Hours of Work during the COVID-19 Pandemic:

Implications for Labor Productivity Measures

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Abstract: The BLS measures hours worked for productivity growth using hours-paid data from its establishment survey adjusted for annual paid leave granted and average sick leave taken to estimate actual hours worked. However, these adjustments miss quarterly variation in paid time off, which is mainly due to seasonal patterns of paid annual and sick leave. However, during the COVID-19 pandemic, a number of factors (illness, the Payroll Protection Program, changes in leave policies, and increased telework) could have caused average weekly hours worked to vary to a much greater extent. Using detailed household data, we develop an alternative hours-worked-to-hours-paid adjustment ratio that accounts for variations in actual paid time off. We start with the research hours series that was constructed based on BLS's new method for estimating hours worked and assess the impact of making this adjustment in the aggregate. We find that, in 2020, this ratio fell considerably in some industries in the second quarter and subsequently rose in the third quarter, resulting in a meaningful impact on measured work hours and labor productivity.

Keywords: productivity, paid leave, hours measurement, COVID-19

JEL Codes: E24; J2

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1. Introduction

The labor market and work arrangements underwent dramatic changes because of the coronavirus pandemic. Initially, to contain its spread, millions of office workers began to work remotely in March 2020, while many U.S. workers in high-contact service industries were on paid furlough supported by the Paycheck Protection Program (PPP) or lost their jobs as nonessential businesses were ordered to stay closed (Autor et al., 2022; Bartik et al., 2020a, 2020b; Bick et al., 2022; Dalton, 2021). In addition, many workers were home sick or caring for others who were sick, especially workers in occupations that were unsuitable for remote work or those working in essential industries (Lyttelton and Zang, 2022). Others were caring for children at home because schools were closed (Heggeness, 2020). Employers also allowed workers more flexibility in scheduling their hours to handle the increased demand for household-provided childcare.

Absences from work shot up in April and May of 2020. The majority were unpaid, as paid leave policies vary widely by industry but are especially limited in the leisure and hospitality sector (figure 1). And the average worker would not have had enough sick leave days to cover one 14-day COVID-19 quarantine (U.S. Bureau of Labor Statistics, 2020a).[1] However, paid absences among employees in the private nonfarm sector were substantially higher in April, compared with normal seasonal patterns (figure 2), partly due to a temporary national paid sick leave policy (the Families First Coronavirus Response Act, or FFCRA) that mandated that employers with fewer than 500 employees provide their employees up to two weeks of paid leave for own illness or care of a child home with a school closure and up to ten weeks of

[1] Workers with paid sick leave plans have about eight days available per year, and 53% of those in private industry in 2020 were not permitted to carry over sick leave to the next calendar year (U.S. Bureau of Labor Statistics, 2022).

expanded family and medical leave at two-thirds their regular pay beginning on April 1st of 2020 through the end of 2020 (Anderson et al., 2020; U.S. Department of Labor, 2022).[2] Compared to the same month in the prior year, absences and paid absences were substantially higher in the spring and fall of 2020 (figure 3). According to the Current Population Survey (CPS), the top reasons for paid absences throughout 2020 included vacation leave, own illness, and "other reason not specified" paid absence (figure 4). The "other reason not specified" reason rose in March of 2020 and shot up in April and May of 2020. Some of this increase likely captures workers who were on paid furlough.[3] Compared to prior summers when many Americans vacationed, many stayed home in the summer of 2020, using less of their annual vacation leave and perhaps saving up leave for times when they could travel again more safely. There was also a spike in both paid and unpaid leave during December of 2020, when U.S. deaths from coronavirus soared, and again during the first Omicron wave in December of 2021 (Centers for Disease Control and Prevention, 2022).

U.S. productivity measures are based primarily on hours paid data from the Current Employment Statistics (CES) survey with ratio adjustments for annual leave earned and sick leave to convert hours paid to hours worked, which is the appropriate denominator for labor productivity. However, during the pandemic (as described above), the use of paid leave deviated substantially from past years. In this paper, we develop and implement a ratio adjustment that

[2] Maclean, Pichler, and Ziebarth (2021), Callison and Pesko (2020), Schneider (2020), and Colla et al. (2014) all find that paid sick leave mandates increase workplace absences. The paid leave tax credits were extended under the American Rescue Plan Act until September 30, 2021, but on a voluntary basis (Internal Revenue Service, 2021).

[3] Beginning in March 2020, CPS interviewers were instructed to classify workers who were not working during the entire survey reference due to COVID-related business closures as unemployed on temporary layoff, but there appears to be some misclassification of these workers as employed but absent (U.S. Bureau of Labor Statistics, 2020b). It is possible that some of the unpaid (and paid) absences should have been classified as unemployed. In the Current Employment Statistic (CES) survey, those who are not working but are paid are counted as employed.

accounts for the large quarterly variation in paid absences during the pandemic. This is important because producing reliable quarterly labor productivity estimates—a principal federal economic indicator closely watched by policymakers, businesses, and researchers— requires accurately measuring hours worked, and it allows us to tell an alternative story of productivity through the pandemic. Accurately capturing cyclical movements in hours worked is also important for measures of firms' costs of adjusting labor, compensation per hour, markups of price over marginal cost, and returns to scale as well as being an important macroeconomic indicator by itself (Aaronson and Figura, 2010).

We find that several major industries—nondurable goods manufacturing, transportation and warehousing, education and health services, leisure and hospitality, and other services—experienced large drops in their paid-time-off (PTO) ratios in the second quarter of 2020 and a subsequent rise in the third quarter of 2020. Applying these ratios, we find that aggregate hours worked fell faster and then rose to a greater extent than documented in a research series based on a new method for estimating hours worked that will be implemented in November 2022. Thus, labor productivity rose substantially faster in the second quarter of 2020 and slower in the third quarter.

We also looked at the effects of applying these adjustments during the Great Recession. During recessions, workers might use less leave and put forth more work effort to keep their jobs, or they may be asked to do the jobs of three persons when others are laid off (Arai & Thoursie, 2005; Lazear et al., 2016; Siegenthaler, 2015). On the other hand, they may take more leave because there is less work to be done, making the leave time less costly to their employer. And during expansions, firms may grant less leave or restrict leave usage if they have not expanded their hiring quickly enough to meet the increase in customer demand. In addition, paid

leave can change as the composition of the workforce changes, because not all workers receive the same paid leave benefits. We find that changes in paid leave are more gradual in this period, but paid leave increased in those industries hardest hit in the Great Recession closer to the peak in the national unemployment series in 2009; labor productivity rose slightly faster when we applied these ratios.

2. Measuring Hours for Productivity

In November 2022, the BLS Productivity Program will release major sector productivity estimates based on a new method for measuring hours worked by wage and salary employees. Because our analysis uses the new hours series as a starting point, it is useful to briefly describe the new method here.[4] We then describe how we adjust the new method to capture the quarterly variation in paid time off during the pandemic.

The new method is designed to adjust the CES all-employee hours estimate from an hours-paid concept to an hours-worked concept. For each quarter, BLS will measure annualized hours worked for wage and salary employees as follows:

$$Hours\ Worked = Hours\ Paid^{CES} \times PTO\_ratio^{NCS} \times OTC\_ratio^{CPS} \times 52 \quad (1)$$

where $Hours\ Paid^{CES}$ is a quarterly average of all-employee weekly hours paid from the Current Employment Statistics (CES) survey; PTO_ratio^{NCS} is a paid-time-off ratio constructed from the National Compensation Survey (NCS); and OTC_ratio^{CPS} is an off-the-clock hours ratio constructed from the Current Population Survey (CPS). To annualize the data, BLS multiplies these weekly hours estimates by 52. The PTO ratio accounts for hours paid but not worked. And because the CES survey asks respondents to report hours paid for salaried and commission-only

[4] For more detail on the new hours method, see Eldridge et al. (2022).

workers based on their standard workweeks, the OTC ratio adjusts for hours worked but not paid.

2.1. Paid-time-off (PTO) ratio adjustment from NCS

Conceptually, the PTO_ratio^{NCS} is a ratio of paid hours worked to paid hours and is measured as

$$PTO\_ratio = \frac{Hours\ Paid - Hours\ of\ Paid\ Time\ Off}{Hours\ Paid} \quad (2)$$

For hourly workers, "hours paid" is equal to hours worked plus hours of paid time off, while for salaried workers hours paid is simply the standard workweek. The numerator, which we refer to as "paid hours worked," is equal to hours worked for hourly workers and the standard workweek (usually 40 hours) minus paid time off for salaried workers.

The NCS is an establishment survey that asks establishments about annual leave earned and usual sick leave taken—there is no information on actual leave taken. The productivity program uses data from the fourth quarter of each year, which is when new sample is introduced and the response rate is at its highest point during the year. Thus, there is no quarterly variation, and the annual ratios tend to be constant over time, which is potentially an issue in times of economic disruption, such as the pandemic recession. For example, given how unusual 2020 was, it is not clear how NCS respondents would report usual sick leave taken. Comparing the change in the NCS ratios for major industries between December 2019 and December 2020, we find that most of the ratios changed at only the third decimal place; an exception was mining where the ratio rose by 0.013 (less leave granted/taken). The productivity program applies the ratios at the NIPA-industry level, and because some of the ratios are based on a small sample of establishments, a five-year moving average of the ratios are used. These annual ratios are converted to quarterly ratios using the Denton procedure (Denton, 1971).

2.2. Paid-time-off (PTO) ratio adjustment from CPS

Our goal here is to replicate the PTO_ratio^{NCS} using CPS data. We use the CPS to calculate the PTO ratio described in equation (2) because the CPS does a better job at capturing changes in actual leave taken. However, the CPS does not collect all the information needed to do the calculations, so it is necessary to do some additional estimation.

The CPS collects information about hourly/non-hourly status and paid time off, but not for all individuals. Hourly/non-hourly status is collected as part of the earner study and is collected for one-quarter of the sample.[5] Information on whether leave is paid or unpaid is collected only if the individual was employed and did not work during the reference week. There is no information on whether leave was paid if the individual took off only part of the week and worked the other part. Thus, it is necessary to estimate the probability that the individual is hourly and the probability that the individual was paid for any time off. Details of this estimation are in Eldridge et al. (2022).

Putting these pieces together, we measure the PTO_ratio^{CPS} as follows:

$$PTO\_ratio^{CPS} = \frac{\sum\Big(\big(AHW \times (1 - MFN)\big) + \big((UHP - PTO) \times MFN\big)\Big)}{\sum\Big(\big((AHW + PTO) \times (1 - MFN)\big) + (UHP \times MFN)\Big)} \qquad (3)$$

where AHW is actual hours worked; UHP is usual hours paid constructed as usual hours worked topcoded at 40; PTO is hours of paid time off calculated as probability(PTO) × max(0, UHP – AHW); and MFN = *I*(Main job) × *I*(Full-time worker) × *prob*(Non-hourly), where *I*(·) is an indicator function.[6] Thus, we assume that hourly workers, part-time workers (defined as having

[5] Non-hourly workers include workers receiving a salary, commissions, or who are paid in kind from a private employer.

[6] Given that the sample weights in the CPS are equal to the number of people the observation represents, the probabilities are best thought of as fractions of the individuals represented by the observation. For example, if the sample weight of an observation is 2,400 and probability(hourly) is 0.75, then the observation represents 1,800 hourly workers and 600 non-hourly workers.

usual hours worked < 35), and those working second jobs are paid for all of the hours they work. In addition, they can be paid for hours of time off. Full-time, non-hourly workers (also referred to as salaried workers) are paid for their standard workweek, and their paid hours worked are paid hours minus hours of paid time off. Note that the numerator of this ratio is identical (at least conceptually) to the denominator of the new OTC_ratio^{CPS}, which is:

$$OTC\_ratio^{CPS} = \frac{\sum AHW}{\sum \Big(\big(AHW \times (1 - MFN) \big) + \big((UHP - PTO) \times MFN \big) \Big)} \qquad (4)$$

The final step in the process is to adjust PTO_ratio^{CPS} so that the level is consistent with the PTO_ratio^{NCS}. We found that the PTO_ratio^{CPS} is higher than the PTO_ratio^{NCS}. One reason for this is that the CPS reference week was chosen to avoid holidays, and thus paid time off may be understated. Evidence presented in Frazis and Stewart (2004) shows that individuals work more hours (and presumably take less paid leave) during CPS reference weeks compared to non-reference weeks.[7] Thus, the PTO_ratio^{NCS} likely does a better job of capturing the level of paid leave. For this reason, we do not use this PTO_ratio^{CPS} directly, but rather only the changes around its trend.

2.3. Hybrid PTO ratio adjustment

To incorporate the key features of paid time off from each series, we constructed a hybrid ratio that combines the two ratios into a single measure that exhibits CPS variation around the NCS level. Our first step was to estimate the trend in the seasonally adjusted PTO_ratio^{CPS}

[7] Similarly, Lachowska, Mas, and Woodbury (2018) find that quarterly hours worked using CPS reports are overstated compared to administrative records from Washington State.

and calculate deviations from this trend.[8] We then added these deviations to the PTO_ratio^{NCS} to arrive at PTO_ratio^{Hybrid}. Thus, the PTO_ratio^{Hybrid} can be written as

$$PTO\_ratio^{NCS} - (Trend - PTO\_ratio^{CPS}) \quad (5)$$

3. Comparison of PTO ratios

Figure 5 shows the three ratios for the 14 major industry groups. There are several things to note. First, as expected, the PTO_ratio^{NCS} lies below the PTO_ratio^{CPS}. The difference in levels varies across industries. The smallest difference is in nonfarm natural resources (about 0.02) and the largest is in utilities (about 0.08). Second, the PTO_ratio^{CPS} exhibits substantially more quarter-to-quarter variation than the PTO_ratio^{NCS}, which reflects the difference between leave granted and leave actually taken. Third, the PTO_ratio^{CPS} trends upward slightly, while the PTO_ratio^{NCS} trends downward slightly for the majority of the industries (construction, wholesale trade, retail trade, transportation and warehousing, financial activities, professional and business services, education and health services). In manufacturing, utilities, and information, the PTO_ratio^{CPS} trends upward slightly, while the PTO_ratio^{NCS} is relatively flat. In nonfarm natural resources, both series trend upward. In leisure and hospitality, both series are flat.

The graphs in figure 5 suggest that there was no change in the aggregate PTO_ratio^{NCS}. In fact, the PTO_ratio^{NCS} decreased sharply from 0.925 in the fourth quarter of 2019 to 0.917 in

[8] We seasonally adjusted the series using ratios constructed for the 2000–2021 period (except for industry 425, where the series starts in 2003); however, we present data here only from the second quarter of 2006 forward, because we are comparing the impact of this ratio on the new hours series, which starts in that quarter with the incorporation of the CES hours paid for all employees. Older data is linked to the new series.

the first quarter of 2020 (figure 6). The PTO_ratio^{NCS} increased by 0.006 to 0.922 between the first and second quarter. These are large changes, considering that the magnitude of the change averaged 0.0001 from 2006 through the end of 2019. The sharp decline in the first quarter was likely due to the massive job losses in the leisure and hospitality sector and other low-wage sectors where paid leave is less prevalent. The increase in the second quarter was likely due to a higher fraction of these workers receiving paid leave through the PPP or under the FFCRA.[9]

The behavior of the PTO_ratio^{Hybrid} was quite different during the pandemic. Ten of the 14 major industries experienced declines in the PTO_ratio^{Hybrid} of 0.01 or more between 2019q4 and 2020q2 (nonfarm natural resources, construction, nondurable manufacturing, wholesale trade, retail trade, transportation and warehousing, information, education and health, leisure and hospitality, and other services), although the drops in nonfarm natural resources, wholesale trade, and information are difficult to distinguish from the usual variation in the ratio.[10] Durable manufacturing and professional and business services saw smaller declines in the ratio and there were no noticeable drops in the utilities and financial activities industries.

The largest drops in the ratio were in retail trade (0.020), transportation and warehousing (0.021), education and health (0.023), leisure and hospitality (0.036) and other services (0.026). The large drops in some industries could be the result of two separate factors. First, workers in industries where PTO is less common, such as leisure and hospitality, other services, and retail trade may have been paid for time off financed by the PPP or covered under the FFCRA—both

[9] The impact of these job losses also contributed to the 10.3-percentage-point increase in labor productivity in the second quarter of 2020. Stewart (2022) shows that changes in labor composition (also known as labor quality) accounted for about 71 percent (7.3 percentage points) of the increase in labor productivity and that changes in the distribution of workers across major industries accounted for about 24 percent (2.5 percentage points) of the 10.3-percentage point increase.

[10] We compare 2020q2 to 2019q4 because changes in the ratio were beginning to show up in 2020q1 in some industries.

designed to aid those in small and medium-sized businesses. Second, it is possible that workers who do not receive PTO may have been disproportionately laid off.

In the third quarter of 2020, the ratios subsequently rose by about as much as they had previously fallen. In utilities, information, and financial activities, changes in the ratio were of about the same magnitude as we found outside the pandemic period. For financial activities and information, this was likely due to the industries' quick shift to remote work (Dalton & Groen, 2022).

Later in the fall of 2020, several industries again experienced drops in their ratios—nondurable goods manufacturing, wholesale trade, and education and health services. And in utilities, information, and financial activities, the ratios fell by a larger amount than in the second quarter of 2020, as there was a spike in COVID cases in December 2020. In 2021, we also saw several instances when the ratios changed by about 0.01. For example, in nonfarm natural resources, durable goods manufacturing, and wholesale trade, the ratio dropped in the fourth quarter of 2021.

Looking at how the ratios changed around the time of the Great Recession, we find that as the U.S. unemployment rate continued to rise to a peak at 9.9% in the fourth quarter of 2009, industries that were particularly hard hit in the recession experienced a drop in their ratios, which is consistent with the hypothesis that taking leave at times of slack work is less costly to employers or with larger employment declines among workers with less paid leave. For example, in construction, the ratio fell by 0.004–0.005 for three consecutive quarters ending in 2009. The ratio for durable goods manufacturing fell by 0.008 in the second quarter of 2009. The ratio for nondurable goods manufacturing fell by 0.007 in the second quarter of 2008 and stayed lower until the unemployment rate began to fall. The ratio in retail trade fell for five consecutive

quarters beginning in the third quarter of 2008. The ratio in financial activities also fell by over 0.01 over the last three quarters of 2009. Education and health services fell by 0.008 in the third quarter of 2009.

4. Comparison of Hours and Productivity

Applying the PTO_ratio^{Hybrid} to hours, we find that in the private nonfarm sector, all-employee hours fell in the second quarter of 2020 to a greater extent and then rose to a greater extent in the third quarter of 2020 than when using the PTO_ratio^{NCS} (figure 7). Similarly, during the Great Recession, hours fell in the third quarter of 2009 to a greater extent.

Figure 8 shows the differences in the annualized quarter-to-quarter growth rates between the hours series using the PTO_ratio^{Hybrid} and the hours series using the PTO_ratio^{NCS} (Hybrid minus NCS). The differences between the series were quite large during the pandemic period. In the second quarter of 2020, hours fell by 2.9 percentage points more using the PTO_ratio^{Hybrid}. In the third quarter of 2020, hours rose by 8.6 percentage points more. In the fourth quarter of 2020, the increase in hours was 2.6 percentage points lower using the PTO_ratio^{Hybrid}. This difference reversed in the first quarter of 2021, when the increase in hours was 2.5 percentage points higher using the PTO_ratio^{Hybrid}. The hours growth rates were more similar in the second and third quarters, but again diverged in the last quarter of 2021, with hours using the PTO_ratio^{Hybrid} rising by 2.5-percentage-points less.

In Figure 9, we show the impact of using the PTO_ratio^{Hybrid} on labor productivity in the nonfarm business sector. The most notable difference between the hybrid and NCS series is during the COVID-19 pandemic, especially in the second quarter of 2020 when labor productivity increased sharply. Table 1 shows the percentage changes in productivity from the

previous quarter at an annual rate using the PTO_ratio^{Hybrid} and PTO_ratio^{NCS}. Using the PTO_ratio^{Hybrid}, we find that productivity grew by 19.4 percent in the second quarter but there was no gain in the third quarter. When using the PTO_ratio^{NCS}, growth was split between the second and third quarter. Except for the third quarter of 2021, the quarter-to-quarter growth rates differed substantially between the two series. In the last quarter of 2021, we find that research-series-based estimates of productivity were again understated because of higher paid leave than was accounted for by the annual ratios.

Thus, research-series based estimates and the hybrid-series based estimates tell stories about the sharp increase in productivity in the second quarter of 2020 that are different from each other and different from the official estimates.[11] The official estimate of labor productivity growth for the second quarter of 2020 was 10.3 percent. Productivity growth using the research-based hours series, which does a better job of accounting for off-the-clock work, was 14.1 percent. When we substitute our hybrid hours series, 2020q2 productivity growth was 19.4 percent.

These alternative estimates also change the story about the role of labor composition in labor productivity growth in the second quarter of 2020. Stewart (2022) found that labor composition accounted for 71 percent of the increase in productivity in the second quarter of 2022 (7.3 percentage points of the 10.3 percent increase in labor productivity). Using the NCS hours series, the 7.3 percentage point labor composition contribution falls to 51 percent. And using the hybrid hours series, the labor composition contribution falls to 37 percent of labor productivity growth in the second quarter of 2020. It is worth noting that a 37 contribution is still

[11] In November 2022, BLS will introduce a new method for estimating hours worked that will be similar to the NCS series presented here.

economically significant. In previous quarters with high productivity growth, which occurred around recessions, labor composition accounted for no more than 6 percent of labor productivity growth.

5. Conclusion

The correct measurement of hours worked is critical for accurately measuring productivity. Yet, it is very hard to properly measure hours worked because the ideal data do not exist. BLS currently uses changes in leave policies reported by establishments to adjust hours paid data to hours worked. This adjustment is sufficient in normal times because most of the variation in annual and sick leave is seasonal. However, the COVID-19 pandemic was not a normal time.

Using household survey data, we developed an adjustment ratio to account for quarterly variation in paid time off. We find a large drop in the PTO ratio in the second quarter of 2020 in many industries, indicating that paid leave increased substantially in that quarter. In addition, as the unemployment rate peaked around the end of the Great Recession, the ratio dropped in industries that suffered substantial job losses, which is consistent with employers granting their employees more leave when there is less work to do and with large employment declines among workers who are less likely to have a paid leave benefit.

Applying these ratios, we find that hours worked fell faster in the second quarter of 2020 and increased faster third quarter than the research hours series. Thus, labor productivity growth was higher than the estimate based on the research series in the second quarter and lower in the third quarter. We find a similar, but much smaller, difference near the trough of the last business cycle.

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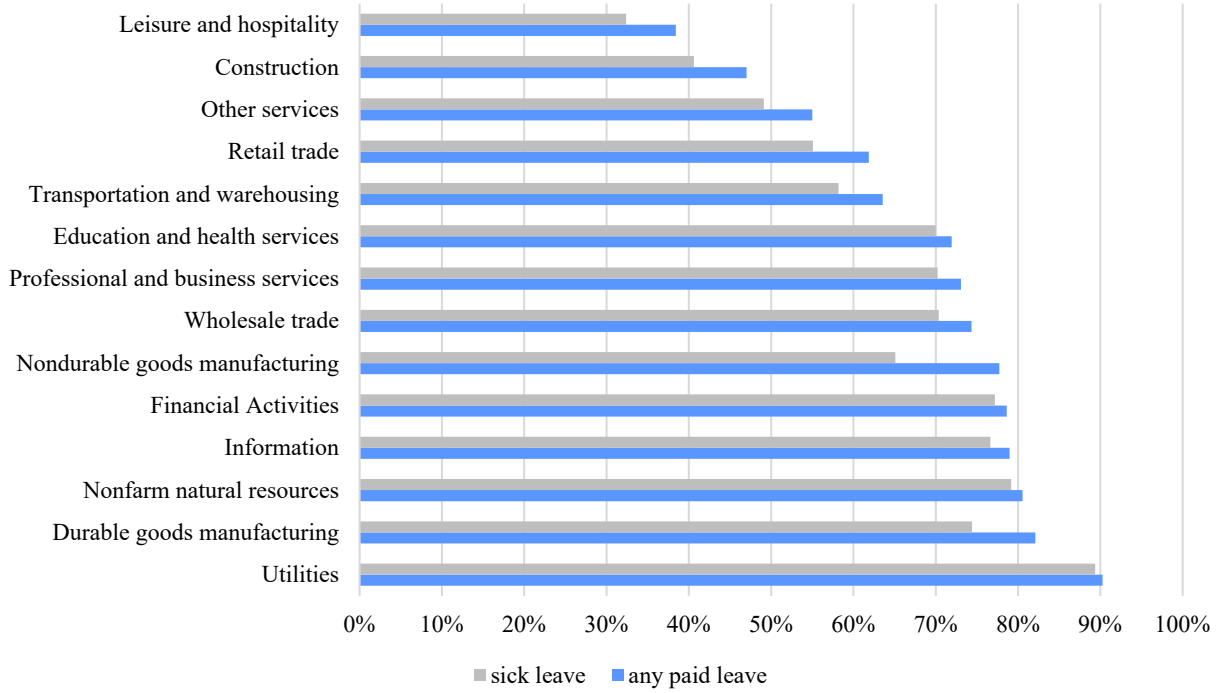
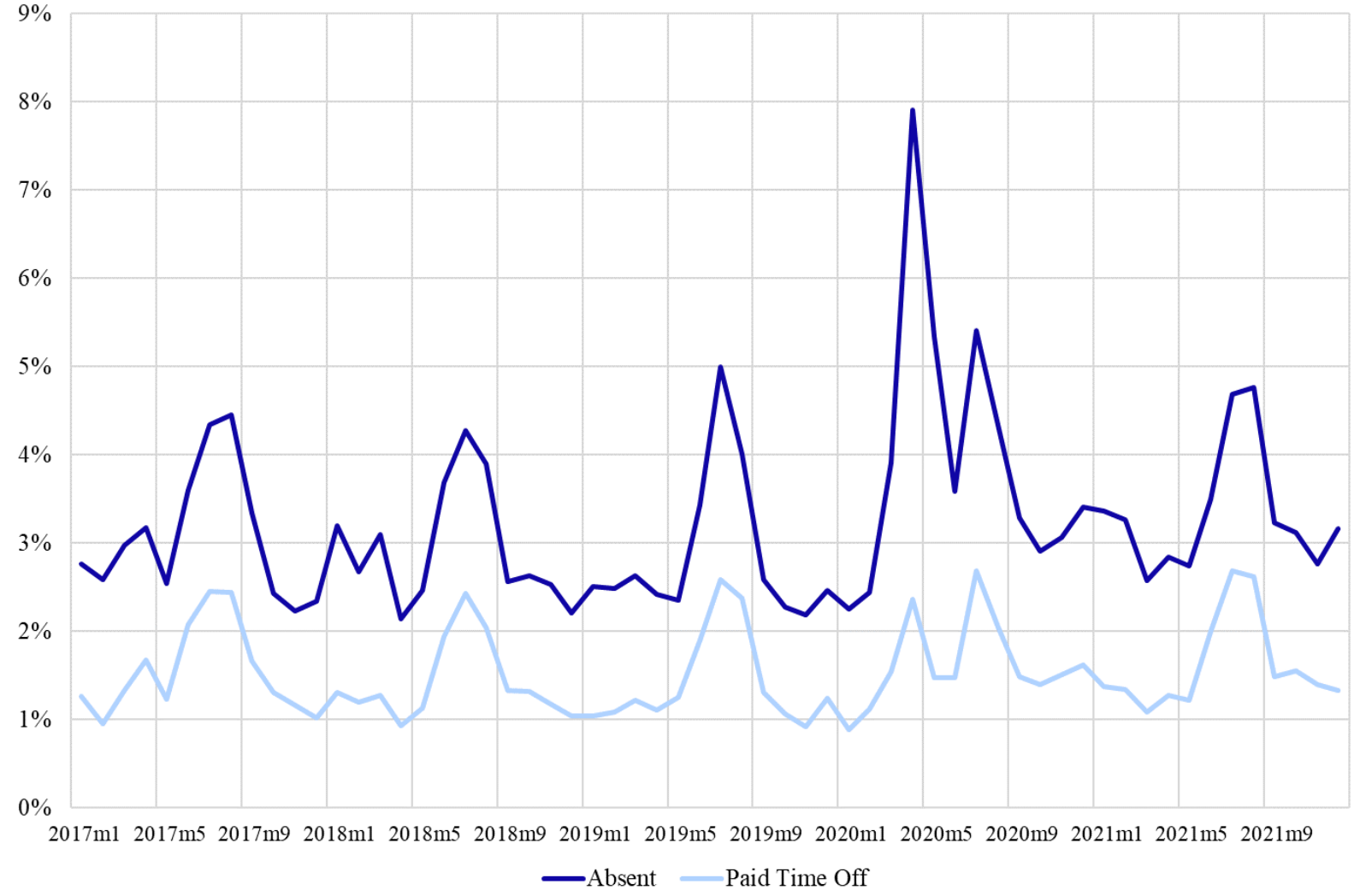
Figure 1. Percentage of Wage and Salary Employees Who Receive Paid Leave and Sick Leave in the Private Nonfarm Sector, 2017–18



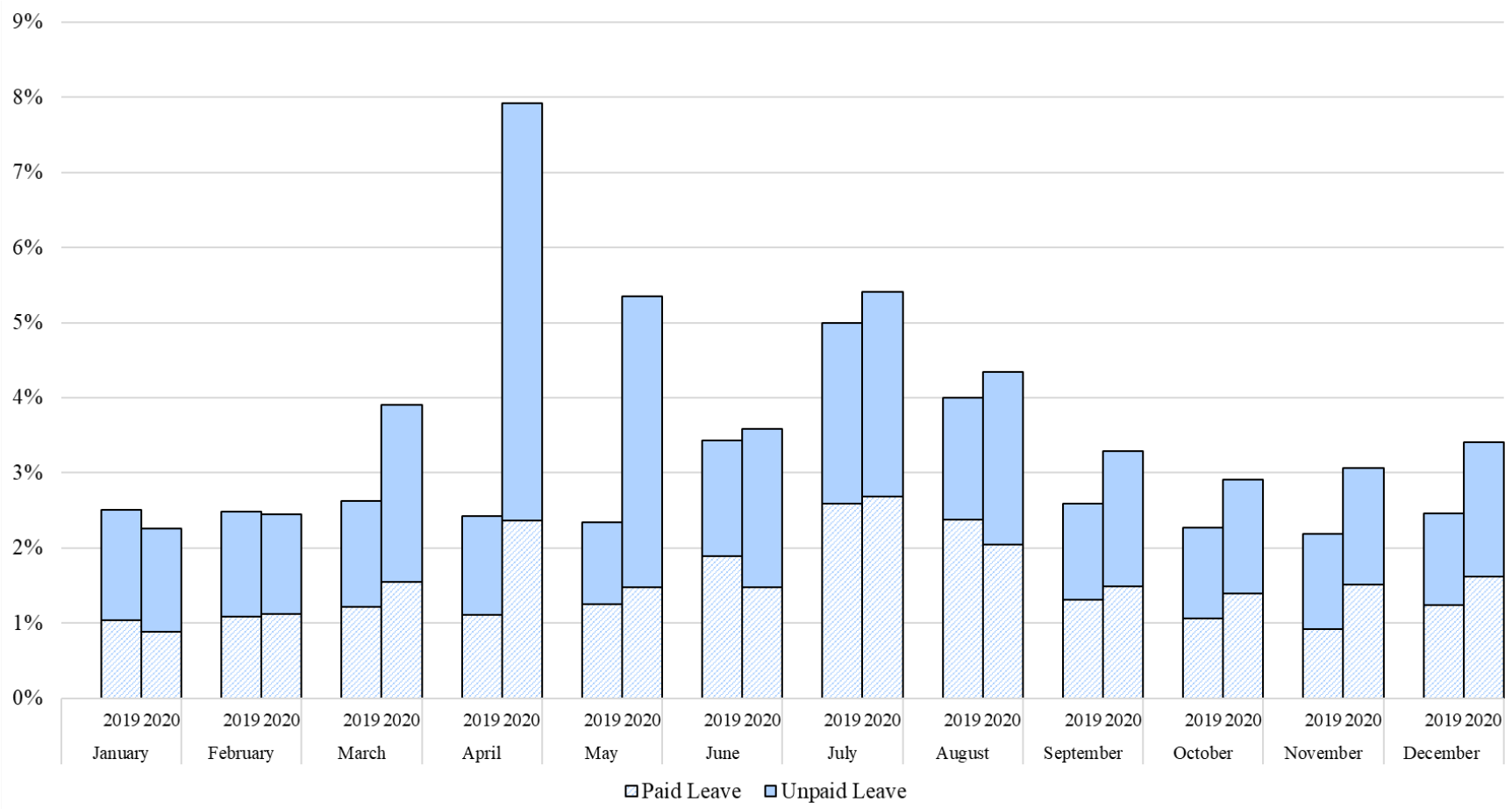
Source: 2017–18 American Time Use Survey Leave Module

Figure 2. Percentage of Wage and Salary Employees Who Were Absent from Work in the Prior Week and Who Were Paid for Time Off in the Private Nonfarm Sector, 2017–21, Not Seasonally Adjusted



Note: Not seasonally adjusted
Source: Current Population Survey Outgoing Rotation Groups

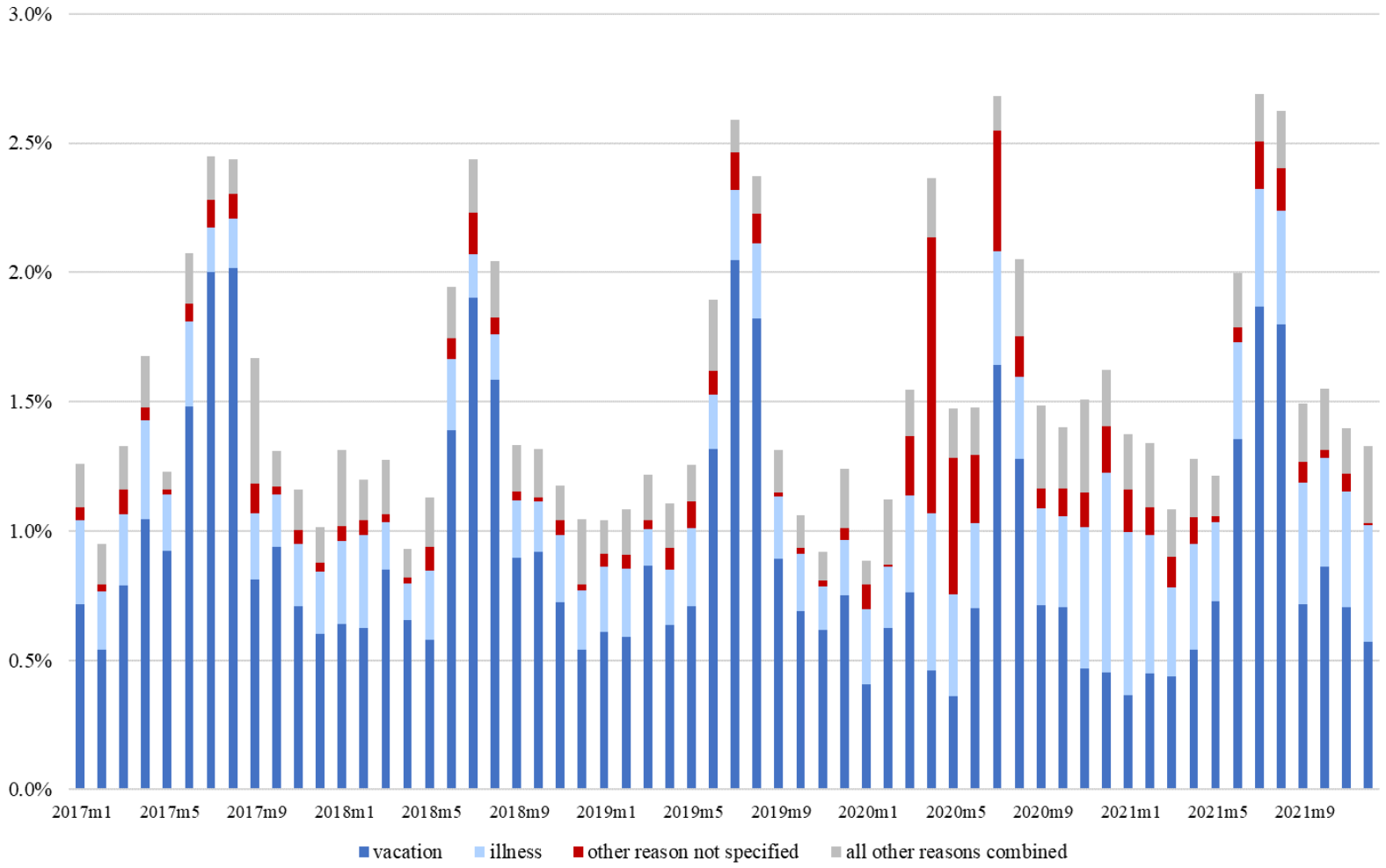
Fig 3. Percentage of Employees Who Were Absent from Work in the Prior Week in the Private Nonfarm Sector, by Paid Leave Status, 2019–20



Notes: Not Seasonally adjusted.

Source: Current Population Survey Outgoing Rotation Groups

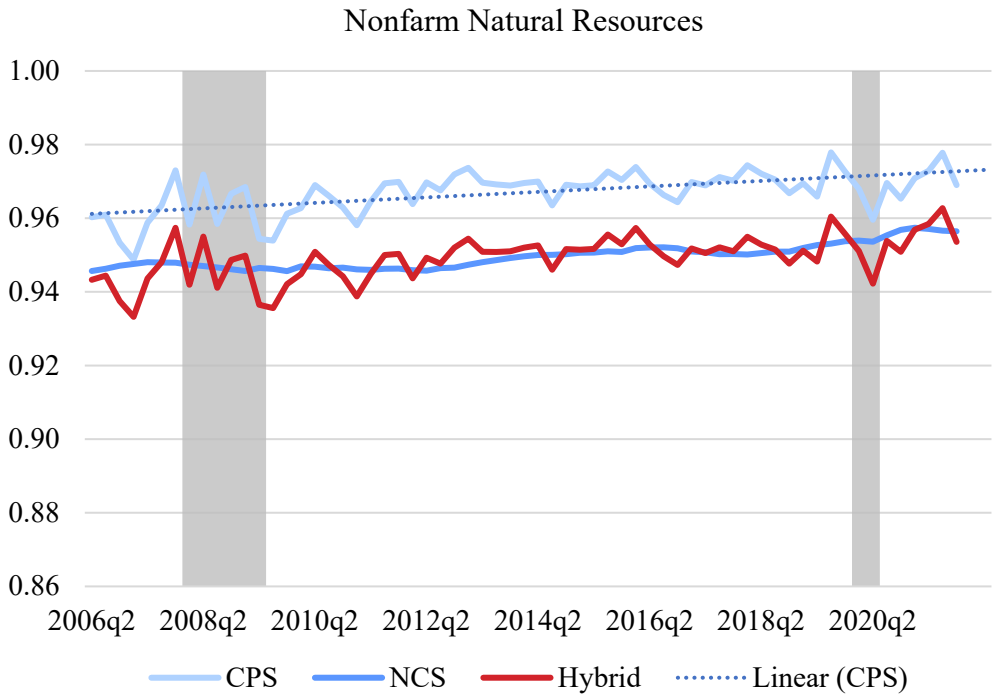
Figure 4. Percent of Paid Absences and Reasons for Absences, Wage & Salary Workers in the Private Nonfarm Sector, 2017-21

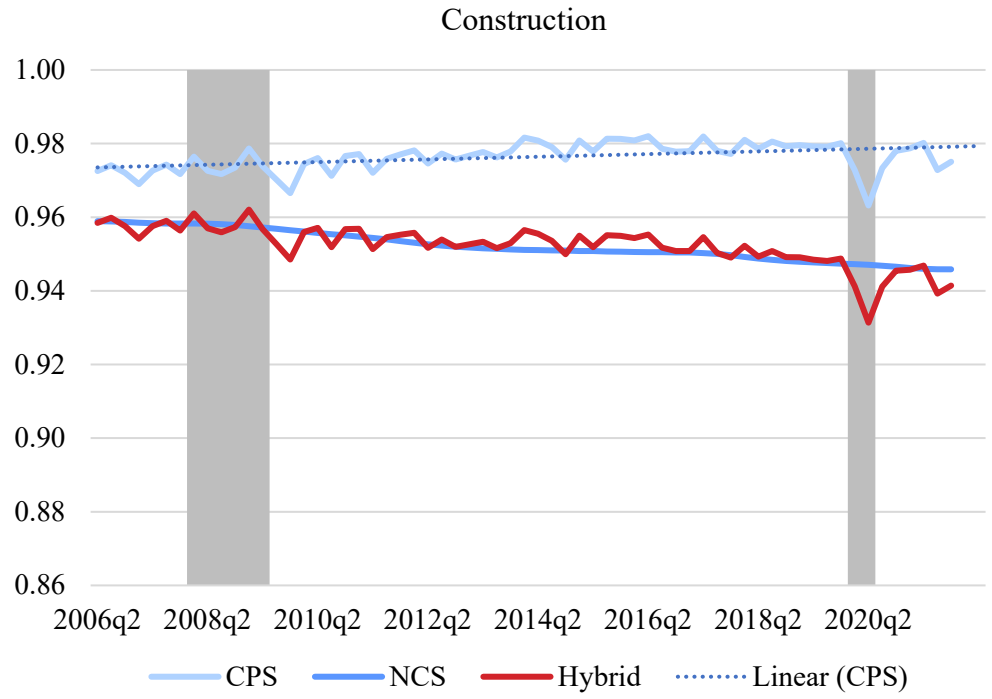


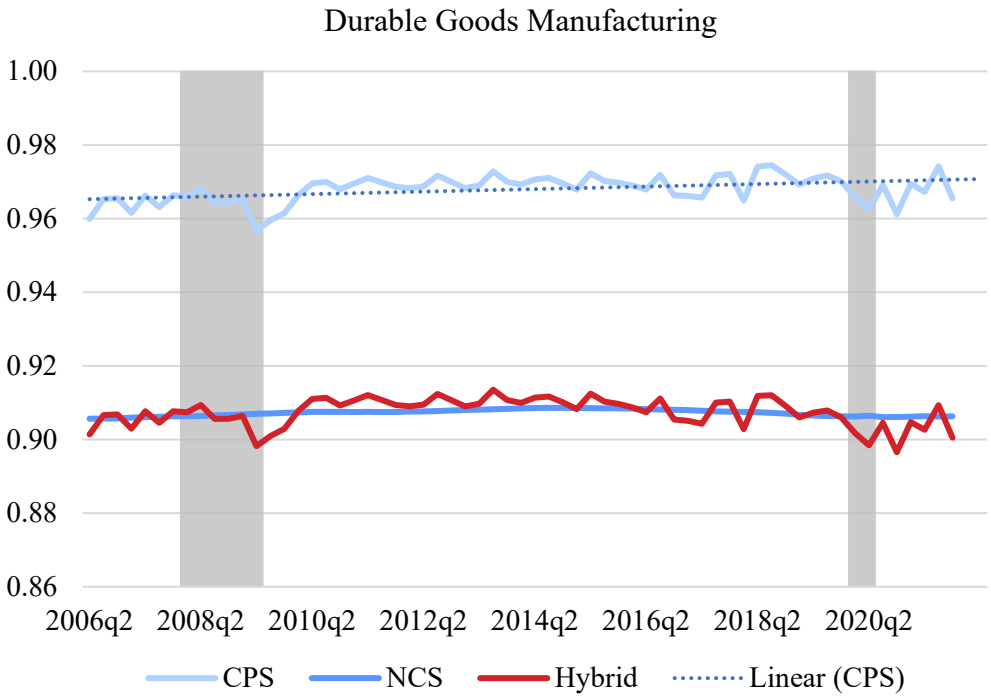
Note: Not seasonally adjusted

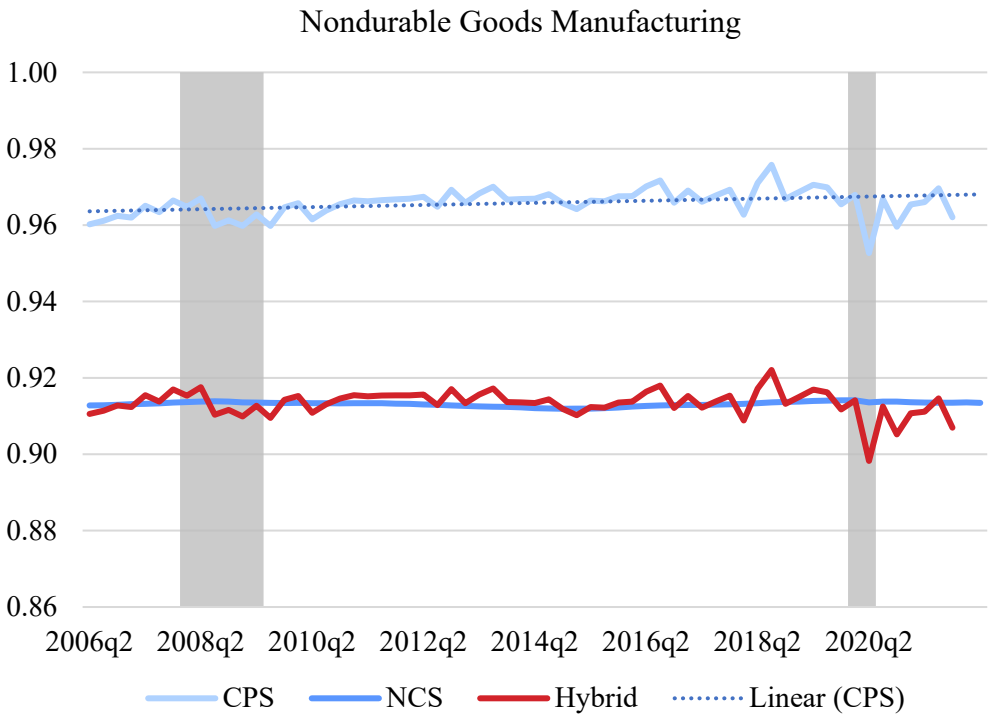
Source: Current Population Survey Outgoing Rotation Groups

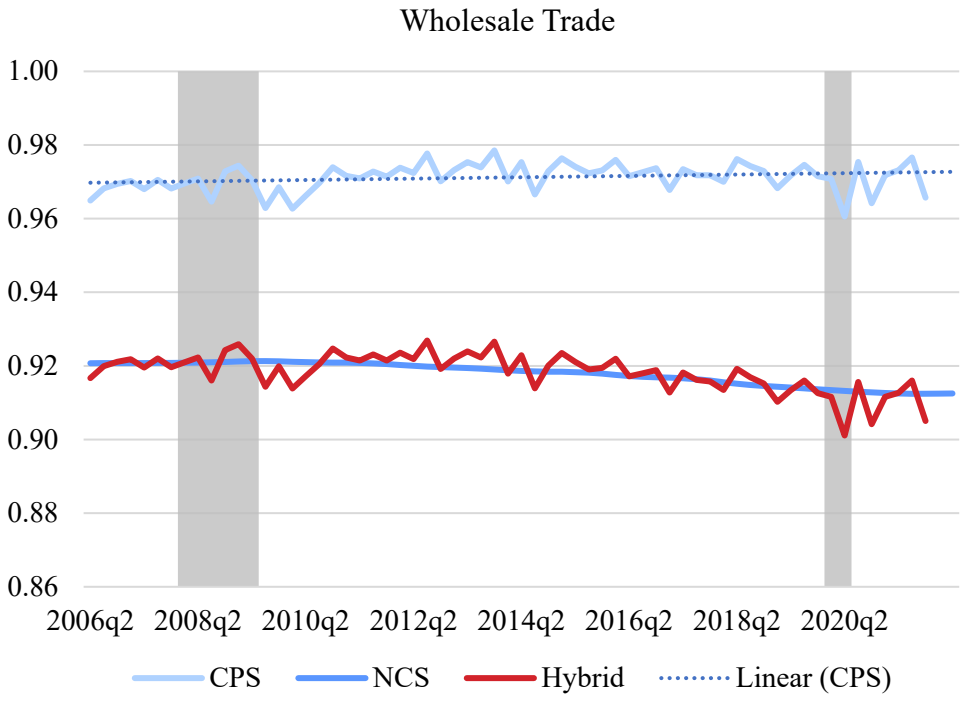
Figure 5. Paid-time-off Ratios by Industry, Second Quarter 2006 to Fourth Quarter 2021

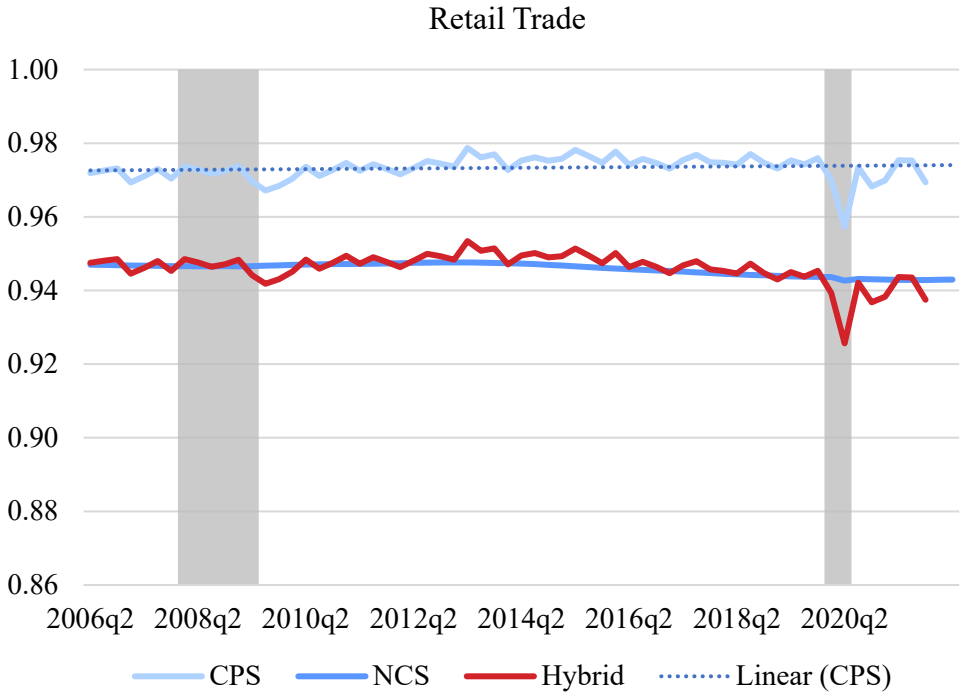


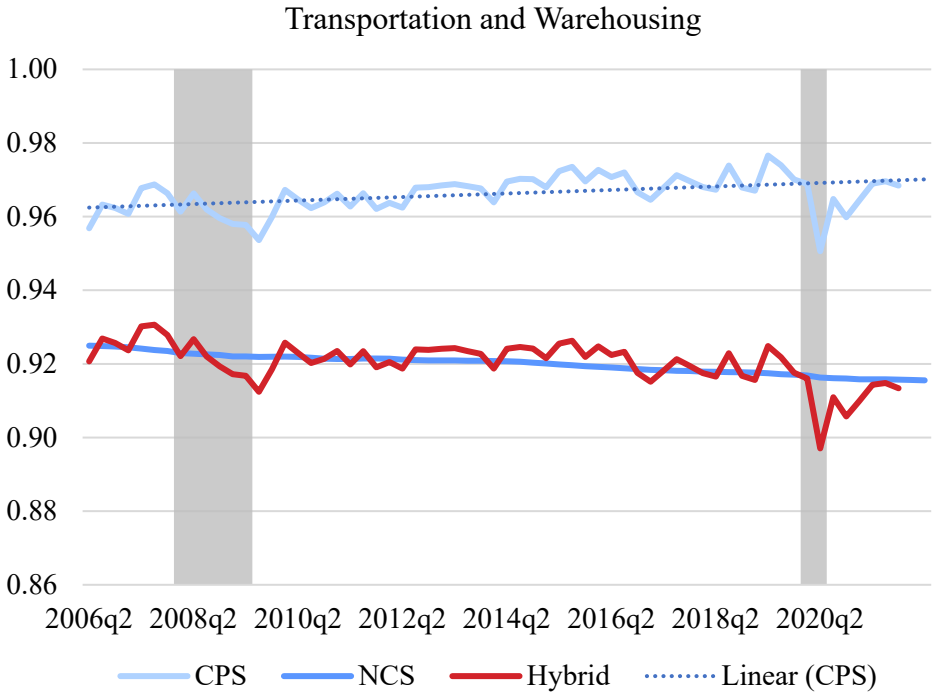


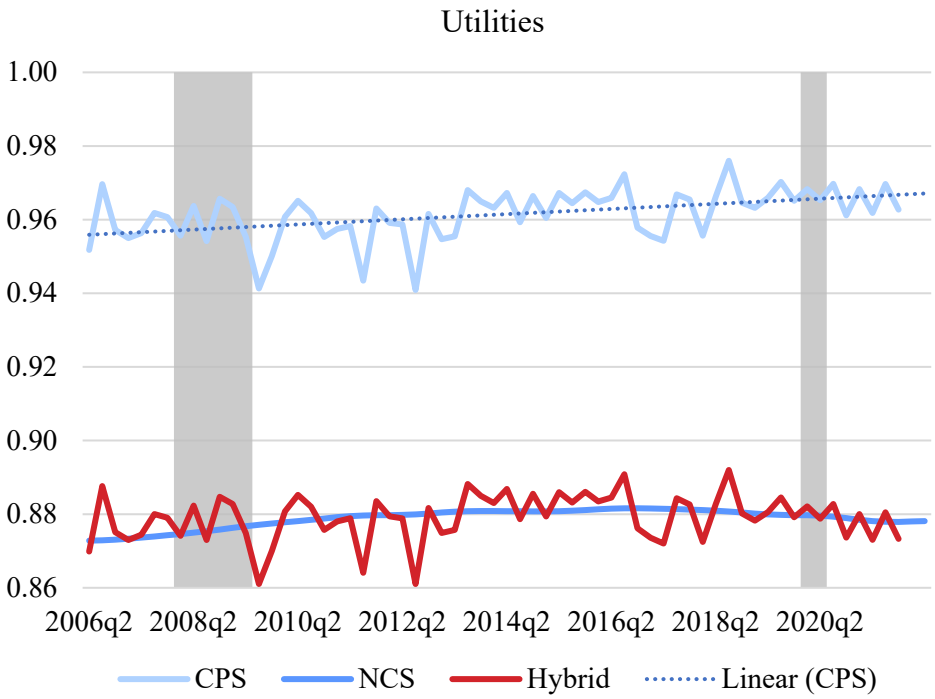

Durable Goods Manufacturing
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

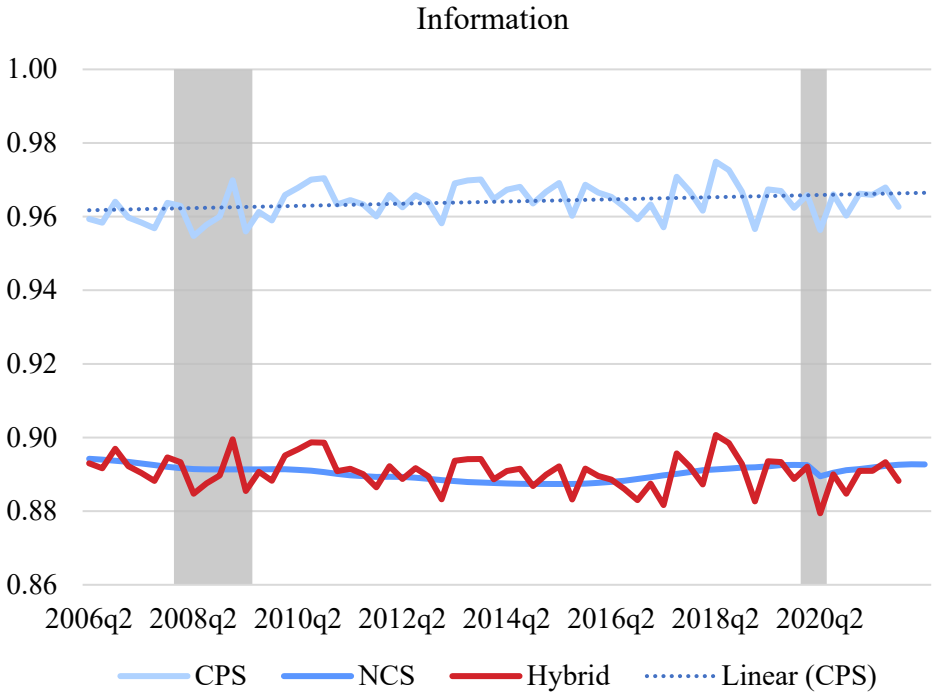

Nondurable Goods Manufacturing
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

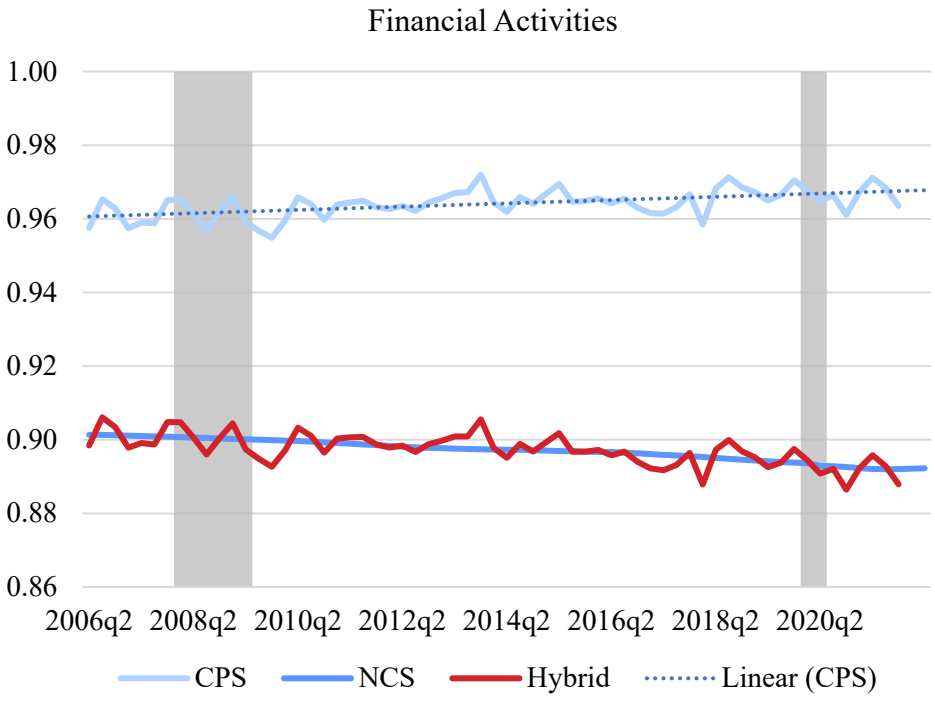

Wholesale Trade
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

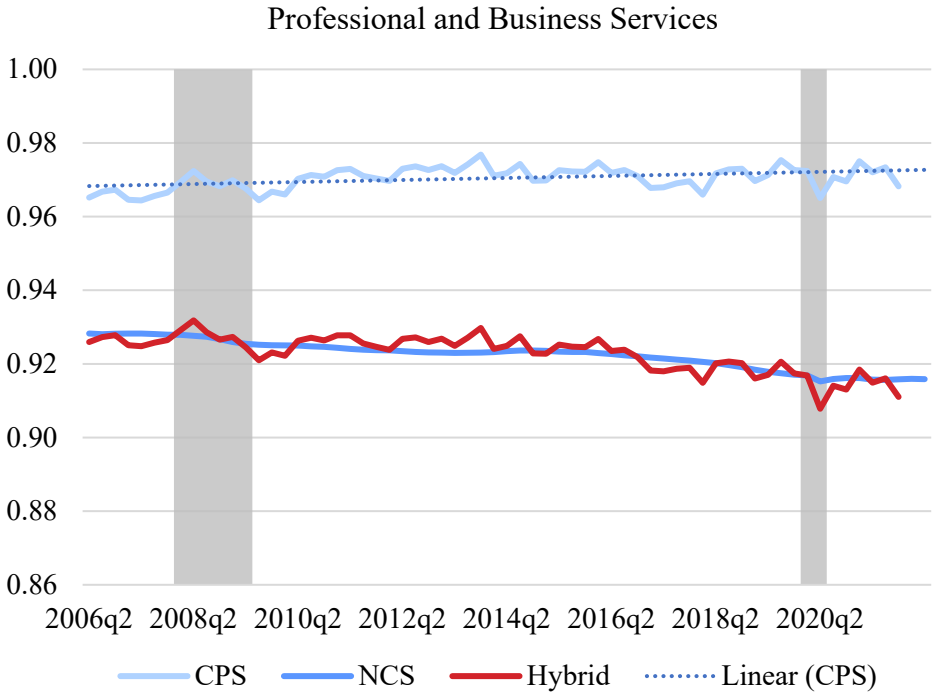

Retail Trade
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

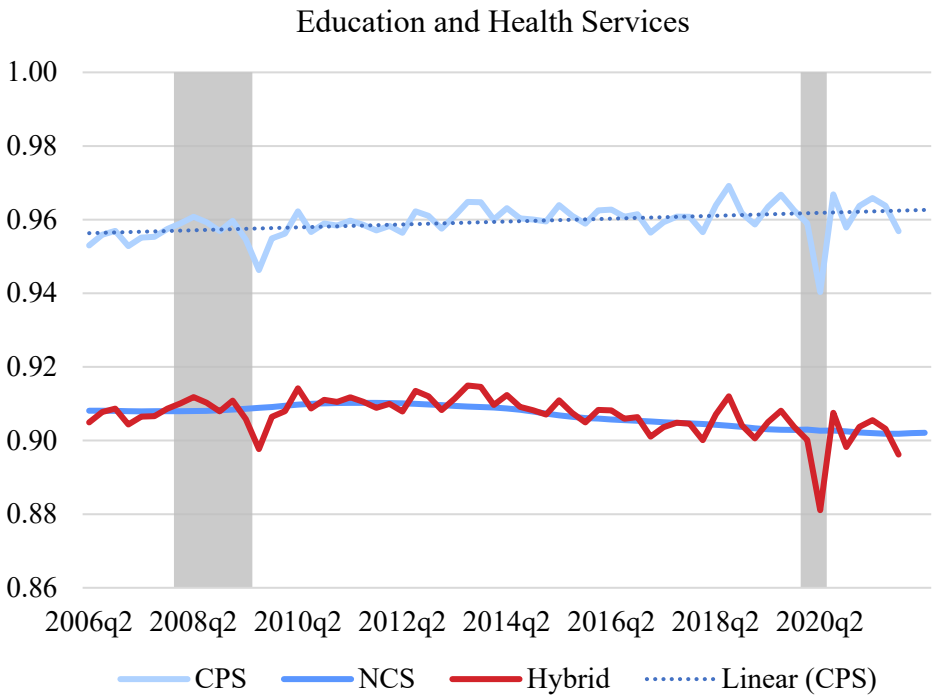

Transportation and Warehousing
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

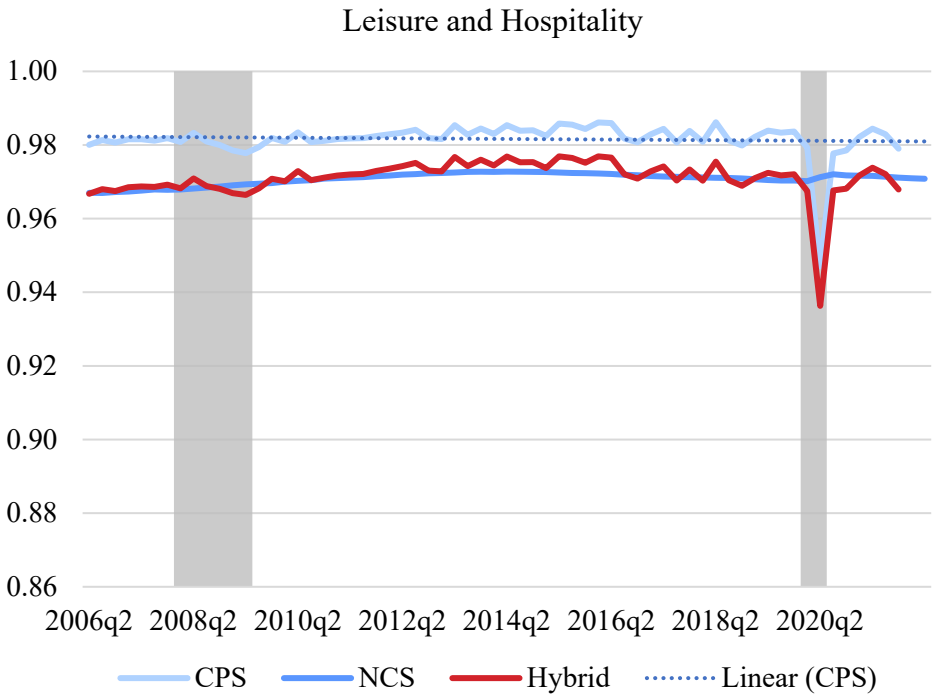

Utilities
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)


Information
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)


Financial Activities
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)


Professional and Business Services
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)


Education and Health Services
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)


Leisure and Hospitality
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

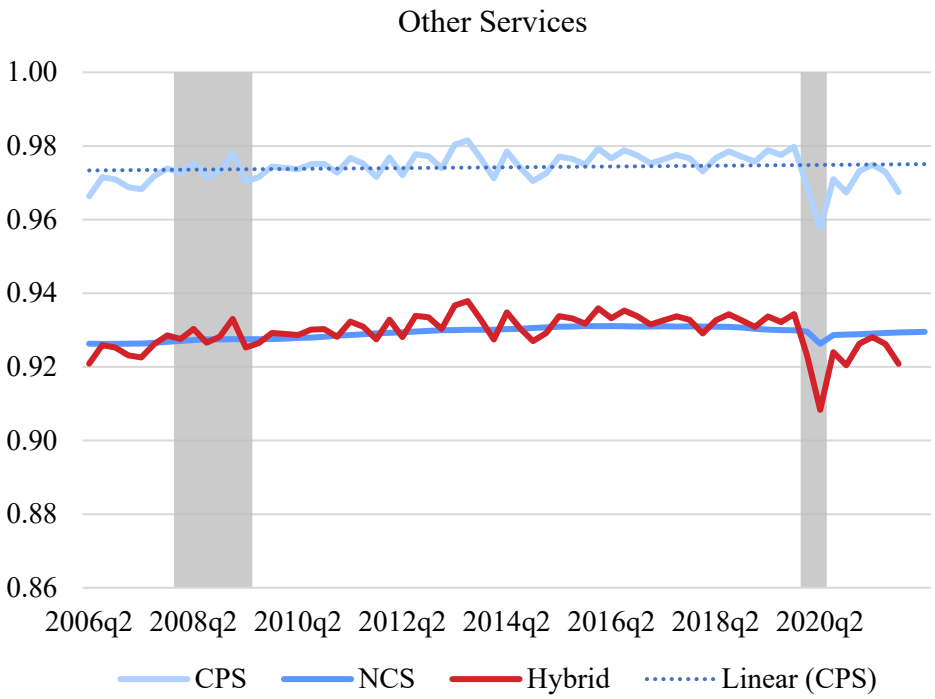
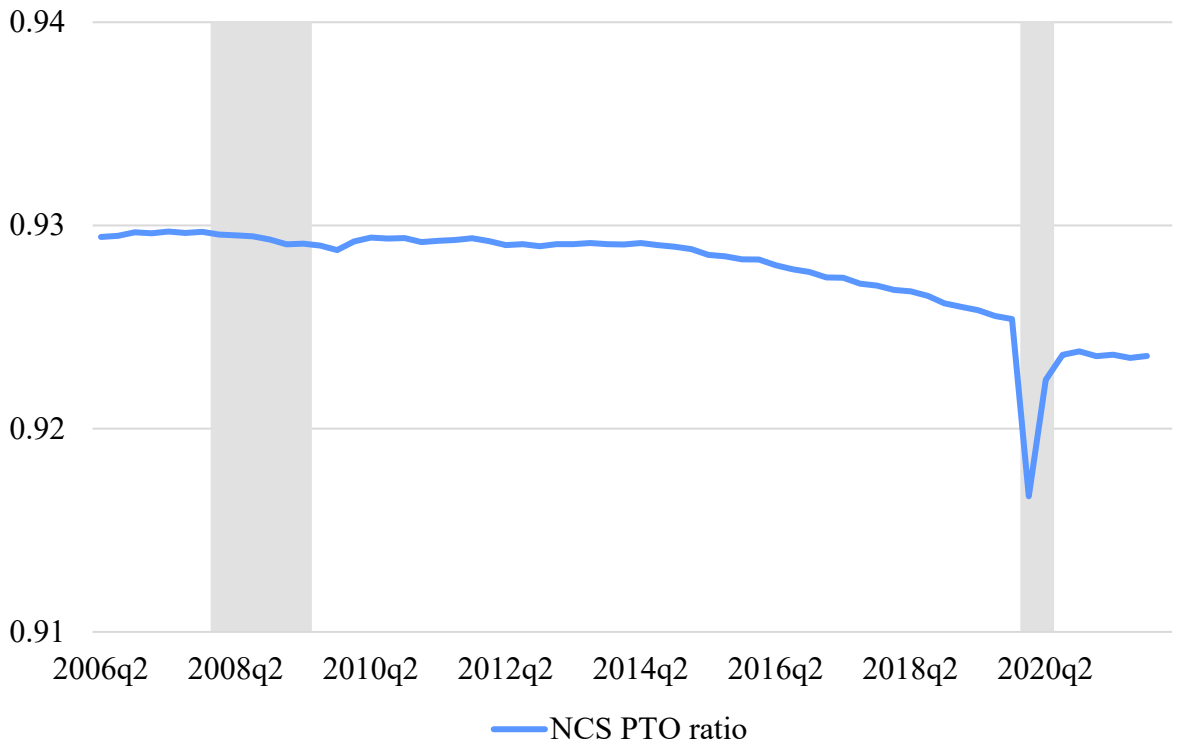

Other Services
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
2006q2
2008q2
2010q2
2012q2
2014q2
2016q2
2018q2
2020q2
CPS
NCS
Hybrid
Linear (CPS)

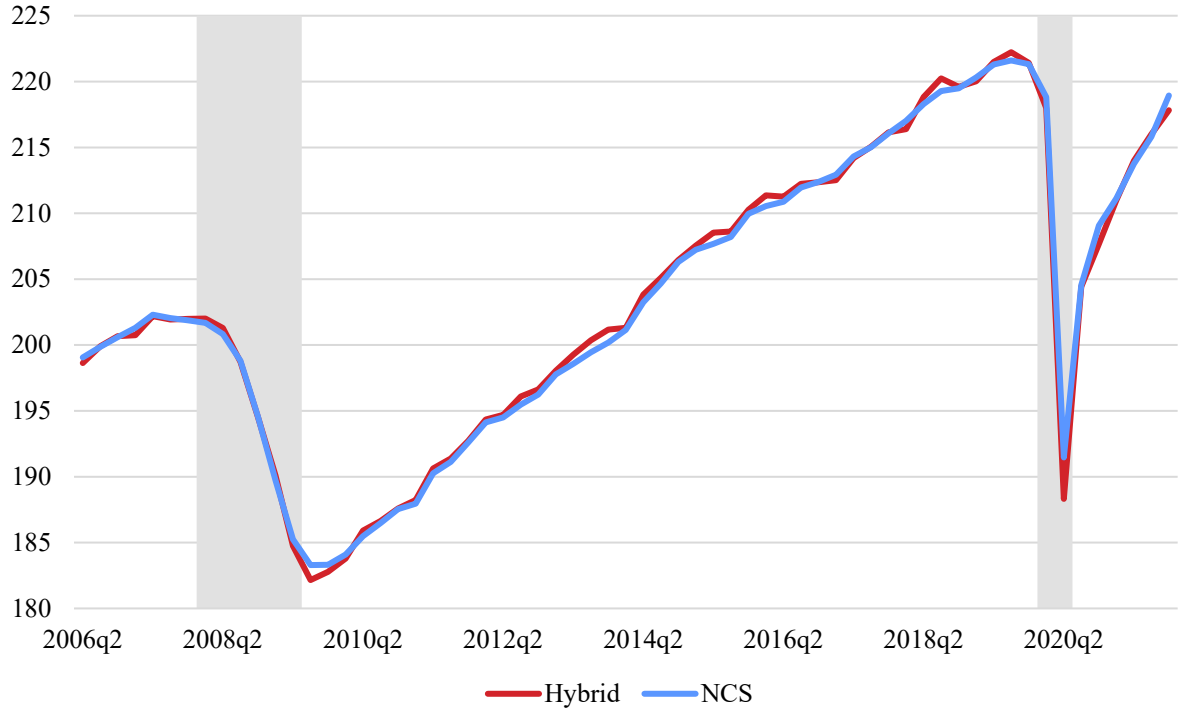
Figure 6. NCS Paid-time-off Ratio for Private Nonfarm Sector Employees, Second Quarter 2006 to Fourth Quarter 2021



Note: The shaded bars denote National Bureau of Economic Research (NBER)-designated recessions.

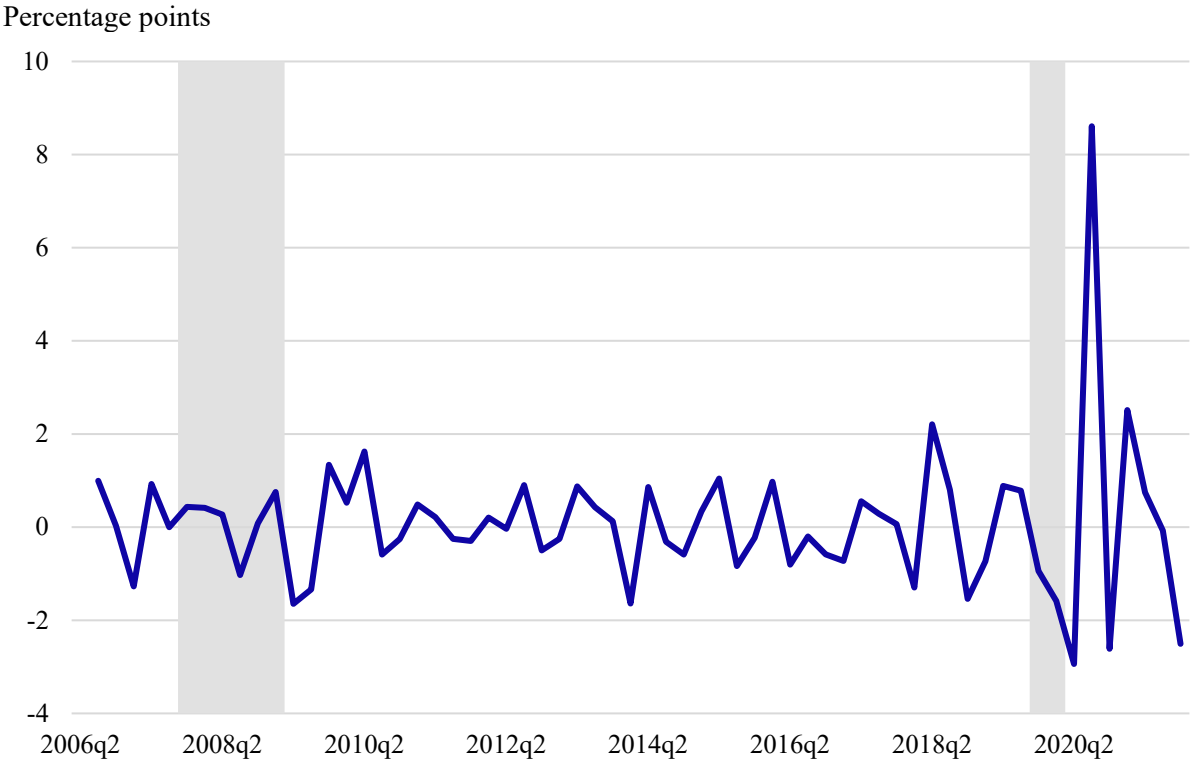
Figure 7. All-employee Hours Levels in the Private Nonfarm Sector, by Paid-time-off Ratio

Billions of hours



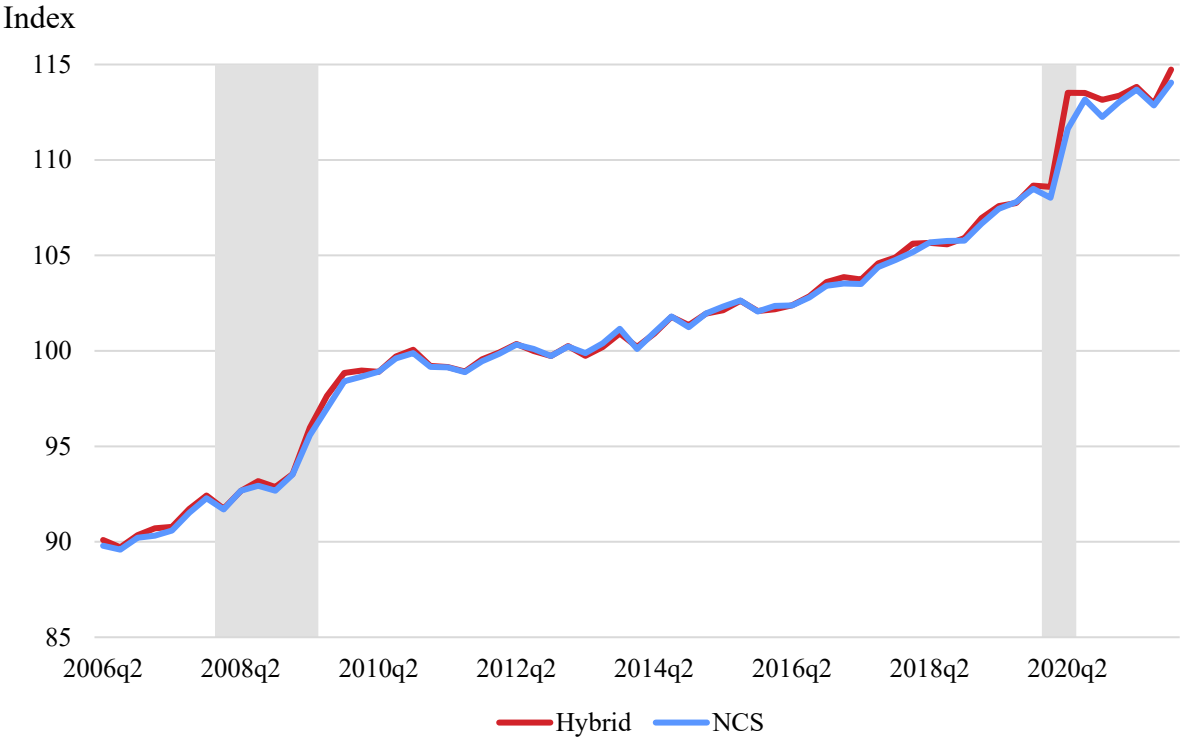
Note: Seasonally adjusted. The shaded bars denote National Bureau of Economic Research (NBER)-designated recessions.

Figure 8. Difference in the Annualized Quarter-to-Quarter Hours Growth for Employees in the Private Nonfarm Sector, Hybrid Ratio Adjustment versus NCS Ratio Adjustment



Note: The shaded bars denote National Bureau of Economic Research (NBER)-designated recessions.

Figure 9. Labor Productivity in the Nonfarm Business Sector, Second Quarter 2006 to Fourth Quarter 2021



Note: 2012=100. The shaded bars denote National Bureau of Economic Research (NBER)-designated recessions.

Table 1. Comparison of Using Alternative Paid-time-off Ratios on Productivity Growth in the Nonfarm Business Sector during the COVID-19 Pandemic

	Hybrid	NCS	Difference (Hybrid–NCS)
2020q1	-0.2	-1.7	1.5
2020q2	19.4	14.1	5.3
2020q3	0.0	5.6	-5.6
2020q4	-1.3	-3.2	1.9
2021q1	0.8	2.9	-2.1
2021q2	1.6	2.3	-1.3
2021q3	-3.0	-2.9	-0.1
2021q4	6.4	4.3	2.1

Note: Percentage change from the previous quarter at an annual rate.