The Impact of Hours Measures on the Trend and Cycle Behavior of U.S. Labor Productivity

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First draft: October 2008
This draft: July 2012

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I. Introduction

Standard government series on U.S. labor productivity have shown significant changes in trends in the post-WWII period. After a very healthy annual growth rate of 2.8 percent between 1947 and 1973, nonfarm labor productivity slowed to only 1.4 percent per year between 1973 and 1997. It accelerated to 3.5 percent between 1997 and 2003, but then decelerated to 1.8 between 2003 and 2011.[1] Thus, *trend* growth of labor productivity seems to have changed across the various regimes.

Separately, the macroeconomics literature has documented a fundamental change in the business cycle behavior of standard series on labor productivity. Barnichon (2008), Galí and Gambetti (2009) and Galí and van Rens (2008) document a dramatic decline in the business cycle correlation between productivity and output. For example, Galí and van Rens (2008) use a Baxter-King filter on quarterly data to show that the correlation of labor productivity with GDP fell from 0.45 in the period from 1948 to 1984 to 0.03 post-1984.

In this paper, I point out that estimated trend and cyclical behavior of productivity can depend significantly on the underlying labor input measure. The hours series used to construct

[1] See Fernald (2012) for the formal statistical tests for the breaks and a more thorough analysis.

the standard productivity series is based mostly on the Bureau of Labor Statistics (BLS) Current Establishment Survey (CES). Numerous papers (discussed below) have noted discrepancies in measured hours and employment between the establishment survey and the household survey, the Current Population Survey (CPS). Building on a recent literature that compares the two surveys, I show that the establishment-level hours series display significant discrepancies both over the business cycle and in the longer-run relative to hours based on the household series. I then argue that new evidence suggests that the household series is a more accurate picture of the true work hours of individuals.

The difference the cyclical behavior of measured productivity *per worker* was noted in a recent paper by Hagedorn and Manovskii (2011). They show that whether the Mortensen-Pissarides model matches the facts well depends on whether one uses employment from the CES or the CPS to calculate output per worker. Although I use output per hour, the message of this paper on the cyclical behavior echoes that of Hagedorn and Manovskii's.

II. Estimates of Hours Worked

A. How the BLS Estimates Hours for its Productivity Series

The BLS Productivity Program constructs its labor productivity estimates by combining estimates of output with estimates of hours worked. All private business is the broadest sector covered. The main source of hours data is the Current Employment Statistics (CES), which is an establishment survey that gathers payroll data on production and nonsurpervisory employees in nonagricultural industries for the week including the 12th of the month. Because the payroll data report hours *paid* rather than hours worked, the BLS uses other sources (such as the BLS *Hours at Work Survey* and the BLS *National Compensation Survey*) to convert hours paid to hours

worked. The CES has long contained information on employment of supervisory and nonproduction workers, but until 2006 it did not contain information on average hours. To create hours series for this class of workers before 2006, the BLS combines information on average weekly hours from the Current Population Survey (CPS), which is a monthly household survey, with the CES information on employment. For the farm sector, the self-employed, and unpaid family workers, the BLS uses information on hours from the CPS. Because the productivity series does not cover the nonprofit sector, the BLS uses data from the Census and the Bureau of Economic Analysis (BEA) to estimate hours of employees at nonprofit corporations, and then subtracts them from its aggregates.

B. The CES versus the CPS

There are a number of other sources on hours worked in the U.S. economy. For example, the BEA provides information on the number of persons engaged, as well as hours of employees. However, this source is missing hours of workers who are not employees. Alternatively, the decennial Census can be used to construct hours worked, but these data are only available once a decade. Finally, the CPS can be used to construct hours worked by all civilians on a monthly basis back to 1947. These data are published in various issues of the *Current Population Reports* before 1959 and *Employment and Earnings* after 1959.

Historically, the CES has been favored over the CPS as a source for measuring monthly employment and hours for several reasons. First, the CES covers 400,000 worksites, whereas the CPS covers only 60,000 households (Bowler and Morisi (2006)). As result, the month-to-month employment changes in the CPS are subject to a much larger sampling error. Second, it has long been thought that individuals in the household surveys over-report their hours worked, so

the CPS measures of hours might be biased upward (e.g. Mellow and Sider (1983) and Robinson and Bostrom (1994)).

At times, however, controversy arises because the cyclical patterns suggested by the CES data are different from those suggested by the CPS data. For example, during the "jobless recovery" after the 2001 recession, several observers noted that the CPS data suggested a more vigorous recovery of employment than the CES data (e.g. Kane (2004)). Aaronson and Figura (2005) investigated whether measurement error in hours paid versus hours worked for salary workers might lead to biases in the cyclical behavior of workweeks and productivity. Although they found some evidence of differences when they used the CPS data, the effect on aggregate hours is small.

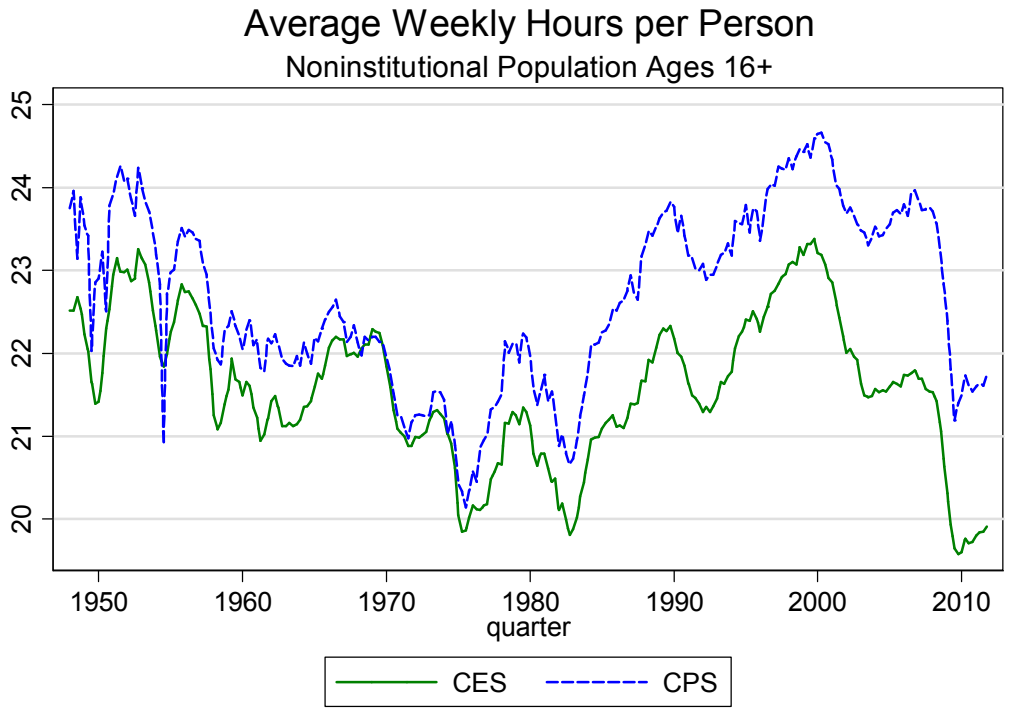
Recent evidence suggests, however, that the hours reported in the CPS are not biased. Frazis and Stewart (2004) compare hours measured in the CPS to hours measured in the new American Time Use Survey (ATUS). Beginning in 2003, the ATUS uses time diary methods on a nationally representative subset of the CPS sample. Time diary methods are generally considered to give the most accurate measure of how time is spent, including work time. Frazis and Stewart found that when they compared the CPS hours worked data to the work hours from the ATUS for the same reference week, the estimates were very similar. Although some segments of the population had a tendency to over-state their hours, others had a tendency to under-state their hours, so there was no bias in the aggregate.

Figure 1 shows average weekly hours per person ages 16 and over quarterly from 1947 through 2011. The CES series is based on unpublished BLS data which also includes the hours of those in the armed forces.[2] The CPS series are available from Employment and Earnings.

[2] Shawn Sprague of the BLS kindly provided these data to me.

Cociuba (2012) collects these series on her web site and seasonally adjusts them. I have used her civilian hours series and added in the unpublished BLS data on armed forces hours.

Figure 1



The CPS-based measure of hours tended to be between 0.5 to 1 hours above the CES-based measure until the late 1960s when the two series were approximately equal. Starting in the mid-1970s, though, the CPS hours series grew more rapidly than the CES hours series and has stayed above it. Currently, the CPS average weekly hours series exceeds the CES hours series by almost two hours.

III. Implications for Trends and Cycles in Productivity

I now examine how trends and cycles in productivity vary according to which hours measure is used. I measure productivity as total real GDP divided by total hours (including military hours).[3] Tables 1 and 2 split the sample into four segments based on Fernald's (2012) structural break tests for productivity. The breaks occur in 1973q2, 1997q2, and 2003q4. Table 1 shows the growth rate of hours according to the two sources.

Table 1. Average Annual Growth of Hours

	1948q3-1973q2	1973q2-1997q2	1997q2-2003q4	2003q4-2011q4
CES	1.17	1.62	0.48	0.07
CPS	0.97	1.84	0.91	0.14

Because of the different growth rates of hours in Table 1, the implied productivity growth rates vary across the measures. These are shown in Table 2. Relative to the CES measure, the CPS measure of productivity shows a more dramatic slowdown in 1973. According to the CPS measure, productivity growth was 0.4 percentage points slower than implied by the CES measure from 1997 through 2003. Post-2003, though, both measures of hours give very similar implications for productivity growth.

[3] The GDP series is the June 28, 2012 version. Each time I have updated this note since 2008, I have been struck by how much GDP revisions can significantly change the results.

Table 2

Average Annual Productivity Growth
(based on ratio of GDP to total hours worked)

	1948q3-1973q1	1973q2-1997q1	1997q2-2003q3	2003q4-2011q4
CES	2.76	1.23	2.78	1.36
CPS	2.96	1.01	2.35	1.30

How do the two measures of hours affect the cyclical behavior of productivity? I examine the cyclical correlation of productivity with GDP both before and after 1984 since 1984 has been identified as an important break-date for the cyclical behavior of productivity. Table 3 shows the results for productivity measured in the two ways. Before 1984, the CES-based measure shows more procyclical behavior than the CPS-based measure. While both measures fall significantly in the post-1984 period, the fall is much greater for the CES-based measure.

Table 3

Correlation of GDP and Labor Productivity
(Cyclical components extracted with Baxter-King Filter)

	Pre-1984	Post-1984
CES	0.49	0.04
CPS	0.38	0.15

IV. Conclusion

In this short note, I have explored the differences in the two main measures of aggregate hours and what those differences imply for productivity measurement. I have found noticeable

deviations in both the trend and cycle behavior of productivity depending on which estimate of hours is used. Hagendorn and Manovskii (2011) have shown that conclusions about the ability of models to match the data can depend critically on whether the employment data come from the CES or the CPS. Thus, researchers should be aware that the source of the labor market data can have important implications for inferences about trends, cycles, and theoretical models.

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