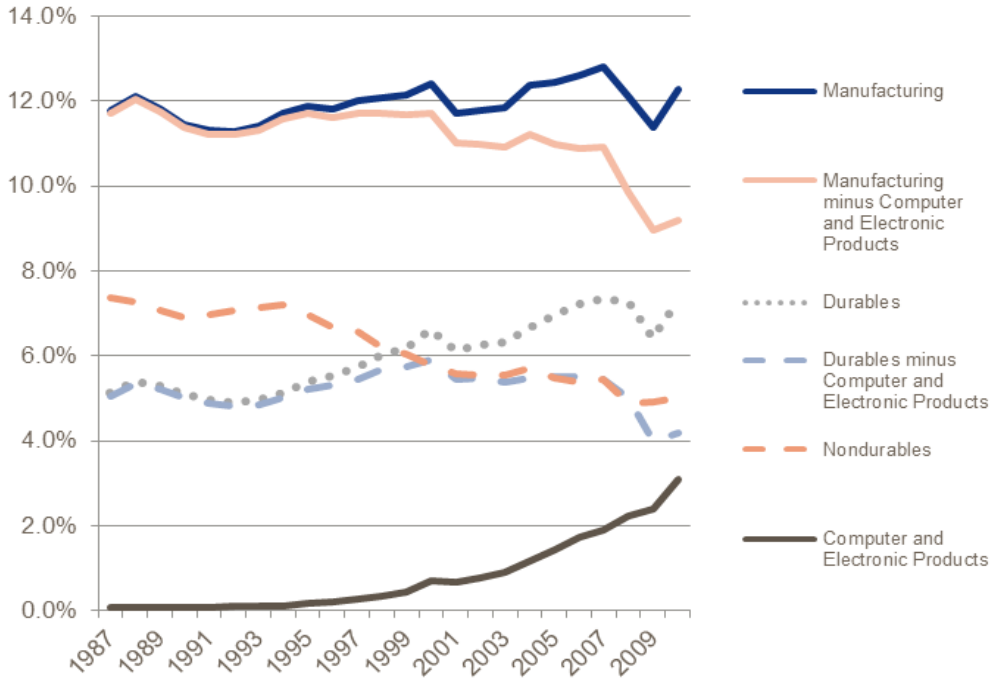

Figure 31: Trends in Manufacturing Sector Real Value Added (approximate ratio to real GDP), 1987-2010[138]

Problem #3: Overstating Output in the Petroleum and Coal Products Industry

The third problem in the output data lies in the Petroleum and Coal Products industry. (Most of this industry is really petroleum, as petroleum refining dominates 94 percent of the gross output of this industry.[139]) According to the BEA, real value added in this industry increased by 88 percent from 2000 to 2010 during a period when GDP increased 17 percent.[140] One would expect this statistic to be bolstered by a similarly impressive increase in the flow of petroleum products coming out of refineries and blending facilities.[141] However, when we look at the petroleum data published by the Energy Information Administration (EIA), we see this is not the case: petroleum and crude oil production increased by just seven percent over the 2000-2010 period.[142] (See Figure 32)

Moreover, the BEA's own statistics show that the petroleum industry's real gross output increased by only 16 percent over the period, while real intermediate inputs decreased by only three percent.[143] In fact, the large value-added increase and the implied productivity increase are really an artifact of statistics. Real value added suffers from several theoretical and statistical drawbacks that can lead to measurement problems and strange results.[144] While it is impossible to tell what exactly is happening in the official BEA data due to

statistical limitations, the numbers do hint that in 2000, real value added may have occupied a rather small margin between real gross output and real intermediate inputs. It seems it did not take a big rise in real gross output or a large drop in real intermediate inputs to nearly double the size of real value added—hence the 88 percent growth figure. Meanwhile, employment in the petroleum industry fell by 26 percent.[145] Does the combination of these two figures really represent an improved ability of the petroleum industry to turn inputs into output or a significantly larger industry? Probably not. The statistical artifact of value-added growth has just biased the output growth figure upward, with no significant corresponding increase in the actual petroleum flowing out of the refineries. To correct for this problem, ITIF adjusts the real output of the petroleum and coal products industry such that it reflects the EIA's production data, with real value added growing at seven percent over the 2000 to 2010 period.[146]

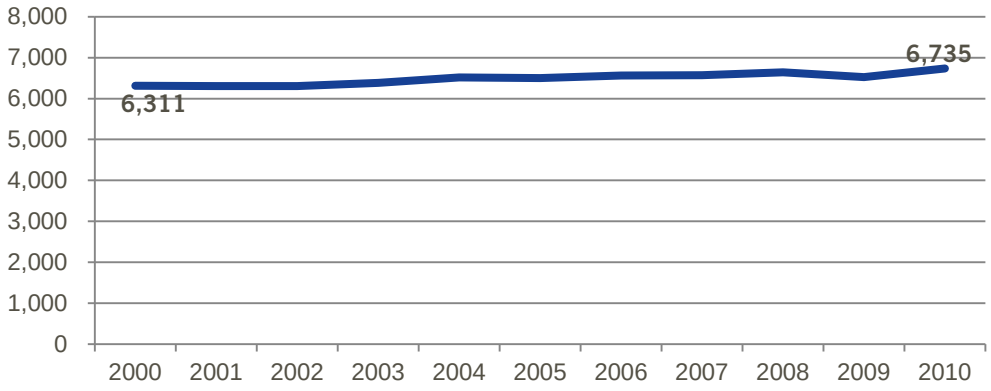

Figure 32: U.S. Refinery and Blender Net Production of Crude Oil and Petroleum Products (million barrels)[147]

Adjusted Manufacturing Value-Added Growth

Once the official output figures are adjusted and aggregated, the recent performance of U.S. manufacturing looks very different from the official figures.[148] As Figure 33 shows, manufacturing real value added actually fell by 11.0 percent from 2000 to 2010, which, in turn, implies that GDP actually grew by only 11.5 percent over the period, and not the officially reported 16.7 percent GDP growth.[149] (Meanwhile, the output of the rest of the private business sector, excluding manufacturing, grew by 16.1 percent.) Manufacturing real value-added growth was robust at least until the 1990s—although the 1990s figure is likely overstated due to the offshoring and rapid technological change biases discussed above. Even with the baseline figures, manufacturing output growth was much lower in the 2000s, yet the adjusted figure shows it in fact actually fell in absolute terms, not just rate of growth.

We can also see the impact of the various statistical biases on the output of the individual manufacturing industries (Figure 34). Computers and Electronic Products and Petroleum and Coal Products are now more in line with other healthy manufacturing industries, with real value added growing by 28 and seven percent, respectively, instead of the incredible 417 and 88 percent numbers. Miscellaneous Manufacturing, of which nearly 50 percent of gross output is dominated by the medical instruments and supplies industry—an industry

that has seen growing markets and strong U.S. international competitiveness—is the highest-performing sector, growing by nearly 35 percent. Import substitution bias is most prevalent in machinery, which falls to seven percent from 13 percent; primary metals, which drops to -41 percent from -36 percent; and motor vehicles, which falls to -52 percent from -45 percent. Figure 34 demonstrates the fact that 13 of the 19 manufacturing industries have experienced substantial declines in output over the last decade, and that of the six growing industries, only two are growing faster than GDP. Indeed, statistical biases are sustaining manufacturing output.

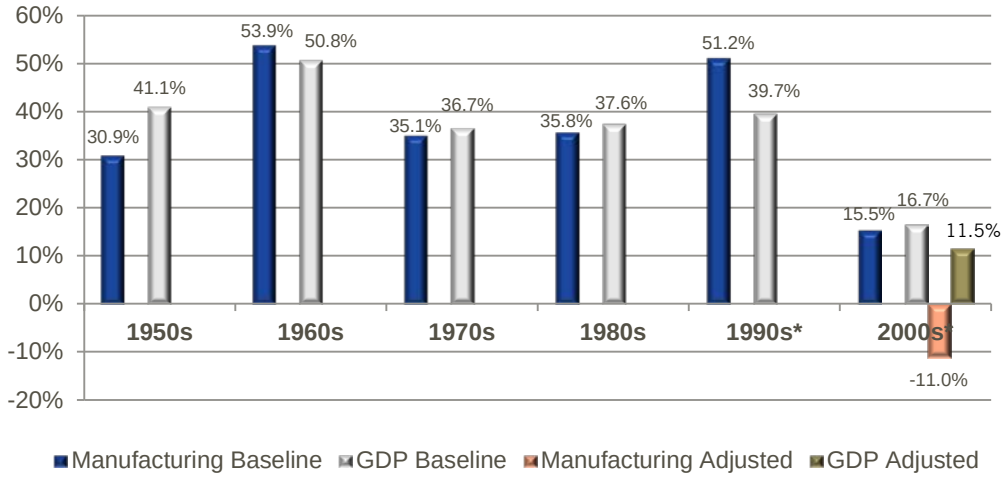

Figure 33: Percentage Change in Real Value Added by Decade[150]

We seem the same loss of output at the state level. In terms of change in real value added for non-durable goods (e.g., chemicals, food, printing, plastics), 32 states, accounting for 79 percent of national non-durables output saw losses in output from 2000 to 2010. And of the 18 that saw increases, when change in real non-durables minus petroleum and coal products is measured, 10 additional states, accounting for another 12 percent of U.S. output, saw absolute declines in non-durable output.[151] For example, while non-durable production increased by 220 percent in Wyoming, when petroleum and coal products are removed, it turns out the state suffered a massive 76 percent decline in non-durables output.

Durable goods presents a similar picture. There were just 10 states that produced less real durable goods output in 2010 than in 2000.[152] However, when we assume that NAICS 334 grew 28 percent in each state during this period, rather than the 477 percent that BEA estimates, the picture is quite different. Then 34 states representing 76 percent of U.S. durable goods output saw losses in output.[153]

Because adjusted growth in real output in manufacturing is much lower, labor productivity growth must be lower as well. The BLS has several departments charged with measuring productivity, but each uses different methods to arrive at its manufacturing productivity figures. The most widely quoted labor productivity figures are from the Major Sector Productivity department, which uses an adjusted version of real gross output (as opposed to real value added) as its manufacturing output measure (but value added for other

sectors).[154] Another department is International Labor Comparisons, which uses real value added as its output measure.[155] Each measure—real gross output or real value added—has benefits and drawbacks. Real value added is more difficult to measure and is more susceptible to statistical bias, but it has a big advantage in that it links into GDP and thus directly translates into changes in living standards.[156] Real value added is frequently used as the output measure when comparing labor productivity numbers across countries. Primarily for this reason, ITIF chose value added as the output measure in its adjusted labor productivity figures.[157] We also used updated BEA value-added data to compute our adjusted labor productivity numbers, so there is a slight discrepancy between ITIF numbers and the official BLS productivity numbers, which use older BEA data.[158] The official BLS figure shows that labor productivity increased by 66 percent between 2000 and 2010.[159] Using the updated BEA value-added figures, ITIF changes this baseline growth number to 72 percent.[160]

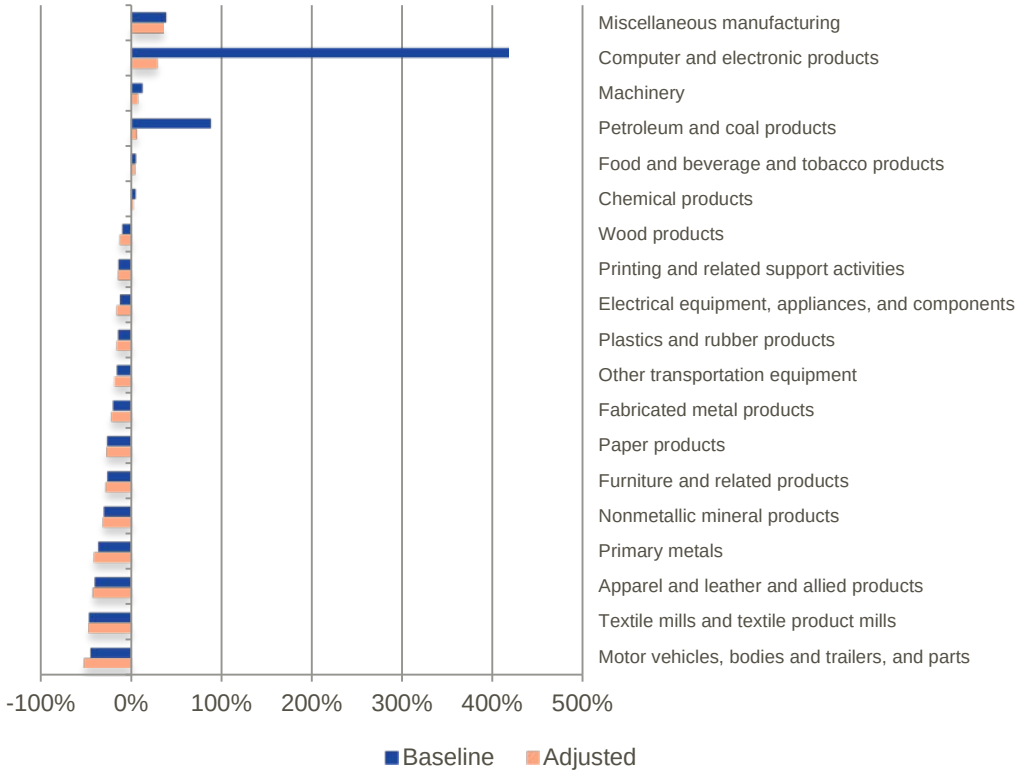

Figure 34: Percent Change in Manufacturing Real Value Added by Industry, 2000-2010[161]

Adjusting for the various statistical biases, ITIF finds that labor productivity increased by only 32 percent during the period, implying that the official figure of 72 percent was a 122 percent overstatement. In other words, almost 40 percentage points of productivity growth between 2000 and 2010—or 55 percent of the growth—were augmented by statistical biases. As Figure 34 shows, almost all industries experienced productivity growth of less than 70 percent. But computers and electronics' products' measured productivity was 764 percent. Figure 35 shows that while productivity growth certainly played a role in manufacturing employment decline, its role was much smaller than believed. Productivity

increased by 20.9 percent in the rest of the business sector, and it did not suffer massive employment declines. Loss of output was the dominant factor in manufacturing job loss.

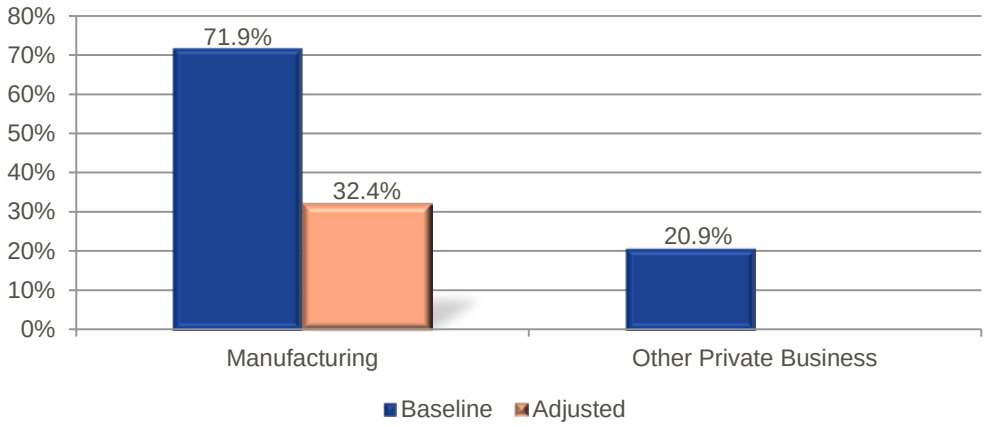

Figure 35: Percent Change in Labor Productivity, 2000-2010[162]

On the industry level, the enormous disparity between the productivity numbers has been reduced. (See Figure 36) Even after adjustment, the computer and electronic products industry still had the highest rate of productivity growth from 2000 to 2010, but it is now a respectable 114 percent growth, instead of the incredible 764 percent growth indicated by the official statistics. Much of this growth was driven by labor force reductions: 2010 hours worked in the computer and electronic products industry was just 59 percent of its year 2000 level. Miscellaneous manufacturing (mostly medical instruments manufacturing) is the second highest performing industry in terms of productivity growth, with an adjusted rate of 75 percent. The productivity of the petroleum and coal products industry has been reduced to 14 percent over the period, down from the officially-reported 101 percent increase. Two industries—motor vehicles and other transportation equipment—actually experienced negative productivity growth from 2000 to 2010 (-6.1 percent each). This occurred despite significant reductions in the hours worked for both: hours in the other transportation equipment industry fell by -13 percent over the period, while hours in the motor vehicles industry fell by -48 percent—behind only the textiles industry (-59 percent) and the paper industry (-62 percent).

Given this reality, how would U.S. manufacturing, and the overall economy, look if manufacturing output had grown at the same rate as that of the rest of the private business sector (16.1 percent) in the last decade? Most economists agree that jobs in manufacturing have a large multiplier effect. For instance, the Economic Policy Institute finds that manufacturing jobs have an employment multiplier of 2.91, compared to 1.63 in business services or 1.66 in transportation (meaning that one manufacturing job supports the creation of 2.91 other jobs in the economy).[163] Similarly, the Public Policy Institute of New York State has found a national average job multiplier of one manufacturing job creating 2.34 jobs in other sectors.[164] Averaging these two figures and applying this multiplier yields striking results. If manufacturing output had grown at the rate of the private business sector growth, it would have lost just 2 million jobs in the past decade, as opposed to 5.8 million jobs. In other words, there would be 3.8 million manufacturing

jobs saved. Using a manufacturing employment multiplier of 2.34, 12.7 million jobs would have been saved in the economy over the past decade—a figure very close the number of unemployed Americans today. (See Figure 37)[165] Of course, not all of these net-jobs would be created because some would be diverted from other industries, but it should be clear that the U.S. labor market today would be much healthier had America maintained its manufacturing output.

If manufacturing output had grown at the rate of the private business sector growth, it would have lost just 2 million jobs in the past decade, as opposed to 5.8 million jobs.

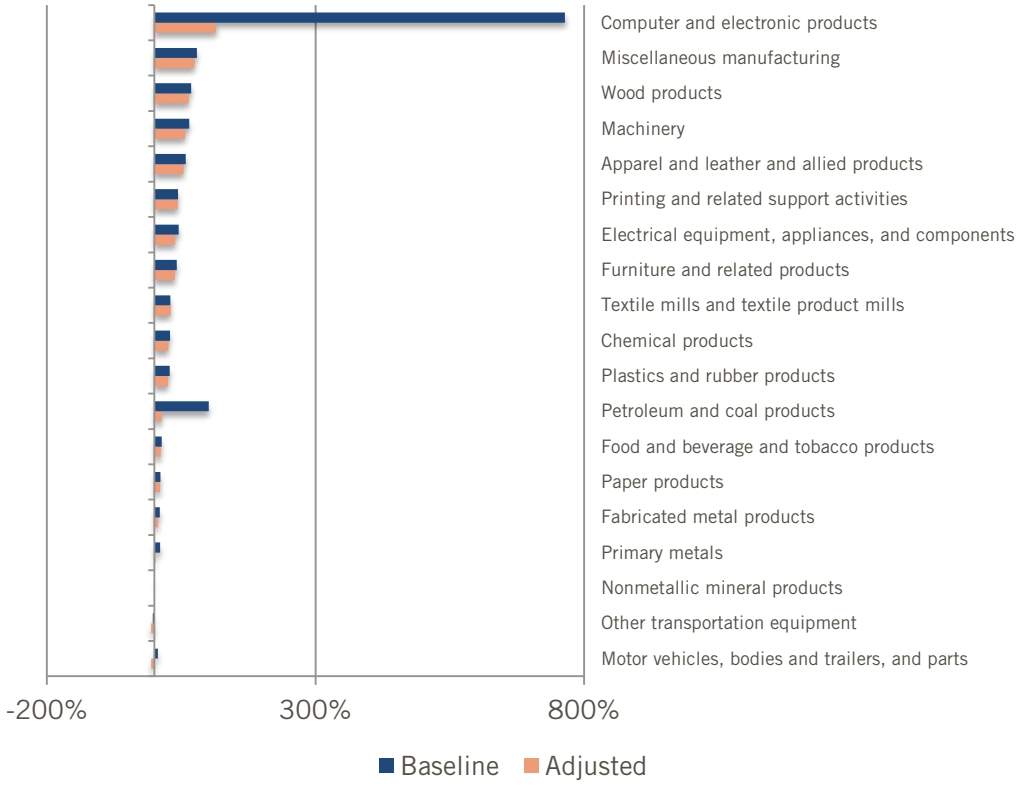

Figure 36: Percent Change in Manufacturing Sector Productivity by Industry, 2000-2010[166]

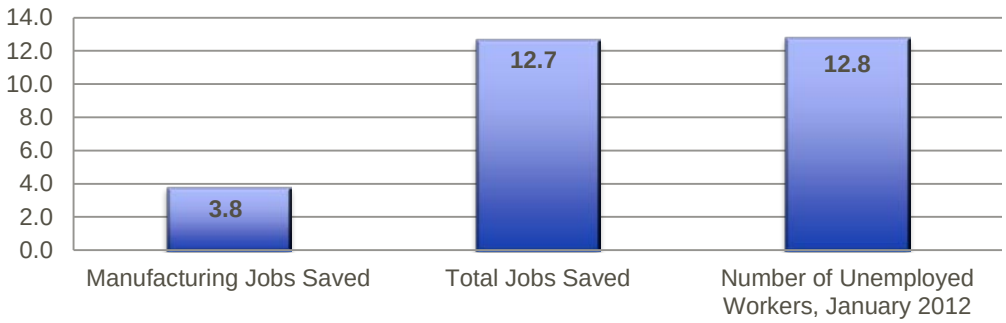

Figure 37: Number of Jobs Saved (millions) if Manufacturing Value-Added Growth Equaled Other Private Business Output Growth, 2000-2010[167]

INTERNATIONAL COMPARISONS

Many skeptics will point to trends in U.S. manufacturing output compared to other nations as evidence that the United States is not facing a competitiveness crisis in manufacturing. For example, Mark Perry of the American Enterprise Institute points out

that, when measured in U.S. dollars, U.S. manufacturing output is still the highest in the world—46 percent higher than that of China, the country in second place. It is also higher than that of Japan, Germany, the United Kingdom, France, Italy, and Korea.[168] However, Perry's analysis is flawed in several respects. Of course U.S. manufacturing output is higher than any other nation, including China, because U.S. GDP is higher than any other nation. (It is 146 percent higher than that of China.)[169] These numbers must be adjusted to account for the size of the economy. As seen in Figure 38, the ratio of U.S. manufacturing real output to real GDP has been growing more slowly compared to competitor nations such as China, Korea, and Japan.[170] Furthermore, if a country has high manufacturing output but intentionally keeps wage rates low (as is the case with China, for example), then the U.S. dollar figure will be artificially low, despite the fact that the actual quantity of goods it produces might be as high or higher than that of the United States. If we broaden this to include other countries and just look at the nominal output as a share of GDP, we see that this international comparison is also troubling, with the United States ranking 11th out of 15 countries in its 2010 share of GDP accounted for by manufacturing. (See Figure 39)

According to the official U.S. statistics, the Bureau of Labor Statistic's International Labor Comparison figures, U.S. manufacturing does quite well, ranking fourth of 19 countries in productivity growth and ninth in output growth. These statistics are cited as proof of U.S. superior performance. Adjusting for the statistical biases described above shows a quite different picture, however. The United States falls to 10th place in productivity growth and 17th—third-last—in output growth. (See Figures 40 and 41)

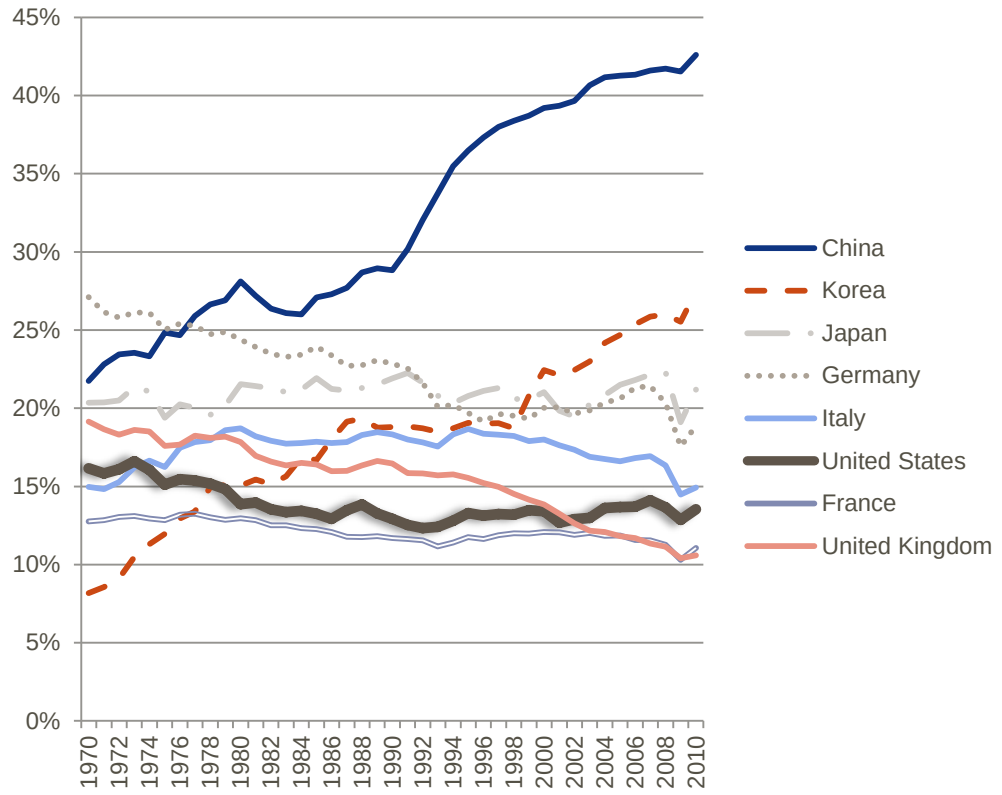

Figure 38: Manufacturing Real Value Added Ratio to Real GDP, 1970-2010[171]

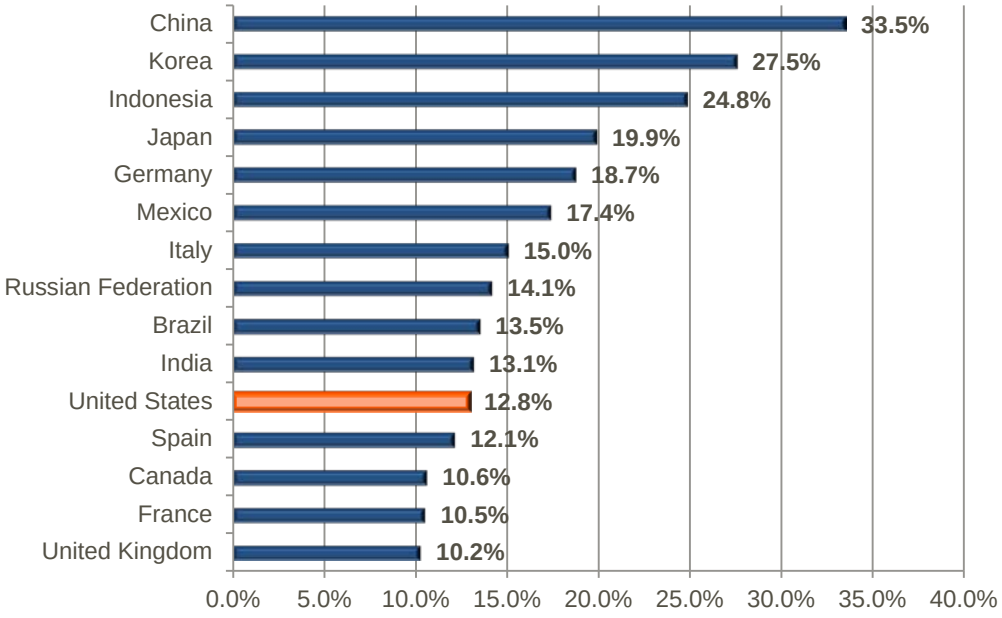

Figure 39: Manufacturing Nominal Value Added as a Share of GDP, 2010[172]

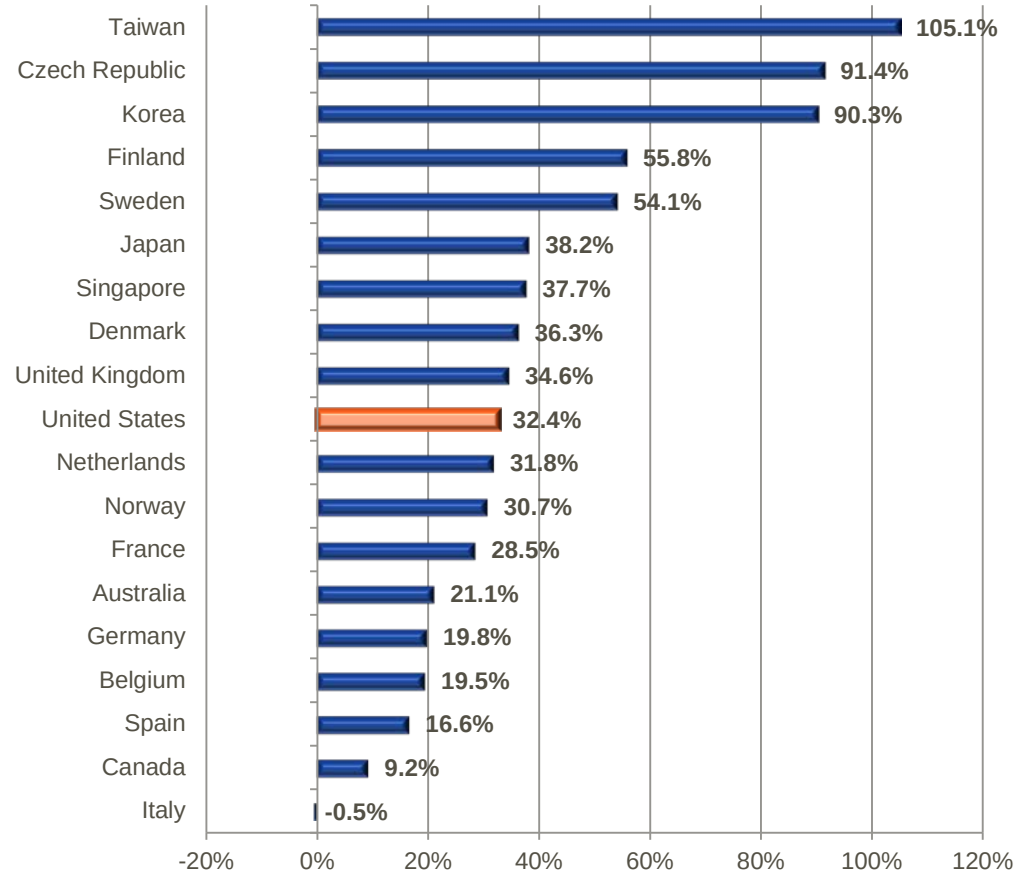

Figure 40: Percent Change in Manufacturing Labor Productivity (U.S. adjusted), 2000-2010[173]

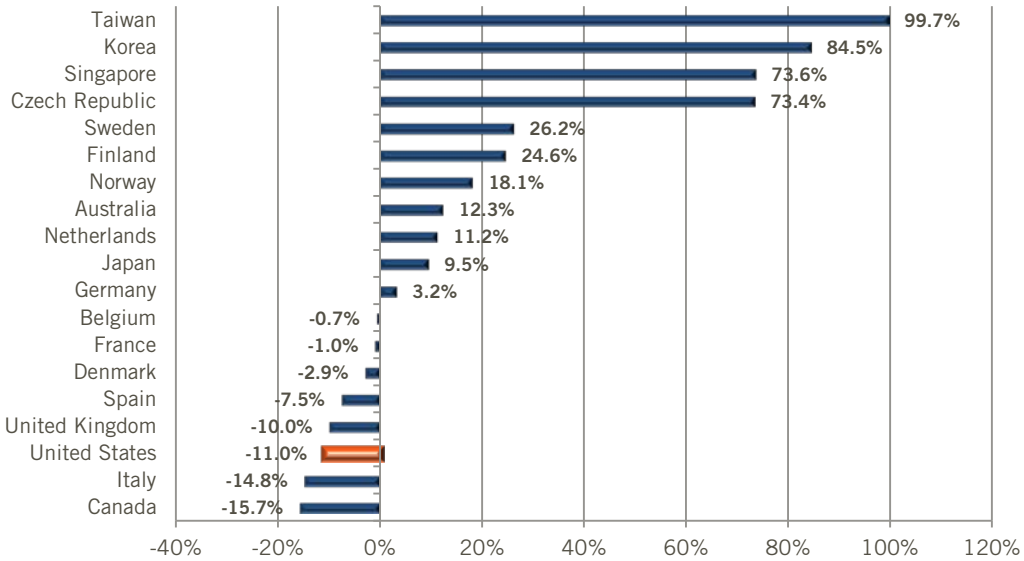

Figure 41: Percent Change in Manufacturing Real Value Added (U.S. adjusted), 2000-2010[174]

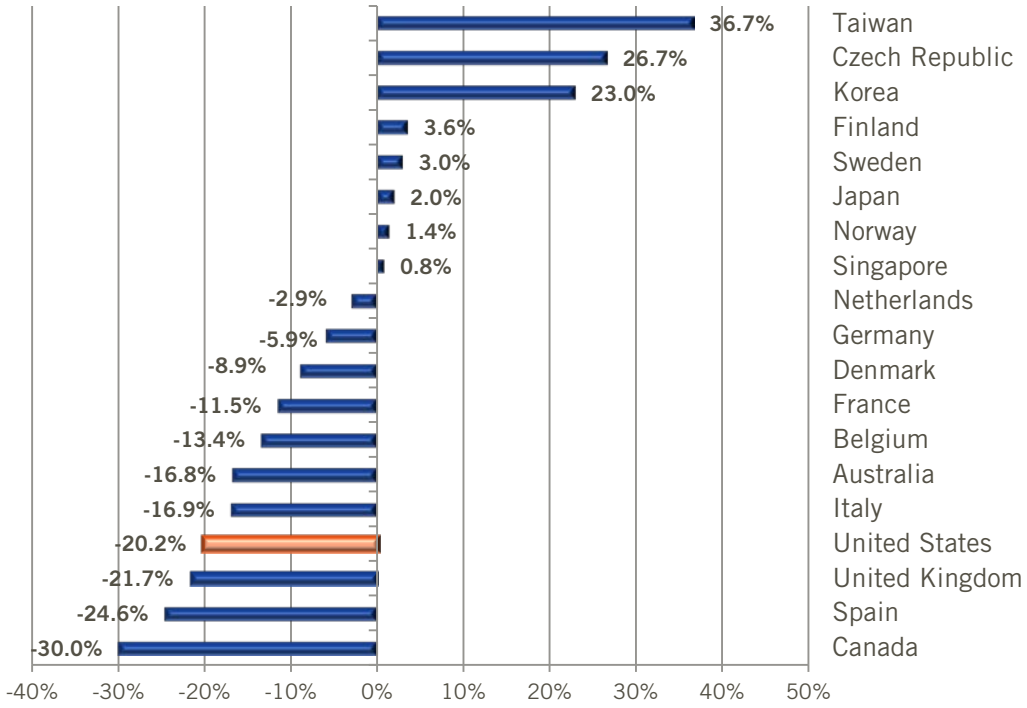

Figure 42: Percent Change in Ratio of Manufacturing Real Value Added to Real GDP (U.S. manufacturing output and GDP adjusted), 2000-2010[175]

Another way to look at this is by comparing the growth in countries' manufacturing output to the growth in countries' GDP. Many skeptics will compare the total manufacturing output numbers of the United States and a country like Japan and tout the fact that the United States is obviously outperforming one of its major international competitors. But the Japanese economy is not growing as fast as the United States economy due to a rapidly aging population and low levels of immigration. Japanese manufacturing's endogenous ability to create output is actually improving quite well. By comparing manufacturing output to GDP growth (using adjusted U.S. figures), we can separate the endogenous performance of manufacturing from the exogenous factors, like demographic concerns, that affect an economy as a whole. Again, in this measure, the United States is performing poorly relative to its competitors, as Figure 42 shows. The United States ranks 16th of 19 countries in the change of its ratio of manufacturing real value added to real GDP.

One further way to look at international productivity is to use employment instead of hours worked as the labor productivity input measure. In this view, the United States underperforms again after adjusting its productivity, ranking just 24th out of 31 countries according to OECD data. (See Figure 43)

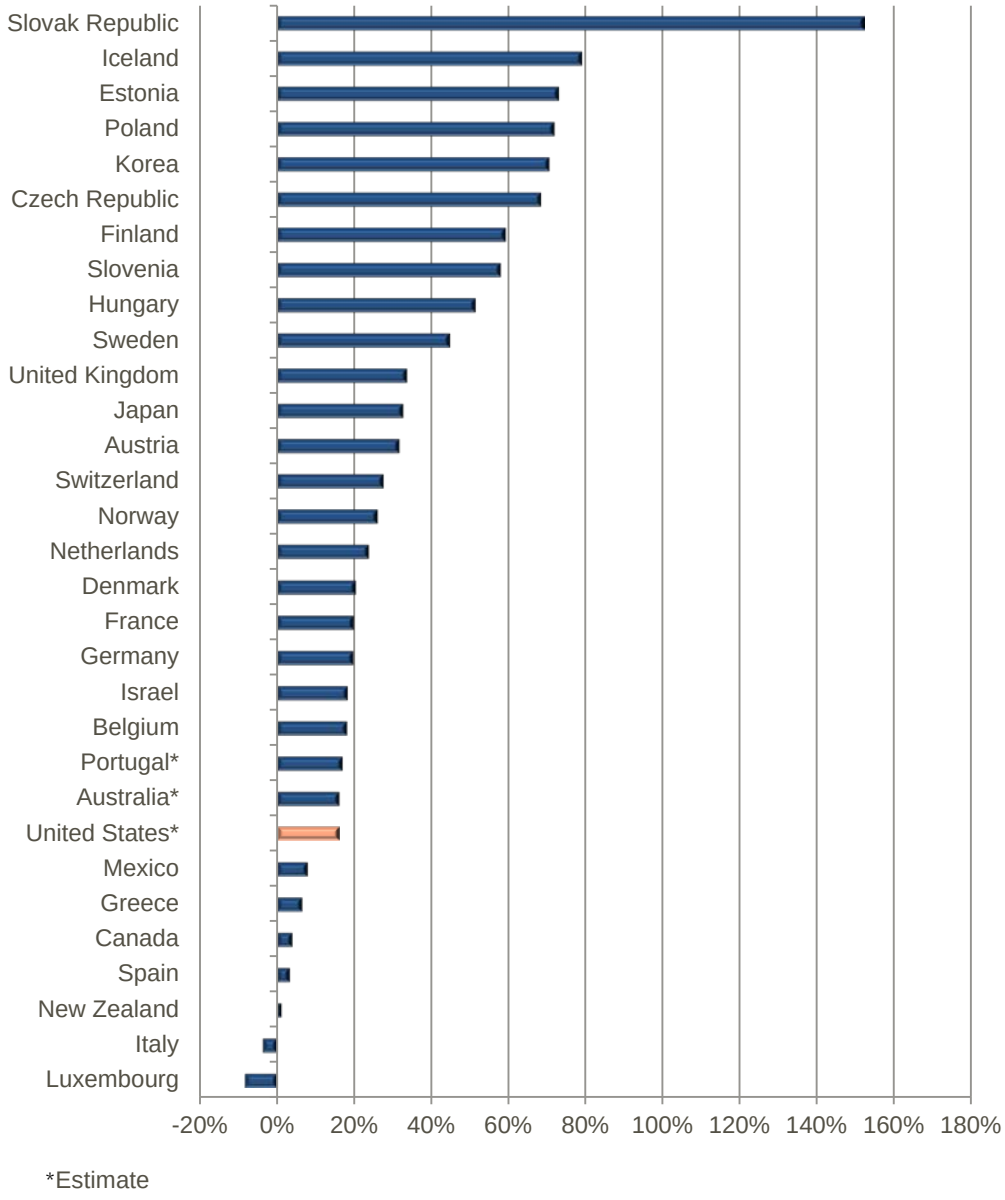

Figure 43: Percent Change in Labor Productivity With Employment as the Input Measure (U.S. adjusted), 2000-2008[176]

Even comparing nominal shares of world manufacturing output, the picture is not promising for the United States. Figure 44 illustrates the U.S. fall and the corresponding—almost equivalent—Chinese rise in share of world manufacturing output from 1970 to 2008. (The U.S. share declined by 12 percentage points, from 28.6 to 17.9 percent, while China's share rose 13 percentage points, from 3.8 to 17.2 percent.)[177] The U.S. fall was not inevitable. Japan and Germany more or less maintained their global manufacturing share (despite ups and downs and despite having a slower-growing population and workforce) over this period, avoiding the precipitous decline experienced in the United States. Thus, deindustrialization of high-wage economies is not pre-ordained; something happened in the United States that did not happen in Germany or Japan.

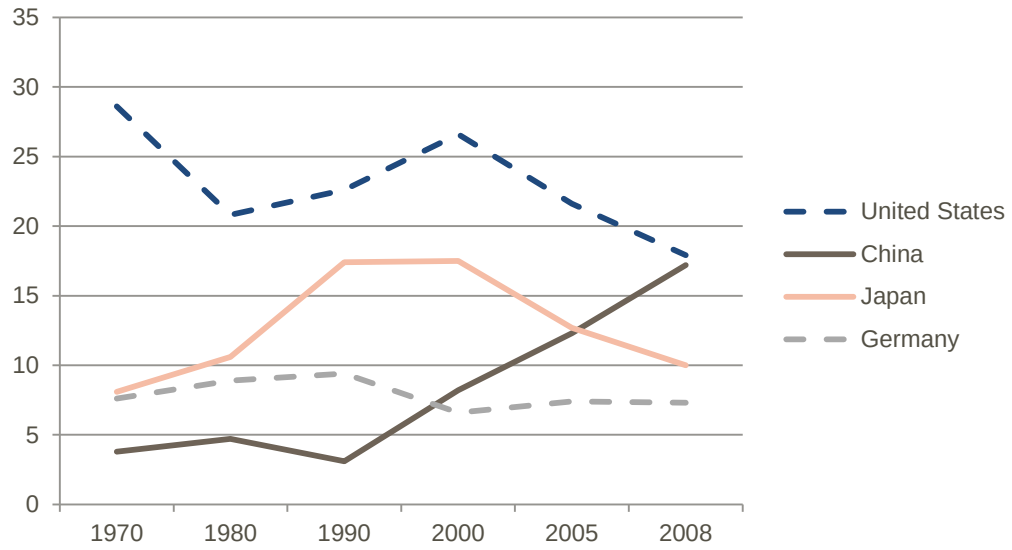

Figure 44: Select Country Share of World Manufacturing Output, 1970-2008[178]

CAPITAL INVESTMENT TRENDS IN U.S. MANUFACTURING

As we have noted, a more accurate measurement of U.S. manufacturing output suggests that superior productivity was not principally responsible for the loss of almost one-third of U.S. manufacturing jobs in the 2000s. If it were, we would also expect to see a reasonable increase in the stock of manufacturing machinery and equipment, for it is difficult to generate superior gains in productivity without concomitant increases in capital stock. Conversely, if loss of output due to declining U.S. competitiveness caused the decline of jobs, we would more likely see flat or declining capital stock. In fact, we see the latter, which is more evidence for the competitiveness failure hypothesis.

U.S. Manufacturing Capital Stock is Stagnant

Over the past decade, as Figure 45 shows, the overall amount of fixed capital investment (defined as investment in structures, equipment, and software) made by manufacturers as a share of GDP was at its lowest rate since World War II, when the Department of Commerce started tracking these numbers. An analysis by year shows that the annual rate has generally declined in the 2000s, going under 1.5 percent for several years for the only time since 1950. (See Figures 45 and 46) This decline represents the decreasing amounts invested, on average, in new manufacturing plants and equipment every year.

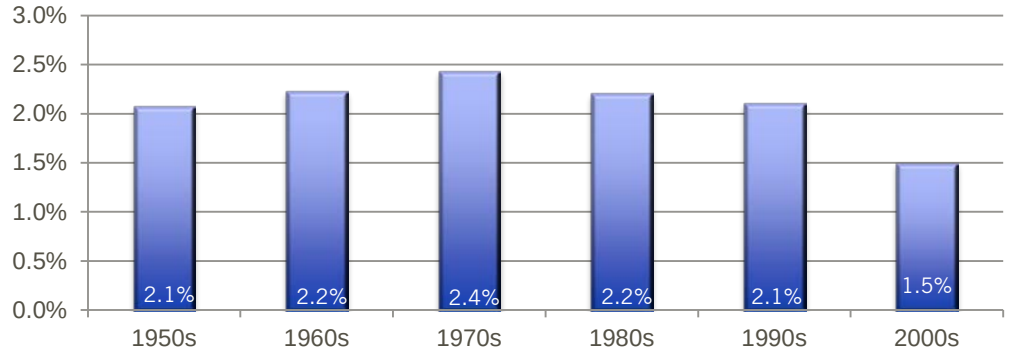

Figure 45: Manufacturing Fixed Investment as Share of GDP by Decade (average)[179]

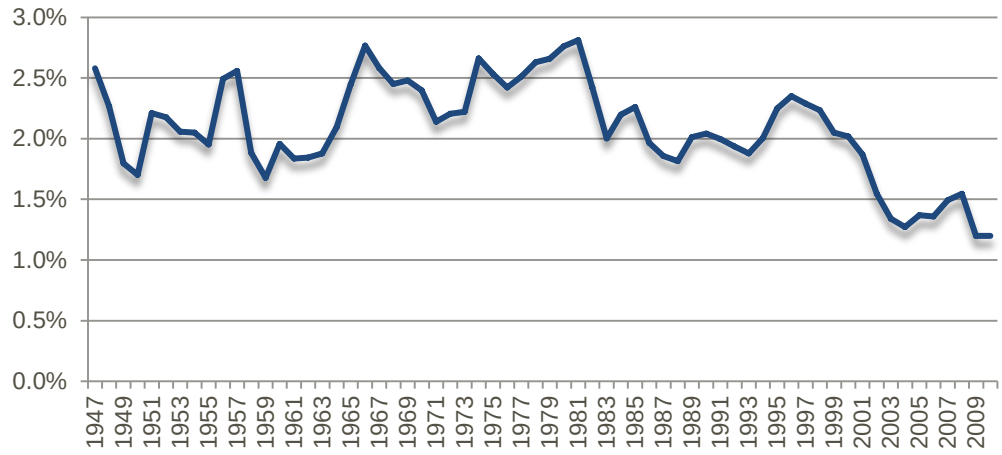

Figure 46: Manufacturing Fixed Investment Share of GDP, 1947-2010[180]

We see the same pattern when we look at the manufacturing fixed investment quantity indexes published by the BEA, as shown in Figure 46. These indexes attempt to measure the actual quantity of fixed investment by adjusting for cost changes. From 1950 to 1999, manufacturing fixed investment grew, on average, by 5.3 percent per year. In the 2000s, however, it fell by 1.8 percent per year on average.[181]

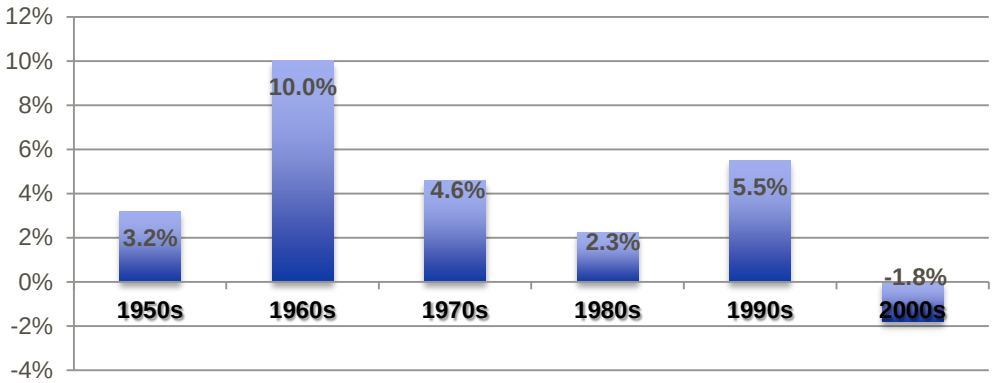

Figure 47: Average Annual Percent Change in Real Manufacturing Fixed Investment by Decade[182]

The influence of the petroleum industry on top-line manufacturing fixed investment numbers is clear. (See Figure 48) While investment in the petroleum and coal products industry increased by 224.8 percent (percentage change in investment) between 2000 and 2010, the next-best performer—the primary metals industry—increased its investment by just 29.2 percent. Indeed, just four industries had rates of investment that were higher in 2010 than in 2000. Paper declined by 44 percent, motor vehicles by 40 percent, furniture by 54 percent, and apparel by 70 percent. Even sectors in which the United States is supposed to lead saw declines or very small increases: investment in computers and electronic products is down 50 percent while chemicals is up just three percent.[183]

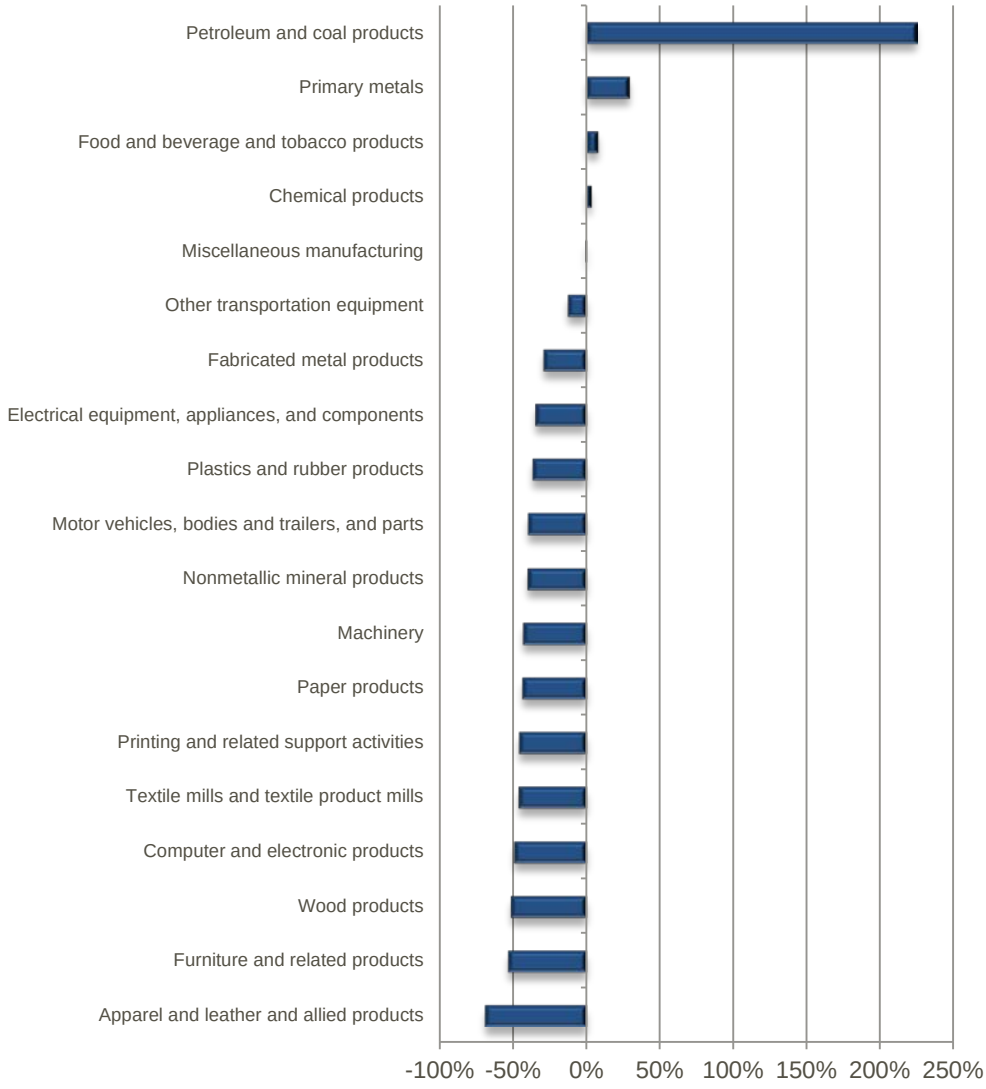

Figure 48: Percent Change in Manufacturing Fixed Investment by Industry, 2000-2010[184]

As Figure 49 shows, most of this stagnation occurred in the three years following the 2001 recession, when manufacturing fixed investment fell 22 percent. In the five years following 2003, manufacturing fixed investment rebounded, increasing by 34 percent. But after falling in the Great Recession and failing to recover, manufactures in 2010 were still investing only 79 percent of the amount they invested in 2000. Some might view the high level of investment in 2000 as a cause. But between 1989 and 1998, real manufacturing fixed investment grew by 101 percent.[185]

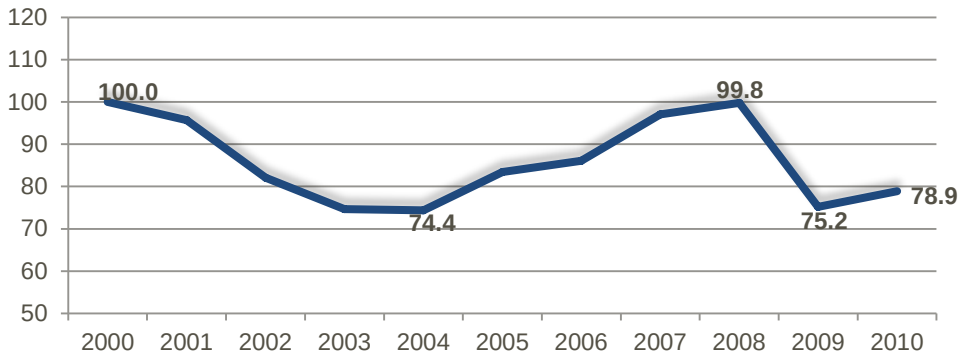

Figure 49: Real Manufacturing Fixed Investment (2000=100), 2000-2010[186]

But after falling in the Great Recession and failing to recover, manufactures in 2010 were still investing only 79 percent of the amount they invested in 2000.

So far, these investment data have been "flow" data, or the amount of money manufacturers invest every year to add new plants and equipment. The more important measure, however, is stock: the amount of capital plants and equipment that manufacturers have and use in production. Because equipment depreciates every year, the amount of investment has to exceed the amount of depreciation in order to prevent overall capital stock (the total value of plants and equipment) from declining. Since World War II, manufacturing capital stock increased at a robust pace. In the 1960s and 1970s, manufacturers expanded their capital stock by 55 and 45 percent respectively. In other words, in the 1960s American manufacturers expanded their buildings and machines by more than 50 percent, and that almost happened again in the 1970s. The growth of manufacturing capital stock fixed assets slowed to 19 percent in the 1980s, in part due to the severe recession at the start of the decade and to the emergence of tough international competition, but it picked up to 26 percent in the 1990s. A very different picture has emerged in the last decade, with manufacturing capital stock growing just barely, at 1.8 percent.[187] (See Figure 50)

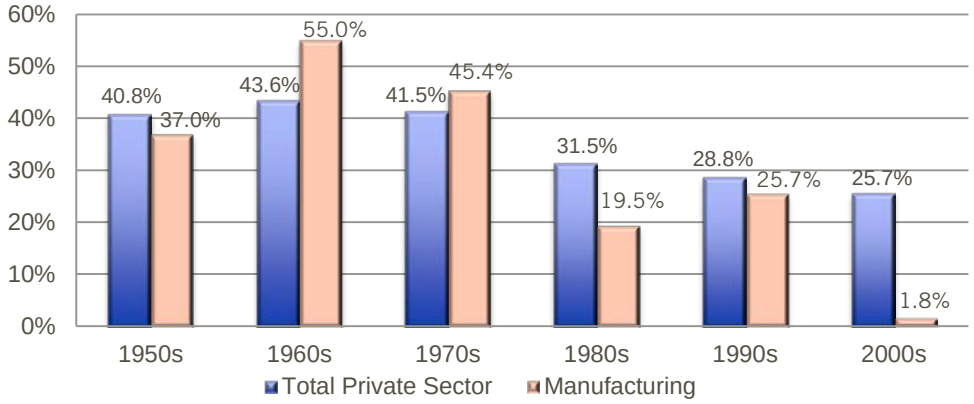

Figure 50: Percent Change in Net Stock of Fixed Assets by Decade[188]

One might argue that the manufacturing sector was just reflecting the overall investment trends in other sectors. In fact, since the 1980s, manufacturing capital stock has grown more slowly than overall private capital stock, but the gap widened enormously in the 2000s. Total private capital stock grew 60 percent faster than manufacturing capital stock in the 1980s, and just 12 percent faster in the 1990s. (See Figure 51) But in the 2000s, total private capital stock grew 13 times more than manufacturing capital stock (22 percent

vs. 1.8 percent). Compare this to growth in the funds and trusts industry (e.g., the mutual funds industry) and performing arts and spectator sports (e.g., sports stadiums), which grew 64 percent and 90 percent, respectively.[189]

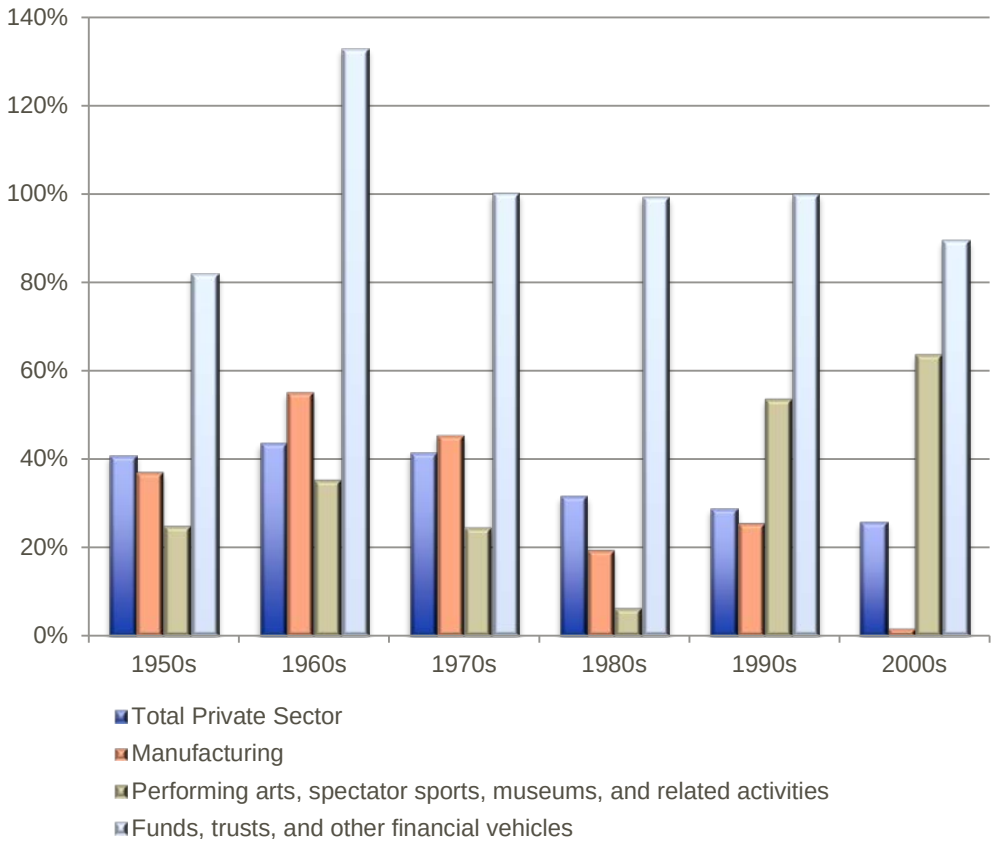

Figure 51: Comparison of Percent Change in Net Stock of Fixed Assets by Decade[190]

Figure 52 shows the year in which the overall capital stock in various U.S. industries peaked, and the change from that peak year to 2010—revealing dramatic decreases in capital stock in a number of U.S. manufacturing industries. For example, the capital stock of the primary metals industry (for example, the steel and aluminum industries) peaked three decades ago, in 1981, and has fallen by 24 percent since. Other industries peaked later, but in some cases they saw a similarly steep fall in capital stock. For example, in just 10 years, the stock of buildings, machines, and equipment in the apparel industry fell by 25 percent. Capital stock in the motor vehicles industry peaked in 2003 and has since fallen by seven percent. Most U.S. manufacturing industries now have less machinery and equipment than they did a decade ago, though a few—chemical products and petroleum products, for instance—have remained stable. Some, including the securities and health care industries, have more capital stock now than ever before.[191]

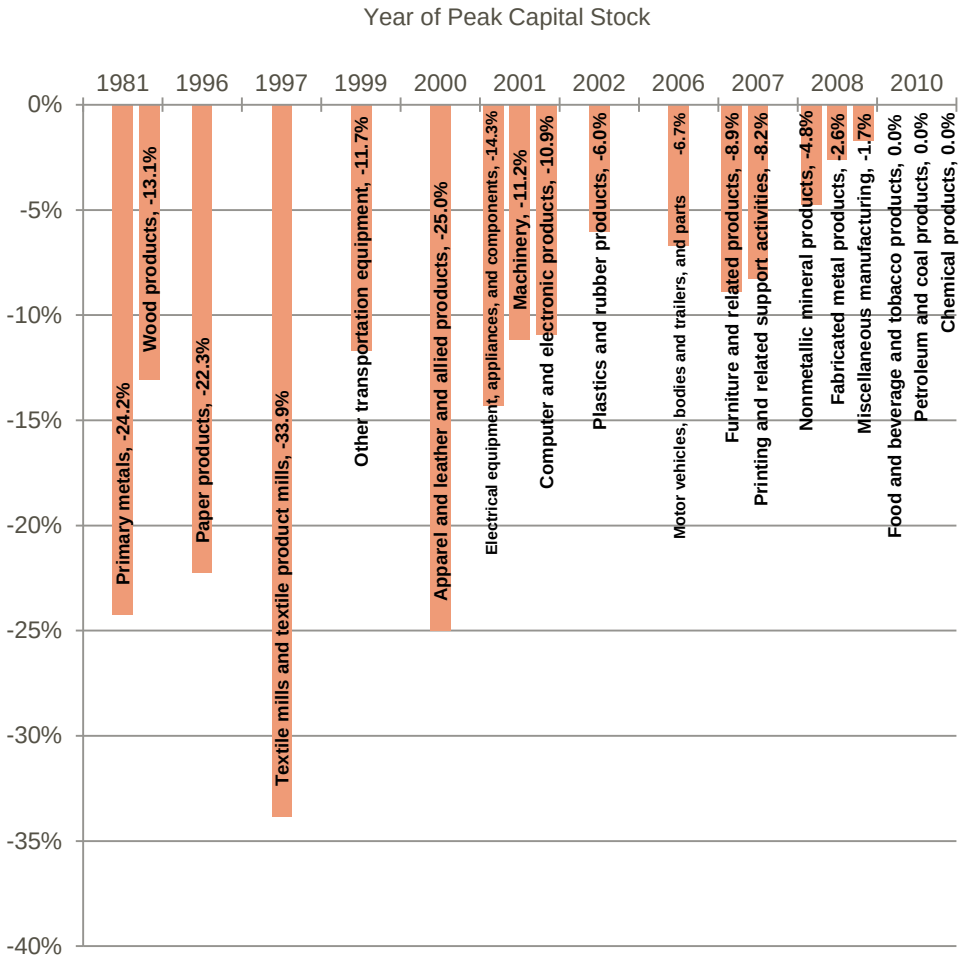

Figure 52: Percent Change in Capital Stock from Peak Year to 2010[192]

Over the last decade, manufacturers in Germany were investing 65 percent more in new machines, computers, software and buildings than manufacturers in America.[194]

Due to this underinvestment, domestic U.S. manufacturing fixed investment as a share of GDP was substantially lower from 2000 to 2010 than that of other countries. Figure 53 shows that the United States ranked 25th of 29 countries in manufacturing fixed investment, investing below 1.7 percent of GDP annually into new manufacturing plants and equipment. Contrast this with Korea, which invested 7.3 percent, Hungary 5.0 percent, Israel 3.4 percent, Sweden 2.9 percent, and Germany 2.8 percent. This is one reason why the performance of German manufacturing has been superior to U.S. manufacturing. Over the last decade, manufacturers in Germany were investing 65 percent more in new machines, computers, software and buildings than manufacturers in America.[193]

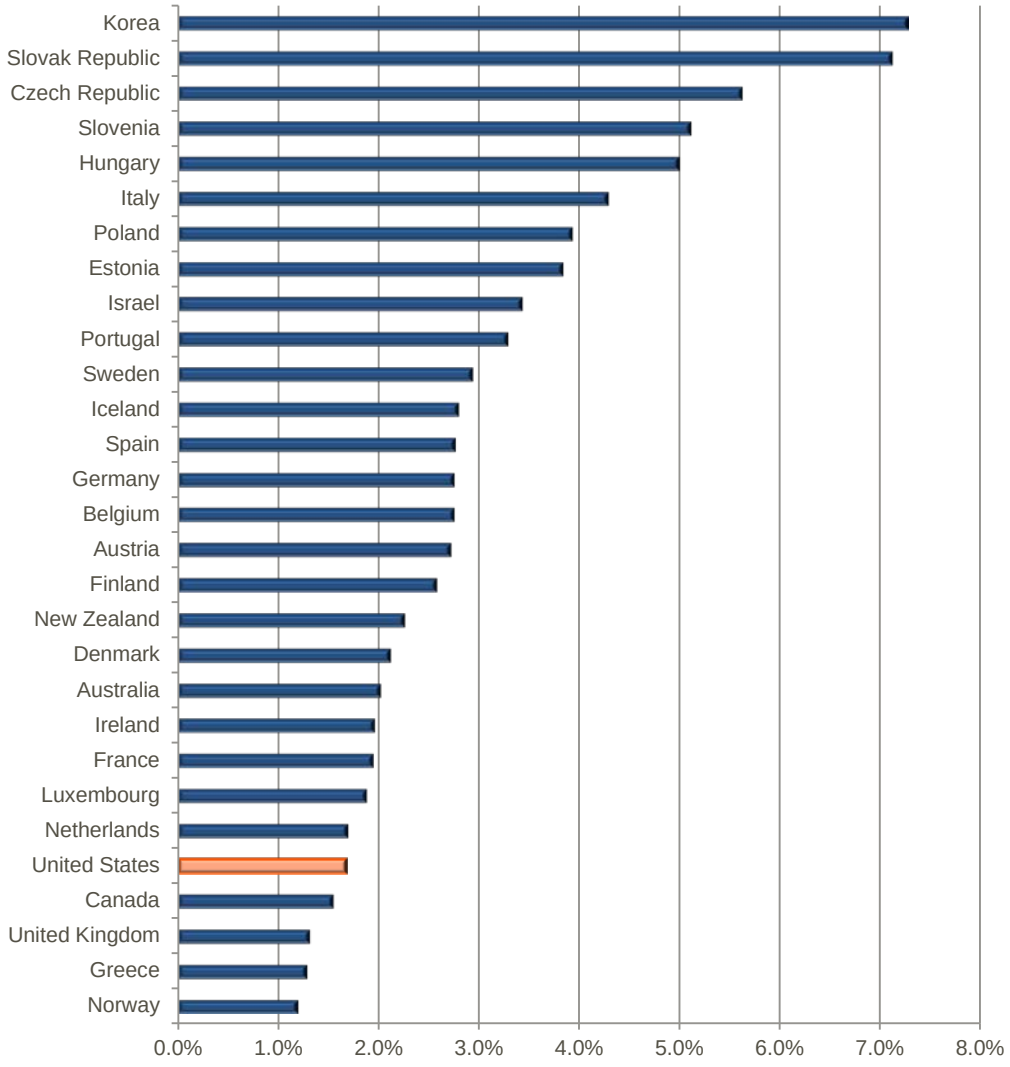

Figure 53: Manufacturing Fixed Investment Share of GDP, 2000-2010 Average[195]

U.S. Manufacturing Capital Stock is Growing Faster Overseas

There are two possible reasons for the decline in domestic capital investment by manufacturers in the United States. First, these companies might just be investing less as companies. Second, U.S. manufacturers might still be investing, but investing more overseas. BEA data shows that the second reason has indeed played a significant role. Figure 54 illustrates the ratio of U.S. multinational manufacturing corporations' capital expenditure overseas to their capital expenditure within the United States. In 2000, U.S. multinational manufacturers invested 33 cents overseas for every dollar invested domestically. By 2009, this ratio had increased to 71 cents overseas for every dollar invested here. Even more striking, when analyzed as a share of GNP, U.S. multinationals' overseas capital expenditure increased by nine percent between 2000 and 2009, while their domestic expenditure *decreased* by nearly 50 percent.[196] (See Figure 55) Today, when a U.S. manufacturer is choosing where to invest in plants and equipment, the company is more likely than ever to choose to invest in a foreign country.

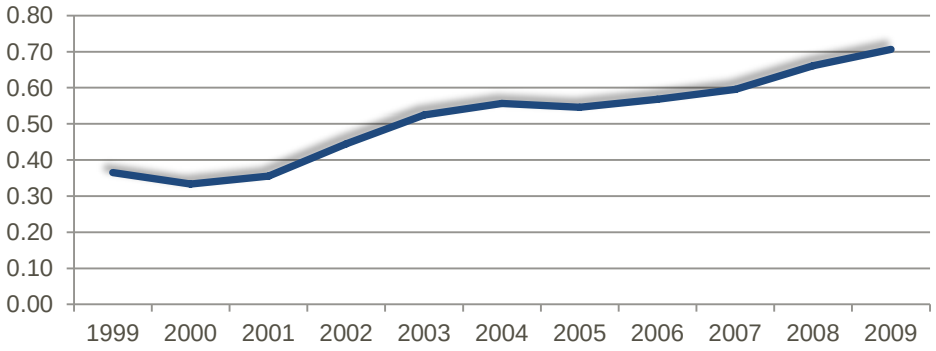

Figure 54: Ratio of U.S. Manufacturing MNC Foreign Capital Expenditure to Domestic Capital Expenditure, 1999-2009[197]

To be sure, some of this overseas growth is a reflection of the more rapid growth in overseas market opportunities, as U.S. multinationals are competing with multinationals from countries around the world. But some of it also reflects the more favorable business investment climate in other nations, in part driven by declining effective corporate tax rates, the provision of large investment incentives for opening up new factories, and other favorable manufacturing policies such as public R&D investment, support for SME manufacturers and workforce training.[198]

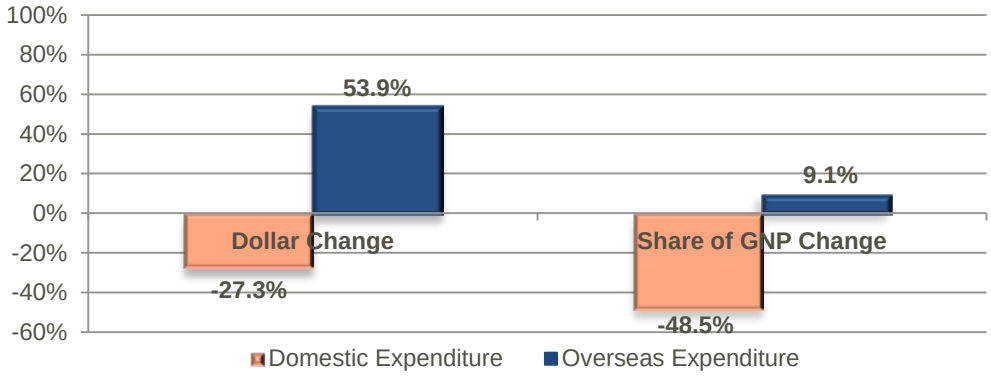

Figure 55: Percentage Change in U.S. MNC Capital Expenditure, 2000-2009[199]

The flows of capital out of the United States and into foreign manufacturing establishments are shown in Figure 56. Between 1982 (the first year of available data) and 1994, these capital flows averaged 0.22 percent of GNP. The year 1995 saw a spike in this foreign investment, and the rate has remained high ever since: between 1995 and 2010, these flows averaged 0.36 percent of GNP.[200]

U.S. Manufacturing Research and Development Trends

Data relating to investment in research and development can also be used to assess the health of U.S. manufacturing. These indicators are not as robust as capital investment data in determining health, however, since U.S. manufacturing companies could still be investing in R&D in the United States even while shifting factories offshore. At first glance, this appears to be the case: the United States is ranked eighth out of 35 countries in manufacturing R&D expenditure as a share of GDP in 2007, and 10th out of 29 countries in the rate of change from 2000 to 2007.[201] But on closer examination, these data carry

some warning signs. First, the share of GDP does not account for R&D cost differences among countries, and thus the actual quantity of R&D that is performed could be vastly different. When controlling for this using constant purchasing-power-parity (PPP) dollars—that is, the real quantity of R&D investment adjusted for cost differences between countries—the United States' ranking falls precipitously. As Figure 56 shows, by this measure, the United States ranks only 20th of 32 countries in the growth of its manufacturers' investments in R&D.[202]

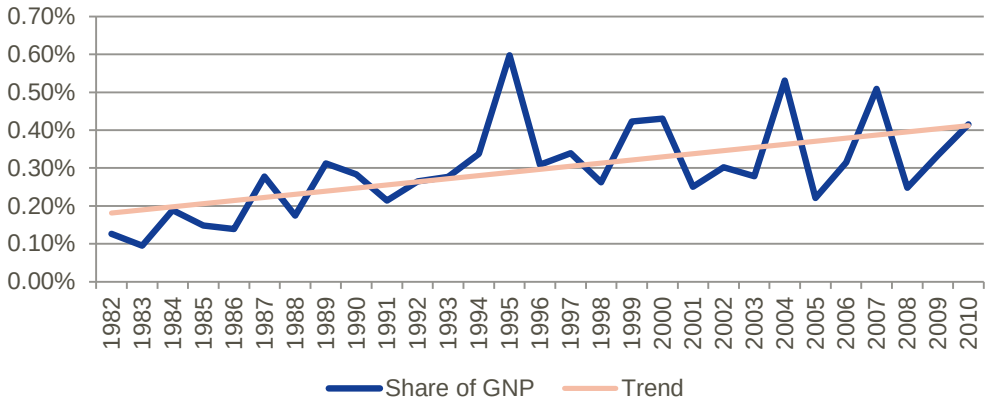

Figure 56: U.S. Capital Outflow into Foreign Manufacturing Affiliates, 1982-2010[203]

Moreover, U.S. manufacturing R&D performance is quite varied when examined by industry. As Figure 58 shows, R&D expenditure is dominated by chemicals and chemical products, which grew by 100 percent between 1998 and 2006. This is in part due to the strong growth in R&D by the pharmaceutical industry. The next highest performing industries in terms of growth are food, beverage and tobacco products, machinery and equipment products, and communications equipment, each with greater than 35 percent R&D expenditure growth over the period. Seven industries increased their R&D expenditure, although the increase for rubber and plastics products was negligible. On the other hand, eight industries saw declines in R&D investment. The leader in declining R&D investment was the fabricated metal products industry, with a 33 percent decline. Surprisingly, both the computing machinery and the electrical machinery industries experienced steep R&D declines—two high-tech industries in which the United States should lead the world.[204]

U.S. manufacturing sectors perform even worse when R&D expenditures are viewed as a share of GDP. By this measure, for example, R&D expenditures fell by 57 percent between 1998 and 2007. By contrast, computer industries in countries such as Finland, Korea, Denmark, Ireland, and the Czech Republic substantially increased their R&D investment as a share of GDP between 1997 and 2005. Finland and Korea increased their business R&D expenditures in IT manufacturing by 67 percent and 73 percent, respectively.[205] Uneven investment in high-tech U.S. industries—chemicals and communications investing heavily; computers and electronics investment declining—has contributed to a lower-tech manufacturing sector in the United States compared to many competitor countries.[206] (See Figure 57)

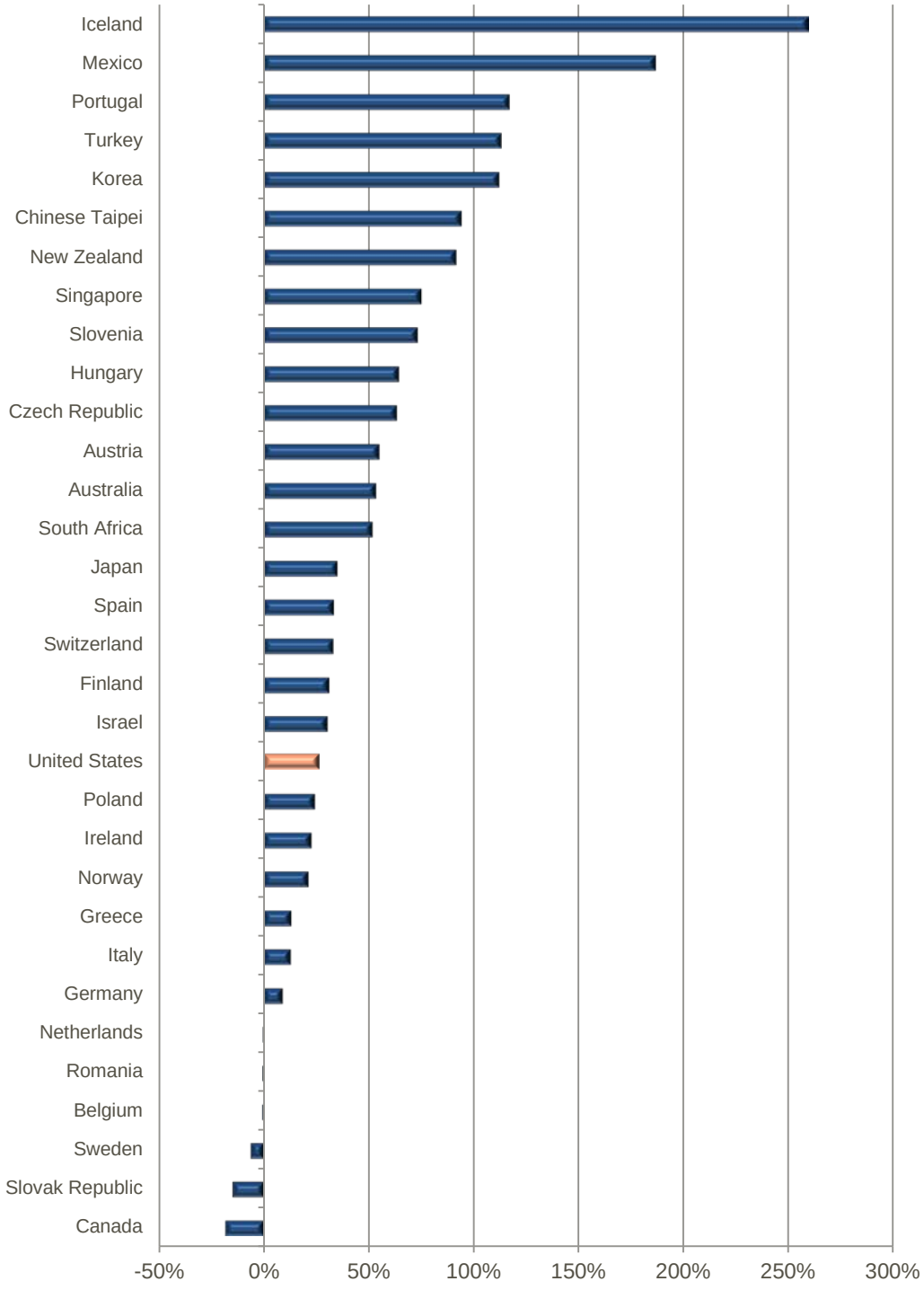

Figure 57: Percent Change in Manufacturing R&D Expenditure (constant PPP), 2000-2007[207]

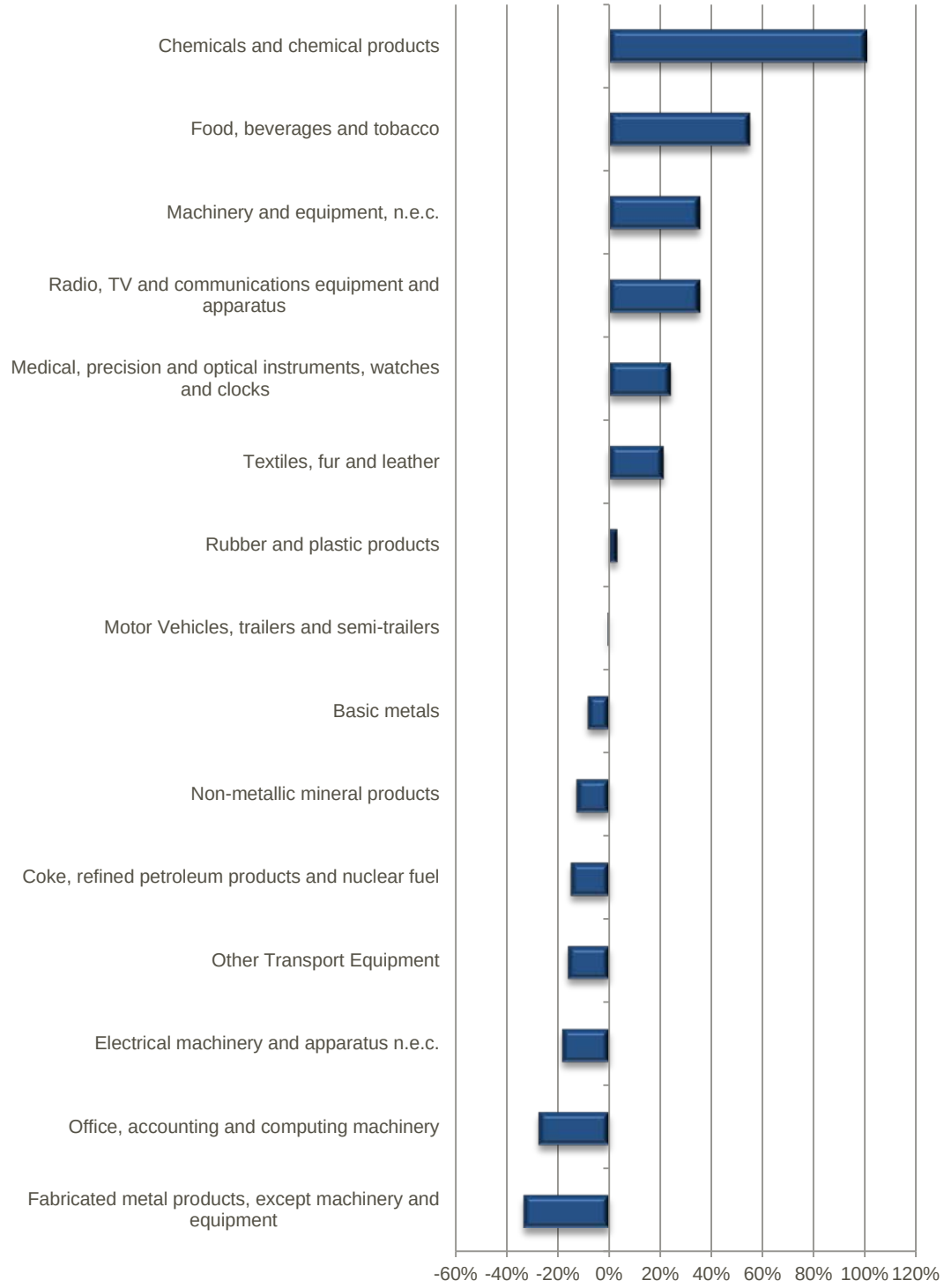

Figure 58: Percent Change in U.S. Manufacturing R&D Expenditure (constant PPP), 1998-2006[208]

Manufacturing Profits Are Declining As a Share of Total Profits

If manufacturing output was not shrinking as a share of the economy, then we would expect to see manufacturing profits stable or growing. Some have argued that this is in fact the case. For example, Mark Perry of the American Enterprise Institute claimed this as evidence that manufacturing is now the economy's "shining star" in an otherwise sub-par recovery. Based on data available from the U.S. Census Bureau through the third quarter, Perry estimates that U.S. manufacturing corporations are on track to earn record profits in 2011: about $600 billion, up from profits of nearly $500 billion in 2010 and approximately $360 billion in 2000.[209] However, while manufacturing profits have indeed increased by 52 percent between 2000 and 2010, overall corporate profits are up much more at 135 percent.[210] As share of the economy, manufacturing profits have been actually falling, especially since the late 1980s and again after 2000, in part as profits have flowed to the financial services industry. (See Figure 59) Any recent "recovery" in manufacturing profits is emerging from a very low base, and the profitability of manufacturing has been underperforming the corporate economy as a whole.

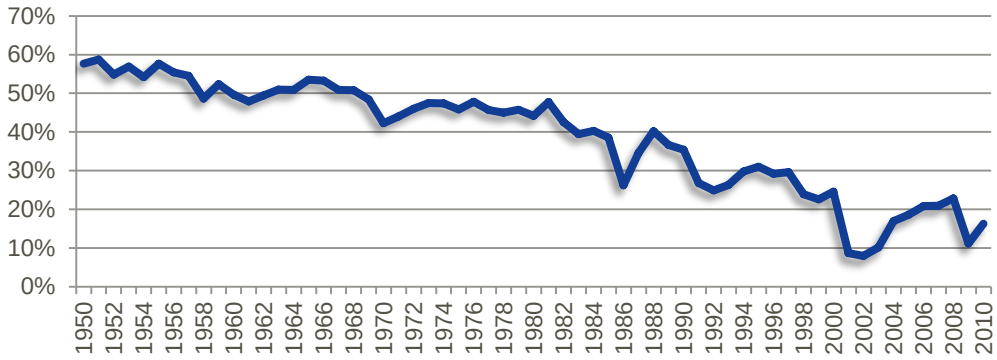

Figure 59: Manufacturing Profits Before Tax as a Share of Total Domestic Corporate Profits Before Tax, 1950-2010[211]

MANUFACTURING TRADE PERFORMANCE HAS DECLINED

The data presented above clearly show that the unprecedented U.S. manufacturing job loss in the last decade was not principally a story about superior productivity performance. Rather, manufacturing output growth fell—especially when compared to the growth of the overall economy—and companies shed workers.

But why did output fall? Some will argue that the loss of output is not a reflection of a decline in global competitiveness, but rather a shift toward a post-industrial economy where as economies get rich they increasingly consume services. According to this notion, the shift over time in consumer demand from goods to services was responsible for the slow growth in output. For example, in 1970, roughly half of all personal consumption expenditures in the U.S. went toward goods, and the other half toward services. By 2010, roughly a third went toward goods and two-thirds toward services.[212] The Congressional Budget Office seems to confirm this trend: "In 2000, 42 percent of U.S. consumer spending was devoted to goods, down from 53 percent in 1979 and 67 percent in 1950.[213]

However, a closer look at the data shows that this interpretation is wrong. It is true that when measured in nominal terms, Americans are spending a smaller share of their total consumption on manufacturing goods than they were a generation ago. This seems to be clear evidence that the relative decline in manufacturing output is of our own making, not the rest of the world's. But just as one has to use real, inflation-adjusted values in assessing change relative to GDP, one has to use real values in assessing changes in consumption patterns. If the average American family spends 1/40th of their income on televisions in 1970 but only 1/60th in 2011, it doesn't necessarily mean Americans are consuming fewer TVs. It could be that TV's are now cheaper relative to other goods and services. And indeed, that is precisely the case. Manufacturing goods are becoming relatively less expensive, so when changes in real consumption are examined, it is evident that that Americans are actually consuming more manufactured goods relative to the rest of their consumption expenditure. Figure 60 demonstrates this: the bottom line shows the nominal goods consumption share of total consumption declining since 1980; however, the top line shows that, when adjusted for price changes, goods consumption actually grew faster than consumption as a whole. Hence, changes in domestic consumer demand do not account for the slower manufacturing output growth.

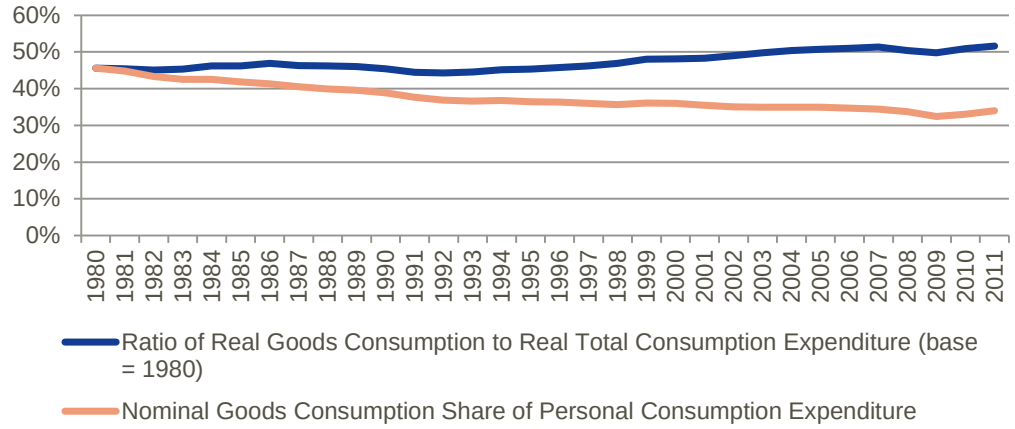

Figure 60: Personal Goods Consumption Relative to Total Personal Consumption Expenditure, 1980-2011[214]

The key factor that accounts for the loss of output is the growth of the U.S. trade deficit. While the U.S. trade balance has been in deficit for more than three decades, it has grown considerably worse since 2000. Over the last decade, the United States has accumulated an aggregate $5.5 trillion negative trade balance in goods and services with the rest of the world.[215] In no year in the last decade did the United States have a negative global trade balance of less than $360 billion, and in five of those years it had negative trade balances of at least $600 billion. But the story is even worse with regard to the U.S. balance of trade in goods: from 2006 to 2011, the United States accrued a trade deficit in goods of at least $729 billion annually. (See Figure 61)

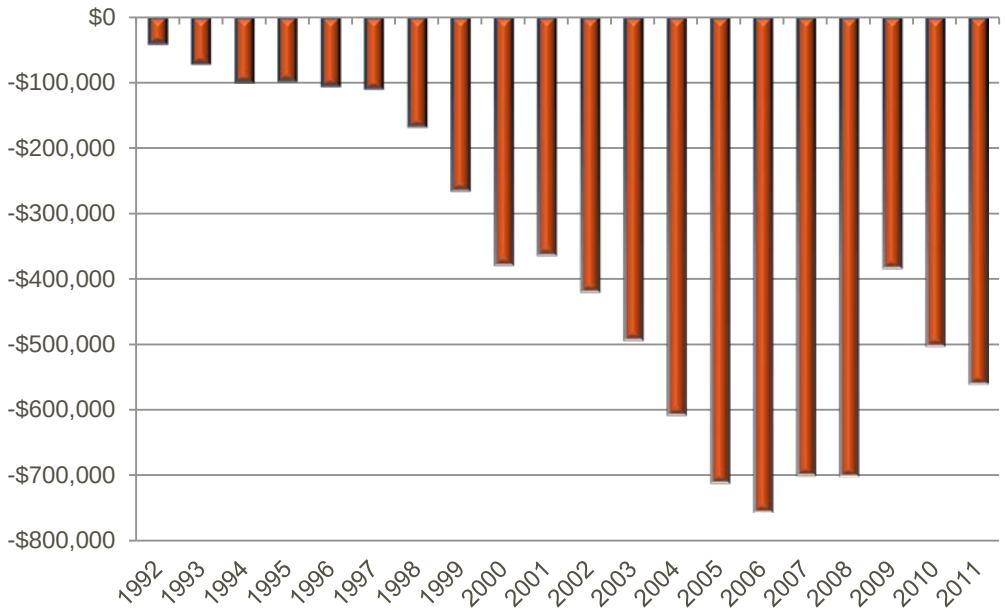

Figure 61: U.S. Trade Deficit (millions), 1992-2011[216]

Why is the trade deficit so intrinsically linked to a decline in manufacturing competitiveness? The simple reason is that manufacturing accounted for approximately 65 percent of U.S. trade over the prior decade, and thus a weak manufacturing sector has contributed substantially to large and chronic trade deficits.[217] As Figure 61 illustrates, the United States ran increasingly large trade deficits over the past two decades, in both manufactured goods (such as vehicles, consumer electronics, and machine tools) and non-manufactured goods (such as agricultural products, oil, and commodity inputs), with the recent mitigation in those trade imbalances caused primarily by the recession and declining U.S. demand for imports. From 1989 to 2000 the U.S. trade deficit in manufacturing products was $1.7 trillion, but between 2000 and 2011 it increased to nearly $4.5 trillion. It would be one thing if the United States were running a trade deficit in low- to mid-technology products like apparel, luggage, or hand tools. But starting in 2002 the United States began to run a trade deficit in advanced technology products (such as life sciences products, medical devices, optoelectronics, information technology, and aerospace products)—the very products in which the United States is supposed to have a competitive advantage. America tallied a $400 billion deficit in advanced tech products over this period, and the trend is worsening. The United States is on pace to run a $120 billion trade deficit in advanced technology products in 2012 alone. (See Figure 62)

Moreover, in 2011, the trade deficit was $558 billion—11 percent higher than in 2010 and 46 percent higher than in 2009. As shown in Figure 62, the trade deficit was smallest in 2009 after the height of the recession, but it has grown since then, approaching 2006 levels.

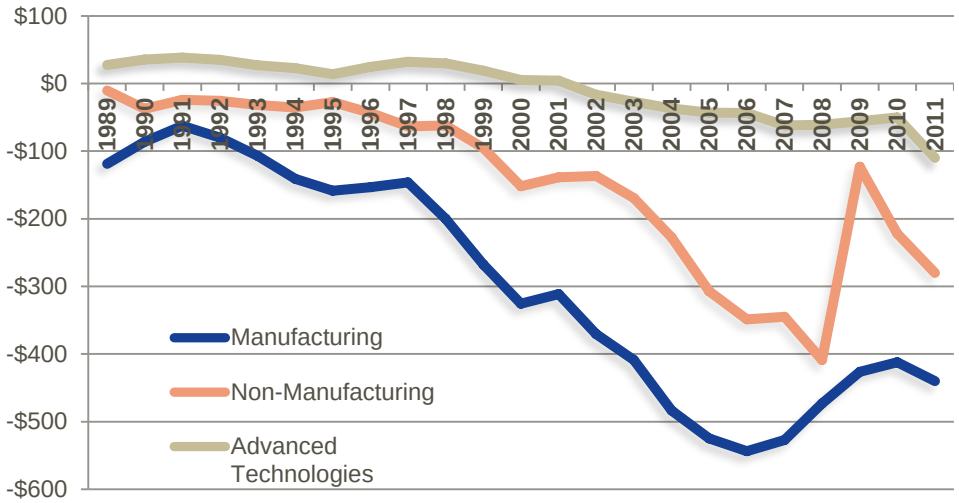

Figure 62: U.S. Trade Balances for Manufacturing, Non-Manufacturing Goods, and Advanced Technology Products (billions), 1988-2011[218]

This declining trade performance for U.S. manufacturing is reflected in the United States' declining share of global exports. Since 2000, the U.S. share of world exports has declined from 17 percent to 11 percent, even as the European Union's share held steady at 17 percent over that time period.[219] We see the same trend with high-tech exports. From 2000 to 2010, the U.S. share of global high-tech exports dropped from 16 percent to 12 percent, while China's share grew from seven percent to 17 percent. China has now replaced the United States as the world's number one high-technology exporter.[220]

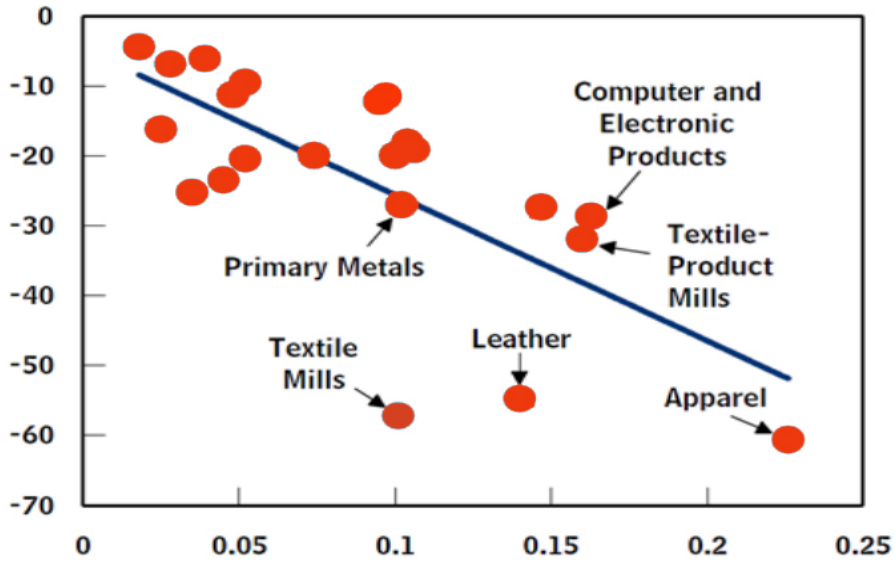

Figure 63: Changes in the Import-Penetration Ratio and Employment, by Manufacturing Subsector, 1999-2007[221]

The trade deficit has a direct impact on manufacturing employment. Studies have found that imports, particularly of intermediary goods, are associated with employment loss, while exports increase employment. For example, economist Lori Kletzner finds that within an industry, a 10 percent increase in sales due to exports leads to a seven percent

increase in employment, while a 10 percent increase in domestic demand leads to just a 3.5 percent increase in employment.[222] With manufacturing accounting for 57 percent of U.S. exports, the fastest way to boost exports—and the jobs they support—will be to increase U.S. manufacturing. However, the opposite is also true. A large trade deficit has a crippling effect on manufacturing employment. As Figure 63 indicates, there is a strong correlation between import penetration (the ratio of imports to domestic demand) and declining employment within the imported sector.

The impact of an increase in import-penetration is particularly apparent when it comes to China. In 2011 U.S. exports in manufacturing increased by $123 billion, while Chinese manufacturing exports increased by $302 billion. In 2000, Chinese manufacturing exports were one-third the size of U.S. manufacturing exports, but by 2011 Chinese exports were larger than those of the United States by $651 billion.[223] As Figure 64 shows, U.S. manufacturing trade deficit with China has been steadily increasing. One study has shown that import competition from China was responsible for between one-quarter to more than one-half of the lost manufacturing jobs in the 2000s.[224] Another study by the Federal Reserve found that Chinese exports can account for between 750,000 to 3.5 million manufacturing job losses in the United States over the last decade.[225]

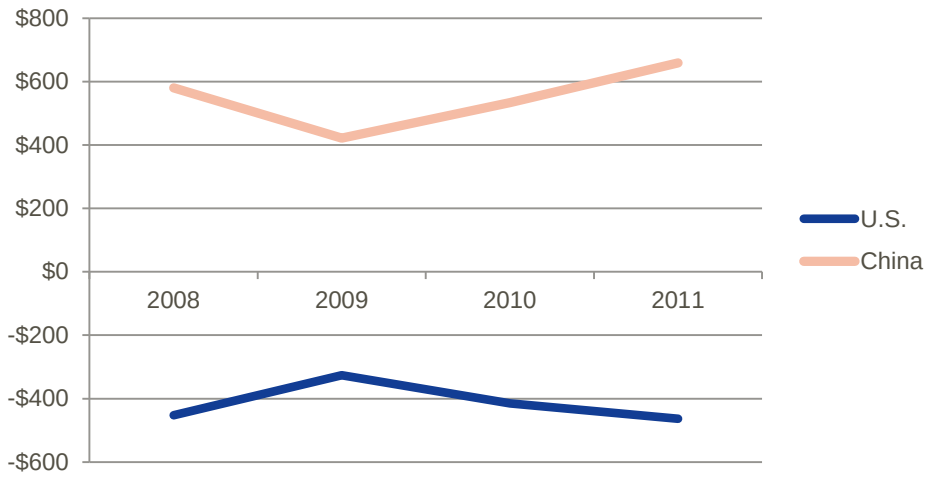

Figure 64: U.S. and China Manufacturing Trade Balances (billions), 2008-2011[226]

APPENDIX 1: OTHER STATISTICAL BIASES IN THE COMPUTER AND ELECTRONIC PRODUCTS INDUSTRY

In addition to the problem of rapid technological change, there are two further problems in the computer and electronic products industry. The first is import substitution bias, as discussed in the section on measuring imports. We would expect to see this bias to have the largest impact on the computer and electronics industry, which is perhaps the most globalized of the American industries.[227] Judging by its real value-added growth, the computer and electronics industry appears to be prime candidate for some serious import substitution bias. This seems to be confirmed when we decompose value added into its gross output and intermediate input components. (See Figure 65)

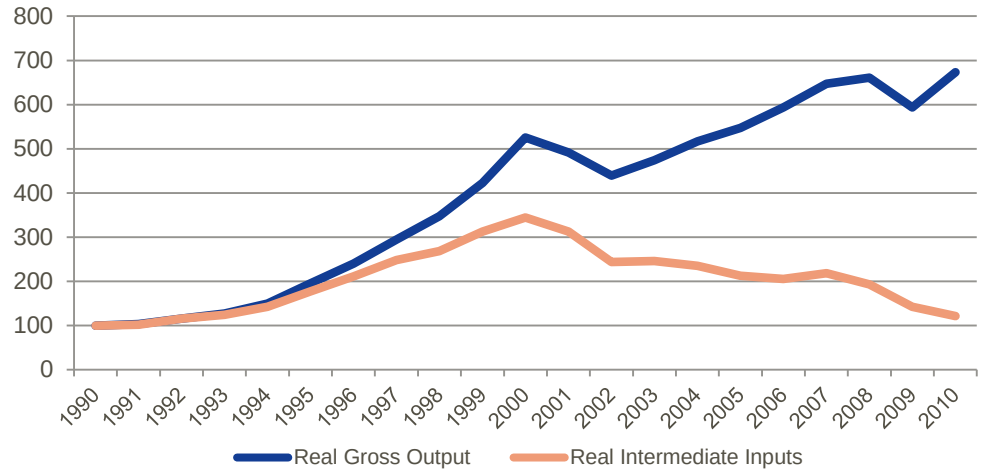

Figure 65: Trends in Computer and Electronic Industry Production (1990=100), 1990-2010[228]

Notice that, in 2000, the real intermediate inputs line changes course and begins an extended drop that continues to this day. This is symptomatic of import substitution bias: an increasingly globalized industry finds lower-cost inputs overseas and the price drop is not reflected in the statistics—meaning input quantities appear artificially low and value added appears artificially high. However, despite these appearances, the Houseman et al. analysis finds that import substitution bias in the computer and electronics industry is surprisingly low: average annual change in value added, they find, was overstated by a maximum of only 15 percent. So, while import substitution certainly contributed to the rapid growth in value added, there must be another factor at work.

It turns out the other factor is a problem caused by the combined effect of offshoring and rapid technological change, which economist Michael Mandel labels the "Nakamura-Steinsson effect" after the two economists who discovered it.[229] According to Mandel, "In product categories with declining prices and rapid model changes—such as cell phones, computers, consumer electronics—the official import price indexes underestimate the size of the price decline for product categories with rapid model changes. The reason is simple—when a new model of an imported good is introduced, the BLS typically treats it as a new good, and misses the entire price decline from one model to its successor."[230] More technically, for particular computer and electronic products (for example, semiconductors), the BLS uses a "matched model" index, in which price changes used to construct the index are given for items deemed "identical."[231] This means that in industries

with rapid technical change, like NAICS 334, input price drops may not be measured. For example, if the quality of semiconductors is rapidly improving and new models are produced frequently, then price change may only occur when the new models are introduced. If those models are dissimilar enough to be deemed not identical to previous models, then the statistical agency may not pick up the price changes in semiconductors overall. And if semiconductor prices are falling, the fall will not be reflected in the NAICS 334 input price index. Much like import substitution bias, the intermediate input price index will grow more rapidly than it should, causing intermediate input quantities to decrease too quickly and thus biasing value-added growth upward. The BLS is aware of this problem (as with import substation bias) and is currently exploring possible solutions.[232] Nevertheless, the precise extent to which the Nakamura-Steinsson effect results in biased output figures is unclear from the current research, which is still very recent.

Feenstra et al. detail two additional output biases that have an outsized effect on the computer and electronics product industry.[233] The first bias results from gains in the United States' terms of trade not being properly picked up in import price indexes. The second results from tariff reductions not being accounted for in the construction of import price indexes. Both function similarly to import substitution bias, in that both result in NAICS 334 import price indexes growing too slowly, biasing value-added growth upward.

Given the litany of biases with the statistical measurement of computer and electronic products, it is difficult to make a precise adjustment to the industry's official output numbers. Hence, Mandel suggests a compromise: although one would expect a rapidly globalizing industry to see its real intermediate inputs rise faster than real gross output instead of falling, a reasonable adjustment would be to grow and shrink real intermediate inputs at the same rate as gross output.[234] ITIF adopts Mandel's adjustment for the computer and electronics industry over the period from 2000 to 2010, which reduces its real value-added growth rate down from 18 percent per year to a reasonable and respectable three percent per year. Three percent per year is still substantially higher than all but one manufacturing industry.[235]

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66. And while the United States does run a trade surplus in services, that positive balance ($179 billion in 2011) was dwarfed by a negative balance in goods imports ($737 billion), for an aggregate U.S. trade deficit of $558 billion in 2011. Moreover, with U.S. exports of goods 157 percent greater than exports of services, one of the fastest ways to boost exports will be through expanding manufacturing. Helper, Krueger and Wial examined export growth rates for services, non-manufactured goods, and manufactured products (or combinations thereof) that would be required to balance the U.S. trade deficit over the next decade. He finds that to balance the trade deficit through increased services exports alone would require them to grow at an annual compound rate of 13.5 percent over the next decade, whereas their annual growth rate from 2000-2011 was 9 percent. To balance trade through increases in non-manufactured goods exports would require them to grow at a 23.7 percent rate over the next decade, whereas they grew at an 11.1 percent rate over the past decade. However, to balance trade by 2019 with only manufacturing exports, they would have to grow at a compound annual growth rate of 9.4 percent, compared to their growth rate of 6 percent over the prior decade. In other words, manufacturing has a "shorter road to hoe" in terms of the increase in exports required of it to balance the trade deficit. See Susan Helper, Timothy Krueger, and Howard Wial, *Why Does Manufacturing Matter? Which Manufacturing Matters?* (Washington, D.C.: Brookings Institution, 2012), http://www.brookings.edu/papers/2012/0222_manufacturing_helper_krueger_wial.aspx.
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235. ITIF did not apply the import substitution bias adjustment to the Computer and Electronic Products (NAICS 334) industry.

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ABOUT ITIF

The Information Technology and Innovation Foundation (ITIF) is a Washington, D.C.-based think tank at the cutting edge of designing innovation strategies and technology policies to create economic opportunities and improve quality of life in the United States and around the world. Founded in 2006, ITIF is a 501(c)(3) nonprofit, non-partisan organization that documents the beneficial role technology plays in our lives and provides pragmatic ideas for improving technology-driven productivity, boosting competitiveness, and meeting today's global challenges through innovation.

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