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Robert Gallman's Capital Stock Project

I.I. Introduction

Robert Gallman was a builder. In a career spanning five decades, he constructed the best estimates that we have of the US capital stock and national product in the nineteenth century. Extending the work of his mentor Simon Kuznets, Gallman placed our knowledge of the long nineteenth century, a crucial period when the United States achieved modern economic growth and became a global economic leader, on a strong empirical foundation. His rock-solid, well documented, and nearly complete numbers replaced the speculative, underdocumented, and partial estimates previously available (Martin 1939). Gallman's approach was to use the blueprints provided by modern national income accounting, and then to search assiduously in the historical record for the best available statistical materials to use in constructing national product flow and capital stock numbers. His philosophy was plain: to measure twice (or more) and cut once. He then added variations to serve specific purposes, and patched as necessary. Where it was impossible to make estimates on solid foundation, he chose not to build.

Gallman sought to measure the flows of output produced by American factors of production. He was interested in the history of the American

This chapter was written by Rhode. Informing this essay are a set of taped interviews that we (Gallman and Rhode) conducted in the months before Gallman's death, as well as countless conversations in classrooms, on the way to seminars, before meetings, at dinners, or on long car trips to conferences.

people, so he focused on factors owned by US citizens rather than on those factors domiciled within the country's borders. (Thus, he typically worked with national product rather than domestic product.) Gallman also sought to measure the American capital stock. As will be noted in the chapters below, he adopted different but related perspectives. One was to see the capital stock as the accumulation saved and invested out of income flows. A second was to view capital as an input into the production process. A third was to use the level and change in the capital stock as proxy measures for long-run economic performance.¹

One of Gallman's key findings was that structures and improvements to land—rather than machinery—represented the most important components of investment in nineteenth-century America. It is not surprising that construction held special interest for Gallman. He collected old builder's books that documented construction costs, hoping to make detailed comparisons between the United States and Britain over the 1820-to-1880 period in order to contribute to the Habakkuk debate on American and British technologies.² His son, Matthew, an important historian in his own right, recalls him as leaving his day job as an economist to engage in home improvement projects on nights and weekends.

E. H. Carr (1961, 17) wrote: "Study the historian before you begin to study the facts." Carr's advice is apt. Gallman's work reflects the activities and interests of his father, who operated a savings and loan to finance housing for working-class families in Passaic, New Jersey, in the 1930s. (Gallman's grandparents were skilled silk workers who migrated from Switzerland.) He was exposed to agriculture by doing chores on a Vermont dairy farm during summers in his youth. Gallman graduated from Cornell (Class of 1948) and began his graduate studies at the University of Pennsylvania. There he worked under Simon Kuznets, the pioneer of national product accounting. Gallman's studies were interrupted by the Korean War, when he served as a military procurement officer in the Washington, DC, area.

With this background, much about Robert Gallman becomes clearer. In the early nineteenth century, investment in structures and land improvement was typically self-financed; farmers cleared the "lower forty" with family labor during the off-season for crop production. As the century advanced, investment in structures was increasingly funded by financial intermediaries including commercial and investment banks, mortgage lenders, insurance companies, and, of course, savings and loans. Part of Gallman's long collaboration with Lance Davis sought to understand this transition.³

Gallman's work was not flashy. He did not employ clever theoretical devices, apply advanced statistical techniques, or address burning policy issues. Instead, he engaged in a painstaking effort to build a large statistical structure on a sound empirical foundation. But the implications of his research were revolutionary. His dissertation work on the expansion of value added in commodity production (agriculture, manufacturing, and mining) showed that before the Civil War, economic growth was more rapid and structural change more dramatic than many supposed. His research undergirded the argument of Thomas Cochran and Stanley Engerman that the 1860s were a period of slow growth rather than the breakpoint leading to modern growth, as the Beards asserted. His works showed that American agriculture was productive and progressing, and they helped bolster the revisionist claim that the economic performance of the antebellum South was impressive by world standards (Easterlin 1960; Fogel and Engerman 1974, 247–57). Another early finding was that the manufacturing producer durable flows increased faster than the economy as a whole before 1860, indicating that the investment rate was rising. Gallman also noted that the share of gross investment in GNP was relatively high as early as the mid-1830s.⁴ The US experience contrasted with that of Britain, where the rate of capital formation reached high levels “only very late in the process of industrialization” (Davis and Gallman 1973, 442; Deane and Cole 1962). These discoveries about product flows led him to begin estimating the US capital stock. His work was always presented in carefully crafted prose that, apart from select passages reflecting his love of literature, was not ornate.

Gallman did not pursue controversy in his scholarship, but he also did not flee conflict when it arose. As one example, he took issue with Edward Pessen's characterization of the Jacksonian period. Pessen (1977, 137) argued that the phrase “the age of the common man” was a fraud because “wealth in early 19th-century America was unevenly distributed and becoming more so” over time. Gallman (1978, 1981) accepted the findings of Lee Soltow (1975) that the antebellum era was a period of great inequality of wealth—most obviously between enslaved African-Americans and their white masters—but with no demonstrable trend toward greater inequality. Such wealth inequality was in part a function of the age structure of the American population, specifically the high fraction who were young. While most young white males did not own property, most would do so at some point in their lives. Gallman (1978, 190) also noted that in 1850, even low-income Americans enjoyed higher consumption standards than most humans who had ever lived.

Gallman was sympathetic to the perspective that GNP and GDP were concepts defined for a particular time and place (Coyle 2014; Fogel 1999, Philpsen 2015). The national income accounts were not universals, but rather were measures of performance appropriate to specific historical contexts. It is not surprising that he chose to focus on the market-oriented economies of the “long nineteenth century” (Gallman’s dating of this period is elastic; it begins as early as 1774 and ends as late as 1909). He was impressed and intrigued that in the mid-nineteenth century, Ezra Seaman (1852) produced national income estimates similar to those that came from a modern framework. He respected the earlier statistical work of Samuel Blodget (1806, 1810), Timothy Pitkin (1835), and George Tucker (1843). Gallman was concerned about the proper valuation of household production, especially of women’s unpaid household labor (see Gallman 1966, 35, 74–76; Goldin 1990, 226). He felt that it made sense to measure performance in the antebellum South by treating enslaved African-Americans as members of the population rather than as components of the capital stock or as intermediate inputs (equivalent to livestock) in the production of output for the free population. As a consequence, Gallman (2000, 18) always treated slaves as people, not property.⁵

Because of his training under Kuznets, Gallman had a different approach to price indexes than is common today. On the one hand, he recognized the great importance of price indexes in creating sensible accounts. He held that his real capital stock numbers were only as good as the indexes of Dorothy Brady (1966) that he used to adjust the nominal figures.⁶ He further believed that introduction of “new goods” represented one of the most important but hard-to-measure ways in which the standard of living changed.

On the other hand, Gallman did not accept the now-standard theoretical approaches—based on utility or production functions—to assess or correct the biases of fixed-weight Laspayres or Paasche indexes. He did not use chain-linked Ideal indexes, and he eschewed double deflation of value added.⁷ Following Kuznets, he argued that index number problems were akin to the standard difficulties of interpreting the past:

For historians, this kind of problem is familiar, and is perhaps no longer perceived as a problem. Histories written by historians of the late eighteenth century differ from those written by historians of the late twentieth century, and the reason is not simply that they made use of different bodies of evidence or different techniques. The two sets of historians have written from two different

historical contexts. The capital stock is an evaluative concept and evaluations depend upon the circumstances—cultural, intellectual, social, economic—in which they are made. The construction of a capital stock series based on, e.g., prices of 1860, means the construction of a series that appraises events in the context of the technology and prices—formed by cultural, intellectual, social, economic conditions—of 1860. It should not be a cause of either surprise or frustration that a series based on, say, 1800 or 1900 or 1990 would yield somewhat different results. Indeed, the contrasts may prove illuminating.⁸

Changes in an index based on 1860 prices showed how conditions would look from the perspective of someone living in 1860. Changes in an index based in 1900 prices would do the same from the perspective of someone living then. Each was “true” from its point of view—which takes quite a postmodern cultural perspective.

I do not know precisely why Gallman held these views. It may be that he did not believe that production or consumption functions were fixed over time, or that he thought creating a chain-weight index was not worth the trouble.⁹ The distortions caused by substitution were small compared with the other issues involved in measuring the aggregate capital stock. For the most important historical change in the early period—from household to market production—price indexes were not illuminating.

Reflecting his desire to look at economic development from different perspectives, Gallman created alternative series. As we will see, he defined and calculated conventional income and capital stock numbers to link with the twentieth-century US Department of Commerce accounts. They reveal growth in the categories that his contemporaries considered important. But he came to see that the conventional definitions of income and capital were inadequate. He went on to define and create broader related measures of income and capital, including unconventional or non-market activities of importance to nineteenth-century participants in the growth process. A key investment activity of this form was the breaking and clearing of land to make it suitable for agricultural production. Economic performance could appear different if one was looking backward or looking forward.

Gallman was aware of the Cambridge Capital Controversy swirling around the economic profession when he was first constructing his capital stock estimates. The papers in his office included literature on this debate, specifically on problems of defining the aggregate capital stock. But the controversy, especially the debate over the validity of specifying an

aggregate production function, did not affect his scholarly enterprise. The total capital stock, in his view, had an obvious meaning to participants in the economic growth process. The empirical difficulties of assembling, refining, and “testing” the historical data outweighed the theoretical problems generated by hypothetical examples of what was called “reswitching.”¹⁰ He was keenly aware of differences among types of capital and of differences in the methods used to compute their values.

One can learn from Gallman’s silences as well, from his general practice of saying only good things about others. He did not appreciate speculative efforts to construct macrodata or to model the aggregate economy. For example, Gallman said of Raymond Goldsmith’s (1952) estimates of the wealth stock in the pre-1900 period that at least Goldsmith provided a full discussion of how his numbers were constructed, so one could easily judge how reliable they were. He did, however, express more confidence in Goldsmith’s twentieth-century numbers.

Gallman trusted the evidence about economic performance presented by the past, and respected the opinions and measurements of past authorities. He relied on published census returns, but expressed skepticism about the accuracy of the micro-level census data.¹¹ Gallman quoted Kuznets likening the census to the lead character in Swift’s *Gulliver’s Travels*. However handsome Gulliver was at normal scale, when tied down and examined by the Lilliputians, his pores appeared as giant imperfections. Similarly, the individual records in the manuscript census contained many inconsistencies and gaps in coverage that were smoothed out at a larger scale.

1.2. The Long Build

Gallman’s capital stock project spanned several decades. Starting in the mid-1960s, he worked with his student Edward S. Howle to estimate the stock by two-digit sector and by category (structure, equipment, inventories, and so on). This work went on hiatus when Howle left academia in the mid-1970s. Gallman restarted the project in the early 1980s. In the interim, he worked with Lance Davis to interpret the findings about the growth of the capital stock and to relate the process of capital accumulation to American financial development.¹²

Table 1.1 lays out a detailed chronology of Gallman’s contributions estimating capital stock and national product statistics. Although he presented

TABLE I.1 **Development, use, and refinement of Robert E. Gallman's national product and capital stock estimates**

Gross national product_t = consumption_t + gross_investment_t + government spending_t + net_exports_t

Gross investment_t = manufactured durables_t + construction_t + changes in inventories_t

Consumption_t = perishables_t + semidurables_t + consumer durables_t + services_t

Capital_{t+1} = capital_{t+1} + net investment_t = capital_{t+1} + gross investment_t - depreciation_t

Estimation of commodity production

Robert E. Gallman, "Commodity Output, 1839-1899," in William N. Parker, ed., *Trends in the American Economy in the Nineteenth Century*, Studies in Income and Wealth, Vol. 24 (Princeton, NJ: Princeton University Press, 1960), 13-67.

Appraisal of existing estimates and refinement of benchmarks

Robert E. Gallman, "Estimates of American National Product Made before the Civil War," in *Essays in the Quantitative Study of Economic Growth, Presented to Simon Kuznets on the Occasion of his Sixtieth Birthday*, special issue, *Economic Development and Cultural Change* (April 1961): 392-412.

Estimation of gross national product and components in current and 1860 dollars

Robert E. Gallman, "Gross National Product in the United States, 1834-1909," in Dorothy S. Brady, ed., *Output, Employment, and Productivity in the United States after 1800*, Studies in Income and Wealth, Vol. 30 (New York: Columbia University Press, 1966), 3-76. Gallman makes additions based on the work of Martin Primack, Albert Fishlow, and Jerome Cranmer.

Addition of decadal average inventory changes

Robert E. Gallman, "The Social Distribution of Wealth in the United States of America," *Third International Conference of Economic History* (Paris: Mouton, 1965), 313-24.

Creation of decadal census-based capital stock estimates, including consumer durables

Robert E. Gallman and Edward S. Howle, *The Structure of U.S. Wealth in the 19th Century*.

Addition of unconventional investment and analysis of structural change

Robert E. Gallman and Edward S. Howle, "Trends in the Structure of the American Economy since 1840," in Robert W. Fogel and Stanley L. Engerman, eds., *The Reinterpretation of American Economic History* (New York: Harper & Row, 1971), 25-37. GNP variant I captures the NBER concept, and GNP variant II includes "the value of improvements to farmlands made with farm construction materials and value added by home manufacturing."

Incorporation of depreciation and unconventional investment

Lance E. Davis and Robert E. Gallman, "The Share of Saving and Investment in Gross National Product during the 19th Century, United States of America," in F. C. Lane, ed., *Fourth International Conference of Economic History, Bloomington, 1968* (Mouton, 1973), 437-66.

Improvement of decadal service sector estimates

Robert E. Gallman and Thomas Weiss, "The Service Industries in the Nineteenth Century," in Victor R. Fuchs, ed., *Production and Productivity in the Service Industries*, Studies in Income and Wealth, Vol. 34 (New York: Columbia University Press, 1969), 287-381.

Calculation of net national product and incorporation of service sector estimates into decadal product

Robert E. Gallman, "The Pace and Pattern of American Economic Growth" in Lance E. Davis et al., *American Economic Growth: An Economist's History of the United States* (New York: Harper & Row, 1972), 15-60.

continues

TABLE I.1 (continued)

Improvement of agricultural product and investment (inventory and nonconventional activities) estimates

- Robert E. Gallman, "A Note of the Patent Office Estimates, 1841–1848," *Journal of Economic History* (June 1963): 185–95.
- Robert E. Gallman, "Changes in Total Agricultural Factor Productivity in the Nineteenth Century," *Agricultural History* 46, no. 1 (Jan. 1972): 191–209.
- Robert E. Gallman, "The Agricultural Sector and the Pace of Economic Growth: U.S. Experience in the 19th Century," in David C. Klingaman and Richard K. Vedder, eds., *Essays in 19th Century Economic History* (Athens: Ohio University Press, 1975), 35–76.

Use of data to critique conjectural estimate

- Robert E. Gallman, "The Statistical Approach: Fundamental Concepts as Applied to History," in George Rogers Taylor and Lucius F. Ellsworth, eds., *Approaches to American Economic History* (Charlottesville: University Press of Virginia, 1971), 63–86.

Analysis of the rise of the net capital formation rate

- Lance E. Davis and Robert E. Gallman, "Capital Formation in the United States during the Nineteenth Century," in Peter Mathias and M. M. Postan, eds., *Cambridge Economic History of Europe Vol. VII: The Industrial Economies, Capital, Labour, and Enterprise. Part 2, The United States, Japan, and Russia* (Cambridge: Cambridge University Press, 1978), 1–69.

Exploration of improvements in construction estimates, and use of producer durable flows to estimate stocks

- Robert E. Gallman, "Investment Flows and Capital Stocks: U.S. Experience in the Nineteenth Century," in Peter Kilby, ed., *Quantity and Quiddity: Essays in U.S. Economic History* (Middleton, CT: Wesleyan University Press, 1987), 214–54.

Improvement of inventory estimates

- Robert E. Gallman, "The United States Capital Stock in the Nineteenth Century," in Stanley L. Engerman and Robert E. Gallman, eds., *Long-Term Factors in American Economic Growth*, Studies in Income and Wealth, Vol. 51 (Chicago: University of Chicago Press, 1986), 165–213.

Push of capital stock estimates back to colonial period

- Robert E. Gallman, "American Economic Growth before the Civil War: The Testimony of the Capital Stock Estimates," in Robert E. Gallman and John Joseph Wallis, eds., *American Economic Growth and Standards of Living before the Civil War* (Chicago: University of Chicago Press, 1992), 79–115.

Examination of forces driving nineteenth-century US economic growth and capital accumulation

- Stanley L. Engerman and Robert E. Gallman, "U.S. Economic Growth, 1790–1860," *Research in Economic History* 8 (1983): 1–46.
- Lance E. Davis and Robert E. Gallman, "Savings, Investment, and Economic Growth: The United States in the 19th Century," in John James and Mark Thomas, eds., *Capitalism in Context* (Chicago: University of Chicago Press, 1994), 202–29.

Incorporation of revisions

- Robert E. Gallman, "Economic Growth and Structural Change in the Long Nineteenth Century," in Stanley Engerman and Robert E. Gallman, eds., *Cambridge Economic History of the United States*, Vol. 2 (Cambridge: Cambridge University Press, 2000), 1–56.
- Lance E. Davis and Robert E. Gallman, *Evolving Financial Markets and International Capital Flows* (Cambridge: Cambridge University Press, 2001).

variants of his estimates, he avoided a range of figures and just gave his best estimate. He sought to provide a single number for each well-defined concept. He refined and corrected the numbers as new data became available and when errors surfaced. He typically began the estimation process by using the census data to create solid decadal benchmarks. He made extensive efforts to ensure consistency and to “test” his series, comparing them against one another and against external evidence. For the flow estimates, he also used available statistics to construct annual series running through the benchmarks. The goal was to remove the effects of short-run fluctuation in long-run comparisons.

Gallman's achievement is all the more impressive given that he was working without computers or spreadsheet software. His accounts were kept on paper, and the tabulations were done on a calculator or adding machine. (After the late 1980s, Gallman had a desktop computer, a technology that he disliked.) His choices have consequences. He left us with a dauntingly large paper trail. It reveals small corrections or revisions made in some parts but not changed everywhere, although such cases are rare. Where he reported rates or ratios of variables over intervals of several years, they are typically ratios of sums, rather than averages of year-by-year rates.¹³ He reported numbers to the same number of places after the decimal, not to the same number of significant digits. When he reported annual growth rates, they are typically compounded annually rather than continuously. The growth rates reported below have been standardized as continuously compounded rates of change calculated to three significant digits. Gallman almost always reported his numbers in tables, and rarely used graphs or figures. He performed numerous consistency tests, comparing one set of estimates with others, but did not use formal statistical tests. He knew, without explicitly saying so, that every number reported came with error bounds.

1.3. Contents of This Volume

This volume brings together Gallman's work estimating the US capital stock over the long nineteenth century, from 1774 to 1900. Chapter 2 introduces the decadal census-style (point-in-time) estimates that form this volume's empirical core. One theme motivating Gallman's investigation into the capital stock is that information about wealth during this period is more readily available and more comprehensive than evidence about

income. The capital stock, when measured at fixed prices, is less volatile than income. An examination of the levels and changes in wealth provides valuable clues about economic performance.

Chapter 3 reproduces Gallman's definitive analysis of the data for the 1840–1900 period. These numbers link well to statistics reported in chapter 2. Chapter 4 pushes the investigation back to 1774, the eve of US independence. It introduces his estimates for the late colonial and early national periods; and it discusses the key role of investments in land clearing and breaking, an unconventional form of capital formation.

Chapter 5 presents and analyzes his annual estimates of national product over the 1834–1909 period. These series, reported as decadal averages, underlie much of what we know about American growth in the mid-nineteenth century. Gallman circulated versions of the annual series widely, but did not publish the details. This chapter documents the construction of the national product series, corrects minor errors, and compares Gallman's series with alternative estimates. The chapter also explains why Gallman considered his annual series to be unsuitable for business-cycle analysis.

Chapter 6 uses Gallman's annual flow data to generate capital stock estimates using perpetual inventory methods. The construction involves cumulating the depreciation-adjusted value of annual flows of real investments in manufactured producer durables and structures to derive alternative estimates of the capital stock. He considered these series useful for testing the census-style estimates for consistency and content. The investigation also revealed how depreciation affected the level and growth of the capital stock.

Chapters 7 to 12 present the detailed construction of the capital stock for individual sectors. Chapter 13 introduces Gallman's estimates of consumer durable expenditures, which are largely based on the annual flow data. Chapter 14 lays out his estimation procedures for capital in the colonial and early national period. These chapters have value for scholars beyond providing the supporting material for the aggregate estimates. They provide research leads, sources, and methods from one of the pre-eminent students of American economic history. Further, these chapters display Gallman's deep knowledge about the structure of the economy, and his considered judgments about available statistical sources. They supply essential materials for those who want to create better estimates, an endeavor that Gallman would have fully appreciated. The chapters on agriculture, manufacturing, and mining are especially rich.

1.4. Gallman's Major Findings

The American capital stock expanded with extraordinary speed over the long nineteenth century. As Gallman's data in table 1.2 show, the real US capital stock increased by a multiplicative factor of 276 between 1774 and 1900. The capital stock grew faster than total output (GNP), which expanded by a factor of 118 over this period, and faster than population, which expanded by a factor of 32. Gallman observed that demand for capital was increasing so rapidly that the risk of investing at the "wrong time" or in the "wrong place" was greatly reduced. One did not build ahead of demand for long. Most American capital was quite young and embodied current technology.

Gallman's numbers reveal that while GNP grew at a relatively steady rate over the long nineteenth century, its growth path was not "balanced" in the way that macro-growth economists assume today. Kaldor's (1961) famous "stylized facts" did not apply; the capital-to-output ratio and saving rate were not constants.¹⁴ Over the nineteenth century, as the work of Abramovitz and David (1973a, 1973b) indicates, the United States was traversing to a new more capital-intensive equilibrium growth path.

TABLE 1.2 Real capital and GNP, 1774–1900

	National capital (in millions of 1860 dollars)	GNP (in millions of 1860 dollars)	GNP per capita (in 1860 dollars)
1774	185	149	63.3
1799	566	360	68.0
1805	830	489	73.6
1815	1,057	641	75.6
1840	2,798	1,610	96.5
1850	4,621	2,628	116.1
1860	8,974	4,226	135.9
1870	10,889	5,547	142.0
1880	16,939	8,711	178.9
1890	34,525	12,915	211.3
1900	51,121	17,546	236.6

Notes: Capital and GNP are conventional constant (1860) price concepts, and include change in inventories. The conventional concept excludes the value of land improvements other than farm buildings. Dating for GNP, 1799 is 1800, 1805 is 1807, 1815 is an average of 1810 and 1820, 1840 is 1834–43, 1850 is 1844–53, 1860 is 1859, 1870 is 1869, 1880 is 1874–83, 1890 is 1884–93, and 1900 is 1894–1903.

Source: Capital is from tables 2.1 and 2.2; GNP and GNP per capita are from Gallman 2000, 7, 22.

TABLE 1.3 Gross capital formation as percentage shares of gross investment in GNP

	Conventional gross I/GNP valued in 1860 prices	Conventional gross I/GNP valued in current prices	Unconventional gross I/GNP valued in 1860 prices
1834-43	12	—	19
1839-48	14	14	17
1844-53	16	16	18
1849-58	17	17	20
1869-78	24	19	26
1874-83	24	19	25
1879-88	25	21	26
1884-93	27	23	28
1889-98	29	23	30
1894-1903	28	21	29
1899-1908	29	22	29

Note: Unconventional capital adds investment flows for land formation to the conventional capital; both the numerator and denominator include changes in inventories. The unconventional income excludes home manufactures, due to the absence of constant price data. See also table 5.7.

Source: Gallman 2000, 39.

Gallman's numbers show that the US capital-to-output ratio more than doubled over the long nineteenth century. Using the conventional constant-price series, the capital-to-output ratio in 1900 was 2.34 times its 1774 value. Focusing on the period when the data are stronger, the 1900 ratio was 1.76 times its 1840 value. The increase in the capital-to-output ratio occurred in virtually every sector.

The share of output devoted to capital formation also soared, driving the rapid growth of the American capital stock. Table 1.3 displays Gallman's series on the rate of gross capital formation.¹⁵ One of Gallman's striking initial findings was how high the rate was by the late 1830s. By the conventional constant-price measure, the United States was saving and investing 12 percent of output between 1834 and 1843; by the unconventional measures, the ratio was 19 percent. From these high levels, the rate of capital formation climbed higher over the nineteenth century.

According to the conventional constant-price series, the rate of capital formation more than doubled over the 1840-1900 period. The rise is slightly less pronounced if one examines the conventional current-price series; allowing for price changes lowers the rates at the end because the relative price of capital goods fell. The rise is also moderated in the unconventional constant-price series; adding investments in land clearing pushes up the rates at the beginning. The capital formation rate increases

even in the new series. In an important way, the new series serves as robustness checks, showing that patterns detected in data series constructed from a twentieth-century viewpoint are present in series constructed from a nineteenth-century perspective. The available evidence, moreover, indicates that the capital formation rate in the 1799–1815 period could not have been as high as it was in the late 1830s and early 1840s, when the data in table 1.2 begin. The large rise in the saving rate was real. Gallman tended to use the concepts “saving rate” and “investment rate” interchangeably. This is appropriate for nineteenth-century America, because government expenditures were typically close to tax and tariff receipts, and net exports were a small share of income. In addition, at least in the early periods, the savers and investors were often the same people.

In a straightforward accounting sense, the rising capital-to-output ratio was not due to the “process of industrialization,” at least as narrowly defined. Gallman and Howle (1971, 31–32) showed that manufacturing was less capital-intensive than agriculture, so that the rising share of the manufacturing sector in economic activity actually lowered the capital-to-output ratio of the overall economy. He performed several shift-share analyses to gauge the effects of the sectoral reallocation. He argued that by broadening one’s perspective to include the spread of the railroad and the growth of urban housing, one could link the process of industrial development with the increasing capital intensity of the American economy.

Including the forces that caused the price of capital goods to fall relative to consumer goods over the second half of the nineteenth century provides another link between industrial advance and the rise in the economy-wide capital-to-output ratio. Gallman showed that over the second half of the nineteenth century, the falling price of capital goods relative to the price of all output, and especially the sharply falling price of equipment, had important consequences for the rate and distribution of capital formation. But to invoke the “age of the machine” misses much of the picture of nineteenth-century American economic growth. The share of structures in the US capital stock was three to four times larger than that of equipment in current price terms (see panel A of figure 1.1). Equipment’s share did rise over time, especially if one examines the constant 1860 price series which adjusted for their declining relative price (see Panel B of figure 1.1). But, as Gallman showed, by either constant or current price measures, structures always made up the largest share of the capital stock.¹⁶

Much of the investment activity in the long nineteenth century was mundane and did not involve sophisticated new machines or technologies.

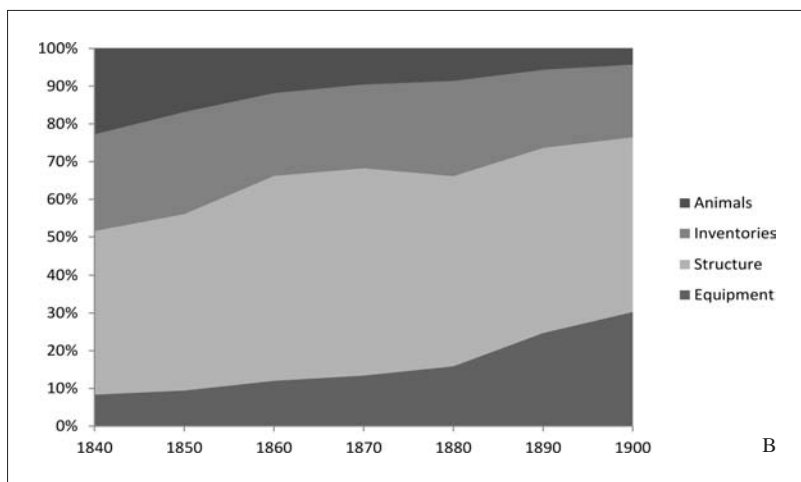


FIGURE 1.1 Shares of conventionally defined domestic capital, 1840–1900: (a) current prices; (b) constant price. Source: table 2.1.

Keeping cattle over the winter to work and breed during the following year, rather than slaughtering and consuming them, is a prototypical example. Clearing forests to create farmland by using simple tools such as axes, wedges, and small amounts of animal power, and breaking the prairie soils with ox-drawn plows are other examples. The importance of these latter activities in the first part of the nineteenth century was so great that

Gallman created an alternative capital stock series including the value of farm improvements. About one-quarter of all capital formation between 1799 and 1840 was in the form of land clearing and breaking. Gallman found that the value of land improvements (which included clearing and breaking, fencing, and irrigation, but excluded buildings) represented about one-eighth (12.2 percent) of the total US reproducible capital stock in 1900. In 1840 the figure was nearly one-third.¹⁷

Mechanization is often argued to be the most important change in American agriculture after 1840. Investment in equipment did increase at a faster rate (4.8 percent per annum) than did land improvement (2.3 percent) between 1840 and 1900. But in terms of absolute values and their changes, land improvements still predominated. The total value of investment in land improvements between 1840 and 1900 was over four times that in equipment. In 1900, the value of land improvements represented more than half (54 percent) of all reproducible capital in the agricultural sector, whereas equipment made up less than 10 percent.

Much of this investment, especially for the do-it-yourself land improvement projects, was produced domestically; most was self-financed. Only a small share of capital goods was imported. Gallman (1966, 17) noted that the largest category of imported capital goods in the late antebellum period was for saddles and harnesses. A small fraction of investments, principally for railroad bonds, was financed in foreign (mainly London) markets. But, due to both domestic accumulation and improved international financial integration, real interest rates fell over the nineteenth century (Davis and Gallman 1994, 211). Capital accumulated as self-financed, do-it-yourself land improvement or housing projects had different effects on income and wealth inequality than are conventionally considered (for example, by Piketty 2014). In the areas dominated by family farms and small businesses, there was widespread participation in the process of economic growth. In this way, the United States and other settler economies present a contrast to Europe that is worth exploring much more fully.

Durable goods did not flow only onto farms and factories, but into households as well. Many kinds of capital equipment, such as sewing machines, were initially producer durables, but once they were made smaller and less expensive, they were sold to consumers and used in domestic production. Gallman and Howle (1971, 33) found that the share of durables in consumption spending “rose strongly between the pre-Civil War period and the third and fourth decades” of the twentieth century. The share (measured both in current and constant dollar terms) doubled from

5 percent in the 1839–58 period to 10 percent in the 1919–38 period, and then remained constant through the 1939–53 period. Such growth refutes a commonly held view that nothing happened until the consumer durables revolution of the 1920s.

Gallman found that the onset of modern economic growth preceded the American Civil War (1861–65) by several decades. His annual data show that per capita output grew at a high, sustained rate from the 1830s at the latest. Available (admittedly weaker) evidence indicates that economic growth was slower before this period. The 1860s saw low growth of income and the capital stock. The post-reconstruction period witnessed more rapid income growth and capital accumulation than before.

From a growth accounting approach, Gallman highlighted a contrast between the nineteenth and twentieth centuries. In the first half of the twentieth century, as is well known from the work of Abramovitz (1956), Denison (1962), and Solow (1957), capital deepening—the rise of the capital-labor ratio—explained only a small share of per capita income growth. Most such growth came from the residual, or what came to be redefined as total factor productivity. Using his conventional capital stock estimates, Gallman showed that, during the mid- and late-nineteenth century, capital formation was a potent force in explaining per capita income growth. (The conventional estimates allow for more consistent comparisons between the nineteenth and twentieth centuries.) But Gallman being Gallman, he did not stop there. He returned to the issue using his broader unconventional capital stock estimates. These numbers start higher than the conventional estimates, and grow more slowly. In this growth accounting exercise, the contribution of capital formation is somewhat diminished, while that of total factor productivity is enhanced. This result is eminently sensible. It adds a nice twist: it is only by fully accounting for the mundane old types of capital that the real contributions of new innovations come to light. The revised calculations do show that the capital formation was an unusually important source of income growth in the mid- and late-nineteenth century.

1.5. Conclusion

Gallman was a builder. What's more, he was an architect and artisan. A problem with undertaking a project as large as Gallman envisioned is that it becomes difficult to stop. It is easier to take a pause than to decide

the work is finally done. Gallman had plans and preliminary material to do much more, adding greater geographic details, extending the current price estimates and making closer connections between the different methods based on stocks and flows.

As the material in this volume reveals, Gallman built a structure of enormous value. He did so with care, knowledge, and insight. He left detailed records about how he proceeded, the materials he used, and the judgments he made. It is all there for those who follow, those who wish to use the data on capital and income, and those who wish to start the construction process anew.¹⁸