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A Century of Work and Leisure†

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We develop comprehensive measures of time spent in market work, home production, schooling, and leisure in the United States for the last 106 years. We find that hours of work for prime age individuals are essentially unchanged, with the rise in women's hours fully compensating for the decline in men's hours. Hours worked by those 14 to 24 years old have declined noticeably, but most of this decline was offset by a rise in hours spent in school. Overall, per capita leisure and average annual lifetime leisure increased by only four or five hours per week during the last 100 years. (*JEL* D13, J16, J22)

In his 1930 essay "Economic Possibilities for Our Grandchildren," John Maynard Keynes predicted that a rise in productivity would result in a large increase in leisure time during the next 100 years. He speculated that the central problem for humanity would be using its abundant leisure time in a meaningful way. According to a number of observers, Keynes' prediction about leisure is coming true. For example, John D. Owen (1969), Stanley Lebergott (1993), Robert William Fogel (2000), and Jeremy Greenwood and Guillaume Vandenbroucke (2008) argue that leisure has increased dramatically over the last century.

In contrast, modern-growth and business-cycle theories accept the long-run stability of leisure per capita as a stylized fact. For example, Edward C. Prescott (1986) states: "A key growth observation which restricts the utility function is that leisure per capita, l_t, has shown virtually no secular trend while, again, the real wage has increased steadily." This type of statement has been repeated countless times in the Real Business Cycle (RBC) literature. In a representative agent model, leisure can be stationary in the face of dramatic rises in real wages only if the income and substitution effects of real wage changes cancel each other. Keynes' prediction assumes that the income effect dominates the substitution effect.

Unlike Nicholas Kaldor's (1961) stylized growth facts concerning productivity and capital accumulation, there are few generally accepted stylized facts on trends in

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time allocation. There is little consensus because there exists no consistent historical dataset on the major uses of time. There have been a number of studies of a few categories of time use by particular segments of society, such as hours worked by manufacturing workers or home production by housewives, but no one has systematically analyzed these data to form an aggregate picture for the United States in the twentieth century. Instead, researchers have had to extrapolate trends from incomplete, inconsistent, and sometimes erroneous estimates of time spent in work, home production, and leisure activities. As a result, a large number of macroeconomic and growth theories are founded on questionable stylized facts.

The need for a consistent set of estimates of long-run trends in time use has become more acute with the recent flourishing of macroeconomic and growth models that incorporate richer categories of time use. For example, Robert G. King, Charles I. Plosser, and Sergio T. Rebelo (1988); Robert E. Lucas, Jr. (1988); Jose-Victor Rios-Rull (1993); Roberto Perli, and Plutarchos Sakellaris (1998); and Francesco Caselli and Wilbur John Coleman II (2001) all consider models with human capital accumulation in which costs include the time taken away from leisure. Although the trends in school enrollment have been well documented, to our knowledge no one has measured trends in the fraction of the aggregate time endowment that is allocated to formal schooling. Yet this fraction is the variable at the heart of these types of models with human capital accumulation. As another example, Jess Benhabib, Richard Rogerson, and Randall Wright (1991); Greenwood and Zvi Hercowitz (1991); Rios-Rull (1993); Greenwood, Rogerson, and Wright (1995); Greenwood, Ananth Seshadri, and Mehmet Yorukoglu (2005); and L. Rachel Ngai and Christopher A. Pissarides (2008) incorporate time spent in home production in macro models. In these models, the cost of time spent in home production is the foregone leisure. Thus, the long-run trend in time devoted to home production is an important piece of information for formulating and testing these models.

In this paper, we seek to fill this gap by developing comprehensive measures of time allocation, both in the aggregate and by demographic group. We compile a large number of different data sources to measure how the United States population has allocated its time over the twentieth century. For example, we use John W. Kendrick's (1961, 1973) data on aggregate hours worked, updated with modern sources, to measure market work. We use census and Current Population Survey (CPS) data to estimate hours by demographic group. We use time-use and other surveys on the length of the school day, along with census data and government statistics on enrollment and days attended, to estimate the total time spent in formal education. We use Valerie A. Ramey's (2009) estimates of time spent in home production, which are based on a large number of time-use studies beginning in 1912.

The new measures reveal a number of interesting twentieth century trends. First, hours worked per member of the working age population have declined much less than hours worked per worker. Although hours per worker declined by almost 16 hours per week during the last century, hours per member of the working-age population have declined by between five and six hours per week. Second, all of the decline in hours worked per capita has been concentrated among the young, ages 14–24, and the old, ages 55 and up. Prime-age individuals between the ages of 25 and 54 are working the same number of hours now as in 1900 because the rise in female hours in this age group has offset the decline in male hours. Third, the decline in hours worked among the young did not translate into a rise in leisure. Instead, almost all of the decline in work hours was reflected in a rise in school hours in this age group.

Estimates of time spent in home production reveal that while prime-age females dramatically reduced their time spent in home production (particularly after 1965), the rise in home production by males offset a large portion of this reduction. We estimate that as older males decreased their labor force participation rates, their time spent in home production rose. Home-production time averaged over the population ages 14 and older decreased by only half an hour per week from 1900 to 2005.

Combining all of the estimates reveals the trends in leisure in the aggregate and by age group. The leisure time of prime-age individuals between 25 and 54 increased by five hours per week from 1900 to 1980, but then fell back down to its 1900 level by 2005. Those ages 18–24 and 55–64 experienced an increase in leisure time by about five hours per week, whereas those 65 years old and older experienced an increase in leisure time of 14 hours per week. The estimates for those ages 14–17 suggest an increase in leisure of six hours. The average for the entire population ages 14 and up, as well as average lifetime leisure, increased by only four hours. Cumulative lifetime leisure time increased by almost 50 percent. Virtually all of this increase was due to extra years of life.

We also consider trends in days spent sick. Our best estimates indicate that adjusting for sick days would change leisure trends by, at most, one hour per week for those under 65, and by two hours per week for those over 65.

The rest of the paper is structured as follows. Section I discusses possible definitions for leisure. Sections II, III, and IV discuss each of the main categories of nonleisure activities, and Section V presents our measures of leisure. Section VI discusses how trends in sickness might affect our leisure estimates. Section VII discusses the implications and concludes.

I. What Is "Leisure?"

Before proceeding, it is important to distinguish which activities should be considered "nonleisure" versus "leisure." Virtually all models assume that utility is increasing in the amount of leisure, but not in the time spent in other activities. It is widely accepted that market work is not leisure, even though some individuals enjoy their work. Moreover, virtually all of the home production models subtract time spent in home production from the time endowment, so that more time spent in home production reduces utility. As for time spent in formal schooling, King, Plosser, and Rebelo (1988) and Rios-Rull (1993) are just two examples of models in which time devoted to schooling reduces leisure, and hence reduces momentary utility.

We follow the theoretical literature in our broad categorizations, but are still faced with potential ambiguities in some subcategories. To guide our classification, we consider three alternative metrics.

We first consider Margaret G. Reid's definition of household production. Reid (1934, 11) defines household production as "those unpaid activities carried on, by and for the members, that might be replaced by market goods, or paid services, if circumstances such as income, market conditions, and personal inclinations permit the service being delegated to someone outside the household group." According to this definition, an active market in a good or service that substitutes for a home activity would suggest that activity should be classified as home production rather than leisure. The active markets in house cleaning services, baby and child care, and yard work services suggest that they are best categorized as home production rather than leisure by this metric.

Fogel (2000, 185) offers a second method for categorizing activities:

> *Chores* and *work* both involve tasks necessary for earning and maintaining a standard of living. Disagreeableness is not the criterion for including an activity in the category chores since then, as now, some chores, such as gardening and cooking, could be pleasurable, as was true of other categories of work. Chores, like work, denotes economic compulsion, whether that compulsion is administered by a "boss," the invisible hand of the market, or is self-administered in order to ensure the maintenance of standards of living.

This definition leads to similar categorizations as the Reid definition. As Fogel argues, even if some activities are, at times, pleasurable, they should be classified as chores if they are necessary to maintain a standard of living.

We offer a third way to categorize activities. Since the models we discuss assume that more leisure gives higher utility, we consider classifying activities by the enjoyment they give. A survey reported in John P. Robinson and Geoffrey Godbey (1999) is useful as a general guideline. As part of the 1985 Time Use Survey, individuals were asked to rate their enjoyment of various activities, with ten being the highest and zero being the lowest rating. Table 1 summarizes some of the key activities listed in Robinson and Godbey (1999, table 0). The activities with the highest enjoyment scores (sex, playing sports, etc.) are those that one would generally classify as leisure.[1] "Work" has an enjoyment index of seven. Since work is generally considered not to be leisure, it would seem logical to classify any activity with an enjoyment level under seven as a nonleisure activity.

Guided by these three metrics, we classify the activities shown in Table 1 (in bold) as nonleisure activities. All but one of these activities have an enjoyment level below work. The exception, baby care, is classified as a nonleisure activity only because of data limitations, since most time-use surveys include this activity in general child care, which has lower enjoyment levels. We should also point out a few other subtle distinctions we have made. First, while we include time spent in formal education (leading to a degree) as nonleisure, we include time spent in classes for personal enrichment as leisure. Second, based on our three metrics, we concur with Mark Aguiar and Erik Hurst (2007) that activities such as talking to, and playing with, children are high-enjoyment activities, and thus classified as leisure. We classify other child care activities as home production. Third, activities such as sleeping, eating, and bathing are counted as personal care time, which will be discussed later.

[1] The enjoyment orderings of activities from the time use survey are quite similar to those using real-time experience sampling, as reported by Daniel Kahneman and Alan B. Krueger (2006, table 2). Also, enjoyment of home production chores was ranked similarly in the early twentieth century. See Ramey (2009) for further discussion.

TABLE 1—ENJOYMENT OF VARIOUS ACTIVITIES IN 1985

9.3	Sex	6.9	
9.2	Play sports	6.8	
9.1	Fishing	6.7	**Second job**
9	Art, music	6.6	**Cook, work at home, shop**
8.9	Bars, lounges	6.5	
8.8	Play with kids, hug and kiss	6.4	**Child care, help adults**
8.7		6.3	**Work commute**
8.6	Talk/read to kids	6.2	
8.5	Sleep, church, attend movies	6.1	**Dress**
8.4		6	Pet care, **classes**
8.3	Read, walk	5.9	**Errands**
8.2	Work break, meals out, visit	5.8	**Housework**
8.1		5.7	
8	Talk with family	5.6	
7.9	Lunch break	5.5	**Home repair, grocery shopping**
7.8	Meal at home, TV, read paper	5.4	
7.7	Knit, sew	5.3	**Homework**
7.6		5.2	**Pay bills, iron**
7.5	Recreational trip	5.1	
7.4		5	**Yardwork**
7.3	Hobbies	4.9	**Clean house, dishes**
7.2	**Baby care**, exercise, meetings	4.8	**Laundry**
7.1	Gardening	4.7	**Child health, doctor, dentist**
7	**Work, homework help, bathe**	4.6	**Car repair shop**

Notes: Categories in bold are classified as nonleisure activities. Baby care is included only because most of the time use surveys do not distinguish baby care from other child care. Pet care is classified as a leisure activity because early time use surveys did not include it as household production.

Source: Robinson and Godbey 1999, Appendix O.

II. Time Spent Working

In 1900, the average work week in manufacturing was between 53 and 59 hours (William A. Sundstrom 2006, tables Ba4568 and Ba4589; Kendrick 1961, table D-10).[2] By 2005, it was around 40 hours per week. A number of macroeconomists have cited the decline in hours per worker in manufacturing as evidence of a dramatic decline in hours worked per person, overall. We will show that this conclusion is wrong for two reasons. First, in 1900, manufacturing represented only 20 percent of total employment, and manufacturing scheduled more hours than most other industries (Sundstrom 2006). Second, changes in labor force participation rates mean that changes in hours per worker do not translate directly into changes in hours per person.

To obtain a more complete picture, we begin by creating a series of aggregate work hours for the entire economy. We include paid hours in the private sector, as well as hours worked for the government (either voluntarily or involuntarily) and unpaid family labor. The inclusion of government workers and unpaid family labor is consistent with the post–World War II (WWII) US Department of Labor, Bureau of Labor Statistics (BLS) labor series, as well as the fact that gross domestic product (GDP) includes the output of these workers.

[2] The high end of the range reflects scheduled hours whereas the low end of the range reflects adjustments for actual hours worked. The estimates presented by Sundstrom are based on Douglas (1930) and Jones (1963).

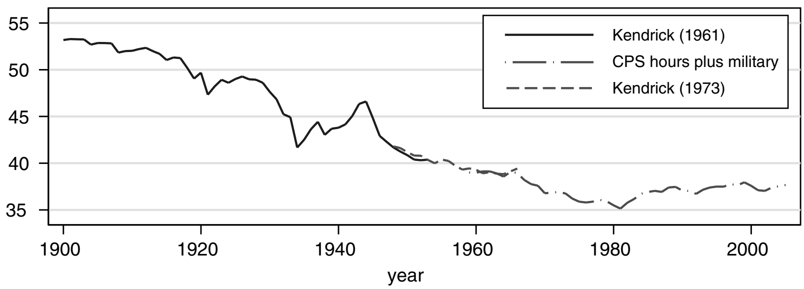
The highest quality consistent source of aggregate and sectoral data from 1900 until 1958 is from Kendrick (1961, 1973). This is the source used in the construction of the hours per worker series for nonfarm private workers reproduced as series Ba4575 in Sundstrom (2006) and by many other researchers such as Casey B. Mulligan (2002) and Robert J. Gordon (2005). Using a variety of data sources, Kendrick constructs total man hours worked on an annual basis. Particularly important is Kendrick's use of detailed Department of Agriculture data to estimate the hours worked by unpaid family workers on farms. Thus, farm work done by children and farm housewives on the family farm is counted. The Data Appendix gives a further description of Kendrick's sources. Beginning in 1959, we use total civilian hours worked from the CPS. We add unpublished data from the BLS on total hours worked in the military to the civilian hours to obtain total hours worked.

Figure 1A shows weekly hours per worker. The series from 1900 to 1953 is total man hours divided by the number of persons engaged, from Kendrick (1961). The series from 1948 to 1966 is defined similarly based on Kendrick (1973). The series from 1959 to 2005 is total hours divided by employment, from the BLS. As the graph shows, our three data sources on hours are strikingly consistent over time. No splicing is necessary. The graph also shows that hours per worker have fallen from 53 hours per week in 1900 to less than 38 hours per week in 2005. Our estimate of 53 hours in 1900 is less than the 58.5 hours from Owen's (1969) series, reproduced as series Ba4575 in *Historical Statistics,* because Owen included only private, nonagricultural workers, and omitted government workers (such as teachers) and agricultural workers (whose employment was seasonal). As Kendrick's (1961) table A-IX shows, average hours for government and farm workers were less than for the other workers. In 1900, government employees averaged 36 hours per week and farm workers averaged 46 hours per week. Also, Kendrick's (1961) table A-VI shows that government and agricultural workers constituted 40 percent of all workers in 1900. Thus, it is important to include them in order to have a complete picture.

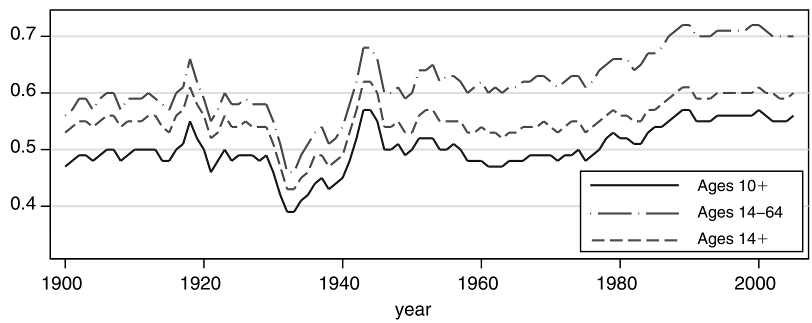
Hours per worker can be a misleading measure of hours per person if there are changes in labor force participation rates. Figure 1B shows labor force participation rates for three age groups.[3] Because of changes in cultural norms and legislation, it is difficult to formulate a consistent measure of the "working-age population" over the twentieth century. Our first measure uses the population ages 10 and older, since 13 percent of the children ages 10–13 were gainfully employed in 1900. The second measure uses the population ages 14 and older, and the third measure uses the population ages 14–64. For the first measure, the labor force participation rate has risen from 51 percent in 1900, to 60 percent in 2005; for the second measure, it has risen from 55 percent to 64 percent; and for the third measure, it has risen from 56 percent to 73 percent.

To show how changes in the labor force participation rates affect estimates of hours per person, Figure 1C shows the ratio of aggregate hours to the three different measures of working age population. Depending on which measure is used, average hours per person have fallen between five and seven hours. Thus, once one takes into

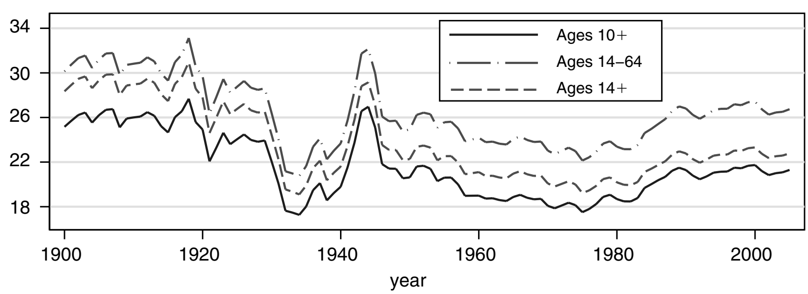
[3] These rates are calculated from census data and updated with published and unpublished BLS data for 2005. The rates are slightly different from the published BLS series because we include the armed forces.



A. Average weekly hours per employed person



B. Employment divided by the working age population



C. Hours per person in the working age population

Figure 1. Measures of Aggregate Hours

Sources: Kendrick (1961, 1973), BLS data, and census data from Ruggles et al. (2004)

account upward trends in labor force participation, it is clear that per capita (or per working-age population) work hours have not fallen as dramatically as one would think just looking at the decline in hours per worker.[4]

[4] Our estimates, relative to the population ages 14 and older, are similar to those of Mulligan (2002). He also used Kendrick's (1961) data updated by the BLS, but because he was unaware that Kendrick (1973) had updated

In order to determine which demographic groups in the population account for the change in hours, we estimate hours worked by sex and age group. We divide the population into six groups ages 10–13, 14–17, 18–24, 25–54, 55–64, and 65 and up. We combined individuals ages 25–54 years because there was little difference within this age group. Hours measures are available decennially beginning with the 1940 census (Integrated Public Use Microdata Series (IPUMS)) Steven Ruggles et al. (2004), and annually beginning with the 1962 Current Population Survey (Miriam King et al. (2004)). To estimate hours by demographic group before 1940, we allocate Kendrick's aggregate hours series by age group and then calculate average hours by age group. The advantage of this procedure is that it builds on Kendrick's widely-used hours series and ensures that the hours of each group sum to the aggregate. It also means that an overestimate for one demographic group will be balanced by an underestimate for another demographic group, so there will be no systematic upward or downward bias. The censuses before 1940 provide employment rates or labor force participations rates, but these do not translate directly into hours, because hours per worker can differ across demographic groups. To estimate hours from employment rates, we assume that hours per worker by group, relative to aggregate hours per worker, were stable from 1900 to 1940. That is, we assume if average hours of all workers were 10 percent higher in 1920, then hours per worker rose by 10 percent for each group. We use the 1940 census to compute the factor giving the hours per worker by age group, sex, and school status, relative to the aggregate. This factor takes into account that employed 15 year olds in school tend to work fewer hours than either employed 15 years olds not in school, or employed 30 year olds. We weight employment data from earlier censuses by the hours factor and then compute the fraction of total hours accounted for by each group. The Data Appendix at the end of this paper contains more details, including the factors used.

To be consistent across time, we also allocate aggregate hours to each group for the period from 1940 on. The average hours per person series we obtain by our allocation method is virtually identical to the direct computations of average hours from the census and the CPS, and to other estimates from the literature (e.g., Ellen R. McGrattan and Richard Rogerson 2004).[5]

Table 2 shows our estimates of hours worked per person by demographic group. The top panel shows the total across sexes and the bottom panels show the numbers by sex. Our aggregates for the rest of the paper concentrate on those ages 14 and older to be more consistent with later definitions of the working-age population. As the table shows, the average hours worked for those ages 10–13 are small relative to the numbers for other age groupings. However, they did account for 2.3 percent of all hours worked in 1900. For this reason, the Table 2 estimate of the decline in average hours worked by those ages 14 and up, 4.7 hours per week from 1900 to 2005, is less than what is shown in Figure 1, which divides total hours (including those by individuals ages 10–13) by the population 14 years of age and older.

his estimates, Mulligan (2002) had to use several splicing factors to match the BLS. Also, Mulligan omits hours of the armed forces.

[5] Our average hours are slightly higher than those from the CPS for males of some age groups because we include hours worked by the armed forces.

Table 2—Estimates of Average Weekly Hours Worked per Person

Year	14+	10–13	14–17	18–24	25–54	55–64	65+
Panel A: Both sexes by age							
1900	27.7	5.2	20.7	29.4	29.6	26.8	19.3
1910	28.5	3.8	19.3	29.1	31.1	29.2	19.0
1920	27.8	1.6	16.9	30.2	30.5	27.3	16.3
1930	24.5	0.9	11.5	26.5	27.6	24.5	14.8
1940	22.0	0.0	5.5	24.2	26.2	21.4	10.5
1950	22.3	0.0	6.1	23.9	26.6	21.9	9.3
1960	21.4	0.0	4.5	23.5	27.0	22.4	6.6
1970	20.5	0.0	4.1	22.2	27.4	22.5	4.8
1980	20.4	0.0	4.5	22.5	28.0	19.0	3.2
1990	23.0	0.0	3.9	23.0	31.6	19.8	3.3
2000	23.5	0.0	3.9	22.6	32.1	21.5	3.6
2005	23.0	0.0	2.9	20.9	31.3	23.1	4.2
Panel B: Males by age							
1900	44.8	7.7	29.1	44.3	49.4	46.1	33.6
1910	45.2	5.4	26.3	41.7	50.8	48.8	33.9
1920	44.0	2.1	22.1	43.1	49.8	45.3	28.7
1930	38.4	1.2	15.3	36.1	44.7	40.8	25.9
1940	34.1	0.0	8.2	32.3	41.4	35.6	18.7
1950	34.4	0.0	8.8	32.2	41.5	35.2	16.4
1960	32.1	0.0	6.3	32.3	40.8	33.5	10.7
1970	29.4	0.0	5.2	28.1	40.1	32.0	7.7
1980	26.7	0.0	5.2	26.5	36.3	26.3	5.1
1990	28.3	0.0	3.9	25.9	38.1	25.6	4.8
2000	28.0	0.0	4.1	25.1	37.6	25.7	5.4
2005	27.3	0.0	2.9	23.5	36.8	27.3	5.8
Panel C: Females by age							
1900	9.6	2.8	12.2	14.9	7.9	6.5	4.8
1910	10.6	2.2	12.3	16.3	9.3	7.4	4.5
1920	10.9	1.0	11.8	17.9	9.8	7.1	3.8
1930	10.4	0.5	7.6	17.4	10.1	6.9	3.7
1940	10.0	0.0	2.9	16.4	11.1	6.7	2.7
1950	10.6	0.0	3.3	16.1	12.2	8.5	2.9
1960	11.5	0.0	2.8	15.2	13.9	12.0	3.2
1970	12.5	0.0	2.9	16.7	15.7	14.1	2.7
1980	14.6	0.0	3.7	18.5	20.0	12.5	1.9
1990	18.1	0.0	3.8	20.2	25.3	14.7	2.2
2000	19.3	0.0	3.6	20.0	26.8	17.6	2.4
2005	18.9	0.0	2.9	18.3	26.1	19.4	2.9

Source: Authors' estimates, based on information from Kendrick (1961, 1973), the census, and the CPS.

Figure 2 shows graphs of the trends for key age groups. First, consider the top panel. The highest line is average hours for the 25–54-year-old age group. Average hours for this age group were the same in the 2000s as they were in the early 1900s, around 31 hours per week. Inspection of the second and third panels shows that the decline in hours by males in this age group was completely offset by the increase in hours by females of the same age.

The age groups just above and below prime age, 18–24-year-olds and 55–64-year-olds, show declines, from 30 hours to 20 hours for the 18–24-year-old group and from 28 hours to 23 hours for the 55–64-year-old group. (These are the middle two lines in the graphs.) Men in these age groups had substantial declines in hours worked, only

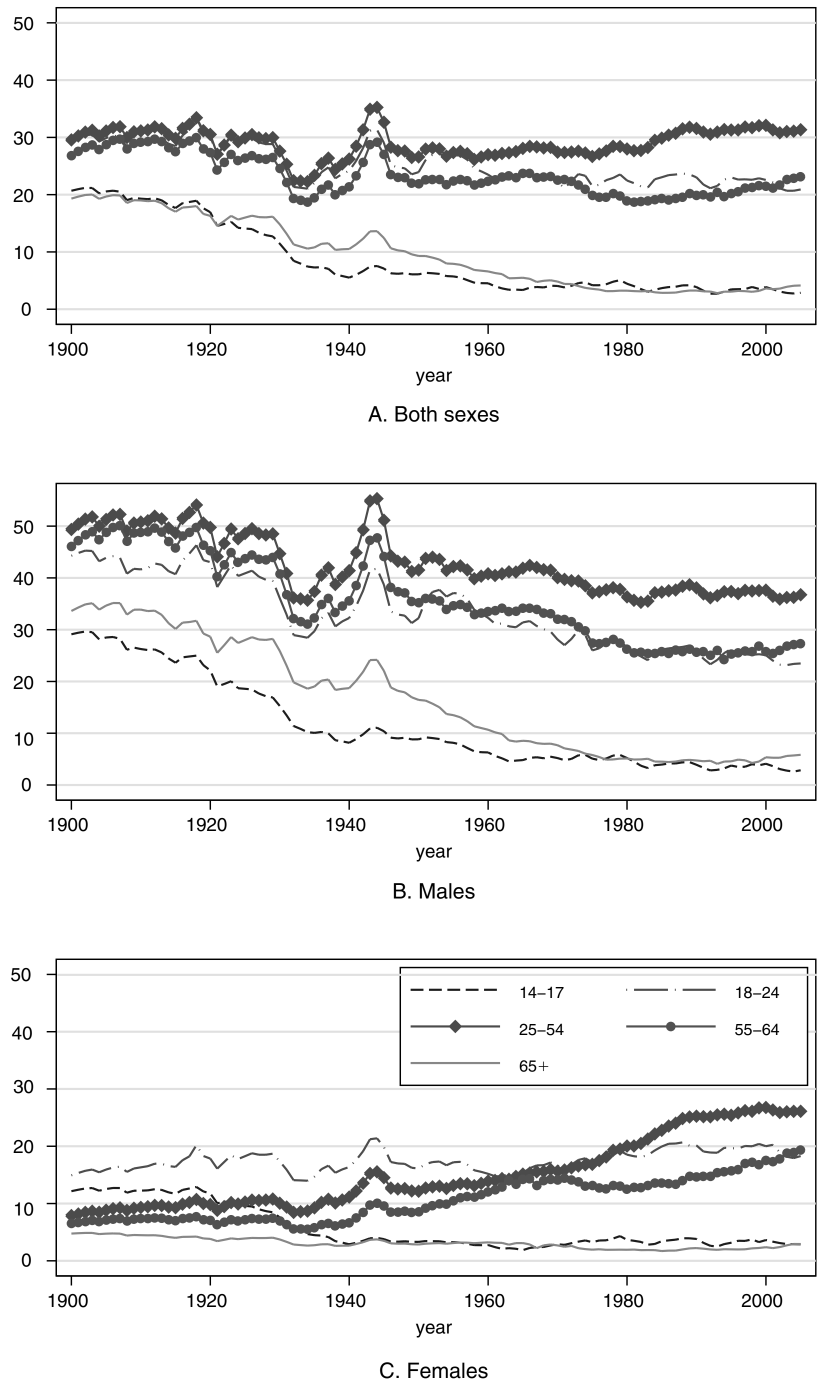


Figure 2. Average Weekly Hours Worked per Person, by Age Group

Source: Authors' estimates, based on information from Kendrick (1961, 1973), the census, and the CPS.

partially offset by increases by women. The age groups with the greatest decline in hours were the 14–17 age group and the 65 plus age group, shown as the bottom two lines in each panel. Both experienced declines in hours worked of about 16–18 hours per week from 1900 to 2005.

We used a Blinder-Oaxaca decomposition to see how much of the change in the average hours of those ages 14 and up was due to changes in the age composition of the population. The contribution of the demographic component is given by either

$$\sum_{i=1}^{n} \Delta W_i H_{i,1900} \quad \text{or} \quad \sum_{i=1}^{n} \Delta W_i H_{i,2005}.$$

ΔW_i is the change in the fraction of the population accounted for by age-group i from 1900 to 2005; and H_i is the average hours worked by age-group i, either in 1900 or 2005. Whichever hours weight we use, we find that demographic changes account for only 0.56 of the total 4.7 hour decline. The rest is due to within-group changes in hours. Thus, measures of aggregate hours of work are not much affected by changing demographics.

To summarize, we obtain four main results from this section. First, focusing on the decline in hours per worker overestimates the decline in hours worked per member of the working-age population because it neglects increases in labor force participation rates. Second, average hours worked by those ages 14 and older have fallen by only five hours per week. Third, average hours of prime-age individuals between the ages of 25 and 54 were virtually unchanged, whereas hours of younger and older groups have fallen significantly. Fourth, almost all of the changes in our aggregate measure of hours per capita are due to changes within age group rather than changes in the age composition of the population.

III. Schooling

One of the most striking trends of the last 100 years is the amount of schooling attained in the United States. Claudia Goldin (2006) chronicles the rise in schooling overall, and Goldin and Lawrence F. Katz (1999) describe the rise of secondary education in particular. These trends translate into a large increase in hours spent in school by potential workers.

In 1900, high school enrollment as a percent of the population of 14–17 year olds was only 10.6 percent (US Census Bureau *Statistical Abstract: Historical Statistics*). This number surely underestimates the fraction of that age group that was in school, however. According to our calculations from the census, in 1900, 47 percent of those 14–17 years old reported being enrolled in school within the past year; 45 percent of boys reported being enrolled in school, and 55 percent reported being gainfully employed. Our reading of the early literature reveals that a significant number of this age group was enrolled in grades 6–8, having fallen behind in their education for various reasons (e.g., Roland P. Falkner 1911; Dennis H. Cooke 1931). Thus, high school enrollment statistics underestimate enrollment by this group. The US Department of Education's *Digest of Education* (DES) begins reporting alternative measures of enrollment rates beginning in 1940. The DES figures are very similar to the census figures in 1940 (79 percent), whereas the ratio of high school students to the 14–17 year old population is 73 percent in 1940.

We estimate time spent in school for the 14–17-year-old age group as the product of:

- the fraction of 14–17-year-olds enrolled in school (using the census estimates before 1940 and the DES statistics afterward);
- the average days per school year attended per enrollee; and
- hours spent in class and on homework per day attended.

The average days attended by enrolled student (grades K–12) are available from Goldin (2006).[6] The hours spent per day attended are based on time-use studies of high school students starting in the 1930s, and other surveys discussed in the Data Appendix. The estimates are about 7 hours per day attended in the 1930s to about 7.8 hours per day attended starting in the 1980s.[7]

We also use enrollment rates from the census and the DES, augmented with college enrollment data, for the population ages 18–24. Time spent by college students is computed as the product of full-time equivalent enrollment in college and annual hours spent by college students. The college enrollment estimates are based on standard sources, detailed in the Data Appendix. Time spent by college students is based on the time-use estimates by Alfred G. Goldsmith and C. C. Crawford (1928); George A. Lundberg, Mirra Komarovsky, and Mary Alice McInerny (1934); and the surveys compiled by Philip Babcock and Mindy Marks (2008). The estimates from the 1920s to the 1960s indicate college students spent about 40 hours per week while in school. Babcock and Marks (2008) find that the time fell to 27 hours per week in 2004. Before 1960, the census estimates of enrollment rates were greater than those implied by college enrollment rates. We assume that these additional students spent the same amount of time as high school students, as detailed above.

Table 3, and the solid lines in Figures 3A and 3B, show our estimates of weekly school hours per person ages 14–17 and 18–24. Note that these are averaged over the entire year, so they are lower than the amount that a student would spend during the school year. Since school enrollment rates for those ages 14–17 were nearly identical across genders, we do not distinguish by gender for this group. However, college enrollment rates differ across gender, so we distinguish by gender for those 18–24 years old. Hours per person spent on schoolwork for 14–17 year olds rose dramatically from 6 to 24 hours and hours per person spent on schoolwork for 18–24 year olds rose from 0.9 to 8 hours. Thus, these two age groups have experienced a substantial increase in the time allocated to formal education.

[6] There is no evidence that average days attended by enrolled students in grades 9–12 were systematically different from other K–12 students (Pamela Barnhouse Walters and Richard Rubinson (1983), *The New York Times* May 27, 1934, N3).

[7] The 7.8 estimate is backed out from time-use studies in 1981, 1993, and 2003. The increase could be due to either more time per day attended, or an increase in days enrolled in summer school.

Table 3—Average Weekly Hours Devoted to School
(*Averaged over entire year*)

	Ages 14–17	Ages 18–24			Ages 14+
Year	Total	Total	Male	Female	Total
1900	6.3	0.9	1.0	0.8	0.8
1910	9.7	2.0	2.0	2.1	1.2
1920	10.5	1.5	1.6	1.4	1.3
1930	13.9	2.5	2.7	2.2	1.7
1940	16.3	2.6	3.0	2.3	1.9
1950	18.4	2.9	4.0	1.8	1.8
1960	20.9	5.1	6.6	3.6	2.5
1970	22.3	6.9	8.4	5.5	3.5
1980	22.5	6.3	6.2	6.5	3.1
1990	23.7	7.6	6.8	8.3	2.6
2000	24.0	7.6	6.6	8.6	2.6
2005	24.0	8.1	6.8	9.3	2.7

Source: Authors' estimates, based on census data, the Digest of Education Statistics, Goldin (2006), and time-use surveys.

Recall from the earlier section that these two age groups experienced substantial declines in hours worked. Some have interpreted this decline as a reallocation of time from work to leisure. However, it is clear that most of the work time was reallocated not to leisure, but rather to formal education. To make this point, Figure 3 also shows the sum of hours spent working and hours spent in school (the dashed line). The increase in schooling hours makes up for the decrease in work hours, casting doubt on the "increased leisure" hypothesis. It is very likely that the disutility from time spent in school is less than from time spent at work, at least in the early part of the century, but it would be inaccurate to categorize it as leisure according to our metrics. Figure 3C shows average school and work hours for the entire population ages 14 and up. Two hours of the decline in hours worked were compensated by an increase in hours in school. Average hours spent in work plus school declined by only three hours per week over the century.

In sum, this section has constructed data that sheds light on trends in time spent by younger groups. In particular, it appears that the decline in hours worked by these groups was offset by an increase in time spent in school. Thus, the dramatic decline in hours worked by the young should not be construed to imply a dramatic increase in leisure.

IV. Home Production

Another important use of time is time spent in home production. Thus, in order to obtain a good estimate of leisure we need to consider trends in time spent in home production. Our estimates are based on the data sources and regression estimates recently compiled and discussed by Ramey (2009). Virtually all of the data sources used are from time diaries, since research has shown them to be the most accurate source of estimates for home production (F. Thomas Juster and Frank P. Stafford 1985, 1991).

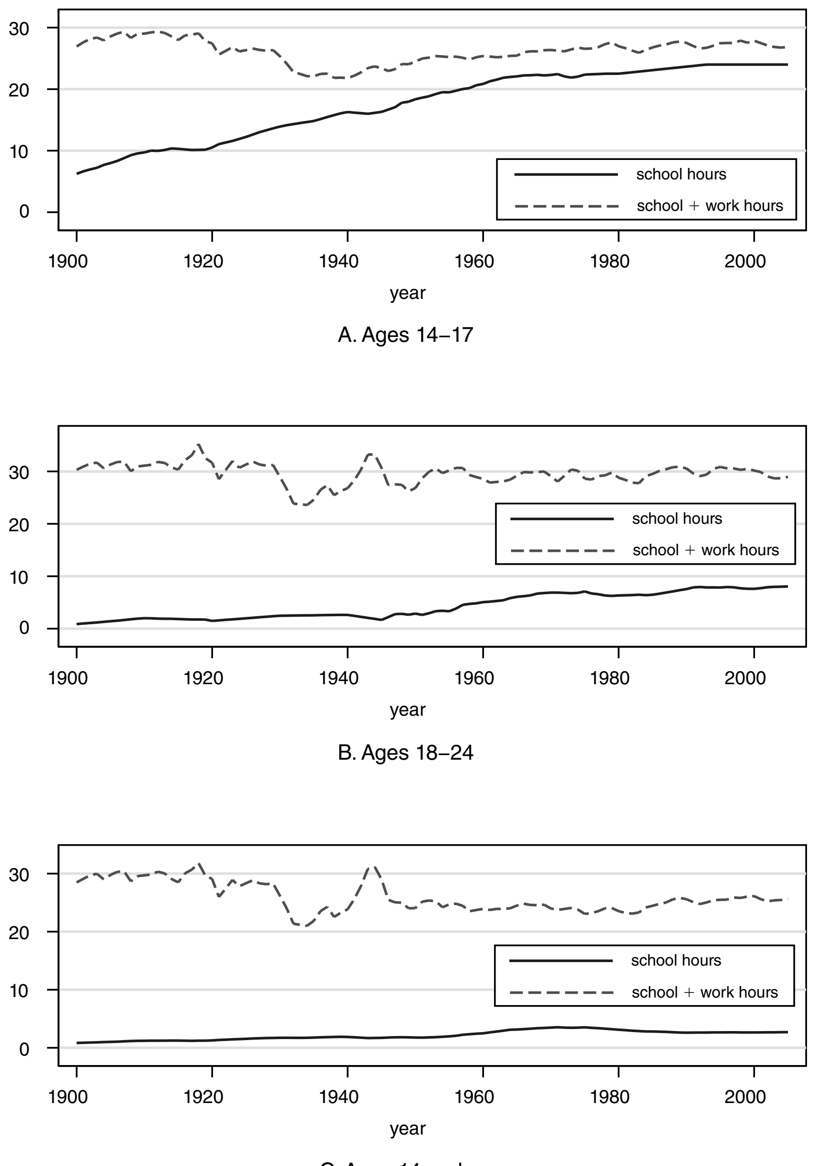


Figure 3. Weekly Hours Spent in School

Source: Authors' estimates, based on census data, the Digest of Education Statistics, Goldin (2006), and time-use surveys.

For consistency over time in the definitions, and for the various reasons discussed by Ramey, the activities included in home production are: planning, purchasing goods and services (except medical and personal care services), care of children and adults (both in the household and outside the household), general cleaning, care and repair of the house and grounds (including yard work, but excluding gardening), preparing and clearing food, making, mending, and laundering of clothing and other household textiles. Ramey uses broader age categories than we do, so we must create subcategories from the raw data. For each of the relevant age, gender, marital status (in the case of women), and employment status cells, we first gather as much information as possible on hours of home production for that category. We then interpolate values between years of the time diary studies. Finally, we weight the estimated hours of home production of each cell by the fraction of the population that falls in that cell. This means that fluctuations in the employment rate will affect the time devoted to home production.

The estimates for married nonemployed women in the categories within the age group 18–64 years old in the early period are based on the regressions from Ramey (2009, table 4, column 3). These regressions, which are based on time-use data from the early 1920s, show how time spent in home production varies by the number of children, the age of the children, and the education level of the housewife. These regression coefficients are then applied to national means calculated from decennial census data in order to form estimates that are more nationally representative. Following Ramey, we also use auxiliary data on the difference in time spent on housework between married and unmarried nonemployed women to adjust the estimates for the fraction of nonemployed women who were not married. The more recent estimates are based on our computations from the American Heritage Time Use Survey (AHTUS) (1965, 1975, 1985) compiled by Kimberly Fisher, Muriel Egerton, and Jonathan Gershuny (2006), and the American Time Use Survey (ATUS) of the BLS (2003–2005). Further details are in the Data Appendix.

Our early estimates for single employed women, married employed women, employed men, and unemployed men are based on Ramey's estimates for the 18–64-year-old age group, adjusted for particular employment-population ratios for the subgroups. These estimates are based on time diary studies from the 1920s and 1930s, such as by Maude Wilson (193-) and Lundberg, Komarovsky, and McInerny (1934). The estimates from 1965 and beyond are based on our computations using the AHTUS and ATUS. Our estimates for the 65-year-old and older age group are identical to Ramey's estimates. It should be understood that there is a great deal of uncertainty about the estimates for this group before 1975, since there are no time-use studies of this group before that year. Fortunately, this group has little effect on our aggregate estimates, since they accounted for such a small portion of the population in the first half of the twentieth century.

For the home production time of teenagers, we use original time use studies, discussed in the Data Appendix, to distinguish time spent by gender. The amount of time spent by high school students doing housework has been relatively constant since at least the 1920s, between five and seven hours.[8] In 1900, however, 29 percent of girls ages 14–17 were neither in school nor employed. We assume that girls in this category spent the same amount of time on home production as women ages 18–24 who were not married and had no children: 43 hours per week. The Data Appendix provides more details. Because the information is so sparse for this category, there is a great deal of uncertainty about the estimates.

[8] Children in the early period also spent time doing farm chores, but these hours are counted as "unpaid family worker" hours in our Kendrick-based hours series.

TABLE 4—ESTIMATES OF WEEKLY HOME PRODUCTION TIME BY DEMOGRAPHIC GROUP

Year	Ages 14+	14–17	18–24	25–54	55–64	65+
Panel A: Total						
1900	22.8	12.3	20.1	26.0	24.2	21.8
1910	22.2	11.7	19.3	25.2	23.4	22.7
1920	22.0	11.1	19.2	24.7	22.9	22.4
1930	22.7	10.5	19.9	25.6	24.1	23.1
1940	23.2	9.8	20.2	25.7	25.5	24.8
1950	24.2	9.2	21.3	26.2	25.6	25.9
1960	24.9	8.6	22.5	27.1	26.3	27.7
1970	22.9	8.1	19.1	26.0	24.9	26.2
1980	20.8	7.3	16.2	23.2	23.9	24.1
1990	21.4	7.3	16.0	22.9	24.3	25.1
2000	22.3	7.4	16.3	24.0	25.1	26.1
2005	22.2	7.5	16.5	24.3	24.1	24.7
Panel B: Males						
1900	4.0	3.8	4.3	3.7	4.2	6.1
1910	4.1	3.9	4.2	3.7	4.4	7.1
1920	4.1	3.9	4.5	3.7	4.4	7.0
1930	6.0	3.8	6.8	5.8	6.3	8.3
1940	7.6	3.7	7.5	7.6	8.8	10.9
1950	9.0	4.1	7.3	9.2	10.4	12.5
1960	10.7	4.5	7.8	11.0	12.5	15.4
1970	11.4	4.8	8.5	12.0	13.8	17.1
1980	12.9	5.2	10.4	13.4	15.1	18.4
1990	14.9	5.6	12.0	15.3	16.8	20.0
2000	16.3	6.0	12.8	16.9	18.9	21.3
2005	16.4	6.2	12.3	17.3	19.0	19.8
Panel C: Females						
1900	42.5	21.0	35.5	50.4	45.2	37.8
1910	41.6	19.6	34.7	49.1	44.6	37.9
1920	40.7	18.2	33.3	47.4	43.8	38.0
1930	39.6	17.3	32.3	45.9	43.3	38.0
1940	38.6	16.0	32.4	43.7	42.8	38.2
1950	38.8	14.4	34.6	42.7	40.9	38.0
1960	38.1	12.8	36.4	42.4	39.2	37.9
1970	33.3	11.4	28.9	39.1	34.8	33.0
1980	28.0	9.5	21.9	32.5	31.6	28.0
1990	27.5	9.1	20.1	30.4	31.0	28.6
2000	27.9	8.9	19.9	30.9	30.7	29.6
2005	27.6	8.8	20.9	31.1	28.7	28.3

Source: Authors' estimates, based on Ramey (2009).

Figure 4 and Table 4 show our estimates of average weekly hours spent in home production. There were significant declines in time spent in home production by women in every age group. For example, women between the ages of 25 and 54 decreased their time spent in home production from 50 hours per week in 1900 to 31 hours per week in 2005. Part of this decrease was among housewives and part was from the increased labor-force participation of women. On the other hand, every age group of men increased its time spent in home production. Men between the ages of 25 and 54 increased their home production time from 3.7 hours per week in 1900 to 17 hours per week in 2005. The increases were similar for men in the two older age categories. For all individuals 25–54 years old, time spent in home production fell

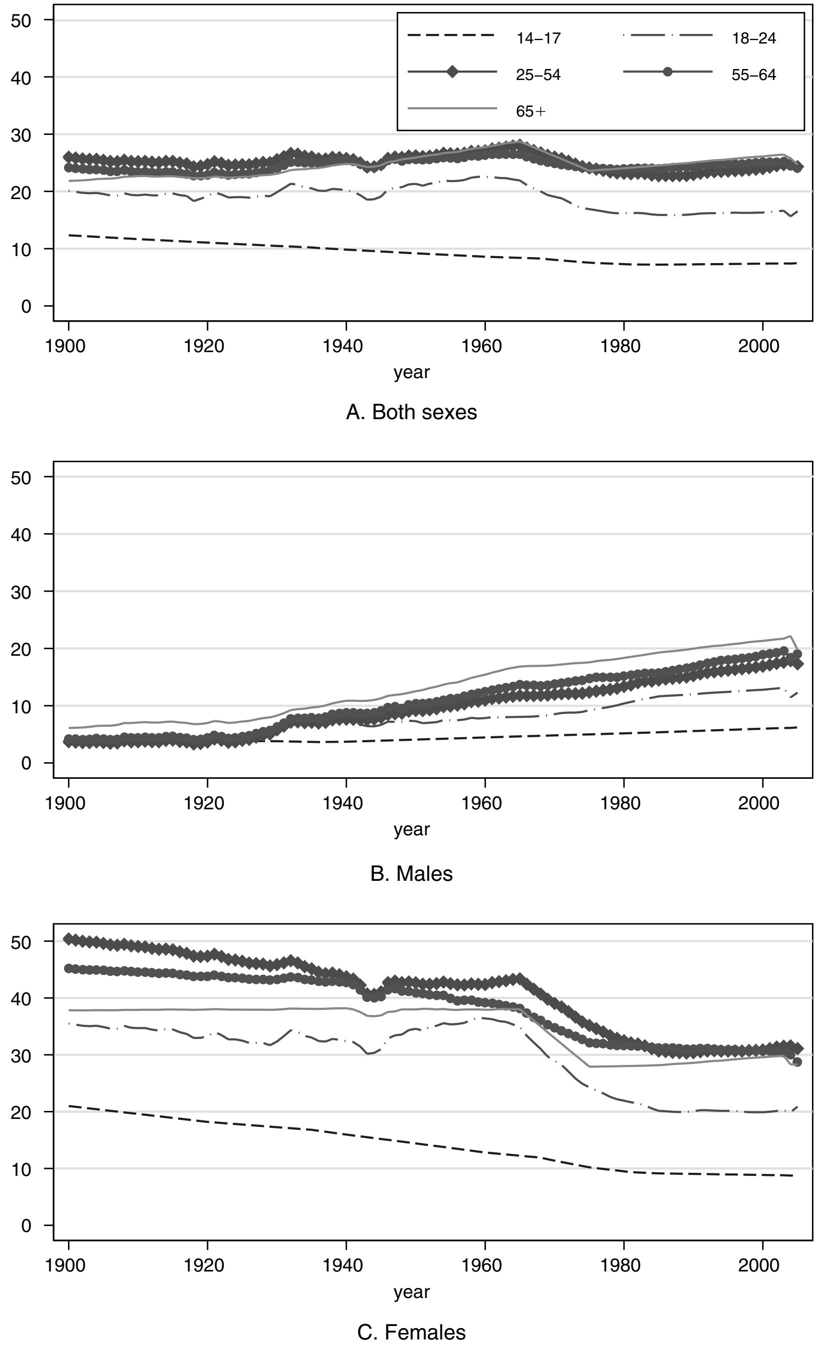


Figure 4. Average Weekly Hours of Home Production

Source: Authors' estimates, based on Ramey (2009).

Table 5—Average Weekly Leisure Estimates by Age

Year	14–17	18–24	25–54	55–64	65+	14+
1900	49.0	37.6	32.5	37.4	47.9	36.9
1910	47.4	37.5	31.6	35.5	47.4	36.1
1920	49.8	37.0	32.7	38.1	50.7	37.0
1930	52.6	39.3	35.1	40.0	51.6	39.5
1940	57.2	41.3	36.4	42.0	54.6	41.6
1950	54.9	40.2	35.6	41.3	54.9	40.4
1960	54.5	37.1	34.2	40.1	56.0	39.8
1970	53.9	39.9	34.8	41.3	59.5	41.7
1980	54.0	43.1	37.1	46.2	63.4	44.3
1990	53.5	41.4	33.3	44.9	62.4	41.4
2000	53.0	41.5	31.7	42.3	60.9	39.9
2005	54.0	42.6	32.2	41.5	61.7	40.6

Source: Authors' estimates, based on multiple data sources.

by only two hours from 1900 to 2005.[9] For individuals 65 years old and older, time spent in home production increased slightly because of the decline in their employment rates.

V. Leisure

We construct leisure as the residual time after subtracting time spent in nonleisure activities from time available. In addition to work, school, and home production, we also subtract commuting and personal care time as nonleisure time. We assume that commuting time is equal to 10 percent of work hours and school hours and that personal care time is 77 hours per week. The Data Appendix discusses the data behind these assumptions. The next section discusses how trends in sickness might affect our estimates of leisure.

Table 5 and Figure 5 show our estimates of average leisure by age. The estimates are total time available per week (168 hours) less 77 hours of personal care time, commute time, market work time, school time, and home production time. The age group with the lowest amount of leisure time is prime-age individuals ages 25–54. According to our estimates, leisure for this group is about the same now as it was in the early 1900s. The estimates by sex (shown in the figure) tell the same story. For 18–24-year-olds and 55–64 year olds, leisure has increased more substantially, by four to six hours per week. For 14–17 year olds, leisure time is six hours per week more now, while our estimates imply an increase of 14 leisure hours per week for those 65 years old and above. It should be remembered, however, that the uncertainty about home production time for the oldest and youngest groups extends into the leisure estimates.

Figure 6 shows three aggregate estimates of leisure time. The solid line in Figure 6A shows our estimate of average leisure for the population ages 14 and over. The estimates suggest an upward trend, punctuated by extreme fluctuations during the 1930s, 1940s, and 1970s, with leisure being 3.7 hours more in 2005 than in 1900.

[9] The average for the entire group is not the simple average of males and females because there were 10 percent more males than females in this age group in 1900.

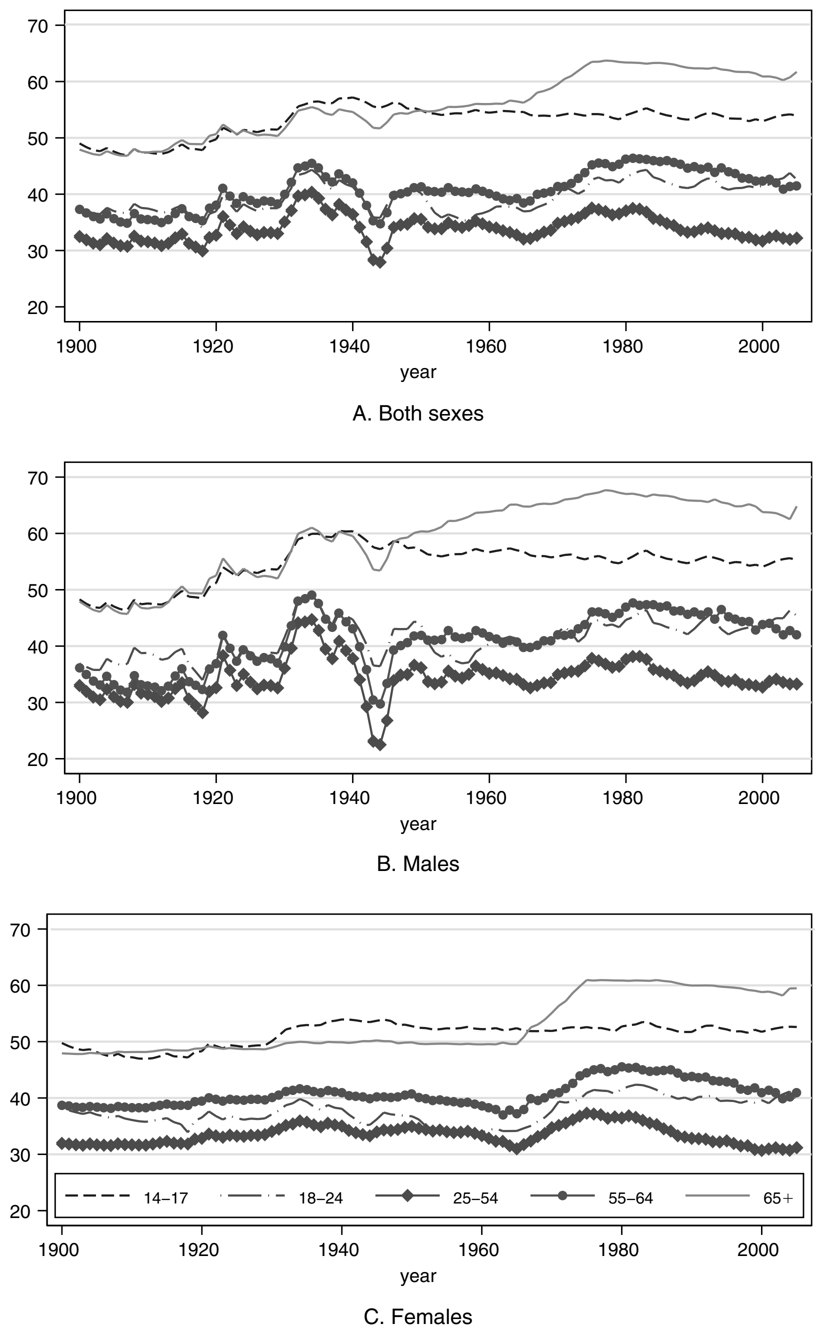
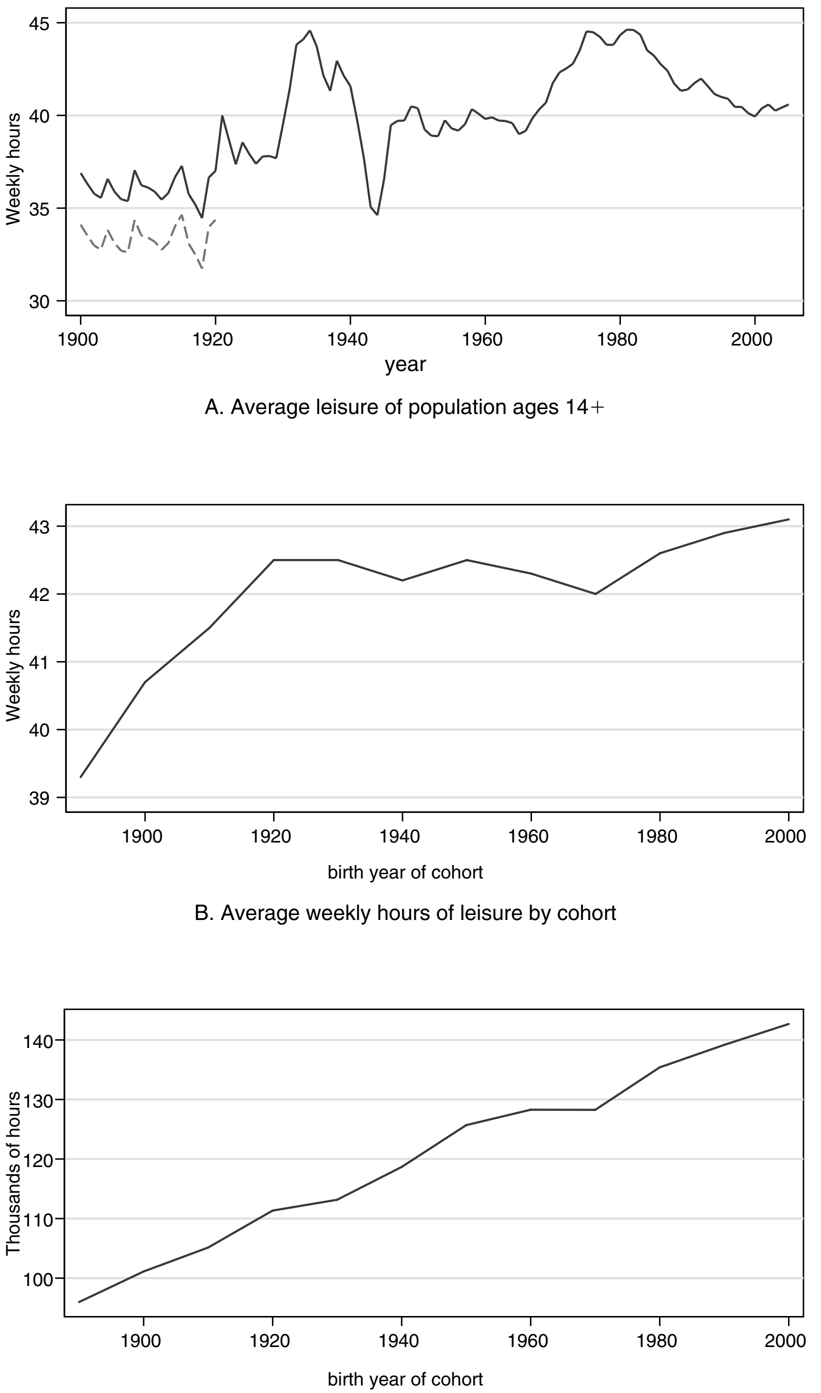


Figure 5. Estimated Average Weekly Hours of Leisure

Blinder-Oaxaca decompositions suggest that between 0.4 to 1.1 hours of this increase were due to the changing age composition of the population, with the rest due to within-age group changes.



A. Average leisure of population ages 14+

B. Average weekly hours of leisure by cohort

C. Cumulative hours of lifetime leisure by cohort

Figure 6. Average Leisure across Individuals and across Lifetimes

Table 6—Lifetime Leisure
(*From age 14 until death, conditional on surviving to age 14*)

Cohort born in:	Average weekly leisure over the lifetime	Cumulative lifetime hours of leisure	Cumulative lifetime leisure as a fraction of total time endowment	Life expectancy at age 14
1890	39.3	95,984	0.235	47.0
1900	40.7	101,117	0.240	47.8
1910	41.5	105,141	0.245	48.7
1920	42.5	111,345	0.251	50.4
1930	42.5	113,163	0.251	51.3
1940	42.2	118,678	0.250	54.1
1950	42.5	125,689	0.251	56.9
1960	42.3	128,283	0.250	58.3
1970	42.0	128,265	0.249	58.7
1980	42.6	135,394	0.252	61.2
1990	42.9	139,172	0.254	62.4
2000	43.1	142,678	0.256	63.6

Note: Lifetime leisure estimates were constructed based on the age-year specific leisure measures and survival probabilities.

The dotted line in Figure 6A shows a lower bound estimate of leisure for the first few decades of the twentieth century, reflecting alternative assumptions for the time-use estimates with the most uncertainty. To produce these estimates, we:

- attributed all hours worked in Kendrick's aggregate series to those 14 years old and older;
- added two standard deviations (equal to 3.6 hours per week) to the time spent in home production for nonemployed women, where the two standard deviations were calculated across the 18 studies (comprising 3,414 total observations) of housewives from the 1920s through the 1950s (Joann Vanek 1973);
- assumed that employed women spent 50 percent more time in home production than indicated by time-use studies in the 1930s;
- assumed girls 14–17 years old, who were not in school and not employed, spent as much time on home production as prime-age married women; and
- assumed that employed men spent 50 percent more time in home production than indicated by the time-use studies in the 1920s.

The joint addition of these five "extreme" assumptions lowers our estimates of leisure from 1900–1920 by three hours per week. One could easily make extreme assumptions in the other direction and raise the leisure estimates by at least two hours per week in 1900. The reason that the change in per capita leisure is relatively small is that the estimates with the most uncertainty (employed women and men) were either a small fraction of the population or did very little home production.

Table 6 and Figure 6B show a measure of "average lifetime leisure." Our lifetime leisure measure is calculated as the average weekly hours of leisure for each year of life from age 14 to expected death for cohorts born from 1890 to 2000. The leisure measure used is the appropriate age-year specific measure for each cohort. We compute the probability of surviving to each age, conditional on surviving to age 14, based on life tables from Michael R. Haines (2006) and the US Centers for Disease Control (2000). We divide the cumulative total by average years of life from age 14. Because leisure by age group has been stable for the last several decades (see Figure 5A), we assume that leisure by group after 2005 is the same as in 2005.

The estimates suggest that average lifetime leisure increased from 39 hours per week for someone born in 1890 and was 14 years old in 1904, to 43 hours per week for someone born in 2000. One would think that the increase in survival rates past 65 years of age would increase average lifetime leisure more. However, survival rates also went up for middle age, when leisure is the lowest. Thus, the overall effect of increases in life expectancy on average hours of leisure per week are quite modest.

Table 6 and Figure 6C also show cumulative hours of lifetime leisure by cohort. This measure increases by 48 percent over the twentieth century. Most of this increase is due to the increase in cumulative lifetime time endowment, not from a change in the allocation of time. As the fourth column of Table 6 shows, cumulative lifetime leisure rose from 24 percent of the lifetime time endowment to 26 percent of the lifetime time endowment.

Overall, our estimates suggest that *average leisure per week* did not increase dramatically during the twentieth century for most of the population. Men and women experienced substantial changes in the allocation of their time as home and market work became less specialized, but aggregate time spent in these activities did not change much. Average market hours declined slightly, but even this decline was counteracted by a rise in hours spent in schooling. Only older individuals experienced significant increases in leisure. On the other hand, as a result of increases in life expectancy, cumulative lifetime leisure rose because the total time endowment of a lifetime rose.

These estimates are quite different from Fogel's (2000, table 5.1) estimates comparing the average time spent per day for the average male household head in 1880 and 1995. He finds much larger increases in leisure time. One possible source of the difference is his earlier starting point. We suspect, however, that most of the difference is due to two key assumptions that he makes. First, he assumes that time spent on home production by men is a constant two hours per day, or 14 hours per week, from 1880 to 1995. This assumption is inconsistent with the time-use evidence we have collected, which suggests an increase from 3 hours per week in 1900 to 16 hours per week in 2005 for prime age males who are working. Second, Fogel's work estimates in 1880 are based on scheduled hours in manufacturing, and amount to 3,109 hours per year. As discussed above, scheduled hours in manufacturing were much greater than the actual hours worked in most other sectors. For 1995, Fogel assumes that male heads of household work 1,730 hours per year. Our measures for males between the ages 25–54, based on census and CPS data, show annual hours of work above 1,900 hours per year.

A recent paper by Aguiar and Hurst (2007) argues that leisure has increased from four to nine hours per week from 1965 to 2003 for those ages 18–64, depending

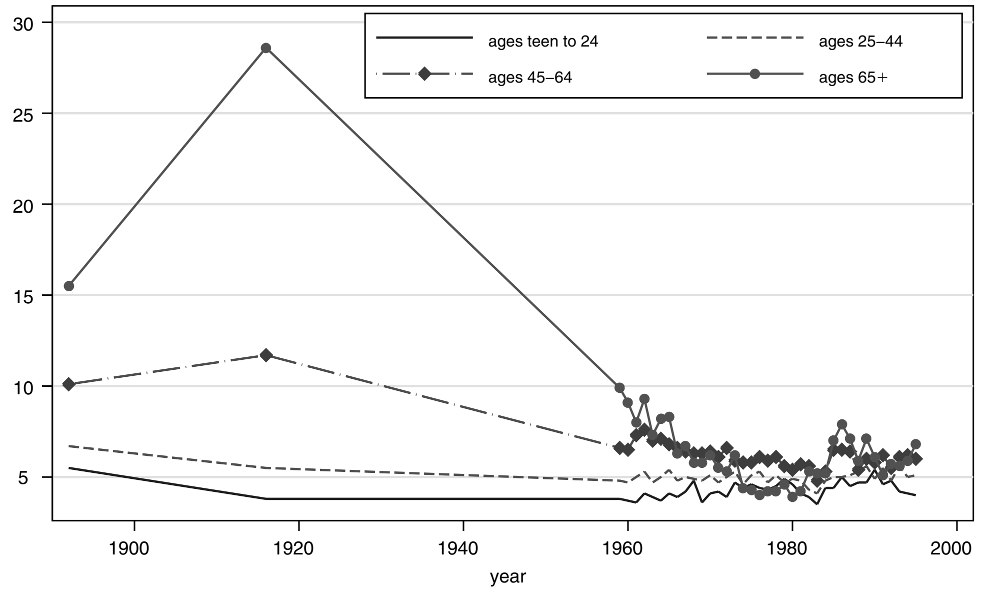


Figure 7A. Annual Days of Work Lost Due to Sickness

Source: Author's estimates based on multiple sources.

on their various classifications of activities. Our results for this population imply somewhat smaller increases in leisure from 1965 to 2003, mainly because we follow the literature and classify child care as home production rather than leisure, we do not count meals at work as "work" in the early sample, and we use CPS data for our hours of work measures.

VI. Effects of Trends in Sickness on Leisure Estimates

An important issue to consider is whether some of what we call "leisure" is actually time spent being sick. It is well documented that mortality rates declined over the twentieth century. The evidence is not so clear on morbidity rates, however. James C. Riley (1991) argues that morbidity rates actually increased as mortality rates fell, while Suchit Arora (2003) presents counter-evidence. The source of the uncertainty is the difficulty in comparing health surveys across time.

Because each possible measure is fraught with potential problems, we consider three measures of trends in sickness. Figure 7A shows estimates of workdays lost due to sickness among those in the labor force. The numbers for the 1880s through 1900 are based on our computations using micro-level data from the *Historical Labor Statistics Project* datasets (Susan B. Carter et al. 1993). Following Dora L. Costa (2000), we use responses to questions asking how many days of work were lost due to sickness. Our sample has over 8,000 observations across a variety of industries and states. The Data Appendix provides more details. We then match these early data to a survey done by the Metropolitan Life Insurance Company from 1915–1917 (Margeret Loomis Stecker 1919) and more recent data from the US Department of Health, Education, and Welfard (DHEW) (1972) *National Health Survey, Series 10* and *Historical Statistics*

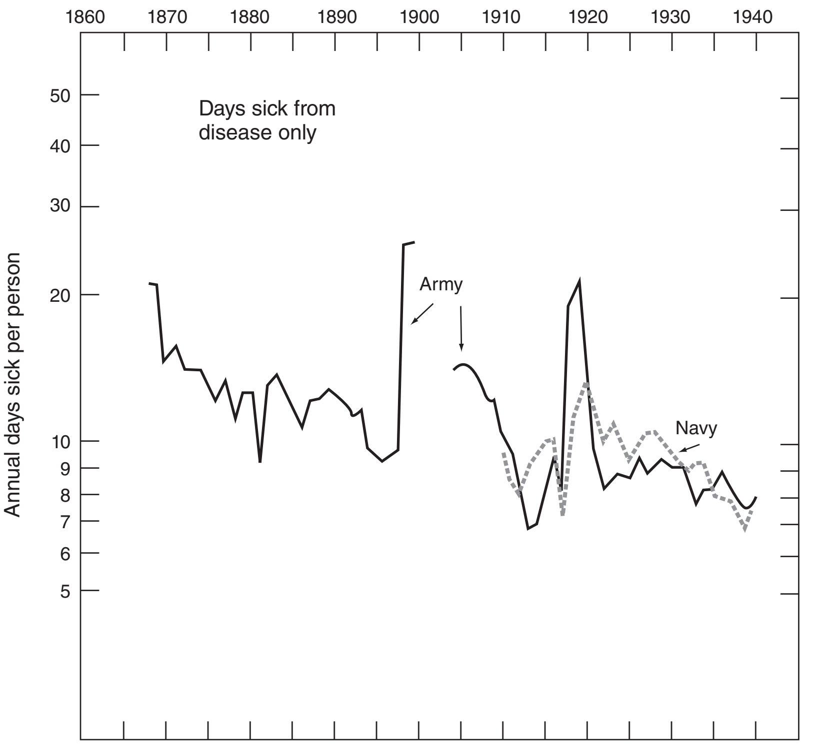


Figure 7B. Annual Days of Disease Sickness in the US Military
(*Reproduced from Collins* (*1945*), *log scale*)

(Richard H. Steckel 2006). The figure shows that for age groups from the teens to 44 years old, there is at most a one or two day decline in annual days of work lost due to sickness per year from the late 1880s to the present.[10] On the other hand, there was a decline of four to five days per year for workers 45–64 years old, and a decline of 10 to 23 days (depending on which early survey is most representative) for those 65 years old and over.

Two features of work-days-lost measures make it difficult to extrapolate trends in leisure time lost due to sickness from these data. First, the work days lost measure is affected by the changing generosity of sick leave. In particular, in the early period, individuals may have worked even when they were sick because they could not afford to lose income. Of course, this behavior means that they were not necessarily spending a greater part of their leisure time being sick and so our leisure estimates are not much affected by sickness trends. Second, the fact that few individuals over 65 years old now work means that there is severe sample selection bias in the more recent data; one would expect that the few older individuals who continue to work after age 65 are much healthier than the vast majority who choose not to work.

[10] We say "teen" because some surveys include those 15 and older, while others include those 17 or 18 and older. Since health hits a peak in the teen years, it is unlikely that the changing definition of "teen" affects the results.

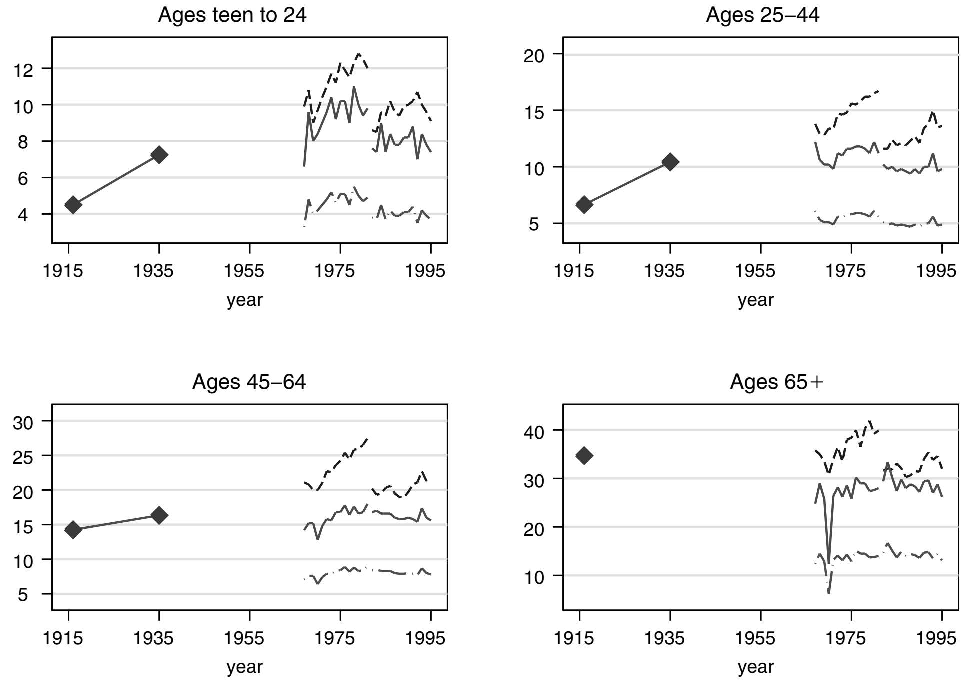


Figure 7C. Days of Disabling Sickness per Year

Notes: The two early data points are based on the Metropolitan Life Insurance Company Survey (Stecker 1919) and the US Public Health Service (1941). The dotted upper lines in the later period are based on "restricted-activity days" from the National Health Interview Survey. The discontinuity between 1981 and 1982 is due to a change in the questionnaire. The lower dotted lines in the later period are "bed-disability days" from the same survey. The solid line in the middle is bed-days multiplied by two.

Thus, it is important to look at other measures as well. Figure 7B reproduces a graph from Selwyn D. Collins (1945), who analyzed days lost due to sickness in the Army and Navy. Arora (2003) discusses the data from 1905 to 1939 at length and argues why they are reasonably consistent. These data suggest a moderate decline in days sick in the Army of around three to six days per year from the early 1900s to 1939, depending on whether one views the decline from 1905 to 1915 as part of a trend or recovery from a temporary upward blip.

The problem with both of the previous measures is the sample selection, particularly in its effect on older individuals. Thus, our third measure is based on more representative surveys. The 1915–1917 estimate is, again, from the Metropolitan Life Insurance Company survey (Steecker (1919). The definition of sickness was "Sickness Involving Disability for Work." The 1935–1936 estimate is from the US Public Health Service *National Health Survey* (1941). The definition of disability in this survey was "Disability, in the case of workers and housewives, means inability to work or care for the home by reason of disease, accident, or physical or mental impairment." We converted the percent disabled on the interview day into days of disability per year. There is no close match to these early definitions in later data, so we offer three possible series for 1967 on from *Historical Statistics*, based on data from the US National Center for Health Statistics (Steckel 2006). The first gives the number of "restricted-activity days," where a restricted-activity day is "one in which a person cuts down on his or her usual activities because of illness or injury. Restricted-activity days include bed-disability, work-loss, and school-loss days." The questionnaire was changed significantly between 1981 and 1982, so there is a large discontinuity in the data, particularly for the restricted-activity measure.

The second measure gives "bed-disability days," where a bed-disability day is "one in which a person is kept in bed either all or most of the day because of illness or injury." It should be noted that linking the bed-disability data to the earlier surveys on disability clearly overstates the downward trend. Collins (1945, 153) states that in the 1930s, the number of days in bed per person was only half the number of disabled days (averaged across age groups) according to the 1930s definitions. Based on Collin's discussion, our third measure is the number of bed-disability days multiplied by a factor of two. We will favor this measure in our comparison with the early data.

Figure 7C shows estimates for various age groups. The bed-disability days in the later sample are clearly lower than the disability days in the early sample. However, as discussed above, comparing these two types of estimates overstates the downward trend in sickness. If we compare the early estimates to twice the number of bed-disability days (shown by the solid lines in the center of the graphs), we see that there is no evidence in these data of a decline in sick days for those under age 65. On the other hand, it appears that there is a decline in sick days for those ages 65 and over, roughly seven days per year.[11]

Based on the various measures presented, it appears that the maximum adjustment for sickness for younger individuals, based on the Army data, is three to six days per year. However, the days-of-work-lost measures suggest that some of those sick days were probably spent at work. For those 45–64 years old, the work-days-lost measures shown in Figure 7A suggest an upper bound of around five days per year. This implies decreasing actual leisure of this group in the early period by about 1.25 hours per week.[12] For those ages 65 and over, adjusting leisure down for eight additional days of sickness per year (as suggested by the estimates shown in Figure 7C that are less subject to sample selection bias) would decrease the early leisure estimate for this group by two hours per week. These adjustments would have no effect on our lifetime leisure calculations since the first cohort we studied (born in 1890) did not turn 65 years old until 1955.

VII. Discussion and Conclusions

The last sections have constructed estimates of time allocation for aggregates as well as by age-sex groups. Before we discuss the implications, we remind the

[11] This rough estimate comes from doubling the bed-days to around 28 per year by 1995 and comparing it to the 1915 disability number.

[12] Recall that we had subtracted 11 hours per day for personal care time before constructing leisure. Thus, the effect of five sick days per year on average weekly leisure hours is $5 \times (24–11)/52$.

reader of the high degree of uncertainty about some of the early estimates. While our aggregate hours series based on Kendrick (1961, 1973) is standard, the decomposition by sex and age group before 1940 depends on estimates of employment rates and hours per worker for each group for the period. Our method, however, assures that an overestimate for one group must be counterbalanced by an underestimate for another group. There is much more precision in the hours estimates by group for the period 1940 to the present, since they are based on census and CPS computations using direct measures of hours. For time spent in school, there is a possibility that we are overestimating the time spent in the early period, since we assume that everyone who reported himself as being enrolled in school spent as much time as someone enrolled in high school. For home production, the best estimates for the period before 1965 are those for housewives. The standard deviation of the mean estimate across time diary studies from the 1920s to the 1950s surveyed by Vanek (1973) is only 1.8 hours per week. On the other hand, the estimates for employed women are based on relatively isolated samples. Although far fewer, all of the early studies suggest that employed men spent very little time in home production, which is understandable given their long work hours. The estimates for teens and the elderly, on the other hand, have a high degree of uncertainty. While there is good evidence on the time spent by high school students, there is no evidence on the time spent by teens not in school and not employed.

We can now assess whether Keynes' prediction is coming true. Keynes predicted that productivity would increase by four to eight times over the 100 years starting in 1930. Productivity in the United States is now 9.2 times that in 1900 and 5.6 times that in 1930. Thus Keynes' prediction, in this respect, is very accurate. However, Keynes also envisioned such a large rise in leisure that the little amount of work left would be spread over the working-age population. Our estimates do suggest that market work (and home production work) is spread more evenly over the population, but they do not suggest the dramatic rise in leisure predicted by Keynes. According to our best estimates, leisure has increased by 10 percent since 1900. This increase contrasts with an increase in the real wage (or productivity) of 820 percent. Over the period for which the data are better, from 1930 to the present, leisure increased by only three percent, whereas labor productivity increased by 460 percent. It is likely that Keynes would be very surprised to see how hard Americans are still working.

Are our estimates consistent with balanced growth? If one looks only at the decline in hours of work by men, one might be tempted to conclude that income effects dominate substitution effects. However, looking at men in isolation would be very misleading because it does not take into account the increase in their household income from another key source—the rise in labor supply of their wives. Perhaps the best way to view the data is from the standpoint of a representative household rather than a representative agent. If one focuses only on prime age households, the data is broadly consistent with little or no trend in leisure. Even for all individuals ages 14 and older, the very small percentage increase in leisure, relative to the very large percentage increase in the real wage, implies that income and substitution effects approximately cancel each other. On the other hand, the reallocation of time among the young from work to school certainly suggests unbalanced growth, since no available models can explain the rising fraction of time spent in school as a balanced growth phenomenon. Furthermore, the dramatic increases in leisure among the elderly cannot be explained in a standard model.

Although the time spent in leisure has not increased dramatically since 1900, it is still possible that people are much better off with respect to their time use. All we have done is count up hours, with some rough categorization of hours across leisure versus nonleisure categories. Is there less disutility from work now than there was in the past? It seems reasonable to suspect that the average office worker today enjoys work more than the average factory worker in 1900. Thus, it might be the case that income effects dominate substitution effects, but that there is now less disutility from work. With respect to home production, while appliances did not necessarily save time, most commentators agree that they greatly decreased the physical labor required by housework. Our estimates have nothing to say about this issue.

Finally, while we think our series gives reasonable estimates of long-run trends in time-use, we are much less confident about the cyclicality of time use. The data on market hours worked and hours spent in school is fairly precise because most of it was collected annually. On the other hand, the cyclical movements of home production are based on the difference in home production done by employed versus nonemployed individuals at a few points in time. Thus, these estimates are very imprecise. The estimates we have produced are probably correct on the directions of movements over the business cycle, but are very imprecise estimates of the quantitative movements.

Data Appendix

I. Population

Estimates of population by age group are from *Historical Statistics Millenium Online Edition* (Haines 2006) and the censuses. We computed decennial noninstitutional population by age and sex from various years of IPUMS Census (Ruggles et al. 2004) and used annual totals by age to interpolate.

II. Market Hours

A. *Aggregate Data*

1900–1947 data are from Kendrick (1961, table A-X). Kendrick (1961) used a variety of sources for each industry. From 1929 on, the main sources were from the BLS and the US Commerce Department. Prior to 1929, the sources were more varied. For example, for manufacturing Kendrick used standard hours from the censuses, adjusted for the ratio of the BLS actual hours to standard hours (see Kendrick 1961, table D-10). The 1920s numbers were based on an NBER survey by Wilford I. King (1923). The early estimates for agriculture are based on estimates of farm manhours from the Department of Agriculture (1956) and extensive field surveys published in the *Works Progress Administration National Project* reports. Surveys measure the male adult labor required per acre of crops and per head of livestock.

Table A1—Hours per Worker Relative to Average

Age	In school 14–17	Not in school 14–17	In school 18–24	Not in school 18–24
Male	0.620	0.986	0.810	1.01
Female	0.628	0.889	0.847	0.926

Age	25–34	35–44	45–54	55–64	65+
Male	1.03	1.04	1.04	1.03	0.999
Female	0.917	0.920	0.930	0.941	0.938

Note: Computations from the 1940 IPUMS.

These estimates are then applied to official estimates of acres and livestock numbers from the Crop Reporting Board. The estimates, however, are given as "man-equivalent" hours. Based on conversations with the Agriculture Department's technicians, Kendrick raised those by 10 percent to obtain "actual hours worked," with the notion being that women and children were less productive. See pages 348–354 of Kendrick (1961) for more detail and a discussion of family workers in agriculture. Kendrick (1973) used similar methods as those for the post-1929 data to update through the 1960s. Our numbers are from table A-10.

For 1959 onward, we use data from the Household Survey CPS estimates reported in *Employment and Earnings*. We obtained these estimates online from a data compilation by Edward Prescott, Alexander Ueberfeldt, and Simona Cociuba at http://www.econ.umn.edu/%7Esimona/US_CPS/. The hours worked by the military are based on unpublished BLS data kindly provided to us by Shawn Sprague of the BLS.

The following is our procedure for allocating hours by age group.

B. *Pre-1940 Estimates by Age and Gender*

Using the 1940 IPUMS, we calculated average hours per employed person for each age-sex group, also distinguishing whether they were in school for the groups ages 24 and younger. Although emergency workers were counted as employed, they were recorded as having zero hours. Thus, we eliminated them from our average hours calculation. We then computed a factor that was equal to the ratio of average hours per worker for each group to the average hours per worker for the aggregate. These factors are shown in Table A1.

We used IPUMS to compute employment rates for 1930 and labor force participation rates for 1900 and 1920. We did not use the 1910 census because of known overcounts of female workers. The "labforce" variable is only available for those ages 16 and older. We used the "gainful employment" definition (based on a 1950 census occupation code below 980) to compute labor force participation rates for those ages 10–15. (The gainful employment definition gives numbers very similar to the labor force participation rate variable for older teens for whom both variables are available.) To convert the labor force participation rate data to employment rates, we used the "empstat" variable from 1910 (it was not available in 1900 or 1920) to compute age-sex specific unemployment rates (the overcounts only affect some women). We then applied these to the labor force participation rate data to convert to employment rates. (The aggregate unemployment rate was very similar in 1900, 1910, and 1920.) Because the census is conducted in April, average weekly hours of work of students are underestimated because students work more during the summer. To account for this feature, we adjusted the employment-population ratios upward for students ages 14–17. We assumed that their summer employment rates and hours factors were the same as the April employment rates and hours factors for nonstudents of the same age and gender. We then applied our hours factors to the employment data to compute the total hours worked by each group. For those ages 10–13, we used the factors for those ages 14–17. We used the total hours by group to compute fractions of the aggregate hours worked by each group. We interpolated the fractions between decades. We applied the fractions to Kendrick's aggregate hours data and divided by the relevant populations to obtain average hours per person.

C. *1940 and After Estimates by Age and Gender*

For 1940, 1950, and 1960, we calculated the fraction of aggregate hours worked by each group from the census, multiplied it by Kendrick's aggregate numbers, and divided by the relevant noninstitutional population to get average hours per person by group. From 1962 on, we used the March CPS to compute fractions of civilian hours worked by each group and applied these to aggregate series. (The estimates were nearly identical to the average hours per person computed directly from the CPS.) Based on monthly CPS data from 1977, we found that average annual hours of work were higher than March hours of work for those in the younger age groups who were often in school in March. Thus, we adjusted upward the hours by the following CPS-based factors: 1.3 times for males 14–17 years old, 1.26 for females 14–17 years old, 1.06 for males 18–24 years old, and 1.04 for females 18–24 years old. For military hours, we used IPUMS to compute decennial estimates of military employment by age and used these estimates to compute fractions to apply to aggregate military hours. Aggregate military hours are based on unpublished BLS data.

III. School Hours

A. *Enrollment Rates*

For 1900–1939, we used the census question on school enrollment to calculate enrollment rates for the 14–17 and 18–24 age groups (school = 2). From 1940 on, we used information from the *Digest of Education Statistics* (DES), table 7. We used the DES and *Historical Statistics* for college enrollment data. From 1969 on, the DES, table 199, provides information on full-time equivalent enrollment in higher education. We were able to calculate the implied weight on part-time students as 0.33 in 1969, and we used this estimate to create full-time equivalent students for the period before 1969.

B. *Average Days Attended per Enrolled Student*

Data for K–12 students are from Goldin (2006).

C. *Hours Spent per Day in School and on Homework*

Hours per day attended for secondary school are based on time-use studies from Lundberg et al. (1934); John F. Fox (1935); C. C. Crawford and Roy W. Mayer (1935); Susan G. Timmer, Jacquelynne Eccles, and Keith O'Brien (1985); and our calculations using micro data from the 1992–1993 AHTUS study and the 2003 BLS ATUS. These estimates were checked against surveys from Robert S. Lynd and Helen Merrell Lynd (1929), J. M. Hughes and Harry H. Herron (1937); Brian P. Gill and Steven L. Schlossman (2003); and the OECD. The evidence suggests 7 hours of homework and class time per day attended in the 1930s and about 7.8 hours starting in 1981. (Note that homework that is done on the weekend is allocated to attendance days.) The hours spent by college students are taken from the time-diary studies of Goldsmith and Crawford (1928) and Lundberg et al. (1934), who present estimates of around 40 hours per week in the late 1920s and early 1930s, and from Babcock and Marks (2008), who found that time spent on class and homework by college students fell from 40 hours per week in 1961 to about 27 hours per week in 2004. We multiply those numbers by 0.64 to allocate them to the entire year (since the college year lasts about 33 weeks). Our numbers for recent years are consistent with those based on the BLS time-use data in 2003.

IV. Home Production

Our home production estimates are based on Ramey's (2009) estimates from early time-diary studies and individual-level data from 1965 to the present.

A. *Early Estimates*

We use the regression reported in Ramey (2009, table 4, column 3), which links time spent in home production by 1920s housewives to the number and ages of children, as well as education level. We apply these coefficients to national variables calculated from the census for 18–24-year-old and 25–54-year-old nonemployed married women. Based on auxiliary evidence discussed in Ramey (2009), we subtract 7.12 hours per week for those nonemployed women who are not married. The estimates for all nonemployed women are nearly identical at the overlap in the 1960s with the nationally representative time-use surveys for 25–54 year olds, but are higher than the 1965 survey for 18–24 year olds by four hours. Thus, we adjust the earlier data down by this amount for 18–24 year olds. For employed women, we use the same base estimates by marital status as Ramey (2009). The estimates for men and those ages 65 and over are the same as in Ramey (2009). For children between the ages of 14–17, we use the time-diary studies of high school students from Inez F. Arnquist and Evelyn H. Roberts (1929); Wilson (193-); Lundberg et al. (1934); Crawford and Mayer (1935); Fox (1935); Timmer et al. (1985); and our computations from the BLS data for those ages 15–17. We distinguish between children either in school or working versus those in neither category. In the early period even girls enrolled in school did much more home production than boys. Based on the evidence, we assume that girls who were either working or enrolled in school did 12 hours of home production per week in 1900, dropping to about 8 hours per week by 2005. In 1900, 29 percent of girls ages 14–17 were neither in school nor employed, falling to 4.5 percent by 2005. We assume that girls in this category spent the same amount of time on home production as women ages 18–24 who were not married and had no children, 43 hours per week in 1900, dropping to 25 hours per week by 2005. With the decline in the fraction of girls who were neither employed nor in school, our overall estimate of time spent in home production by all girls 14–17 years old falls from around 21 hours per week in 1900 to below 9 hours per week in 2005. For boys, the time-use estimates indicate that boys who either worked or were in school spent about three hours per week in the early period rising to about six hours per week in 2005. We assume that boys who were neither in school nor working spent the same amount of time as unemployed men, between 12 and 13 hours per week over the century.

B. *Estimates from 1965–2005*

We use the following definitions of home production in the modern surveys.

AHTUS 1965, 1975, 1985.—Following Ramey (2009), we define home production as the sum of codes tmain20–tmain27, tmain30–tmain35, tmain37–tmain40, tmain95, tmain96. Note that we exclude playing with children and purchasing own medical and personal services, since they were excluded from the early studies. The 1992–1994 survey is not used because of known undercounts of home production time.

BLS 2003–2005.—We first extracted gardening from "lawn and garden" as in Ramey (2009). Home production is defined as the sum of first tier codes 2 + 3 + 4 + 7 + 8 (excluding second tier codes 4 and 5) + 9 + 10, plus travel codes 17.2, 17.3, 17.7, 17.8, 17.9, 17.10, less the adjustment for gardening, pet care (2.6), and playing with children (3.1.3, 3.1.4, and 3.1.5, 4.1.3, 4.1.4, and 4.1.5). (The travel codes for the 2005 survey are 18.2, 18.3, 18.7, 18.8, 18.9, and 18.10.)

To create total hours spent in housework, we use employment-population ratios and fractions of the population by age and gender. We calculate labor force participation rates by group for the early part of the twentieth century and use unemployment estimates to convert them to employment rates. For 1930 on, we base the series on decennial census estimates by group, augmented with available annual estimates. Ramey (2009) describes the sources in more detail.

V. Commuting Time

The time diary data starting in 1965 suggest average time spent commuting to work has been between 8 and 11 percent of hours of work. There is little systematic evidence on commute times in the first half of the twentieth century. Lynd and Lynd (1929) found that 83 percent of the workers at the three local plants lived less than one mile from the plant, suggesting short commute times. Lundberg et al. (1934) found that commuters living in the suburb of Westchester spent about six hours commuting per week. One would expect that the large number of farmers in the early sample spent much less time commuting. In the absence of firm evidence, we assume that commute times were 10 percent of total hours worked, equal to the average during the last 40 years of the sample. This assumption implies commute times per employed person were higher in the early part of the twentieth century than in the last part, since hours worked per employed person were higher. This implication is not unreasonable since part of the increase in hours per employed person was accomplished by working a sixth day, which required an extra day of commuting. The time-use studies of high school and college students from the late 1920s to the present all suggest school commute times approximately equal to 10 percent of total time spent on school and homework. Thus, we use a constant ten percent commute time for this activity as well.

VI. Personal Care Time

Typical measures of leisure also omit time spent in personal care, such as sleeping, eating, and personal care. According to Wilson (193-) and the USDA (1944), housewives in the 1920s spent about 77 hours per week on sleep, rest, eating meals, and personal grooming. This number is very similar to the estimates for all individuals ages 15 and up in the time-use surveys of the 2000s. Thus, we subtract 77 hours from the time endowment when computing leisure.

VII. Health Variables

Workdays Lost Due to Sickness.—The estimates from the late 1800s were computed from the Historical Labor Statistics Project, available online from eh.net/databases/labor. We used all surveys that included employees and the variable “dlostsic.” There are a large number of “no responses” (–9) yet no observations with “0 days.” Following Costa (2000), and based on our analysis of the other health status variables which indicate that the individuals with –9s report better health than the individuals with positive days lost due to sickness, we treat the –9s as zeroes in our calculations. The data from 1915 is from the Metropolitan Life Survey (Stecker 1919). We used “Average Days of Disability for Work per Year of 300 Days” from table VII. The data from 1959–1966 are from the US Department of Health, Education, and Welfare; National Health Survey, Series 10, No. 71; and the data from 1967 to 1995 are from Steckel in *Historical Statistics.*

Sickness in the Army and Navy.—Compiled by Selwyn Collins, based on reports from the *Annual Report of Surgeon General of Army.*

Days of Sickness per Year.—The 1915 data is from the Metropolitan Life Survey. The 1935–36 estimates are based on calculations on data from the US Public Health Service National Survey of Health, table 2. The data from 1967–1995 are from Steckel in *Historical Statistics.*

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