

US Hours at Work*

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Abstract

We construct quarterly average hours worked for the US economy using Current Population Survey data on *employed persons at work* and their *actual hours worked*. Our measure of hours provides a novel alternative to the common practice of using data on all employed persons, which requires adjusting hours per employed with estimates of weeks worked. We also construct hours worked by age and gender to illustrate that our methodology can be applied to subgroups of the working-age population, providing researchers with readily available long-run series of hours.

Keywords: labor supply, actual hours worked, employed persons at work

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1 Introduction

We construct a quarterly measure of hours for the US economy since 1947, using the Current Population Survey (CPS) of the Bureau of Labor Statistics (BLS). The goal of this paper is to describe our methodology for constructing average hours worked—defined as total hours at work per working-age person—to allow other researchers to apply it in their analyses. To illustrate how our methodology can be applied to different subgroups of the working-age population, we construct hours worked by gender and age group.

Our measure of hours is novel since it uses data on *employed persons at work* and their *actual hours worked*. Alternate measures of hours in the literature use data on all employed persons and adjust hours per employed with aggregate estimates of weeks worked (e.g., [Bick, Brüggemann, and Fuchs-Schündeln \(2018\)](#)). By restricting the pool of employed to persons who were at work, our measure of hours eliminates the need for weeks worked. This is useful, since data on weeks worked are hard to come by, and only available annually.¹ As a result, our methodology provides the only direct measure of quarterly hours worked. Moreover, since it is based on actual rather than usual hours, our measure of US average hours worked enables accurately measuring labor productivity.²

The BLS has two independent surveys which allow for measuring hours: the household survey (CPS) and the payroll survey (Current Establishment Survey, CES). While differences exist between the surveys, recent academic papers provide support for using the CPS. For example, [Perry \(2005, p. 1\)](#) argues that “overwhelming preference for the payroll data” is not justified, and [Hall \(2008, p. 241\)](#) concludes that “the household survey is the only source of data that supports a clean set of measures of hours and employment.”

That said, the BLS constructs a quarterly measure of total US hours worked based primarily on the CES and augmented with CPS and other data, as necessary.³ These US hours series are provided to the Organisation for Economic Co-operation and Development (OECD) and the Conference Board, and have been used in previous academic research (e.g., [Prescott \(2002\)](#), [Rogerson \(2006\)](#)). This computation of total hours is quite involved—e.g., it requires converting CES hours paid to hours worked, adding hours for groups of the population not covered by the CES—and does not allow disaggregating

¹Weeks are not available in the CPS monthly samples, but only in the Annual Social and Economic Supplement of the CPS. The questionnaire asks: *How many weeks did this person work even for a few hours?* Respondents are prompted to include paid vacation and sick leave as work, so weeks paid are measured.

²[Wingender \(2018\)](#) also stresses the importance of actual hours worked for productivity measurements. [Baum-Snow and Neal \(2009\)](#) discuss reporting errors for usual hours in the US Census and American Community Survey. They argue the CPS collects better data, via interviewers who help clarify questions.

³This payroll-based series is available at: <https://www.bls.gov/lpc/tables.htm>. Detailed methodology about the construction of these hours is available at: <https://www.bls.gov/lpc/lpcmethods.pdf>.

the hours by subgroups of the total population. In comparison, our methodology of constructing hours worked based on the CPS allows researchers to easily construct hours worked for different demographic groups.⁴

2 US Total Hours at Work

We define US average hours worked as total hours at work per noninstitutional working-age population. In this section, we describe how we construct our series.

Hours worked and population data are based on the Current Population Survey (CPS). The CPS collects information on labor market activities during one week—the *reference week*—each month. The CPS questionnaire asks: *How many hours did this person actually work last week at all jobs?* Persons temporarily absent from their job or business are classified as employed, not at work last week.⁵ Aggregating this information, the US Census and BLS report monthly data on: (i) employed persons at work, and (ii) their average actual weekly hours worked since July 1947. We label these data BLS-CPS and use them to construct total civilian hours worked. Appendix A contains detailed data sources.

We convert the monthly observations on persons at work and their actual hours into quarterly averages, as shown in Section 2.1. We seasonally adjust the resulting data using the US Census X12 algorithm. Total quarterly civilian hours worked at an annual rate equal employed persons at work times average actual weekly hours worked times 52.

Our measure of total hours worked includes both civilian and military hours. Since CPS hours data do not cover the military, we estimate their hours using total military personnel worldwide from the Department of Defence and a 40-hour workweek. Similarly, our measure of the working-age population includes both civilians and military personnel. This allows our total hours worked to be used for measuring labor productivity—gross domestic product per hour worked—as in Cociuba, Prescott, and Ueberfeldt (2012).⁶

Figure 1 plots our quarterly measure of US average hours worked, labelled BLS-CPS. Americans of working-age (16 – 64) worked 1400 hours annualized (or 26.9 hours per week) in the third quarter of 1947, and 1462 annualized (or 28.1 hours per week) in the fourth quarter of 2017. This seemingly small change hides a sizable increase in average

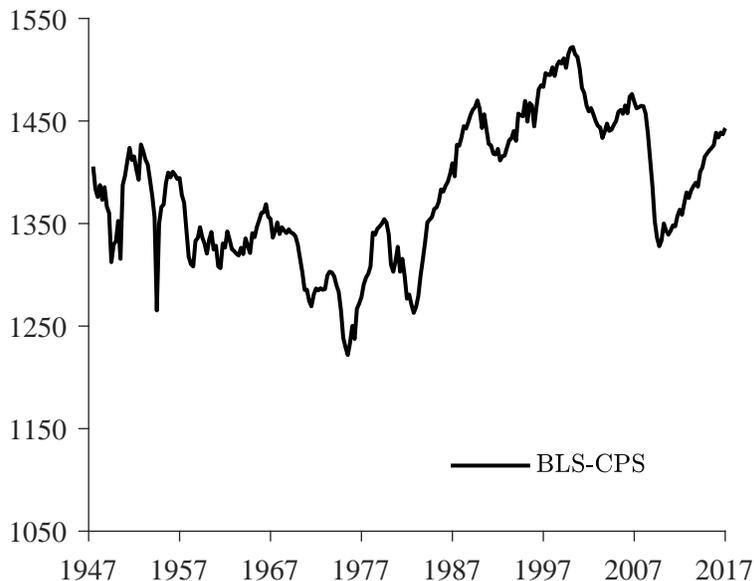
⁴Frazis and Stewart (2010) document that weekly hours collected in the CPS and CES surveys have diverged since the mid-1980s. While the jury is still out as to why, our paper does not address this issue.

⁵Temporary absences from work in the CPS are due to vacation, illness, bad weather, childcare problems, maternity or paternity leave, labor-management dispute, job training, or other family or personal reasons.

⁶The gross domestic product measure provided by the Bureau of Economic Analysis includes on the cost side the salaries to military personnel worldwide, and not only the salaries of the military personnel within US borders. This justifies adding the hours of military personnel worldwide to total hours.

hours worked from the early 1980s to the 2000s, which largely leveled off during the Great Recession. Excluding the military, civilian hours were about 0.9 percent lower.

Figure 1: US AVERAGE HOURS WORKED AT ANNUAL RATE, 1947-III TO 2017-IV



NOTES: Average hours worked are total hours worked per working-age population. Both hours and population cover civilians and military personnel. Appendix A provides detailed data sources.

2.1 Eliminating Outliers from Monthly Hours Worked Data

The CPS reference week is typically the 7-day period, Sunday through Saturday, that includes the 12th of the month.⁷ Occasionally, the CPS measure of actual hours worked drops at random, for example when a holiday falls in the reference week. When converting the monthly hours CPS data into a quarterly average, we eliminate outliers as follows. For monthly data on employed persons at work, we use a simple average.

Let m_i with $i \in \{1, 2, 3\}$ denote monthly hours data in a quarter. Let $\bar{m} \equiv \frac{m_1+m_2+m_3}{3}$ and let $d \equiv \frac{\min\{m_1, m_2, m_3\}}{\bar{m}}$. We define as an outlier any monthly hours observation that is at least 3 percent lower than the average of the three months in the quarter. The quarterly average, call it q , eliminates outliers, as shown in equation 1.

$$q \equiv \begin{cases} \frac{3 \cdot \bar{m} - \min\{m_1, m_2, m_3\}}{2} & \text{if } d < 0.97 \\ \bar{m} & \text{if } d \geq 0.97 \end{cases} \quad (1)$$

⁷The reference week in earlier surveys—in the late 1940s and early 1950s—did not always include the 12th of the month. Moreover, the November and December reference periods are sometimes moved one week earlier to avoid holiday periods (as noted in the CPS overview at: <https://www.bls.gov/cps/>).

Applying this procedure to actual hours worked from the US Census and BLS, we identify as outliers all of the September months when Labor Day fell during the reference week (1948 – 1951, 1953, 1954, 1959, 1964, 1970, 1981, 1987, 1992, 1998, 2009, 2015), and three instance when Good Friday fell during the reference week (April 1968, 1974, 1979).

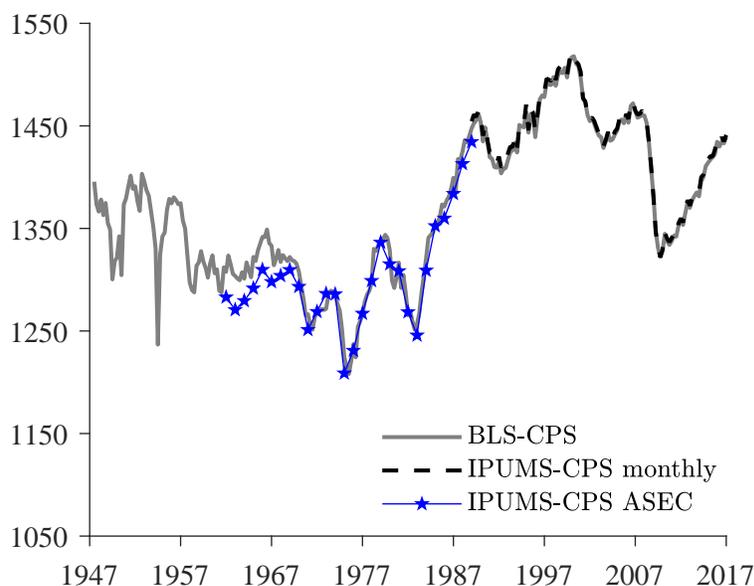
2.2 US Civilian Hours at Work

In this section, we show that average hours worked based on BLS-CPS data are very close to hours measured using micro survey data from IPUMS-CPS (Flood et al. (2017)).

Figure 2 plots three measures of civilian average hours worked. The BLS-CPS hours are those plotted in Figure 1 minus military hours. The IPUMS-CPS monthly and IPUMS-CPS ASEC hours are constructed by applying our methodology to the monthly and the Annual Social and Economic Supplement (ASEC) samples of the CPS survey.

Our calculations show that quarterly civilian hours worked from BLS-CPS (solid line in Figure 2) and IPUMS-CPS monthly (dashed line) are indistinguishable. Annual hours from the ASEC samples (starred line in Figure 2) are 1 percent lower, on average.

Figure 2: US CIVILIAN AVERAGE HOURS WORKED AT ANNUAL RATE



NOTES: BLS-CPS data (1947 – 2017) and IPUMS-CPS monthly (1989 – 2017) are aggregated to quarterly (see Section 2.1). IPUMS-CPS ASEC (1962 – 1989) are annual. Appendix A provides more details.

Next, we compare our series to the alternate measure of hours used in the literature, which relies on estimates of weeks. The IPUMS-CPS ASEC annual data contains informa-

tion on weeks, albeit weeks paid as acknowledged in footnote 1. We construct an alternate annual measure of civilian average hours worked using the weeks information reported in the ASEC samples. These alternate ASEC hours equal total employed (at work plus not at work) times average actual weekly hours worked times weeks worked during the year. While we do not plot these series here, they track very closely the hours plotted in the starred line of Figure 2, but are 4 percent lower, on average.

The ASEC data on weeks is not ideal, since it counts paid vacation and sick leave as work. For this reason, we redo our alternate ASEC hours calculation using US aggregate weeks worked measured by [Bick, Brüggemann, and Fuchs-Schündeln \(2018\)](#) for 1983 – 2015. We find that average annual weeks constructed from the ASEC samples differ on average by only 0.2 percent from the weeks worked reported by [Bick, Brüggemann, and Fuchs-Schündeln \(2018\)](#). Our result stands: the alternate measure of ASEC annual hours is 4 percent lower, on average, than our measure based on employed persons at work.

While using weeks worked leads to comparable series of annual hours worked, our methodology which relies on employed persons at work is the only direct way to measure quarterly hours worked, since quarterly weeks data is not available.

3 US Hours at Work by Gender and Age Group

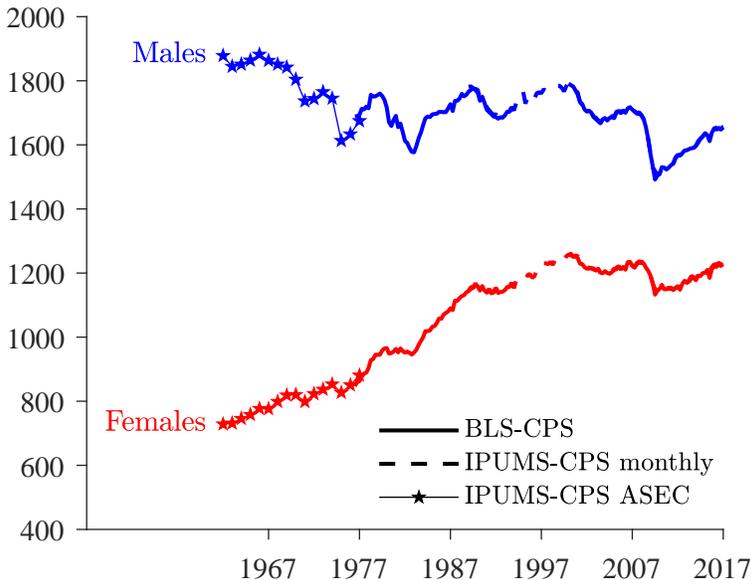
Our methodology enables us to easily disaggregate civilian average hours worked by demographic groups. Since our measure of hours doesn't use data on weeks worked, disaggregating total hours simply entails constructing measures of employed persons at work and their actual hours worked by subgroups of the working-age population.

Figure 3 plots hours worked for males and females. Quarterly measures of hours from BLS-CPS (solid line) overlap with those from IPUMS-CPS monthly (dashed line). Annual IPUMS-CPS ASEC hours extend the data back to 1962. Figure 4 plots hours for the young (16 – 24), middle-aged (25 – 54) and old (55+). Data for these age groups is not available from the BLS-CPS. We construct hours using the monthly and ASEC samples of the CPS.⁸

Figures 3 and 4 show that the sizable increase in US average hours worked from the early 1980s to the 2000s shown in Figure 1 is largely accounted for by females and middle-aged workers, and partly by the old. All demographic groups plotted see a collapse in hours following the Great Recession. For more in-depth analyses of US aggregate hours, our methodology can be extended to other groups (e.g., by education, or industry).

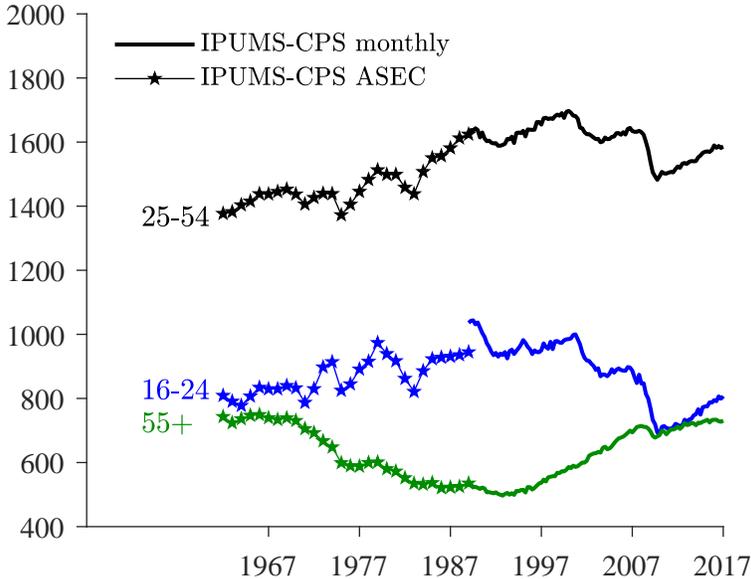
⁸Figures 3 and 4 do not plot ASEC hours up to 2017, to avoid clutter. However, ASEC hours track IPUMS-CPS monthly hours for females, the middle-aged and the old. Annual male hours are, on average, 2.5 percent lower in ASEC than IPUMS-CPS monthly, while hours for the young are about 7.5 percent lower.

Figure 3: US AVERAGE HOURS WORKED AT ANNUAL RATE, BY GENDER



NOTES: BLS-CPS data (1976 – 1993, 2000 – 2017) and IPUMS-CPS monthly (1989 – 2017) are aggregated to quarterly (see Section 2.1). IPUMS-CPS ASEC are annual (1962 – 1977). Appendix A provides more details.

Figure 4: US AVERAGE HOURS WORKED AT ANNUAL RATE, BY AGE GROUPS



NOTES: IPUMS-CPS monthly data (1989 – 2017) are aggregated to quarterly (see Section 2.1). IPUMS-CPS ASEC are annual (1962 – 1989). Appendix A provides more details.

4 Conclusion

This paper presents a novel methodology for constructing series of US hours worked using CPS data on employed persons at work and their actual hours worked. The methodology lends itself to disaggregating total hours by different demographic groups, and allows researchers to easily construct long-run series of US hours.

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A Appendix: Data Sources

Average hours worked equal total hours worked per working-age person. Hours built from aggregated data available online or in historical publications are labelled *BLS-CPS*. Hours based on micro survey data are labelled *IPUMS-CPS monthly* or *IPUMS-CPS ASEC*.

BLS-CPS

We construct quarterly total civilian hours worked from 1947-III to 2017-IV using monthly data on the number employed, at work and their average actual hours at work. The data cover persons 14 years and over prior to 1967, and 16 years and over otherwise.

- July 1947 to May 1959 data are from the monthly issues of the Current Population Reports, P-57, Labor Force, published by the US Bureau of the Census, Table 8 or 9.
- June 1959 to May 1976 data are from the monthly issues of the Employment and Earnings publication of the BLS, various tables (e.g., Table A–24 after May 1973).
- Since June 1976, data are from the BLS, <http://data.bls.gov/cgi-bin/srgate>. To download, use series id LNU02005054 for (Unadj) Average Hours, Total At Work, All Industries and LNU02005053 for (Unadj) Number Employed, At Work.

We construct quarterly total military hours from 1947-III to 2017-IV using data on total military personnel worldwide and assuming a 40 hour workweek.

- July 1947 to June 1959 data are from the monthly issues of the Current Population Reports, P-57, Labor Force, published by the US Bureau of the Census, Table 3 or 1.
- For all other years, military data is from the [Department of Defence](#).

We construct quarterly hours worked by gender from 1976-I to 1993-IV and 2000-I to 2017-IV using *BLS* monthly data. Use series id LNU02005117 for men employed at work and LNU02005149 for women, LNU02005118 for average hours at work for men and LNU02005150 for women. Hours data for 1994 – 1999 are missing.

Civilian noninstitutional working-age (16 – 64) population data is computed from BLS data on population 16 and over and population 65 and over.

IPUMS-CPS monthly and IPUMS-CPS ASEC

We construct civilian average hours worked (total, by gender and age group) using the basic monthly samples and annual ASEC samples of IPUMS-CPS ([Flood et al. \(2017\)](#)) available at: <https://cps.ipums.org/cps/>. We focus on persons 16 years and over who were employed at work (EMPSTAT= 10) during the reference week, to be comparable to the BLS-CPS series. The hours variable used is AHRSWORKT (hours at work last week).