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Notes

Chapter One

1. He was interested in the reproducible physical capital stock excluding financial assets and raw land. In Gallman's conceptual framework, raw land was nonreproducible and was a part of wealth, but not of the capital stock. The only financial assets that Gallman considered were stocks of monetary metals, and net claims on foreigners. These were parts of "national wealth," though not "domestic wealth." Gallman focused on the tangible capital stock and did not include the value of intellectual property or human capital. He did enumerate consumer durables, long-lasting goods owned by households.

2. As an example, his library contained Peterson 1971. See also "Letter to W. Erwin Diewert," proposing a paper for the fiftieth anniversary meeting of the Conference on Research on Income and Wealth, Gallman papers.

3. According to Gallman, the two first met around 1960 after Davis offered a trenchant analysis, delivered in his characteristic rapid-fire fashion, of John F. Kennedy's election prospects. Gallman, a Democrat in the era of Eisenhower, liked what he heard.

4. Gallman, NSF Proposal, 19 August 1981, p. 3, Gallman papers.

5. Although Gallman treated enslaved African-Americans as people and not property in calculating the US capital stock, he also noted how slaves differed from wage labor. See Anderson and Gallman 1977.

6. The Brady indexes, which were constructed largely from prices in northeastern cities, were akin to GDP deflators in that they were based on currently produced goods.

7. Chain-linked price indexes vary the price weights over time using information on quantities or shares. Double-deflation of value added used different price indexes to deflate the input and output bundles. See David 1962.

8. "Chapter 2: Problems of Concept and Measurement: The Capital Stock," p. 4 in Gallman's papers. Gallman (1972, 47–50) discusses index numbers in more conventional terms.

9. He did take pains to recenter the Brady price indexes to conform to the census dates.

10. "Reswitching" occurs if the ordering of two production techniques in terms of the capital-to-labor ratio changes as the rate-of-profit-to-wage ratio changes. One technique may be more capital-intensive than the other at a high rate-of-profit-to-wage ratio, and less capital-intensive at a low ratio.

11. Together with William Parker, he was among the first economic historians to assemble and analyze a microsample from the manuscript census—the Parker-Gallman sample of individual agricultural operations in cotton-producing counties from the 1860 census. Samples for rice and sugar followed.

12. A joint paper by Gallman and Howle on the capital stock was presented at the February 1965 meetings of the Purdue University Seminar on the Application of Economic Theory and Quantitative Techniques to the Problems of Economic History. Gallman's return to the capital project can be dated to a 1981 NSF grant, which noted the possibility of linking to the work of Alice Hanson Jones for 1774.

13. As an example, when calculating the gross capital formation rate over a decade, he sums the ten years of gross investment flows and divides by the ten years of GNP. He does not take the ten-year average of the yearly rate. Given the nature of his data and the way he adds components available at different frequency, this choice is sensible. It can lead to different results for cyclical variables or cases where the numerator and denominator are correlated. As another example, when calculating annual growth rates between decadal benchmarks, Gallman uses annual compounding rather than continuous compounding.

14. The growth rate of NNP was slowing (as capital consumption comprised a rising share of output); the growth rate of GNP per capita was rising.

15. The inclusion of inventory changes leads the series reported in table 1.3 to differ from Gallman's widely reproduced series. See the discussion in section 8 of chapter 5.

16. This discussion relates to the capital stocks. The picture for gross investment flows was different. (The depreciation rate for equipment was much higher than for structures.) As Gallman (1966, 15) noted in his analysis of the changing composition of gross domestic capital formation over the 1834–1908 period, the "share of construction fell from about 80 per cent to less than 50 per cent, while the share of manufactured producer durables rose from about 20 per cent to over 50 per cent." This discussion related to conventionally defined investment flows, excluding land breaking and clearing.

17. Gallman (1986) quotes a share of 38.4 percent, based on a concept consistent with the 1900 number quoted in the text. The concept includes land clearing and breaking, fencing, and investments for irrigation and drainage. Gallman 1992, table 2.8, has somewhat lower shares. This is based on a concept including land clearing and breaking, but excluding fencing, irrigation, and drainage.

18. His work on the levels and growth rates of income almost always included international comparisons. Incorporating the role of capital formation in such cross-country comparisons was an unfinished task (Davis and Gallman 2001).

Chapter Two

1. Gallman, NSF proposal, 19 August 1981, p. 28, Gallman papers.

2. Net international assets include stocks of monetary metals and net claims on foreigners. Note that domestic capital = national capital – net international assets. During the 1850–1900 period, net international assets were negative, so domestic capital was larger than national capital.

3. For the period before 1840, Gallman says, "The bases for estimating the value of fences, irrigation works, and drainage works are very slender. These improvements have been, therefore, omitted." Gallman papers.

4. Gallman's own labeling sometimes creates confusion. Gallman (1992) properly defines his series in panel B of table 2.8. But Gallman (2000) reproduces the numbers in panels C and D in table 13 and states that the data include fencing. They do not.

5. Carter, et al. 2006, series Bb 213, reports the value of slave stocks in current prices as $1.286 billion in 1850 and $3.059 billion in 1860. According to Gallman (1986), table 4.A.1, the current value of national wealth, excluding slaves, was $7.89 billion in 1850 and $16.39 billion in 1860. If one adds the value of slaves to that of land and capital, slaves comprise 14.1 percent of the total in 1850 and 15.7 percent in 1860.

6. As detailed in chapter 9, Gallman allocated the value of nonagricultural residential real estate according to a fixed ratio—0.638 to structures and 0.362 to land—across the 1840–1900 period.

7. These are current-price series, which differ from the constant-price series discussed in chapter 1.

8. See Gallman and Howle 1972, 32; and Davis and Gallman 1973, 457, for ratios based on prior series.

9. Substitution and sectoral shifts were of roughly equal importance. Measured in 1860 prices, the share of equipment in the sum of equipment and structures climbed from 16.2 percent in 1840 to 40.1 percent in 1900, a change of 23.9 percentage points. If one conducts a shift-share analysis, fixes the equipment ratios at their 1900 values, and allows the sectoral shares to change, one finds that the aggregate equipment share rises by 12.9 percentage points between 1840 and 1900. Sectoral shifts account for slightly more than one-half (53.7 percent) of the change.

Chapter Three

1. The following discussion was developed with fixed capital chiefly in mind, although it can also be made to apply to inventories and international claims, with exceptions: there is no clear correspondence between "acquisition cost" and any single system of inventory accounting. For present purposes, that is not an important matter. All inventories treated herein are valued at market prices. So far as

international claims are concerned, there is no good counterpart of reproduction cost, other than market price.

2. A fourth method—not relevant to the series of this chapter, and therefore left undiscussed here—measures capital in terms of its current capacity to produce output. The problems of defining capacity and of measuring it in a meaningful way are ably discussed in Denison 1957, and Ruggles 1961.

3. Whether loss of value due to obsolescence should figure in capital consumption has been hotly debated; see Denison 1957 and Ruggles 1961. As a practical matter, it almost always does. We take no final stand on the theoretical issue, though the case of those who accept obsolescence as a factor in capital consumption seems the stronger of the two. Similar arguments apply to casualty losses.

4. This analysis ignores the problems posed by taxes and subsidies, problems of modest dimensions throughout most of the nineteenth century.

5. This is particularly true with respect to the manufacturing sector, which was experiencing extraordinarily high rates of growth.

6. That is, the fit for 1840 is almost as good as the fit for 1850 or 1860; the fit for 1870 is at least as good as the fit for 1880, 1890, or 1900.

7. Following Kuznets (1946), Gallman and Howle (1965) report a separate set of estimates—distinct from the agricultural estimates—of irrigation improvements, which they treated as part of the capital stock.

8. Rhode adds: This index in Davis et al. (1972, 34) was based in 1840. It ran 1840 (100), 1850 (181), 1860 (357), 1870 (512), 1880 (785), 1890 (1559), 1900 (2343). It matches the series reported in table 3.3. The 1840 = 100 series is slightly more precise and is used to compute the annual growth rates.

Davis and Gallman (1973, 457) report that, using the 1860 constant price series, the ratio of depreciable capital to annual output in 1860 was 1.6. The capital estimates were based on the original Gallman-Howle series and the output on Gallman (1966). Output in 1859 value at 1860 prices was $4.10 billion, making the depreciable capital stock estimate $6.56 billion, with bounds of 0.205 billion on either side due to rounding error. Depreciable capital, which Gallman also calls fixed reproducible capital, includes improvements and equipment but excludes inventories. The variant B estimate depreciable national capital stock for 1860 is $6.07 billion, which is below the lower bound for the original series.

9. Goldsmith and Kuznets apparently include farmland improvements, other than structures, with land rather than with capital.

10. The analysis uses the dating scheme relevant to the capital stock series (1840, 1850, etc.). Notice that the GNP series is dated to years different from these, the disparity being particularly wide in the case of the first post–Civil War date. See the notes to table 3.5.

11. If the measure of capital employed here had included inventories, this result might have been different.

12. The indirect effects, through changing supply and demand conditions for capital goods, constitute another matter. The rapid expansion in the stock

of machinery and equipment, for example—a development that, we have seen, played a role in the rise of the overall capital-to-output ratio—was related to the revolutionary growth of the industrial sector (mining, manufacturing, hand trades).

13. See Davis and Gallman 1973 for an effort to work through an analysis of this type in quantitative terms, making use of the original Gallman-Howle capital stock estimates.

14. Notice that the postbellum pattern of change differs between the estimates based on the stock and flow data. In the former series, the net proportion peaks in the 1880s; in the latter, the net proportion is higher in both the 1870s and 1890s than in the 1880s.

15. The Goldsmith (1982) series differ from the Goldsmith series discussed in the previous sections. The latter consisted chiefly of census-style estimates, whereas the twentieth-century series were built up by perpetual inventory procedures. Goldsmith (1982) provides a statement of the valuation system followed in assembling the series. The Goldsmith series excludes net claims on foreigners.

16. These results were worked out from Goldsmith et al. 1963, 2, 72–73, which is the source of the 1900 data in Goldsmith 1982.

17. It is well known that the deflation base selected can affect the rate of change of a real capital stock series, earlier bases typically producing higher rates of growth than late ones. It is therefore fortunate, for present purposes, that the deflation bases of the two series being considered here occupy similar relative temporal positions. Thus, the Goldsmith series is deflated on the base 1929, twenty-eight years from the first year in the series and fifty-one years from the last; the Gallman series, on 1860, twenty years from the first year in that series and forty years from the last.

Chapter Four

1. Should the value of slaves be counted as part of the value of the capital stock? If we are interested, say, in the savings and investment behavior of planters, then the answer is surely yes. This chapter is not concerned with that topic. It is concerned with the measurement of long-term economic growth. Slaves are regarded as part of the labor force. They are also treated as part of population, for purposes of computing per capita levels of the capital stock.

While this chapter will present no estimates of the value of human capital, the general pattern of change in this variable before 1860 is quite clear. Both the fraction of the population of children attending school and the length of the school year increased as time passed, as did the fraction of the work force holding semiskilled and skilled jobs. The rate of increase of human capital is therefore almost certain to have risen as time passed. See Fishlow 1966a, 1966b; and Uselding 1971.

2. The value of consumer durables is also sometimes incorporated in capital stock estimates, but it appears in only one table in this chapter, because

appropriate figures are only intermittently available. The loss is not great. The value of consumer durables was small, compared with the rest of the capital stock, through most of the period considered in this chapter, and the rate of change of the capital stock is approximately the same, regardless of whether durables are treated as capital.

3. The calculations also assume that the treatment of stumps was the same at all dates: specifically, that one-third of the stumps were removed immediately, and that the rest were left in the land to rot away on their own. It may be that an even smaller share of the stumps was taken out in the earlier years, but allowing for the removal of no stumps would not bring the current estimates and Blodget's very much closer together.

The matter of stumps is tricky. What is the reproduction labor cost of ten acres of stumpless cleared land that was formerly under trees? Is it the full labor cost of clearing the land and removing all the stumps? Or is it the labor cost of cutting down the trees, removing the one-third of the stumps that were originally removed, and then plowing the land? The estimates assume the latter, but clearly one could make a case for other options.

4. A word should be said about the land series, although there is inadequate space to go through the estimating procedures and tests. The 1850–1900 data come from the census, with some adjustments. The adjustments depend in part on the work of Primack (1962). The 1840 figures are weaker. They come from Seaman (1852), again adjusted and distributed, partly on the basis of the work of Primack. The figures for 1774 through 1805 are from Blodget 1806, adjusted in various ways. The 1815 figure is a rough extrapolation from 1805. For a discussion of these matters, see Gallman 1972.

5. One should not infer much about productivity changes from the relative movements of price and cost indexes between 1836 and 1844, however. Between these two dates lay a very sharp contraction. At least part of the decline in prices reflected falling profits, not rising productivity. It is also likely that workers discounted standard wage rates in order to hold their jobs.

6. For example, "Although many authorities assert that balloon frame construction had 'almost completely replaced the hewn frame for domestic construction by the time of the Civil War' . . . in North Carolina field surveys demonstrate the prevalence of heavy mortised-and-tenoned house frames until the Civil War" (Bishir et al. 1990, 457). An architect whose book was published in 1855 writes: "There is no doubt that if the subject received closer attention, a better mode of framing than that generally employed, could be suggested. Timbers are often unnecessarily heavy, but are afterwards so weakened by the mode of framing which is in vogue, and which compels the cutting of mortices and tenons and insertion of one timber into another, that the frame is less substantial than if constructed of lighter stuff differently put together. It is difficult to persuade carpenters of this" (Wheeler 1855, 407). The implication of the last statement is important. The

building industry was a conservative, locally organized industry. The architect goes on: "The *New York Tribune* of January 18, 1855, reported a meeting of the American Institute Farmers' Club, and contained amongst other items some remarks from one of the members upon a novel mode of constructing cheap wooden dwellings" (408). The "novel method" was the balloon frame.

The extent to which innovations had diffused is relevant because it would have determined the degree to which prices responded to innovations. Prices would have been potentially affected only in localities in which the new framing system had begun to diffuse; and even there, prices need not have fallen immediately if competition among builders was not severe. If builders commonly used cost plus pricing, of course, prices would have fallen immediately in areas where the balloon frame was put in use.

There is a question as to whether Brady's prices refer to average practice or best practice. The estimates are based on the assumption that they refer to average practice. If this assumption is wrong, and if builders followed cost plus pricing practices, then the Brady price index numbers exaggerate the true decline in average prices. The course of average relative prices of residences after 1849 suggests that the ambiguity with respect to the meaning of the price indexes is unimportant for these years.

7. The two indexes should ideally be weighted by the state distribution of the real value of houses in the capital stock. These in fact are the weights used for 1799, but the weights for 1840 are the real values of houses built in the census year.

8. The capital and income (Weiss) data permit a check on an inference advanced by Davis and Gallman (1978, 2), who estimated that the net investment rate averaged between 6.2 percent and 7.0 percent in the period 1805–40. The rates of growth and capital-to-output ratios in or underlying table 4.7 are consistent with net investment rates (relative to GDP) of between 5 percent and 6.5 percent. The Davis and Gallman figures were computed as a share of NNP, however. If the data in and underlying table 4.7 are adjusted to make them conform more nearly to the concepts that Davis and Gallman were employing, the implied investment rates become roughly 5.9 percent and 7.2 percent, reasonably close to the Davis-Gallman figures.

9. The estimate is based on Jones (1980, 30) and Weiss (1992). According to Jones, there were 53,056 indentured servants in 1774 and 480,932 slaves. All indentured servants were in the work force; following Weiss's judgment for 1800, slaves aged ten and older probably amounted to 65 percent of the population of slaves, and nine-tenths of these people were in the work force. According to Jones, there were 396,158 free adult males, of whom, if we follow Weiss's treatment for the nineteenth century, 87.2 percent were in the work force. The rest of the population—1,034,456—consisted of youths and children, by Jones's account. Assuming that half were males (a safe guess) and that they were distributed among the age groups as was the white population of 1800, then there were about

55,000 males who were ten to fourteen years old, of whom 22.1 percent were in the work force (following Weiss's judgment for 1800), and there were 53,815 who were fifteen to twenty years old, of whom (again following Weiss) 87.2 percent worked. Adding free females ten years old and older (497,973, with a participation rate of 7.5 percent, per Weiss), brings the total labor force to 776,241. A check on the total, assuming an overall participation rate of 32.5 percent (typical of the early decades of the nineteenth century, according to Weiss), yields a figure of 765,039, which is close enough.

10. First in principle, but not in fact. The quality adjustments were worked out first.

11. Gallman 966, 35, variant I. The estimates are available in constant prices only. Current price estimates were made by assuming that the ratio of improvements to farm value added was the same in current and constant prices. The average value of improvements for 1834–43 was taken to correspond to the value of improvements in census year 1839, and so forth. The ratio of the value of improvements to the value of farm value added in 1859 was estimated on the basis of the ratio of improvements, 1849–58, and farm value added 1854. A similar procedure was followed to obtain the ratio for census year 1869.

Chapter Five

1. Parts of these data have been published in Carter et al. (2006), series Ca 192–207 (for 1869–1909) and Ca 219–32 (for 1834–1859).

2. "Notes for the File on National Accounts," p. 5, Gallman papers. This note was not dated, but internal evidence suggests that Gallman composed it in 1996 and 1997 while working on Davis and Gallman 2001.

3. Gallman (2000, 8) generally believed that as decadal averages the "estimates for the latter years are more reliable than those for the earlier years."

4. Tables A-2 and A-3 in Gallman 1966 provide current-value estimates, broken down by major spending category, for the years 1839, 1844, 1849, 1854, and 1859.

5. Gallman revised his postbellum manufactured producer durable series between the preparation of the volume 30 paper for publication and June 1965. The June 1967 spreadsheets note that manufactured producer durables "may be slightly different from the series underlying Vol. 30." During the 1990s, Gallman was apparently unable to locate the exact spreadsheets used in the volume 30 tables. In a 21 January 1994 letter to Richard Sutch, Gallman recounted having "a dim recollection of making minor changes of this cost (of manufacturing durables) after the Vol. 30 paper was in press." Similarly, on 15 August 1995, Gallman wrote to Benjamin Friedman, "The series I am sending you differ slightly, but only slightly—from those that figure in the Volume 30 paper."

As Gallman's notes for 13 March 1985 indicate, manufactured producers' durables series from the June 1965 worksheet "misses consistently—clearly modestly

different series." While spreadsheets exist that perform some of the interpolations used in the new series, none fully document the changes. It is likely that they were the result of Gallman's creation of new benchmarks using better price series. One extant set of spreadsheets in the manufacturer's producer durable files contains the notes "price data . . . found after conference paper series completed." Gallman papers.

6. Mimeo June 1965, Gallman papers.

7. Material sent to Robert Margo, 7 February 1996, Gallman papers.

8. Letter from Robert E. Gallman to Benjamin Friedman, 15 August 1995, Gallman papers.

9. "Notes for the File on National Accounts," p. 5. The 1860-value inventory change estimates are from a spreadsheet labeled D-1 in the inventory estimation files; the current-value estimates from sheets labeled B-1. Gallman papers.

10. Handwritten spreadsheet, June 1967, Gallman papers.

11. See point 1.e: "There are no net national product estimates." in "Memo to Mike Butler, 20 May 1985," Gallman papers.

12. See above. Also, "Notes on Mat'ls taken to England," Gallman papers.

13. The errors were not offset by corresponding errors in the series on "all other construction." As a result, they carry through to Gallman's total construction, capital formation, and GNP estimates for these years. There is some evidence that Gallman found the movements of the railroad series suspicious, because there is a checkmark next to the numbers. As noted below, Gallman produced in 1994 a new set of railroad construction estimates that avoid these problems entirely.

14. In addition to minor typos, there was an inconsistency in the current-price inventory estimates for livestock over the 1869–79 period. Gallman employed the *Historical Statistics* (1975) values for farm animals, K 564–73. These series use gold rather than greenback values, though that is not explicitly noted in the source. This was made more consistent by converting the livestock values into greenbacks using prices from the USDA, *Annual Reports*, 1869–78.

15. Shaw (1947) provided annual estimates of commodity production after 1889 and single-year estimates for 1869 and 1879. Kuznets (1946) then interpolated between the 1869, 1879, and 1889 benchmarks using annual series for available components; see his *National Product*, pp. 90–117, for details. See also Simon Kuznets, "Annual Estimates, 1869–1953, T-Tables 1–15 (technical tables underlying series in *Supplement to Summary Volume of Capital and Financing*)," New York, NBER, c. 1961. http://www.nber.org/data-appendix/c1454/appendix.pdf.

16. To deflate the value of production of perishables, semiperishables, consumer durables, and manufactured producers' durables, Gallman used detailed information on commodity flows from Shaw and his own volume 24 piece and on prices from Brady to create benchmark estimates for 1869, 1879, 1889, and 1899 using 1860 prices. He then employed the yearly variations in the corresponding Kuznets constant 1929-price annual series to interpolate between the benchmarks. The 1900–1909 figures were simply extrapolated on the basis of the Kuznets series.

Simon Kuznets published his series on national product and its subcomponents only as five-year moving averages.

17. Gallman (1966, 37) estimated service flows differently in the antebellum and postbellum periods. For the 1869–1909 period he followed the procedure of Kuznets, using budget studies to derive the ratio of consumer expenditures on services relative to commodities and then multiplying the commodity flow series by this ratio. For the antebellum period, Gallman built up service flows primarily from capital stock estimates, particularly on the value of housing.

18. In a world with high compound growth rates, the use of straight-line interpolation also introduces biases in the timing of the expansion. The direction of the bias depends on whether the interpolator series grows faster or slower than the benchmark series.

19. For these reasons, Gallman was generally opposed to work using his annual national product series to compare the volatility of nineteenth and twentieth century business cycles. But he also took strong issue with claims that his procedures to estimate noncommodity production over the 1839–59 period were "flawed" and generated excessively volatile series. In his view, any bias in volatility due to his construction procedure was likely to be weak or to work in opposite direction from what is usually suggested. The antebellum series were not constructed using the Kuznets ratio method to estimate service flows, but rather using the growth of housing stocks, which was far smoother. Note services accounted for about 24 percent of Gallman's real-value estimate of national product (excluding changes in inventories) over the 1834–59 period. In addition, the estimates for firewood production, which accounted for about 6 percent of national product, relied on straight-line interpolation. One offsetting force was the interpolation using net imports, which tended to "oscillate fairly widely" over the 1834–42 period (Gallman 1966, 64). But, as p. 71 notes, he "attempted to dilute the effect of these oscillations by bringing the leather series into the interpolator." Clearly, the volatility displayed in the annual series was the product of explicit, conscious data collection and assembly choices.

20. See especially table 8 in Davis and Gallman (1973, 456–57) which was based on a 1966 version of Robert E. Gallman and Edward S. Howle, "The Structure of U.S. Wealth in the Nineteenth Century" in Gallman papers.

21. Mimeo with pen note "Corrected Copy, Oct. 28, 1963," Gallman papers.

22. "Chapter 3: Appendix U.S. Estimates of National Product" in Davis and Gallman 2001, 342–44. Also see "Notes for the File on National Accounts," Gallman papers. Gallman is presumably referring to Kuznets's T-tables. Kuznets (1961a, 546) observed that "the series available as annual interpolators were most frequently the more sensitive indexes and would yield annual series exaggerating the short-term changes." His annual gross product estimates "would not be acceptable measures of the amplitude of short-term changes" and, therefore, "are not shown."

23. The contrast between the antebellum and postbellum periods is largely the result of using benchmarks every five years in the early period and every ten years in the later period. It also helps that few of the postbellum benchmark years coincided with peaks or troughs of the business cycle.

24. There is internal evidence in Gallman's files that he and his research assistants made such comparisons themselves. "Gallman vs. Berry" file, Gallman papers.

25. "Notes for the File on National Accounts" pp. 7–8, Gallman papers.

26. Gallman created no current-value estimates for the 1834–59 period that can be considered "finished work," so no implicit price deflators exist for the antebellum period.

27. The rate was likely even lower before the 1830s than afterward (Davis and Gallman 1994).

28. Memo to Mike Butler, 20 May 1985, Gallman papers.

29. "Measurement of U.S. Nineteenth Century National Product," Gallman papers. Butler and Gallman's attempt to remove the $6.4 million spent on the Pennsylvania Mainline railroad between 1829 and 1845 yielded the revisions to the 1834–45 series, shown in the far right columns of table 5.1. The revisions changed real GNP by more than the rounding error only in 1834 and 1838. "Note on the Adjustment of Canal Construction Estimates," Gallman papers.

30. Sutch to Gallman, 26 September and 19 November 1993; Gallman to Sutch, 14 and 21 January 1994.

31. *Railway Age* 128, no. 1, 7 January 1950, p, 246. This series is also available at the NBER macrohistory website and is quite similar to the railroad construction series reported in *Poor's Manual* from 1880 on.

32. Based on series Q-329, -321, and -287 from *Historical Statistics, Bicentennial Edition* (1975). The Q-329 series had an unexplained gap between 1879 and 1893. Gallman instead interpolated using the changes in the Q-321 and -287 series, the number of railroad miles operated. The correlation with the *Railway Age* series is close but not exact. Using his improved capital stock estimates, Gallman created a revised series on railroad construction investment over the 1870–1909 period. He allocated his decadal estimates of real gross investments in railways over the years based on the miles of track constructed annually (or on the changes in railroad miles operated). Letter to Sutch, 14 January 1994, and spreadsheet dated 27 January 1996, Gallman papers.

33. Letter to Diane Lindstrom, 10 June 1988, Gallman papers. The common practice of presenting real GNP, nominal GNP, and the implicit price deflator as separate columns in tables misstates their interdependence. Obviously any two aggregate series yield the third, but the procedures used to construct the aggregates typically involve combinations of all three. That is, for some components, price indes and quantities are multiplied to derive values; for others, quantities are estimated from values divided by a price series; and for still others, implicit prices

are derived from values divided by quantities. This implies that decisions about the price concepts must be made in the process of generating the real product series.

34. The procedure used to derive the antebellum service flows appears as follows. Gallman had estimates for the 1869 value of services in 1860 prices and three extrapolating series: (a) the value of churches (available in 1870 and 1860), (b) the value of tax receipts of state and local governments (running back to 1849), and (c) the value of residential housing (with existing estimates available back to 1850 and Gallman's extrapolation to 1840). Gallman first converted all of the extrapolators into 1860 dollars, and then used all three to estimate the 1859 benchmark from the 1869 value. Then he used real values of (b) and (c) to derive the 1849 benchmark, and finally (c) alone to calculate the 1839 benchmarks. To interpolate between the 1839, 1849, and 1859 levels, Gallman employed Gottlieb's estimates of the stock of residential housing (which must be a fairly smooth series); and to extrapolate back of 1839, he used his lumber series. See Gallman 1966, 57–60, 63–64.

35. Inclusion of ΔINV in the numerator and denominator of the series in column 1 of table 1.3 created the differences for Gallman's widely reproduced series on conventional gross investment (GI) to GNP (in constant prices) reported in table 3 of Gallman (1966, 11). Call the series in table 1.3, x = GI/GNP, and the series in Gallman 1966, y = (GI – ΔINV)/(GNP – ΔINV). One can relate the two series using the ratio z = ΔINV/GI, reported in column 6 in table 2.10. Writing all the ratios in decimal terms, one can show that x = y/(1– z + zy).

36. Recall structures that depreciate more slowly than equipment. Davis and Gallman (1973, 438), for example, assume "a longevity of 50 years for structures and 15 years for equipment. . . ."

Chapter Six

1. In the period after the Civil War, the series depend importantly on Simon Kuznets's (1961b) work sheets. See chapter 5.

2. As Lance Davis has pointed out, a second version of net reproduction cost values each piece of capital at the price required to replace it in a given year (or in the base year, in the case of constant-price estimates with an equally productive piece of capital). How "equally productive" should be defined is not clear, nor are the uses to which such a series could be put. One leading solution to the definition problem would turn the capital stock into a simple transformation of national income. See the exchanges between Edward F. Denison (1957, 233–54) and Simon Kuznets (1957, 273–84).

3. The question addressed to farmers and householders appears to have referred to market value, or possibly to net reproduction cost.

4. All the estimates computed were of gross stocks. I also made calculations with net stocks (straight-line depreciation) for 1869. The resulting ratio was 0.93, the same as the ratio of the gross estimates for that year.

5. Based on Davis and Gallman 1978, p. 23, table 7, col. B(1), and p. 26, table 9, col. 5, and sources underlying these tables.

6. Kuznets (1946, 116–17); inferred from the notes to col. 1, lines 1–10 and col. 4, lines 3–9, of the table. See also p. 197, where the content of capital consumption is defined.

7. See also Goldsmith 1956, vol. 3, table W-7, pp. 32–38.

8. R. Winfrey, *Statistical Analysis of Industrial Property Retirements*, as reported in Young and Musgrave 1980.

9. Where it was possible to identify census-style capital produced from farm materials (e.g., certain types of fences, the value of land clearing), it was deleted from the estimates used in the consistency tests described in this section. But the census did not distinguish buildings by the types of materials from which they were built.

10. The Goldin and Lewis figure is the Civil War loss, discounted back to 1861. I probably should have used the undiscounted figure (about $200 million higher), but in view of the roughness of the calculations, I decided that this would represent an unjustified refinement.

11. In principle, a separate calculation of net losses should be made for each of the five primary series underlying table 6.5, instead of the two sets of estimates made here. Such a refinement would be unlikely to alter table 6.5 very far.

Chapter Seven

1. Primack (1962, 33–45) offers a criticism of Tostlebe's work.

2. Materials prices were measured by the Warren-Pearson building materials price index from US Bureau of the Census (1949), series L-10; labor costs, by Donald Adams's Philadelphia series (1975, 809–10), linked with US Bureau of the Census (1949), series D-110 and D-111, all series shifted to the base 1860 without reweighting. The labor and materials indexes were combined on the assumption that the shares of labor (60 percent) and materials (40 percent) in current price value of output were constant, an assumption supported by evidence in Adams (1975). We assumed that antebellum census-year price indexes could be approximated by averaging calendar year prices; e.g., census year 1849 = the mean of calendar years 1849 and 1850. Adams's variant B construction cost index would have served as well for the antebellum period, but we preferred to build an index with a common materials price component for both the antebellum and the postbellum periods.

3. The relevant data are gathered in US Bureau of the Census (1975), series K564-573). See also US Department of Agriculture, *Agriculture Statistics* (1936-). Farms include ranches. For discussions of the problems posed by range animals, see US Census Office (1872, 73; 1883a, xv; 1902, cxliii–cxlvi). The USDA data appear to include range animals.

4. See also table 7.3. We established the relationship between June 1 and January 1 values on the basis of average relationships for the years 1920 and 1921.

5. The labor time needed to prepare farm materials for use in fencing—e.g., rail-splitting—was included by Primack and by us in the total labor required to build fences.

6. Gallman (1956) suggests other revisions to the census data, none of which could be carried through in the construction of our estimates of improvements. (None of them is of great importance for present purposes.)

7. For Rhode's comments on the 1840 estimates, see this chapter's epilogue.

8. In the case of Illinois, there appears to be something wrong with Primack's estimates of grassland improved in the 1890s and perhaps the 1880s. We therefore reversed the procedure described above, estimating acres of forest improved and taking grassland improved as a residual.

9. Primack's figures differ slightly from one table to the next, almost certainly due to rounding errors (except for a typographical error in table 20, by which the total rods of fencing for 1890 and 1900 are reversed). The 1880 figure for rods of fencing per acre in text table 23 is given as 3.6, but should apparently be 4.0.

10. We assumed that woven wire (probably unimportant before 1900, in any case) and plain wire fences called for the same amounts of labor and materials per rod.

11. Earl W. Hayter (1929, 191) says that production ran 400,000 to 600,000 miles of single-strand wire between 1880 and 1884, about 150,000 tons in 1888, and about 157,000 tons in 1895. Hayter implies that a ton of wire ran to five to six miles in length. We converted his ton estimates into miles at 5.5 miles per ton, assumed 330 rods per mile, and then created the following production estimates (in million rods): 1880, 132.0; 1881, 148.5; 1882, 165.0; 1883, 181.5; 1884, 198.0; 1885, 216.6; 1886, 235.1; 1887, 253.7; 1888, 272.3; 1889, 274.1; 1890, 275.9; 1891, 277.7; 1892, 279.5; 1893, 281.3; 1894, 283.1; 1895, 284.9; 1896, 286.8; 1897, 288.6; 1898, 290.4; 1899, 292.2.

12. Man-months of labor required to produce one rod of fencing: worm, 0.01538 all years; post and rail, 0.01307 all years; hedge, 0.01423 all years; stone, 0.07693 all years; board, 0.007693 all years; wire 0.003461 1840–70; 0.003077 1880–90; 0.002308, 1900.

13. See US Department of Agriculture 1871. Compare the tables on pp. 508–9. Since there were unlikely to have been fewer than four rails per fence (see p. 497), an average of four to five rods of fencing per rod of fence implies that often (but not always; perhaps half the time), farm materials were used for posts, which is probably what was in fact practice.

14. We estimated the July prices for pine in 1840 and 1850 from the annual average price and data on pine boards in US Senate 1893, 229.

15. Regional averages were produced by weighting the state cost data with 1870 fencing totals (since we had no data on fencing by type, by state). The regional average costs of each type of fencing were then weighted by the regional distribution of that type of fencing in 1870, per Primack, to produce weighted national average cost figures by type of fence.

16. The value of farms was taken from the census. It also appears in the various volumes of *Historical Statistics* (e.g., US Bureau of the Census 1960, series K-4).

However, the 1949 edition carries the census estimate of the gold value of farm property in 1870, in place of the current value.

17. We took data on the value of buildings from Primack 1962, 174–75). With respect to fencing, we computed the average value per acre for the United States, and then adjusted this figure upward according to the ratio of the value of farm buildings per acre in the four states, divided by the value of farm buildings per acre in the United States, on the grounds that states well-endowed with farm buildings—as these four were—would also be likely to be well-endowed with fences.

Chapter Eight

1. Statements to this effect are found in several places in the censuses. See, for example, the quotation in section 8.2.4, above, regarding a similar question posed to mine owners.

Chapter Nine

1. The 1890 census may have included some utility property in the real property returns for a few states, but it is impossible to determine how much. Insofar as the manufacturing and mining estimates deviate from market value, the residuals in tables 9.1 are in error, but we do not believe that this is a serious source of error. For evidence that the census was attempting to obtain market values, and that the attempt was well planned, see US Bureau of the Census 1907, 4-6; US Census Office 1895c, 7; US Census Office 1884a, 100–11.

2. The tax duplicates showed that real property was $6,973 million, personal property $5,112 million, and total property $12,085 million. The marshals estimated the true value of real and personal property together at $16,160 million, a mark-up on assessed value of 33.7 percent. See US Census Office 1866, 294–95.

3. Taking the owner estimate of the value of real estate ($10,930) plus 0.25 × the sum of lines 2 and 4 for 1860 table 8.8 ($122) plus 0.25 × the sum of lines 44 and 46 for 1860 table 8.3 ($21) plus 0.55 × the current value of land and improvements, table 10.9 ($392) yields $11,465 million.

4. Railroads, however, had sizable real estate holdings, and our assumption that railroads were of corporate form and hence excluded is crucial. It is also reasonable.

5. For the method and the data, see the estimation procedures for 1860 and table 9.3.

6. US Bureau of the Census 1960, series A-75, A-84, "white," divided by two. Free nonwhites—not very numerous—were left out of the calculations.

7. Goldsmith (1952, 317) estimated the value of nonfarm residences at $800 million, and appears to have believed that the value of "factory, office, store and

miscellaneous business buildings" (p. 320) probably ran about one-third below the figure given by Willford King ($563 million), or at about $376 million. Deducting the value of improvements in mining and manufacturing (tables 8.3 and 8.8, above) from the latter figure yields an approximation to the value of "trade" improvements, roughly $300 million. As to the value of nonfarm residential and trade land, Goldsmith's position is a little unclear. On page 318 he says that land accounted for about one-third of the value of real estate, which implies that nonfarm residential and trade land was worth $550 million ([800 + 300] × 0.5). But in table V (p. 317), he lists all nonfarm land at $400 million. Yet another possibility is that his statement "Approximately one-third of the value of non-farm real estate represented the value of non-agricultural land" was in error, and that he intended to say that the ratio of the value of land to the value of improvements was as one is to three (p. 259), in which case the required figure should be: (800 + 30) × 0.333 = $366 million. Goldsmith's estimates, then, imply that the value of nonfarm residential and trade real estate in 1850 amounted to $1,466 million, $1,500 million, or $1,650 million. The figures bracket our estimate, and the one that most probably represents Goldsmith's views—the second—is virtually identical to ours.

8. The Virginia appraisal data (1838 and 1852) are from Seaman 1852, 616; the New York figures are from the *Auditor's Report*, 1834–36 and 1852, from De Bow 1854. Data were extrapolated from 1835, 1838, and 1852 to 1840 and 1850 on population series. US Bureau of the Census 1960, 12–13.

9. We used the decadal national-level gainful worker series in US Bureau of the Census 1960, Series D-57 and D-58, for reasons given in Gallman 1975, 35–39, 49–51. The data had to be adjusted after 1870 to compensate for a change in the classification method. We multiplied the estimates for 1880–1900 by the ratio (1.0653 = 6850/6430) of the first 1870 figure (the one comparable to the data for earlier years) to the second 1870 figure (the one comparable to the data for later years). The estimates of all gainful workers and agricultural gainful workers were so adjusted. The number of nonagricultural workers in each year was taken as a residual. [Rhode: My best attempts to replicate the regression, including creating the relevant data series, yielded an estimate of the ratio of 0.930, rather than 0.941 as Gallman reports. The discrepancy speaks to the error bounds associated with all the numbers reported. There are several possible sources, including differences in rounding or statistical software. In this case the difference is neither economically nor statistically significant.]

10. This ratio is implicit in Kuznets's estimates. See table IV-2, line 4; table IV-3, line 4; and the notes to line 4.

Chapter Ten

1. The official system of measuring vessels changed in 1865, with problematic consequences for total tonnage (US Bureau of the Census 1960, 439). Professor Brady's price index numbers apparently do not recognize the change. Her price

index numbers for the antebellum period refer to old style tons; her index numbers for the postwar years refer to new style tons. Since we used Brady's work to develop both our current and our constant price series, we were able to make use of the official tonnage series, unadjusted for changes in measurement. See the notes to table 10.1.

2. Since we necessarily used the aggregate equipment index produced by Fishlow, the relative levels of the equipment index numbers in the various years reflect relative equipment prices in 1909, not 1860.

3. Data supplied by Fishlow in correspondence.

4. The sample contains date for fifty-eight railroads and was taken from Stow 1859. Fishlow (1965, 351, table 48) has developed an asset breakdown for 1851–60 with percentages almost identical to ours: 88.5 and 11.5 percent (1965, 351, table 48). We counted as improvements graduation, masonry and bridging; superstructure; buildings and machinery; and engineering.

5. The assumption would probably not affect the rate of increase in improvements indicated by Fishlow's index. In the late 1900s railroad growth slowed considerably, causing the capital in rails and ties to become older; but the increasing life of these assets is a counterbalancing influence.

6. The life of ties was seven to eight years, while the life of rails varied greatly with the use they received (Fishlow 1965, 380).

Chapter Eleven

1. The balance sheet data in US Census Office 1883b, 783, indicate that the dividend was recorded in this way.

2. The estimates of several experts, including a joint estimate by the presidents of the three largest telegraph companies, are found in Senate Executive Document 49, 39th Congress, 1st Session, (US Senate 1865/66), henceforth called "Document 49."

3. Physical data are available from a variety of sources. See notes to tables.

4. Dennison provided his estimates to a Senate select committee formed to consider incorporating a national telegraph company as part of the Postal Service (US Senate 1865/66, 1). Presumably Dennison based his judgments on the advice of experts. The written testimony of two experts (US Senate 1865/66, 2, 5) contains very much higher figures. But both of these men had in mind the construction of the "most permanent" lines, "far superior . . . to the lines which have been constructed by private companies. . . ." The postmaster general apparently was thinking in terms of a less exalted standard.

5. "Miles of poles" refers to the distance covered by a line. "Miles of wire" refers to the amount of wire used in a line. Thus, a six-wire line between two towns 200 miles apart would consist of 200 miles of poles and 1,200 miles of wire.

6. This implies a cost per mile for a good quality one-wire line of $92, or $30 more than Prescott's estimate of the cost of construction in 1860. But Prescott

goes on to say that the 1860 cost would have been $150 per mile, if the lines had been built "as they should be" (US Senate 1865/66, 4). Presumably what we have here are figures of (1) historical cost ($61.80), (2) the cost that would have been incurred had the lines been built in 1860 to a "good" standard ($92), and (3) the cost that would have been incurred if the lines had been built to an "excellent" standard ($150).

7. US Senate 1865/66, 27. The Western Union and US companies owned $360,000 in office fittings; the American Company owned $400,000.

8. See price index, table 11.6, line 7. This assumes that one-third of the stock was bought at 1860 prices (index of 100), that prices increased at 11 percent each year from 1860 to 1866, and that the average prices at which equipment was purchased during the years 1861 to 1866 were the prices of 1864 (index 151.8).

9. Sources as follows: "E" from text above (these three companies made up perhaps 90 percent of the industry), "n" from table 11.4 interpolated to 1866, and "w" and "p" from table 11.3, interpolated to 1866.

10. The presidents of the three leading telegraph companies stated in 1865 that telegraph lines lasted ten years (US Senate 1865/66, 2–3, 13). According to Ulmer (1960, 380), telephone assets lasted ten years circa 1880.

11. Ulmer (1960, 368, tables E-3 and E-4) made use of *Report on the Investigation of the Telephone Industry in the United States* (Federal Communications Commission 1939, exhibit 1360-A).

Chapter Twelve

1. The omission does not appear to be very serious. In 1860, assistant census marshals estimated the number of such animals; see US Census Office 1864, cix, 192. Their value (horses, asses and mules, cattle, sheep, and swine), priced at the same prices we used for agricultural animals, comes to 10.6 percent of our estimate of the value of animals on farms and ranges. In 1900, the census again collected data on the numbers "kept in enclosures." Whether the qualification has any significance we do not know. In any case, their value comes to 6.7 percent of our estimate of the value of animals on farms and ranges in 1900. Some part of this group consisted of work animals in mining, manufacturing, transportation, and other sectors, all or most of which are included in our estimates of the value of equipment in these sectors. Another part comprised consumer durables: carriage horses, and milk cows kept by nonfarm families. Thus it is probable that very few animals were improperly omitted from our capital stock estimates.

2. Secular changes in inventory investments merit more investigation. Field (1987) posits that large-scale enterprise, or modern business enterprise in Chandler's parlance, represented a capital-saving innovation that reduced the inventory-to-output or inventory-to-sales ratios. Abramovitz (1950) is the name most closely

associated with the study of inventory movement, but his analysis focuses on business cycle fluctuations.

3. The series on duties is not altogether consistent with the North and Simon import series. It is also gross of drawbacks, and probably lags behind actual imports. But it is the best series available for present purposes.

4. See Gallman (1960, 44–53). The items omitted were the value of home manufacturing, farm improvements, market garden products (assumed equal to $50 million in 1890 and 1900, in prices of 1879; and $50 million in 1890, in current prices), grapes, dairy products, chickens and eggs, and orchard fruits. The antebellum value of the output of corn, oats, and hay was approximated by dividing the gross incomes from these crops (Gallman 1960, 46–47) by the ratios in Gallman 1960, table A-3, 52. For the postbellum years the values were derived from Strauss and Bean 1940, 39 (corn, crop year farm value; crop year production times 1879 crop year price), 43 (oats, crop year farm value; crop year production times 1879 crop year price), and 59 (production of all hay and hay prices).

5. "Fuel and lighting" for mining (series E-6, E-19) and "all commodities" for manufacturing (series E-1, E-13) in US Bureau of the Census 1960.

6. See Raymond W. Goldsmith and Robert E. Lipsey 1963, 159–60, which argues, in an analogous case, that deflation should yield the purchasing power of the item of wealth, in base year prices. Notice, however, that this involves a change in the conceptual basis for deflation that we have adopted with respect to the other components of the capital stock. That is, up to this point, all of our deflations have been asset-specific, and they have had the purpose of producing capital stock series that reflect the changing volume and quality of specific assets, not the purchasing power of the liquidated value of these assets.

Chapter Thirteen

1. Gallman (1977) stressed the importance of additions to American stocks of human capital from immigration. Gallman (2000, 29) compared estimates from Fishlow (1966b) of the opportunity cost of schoolchildren's time to his own estimates of GNP. This component of the investment in human capital equaled 0.5 percent of GNP in 1860, 0.7 percent in 1880, and 1.2 percent in 1900. The opportunity cost of time "came to roughly 40 percent of total school costs, direct costs plus opportunity costs."

2. For the debate over the consumer durables revolution in the 1920s, see Vatter 1967, Juster 1966, and Olney 1991. For a related recent contribution, see Greenwood, Seshadri, and Yorkoglu (2005).

3. The emphasis on the shares of consumer durables spending in GDP and total consumption differs from the definition of the consumer durable revolution presented elsewhere. For example, Olney (1991, 2) defines "the existence of a

Consumer Durables Revolution as the existence of shifts in the demand for durable goods. . . ." This definition is intended to capture, in an observational testable form, Vatter's claim that the 1920s witnessed a structural shift in consumers' tastes in favor of durables. In her empirical analysis, Olney found that consumers did indeed display greater responsiveness (in terms of income- and price-elasticity parameters) in their durables purchase decisions during the 1920s than during the previous (1902–19) period. These parameter shifts, linked in the book's narrative to changes in the availability of consumer credit and the volume of adverting, implies in Olney's view that a consumer durable revolution did occur in the 1920s. Given data availability, conducting such a demand-side analysis for the nineteenth-century American economy is problematic. The shares approach has the advantage of embracing supply-side shifts, such as innovations reducing their relative prices or increasing the variety of products available to consumers, that increase the importance of consumer durable goods in the economy.

4. The boom in the late Eighties and early Nineties has received little scholarly attention. It coincides with the bicycling craze following the invention of the "safety" bicycle. But the surge must have included a much wider range of durables.

5. The historical literature on "the birth of the consumer society" is large, complex, and global in scope. For a point of entry, see Trentmann 2012.

6. Cowan (1997) argued that the stove, like many other household innovations, created "more work for mother." The stove saved the male labor devoted to supplying firewood, but increased the female work load in cleaning and polishing the stove. Brewer (2000) presents a learned discussion of the cultural aspects of the spread of the cast-iron stove and oven.

7. US Department of Agriculture 1921, 33, indicates that stove-size cordwood was 43 percent more expensive than ordinary cordwood.

8. Schurr and Netschert (1960, 50) also attribute the slow diffusion to "the high cost of manufactured equipment and the transportation difficulties prevailing around the middle of the nineteenth century."

9. Lebergott (1976, 276) further documented the shift toward fossil fuel over the late nineteenth and early twentieth centuries. In 1908, 63 percent of US households used coal, 1 percent petroleum, and 36 percent used wood.

10. According to Adams (1975, 797), masonry was a major expense, accounting for about one-third of the cost of building American homes over the 1785–1830 period.

11. Gallman, March 1996 notes, Gallman papers.

12. This is not a perfectly accurate way of handling the problem (it would be better to distinguish flows of durables of different life expectations), but it is a good approximation, and certainly adequate for present purposes. No effort was made to allow for differences in the actual lifespans of durables of a given type, a matter of small importance in the present context.

13. Goldsmith (1952, 306) provides alternative estimates. He places the value of consumer durables, in billions of current dollars, at 0.3 in 1850, 2.4 in 1880, 4.5 in

1890, and 6.0 in 1900. The consumer durable share of the combined capital stock changed from 7.2 percent in 1850 to 9.8 percent in 1900.

14. Thomas Weiss is to be thanked for raising this issue. The 1774 current price figures taken from Alice Jones appear more reliable than the 1840 or 1870 values, which were obtained by cumulating annual flows. As Gallman notes, "Clearly, hard data figure more importantly in the estimate for 1880 (95%) than in the estimates for 1840 (70%) and 1870 (30%). The figure for 1880 seems quite secure; the figures for [1840 and 1870] . . . much less so."

Chapter Fourteen

1. Blodget's 1806 and 1810 editions of *Economica* appear to be identical, except that the later edition extends his estimates to 1809.

2. Pitkin (1835, 310–14) reports the results of the laws of 1798, 1813, and 1815. See also Pitkin 1816, 325–34, and Seybert 1818, 50, 504, 506.

3. While this description sounds more inclusive than the one that established the tax base for 1799, Seybert and Pitkin treat the appraisals under the 1798, 1813, and 1815 laws as though they covered the same property, and Pitkin (1835, 313) refers to the data he drew from the 1814 and 1815 tax records as "the valuations of houses, lands, and slaves."

4. See North (1960, 600) for estimates of the value of imports and net claims. Jones (1980) estimated the financial credits and debits of Americans in 1774. Since each American debt to an American produces an exactly offsetting credit, Jones's net balance (negative) must measure the net position of the American colonies in 1774—exclusive, of course, of the net balance attributable to institutions such as governments and corporations. The North net claims estimates were modified slightly when they were prepared for publication in *Historical Statistics*, to make them conceptually closer to the twentieth-century series, with which they link. (See US Bureau of the Census 1975, p. 858, for a discussion of the North series, and pp. 742–44 and 750, for data on shipping.) The US Bureau of the Census (1975) series on imports also differ from the North series, because the former includes the value of specie, while the latter does not. The unadjusted North series on the value of imports is the better one for present purposes, and it was therefore employed.

5. According to Seybert (1818, 504), land was appraised by the officials of the 1798 direct tax assessment at about 77 percent of the value of land and dwellings, taken together; Soltow puts the ratio at 76 percent. Adding in nonresidential property might reduce the fraction of the value of real estate accounted for by land nearer to two-thirds, while adding in the land under structures (see below) would probably raise it to closer to three-quarters. Notice that the ratio between "Blodget's" land estimate and Jones's real estate estimate, implied by the text calculations, is 68 percent, which suggests that the reconstructed Blodget figure may

very well be the value Jones had in mind. That is, if land accounted for about 75 percent of the value of real estate in 1774, then Jones's characterization of Blodget's land estimate for 1774—similar to but lower than hers—fits the reconstructed Blodget figure very well. Is it possible that Jones, when she referred to Blodget's land estimate, had in mind his figure for improved land alone? It is true that only the improved land estimate appears on the page in Blodget, cited by Jones. But the value of this land comes to only $52 million, which seems to be much too low to be characterized as being of "the same order of magnitude" as Jones's estimate.

6. This is roughly the share of nonresidential structures (exclusive of public buildings) in the total value of all nonfarm structures in 1840 and 1850. In principle, mills, in addition to public buildings, should also have been dropped from the numerator of this ratio, but there is no readily defensible way to estimate the value of mills and remove them from the numerator.

7. The careful reader of Blodget and Soltow may be led to a different conclusion, since Soltow claims that there were only 577,000 dwellings of free persons in 1798, while Blodget (1810, 58) puts the total of all dwellings of free persons and slaves at 1,010,000 in that year. It is likely that the two are using the term differently: by Soltow to refer to houses, and by Blodget to refer to family dwellings, of which any house may have more than one. But it is true that Blodget's 1798 estimate of "dwelling houses inhabited" (p.58), if it be taken to be equivalent to "families," implies a larger number of free families than Soltow recognizes. Thus, if we deduct 147,000 from Blodget's "dwellings" total, to allow for slave families (838,000 slaves, per Blodget 1810, 58, divided by a family size of 5.7), we arrive at an estimate of 863,000 dwellings inhabited by free families—136,000 more families than Soltow allows for. It seems clear that Soltow and Blodget differ in their view of typical family size in 1798; but that appears not to be the case with respect to Soltow 1798 and Blodget-Goldsmith 1805. Blodget's estimates of dwellings (and thus families) in the 1790s are rather peculiar, as will be seen. While the valuation base of the direct tax seems to have been 1799, Soltow attaches the date 1798 to his estimates.

8. The estimate—or perhaps "guess" is the better word—was previously advanced that no more than three-tenths of the value of structures, exclusive of mills and public buildings, consisted of nonresidential buildings in 1805. Adding mills and public buildings to the totals raises this share to 35 percent.

9. The Massachusetts–New York index was supposed to represent New England and New York; the Adams index, Pennsylvania, Delaware, and Maryland. According to Pitkin, the value of real estate in these two areas was about equal in 1799. The two indexes were therefore weighted equally.

10. The regression equation is $Y = 170{,}570 + 2{,}734x + 301z$ where Y = the total value of dwellings; x = brick and stone dwellings; and z = wooden dwellings. While the range of these index numbers is very wide indeed, and there are some implausible figures, on the whole the pattern that emerges is reasonable. That is, it

captures what seem to be probable cost-quality-size differences among the states. Notice that if the index numbers for Massachusetts–New York and Pennsylvania, discussed in the text, capture differential price trends in these two regions, then the disparity between the levels of prices in these two regions was very much smaller in 1799 than in 1840.

11. There was much experimentation with new types of animals, but there seems to have been no widespread adoption of improved breeds before the mid-1840s or 1850s; and even then, most farmers must have been using stock that was not blooded, even to the slightest degree. Indeed, for parts of the period between 1774 and 1860, and for important segments of the United States, the quality of animals, on average, was probably deteriorating rather than improving. Failure to allow in the estimating procedure for changes in the average quality of animals between 1774 and 1840, or 1850, or even 1860, is unlikely to amount to a major source of error, however. See Gray 1941, ch. 35; Bidwell and Falconer 1973, ch.12, 13, 17, 33–38; Bogue 1963, ch. 5 and 6; and Bonner 1964, ch. 9. [Rhode suggests reading Olmstead and Rhode 2008. The introduction of Merin sheep in the 1800s represented an early adoption of improved stock.]

Chapter Fifteen

1. See Weil 2009, 75, which treats capital accumulation as one part of the growth process but not the main driver. The argument about Germany and Japan is not altogether convincing, because the rate of capital formation helps determines the speed of recovery from the wartime destruction.

2. One needs a measure of the capital stock to perform the growth accounting exercise to calculate TPF.

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