CHAPTER 11

Compensation of Manufacturing Workers

11.1 Nominal Compensation, Real Compensation, and Standard of Living

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11.1.1 Compensation and Its Components

The main results of Officer (2009) are presented in Table 11.1: time series of average hourly compensation (AHC), average hourly earnings (AHE), and average hourly benefits (AHB)—the two latter series constructed in Chapters 5–6 of Officer (2009), the first series their sum. AHB is assumed zero until 1900, then computed for positive values but rounds up to a level of one-tenth of one cent only in 1912. The three variables are rounded to a tenth of a cent (that is, shown to three decimal places) until AHB reaches one cent, which happens in 1936. From then on, the variables are rounded to the nearest cent.

There is a tremendous increase in AHC over the two centuries—understandable because all three variables are measured in nominal (money) terms, that is, they incorporate inflation. The growth in compensation is so great that it can be graphed meaningfully only in logarithmic (ratio)

L. H. Officer, *Essays in Economic History*,
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Table 11.1 Average hourly compensation, earnings, and benefits: 1800–2006

Year	*AHC*	*AHE*	*AHB*	*Year*	*AHC*	*AHE*	*AHB*
1800	0.040	0.040	0	**1904**	0.152	0.152	0.000
1801	0.040	0.040	0	**1905**	0.156	0.156	0.000
1802	0.044	0.044	0	**1906**	0.163	0.163	0.000
1803	0.044	0.044	0	**1907**	0.173	0.173	0.000
1804	0.046	0.046	0	**1908**	0.163	0.163	0.000
1805	0.047	0.047	0	**1909**	0.167	0.167	0.000
1806	0.046	0.046	0	**1910**	0.175	0.175	0.000
1807	0.046	0.046	0	**1911**	0.178	0.178	0.000
1808	0.047	0.047	0	**1912**	0.187	0.186	0.001
1809	0.048	0.048	0	**1913**	0.197	0.196	0.001
1810	0.046	0.046	0	**1914**	0.199	0.198	0.001
1811	0.051	0.051	0	**1915**	0.200	0.198	0.002
1812	0.052	0.052	0	**1916**	0.237	0.235	0.002
1813	0.050	0.050	0	**1917**	0.285	0.283	0.002
1814	0.051	0.051	0	**1918**	0.358	0.356	0.002
1815	0.051	0.051	0	**1919**	0.431	0.429	0.002
1816	0.049	0.049	0	**1920**	0.539	0.537	0.003
1817	0.047	0.047	0	**1921**	0.483	0.481	0.003
1818	0.047	0.047	0	**1922**	0.444	0.441	0.003
1819	0.045	0.045	0	**1923**	0.481	0.478	0.003
1820	0.044	0.044	0	**1924**	0.507	0.504	0.003
1821	0.050	0.050	0	**1925**	0.503	0.499	0.004
1822	0.046	0.046	0	**1926**	0.510	0.506	0.004
1823	0.046	0.046	0	**1927**	0.516	0.512	0.004
1824	0.049	0.049	0	**1928**	0.519	0.515	0.004
1825	0.048	0.048	0	**1929**	0.516	0.512	0.004
1826	0.051	0.051	0	**1930**	0.527	0.523	0.004
1827	0.050	0.050	0	**1931**	0.513	0.509	0.004
1828	0.048	0.048	0	**1932**	0.446	0.441	0.005
1829	0.055	0.055	0	**1933**	0.441	0.437	0.004
1830	0.057	0.057	0	**1934**	0.527	0.523	0.004
1831	0.056	0.056	0	**1935**	0.542	0.537	0.005
1832	0.052	0.052	0	**1936**	0.55	0.54	0.01
1833	0.057	0.057	0	**1937**	0.63	0.61	0.03
1834	0.052	0.052	0	**1938**	0.64	0.60	0.04
1835	0.054	0.054	0	**1939**	0.64	0.60	0.04
1836	0.052	0.052	0	**1940**	0.67	0.63	0.04
1837	0.061	0.061	0	**1941**	0.74	0.70	0.04
1838	0.058	0.058	0	**1942**	0.86	0.83	0.04
1839	0.058	0.058	0	**1943**	0.98	0.93	0.04

(continued)

Table 11.1 (continued)

Year	*AHC*	*AHE*	*AHB*	*Year*	*AHC*	*AHE*	*AHB*
1840	0.057	0.057	0	**1944**	1.05	1.00	0.05
1841	0.058	0.058	0	**1945**	1.06	1.01	0.05
1842	0.064	0.064	0	**1946**	1.13	1.08	0.05
1843	0.056	0.056	0	**1947**	1.30	1.24	0.06
1844	0.057	0.057	0	**1948**	1.41	1.35	0.06
1845	0.057	0.057	0	**1949**	1.46	1.39	0.07
1846	0.057	0.057	0	**1950**	1.55	1.46	0.09
1847	0.061	0.061	0	**1951**	1.72	1.61	0.11
1848	0.065	0.065	0	**1952**	1.83	1.71	0.12
1849	0.063	0.063	0	**1953**	1.94	1.81	0.13
1850	0.061	0.061	0	**1954**	1.97	1.83	0.14
1851	0.064	0.064	0	**1955**	2.05	1.90	0.15
1852	0.067	0.067	0	**1956**	2.16	1.99	0.16
1853	0.068	0.068	0	**1957**	2.24	2.06	0.18
1854	0.068	0.068	0	**1958**	2.39	2.19	0.20
1855	0.068	0.068	0	**1959**	2.45	2.24	0.22
1856	0.067	0.067	0	**1960**	2.54	2.30	0.24
1857	0.069	0.069	0	**1961**	2.60	2.35	0.25
1858	0.075	0.075	0	**1962**	2.71	2.44	0.28
1859	0.076	0.076	0	**1963**	2.83	2.53	0.29
1860	0.077	0.077	0	**1964**	2.89	2.61	0.29
1861	0.081	0.081	0	**1965**	3.00	2.69	0.32
1862	0.091	0.091	0	**1966**	3.14	2.78	0.35
1863	0.096	0.096	0	**1967**	3.29	2.92	0.37
1864	0.105	0.105	0	**1968**	3.52	3.11	0.41
1865	0.112	0.112	0	**1969**	3.72	3.27	0.45
1866	0.114	0.114	0	**1970**	3.93	3.43	0.49
1867	0.112	0.112	0	**1971**	4.26	3.69	0.57
1868	0.112	0.112	0	**1972**	4.59	3.95	0.64
1869	0.113	0.113	0	**1973**	4.95	4.21	0.74
1870	0.113	0.113	0	**1974**	5.44	4.59	0.85
1871	0.116	0.116	0	**1975**	6.02	5.04	0.98
1872	0.117	0.117	0	**1976**	6.53	5.43	1.11
1873	0.120	0.120	0	**1977**	7.15	5.89	1.26
1874	0.118	0.118	0	**1978**	7.77	6.37	1.40
1875	0.116	0.116	0	**1979**	8.34	6.81	1.53
1876	0.114	0.114	0	**1980**	9.12	7.41	1.71
1877	0.110	0.110	0	**1981**	10.00	8.09	1.91
1878	0.108	0.108	0	**1982**	10.80	8.70	2.10
1879	0.107	0.107	0	**1983**	11.22	9.00	2.22

(continued)

Table 11.1 (continued)

Year	*AHC*	*AHE*	*AHB*	*Year*	*AHC*	*AHE*	*AHB*
1880	0.111	0.111	0	**1984**	11.78	9.41	2.38
1881	0.110	0.110	0	**1985**	12.50	9.94	2.56
1882	0.113	0.113	0	**1986**	12.90	10.21	2.69
1883	0.114	0.114	0	**1987**	13.05	10.35	2.70
1884	0.116	0.116	0	**1988**	13.58	10.68	2.90
1885	0.116	0.116	0	**1989**	14.00	10.95	3.04
1886	0.119	0.119	0	**1990**	14.41	11.25	3.16
1887	0.126	0.126	0	**1991**	14.93	11.57	3.36
1888	0.128	0.128	0	**1992**	15.63	11.95	3.68
1889	0.133	0.133	0	**1993**	16.12	12.17	3.95
1890	0.133	0.133	0	**1994**	16.56	12.40	4.16
1891	0.133	0.133	0	**1995**	16.66	12.67	3.99
1892	0.132	0.132	0	**1996**	16.84	12.97	3.86
1893	0.135	0.135	0	**1997**	18.12	13.99	4.13
1894	0.126	0.126	0	**1998**	18.18	14.20	3.99
1895	0.126	0.126	0	**1999**	18.75	14.70	4.05
1896	0.128	0.128	0	**2000**	19.36	15.17	4.19
1897	0.127	0.127	0	**2001**	19.36	15.29	4.07
1898	0.128	0.128	0	**2002**	21.02	16.47	4.55
1899	0.131	0.131	0	**2003**	21.54	16.65	4.90
1900	0.137	0.137	0.000	**2004**	23.07	17.26	5.81
1901	0.139	0.139	0.000	**2005**	23.92	17.74	6.19
1902	0.148	0.148	0.000	**2006**	24.37	18.33	6.05
1903	0.154	0.154	0.000				

Note AHE and AHB may not sum exactly to AHC, due to rounding

scale, done in Fig. 11.1. Note that equal distances on the vertical axis represent equal percentage (not equal absolute-dollar) increases in AHC.

The composition of AHC is of great-interest. The ratio of benefits to compensation, taken as a percent, is $100 \cdot (\text{AHB}/\text{AHC})$ and plotted in Fig. 11.2. The proportion mark-up of benefits over compensation (AHB/AHC) is different from, and smaller than, the proportion mark-up of benefits over earnings (AHB/AHE), which is used to derive AHB for 1929–2006. Also, the gross-earnings foundation of AHE and the consequent residual concept of AHB imply a lower benefits/compensation ratio than otherwise (see Officer 2009, chapter 1, Gross Earnings versus Regular Earnings; chapter 4, *Average Hourly Benefits*; and chapter 6 , 1929–2006).

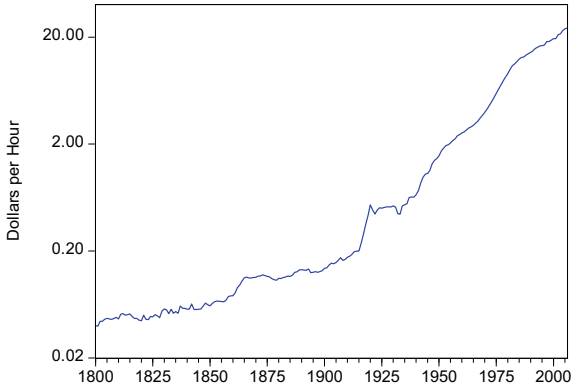

Fig. 11.1 Average hourly compensation (logarithmic scale)

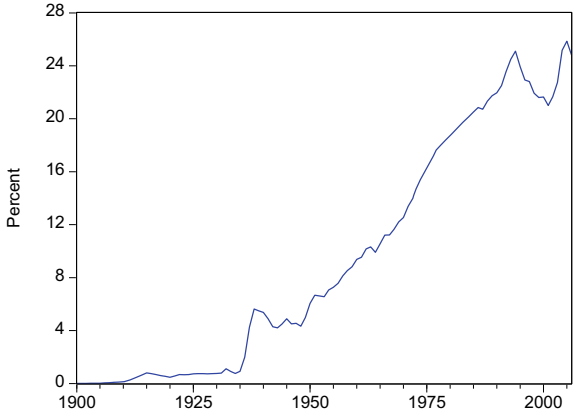

Fig. 11.2 Ratio of benefits to compensation

Until 1900, AHB is so low that it is taken literally as zero. As the graph shows, while the benefits/compensation ratio has an upward trend, the increase is not steady. Benefits reach one percent of compensation only in 1932, fall below that level for three years; exceed five percent in 1938–1940, but fall below five percent in 1941–1949. Benefits first exceed ten percent of compensation in 1962, falling below (but only slightly below) that level only in 1964. In 1984 benefits reach 20% of compensation and

never again fall below that figure. The 25-percent level is achieved in 1994 and 2004–2005.

11.1.2 Standard of Living: Alternative Measures

Thus far this chapter has been concerned with the *nominal* wage rate, that is, the wage rate denominated in current dollars. The particular "wage" is AHC, including benefits and expressed in dollars per work-hour. Thus the long-run nominal AHC series is the main contribution of the study.

However, there is an important property of any nominal series: it includes the effect of inflation, and therefore a nominal wage series cannot measure changes in workers' standard of living. From 1800 to 2006 (nominal) average hourly compensation—that is, AHC—increases 608-fold. The corresponding increase in "real" average hourly compensation is far less. The real wage is defined as the nominal wage divided by the consumer price index (CPI). A long-run CP1 series, with reference base 1982–1984 = 100, is developed in Sect. 12.4 and Officer (2008a). Then real average hourly compensation (AHCR) is constructed as AHC/(CPI/100). AHCR is denominated in "1982–1984 dollars per work-hour," listed in Table 11.2, and graphed in Fig. 11.3.

AHCR increases 37-fold from 1800 to 2006, a far lesser magnitude than for nominal compensation. On the one hand, one sees that in earlier years the standard of living of production workers was greater than a comparison of values of the nominal series over time indicates. On the other hand, any CPI series is beset with problems—such as changes in quality of existing commodities, introduction of new commodities, and omission of important commodities—that tend to bias the series upward as one moves forward in time. So there is a sense in which even AHCR understates improvements in the standard of living over time.

Also, it should be remembered that it is the standard of living of *production workers in manufacturing* that is being measured. The CPI series is based on the official Bureau of Labor Statistics (BLS) series for 1917–2006. Until 1978 the official series relates to urban wage-earners and clerical workers. From that date, the series pertains to all urban consumers. To the extent that the consumption pattern of manufacturing production workers differs from the patterns of these groups, the AHCR series incorporates conceptual error. Also, the quality of the CPI series generally deteriorates as one goes backward in time—as it usually does for economic data (including the AHC series).

Table 11.2 Real average hourly compensation: 1800–2006

Years	*Compensation*										
1800–1810	0.33	0.32	0.42	0.40	0.40	0.41	0.39	0.41	0.38	0.40	0.39
1811–1820	0.40	0.40	0.32	0.30	0.34	0.36	0.36	0.38	0.36	0.39	
1821–1830	0.46	0.40	0.45	0.52	0.50	0.53	0.51	0.52	0.61	0.64	
1831–1840	0.67	0.63	0.70	0.63	0.64	0.58	0.66	0.65	0.65	0.68	
1841–1850	0.68	0.81	0.79	0.78	0.78	0.77	0.76	0.85	0.85	0.81	
1851–1860	0.87	0.90	0.91	0.83	0.81	0.81	0.82	0.94	0.94	0.95	
1861–1870	0.95	0.93	0.79	0.69	0.71	0.74	0.78	0.81	0.85	0.90	
1871–1880	0.98	0.99	1.03	1.06	1.09	1.10	1.09	1.11	1.10	1.12	
1881–1890	1.11	1.14	1.18	1.22	1.24	1.30	1.37	1.39	1.49	1.51	
1891–1900	1.50	1.49	1.55	1.51	1.55	1.58	1.57	1.60	1.63	1.69	
1901–1910	1.69	1.78	1.80	1.76	1.83	1.87	1.90	1.83	1.89	1.90	
1911–1920	1.93	1.99	2.05	2.06	2.05	2.23	2.22	2.38	2.49	2.69	
1921–1930	2.70	2.65	2.82	2.97	2.87	2.88	2.97	3.03	3.01	3.16	
1931–1940	3.37	3.27	3.40	3.94	3.95	3.99	4.41	4.54	4.59	4.78	
1941–1950	5.00	5.30	5.64	5.95	5.90	5.79	5.83	5.85	6.13	6.45	
1951–1960	6.64	6.89	7.24	7.33	7.65	7.94	7.95	8.27	8.42	8.56	
1961–1970	8.69	8.96	9.23	9.33	9.52	9.66	9.86	10.11	10.15	10.11	
1971–1980	10.52	10.98	11.14	11.03	11.19	11.48	11.80	11.92	11.50	11.07	
1981–1990	11.00	11.19	11.26	11.34	11.62	11.77	11.49	11.48	11.29	11.03	
1991–2000	10.96	11.14	11.16	11.18	10.93	10.73	11.29	11.16	11.25	11.24	
2001–2006	10.93	11.69	11.71	12.21	12.25	12.09					

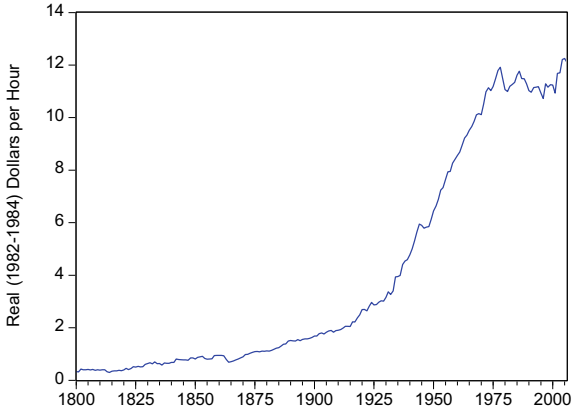

Fig. 11.3 Real average hourly compensation

An alternative measure of the standard of living of manufacturing production workers, original to the present study, is the number of work-hours required to purchase "the consumer bundle." The "value of the consumer bundle" (VCB) is a term invented by the present author (see Sect. 12.3 and Officer 2008b) to describe the "average annual expenditures [per consumer unit]," a BLS series that this author extends back to 1900. VCB emanates from earlier terms—"value of the household bundle" (VHB) and "cost of the (average) household bundle"—developed by Officer and Williamson (2006). VCB is the preferred term, because a "consumer unit" is not the same as a "household." While a household consists of all persons occupying a housing unit, a consumer unit is the decision-making unit for consumer expenditure. Thus a given household can contain more than one consumer unit. This issue, and others relating to the VCB, are discussed in Sect. 12.3 and Officer (2008b).

Let VCB denote the Officer series and HVCB the number of work-hours required to purchase the consumer bundle. For 1900–2006, HVCB is constructed as VCB/AHC. Table 11.3 and Fig. 11.4 ("Required Hours" line) present the HVCB series. Unlike the real wage, standard of living is inversely (rather than directly) related to HVCB. The fewer the number of hours to purchase the consumer bundle, the higher the workers' standard of living. There is a downward trend in HVCB until

Table 11.3 Work-hours required to purchase consumer bundle: 1900–2006

Years	*Number of work-hours*										
1900–1910	5,338	5,599	5,524	5,442	5,618	5,736	5,756	5,619	5,799	6,100	6,020
1911–1920	5,833	5,837	5,659	5,625	5,385	5,248	5,261	4,657	4,358	3,651	
1921–1930	3,286	3,779	3,776	3,551	3,821	3,899	3,796	3,854	3,968	3,466	
1931–1940	3,058	2,814	2,658	2,457	2,555	2,505	2,367	2,272	2,392	2,427	
1941–1950	2,488	2,257	2,127	2,095	2,261	2,698	2,624	2,554	2,429	2,409	
1951–1960	2,284	2,233	2,214	2,230	2,287	2,249	2,267	2,172	2,241	2,221	
1961–1970	2,167	2,138	2,129	2,183	2,205	2,230	2,192	2,182	2,173	2,155	
1971–1980	2,098	2,070	1,921	1,865	1,827	1,825	1,813	1,810	1,842	1,775	
1981–1990	1,699	1,618	1,697	1,865	1,879	1,850	1,871	1,906	1,987	1,969	
1991–2000	1,983	1,909	1,904	1,916	1,936	2,007	1,921	1,954	1,974	1,965	
2001–2006	2,042	1,935	1,895	1,881	1,940	1,986					

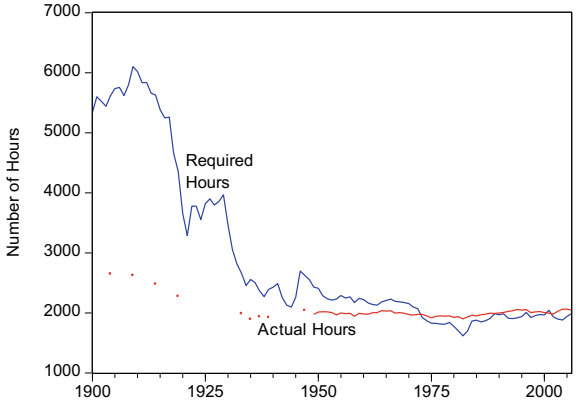

Fig. 11.4 Work-hours: actual and required-to-purchase-consumer-bundle

1982, when the global minimum (1618 hours) occurs, then HVCB increases to 1865 in 1984 and remains within the 1850–2050 range thereafter.

To understand the order of magnitude of the HVCB variable, consider that a 10-hour day (achieved by 1900), 6-day week, and even 52-weeks' work together yield only 3,120 annual work-hours—exceeded by "required work-hours" until 1931. In other words, according to the HVCB measure, the standard of living of the manufacturing production worker was so low in the first three decades of the twentieth century that the fullest-time typical worker could not, by his or her own labor, purchase the consumer bundle! It is also interesting that, while AHCR increases by a multiple of 7.2 over 1900 to 2006, HVCB falls by only a factor of 0.37. For comparison with the AHCR behavior, the inverse of the 0.37 figure is 2.69. Given the criterion of purchasing power over the consumer bundle, AHCR exaggerates the improvement in standard of living by a multiple of more than two-and-a-half.

In the above paragraph, a *hypothetical maximum full-time* work-year provides comparison with the number of work-hours required to purchase the consumer bundle. An alternative comparison measure is the *actual* number of annual work-hours (HACT) per manufacturing production worker. Reliable figures for this variable can be constructed only for certain Census years in the twentieth century: scattered years until 1949 and then continuously. For 1904, 1909, 1914, and 1919, HACT is the

product of ADO (average number of days of operation of manufacturing establishments—Officer 2009, Table 5.8) and ADH (average daily hours, using Rees figures—Officer 2009, chapter 3, COMPOSITE SERIES). For 1933, 1935, 1937, 1939, the source of HACT is Census Man-Hour Statistics (see Officer 2009, chapter 2, *Special Reports* under EARNINGS AND WAGES). For 1933, HACT is the sum of "average hours per wage-earner" in the twelve months; for the other years, HACT is 12 times "average hours per month." For 1947 and 1949–2006, HACT is the ratio of the total hours of production workers (source: Annual Survey of Manufactures—see Officer 2009, chapter 5, 1920–2006) to the average number of production workers (same source).

HACT ("Actual Hours") is plotted along with HVCB in Fig. 11.4. While there is a downward trend in HACT, the trend ends at around 1935—because of missing observations and the limitations of the Man-Hour Statistics themselves, there is an element of uncertainty here—which is much earlier than the corresponding date (1982) for HVCB.

Another innovative standard-of-living measure is the HACT/HVCB ratio: the proportion of the consumer bundle that the typical manufacturing production-worker can purchase from his or her annual earnings. This standard-of-living measure incorporates not only wage but also employment, and is shown in Table 11.4. The actual/required ratio does not exceed fifty percent until 1919, though this milestone could have been reached during the war years (for which data are missing). Not until 1937 is the ratio ever above 80% (with the same caveat of missing observations), and the 90-percent level is reached in 1952–1953 temporarily

Table 11.4 Ratio of actual to consumer-bundle-required work-hours: 1904–2006

Years	*Work-hours actual/required ratio*
1904–1950[a]	0.47 0.43 0.44 0.52 0.75 0.74 0.82 0.80 0.78 0.81 0.84
1951–1960	0.88 0.90 0.91 0.88 0.87 0.88 0.88 0.89 0.89 0.89
1961–1970	0.91 0.94 0.94 0.93 0.92 0.91 0.91 0.92 0.92 0.91
1971–1980	0.94 0.95 1.03 1.05 1.05 1.06 1.08 1.07 1.06 1.08
1981–1990	1.14 1.17 1.14 1.05 1.04 1.06 1.06 1.05 1.00 1.02
1991–2000	1.01 1.06 1.07 1.07 1.06 1.02 1.04 1.03 1.02 1.02
2001–2006	0.98 1.02 1.07 1.09 1.06 1.03

[a]Scattered years, as follows: 1904, 1909, 1914, 1919, 1933, 1935, 1937, 1939, 1947, 1949, 1950

and from 1961 continuously. Only from 1973 onward (with a slight dip in 2001) does the ratio exceed unity. Concretely, only from 1973 does the typical manufacturing production worker have sufficient annual earnings from his or her labor to purchase the entire consumer bundle. Further, in only three years (1981–1983) are annual earnings more than ten percent the cost of the consumer bundle.

It cannot be an exaggeration to state that historically the manufacturing production worker has not been a leading group among consumers in achieving enhancement of standard of living.

11.1.3 Standard of Living: Comparison with Other Studies

Almost every scholar who develops nominal-wage series does so with the ultimate objective of generating corresponding real-wage series or other real-wage information. Therefore application of the real average hourly compensation (AHCR) series of this study to examination of previous historical-studies' conclusions regarding the real wage is instructive. Arbitrarily, a selection is made only from historical studies published after 1965.

Adams (1968, p. 415—see Officer 2009, chapter 2, *Antebellum Records of Firms*) examines changes in real wages in Philadelphia in 1790–1830 to state: "Two periods of rapid increase [in real wage rates] stand out—the 1790's and the period 1815–1830. The real wage increases of the 1790's were largely dissipated by 1815, but from that point on growth was the rule." Adams exhibits the average annual change in real wages of laborers (here representing unskilled occupations) and separately for five skilled occupations over 1790–1815 and 1815–1830. Taking an unweighted average of the results for the skilled occupations and combining the skilled and unskilled figures using the ten-year (1851–1860) Coelho and Shepherd (CS) Northeast weights (see Officer 2009, chapter 5, *Interpolator and Extrapolator Series*), the average annual change in the real wage is 0.39% for 1790–1815 and 4.05% for 1815–1830.

Here the average annual percentage change in any variable Z is computed as $100 \cdot \log(Z_{t+n}/Z_t)/n$, where log represents the natural logarithm, t is the initial year, and $t + n$ the final year. The average annual percentage change in AHCR is 0.31% for 1800–1815 (of necessity, replacing 1790–1815) and 4.15% for 1815–1830—amazingly close to the Adams figures, considering that the Adams Philadelphia data are

not utilized in the present study. In all computations in this section (and, in fact, throughout Officer 2009) unrounded figures are used, resulting in superior precision to that provided by rounded figures shown in a table or stated in the text.

Putting to national use his 1821–1860 wage series based on records of civilian Army employees, Margo (2000, p. 109—see Officer 2009, chapter 2, *Records of Civilian Employees of U.S. Army*, and chapter 5, *Interpolator and Extrapolator Series*) estimates the annual growth rate of the U.S. real wage as the coefficient of a time trend, that is, the least-squares estimate of β in the equation $\log W_{RE} = \alpha + \beta \cdot T + \varepsilon$, where W_{RE} is the real wage, T a linear time trend, and ε an error term. Consider Margo's "variable-weights" results (which allow occupation-specific labor-force shares to vary over time in the computation of the real wage—consistent with a current-weight compensation series). Weight Margo's common-laborer and artisan growth rates according to 10-year (1851–1860) Coelho-Shepherd national weights (0.3564, 0.6436)—computed from data in CS 1976, pp. 226, 228). Then the estimated growth rate is 0.84% per year. Applying the same technique and time period to AHCR, the average annual growth rate of the real wage is much greater, at 1.80%.

This divergence in results has several possible interpretations. It is possible that the Margo data underestimate wage growth in the economy at large; it is also possible that the AHCR series overestimates this growth. Perhaps both series are reliable; but, with the Margo series confined to males, the explosive growth in the female wage during this period (see Officer 2009, table 5.12) is incorporated only in AHCR.

Considering the CS real-wage series (see Officer 2009, chapter 5, *Interpolator and Extrapolator Series*, regarding the CS nominal wage), Margo (2000, p. 9) derives an implication for real-wage behavior during the 1850s decade: "the unweighted [Coelho-Shepherd] series suggest that real wages fell during the first half of the 1850s….Real wages then increased but were no higher in 1860 than in 1851 in any region. Thus, the Weeks Report data suggest that the 1850s was a decade of little or no overall real wage growth."

Although Margo is interpreting certain CS regional series, take here the CS (1976, p. 212) national real-wage series. This series combines all observations, unweighted across occupations and regions. For 1851–1855 the average annual growth rate is −2.29%; for 1856–1860 it is 1.45%. Corresponding figures for AHCR are −1.89 and 3.30%. Thus the

AHCR series is not as pessimistic about the 1850s. In fact, while the CS national real-wage series is 2% lower in 1860 than in 1851, AHCR is 9% higher.

The CS series have an honorable but limited role in developing the AHC (and therefore AHCR) series. The methodological and data differences between AHCR and the CS series are so numerous and substantive that the differences in results are not surprising.

Margo (2006b, p. 2.44) computes a real-wage index for unskilled labor for 1774–1974. He exhibits the series not as a table but only as a graph. Both the numerator (nominal wage) and denominator (CPI) of the Margo series are series constructed by David and Solar (1977, pp. 16–17, 59–60) and reprinted in Margo (2006a) and Lindert and Sutch (2006), respectively. It is interesting that David and Solar themselves do not construct a real-wage series.

Using the time-trend regression technique, Margo estimates the average annual growth rate of that real wage for 1774–1974 (1.5% per year), 1774–1900 (1.2% per year), and 1900–1974 (2.5% per year). Using the same technique, but (of necessity) for 1800–1974, 1800–1900, and 1900–1974, corresponding average annual growth rates for AHCR are 2.0, 1.6, and 2.8% per year. Margo's (2006b, p. 2.44) statement that "two full centuries…over this very long period, real wages have increased substantially" is confirmed—even more so—via the AHCR series. Also substantiated is his observation that "the growth rate of real wages accelerated; growth was slower during the nineteenth century than in the twentieth."

The higher growth rates for AHCR are not surprising, because the David-Solar wage series pertains only to unskilled labor, whereas AHCR incorporates both skilled and unskilled workers. There are other differences between the David-Solar wage series and AHCR, but the directions of their effects are uncertain. Prior to 1890, the David-Solar data are based on unadjusted daily rather than daily-adjusted-to-hourly wage quotations; their series is occupational rather than industry based and so not specific to manufacturing; and, until 1890, their data sources are entirely different from those of AHCR. Inconsequential for the real wage but detracting from direct use is the fact that the David-Solar (nominal) wage series is an index number rather than dollar-denominated. The David-Solar wage series is discussed in David and Solar (1977, pp. 57–68)

and Margo (2006a, p. 2.257). There are also conceptual and data differences between the AHCR CPI-component and the David-Solar CPI, discussed in Officer 2008a.

The real-wage growth results of Goldin (2000, p. 565), for 1900–1929 and 1948–1973, are not considered here, because her time dimension of earnings is annual rather than daily or hourly. A comparison with AHCR growth would not be legitimate.

Margo (2006b, p. 2.44) draws the following implication from his graph of the David-Solar real-wage series: "it is apparent that year-to- year (or longer-term) variability in growth rates of real wages—volatility—was very considerable in the nineteenth century but was dampened in the twentieth century." It is not at all clear that this phenomenon is repeated in the AHCR series (Fig. 11.3). In particular, the first half of the twentieth century appears to exhibit cycles not present in the David-Solar series.

To examine relative volatility of the real wage in the two centuries, a technique superior to visual inspection of a graph is to use the Hodrick-Prescott filter to decompose AHCR into trend and cycle. Although Hodrick-Prescott is applied in the same way as in Officer (2009, chapter 5, *Days of Operation*), there are two differences. First, the time period here is 1800–2006. Second, the cyclical component (CAHCR) is defined in the conventional way as AHCR *minus* TAHCR, where TAHCR is the trend component. CAHCR is graphed in Fig. 11.5.

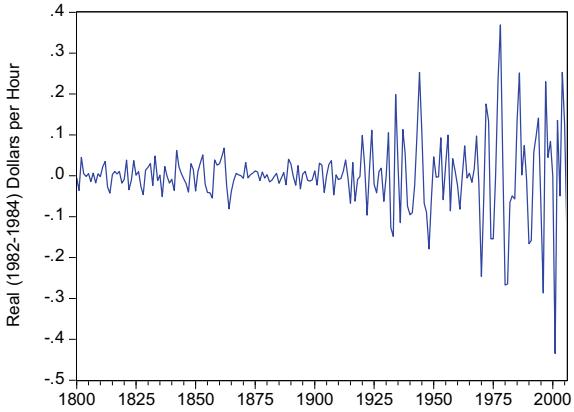

Fig. 11.5 Real average hourly compensation: cycle component

Figure 11.5 shows unambiguously that the cyclical volatility of the real wage AHCR is greater in the twentieth than the nineteenth century—the opposite of Margo's conclusion. Of course, the divergent results are due both to the differing techniques and the different real-wage series.

The relative standard deviations of CAHCR confirm the pattern in Fig. 11.5. For 1800–1899, the standard deviation is 0.027; for 1900–1999, it is 0.111—higher by a factor of 4.1. (The coefficient of variation [ratio of standard-deviation to mean] is not meaningful, because—inherent in the Hodrick-Prescott technique—the mean of CAHCR is zero for the entire time period [1800–2006], and therefore the mean is close to zero for the subperiods.)

In contrast, another of Margo's (2006b, p. 2.44) statements is confirmed using the AHCR series: "the so-called productivity slowdown…began about 1973. A consequence of the slowdown in productivity growth was a marked slowdown in the rate of growth of real wages." Similarly, Goldin (2000, p. 549) notes "labor productivity and real wages lagging in the United States since the mid-1970s." As evidence, Margo examines (separately) the median annual real earnings of male and female full-time workers in the entire economy for 1973–1997. Here, applying the time-trend regression technique to AHCR for 1973–1997, the estimated average annual rate of growth of the real wage is −0.12%. Retardation of real-wage growth during this time period applies, on average, also to manufacturing production workers (males and females together).

11.1.4 Concluding Comments

In summary, and notwithstanding the productivity-slowdown effect on the standard of living, two interesting results follow from historical analysis of the standard of living of the U.S. production worker in manufacturing:

1. Applying the new series of average hourly compensation to the conventional definition of the standard of living—the real wage—the workers' standard of living exhibits greater increases than previous authors have calculated.
2. Applying the new series of average hourly compensation to original and unconventional measures of the standard of living, the increase in workers' standard of living is less impressive—much less impressive—than indicated by the real wage.

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