

# CHAPTER Dd

## Manufacturing

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### MANUFACTURING

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Manufacturing is an economic activity that combines human effort (labor) with physical plant and equipment (capital) to transform raw materials into products that are neither available in nature nor resemble the various materials from which they were fabricated. At its most rudimentary level, this may require human skill and effort using only hand tools, and when this is so, it is referred to as craft or artisan production. At its most advanced and sophisticated level, manufacturing integrates a complex set of human skills (including managerial and entrepreneurial abilities) with automated techniques. Thus, although “manufacturing” literally refers to manual fabrication of goods, today’s industrial production extends far beyond that original definition. We may generalize as follows.

Manufacturing differs from agriculture because its *process* is not essentially biological. It is distinguished from services in that the *product* is tangible. Certainly there are numerous exceptions to these general rules – the manufacture of cheese or butter, for example, or the manufacture of many industrial gases – but they suffice for the majority of cases.

Some manufactured products, classified as “consumer goods,” are used by buyers in the form in which they leave the factory. Certain of these – those with life expectancies longer than three years – are called “durable goods.” These include products such as automobiles, computers, and refrigerators. Others are considered consumer “nondurable” goods – products such as a loaf of bread or a pair of shoes. Still other products are manufactured not for immediate use by consumers but rather are created as inputs or components for other goods. These “intermediate” goods – steel, glass, or plastic parts, for example, may be used to produce an automobile. Finally, some manufactured output, referred to as “capital goods” or “producers’ goods,” provides machines and equipment for use in creating consumer goods or intermediate products. The pace and pattern of manufacturing development, the innovation and adoption of specific technologies, shifts in organizational structure, and the impact of manufactures on the growth and development of the American economy have all been subjects of extensive scholarly literature over the years. Key historical documents include works by Coxe (1814), Bishop (1861), Depew (1895), and Clark (1916–1928). Key works of modern synthesis are Porter (1973),

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Chandler (1977), Cochran (1977), Bruchey (1990), and McGaw (1994).

### Early Manufacturing

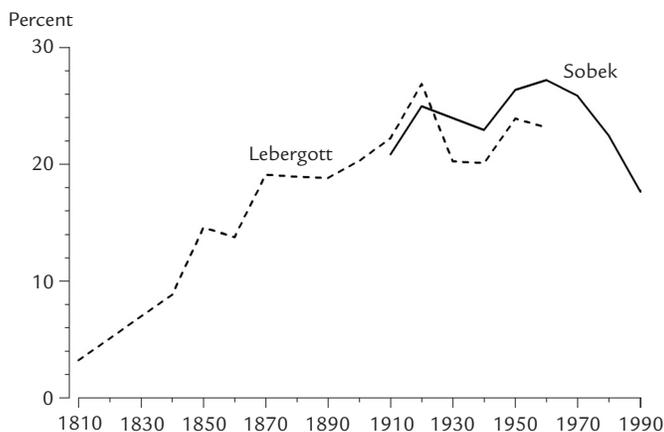
In his celebrated book *The Wealth of Nations*, the economist Adam Smith asserted that “the most opulent nations, indeed, excel all their neighbors in agriculture, as well as in manufacturing, but they are eminently more distinguished by their superiority in the latter than in the former.” The United States’ founders held divergent opinions on this issue. Alexander Hamilton, for example, tended to agree with Smith that a truly “developed” economy should have sectoral diversity that included manufacturing as well as agriculture. Indeed, he viewed manufacturing as the key to high levels of per capita income. Thomas Jefferson disagreed. He wrote, “Let the factories remain in Europe,” distant from the rural, agricultural arcadia that he favored for the new nation. Jefferson’s agrarian vision initially seemed compelling. Rich in land and other natural resources, and attractive to immigrants who had been farmers in their native lands or aspired to be, the early United States appeared destined to become and remain an agricultural nation, a consumer rather than producer of manufactures. Cultural and political attitudes fostering family farming as “a way of life” reinforced this economic tendency – what economists call “comparative advantage.”

It was not that colonial America totally lacked industry. Shipbuilders on the New England shore thrived, converting lumber and other natural materials into ships sold abroad. Flour and lumber mills were present along the Eastern seaboard and supplied domestic and foreign markets. Craft shops making silverware, shoes, decorative objects, and other items could be found in cities such as Boston or New York. Itinerant craftspeople wandered the rural countryside selling pots, pans, and similar basic items. But the most ubiquitous industrial form was household manufacturing – individuals producing, literally manufacturing, their own clothing, furniture, soap, and other necessities of colonial life for use by and within the family. Farmers occupied themselves and their families in such manufacturing activities until well into the national period during their off-season, which, in the colder northern latitudes, could be lengthy. For quantitative evidence on the extent of this home manufacture, see Tables Ba4999–5081.

Between the American Revolution and the Civil War, however, industrial stirrings became increasingly more pronounced. An early impetus was provided by the interruption of trade that cut off Americans from access to English goods during the American Revolution and again during the Jeffersonian Embargo and the War of 1812. As a result, the new nation began to experiment with domestic manufacturing, often within households, but increasingly

for market sale by dedicated artisan shops, manufactories, mills, and factories. The textile mill of Almy and Brown established in 1790 in Pawtucket, Rhode Island, which pioneered the use of British textile machinery introduced by Samuel Slater, is one example. Indeed, after the Embargo of 1807 threatened to deprive the nation of much-needed manufactures, the House of Representatives passed a resolution requesting that Treasury Secretary Albert Gallatin report on how best to foster domestic industry. Gallatin protested that he did not have the resources to comply but noted that the Third Census would afford an ideal opportunity to collect the necessary information. Congress agreed and amended the act for the Third Census on May 1, 1810 – just three months before it was to be conducted – requiring that the enumerators render an accounting of the manufacturing establishments and their production in their districts according to whatever instructions the Secretary of the Treasury might give. Unfortunately, Gallatin gave them little direction about how this should be done, or even what questions should be asked. Enumerators, nevertheless, tried to discharge their duties to the best of their individual abilities, and the task of making sense of the resulting imperfect data fell to Tench Coxe (Coxe 1814). Despite the obvious inconsistencies in the underlying data, Coxe's efforts to present and interpret them have been praised by subsequent generations.

Perhaps a more far-reaching venture than Almy and Brown's was the establishment by Francis Cabot Lowell of the Boston Manufacturing Company – the first integrated spinning and weaving cotton mill – in Waltham, Massachusetts, in 1813. After the War of 1812, manufacturing at first faltered, but by the 1830s it had recovered, and by 1860 most settled areas had some manufacturing producers. The ups and downs of manufacturing initiatives during the period are nicely illustrated by data on new business incorporations in manufacturing, as shown in Table Ch330–379. The positive effects of the Embargo and War of 1812, the devastating effect of increased imports of cheap foreign manufactured goods following the peace, and the subsequent recovery and development of industry are all evident. Lebergott estimates that fully 14 percent of the labor force was engaged in manufacturing by the end of the antebellum period (Figure Dd-A).



**FIGURE Dd-A Manufacturing as a percentage of total employment: 1810–1990**

**Sources**

1810–1960: series Ba821 as a percentage of series Ba814. 1910–1990: the sum of series Ba657–658 as a percentage of series Ba652.

Although the older areas of the Northeast were home to some large (even by today's standards) cotton textile plants and iron-works, most manufacturing operations of the period were small businesses that served nearby local markets where they faced little competition. Few produced more than a limited range of products, and fewer still operated more than one plant, especially in separate locations. In the slaveowning South, however, even this rudimentary manufacturing was often absent (Bateman and Weiss 1981).

At the middle of the nineteenth century, most manufactured output originated in just five industries: flour and grist milling, lumber milling, textiles, iron and steel, and leather. All of these industries involved the processing of raw materials, which were relatively abundant in the American environment of the late eighteenth and early nineteenth centuries. It is also interesting that all of these industries were dramatically reduced over the subsequent century or were reclassified out of manufacturing. Measured in terms of tons per capita, flour and grist milling peaked about 1890 (series Aa7 and Dd368). The second largest industry at that time, lumber milling, is no longer classified as manufacturing, nor is blacksmithing, which in the antebellum period produced many of the nation's agricultural implements, wagons, and carriages as well as shoeing its horses. Details of the evolution of American manufacturing by industry group can be seen in Tables Dd366–436 and Dd561–625.

At the forefront of industrial innovation were factories – manufacturing establishments powered by inanimate sources – which were well established outside of the textile industry from New England west to Indiana by 1850. Some produced items such as clocks and guns, using interchangeable components to produce standardized products in what became known as the “American System” (Hounshell 1986). Despite the productivity gains from this method of manufacture, however, most manufactured goods produced in the antebellum period still originated in small local artisan shops or mills (Sokoloff 1984; Atack 1987).

The first comprehensive Census of Manufacturing was conducted in 1850. It revealed the aggregate value of industrial production was about one billion dollars, considerably below that of farming. At the time, there were almost 1.5 million individual farms, but only 123,000 industrial establishments employing slightly fewer than one million workers from a total national population of 23.2 million and a labor force of perhaps 8.25 million. Just three states – Massachusetts, New York, and Pennsylvania – accounted for 53 percent of all manufacturing capital and 54 percent of national manufactured output.

Power used to manufacture goods remained predominantly traditional until after the Civil War. Small shops and mills initially relied on human or animal power to convert raw materials from farms or mines into finished goods. Even larger, older, and more advanced enterprises in New England utilized the most ancient form of inanimate motive power, water, albeit using increasingly efficient and powerful water turbines in place of the traditional waterwheel. From the standpoint of locational choice, the availability of exploitable water power provides a major explanation for the earliest emergence of factories in that region, where natural waterfalls and waterways were abundant. Steam power was used only rarely until cheap coal could be shipped from Pennsylvania and Virginia (Hunter 1979; Atack, Bateman, and Weiss 1980).

Technology was equally simple and traditional. Hand tools continued to be used in shops as they had for centuries. Moreover, even where technology had become more complex – among Eastern

textile producers, for example – it remained based on machines made of wood and employed belts made of leather, both abundant products closely related to the country's natural resource base.<sup>1</sup>

### Manufacturing after the Civil War

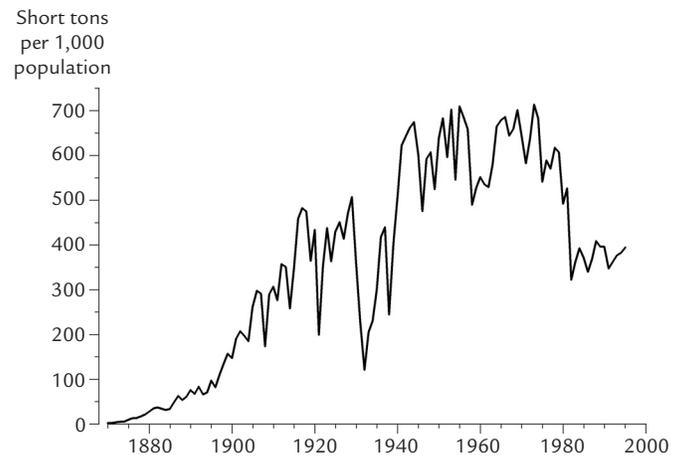
During the Civil War, the industrial sector remained small outside of the Northeast. The war did not rely heavily on complex technology, so even the relatively unindustrialized Southern states could survive militarily for several years. Still, more basic issues such as clothing and feeding a large army created challenges. Overall, however, there is relatively little evidence that the war significantly stimulated or accelerated industrial change (Engerman 1966).

After the war, however, the nation embarked on its “Golden Age of Manufacturing.” Virtually no segment of the American economy was left untouched. Steel produced in increasingly large Bessemer blast furnaces concentrated in just a few locations displaced iron made in small furnaces throughout the countryside. The confluence of the railroad, which began to create a national market, new technologies based on steel, and an expanded use of the corporate form led the nation into “the age of big business.” A measure of the rising importance of steel production is displayed in Figure Dd-B, which graphs raw steel production per capita. Over the three decades beginning in 1870, this measure rose by more than a factor of 75. Other big business–related industries – tobacco, food processors and meat packers, chemical firms, and oil refiners – grew apace. Overall, manufacturing value added, in real terms, grew 660 percent between 1870 and 1900 (see Table Dd1–12).

The “modern business enterprise,” as historian Alfred D. Chandler refers to it, lay at the center of this industrial transformation as manufacturing became large-scale, corporate, and national (Chandler 1977). Energy intensity also increased dramatically as manufacturers used higher pressures and temperatures in conjunction with mechanical conveyances to accelerate production. The first data quantifying the importance of the corporate form in manufacturing became available in 1899 and 1904. Even at these early dates, already 65 percent of manufacturing value added and 70.6 percent of manufacturing employees, respectively, were associated with manufacturing establishments owned by corporations, although they represented only a small fraction of the nation's manufacturing firms (see Table Dd903–904). The merger movement of the 1890s created many highly concentrated industries (Lamoreaux 1985). One measure of industrial concentration, or monopoly power, is the percentage of value added created by the four largest firms in an industry. For manufacturing in 1901, this figure stood at 32.4 percent, with individual industries ranging from a high of 100 percent in rubber to a low of only 0.5 percent in lumber and timber products (see Table Dd895–902).

Technological change also exerted more influence, as the pre-war factory system blended into the corporate organization to serve a huge American market. Manufacturing output began to expand drastically, and the nation left behind its former agriculturally dominated economy and its small-scale, locally oriented industrial sector. The decade of the 1870s saw the United States abandon its old manufacturing forms to embark on becoming the world's industrial leader. This industrialization brought mass production to the mass

<sup>1</sup> For a detailed and highly readable account of manufacturing during the antebellum era, see Bruchey (1990), Chapter 5, pp. 137–64.



**FIGURE Dd-B Raw steel output per 1,000 population: 1870–1995**

#### Sources

Series Aa7 and Dd399.

market. Even the “populist revolt” that occurred during the last third of the nineteenth century could not stop this transformation.<sup>2</sup> Industrialization nevertheless brought with it new problems such as pollution and exacerbated the social evils and extent of unemployment.

### Manufacturing at the Turn of the Twentieth Century

The industrial transformation was swift: the modest manufacturing sector of 1850 had evolved into a complex multiplant, multiproduct producer of manufactured goods by 1900. Factories using new types of machinery and new power sources – steam and centrally generated electricity – were mass producing a wide variety of products in an industrial belt extending from southern New England to the Great Lakes (Hounshell 1986; Hunter and Bryant 1991). Chicago and nearby Gary, Indiana, where America's newly created largest industrial corporation, U.S. Steel, was headquartered, became the Western metropolis for this new industrial age (Meyer 1989). Even agriculture industrialized rapidly, adopting mechanical farm implements produced by Midwestern manufacturers and becoming increasingly reliant on the manufacture of chemical fertilizers (Atack and Bateman 1987). The resultant rise in agricultural labor productivity – output per labor hour – permitted more people to work in manufacturing without any diminution in the nation's food supply.

America had become the land of big business, an industrial economy comprising huge corporations mass producing standardized products for a national market. No product better symbolized this system's success than the automobile, a product that epitomized the nexus of mass production, consumer goods, and corporate organization. When Henry Ford adopted assembly-line techniques for producing a low-priced product, he brought together elements of the manufacturing sector that had individually evolved over the previous century. His product transformed American society profoundly. By 1929, the auto industry was the nation's largest

<sup>2</sup> For an influential and authoritative account of organizational change during this period, see Chandler (1977). See Lamoreaux (1985) on the merger movement of the 1890s.

industry (Davis 1988). Many scholars consider the automobile the single most influential manufactured product of the twentieth century (see Cochran 1957; Flink 1970).

The Great Depression of the 1930s caused a massive setback to the nation's industrial economy. Manufacturing production shrank dramatically, particularly for consumer durables such as the automobile and consequently for inputs used in its production such as steel. As industrial production declined, unemployment reached 25 percent of the national workforce. The Depression engulfed virtually every economic activity and was perceived as a massive failure of the nation's industrial system. Employment and output in manufacturing declined more than in other sectors of the economy. Particularly hard hit was the manufacture of consumer durables as households postponed their purchases of items such as automobiles, refrigerators, and other household appliances.

The nation's factories and its experienced labor force were still there, of course, and they were fully reemployed (and expanded) during World War II, a military conflict that relied heavily on industrial capacity. During the war, the manufacturing system attained new heights in output and productivity. Interchangeable parts, standard design, and the techniques of conveying products in assembly from work station to work station converted shipbuilding from a craft to a factory process with the production of more than 2,500 "Liberty" ships by shipyards that could turn out one ship in as little as 5 days (the *Robert E. Peary*) and where productivity grew at an average annual rate of 40 percent for three years (Thornton and Thompson 2001). Table Dd494–497 displays several indices of industrial production, all of which clearly show the dramatic decline during the Great Depression and its recovery and growth during World War II. Among the notable changes during this military conflict was the widespread employment of women workers in industries, such as shipbuilding, where none had been employed previously (Hartmann 1982, Chapter 5).

America emerged from World War II as the world's strongest economy and the leading producer of manufactured goods. In the early postwar era, products previously unknown or greatly improved burst onto the American market. From kitchen appliances to television receivers, new and attractive manufactured products appeared on the scene, most reliant on the spread of electricity to the home and a new spirit of optimism among increasingly wealthy consumers. After some twenty years of austerity and with large savings accounts created by overtime war-related work, pent-up demand increased the demand for manufactured products. Automobile production resumed its pre-Depression trend, as Americans replaced their aging cars, and as two-car household ownership became common. Manufacturers continued to serve the national consumer market virtually nonstop through the 1960s. The indexes of industrial production in Table Dd494–497 show the strength of this rapid and long-lasting expansion.

The 1970s marked a turning point for U.S. manufacturing. In particular, sharply higher oil prices rendered much of the nation's technology, which had evolved during decades of abundant and therefore low-priced energy, economically inefficient. Postwar industrial growth and the technology that lay behind it relied on a continuous flow of inexpensive energy, particularly that provided by petroleum. What economists term the "oil shock" broke that continuity, raised many industrial prices, and fundamentally altered the "rules of the game" for manufacturing. The remarkable rise in fuel oil prices in the 1970s is shown in series Cc25.

Prompted by the rise in gasoline prices, American consumers shifted their automobile purchases away from American-produced "gas guzzlers" toward the fuel-efficient cars produced by European and Japanese automakers. The effect on the economy was profound, as about 5 percent of the economy depended directly or indirectly on the auto industry.<sup>3</sup> At the same time, American manufacturers found themselves forced to deal with new environmental regulations. Traditional "smokestack" industries, epitomized by automobiles and steel, were particular targets. Manufacturing eventually began responding to the changed competitive environment and was reborn. "Downsizing" was among the first visible signs, as companies reduced their labor forces and substituted machines for people. No single new technology was more important in this transition than the computer. Automated factories, robotics, "just-in-time" inventory, and a host of other computer hardware and software innovations changed the way manufacturers operated and helped restore their competitiveness during the final two decades of the twentieth century. Both blue-collar and white-collar labor productivity grew as a consequence of new technologies and business reorganization. Better information systems, for example, reduced inventories and goods in process, and marketing was better able to identify and meet localized demand. By the turn of the century, American manufacturing had once again been transformed to meet new market realities.

Some observers viewed downsizing with alarm, suggesting that the United States was losing its industrial base. In terms of sheer numbers on the payroll, manufacturing employment peaked in the late 1970s. Since then, about 2.5 million jobs have disappeared in manufacturing, and numbers on the payroll have declined almost 15 percent (see series Dd661 or series Ba843). In terms of relative employment share, manufacturing peaked during World War II, when it employed about 40 percent of the nonagricultural workers, compared with less than 15 percent today. On the other hand, industrial production has generally risen (despite periodic downturns) and is now about 75 percent higher than it was at its employment peak in the late 1970s – evidence of rapid productivity growth in the manufacturing sector (see, for example, series Dd498). Nonetheless, despite this growth in manufacturing output and the sharp gains in productivity, other sectors have grown even more rapidly. As a result, the United States is relatively less industrial than it once was, and the manufacturing share of gross domestic product (GDP) has fallen from about 30 percent during the early 1950s to about 16 percent today.

The industrial product mix has also changed over the years, from the earliest days when small local manufacturers provided simple goods to predominantly rural buyers to the era of globally mass-produced consumer goods epitomized by the automobile to more recent production of consumer electronics and computers. In the 1950s, "Made in America" on a well-known brand meant just that: made in America. More recently, a purchaser might find that the "domestic content" – that portion of the product actually manufactured in the United States – might well be much less than 100 percent. An American brand of computer, with American-designed components manufactured into subassemblies in countries throughout South America, Africa, and Asia but assembled in the United States and controlled by an American-designed and

<sup>3</sup> See, for example, the Internet site of the Center for Automotive Research at the University of Michigan.

American-produced central processing unit, is an exemplar of the trend. Increasingly, manufactured goods have become multinational both in production and sales. Although many of the highest value-added activities remain on U.S. shores, less rewarding (or more polluting) activities are increasingly performed elsewhere.

### **Manufacturing Statistics and Sources**

For the nineteenth century, the primary source of data on U.S. manufacturing comes from censuses (Fishbein 1973). In 1810, 1820, 1840, and every ten years thereafter, the Census of Manufactures was taken as a part of the decennial Census of Population required by the U.S. Constitution. The 1810–1840 Censuses had problems in geographic coverage, the range of industries embraced, and the level and economic sophistication of the questions asked, so the first truly comprehensive Census of Manufactures was not conducted until 1850. Thereafter, the economic component of the decennial census increased in precision and detail. The timing of the Census of Manufactures changed beginning in 1904, when they were collected at five-year intervals until interrupted by World War I. Thereafter, for a while they were taken even more frequently until war again interrupted their collection. The process was finally regularized in the 1960s, with manufacturing censuses taken every five years in years ending in “2” and “7.” A variety of data is collected and tabulated, although the subjects covered vary by industry. Several key statistics are tabulated for all industries, including the number of establishments; number of employees; payroll; and various measures of output, value of shipments, and value added. However, no single statistic was collected at every census. For example, the definition of what constituted an establishment changed over time: what was meant by “manufacturing”; who should be included among the workforce (corporate officers and salaried staff as well as production line workers, for example); or how inventories should be treated. Indeed, early Census Bureau officials outspokenly criticized some statistics that they were required to report, most notably capital valuation.

Most records of the 1810 Manufacturing Census were lost when the British burned parts of Washington during the War of 1812. Other assorted manufacturing manuscript records have been lost over the years – some by accident (for example, in January 1921, a fire at the Commerce Department destroyed most of the returns of the 1890 Census), others by design, including most of the twentieth-century Censuses of Manufactures, which were destroyed by Congressional order.<sup>4</sup> Nevertheless, Americans have kept a voluminous quantitative record documenting the nation’s industrialization. Among the more valuable, but certainly not the only, continuing data source is found in the published volumes of the federal Census of Manufactures. Some of the evidence in this chapter comes from this source. As time passed, however, other government documents such as patent filings, trade statistics, tax records, regulatory reports, and private sector sources that include corporate records, trade association data, and similar materials have become available to provide a fuller account of the emergence of manufacturing in the United States.

Although the complete enumerations provided by the census are invaluable, the insights that they provide are for discrete, widely separated intervals of time. These gaps are partly filled by a variety

of programs, including the Annual Survey of Manufactures (ASM) and commodity surveys used to prepare Current Industrial Reports (CIRs). Although these data are more timely, they are not as detailed as those in the censuses. The ASM, which provides information for the years between the censuses, has been taken since 1949. Because it collects data from a sample of several tens of thousands of manufacturers (about 55,000 in 1991, for example), rather than all manufacturers as in the census, the ASM data are generally provided only for the nation and the states rather than at the level of Statistical Metropolitan Areas (SMAs). The CIR series provide monthly, quarterly, and annual data on production, shipments, and inventories of selected products or on special subjects. These data come from nearly 70 separate surveys of producers of particular product groups that cover about 4,400 of the 11,000 seven-digit Standard Industrial Classification (SIC) product categories. The CIRs deal mainly with the quantity and value of shipments of particular products and occasionally with information on production and inventories: unfilled orders, receipts, and consumption. They could also include comparative data on domestic production, exports, and imports of the products they cover. Some CIR data are displayed in Table Dd626–643.

Another source is the Enterprise Statistics program. This counts companies rather than plants. Summary statistics on companies and plants (establishments) are reported in Tables Ch440–509.

Readers seeking more detailed quantitative information bearing on American manufacturing should consult the abundant government documents available in many libraries, particularly those classified as “Government Depositories,” and online at the Census Bureau’s Internet site.

Trade associations for major industries publish statistical series, as do other private agencies. Indeed, some of these have taken over more of the government’s role in collecting statistics – for example, the U.S. Bureau of Mines no longer disseminates data on petroleum products; rather, this has been taken over by the American Petroleum Institute. One consequence of this privatization is that statistical data are becoming more privileged and proprietary, and lack of knowledge poses problems in a free society. Annual reports issued by individual corporations can also provide statistical detail for their companies.

Those interested in details on early manufacturing are referred to a set of data samples by the authors that cover the years 1850, 1860, 1870, and 1880. In computer-ready format, they can be obtained through the Inter-University Consortium on Political and Social Research at the University of Michigan (Atack and Bateman 1992a, 1992b). There are many scholarly studies of individual industries at different points in time. A useful reference is McCloskey and Hersh (1990).

Lastly, note that shifts in the sources and in the fundamental nature of the data have also affected and influenced cyclical behavior, especially volatility and persistence. These concerns are dealt with at length by Romer (1985, 1991).

### **Definitions**

The term “establishment” refers to a single facility or plant where the manufacturing business is conducted. The term “enterprise” refers to a business organization (sole proprietorship, partnership, cooperative, or corporation) under common control. Throughout most of the nineteenth century, “establishment,” “plant,” “firm,”

<sup>4</sup> For example, U.S. Congress 1912, 62d Congress 2d Session H Doc 460.

and “enterprise” were essentially synonymous; that is each enterprise operated just a single plant. This is no longer the case, and plants belonging to a single enterprise may be located in numerous locations anywhere around the world.

As noted, the definition of manufacturing defies any hard and fast categorization. In general, manufacturing industry is taken to encompass a specific range of products, although intended use or users play some role in the classification. Until recently, data have been organized according to what is known as the SIC coding system, which classifies establishments according to the principal type of products produced. This scheme dates back to the 1930s and has been revised several times, most recently in 1987. It has even been applied retrospectively to several nineteenth-century manufacturing statistics since firms were assigned to an industry by the principal product they produced (Niemi 1974). Beginning in 1997, however, the SIC classification scheme was superseded by the North American Industrial Classification System (NAICS).<sup>5</sup>

The statistics in this chapter are presented by SIC – the system under which many of them were originally collected and classified – although we have indicated the appropriate new NAICS code for each where possible. For manufacturing activities, this translation works tolerably well most of the time, but the mapping is not perfect, nor apparently will we ever have a complete measure of the distinctions between the two schemes in cold hard numbers. Although the Census Bureau has provided a subset of sector statistics assembled using both SIC and NAICS for the 1997 Census of Manufactures, this project is incomplete and is unlikely to be finished. This change will likely confound future efforts to extend most of these series.

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<sup>5</sup> See the Introduction to Part D for additional discussion of economic sectors, industrial classification, and the SIC and NAICS systems.