3

"Good Jobs"—Trade and US Manufacturing Employment

The manufacturing sector has historically played an important role in providing employment opportunities for less educated workers, especially men. Many Americans were able to join the middle class and live well in blue-collar jobs in industries such as automobiles and steel that are especially remunerative. Thus, expanding manufacturing employment is often viewed as the key to creating "good jobs." Manufacturing has also played a pivotal role in many regional economies, and its decline has adversely affected many towns and cities. Its revitalization is also seen as important for urban renewal.

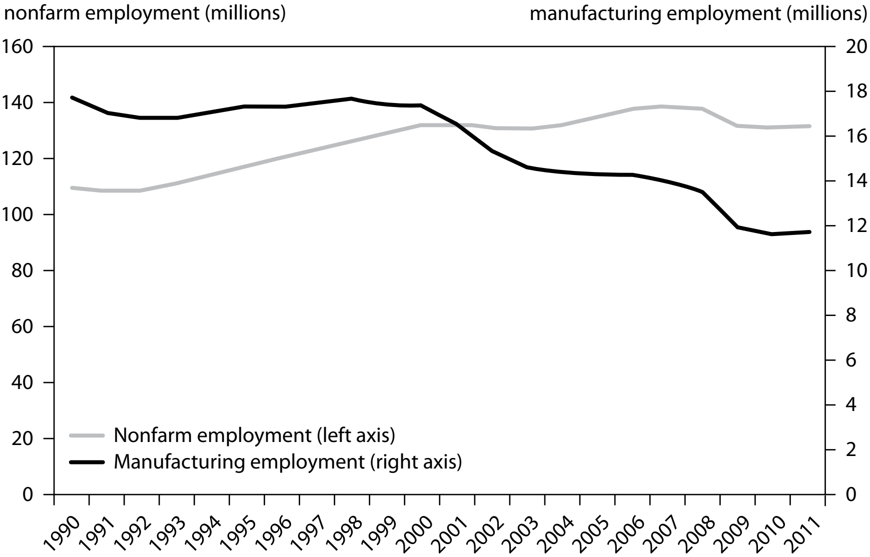
But since 2000, manufacturing employment has plummeted.[1] As shown in figure 3.1, employment in manufacturing in the 1990s remained fairly constant (right scale) while overall employment grew rapidly (left scale). By 2011, however, manufacturing employment had been reduced by almost 6 million—a 35 percent decline from the 17.3 million jobs that existed in 2000—to just 11.6 million. This more than accounted for the 1.5 million overall decline in employment over the same period.

Manufactured products are highly tradable, and between 1998 and 2010 the US trade deficit in manufactured goods doubled.[2] It is no surprise, then, that America's trade competition with emerging-market economies in Asia and the development of international supply chains are frequently cited as the reasons for manufacturing's weak employment growth. These forces have in-

1. For an excellent discussion of the hardships this has created, see Longworth (2008).

2. As an example of the tradability of manufactured products, in 2008 they made up 64 percent of US imports of goods and services (78 percent of goods imports) and 54 percent of US exports of goods and services (85 percent of goods exports).

Figure 3.1 Manufacturing and nonfarm employment, 1990–2011



Source: Bureau of Labor Statistics.

deed contributed to the decline, but this chapter shows that domestic forces are primarily responsible for manufacturing's recent employment performance.

In this chapter, we first place our discussion in context by demonstrating that, surprisingly, the share of total employment represented by Americans working in sectors producing tradable goods and tradable services combined has been declining. While a higher share of US workers has become exposed to international services trade because of improvements in communications technology along with trade liberalization, this increased international exposure of services has been more than offset by the shrinking share of workers employed in producing tradable goods. Manufacturing plays the largest role in this declining share and this chapter demonstrates the remarkably persistent links between declining manufacturing employment and total employment over time.

We also show that this development in the United States is very similar to that in other industrial countries—suggesting that those blaming US policies and performance are ignoring something more fundamental and pervasive. We then consider both the domestic and international factors that explain manufacturing employment. We find that the most important reason for the declining share of manufacturing employment has been the combination of relatively rapid productivity growth and relatively unresponsive demand. Surprisingly, we find that because of faster productivity growth, between 1998 and 2010 the employment content of the trade deficit in manufacturing barely changed (box 3.1).

Box 3.1 The manufacturing employment multiplier

A common argument in favoring the promotion of manufacturing is the claim that such activity has a high employment multiplier. Reports from the National Association of Manufacturing (NAM) indicate that each dollar's worth of manufactured goods creates another $1.43 of activity in other sectors, twice the $0.71 multiplier for services (NAM 2010). The impression sometimes given by such claims is that a dollar spent on manufacturing will "create" more employment opportunities than a dollar spent on services.

It is certainly the case that when manufactured goods finally reach consumers, they are likely to contain value added from a variety of sectors of the economy. For example, autos purchased by consumers contain not only value added by auto assembly firms but also value added that can be ascribed to raw materials (iron ore, glass, rubber, etc.), transportation, and additional services such as banking, accounting, advertising, and wholesale and retail distribution. And it may well be the case, by contrast, that a much higher share of the value of certain services (haircuts, for example) is added in the haircut industry and therefore haircuts have a smaller multiplier in this sense. But before we jump to conclusions about employment, caution is in order.

First, ultimately what matters for total employment in any production process is the overall value of that product divided by average labor productivity. To simplify, assume that output per hour is $40 in every industry in the economy. How many hours of work would be created by the final sale of $10,000 worth of haircuts? Let's say 250 hours of work—almost all in the haircut industry. How many jobs would benefit from the final sale of $10,000 worth of autos? Again the total would be 250 hours of work, some in assembly, but many hours as well in a variety of sectors. If we assume that all the value added for haircuts was added by hairdressers, the haircut multiplier would be zero. If we assume that of the 250 hours it took to make autos, 100 occurred in auto production and the rest in other parts of the value chain, the auto multiplier would be 2.5. Thus, even though haircuts have a "multiplier" of one and manufacturing a multiplier of 2.5, the $10,000 in spending on each would give rise to exactly the same number of jobs. In practice, in fact, because such activity is capital intensive, value added per worker could well be higher in manufacturing than services, in which case actually fewer jobs would be created.

A second issue relates to the location of the jobs. The US Input-Output Tables on which these multiplier estimates are based actually assume all production in the value chain takes place in the United States. But in reality the raw materials, transportation, and other intermediate inputs used in manufacturing need not be

(box continues next page)

Box 3.1 The manufacturing employment multiplier *(continued)*

produced within the same country. Thus, the multiplier does not necessarily refer to domestic jobs. Indeed, the domestic jobs may depend on access to imported inputs in order to be competitive. And even when finished manufactured products are imported they are still associated with domestic employment in the distribution sector. Actually, since services generally contain much smaller shares of imports, the domestic employment impact of a final dollar's worth of spending on services is actually likely to give rise to more domestic employment than spending on manufacturing of equal value.

A third issue relates to the quite arbitrary allocation of activities and value added to manufacturing. Research and development, for example, can be performed in universities and laboratories and thus represent services, or within manufacturing firms and thus be counted as manufacturing value added. The same is true for many other services—janitorial, data processing, accounting, marketing, advertising, legal, etc.

All told, the implication is that these multipliers do not warrant the causal significance often attributed to them. Thus we draw conclusions about employment using them at our peril.

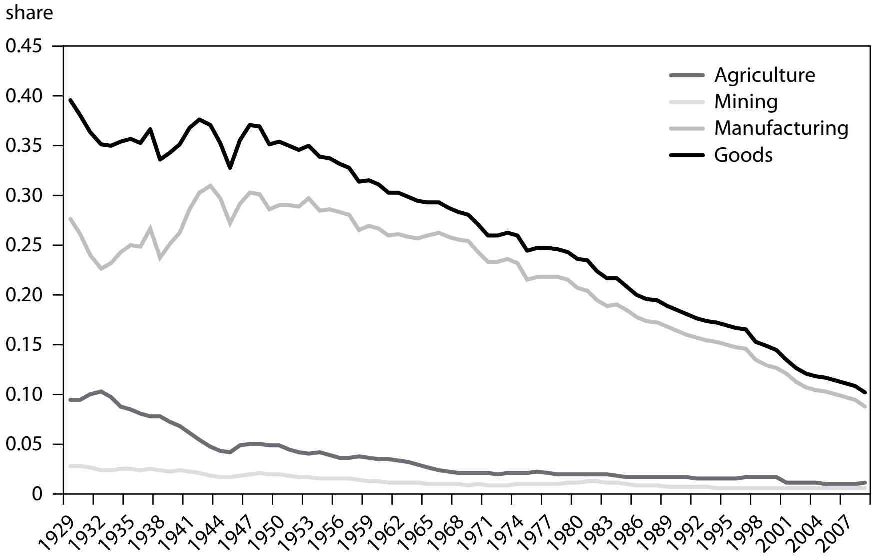
Closing of the US Labor Market

It is often taken as given that the US economy has become more open and globalized, and indeed international competition is increasingly important for US goods producers both at home and abroad. In 1960, only 7 percent of all US goods purchases were imports; by 2010 this share had increased to almost 40 percent. In 1960, exports accounted for 9.2 percent of overall goods output in GDP, while they were 27 percent of goods output in GDP in 2010. In most manufacturing industries, therefore, domestic producers face more intense foreign competition at home and are relatively more dependent on foreign sales.

But the globalization of the US labor market has been offset by a more powerful force, namely the shift by larger shares of workers into nontradable sectors. Figure 3.2 presents the share of employment in agriculture, mining, and manufacturing in total employment. These sectors represent a rough measure of tradable goods.[3]

3. The GDP accounts report full- and part-time employment going back to 1929, but use four different classification systems over the period, according to the Bureau of Economic Analysis (available at www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1). Nonetheless we have spliced these series together as a rough measure of tradable goods.

Figure 3.2 Sector share in total employment, 1929–2009



Source: Bureau of Economic Analysis.

The strength of the trends in the declining share of employment in US goods-producing industries is remarkable. Until 1950, manufacturing's employment share increased but was offset by declining shares in agriculture and mining. In the early 1950s, the manufacturing share was fairly constant, but thereafter the share began to decline. In combination with the declining shares in agriculture and mining, there is a consistently strong downward trend in the manufacturing goods employment share for the subsequent 60 years, reaching just 10 percent of the labor force by 2010. However we also need to take into account international trade in services. Advances in communications technology along with deregulation and privatization around the world have also made services more tradable and the economy more open. Yet, even the inclusion of employment in tradable services is not sufficient to offset the overall decline in the share of Americans employed in tradable sectors. This conclusion emerges when using either of the two leading methodologies to measure the tradability of services.

Alan Blinder (2006) has examined occupational data to distinguish all the jobs that can potentially be offshored.[4] He identifies these jobs based on two criteria. Either the output produced through the job can be delivered to a remote location, or the job itself need not be undertaken in a particular US location. Thus, his definition includes all potentially tradable goods and services. He estimates that in the mid-2000s, the share of such jobs in the United

4. See also Bhagwati and Blinder (2009).

States was between 22.2 and 29 percent with a midrange estimate of 25.6 percent of the labor force. Most goods are tradable. Yet, as we see in figure 3.2, in 1950 the US employment share in tradable goods alone was 35 percent. To be sure, many of these industries were quite closed and protected by trade barriers and high transportation costs. Nonetheless, by 1980, when the employment share in goods was 23.7 percent, almost all goods markets in the United States were internationally contestable (with the possible exception of some aerospace spending used for national defense). Using Blinder's mid-range estimate, therefore, and making some allowance for services that were tradable in earlier years—services imports plus exports were equal to 3.7 percent of GDP in 1980—suggests that the US labor market was actually less internationally contestable in 2006 than it had been 30 years earlier.

Bradford Jensen and Lori Kletzer (2005) use another methodology. They identify tradable services industry jobs based on the degree to which production in industries is concentrated geographically within the United States. Michael Spence and Sandile Hlatshwayo (2011) have adjusted these estimates to eliminate the goods and services that are internally tradable but because of regulatory and other reasons are not traded internationally. By their estimates, the Jensen and Kletzer approach implies that between 1990 and 2008, employment in the tradable sectors in the United States fell from 27 to 23 percent—a figure that is close to Blinder's midrange number.[5] Our data indicate that over the same period, the employment share of tradable goods (manufacturing, agriculture, and mining) fell from 18.4 to 10.3 percent. This implies that the employment share in tradable services increased from 8.6 to 12.6 percent.[6] Thus the increased share of employment in services that are potentially internationally tradable has been insufficient to offset the declines in the share of employment in tradable goods.[7]

The finding that the share of Americans employed in all tradable sectors has been falling has important implications for concerns about unemployment, job losses, and wages that we consider in the following chapters. As we have noted and will discuss in some detail in chapter 9, some theories (such as Stolper-Samuelson) that explain how trade affects factor prices assume that factors of production are homogeneous and mobile and that specialization is incomplete. If these conditions hold, the size of the tradable sectors does not matter because trade affects wages and other factor prices throughout the economy. But other theories assume that factors are industry-, firm-, and

5. Spence (2011) claims that declining employment in tradables is due to global production chains and also argues that the decline is responsible for growing US wage inequality.

6. Bureau of Economic Analysis, "National Income and Product Account Table 6.4, Full-Time and Part-Time Employees by Industry," www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1 (accessed on November 1, 2012).

7. Indeed, the 23 percent employment share estimated by these authors in 2008 for tradable goods and services is roughly equal to the 23.6 share of tradable goods *alone* in 1980 employment, and the 27.1 share accounted for by goods alone in 1970 is the same as the share of the whole tradable sector employment share for goods and services that they estimate for 1990.

occupation-specific (immobile), and some allow for complete specialization. If these conditions hold, the size of tradables will influence the importance of shocks transmitted through trade in economywide measures such as wage inequality and aggregate job loss.

In addition, our evidence points to two contrasting political implications: on the one hand, global competition has become more intense for those workers who are employed in tradable goods and services, and indeed there is evidence these workers are more anxious about trade (Scheve and Slaughter 2004, Anderson and Gascon 2007). On the other hand, international competition is becoming less relevant for a growing share of American workers over time. Thus, while in some locations trade concerns could become more important, in the economy as a whole the salience of trade as a political issue could diminish over time. Indeed, Craig Van Grasstek (2011) produces considerable evidence that policy attention to trade has declined.

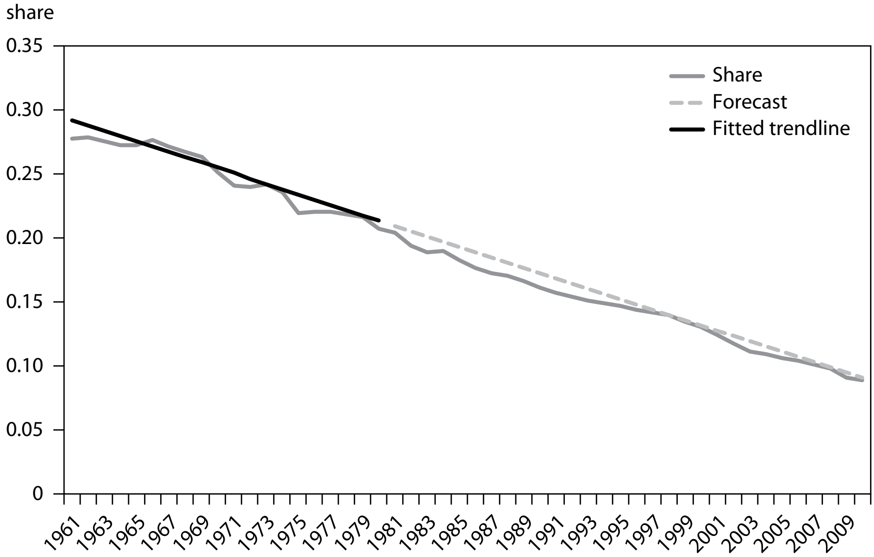
Manufacturing Employment: Tracking the Decline

The definition of the industries included in manufacturing has changed several times over the years, and it is hard to come by a consistent time series of employment or output over the long term. However, establishment data are available for manufacturing and nonfarm employment on a consistent basis since 1961 and are therefore suitable for a regression analysis. Figure 3.3 plots the manufacturing share of nonfarm employment against time. The dramatic decline in the share of manufacturing employment in total nonfarm employment is clear. In 1961, manufacturing accounted for 27.7 percent of nonfarm employment; by 2010, this share had fallen to just 8.9 percent. Most remarkable, however, is the persistence and stability of the relationship, irrespective of the changing trends in trade flows and other factors during this period. To illustrate this, a regression line has been fitted to the data from 1961 and 1980 and then extrapolated through 2010. Using the relationship from 1961 to 1980, a forecaster in 1980, knowing that in 2010 total nonfarm employment would be 129 million, would have predicted manufacturing employment in 2010 within 25,000 of its level of 11.524 million, that is, with an error of less than 1 percent.

We have also split the sample period from 1961 to 2010 into two periods and regressed the manufacturing employment share against time. The trend coefficients in both periods are very similar and reveal an annual decline in the manufacturing employment share of about four-tenths of one percentage point.[8] This fairly constant shift in the US employment share is similar to that of sand falling through an hourglass. While the same amount of sand moves from the top to the bottom, it represents an increasing share of the sand at the top and a decreasing share at the bottom. Similarly, this coefficient implies

8. Splitting the 50-year sample in half, we obtain very similar coefficients: .0043 per year prior to 1985 and .0037 per year from 1985 through 2010.

Figure 3.3 Manufacturing share in total nonfarm employment, 1961–2010



Source: Bureau of Labor Statistics.

that over time, the declining share of employment in manufacturing is an ever greater percentage of the jobs that remain in manufacturing employment, but a smaller percentage addition to employment in the rest of the economy.[9]

The 2 Percent Solution

The decade between 2000 and 2010 was unusual not because the share of manufacturing declined but because there was an absolute decline in manufacturing employment. Yet this too would have been predicted on the basis of historic relationships between manufacturing employment growth and employment growth in the rest of the economy.[10] We capture this relationship

9. If we assume that over time manufacturing employs a higher share of unskilled workers than the rest of the economy, and that a constant fraction of job opportunities in manufacturing disappears, the share of unskilled workers employed in other sectors of the economy will have to increase. However, if the elasticity of substitution between skilled and unskilled workers is constant, since the nonmanufacturing sector is growing over time, the downward pressure on the relative wages of unskilled workers that results from these diminished opportunities will decline. If the least skilled workers are the first who are displaced, the impact on wage inequality will diminish even faster.

10. The Bureau of Labor Statistics has two major surveys that provide employment data. The Current Employment Statistics (CES) Survey, which is obtained by surveying firms (establish-

by relating annual percentage changes in manufacturing establishment employment (%ΔM) to annual percentage changes in establishment employment (%ΔE).[11] The equation we obtain explains manufacturing employment growth very accurately. It accounts for 91 percent of the overall variance. The average prediction error (root mean squared error) is just 1.1 percent and both coefficients are highly significant.

The coefficient on the growth in employment highlights the sensitivity of manufacturing employment to overall economic conditions. The equation indicates that if there is no overall employment growth, employment will fall by 3.74 percent (the negative constant term in the regression).[12] However, for each percentage increase/decrease in employment, manufacturing employment will grow/fall by 1.8 percent. Thus, manufacturing employment falls unless employment in the economy grows at a rate that exceeds 2 percent per year (i.e., 3.74/1.89).

This relationship can be seen back in figure 3.1. When employment in the rest of the economy was expanding through the 1990s at an average of around 2 percent, manufacturing employment basically remained constant. But when aggregate employment stagnated after 2000, manufacturing employment fell rapidly. This decline in manufacturing employment after 2000 is well predicted by the simple regression model. If we forecast manufacturing employment growth using an equation estimated over the period from 1961 to 2000, we predict an annual average decline over the decade of 4.05 percent—almost exactly the 3.9 percent average annual decline that actually occurred.[13]

Therefore, as with the trend regression in figure 3.1, there is little to suggest that something fundamental has changed recently in the relationship between manufacturing employment growth and employment growth in the economy as a whole.

The regression results we have just reported are not carefully constructed structural models. In fact, they are simply statistical summaries of the relationship between two (endogenous) variables that are each affected by the numerous causes that determine the level and composition of output and employment. In a complete account these links should all be modeled in a general equilibrium setting. Nonetheless, given the complexity of forces that link them, the stability of the comovement of these variables is remarkable

ments), and the Current Population Survey, which surveys households. We use the CES (establishment) data for our measure of manufacturing employment.

11. The regression we obtain is:

Period 1962 to 2010 (t statistics in parentheses)

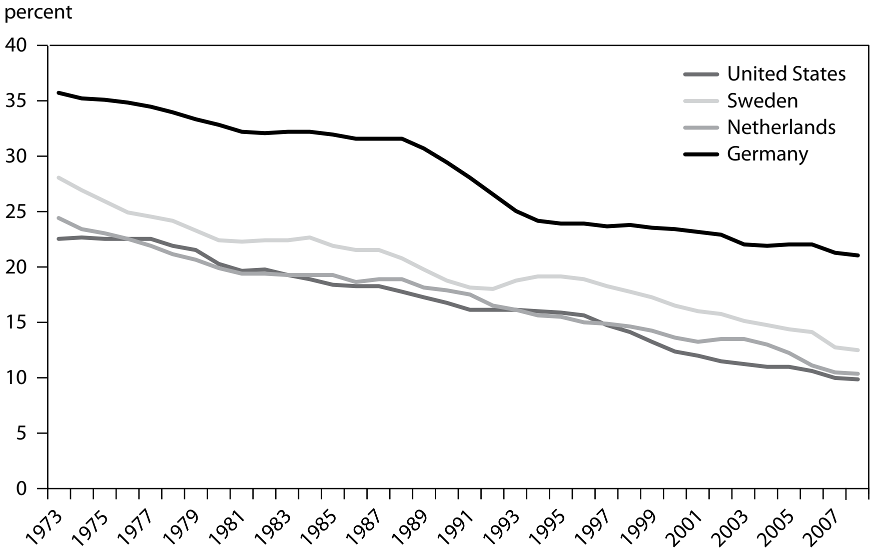
$$\%\Delta M = -3.74 + 1.80 \times \%\Delta E$$
$$(17.5) \quad (22.26)$$

12. This is indicated by the constant term in the regression.

13. Period 1961 through 2000:

$$\%\Delta M = -3.81 + 1.81\%\,\Delta E \qquad RMSE = .011$$
$$(t = 12.5) \quad (t = 17.0)$$

Figure 3.4 International comparison of share of employment in manufacturing, 1973–2008



Source: Bureau of Labor Statistics.

and suggests that while recent shocks may have affected employment, something far more persistent is driving the declining share of manufacturing employment.

International Comparisons

Before we explain these more fundamental forces, we briefly point to the international experience. Much of the discussion about deindustrialization in the United States focuses on policies and practices that are specifically American, with the presumption that had these been different, the United States might have avoided the shrinking share of manufacturing employment. It is useful therefore to compare the US experience with that of other industrial countries. Data on the share of manufacturing employment for industrial countries going back to 1973 have been assembled by the Bureau of Labor Statistics (BLS).[14] As illustrated in figure 3.4 we select industrial countries with large manufacturing trade surpluses and compare them with the United States. The trends in these other industrial countries are actually remarkably similar. While the share of manufacturing employment in Germany in 2010

14. When developing countries are included in the sample, the share of industry in the economy rises with incomes at low levels of income, but then reaches a peak and falls as incomes rise further. See Herrendorf, Rogerson, and Valentini (2011).

Table 3.1 Share of employment in manufacturing, 1973–2010 (percent)

Country	1973 (1)	1990 (2)	2000 (3)	2010 (4)	Change (4) – (1)
United States	24.8	18.0	14.4	10.1	–14.7
Canada	22.0	15.8	15.3	10.3	–11.7
Australia	23.3	14.4	12.0	8.9	–14.4
Japan	27.8	24.3	20.7	16.9	–10.9
France	28.8	21.0	17.6	13.1	–15.7
Germany	36.7	31.6	23.9	21.2	–15.5
Italy	27.9	22.6	23.6	18.8	–9.1
Netherlands	25.3	19.1	14.8	10.6	–14.7
Sweden	27.6	21.0	18.0	12.7	–14.9
United Kingdom	32.3	22.4	16.2	10.0	–22.3

Source: Bureau of Labor Statistics.

(21 percent) was twice as high as in the United States, the downward slope in a trendline fitted to the data is –0.46 percent per year. This is actually larger than the US trendline coefficient of –0.39 percent. Moreover, this US trend is very similar to the Netherlands (–0.36) and Sweden (–0.38).

Table 3.1, which includes additional countries, shows that in 2010 the US employment share in manufacturing was actually quite typical of an industrial country. It was the same as the United Kingdom (10 percent), Canada (10.3), and the Netherlands (10.6), somewhat higher than Australia (8.9), and lower than Sweden (12.7) and France (13.1). The range of declines in the shares over the period is also very similar and typically on the order of 15 percentage points over the 37-year period. It is also noteworthy that several of these countries on average ran large trade surpluses in their goods trade between 2000 and 2010: the Netherlands (7 percent of GDP), Sweden (5.4 percent), Germany (6.2 percent), and Canada (4 percent). As shown in figure 3.4, these surpluses have not mitigated these countries' declining trends in manufacturing employment. These data suggest a cause that is common, pervasive, and not closely related to the size of the trade balance. And we argue that the cause is found in the interaction between productivity growth and demand patterns.

Explaining Deindustrialization

The debate over the declining share of manufacturing employment often focuses on the relative importance of two forces: international trade and technological change. On one side are those who point to the offshoring of production by US companies and on the other are those who emphasize the role of automation and advances in technology in displacing workers—especially those who are relatively unskilled (McAfee and Brynjolfsson 2011). While both these forces undoubtedly contribute to the decline, economists since Alfred Marshall have focused on supply *and* demand in determining output. Yet, automation and offshoring are supply factors, and conspicuously missing from most explanations is attention to the role played by demand. This is a problem because ultimately it will be the response of demand to these supply shocks that determines whether offshoring or automation leads to fewer or more manufacturing jobs.

The sections that follow explore these supply and demand forces. We start by comparing measures of productivity growth in manufacturing with measures for the economy as a whole, noting that productivity growth in manufacturing has persistently been relatively faster than in the economy as a whole. Next we point out that these productivity differentials have resulted in similarly persistent declines in the relative prices of manufactured products. Finally, we turn to demand and explore how final spending on goods has responded to the declining relative prices.

Productivity, Output, and Employment in Manufacturing

Trends in manufacturing employment are a combination of two components: changes in labor productivity and changes in output. Improvements in productivity increase the output produced by each worker. With fixed quantities of output, therefore, this would reduce manufacturing employment. However, faster productivity growth does not necessarily mean less employment, since higher productivity growth could enhance profitability and increase supply. In response, prices would fall, and induce more demand. If demand is very responsive, therefore, the induced expansion and consequent increase in demand for workers could more than offset the effects of the decline in the employment intensity of output. In addition to the impact of these price changes, the demand for manufacturing output will be affected by changes in income and in tastes. Thus in some cases, employment could grow despite rapid productivity growth, while in other cases it could fall.[15]

Which case pertains to the United States? Table 3.2 draws on a time series database developed by Dale Jorgenson, Mun Ho, and Jon Samuels (2010) to present average annual growth (log change) in real value added, employment, and labor productivity (value added per person employed) in US manufacturing and the total economy for periods from 1960 to 2007. As shown in the table and discussed earlier, employment in manufacturing experienced a long-term decline relative to total employment. However, the source of this deindustrialization is not a decline in real manufacturing value added (output). Real growth in manufacturing value added was actually remarkably similar to growth in the economy as a whole and averaged 3.1 percent per year over the

15. Total employment in manufacturing (E^M) = $n_m Q^M$, where (n_m) is the employment intensity of output and Q^M the level of manufacturing output. This relationship also holds for total employment (E^T). We can therefore decompose changes in the manufactured goods share of total employment into changes in the employment intensity of production (commonly referred to as technological change) in manufacturing relative to the entire economy ($dln\left(\frac{n_m}{n_T}\right)$) as well as changes in the relative quantity of output ($dln\left(\frac{Q^M}{Q^T}\right)$) as follows:

$$(dln\left(\frac{E^M}{E^T}\right)) = (dln\left(\frac{n_m}{n_T}\right)) + (dln\left(\frac{Q^M}{Q^T}\right)).$$

Table 3.2 Growth of employment, output, and labor productivity, 1960–2007 (percent)

Indicator	1960–2007	1960–79	1980–99	2000–2007
Employment (BEA data)				
Manufacturing	–0.3	1.1	–0.5	–3.1
Total	1.6	2.0	1.6	0.5
Output (real value added)				
Manufacturing	3.1	3.9	3.5	0.7
Total	3.2	3.8	3.2	2.3
Output per person employed				
Manufacturing	3.3	2.8	4.0	3.8
Total	1.6	1.8	1.6	1.7

Source: Authors' calculations using data from the Bureau of Economic Analysis (BEA) and the World KLEMS Database, www.worldklems.net/data/index.htm (accessed on November 1, 2012).

period from 1960 to 2007. The share of manufacturing in real value added in 2007, at 16 percent, hardly differed from its share in 1960, at 17 percent. The deindustrialization of the US economy is therefore not a symptom of the failure of the US economy to grow its manufacturing sector.[16]

The proximate source of the decline in the manufacturing share of employment is labor productivity growth. In most periods, the productivity differentials between manufacturing and the overall economy have dominated the differences in real output growth between the sectors. Value added per person employed grew by 3.3 percent per year from 1960 to 2007 in manufacturing, compared to only 1.6 percent per year for the economy as a whole. The implication is that the amount of labor required to produce a real dollar of manufacturing value added fell by 1.7 percent (3.3 – 1.6) per year relative to the economy as a whole. Consequently, for the manufacturing share of total employment to have remained constant or grown over this period, growth in real value added in manufacturing would have had to exceed that of the overall economy by at least 1.7 percent per year. But, since growth in manufacturing only equaled that of the economy as a whole, it led to the secular decline in the share of manufacturing in employment shown in figure 3.3.

This decomposition is not a causal explanation of the sources of employment change. Changes in labor productivity and output growth are not independent of each other and are themselves outcomes of many changes in the economy, including total factor productivity (TFP) growth, international competition, industrial restructuring, labor supply, and domestic and foreign demand. We do not try to isolate the exact contribution of these many factors in driving the sources of growth in labor productivity and output. We do, however, concentrate on the contribution of TFP in driving both labor productivity and demand for manufactured output.

16. This point is made by Robert Rowthorn and Ramana Ramaswamy (1997) in their cross-country comparison of deindustrialization in advanced economies.

Jorgenson, Ho, and Samuels (2010) have developed time series estimates of TFP growth for the period from 1960 to 2007 using a consistent classification system.[17] We use their data in figure 3.5 to plot TFP and labor productivity (real value added per person employed) in manufacturing relative to these variables for the economy as a whole. We also plot the ratio of GDP prices (deflators) to those for manufacturing. What is striking is that the series track each other fairly closely.

The most comprehensive productivity measure is TFP, which is designed to capture improvements in technical efficiency by taking account of all the inputs (i.e., capital and labor used in production). By contrast, the amount of output produced by each person employed (labor productivity growth) will be influenced not only by changes in technical efficiency but also by the skills of workers and the available stock of capital. TFP appears to be the driving factor differentiating labor productivity in manufacturing compared to the rest of the economy, since the differences between these measures for manufacturing and the economy as a whole are quite similar. For example, over the period 1960–2007, TFP grew by 1.18 percent per year faster in manufacturing than in the economy as a whole, while over the same period labor productivity growth in manufacturing increased 1.51 percent per year more rapidly than labor productivity growth in the economy. The faster growth in relative labor productivity can be attributed to a gradual increase in the capital intensity of production in manufacturing compared to the rest of the economy.[18]

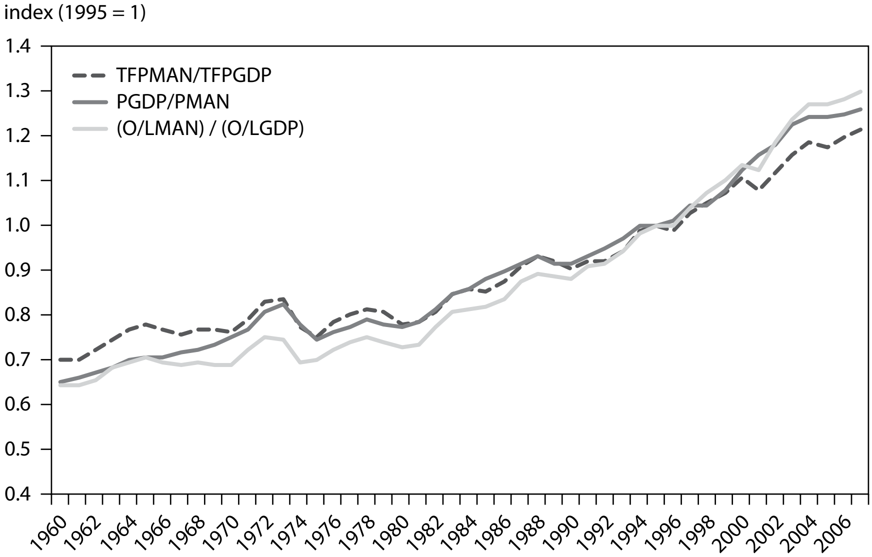
The data therefore suggest that close to 80 percent of the long-term differential in labor productivity growth between manufacturing and the economy as a whole is explained by faster TFP growth in manufacturing. This changes little if we look over the more recent period: In all periods, relative TFP growth accounts for a substantial portion of the relatively faster growth in labor productivity in manufacturing. It turns out, therefore, that relatively fast TFP growth in manufacturing plays a substantial role in explaining the deindustrialization of the US economy.

Why has productivity growth generally been so much faster in manufacturing? One explanation is that the sector accounts for the vast majority of research and development spending. Presumably, this spending is not exogenous but actually indicates the greater potential for innovation in this sector. By contrast, it seems more difficult to improve productivity growth in services. Indeed, the relatively slow productivity growth in services is sometimes described as "Baumol's cost disease" after William Baumol, who with William Bowen first pointed out the inherent limitations on productivity growth in some services (Baumol and Bowen 1965). In the 1960s, they studied the performing arts and observed

17. They use the US North American Industry Classification System (NAICS).

18. In 1960, capital services (1995 prices) per employed person in manufacturing equaled $391,000 and $647,000 in the economy as a whole. By 2007, manufacturing had become more capital intensive than the rest of the economy. Real capital services per worker in the total economy rose to $2.83 million, whereas in manufacturing it rose to $3.76 million.

Figure 3.5 Measures of relative manufacturing productivity and prices, 1960–2007



TFP = total factor productivity; MAN = manufacturing; GDP = gross domestic product; P = price; O/L = output per worker

Source: Jorgenson, Ho, and Samuels (2010).

that the same number of musicians are needed to play a Beethoven string quartet today as were needed in the 19th century; that is, the productivity of classical performance has not increased.[19] Baumol has explored this theme with various coauthors in later work. However, it could also be the case that improvements in services are inherently more difficult to measure.[20]

This differential productivity growth between manufactures and services will affect relative demand through the impact on product prices. In a competitive market, if productivity increases in an industry, eventually its prices will fall. Assuming given input costs, if this were not the case and prices did not fall, firms would be earning excess profits and over time new entrants would increase supply. Thus, ultimately, competitive pressures should ensure that

19. These are cited by William Nordhaus (2006), who also presents an overview of the evidence on this issue. We should note that Nordhaus (2005) presents evidence based on pooled samples of manufacturing industries and finds that the demand for manufactured goods is actually slightly price elastic. This leads him to give greater weight to international competition as a source of deindustrialization, especially between 1998 and 2004. See, however, the final section of this chapter in which we estimate the employment impact attributable to trade. In addition, Nordhaus' more recent data could be influenced by the association between the rapid productivity growth in computers after 1995 together with the dot.com boost in demand.

20. For a discussion of measurement issues, see Bosworth and Triplett (2003).

relative price changes reflect relative productivity changes. In noncompetitive markets, a similar result occurs in the face of constant demand elasticity, since cost markups are unchanged.[21] Thus, faster productivity growth in an industry will generally lead to lower relative prices. In the long run, therefore, a reasonable assumption is that relative prices will (roughly) keep step with TFP differentials.[22]

Indeed, this is what we find using the Jorgenson, Ho, and Samuels (2010) time-series data. As shown in figure 3.5, the ratio of TFP for manufacturing relative to TFP in the economy has risen steadily over time, roughly matching the rise in the relative price deflator for overall output relative to the deflator for manufacturing. Between 1960 and 2007, for example, the price deflator for manufacturing declined by 1.42 percent per year relative to the deflator for all industries (GDP) over the period. Similarly, TFP growth and labor productivity growth increased, respectively, by 1.2 percent and 1.5 percent per year more rapidly in manufacturing production than in the economy as a whole. Since manufacturing is part of GDP, these measures understate the differentials in productivity and price behavior between manufacturing and services. William Nordhaus (2006, 18) performs more disaggregated tests at the industry level and confirms a powerful negative association between TFP growth and relative prices. For industries with well-measured data the summary coefficient of –0.965 is not significantly different from one.[23]

Price Effects

The net response of industry employment to productivity changes will depend on the responsiveness of demand to these price changes. If demand is elastic, i.e., if the percentage increase in the quantity demanded is greater than the percentage decline in price, lower prices could raise demand sufficiently to increase the demand for inputs. However, if demand is inelastic, fewer inputs may ultimately be required. Offshoring some parts of the manufacturing production process, for example, could similarly reduce the prices and thus increase the demand for the final goods that embody these services, and thus in theory, the demand for those employed in the remaining activities onshore could actually increase. Ultimately, therefore, the employment implications

21. The markup is generally a function of demand elasticity. As long as demand elasticity does not change, markups will be constant.

22. Actually, this assumes (Hicks) neutral productivity growth and that factor shares are the same in manufacturing and other sectors of the economy. More generally the definition of TFP in the dual is a share-weighted average of changes in factor prices minus product prices. Thus when there are two factors, labor *L* and capital *K* (both in logs) with wages *W* and rental rate *R*, $TFP = (S_l dW + S_k dR) - dP$, where *d* denotes marginal change, *P* is product price (in logs), S_l and S_k are the shares of labor and capital in costs, respectively, and $S_l + S_k = 1$. This implies that changes in product price $dP = TFP - (S_l dW + S_k dR)$. See, for example, Feenstra (2004, 125).

23. But he reaches different conclusions from ours about manufacturing.

of lower prices that reflect productivity improvements will depend on how spending responds.

Income Effects

We should note that productivity-driven changes in the employment intensity of production are only one side of the story explaining the declining share of manufacturing in total employment. Productivity growth raises national income and through this the demand for goods and services. And this increased expenditure is not necessarily allocated in the same proportions as the products already consumed. As economies grow, patterns of demand could shift and thus affect the composition of production and employment. For example, shifts in the pattern of demand from agricultural products to manufactured products and services during the industrialization stage of development in advanced economies contributed toward the movement of employment from agriculture to industry—known as Engel's law.[24] On the whole, however, differences in the income elasticity of demand for manufactures and services appear to be less of a consideration in explaining the decline in the share of manufacturing in employment. Cross-country estimates of the income elasticity of demand for services are close to unity (Falvey and Gemmel 1996). All else being constant, income growth alone should result in a constant share of services in expenditure (box 3.2).

Domestic Spending

We now shift our focus to the demand side of the ledger and consider what has happened to overall US spending on goods. While there is considerable debate about American prowess when it comes to production, no one doubts the ability of Americans to spend. Thus it is informative to ask how they have allocated their spending between goods and services.

To do this we have developed measures of total US spending on goods and services in both nominal and real terms. These measures reflect spending on finished goods by final purchasers and thus include more than just value added in US manufacturing and represent the variables that ultimately drive manufacturing employment. When they buy finished manufactured goods in the United States, consumers, for example, have to pay not only for manufacturing but also for the raw materials that are embodied in these goods and the distribution services required to bring the goods to markets. Moreover, they will buy not only goods that are produced in the United States but also those imported from the rest of the world.

The national income accounts data allow us to develop separate measures of US spending on goods and on services. We determine national expenditure on goods (i.e., $C + I + G$) by totaling the line items that are reported for

24. See Rowthorn and Wells (1987) and Rowthorn and Ramaswamy (1997).

Box 3.2 Productivity and real wages

We have shown that productivity growth has been relatively rapid in manufacturing and that this has for the most part been reflected in declining relative prices of manufactured goods. Michael Spence (2011) has claimed that this difference in labor productivity growth, which he ascribes to global supply chains, is an important driver of income inequality in the United States. But as one of us argued in Lawrence (2011), Spence's argument is seriously flawed and confuses product wages (i.e., wages in terms of what workers produce) with consumption wages (wages in terms of general buying power). Most of the additional productivity gains in US manufacturing did not take the form of higher wages or profits in manufacturing, which might cause inequality but instead were passed through to consumers in the form of lower prices. This means that while product wages increased more in manufacturing, consumption wages did not.

We do generally expect that wages measured in terms of what workers produce will increase with value added per worker. And in this sense, Spence is right. For example, if the price of computers falls rapidly because of improvements in productivity in the computer industry, the wages of workers in the computer industry measured in terms of computers will rise. But this change will not lead to increased wage inequality because the wages of workers who do not work in computers—say, hairdressers—will *also* rise in terms of computers. Indeed, since the invention of the scissors there has probably been no increase in the real value added per worker among hairdressers, but that has not stopped their real wages from rising together with similar workers employed elsewhere. This is basically the reason for Baumol's cost disease discussed in the main text, since it means that industries with slow productivity growth experience relative cost increases. We would expect that, especially over periods of more than a decade, workers with roughly similar general skills would tend to earn similar wages regardless of where they work. Using the data in Jorgenson, Ho, and Samuels (2010), we find that between 1960 and 2007 nominal value added per worker in the United States increased by 6 percent and 5.6 percent in manufacturing and the economy as a whole, respectively. This difference of 0.4 percent annually is considerably smaller than the 1.5 percent difference in the growth of real value added per worker in manufacturing and in the economy as a whole over the same period. And it should be noted that between 1960 and 2007, real value added per hour increased by 3.5 and 1.9 percent in manufacturing and the overall economy, respectively.[1]

1. William Nordhaus (2006, 19) similarly explores the relationship between productivity growth and wages in disaggregated industry data and finds effects that are either very small or negligible.

(1) personal consumption expenditure on goods, (2) private and government investment expenditure on equipment (and software), and (3) government consumption expenditure on goods.[25] Most of this spending on goods reflects personal consumption—on average, personal consumption expenditure accounted for 73.4 percent of overall US spending on goods between 1969 and 2010. We measure services expenditure by aggregating personal and government consumption expenditure on services. These measures of US domestic spending are thus inclusive of imports, but exclude exports.[26]

As illustrated in figure 3.6, there are powerful trends in the data. The top line shows the dramatic decline in the prices of goods relative to services over the period—by 100 log points over the 50 years or 1.95 percent per year.[27] If relative price changes for goods do move in line with relative changes in TFP, as is suggested by our earlier analysis, the quantity of goods grows at the same rate as the quantity of services, and if the United States were a closed economy or imports a constant share of value-added goods, this would imply a reduction in the relative demand for labor in the production of consumption and investment goods relative to services of around 1.95 percent per year. However,

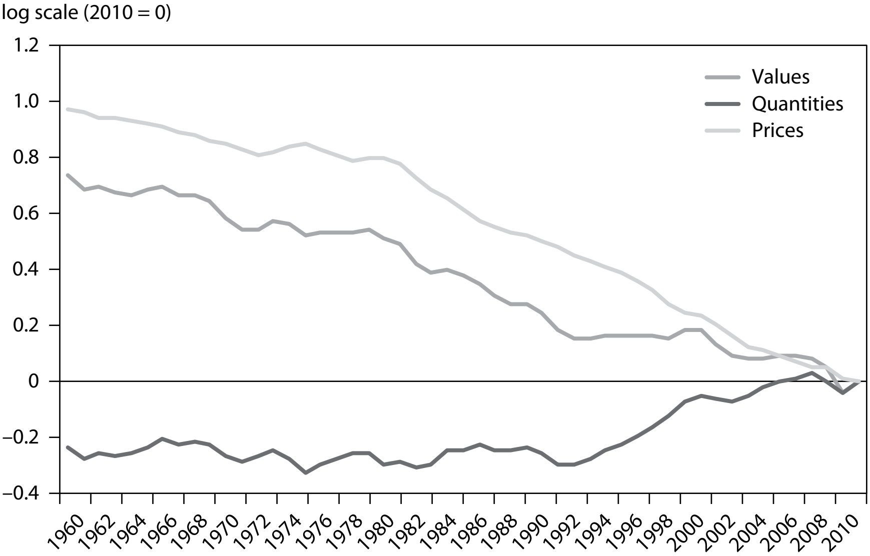
---

25. In the national accounts, government consumption expenditures are services (such as education and national defense) produced by government. One approach is therefore to treat all government consumption expenditure as a service. Our interest is to obtain the closest link between expenditure on goods and the production of goods. We therefore use Bureau of Economic Analysis (BEA) Table 3.10 and its subtables on Government Consumption Expenditures and General Government Gross Output to identify intermediate goods and services purchased as part of government consumption expenditure. The value-added component of producing government consumption expenditure is omitted, implying that our total measure of government consumption and investment expenditure is less (by value-added amount) than total government consumption and gross investment expenditure provided in the national accounts data. The BEA's Table 3.9 and its subtables are used to obtain government investment expenditure on equipment and software. Private and government investment expenditures on nonresidential and residential structures are excluded. Real values of aggregate expenditure on goods and services are constructed by deflating the nominal value with a share-weighted average price index constructed using the subcomponents of each expenditure item. See www.bea.gov (accessed on November 1, 2012).

26. US spending is on final goods and services. Spending on domestic final goods is therefore not equivalent to US production of goods. Goods produced by US firms are used as intermediate inputs in the production of final goods in other sectors of the economy, including services. For example, coal output is used in the production of electricity—a service. There is no direct expenditure by consumers or government on coal. Demand for US coal production is indirect through demand for electricity. In our analysis we use US spending on final goods relative to final services as a measure of relative demand for manufacturing production to services production. This could be problematic insofar as manufacturing inputs are used to produce services. However, according to the total requirement matrices of the 2005 US Input-Output Tables, the value added in manufacturing associated with $1 of US spending on final goods is 5.5 times higher than $1 of spending on services.

27. The goods prices relevant for *final* goods demand are not only those for the value added in the manufacturing process, but also the costs of wholesale and retail distribution and those of the primary commodity and services inputs that are used in goods production. Given the final demand for goods, therefore, the demand for manufactured goods will thus also reflect any changes in distribution margins.

Figure 3.6 US spending on goods relative to services, 1960–2010



Source: Bureau of Economic Analysis, www.bea.gov/iTable/index_nipa.cfm (accessed on November 1, 2012).

the quantity of goods consumed relative to services responded in part to these falling prices. As shown in the bottom line in the figure, while remaining flat until about 1992 and rising thereafter, the quantity of goods consumed relative to the quantity of services consumed increased over the period as a whole, but by only 24 log points (0.5 percent per year). The labor demand effect of the increase in quantity of goods consumed relative to services was therefore insufficient to offset the decline in relative labor demand associated with the relatively strong productivity growth in the goods sector.

All told, therefore, as captured by the middle line in the figure, dollar spending on goods relative to services has a strong downward trend. In combination, consumers, government, and investors have been devoting declining shares of nominal spending to goods relative to services.[28] In 1960, for example, US consumers were allocating half of all their spending on consumption to goods—50.3 percent. By 2010 that share had fallen to 33 percent. Similarly, US government consumption and investment expenditure on goods made up 61 percent of expenditure in 1960, but by 2010 this had fallen to 42 percent.[29]

---

28. Thus, even if the demand for goods is elastic, as found by Nordhaus (2005), if the income demand elasticity is less than one, the share in overall spending on goods and employment could fall over time.

29. Note that these shares are calculated using government investment expenditure on equipment and software and the intermediate goods and services purchased as part of government consumption expenditure.

The overall impact, inclusive of investment expenditure on equipment and software, was a decline in US spending on goods relative to services by 1.47 log points per year over the entire period.

This sluggish increase in the relative volume of goods purchased in the face of relatively rapid growth in productivity in manufacturing and declining relative prices implies that even if the US economy had had no trade, the share of employment in the production of goods would have fallen relative to employment in the production of services.

Investment

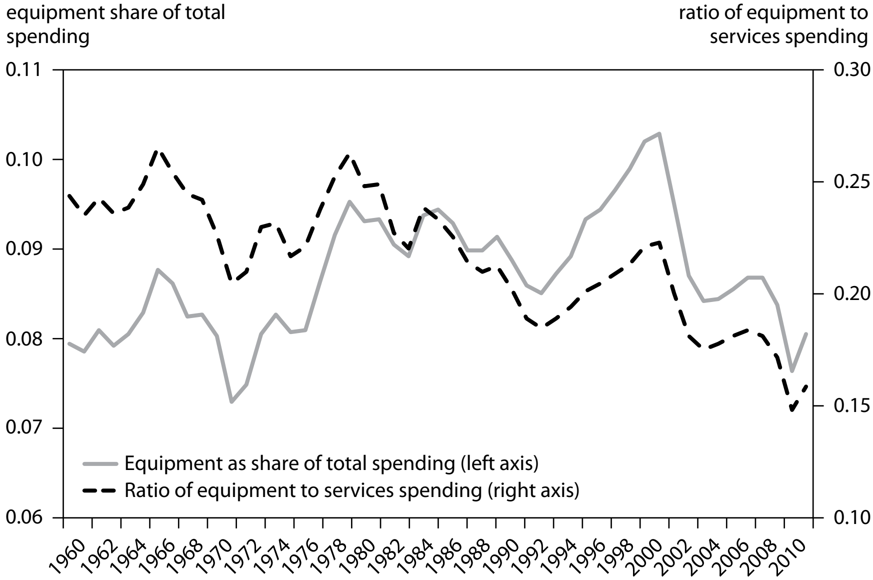
While the big picture is one of falling prices of goods and insufficient responses in quantities demanded to prevent expenditure shares from declining, this is not true of all periods, especially when it comes to investment spending. As shown in figure 3.6, in the 1970s, relative goods prices declined more slowly, and in the 1990s there were increases in the relative quantities of goods demanded. Indeed, for three-quarters of the 1990s, growth in the demand for goods relative to services was more than sufficient to offset the decline in the price of goods relative to services.

This can be attributed to investment expenditure on equipment and software in what became the dot.com boom. As can be seen in figure 3.7, an important source of this behavior is equipment spending, which is much more volatile than other spending. There were actually some periods when there were strong upward trends in relative spending on equipment—these took place in the 1970s and the 1990s and bolstered overall spending on goods in those periods. In the 1990s, spending on computers and other forms of information technology was especially strong, indicating that innovation can indeed spur demand sufficiently for employment creation. But even in the investment category overall between 1960 and 2010, a declining share of spending was allocated to goods. Over these 50 years, the drop in nominal spending by government and private investors on equipment relative to overall services expenditures was about 0.9 percent per year, and since 2000 and the bursting of the dot.com bubble spending on equipment has been particularly weak—its share in overall US spending fell by close to a half.

While these final spending numbers are indicative of the powerful role played by demand, the precise numbers we derive need to be treated with some caution. First, trade *has* taken its toll since the United States has had a growing deficit in merchandise (and manufacturing) trade in recent years. In addition, our use of final goods measures has not explicitly considered the role of distribution services in addition to manufacturing and raw materials production. Further, the relatively rapid growth in productivity in manufacturing could itself be related to increased import competition.[30] Without

30. Trade-induced changes in the composition of firms within industries, for example, have been an important source of overall productivity gains in US manufacturing sectors. See Bernard, Jensen, and Schott (2006).

Figure 3.7 Spending on equipment relative to total and services spending, 1960–2010



Note: Total spending is calculated as GDP + imports – exports.

Source: Bureau of Economic Analysis, GDP accounts data, www.bea.gov/iTable/index_nipa.cfm (accessed on November 1, 2012).

import competition, productivity growth in manufacturing may have been slower, which could have attenuated the decline in the share of manufacturing in total employment. But even this cursory look at the data points to a dominant role for demand patterns in explaining the decline in employment in goods in general and manufacturing in particular. Unless these spending patterns change dramatically, long-run trends in relative productivity growth will inexorably lead to the deindustrialization of the US economy in terms of employment.

In sum, by looking at spending on goods rather than production we have seen that an important reason for the declining share of manufacturing in the United States is that Americans have increasingly chosen to allocate smaller shares of their spending to goods. We have not attempted to estimate price and income elasticities or to explore the role of changes in distribution margins, but we can conclude from this evidence that in combination, spending responses to higher incomes and faster productivity growth have played a powerful role in US deindustrialization.

We should emphasize that by pointing to the role of inelastic demand and productivity growth we are not arguing that trade has played no role at all. The declines in manufacturing employment relative to services employment since 1980 have been about 2.7 percent per year. Thus there is room for trade to have played some role, but the productivity/demand story is significant, and even if trade had been balanced, the forces driving reduced demand for goods would have been powerful.

Finally, we should also observe that as our data on equipment and computers indicated, there have been some periods when the share of spending on goods has increased. Typically these spurts have been associated with the diffusion of new technologies. Thus another key lesson is that innovation in new products that consumers and firms want to buy could be important in forestalling or reversing declines in demand.

Did the Manufacturing Trade Deficit Play a Large Role in Manufacturing Employment Losses?

So far we have tracked US spending on goods of various kinds, i.e., $C + I + G$. But ultimately employment in manufacturing depends not only on employment due to domestic spending ($C + I + G$) but also on employment due to the trade balance ($X - M$). In what follows, therefore, we calculate the employment equivalence of the manufacturing trade deficit.

There is a widespread view that the dominant reason for declining manufacturing employment after 2000 was the growing trade deficit and jobs going abroad, so it is revealing to obtain a measure of the employment content of the manufacturing trade deficit. These estimates need to be treated with great care. This is an arithmetic exercise rather than a simulation with an economic model. We provide it simply to give a sense of the order of magnitude of the jobs embodied in the manufacturing trade balance.[31] As our discussion in chapter 1 emphasized, the trade deficit is an outcome, not a cause. And thus the estimates we obtain here only indicate after the fact the manufacturing employment equivalence of the manufacturing trade deficit and do not accurately capture the number of manufacturing jobs that might be added if the deficit was actually to be closed in one way or another.

Indeed, in practice the impact on manufacturing employment would depend on exactly how the deficit was reduced. We can give two examples with very different implications. First, assume there is a recession in the United States that reduces manufacturing imports and thus the employment content of the smaller trade deficit. If the recession was caused by less US spending on manufactured goods, even though the "contribution" of the trade deficit would now be smaller, this might be more than offset by the negative contribution of domestic spending, and thus overall manufacturing employment might fall. Second, assume the manufacturing deficit declined because exports increased due to faster foreign growth, for example. In this case, total manufacturing employment would rise not only because of the direct impact

31. An earlier calculation along these lines is provided by Martin Baily and Robert Lawrence (2004).

of more exports but also because of the additional domestic spending due to the multiplier effect. Moreover, since such spending would also increase imports, the changed employment equivalence of the trade deficit after the fact could seriously underestimate the impact of "trade," i.e., the impact of export growth on employment.

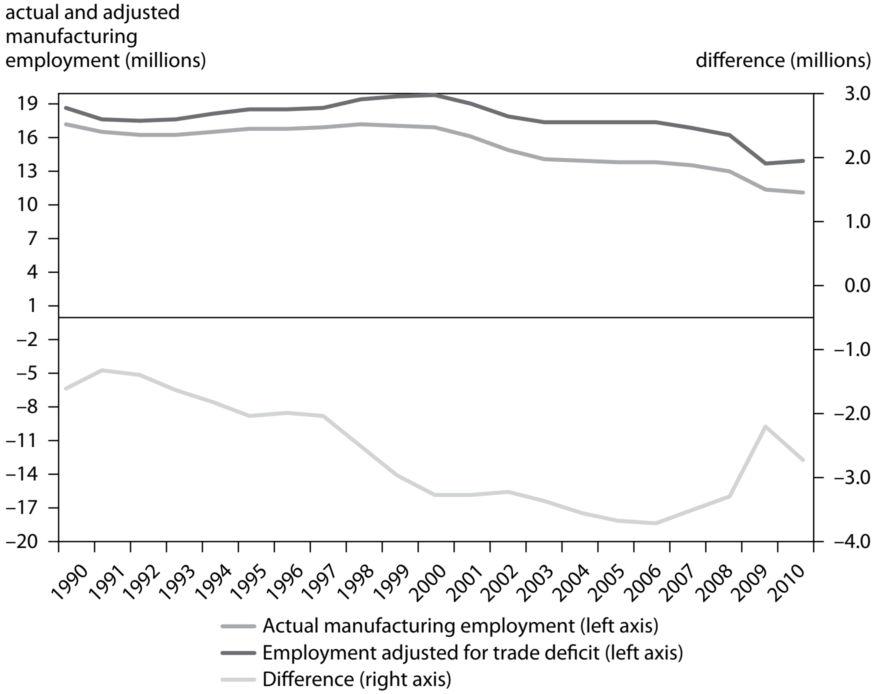
To carry out the estimation we assume that in the industries in which the United States ran trade deficits domestic expenditure is reoriented toward domestic products such that the deficit is eliminated. Similarly we assume that in industries in which the United States ran trade surpluses, exports and domestic production would have been reduced so that they matched imports. We thus add the employment content of the trade balances in the manufacturing industries in which the United States had deficits and subtract the employment content of the trade balances in industries in which the United States had surpluses. We also assume that labor productivity growth would have been the same as was actually experienced in each industry (and those that supply it).

To undertake this analysis we use the annual Input-Output Tables produced by the US Bureau of Economic Analysis to link the changes in US spending to production (value added) in the US manufacturing sector. We use the tables to take account of not only the direct output effects of eliminating the deficits (or surpluses) in manufacturing, but also the indirect effects on output in other manufacturing sectors. Given the changes in sector output we can then estimate the employment equivalence using the nominal employment/output ratios in each year.[32]

Figure 3.8 shows actual manufacturing employment and an employment series that adds back the employment equivalence of the manufacturing trade deficit over the period from 1990 to 2010. This period coincides with a strong increase in the manufacturing trade deficit up to 2006/2007, a narrowing of the deficit during the global financial crisis of 2008 and 2009, and a rise as the economy began to recover in 2010. In 1990, the manufacturing trade deficit was equivalent (both directly and indirectly) to 1.65 million full-time equivalent jobs in manufacturing. This rose to 3.3 million jobs in 2000 with the

32. To develop the calculations, we construct nominal net export values for 19 manufacturing sectors using export and import values obtained from the annual Input-Output Tables (after redefinitions) for 1998–2009. Trade data from 1990 to 1997 are obtained from Feenstra, Romalis, and Schott (2002) and for 2010 from the US International Trade Commission. These data are adjusted to the equivalent prices in the Input-Output Tables using the implicit margins derived from the input-output-based trade data. The manufacturing GDP content of net trade in manufacturing is then calculated using the Input-Output Tables for 2005. To capture the indirect effects, we construct a domestic use table using the Total Requirements Table for 2005 and the Use and Make Tables. We do not use the total output requirements matrix, which estimates the total goods and services required from both domestic and foreign sources adjusted to meet final demand, because we are interested in the impact on US production only. Finally, the employment content is calculated using nominal GDP per worker obtained from the BEA GDP by Industry Data Tables, www.bea.gov/industry/gdpbyind_data.htm (accessed on November 1, 2012).

Figure 3.8 Manufacturing employment, actual and adjusted for manufacturing trade deficit, 1990–2010



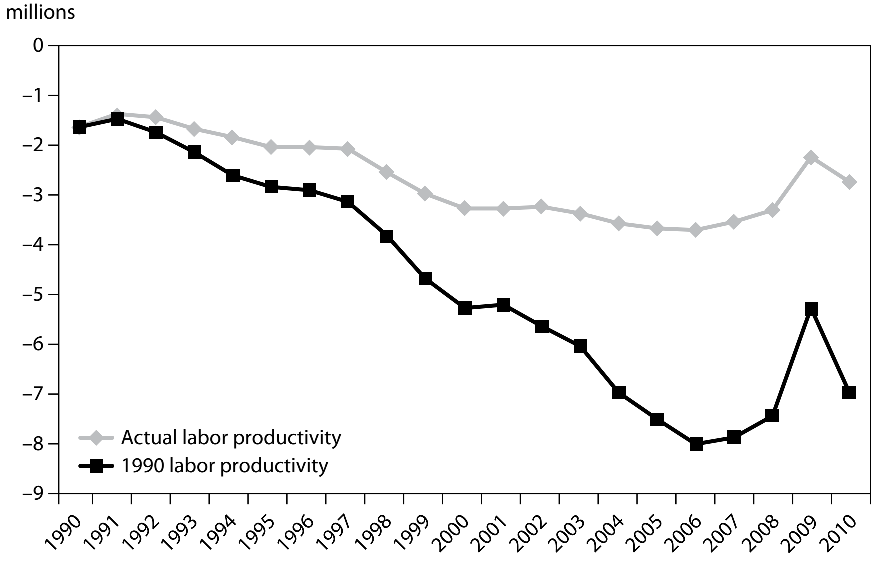
Note: Estimates include the direct and indirect employment (full-time equivalent) effects in manufacturing, calculated using the 2005 Make and Use Tables of the Bureau of Economic Analysis, www.bea.gov/iTable/index_nipa.cfm (accessed on November 1, 2012).

Source: Authors' calculations using data from the Bureau of Economic Analysis and Bureau of Labor Statistics.

sharp increases in the manufacturing trade deficit. As a percentage of actual manufacturing employment, adding the jobs equivalent to the deficit raises manufacturing employment by 10.4 percent in 1990, 20 percent in 2000, 26 percent in 2007 just prior to the financial crisis, 20 percent in 2009, and 26 percent in 2010 as the economy began to recover.

However, another revealing feature of the series is that the rise in the manufacturing trade deficit basically had very little impact on the total job equivalence of the trade deficit between 1998–99 and 2010. This conclusion is surprising. After all, despite the recession, the trade deficit in manufactured goods in 2010 of $644 billion was far more than twice the $256 billion deficit in 1998. But the manufacturing employment equivalence of the $256 billion deficit in 1998 was 2.5 million, whereas the employment equivalence of the $644 billion deficit in 2010 was only marginally higher at 2.7 million.

Figure 3.9 Manufacturing job (full-time equivalent) content of manufacturing trade deficit, actual productivity versus 1990 productivity, 1990–2010



Note: The 1990 value added per worker is adjusted for inflation using the sectoral GDP deflator.

Source: Authors' calculation using data from the Bureau of Economic Analysis and Bureau of Labor Statistics.

The explanation for this paradox is that productivity growth in manufacturing was extraordinarily rapid over this period. Thus, over time any given trade balance translates into fewer jobs. As shown in figure 3.9, which compares the manufacturing job content of the manufacturing trade deficit using actual labor productivity and constant 1990 labor productivity, faster productivity growth (real GDP per worker) had a very large impact on the employment equivalence of the manufacturing trade deficit over time. Indeed, at 1990 productivity levels the deficit in 2007 would have represented about 8 million jobs.

Two other interesting results are revealed by the data. First, while manufacturing employment is higher if the jobs embodied in the deficit are added to domestic production, the trends and timing of changes in manufacturing employment growth over the past decade are not very different. Both series indicate large drops in employment between 2000 and 2003 and between 2007 and 2009, demonstrating the powerful role of recessions rather than trade deficits as the major reason for the timing of the job loss. Clearly both series are heavily influenced by the combination of domestic demand and productivity growth that we identified earlier.

Table 3.3 Manufacturing employment content of the manufacturing trade deficit, 1990, 2000, and 2010 (thousands)

Category	1990	2000	2010
Wood products	30	112	62
Nonmetallic mineral products	46	79	65
Primary metals	109	209	177
Fabricated metal products	82	190	200
Machinery	20	63	13
Computer and electronic products	130	500	375
Electrical equipment, appliances, and components	34	110	127
Motor vehicles, bodies and trailers, and parts	294	371	422
Other transportation equipment	–181	–109	–156
Furniture and related products	46	120	115
Miscellaneous manufacturing	171	256	162
Food and beverage and tobacco products	10	33	45
Textile mills and textile product mills	104	166	177
Apparel and leather and allied products	672	950	751
Paper products	38	46	26
Printing and related support activities	3	16	18
Petroleum and coal products	7	21	5
Chemical products	0	98	90
Plastic and rubber products	44	79	94
Total	1,660	3,312	2,770

Note: The figures refer to full-time employment content of net exports in manufacturing. Trade data from 1990 to 2006 are obtained from Feenstra, Romalis, and Schott (2002). Estimates include the direct and indirect employment effects in manufacturing, calculated using the 2005 Make and Use Tables obtained from the Bureau of Economic Analysis. The results for 2010 are not presented as the sector-level employment data are not available. The total figures do not equal the sum of the components due to rounding.

Source: Authors' calculations using data from the Bureau of Economic Analysis and Bureau of Labor Statistics.

Second, after 2006 the gap between the two series—shown as a third line at the bottom of figure 3.8—narrowed considerably from 3.7 million in 2006 to 2.3 million in 2009. This suggests that "trade" actually boosted rather than reduced manufacturing employment opportunities during the 2008–09 recession. With recovery in 2010, the difference increased again back to about 2.7 million but still remained 1 million below the 2006 peak.

We also calculate the effects across sectors—these results are presented in table 3.3. There are substantial differences in the levels and trends of the sectoral trade balances over the period. The rise in the deficit in apparel was particularly high. If the employment content of the apparel trade deficit had been added back, employment in this sector would have been 950,000 higher in 2000 and 751,000 higher in 2010.

Another sector driving the overall trend in the manufacturing trade balance is computer and electronic products, where balancing of trade would have raised employment by approximately 500,000 jobs in 2000, but because of rapid productivity gains a lower 375,000 jobs in 2010. In other sectors, the employment equivalence of the manufacturing trade deficit in 2010 was equal to 177,000 in both textiles and primary metals, 422,000 in motor vehicles, 200,000 in fabricated metal products, and 162,000 in miscellaneous manufacturing. In many sectors, however, labor productivity growth exceeded the growth in the trade deficit, leading to a decline in the manufacturing employment content of the deficit from 2000 to 2010. The overall employment content of the deficit in 2010 was therefore lower than that of 2000.

Offshoring

In US policy discussions, the offshoring of US jobs by multinational companies is often given considerable attention and widely believed to be a major reason for declining US employment in manufacturing—especially since 2000. Indeed, offshoring was an important focus of the 2012 presidential campaign.[33] But how significant has the relocation of US manufacturing jobs to the foreign plants of US-owned firms actually been as a reason for declining US manufacturing employment? It requires an extensive study. But as a starting point, we can use the data on employment in the foreign affiliates of US-owned manufacturing multinationals.

According to the Bureau of Economic Analysis, which surveys US multinationals, between 1999 and 2009, employment in majority-owned foreign manufacturing affiliates increased from 4.58 million to 5.22 million—by 638,000—most of which was added in Asia and the Pacific.[34] In 2009, according to the same survey, in the United States, employment in the manufacturing parents of these affiliates amounted to 6.898 million.[35] In other words, even if every job added abroad since 2000 had instead been added in the United States, employment in these companies would have been only 9.25 percent higher than it actually was. Indeed, the additional 638,000 jobs amount to 11 percent of the overall loss in manufacturing employment between 1999 and 2009. Moreover, this is surely an upper-bound estimate of the jobs that were actually lost because (1) typically US workers are more productive than workers in developing countries and thus fewer workers would have been required to produce the same amount of sales; and (2) some of the jobs that were added abroad were devoted to servicing foreign markets that could not have been serviced by producing in the United States.

Conclusions

In sum, over the past decade, the decline in US manufacturing employment has been rapid, but it has been roughly in line with what would have been

33. See, for example, www.factcheck.org/2012/10/talking-tax-breaks-for-offshoring.

34. See Barefoot and Mataloni (2011, 35, table 4).

35. See Barefoot and Mataloni (2011, 39, table 6).

expected, given the slow overall employment growth. Even though productivity growth has been relatively rapid in manufacturing and goods have become cheaper, Americans (and consumers in other industrialized countries) have allocated ever smaller shares of their income growth to buying consumer goods and equipment. At times larger manufacturing deficits have contributed to lower manufacturing employment, but manufacturing's declining share in the economy reflects a particular combination of domestic demand patterns and productivity growth rather than a major role for trade. Rapid productivity growth in manufacturing implies that over time, the job equivalence of any given trade deficit declines.

It seems appropriate to end this chapter with another metaphor—that of an escalator. Boosting US employment in manufacturing by closing the trade deficit is like trying to walk up an escalator that is moving down. Closing the trade deficit—say, by increasing US exports of manufactured goods—would provide a one-time boost to manufacturing employment. But eventually, if the past is prologue, the combination of strong productivity growth and the income- and price-inelastic demand for goods would take over and the share of employment in manufacturing would likely resume its decline.

This is what we have seen happen even in the industrial countries with large trade surpluses, such as Germany. So while manufacturing employment growth may be required for a robust US recovery, over the long run US demand and productivity patterns are unlikely to change. Thus, unless the United States runs ever larger trade surpluses, or there is a fundamental change in demand and productivity patterns, the declining trend in the share of manufacturing employment is likely to continue. The only way to permanently reverse these trends would be to continuously come up with new innovative products that consumers and purchasers of equipment wish to buy. But absent this, Americans seeking good jobs will increasingly have to find them in sectors other than manufacturing.

There are claims that the United States will not be able to achieve full employment unless it creates more jobs in manufacturing. Spence (2011), for example, suggests the constraint will be insufficient domestic demand for services. Andrew Liveris (2010) claims the services sector alone cannot create enough jobs. But recent history is different. Demand has shifted increasingly to services, and while some rise in manufacturing employment is likely to accompany a rebound in aggregate employment, over the longer run it is likely that the contribution of manufacturing to overall employment growth will be modest. As has been the case in the recent past, most of the jobs of the future will be in the services economy.