The effect of working from home on major time allocations with a focus on food-related activities

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Abstract

Telecommuting has been on the rise in the U.S. and working from home may affect how workers allocate their time over the course of a day. In this paper, using a seemingly unrelated regression (SUR) framework, we examine differences in time spent in major activities between individuals who worked from home and away from home. We use data on prime working-age adults (age 25–54 years old) who participated in the 2017–18 *Leave and Job Flexibilities Module* of the *American Time Use Survey*. Results show that prime working-age American adults who worked from home during their diary day spent less time working and on personal care, but more time on leisure, sleeping, and on food production and consumption than those who worked away from home. For instance, among individuals with a spouse or partner present, those who worked from home spent 25 more minutes engaged in food production and 48 more minutes eating and drinking at home than did individuals who worked away from home, which are large relative to the sample averages of 33 and 31 min, respectively. These results show that there is important variation in the daily time allocation of workers in their prime working years and suggest in particular that working from home may allow for substantially more time to produce food and consume food at home, which may provide teleworkers with health benefits since home-produced meals tend to be lower in calories and higher in nutrients than meals prepared away from home.

Keywords Time use · Work from home · Telework · Work · Food production · Eating and drinking at home

JEL Codes D13 · I12 · J22

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1 Introduction

In the U.S., the first confirmed case of the Novel Coronavirus (COVID-19) occurred on January 19, 2020 (Holshue et al. 2020) and since then, COVID-19 has spread to every state in the nation. On March 16, 2020, to slow the spread of COVID-19, the federal government announced federal social distancing guidelines (“15 Days to Slow the Spread”) and many U.S. jurisdictions followed with implementation of stay-at-home orders. As a result, many American workers are performing their jobs from home. According to Gallup Panel data, the percentage of U.S. workers who said they had worked from home during the COVID-19 pandemic doubled from 31 percent in mid-March to 62 percent in early April.¹ The widespread and extraordinary state of affairs caused by the pandemic raises an important question: how does the daily time allocation of Americans who work from home differ from that of Americans who work away from home?

While many Americans are currently doing their jobs from home to prevent getting and spreading COVID-19, the share of American workers who regularly exert a portion of their work effort away from their offices has been on the rise for a number of years. Researchers from a consulting firm *Global Workplace Analytics* estimated that regular telecommuting (i.e. working from home at least half of the time) grew 115 percent from 2005 to 2015 (FlexJobs 2017). A recent survey of employers conducted by the *Society for Human Resource Management (SHRM)* indicated that from 2015 to 2019, ad-hoc, part-time, and full-time telecommuting grew by 23.2, 16.7, and 22.7 percent, respectively (see Fig. 1). As of April 2019, over 1 in 4 employers surveyed by the SHRM offered full-time telecommuting to their employees (SHRM 2019). All of these data are roughly in line with nationally representative data provided by the Bureau of Labor Statistics (BLS): over 2017–18, 25 percent of wage and salary workers worked from home at least occasionally (BLS 2019).

Fig. 1 Telecommuting benefits offered to employees by employers, by year (2015–2019). Source: Society for Human Resource Management (2019)

¹ These data were drawn from an article titled “U.S. Workers Discovering Affinity for Remote Work” by Megan Brennan, which can be found here: <https://news.gallup.com/poll/306695/workers-discovering-affinity-remote-work.aspx> (Accessed May 25, 2020).

Existing data clearly show that the share of Americans who occasionally or always work from home has grown over time, which has implications for how today's workforce allocates its time over the course of a day. The reasons for working remotely are varied, but many remote workers indicate that it enhances their ability to balance work and life responsibilities (BLS 2019; Owl Labs 2019). Despite the clear shift in telework participation among Americans in the modern-day labor force in recent years, there exists a lack of research that explores differences in the amount of time devoted to different activities by the location where work is performed. Naturally, the first relevant major activity is the number of work hours: do at-home workers allocate more or less time to work than do workers who supply their work effort away from home? Many American would-be office-goers are currently working from home due to greater risk of exposure to COVID-19 in workplaces and employers may be concerned about their employees "shirking from home." However, extant evidence indicates that working from home does not necessarily mean lower productivity. Bloom et al. (2015) find that, using data from a Chinese travel agency that randomly assigned workers to either work from home or in the office for nine months, home workers actually performed better by logging more minutes per shift and more calls per minute. Without knowing how much a given worker can produce per minute of work effort, a difference in time spent working does not necessarily translate into a productivity difference, but we argue it is still useful to learn about variation in time devoted to work by worksite and explicitly investigate this issue here using American data.

Changes in work hours in recent years have been accompanied by changes in other time allocations, especially leisure. Aguiar and Hurst (2007a) find that, from 1965 to 2004, as market work hours (home production hours) declined for men (women), leisure time rose. Given these findings, in this paper, in addition to working, we focus on activities that the vast majority of American workers report engaging in during a time diary interview of a nationally representative survey: personal care (e.g. grooming), leisure (e.g. watching TV), sleeping, food production (e.g. food preparation and presentation) and at-home eating activity. These are major activities that we expect teleworkers to consider substituting towards when they decrease at-home work time since they are easily performed in home settings.

The production and at-home consumption of food are of particular importance. These are health-promoting daily activities that are frequently performed and ubiquitous among humans (Davis 2014), but also ever-changing with work-life responsibilities. As with variation in work hours by worksite, analysis of these activities is especially timely given that Americans are currently spending more time at home and many U.S. jurisdictions have limited foodservice establishments to services (e.g. takeout) they can safely provide to consumers during the COVID-19 pandemic. Investigation into this issue is also important from a historical perspective because time spent eating and drinking among U.S. adults decreased by 5 percent from 2006–08 to 2014–16,² which suggests that American adults may be eating faster (Zeballos and Restrepo 2018) and such downward pressure on time spent eating could potentially have adverse health consequences. This may be especially

² Hamermesh (2007) found that, from 1985 to 2003, time spent eating meals among U.S. adults fell by 10 percent.

true if the daily time American workers devote to healthy eating is shrinking in part because of rising work-related time pressure and stress (Escoto et al. 2012; Jabs and Devine 2006; Welch et al. 2009).

Slower eating speed and higher consumption of home-prepared meals have been found to be associated with a lower risk of weight gain and a higher-quality diet. For instance, previous studies have found that, among adults, eating more slowly inhibits the development of obesity (Hurst and Fukuda 2018), and eating slower is associated with a lower risk of elevated triglycerides (Paz-Graniel et al. 2019). Hamermesh (2010) and Zeballos and Restrepo (2018) show that there is an inverse relationship between time spent eating and body mass index (BMI), which suggests that the amount of time people spend eating may play a role in obesity. Studies have also found that, among adults, a higher frequency of at-home cooking is associated with higher intake of fruits and vegetables (Monsivais et al. 2014), lower consumption of energy, fat, and sugar (Wolfson and Bleich 2015), and a higher Healthy Eating Index (HEI) score (Wolfson et al. 2020).³ Consistent with these latter results, Todd et al. (2010) estimated that substituting a meal prepared away from home (FAFH) for a meal prepared at home (FAH) increases total daily intake among adults by about 134 calories—or about 7 percent for those on a 2000-calorie-per-day diet—and lowers diet quality as measured by the HEI. While this area of research suggests that a diet consisting of mainly home-produced meals is healthier, the time cost of preparing FAH relative to the total cost of food has been estimated to be nontrivial in magnitude (Davis and You 2010; Raschke 2012; You and Davis 2019). For time-constrained individuals, cheap convenience foods and ready-to-eat meals may be appealing alternatives, especially when non-labor time is scarce.

Labor market circumstances and opportunities have the potential to produce heterogeneity in the allocation of time devoted to nonmarket activities, including FAH production and consumption. In a recent review of the literature on food production and consumption, Davis (2014) noted that scholars have consistently found that an increase in the opportunity cost of time causes a substitution away from FAH toward FAFH. For example, over periods of time when labor market opportunities for women increased, a rise in women's employment was followed by a fall in home cooking by women (Nayga 1996; Kohara and Kamiya 2016; Etilé and Plessz 2018). Labor supply increases among men have also been found to reduce the amount of time they allocate to at-home meal preparation (Dunn 2015).⁴

The previous literature has focused on how labor supply affects FAH production, but it is currently unknown how a worker's place of work may affect time devoted to food-related activities. Working from home may allow for greater time for FAH production and consumption during work breaks and lunch breaks. It is also possible that teleworking prevents workplace distractions, enhances worker productivity, and thereby frees up more time for FAH production and consumption. This paper uses data from the 2017–18 *Leave and Flexibilities Job Module* of the *American Time Use*

³ The HEI is a measure of diet quality that assesses how well a set of foods aligns with key recommendations of the *Dietary Guidelines for Americans*.

⁴ In a related literature, researchers have found evidence that retirement increases time spent engaged in meal preparation and other housework activities (Aguiar and Hurst 2005; Aguiar and Hurst 2007b; Luengo-Prado and Sevilla 2013; Ciani 2016; Atalay et al. 2020).

Survey to contribute to the literature by analyzing variation in the amount of time prime working-age adults (25–54 years old) American workers spend engaged in major activities by the location the ATUS respondents reported working the day before their time diary, namely: (i) those who are telework-eligible and worked only from home the day before their time-use interview (i.e., worked from home) and (ii) those who worked only in their office or somewhere else the day before their daily time-use interview (i.e., worked away from home). The six major activities we analyze are grouped into three categories: (1) labor market work, (2) leisure-related time use (personal care, leisure, and sleeping), and (3) food-related time use (food production and eating and drinking at home).^{5,6} About two-thirds of prime working-age adults engaged in each activity and spent 82.4 percent of their day engaged in these six activities (1187 min), on an average weekday over 2017–18. We focus on prime working-age adults because they have a very strong attachment to the labor force—80 percent of Americans age 25 to 54 are employed at the present time (BLS 2020)—and workers 25 years and older are far more likely than younger Americans to work from home (BLS 2019).

We first document that demographic and employment characteristics vary by worksite, which may help to explain variation in major time allocations under consideration. Indeed, previous research has found that individual socioeconomic characteristics and household composition influences the time allocated to FAH meal preparation (Mancino and Newman 2007; Senia et al. 2017). Thus, in a seemingly unrelated regression (SUR) framework, we jointly estimate the conditional associations between working from home and major time allocations—net of a host of other factors including the presence of children, part- or full-time employment status, etc.—that potentially determine daily time use. We jointly estimate these time-use equations in a SUR framework in order to facilitate the comparison of the magnitude of estimated differences by worksite across major activities. We separately examine single-headed and dual-headed households because intrahousehold time allocation decisions depend on whether a spouse or partner is present.

We find that, controlling for a wide variety of other potentially important determinants of time use, prime working-age American adults who worked from home during their time diary day spend substantially less time working than individuals who worked away from home. Consistent with a priori expectations, teleworkers also spend less time on personal care, but more time on leisure and sleeping. We also find that teleworkers spend more time engaged in food production and at-home consumption activities. The positive effects of working from home on these activities are substantial. For example, among individuals with a spouse or partner present, they amount to 25 min for food production (75 percent of sample mean) and 48 min for at-home consumption (156 percent of sample mean). To get a better sense of these estimated effects, we formally tested whether coefficients associated with working from home across time-use equations were equal. We could not reject the null

⁵ 2017–18 ATUS data. Secondary eating time data are available in the 2006–08 and 2014–16 Eating and Health Module of the ATUS.

⁶ Zeballos et al. (2019) found that secondary eating occasions accounted for 0.7 of 2.7—or about one-quarter—of the total number of eating occasions captured in the 2014–16 Eating and Health Module of the ATUS.

hypothesis that the effects of working from home on food production and at-home consumption were equal to the effect of working from home on leisure, which is an activity that is more easily performed while working from home and represents a substantial share of daily time allocation in our sample. Taken together, the results suggest that working from home may free up more time for several activities, including health-promoting activities such as food production and consumption, which may offer health benefits and help to enhance a worker's quality of life.

The rest of the paper is organized as follows. Section 2 describes the data used in our study. Section 3 presents descriptive statistics to help motivate the regression specification and analysis shown in Section 4. Finally, Section 5 provides a discussion of our results and concluding remarks.

2 Data, measures, and methods

The American Time Use Survey (ATUS), which is conducted by the U.S. Census Bureau for the Bureau of Labor Statistics (BLS), has been administered annually since 2003 and is still ongoing. One individual who is at least 15 years old from each sampled household is interviewed by a U.S. Census Bureau representative to obtain detailed information about his or her activities the day before the interview. ATUS respondents are asked to identify their primary activity (if they were engaged in more than one activity at a time) from 4 a.m. the day before the interview to 4 a.m. of the interview day, where they were when they performed the activity, and who else was present when the activity was performed. All ATUS respondents participated in the Current Population Survey (CPS).⁷ The ATUS data include a time diary, individual demographic characteristics, labor force participation, and household information.

The U.S. Department of Labor's Women's Bureau sponsored the Leave and Job Flexibilities Module (LJFM) as a supplement to the ATUS. The LJFM was initially fielded in January through December 2011 and asked about wage and salary workers' access to paid and unpaid leave and the ability to adjust their work schedules and locations instead of taking leave or because they did not have access to leave. The LJFM was redesigned and fielded once again from January 2017 through December 2018 and now includes questions about workers' usual schedules and their access to schedule and workplace flexibilities, including telework eligibility and participation. The 2011 and 2017–18 Leave Modules are not directly comparable. Also, we are particularly interested in exploring how daily time allocation in major activities varies by worksite and telework eligibility is an important control, so the analysis in this paper uses only the pooled 2017–18 data.⁸ The LJFM-ATUS data pertain to wage and salary workers, so our analysis uses weekday data since the majority of work effort is performed on weekdays (please see our sample selection

⁷ Specifically, for the ATUS, individuals are randomly selected from a subset of households that have completed their 8th and final month of interviews for the CPS (BLS 2017a).

⁸ Note that pooling two years of consecutive data generates more precise estimates for subgroups of the population of wage and salary workers and increases the power to determine whether (sometimes small) differences in variables between subgroups are statistically significant. Also, since data are pooled, the analysis of the 2017–18 data provides estimates for an average weekday over 2017–18.

criteria and Fig. 2 below). Moreover, since we are interested in comparing workers by worksite and 84.6 percent of telework-eligible workers have a management, professional, or office occupation (“white-collar” occupation), our analysis is restricted to respondents in white-collar occupations.

Our main analysis sample consists of two subgroups of prime working-age adults (age 25–54):⁹ (1) respondents who are telework-eligible and worked only from home the day before their ATUS interview (worked from home [“WFH”]) and (2) respondents who worked only in their office or somewhere else the day before their

Fig. 2 ATUS participants and the main analysis sample. LFJM: Leave and Job Flexibilities Module. Source: Authors’ calculations, using data from the Bureau of Labor Statistics’ 2017–18 LFJM-ATUS

⁹ Fifty-two participants (2.8 percent) are not classified in either of the two types because they either worked in multiple places (e.g., home and office) the day before their ATUS interview (27 individuals),

ATUS interview (worked away from home [“WAFH”]). In each section below, we discuss statistically significant differences between the two subgroups since the amount of time available to perform such activities is likely to vary depending on where people work.¹⁰ Unless otherwise indicated, all differences we discuss in the text between subgroups of Americans are significant at the 90-percent level of confidence (i.e., $p < 0.10$).¹¹ The LJFM survey sampling weights are designed to produce nationally representative estimates. We apply LJFM survey sampling weights in all analyses to account for the complex survey design and to obtain nationally representative estimates for prime working-age adults (age 25–54) with a white-collar occupation over an average weekday over 2017–18.¹²

Our sample selection criteria are as follows. Between January 2017 and December 2018, 19,816 individuals participated in the ATUS survey and 50.8 percent (10,071 individuals) also participated in the LFJM. The LFJM respondents are all wage and salary workers (i.e. they are all employed by someone else for pay). We limit the analysis to prime working-age adults (age 25–54) (68.6 percent) with a white-collar occupation (62.1 percent) who worked the day before the interview (57.0 percent). Our main analysis sample consists of 2441 individuals: 76.5 percent of them worked during a weekday and the remainder (23.5 percent) worked on a weekend. In an effort to ensure comparability across the two different types of workers, the main analysis focuses on the 1867 individuals who worked on a weekday (Fig. 2). When we turn to the regression analysis, since some respondents are missing data on some of the covariates, the sample size available for the regressions reduces to 1784 individuals.

3 Descriptive results

Building on recent time-use studies by Zeballos and Restrepo (2018) and Anekwe and Zeballos (2019), we first present national descriptive statistics on a wide variety

they worked from home when they are not telework eligible (19 individuals), or because they did not provide enough information to determine if they are allowed to telework (6 individuals).

¹⁰ It is important to note that all data used in our analysis are based on self-reports. Respondents may answer survey questions based on how they would like to be perceived rather than on how they actually behaved. Thus, as is typical in survey data, the self-reported data used here may have been influenced by social desirability concerns.

¹¹ All analyses in this paper are consistent with BLS standards. BLS analyses using ATUS are generally conducted at the 90-percent level of confidence (BLS 2017b), so we also follow this convention in our analyses. Also, BLS determined that 77 observations was the minimum number of respondents who could support an ATUS cell estimate. Thus, all statistics presented in this paper are based on at least 77 respondents and 10 or more people who reported doing the activity. We only present participation rates in cases with fewer than 10 people who reported doing the activity, and we verified that the estimated standard error is less than 5 percent. For all other statistics with 10 or more people reported doing the activity, we verified that either the estimated standard error is less than 5 min or that the estimated coefficient of variation is less than 0.3.

¹² The CPS has both a stratified and clustered sampling procedure and thus is nonrandom; the ATUS follows a similar sampling procedure. We performed the balanced repeated replication (BRR) method using the final and replicate weights and a Fay coefficient of 0.5 to generate standard errors that are more precise than a method assuming a random sample.

of worker characteristics for prime working-age adults and on the amount of time these adults allocate to major activities. These descriptive analyses are meant to motivate the need to control for observable demographic and employment characteristics by worksite in a regression analysis that follows in Section 4.

3.1 Descriptive statistics

Table 1 shows that prime working-age adults in the main analysis sample are, on average, 39 years old; 54.4 percent are female, 68.5 percent are non-Hispanic White, 12.1 percent are Hispanic, and 9.7 percent are Non-Hispanic Black. About 11.5 percent of the main analysis sample respondents reported their highest level of educational attainment to be a high school diploma or GED, 21.9 reported some college, and almost two-thirds reported a bachelor's degree or more. Almost half of the individuals have a professional or related occupation, followed by management, business, and finance occupation (31.5 percent), and office and administrative support occupation (19.1 percent). We also provide descriptive statistics by worksite in Table 1. There are many large and statistically significant differences. For example, compared with individuals who worked away from home, individuals who worked from home are less likely to be hourly workers, more likely to have beyond a bachelor's degree, and have higher hourly wage rates.

3.2 Selected activities

We investigate six major activities that we grouped into three categories: labor market work, leisure-related time use (personal care, leisure, and sleeping), and food-related time use (food production and eating and drinking at home).¹³ About two-thirds of prime working-age adults engaged in each activity. On an average weekday over 2017–18, prime working-age adults spent 82.4 percent of their day engaged in these six activities (1187 min). We now discuss unconditional differences in time spent in these major activities by worksite (Table 2).¹⁴

3.2.1 Labor market work

On an average weekday over 2017–18, prime working-age adults spent 498 min working in their main job. Individuals who worked from home the day before their ATUS interview spent 402 min working, which is 105 min less than individuals who worked away from home (507 min).

¹³ These activity groups are mutually exclusive. Please see Appendix Table 1 for activity codes.

¹⁴ For comparison, we present descriptive statistics using a pooled sample of weekends and weekdays. The descriptive statistics for our main analysis sample, which includes only weekday observations (Table 2) are similar to those from a sample that includes weekdays and weekends (Appendix Table 2).

Table 1 Demographic and employment characteristics of prime working-age adults (25–54 years old) with a white-collar occupation in 2017–18, overall and by worker type

		All	Worked from home	Worked away from home	Difference
Age	<i>years</i>	39.0 (0.202)	39.0 (0.755)	39.0 (0.221)	0.0
Gender					
Male	<i>percent</i>	45.6 (1.036)	42.2 (4.535)	45.9 (1.071)	−3.7
Female	<i>percent</i>	54.4 (1.036)	57.8 (4.535)	54.1 (1.071)	3.7
Household					
Spousal/partner present	<i>percent</i>	68.9 (1.183)	72.5 (4.168)	68.6 (1.241)	3.9
Child/children	<i>percent</i>	46.8 (1.030)	48.9 (4.521)	46.6 (1.083)	2.3
Ethnicity and race					
Hispanic	<i>percent</i>	12.1 (0.798)	10.0 (2.449)	12.2 (0.866)	−2.2
Non-Hispanic White	<i>percent</i>	68.5 (1.270)	68.7 (4.176)	68.5 (1.378)	0.2
Non-Hispanic Black	<i>percent</i>	9.7 (0.680)	10.1 (2.778)	9.7 (0.697)	0.4
Non-Hispanic Other	<i>percent</i>	9.7 (0.805)	11.2 (3.075)	9.5 (0.851)	1.7
Education level					
Lower than high school	<i>percent</i>	0.9 (0.268)	0.0 0.000	1.0 (0.292)	−1.0
High school degree or GED	<i>percent</i>	11.5 (0.936)	7.0 (2.328)	11.9 (0.998)	−4.9
Some college or associate's degree	<i>percent</i>	21.9 (1.120)	11.0 (2.624)	22.8 (1.213)	−11.8
Bachelor's degree	<i>percent</i>	37.2 (1.294)	38.0 (4.922)	37.1 (1.384)	0.9
More than bachelor's degree	<i>percent</i>	28.6 (1.105)	44.0 (4.759)	27.2 (1.149)	16.8
Work status					
Live in a metropolitan area	<i>percent</i>	91.7 (0.780)	97.5 (1.281)	91.2 (0.845)	6.3
Hourly wage	<i>dollars</i>	31.4 (0.430)	36.2 (1.339)	31.0 (0.448)	5.2
Hourly worker	<i>percent</i>	34.8 (1.235)	23.2 (3.885)	35.8 (1.232)	−12.6

Table 1 continued

		All	Worked from home	Worked away from home	Difference
Full time worker	<i>percent</i>	84.2 (0.920)	83.1 (3.501)	84.3 (0.967)	−1.2
Telework eligible	<i>percent</i>	43.4 (1.169)	100.0 0.000	38.5 (1.174)	61.5
Occupations					
Spousal/partner work hours per week	<i>percent</i>	36.1 (0.625)	40.5 (1.763)	35.6 (0.667)	4.9
Management, business, and finance	<i>percent</i>	31.5 (1.292)	35.9 (4.172)	31.1 (1.337)	4.8
Professional and related	<i>percent</i>	49.4 (1.396)	53.8 (4.531)	49.0 (1.468)	4.8
Office and administrative support	<i>percent</i>	19.1 (1.073)	10.3 (3.128)	19.9 (1.109)	− 9.6
	<i>percent</i>				
Number of observations		1784	147	1637	

Survey weights were used to compute nationally representative coefficient estimates and appropriate standard errors. Standard errors in parentheses. The difference between individuals who worked from home and individuals who worked away from home the day before their ATUS interview is bolded if it is statistically significantly different from zero (p -value < 0.10). Child/children refers to a household with at least one person age 17 and younger

Source: Authors' calculations, using data from the Bureau of Labor Statistics' 2017–18 LFJM-ATUS

3.2.2 Leisure categories

Personal care On an average weekday over 2017–18, 93.2 percent of prime working-age adults engaged in personal-care related activities and spent 48 min on average. Individuals who worked from home the day before their ATUS interview are less likely to engage in personal care-related activities and spent less time than individuals who worked away from home (28 versus 50 min).

Leisure On an average weekday over 2017–18, 85.4 percent of prime working-age adults engaged in leisure-related activities and spent almost two hours on average (116 min). Individuals who worked from home the day before their ATUS interview spent significantly more time engaged in leisure-related activities than individuals who worked away from home (164 versus 112 min).

Sleeping While everybody slept on an average weekday over 2017–18, individuals who worked from home slept 37 more minutes than individuals who worked away from home (498 versus 461 min). On average, prime working-age adults slept almost eight hours (464 min).

Table 2 Percentage of prime working-age American adults engaged and time spent in selected activities on an average weekday in 2017–18, overall and by worker type

	All	Worked from home	Worked away from home	Difference
Labor market work				
Main work				
% engage in activity	100.0 0.000	100.0 0.000	100.0 0.000	0.0
Minutes	498.4 (3.329)	401.6 (18.752)	506.9 (3.118)	−105.3
Leisure-related time use				
Personal care				
% engage in activity	93.5 (0.617)	74.4 (3.790)	95.1 (0.560)	−20.7
Minutes	48.4 (0.765)	27.6 (2.000)	50.2 (0.803)	−22.6
Leisure				
% engage in activity	85.4 (0.921)	88.8 (3.463)	85.1 (0.983)	3.7
Minutes	116.3 (2.799)	163.6 (13.200)	112.1 (2.725)	51.4
Sleeping				
% engage in activity	100.0 (0.034)	100.0 0.000	100.0 (0.037)	0.0
Minutes	463.6 (2.392)	497.7 (10.553)	460.6 (2.435)	37.1
Food-related time use				
Food preparation				
% engage in activity	64.0 (1.345)	75.1 (4.117)	63.0 (1.414)	12.1
Minutes	31.2 (1.253)	40.7 (5.433)	30.3 (1.216)	10.4
Eating at home				
% engage in activity	77.9 (1.067)	88.9 (2.798)	76.9 (1.167)	12.0
Minutes	28.6 (0.640)	49.2 (3.154)	26.8 (0.658)	22.4
Number of observations	1784	147	1637	

Survey weights were used to compute nationally representative coefficient estimates and appropriate standard errors. Standard errors in parentheses. The difference between individuals who worked from home and individuals who worked away from home the day before their ATUS interview is bolded if it is statistically significantly different from zero (p value < 0.10). Food production includes food and drink preparation, food presentation, kitchen and food clean-up, grocery shopping, and travel to the grocery store

Source: Authors' calculations, using data from the Bureau of Labor Statistics' 2017–18 LFJM-ATUS

3.2.3 Food categories

Food production Food production includes time spent on food and drink preparation, food presentation, kitchen and food clean-up, grocery shopping, and travel to the grocery store. In 2017–18, over an average weekday, prime working-age adults spent 31 min engaged in food production, and 64.0 percent spent time engaged in these activities. Prime working-age adults who worked from home the day before their ATUS interview are more likely to engage in food production and spent significantly more time than individuals who worked away from home (41 versus 30 min).

3.2.4 Eating and drinking at home

On an average weekday over 2017–18, prime working-age adults spent 29 min engaged in eating and drinking at home, and 77.9 percent engaged in the activity. Individuals are more likely to eat at home when working from home than when working away from home (88.9 percent versus 76.9 percent). Individuals who worked from home the day before their ATUS interview spent 49 min engaged in eating compared to 27 min spent eating at home by those individuals who worked away from home.

While the national descriptive statistics are interesting on their own, it is unclear whether many of the differences we see in these activities merely reflect differences in the demographic and employment characteristics shown in Table 1. We now move to a regression analysis in which we control for all of the characteristics shown in Table 1 as well as residential (state of residence and metropolitan area) and interview-related factors (day of the week, the month of the interview, and year of the interview).

4 Regression results

To estimate the conditional association between working from home and the time spent in major activities (net of other observable differences between types of workers), we follow similar work on estimating the demand for sleep (Biddle and Hamermesh 1990; Ásgeirsdóttir and Ólafsson 2015). However, since we are interested in comparing the effects of working from home the day before their ATUS interview on multiple uses of time, we specified regression equations of the following form in a seemingly unrelated regression (SUR) framework,¹⁵

$$T_i = \alpha_1 + \alpha_2 WFH_i + \beta X'_i + \gamma UR_i + \delta STATE_i + \phi INTERVIEW'_i + \varepsilon_i, \quad (1)$$

¹⁵ Note that, because of missing information on some Table 1 covariates for some respondents, the sample size reduces from 1867 to 1784.

where T is the (*inverse hyperbolic sine transformed*) time spent by individual i in a given activity {main work, personal care, leisure, sleeping, food production, or eating and drinking at home};¹⁶ WFH is a dummy equal to 1 if individual i worked from home the day before the ATUS interview; X is a vector of individual-level characteristics—age, age squared, gender, presence of household children dummy, education level, race/ethnicity, hourly worker dummy, full-time worker dummy, the logarithm of hourly wage, occupation dummies, telework eligibility dummy, and dummy for metropolitan area residence; UR is the time-varying state-level unemployment rate where individual i resides (to capture the effect of macroeconomic changes on health behavior) (Ruhm 2005); $STATE$ is a dummy of the state-of-residence of individual i (to absorb all time-invariant state characteristics, including permanent differences in state-level food environments and prices); $INTERVIEW$ is a vector of interview-related factors for individual i (dummies for year of interview, month of interview, and day of the week) that may affect time use; and ε_i is an idiosyncratic error term. The coefficient α_2 is our coefficient of interest in Eq. (1), which represents the estimated associations between time use and working from home. Notice that these coefficients are estimated relative to individuals who worked away from home the day before their ATUS interview since they are the omitted category of workers. To allow for arbitrary correlation among individuals from the same state, we cluster our standard errors at the state level.

Individuals with a partner or spouse present in their household face different time constraints than do individuals without a partner or spouse present. For instance, in the former types of households, partner/spousal labor supply influences own time allocations, while in the latter this is clearly irrelevant. As a consequence, we estimate Eq. (1) for individuals for whom a spouse or partner is present and control for the hours worked by the spouse or partner, and we then separately estimate Eq. (1) for individuals for whom a spouse or partner is not present.

Table 3 shows that working from home has economically important and statistically significant effects on most of the main activities considered for both individuals with and without a spouse or partner present in the household. Column 1 of Table 3 shows that individuals who worked from home spent significantly less time working, and this effect is magnified for individuals with a spouse or partner present in the household. We estimate that individuals with a spouse or partner present in the household who worked from home spent 218 fewer minutes than did individuals who worked away from home. Individuals without a spouse or partner present in the household who worked from home spent 123 fewer minutes than did individuals who worked away from home. These represent differences of 43.6 and 24.8 percent, respectively, relative to sample means.

Given a 24-h time constraint, workers who spend less time working on a given day have more time available for other activities, especially for activities that do not allow for multitasking. For individuals who have a partner or spouse present, individuals who worked from home spent significantly less time on personal care

¹⁶ We transform the right-skewed activity variables in order to better approximate normal distributions. Specifically, we use the Stata command *asinh* (i.e. inverse hyperbolic sine transformation) since we have observations with zero time use (i.e., respondents who did not engage in a given activity). Thus, the average percentage difference in time allocated to a given activity for a person who worked from home (relative to a person who worked away from home) is given by the formula $\exp(\alpha_2) - 1$.

Table 3 Coefficients and standard errors from seemingly unrelated regressions of time spent in major activities on worked from home dummy and other worker characteristics

Dep Var [<i>IHST</i> (Time spent in minutes)]	(1)	(2)	(3)	(4)	(5)	(6)
Spouse or partner present						
Worked from home	-0.574*** (0.126)	-1.182*** (0.317)	0.635*** (0.235)	0.083*** (0.026)	0.556** (0.258)	0.940*** (0.159)
Calculated effect in minutes	-217.8	-33.3	93.7	39.8	24.8	47.7
Average minutes spent in the activity	499.0	48.1	105.5	459.8	33.4	30.6
Number of observations	1200					
Spouse or partner NOT present						
Worked from home	-0.285*** (0.095)	-1.005*** (0.356)	0.685* (0.360)	0.113* (0.061)	0.694 (0.518)	0.853*** (0.325)
Calculated effect in minutes	-123.2	-31.2	137.7	56.6	26.4	32.7
Average minutes spent in the activity	497.3	49.1	140.1	472.0	26.3	24.3
Number of observations	584					
All covariates included	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Note: *IHST* Inverse hyperbolic sine transformation. Estimates from seemingly unrelated regressions. Robust standard errors adjusted for clustering at the state level and for the survey design appear in parentheses below coefficient estimates. Individuals who worked away from home the day before their ATUS interview is the omitted category. Food production includes food and drink preparation, food presentation, kitchen and food clean-up, grocery shopping, and travel to the grocery store. All dependent variables are mutually exclusive. Covariates include age, age squared, gender, presence of household children dummy, education level, race/ethnicity, hourly worker dummy, full-time worker dummy, logarithm of hourly wage, number of hours worked by the spouse or partner, occupation dummies, the state-level unemployment rate, metropolitan area, day-of-week dummies, month dummies, year dummies, and state dummies. *, **, and *** denote statistical significance at the 10, 5, and 1% level, respectively

Source: Authors' calculations, using data from the Bureau of Labor Statistics' 2017–18 LFJM-ATUS

(33 min), which is perhaps partially attributable to the fact that they do not have to spend as much time to get ready before being able to start their workdays. By contrast, individuals who worked from home spent significantly more time engaged in leisure (94 min) and sleeping (40 min), which are activities that are not easy to perform inside office settings. These patterns conform to expectations and the estimated effect sizes are large relative to sample means. For individuals who do not have a partner or spouse present, the patterns are qualitatively similar, although with the exception of main work the coefficients are less precisely estimated.

We now move to food production and eating and drinking at home. Columns 5 and 6 of Table 3 shows that individuals with a spouse or partner present who worked from home spent significantly more time devoted to food production and eating and drinking at home (25 and 48 min, respectively).¹⁷ These represent differences of 74.5 and 156.0 percent, respectively, relative to sample means. Individuals without a spouse or partner present who worked from home spent significantly more time devoted to eating and drinking at home (33 min) than those who worked away from home. Although the estimated gap for food production is economically important (26 min), it is not statistically significant at conventional levels.

To get a sense of the magnitude of the gaps in time allocated to food activities, consider how the effect of working from home on these activities compares to its effect on leisure, which is more easily performed while working from home and accounts for a substantial share of daily time allocation for workers in our sample. For example, among individuals with a spouse or partner present, who spend about 106 min engaged in leisure daily, we fail to reject that the estimated effects of working from home on food production and eating at home are equal to the estimated effect of working from home on leisure time with a p-value of 0.80 and 0.26, respectively. Among individuals without a spouse or partner present, who spend an average of 140 min per day on leisure, the corresponding tests of equality of coefficients produce p-values of 0.98 and 0.63, again indicating that effects of working from home on food production and eating at home are statistically indistinguishable from the impact of working from home on leisure. Combined with evidence that the

¹⁷ To save space, we suppress coefficient estimates of other variables in the SUR analysis, but some coefficients in the regressions are also worthy of discussion. The estimated effect of hourly (log) wage proxies for the opportunity cost of engaging in non-work activities. Since there are substitution and wealth effects, the sign of the hourly wage effect is a priori unclear and must be empirically determined. On the one hand, the (shadow) price of food activities, for example, is increasing in the hourly wage rate, so one may expect that high-wage individuals spend less time engaged in food production and consumption than do lower wage individuals. On the other hand, high-productivity individuals may be better able to as well as prefer to spend more time on food activities. The estimated effect of the (log) wage on time spent in food production is negative and statistically significant for individuals without a spouse or partner present in the household. In the case of eating and drinking at home, the effect of the (log) wage, while negative, is not statistically significant for either those with or without a partner/spouse present. Du and Yagihashi (2017) found that time spent on health-enhancing activities tend to rise with an individual's wage rate. However, as the authors note, some activities (e.g. eating and drinking time) do not have a clear health impact because time-use data do not allow researchers to determine the healthfulness of the food produced and consumed. Relative to part-time workers, full-time workers with a spouse or partner present spent less time engaged in eating and drinking at home. Compared with women, men spent less time in food production, but this is only statistically significant for individuals with a spouse or partner present in the household. And finally, for individuals with a spouse or partner present, we estimate that a rise in spousal hours increases time spent on food production and decreases the time spent eating and drinking at home. Full results are available upon request.

difference in food production and consumption—relative to sample means—is also economically important, this is further evidence that the place where work is performed has important implications for how much time is allocated to food-related activities over the course of a day.

Clearly, working from home leaves more time for both the production of food and the consumption of food at home. However, we cannot ascertain the health implications of these differences since we cannot determine whether the food consumed at home was prepared at home or purchased and brought home from a foodservice establishment. However, to the extent that food eaten at home is mostly prepared at home, our results may be taken to suggest that individuals who work from home spend more time eating more healthful foods than do individuals who work away from home. It is also important to note that uses of time other than eating may also have effects on health, and there are clear differences in time spent on other activities in Table 3. However, an investigation of the overall effect of time use on health is beyond the scope of this study.

In a robustness check, we investigate whether a change in the control group matters for the analysis. In the main analysis, we compare time use of individuals who worked from home to time use of individuals who worked away from home (including both telework-eligible and telework-ineligible workers). One may be concerned that, while telework-eligible workers can compensate for reduced work time during a telework day by working more hours when they return to their offices later in the week, this is not a possibility for telework-ineligible workers. We re-ran our main regressions—in which we previously included a dummy for telework eligibility as a control (summarized in Table 3)—but now drop telework-ineligible workers. In Appendix Table 3, we show that, while sample size and precision of estimates are reduced, the patterns in Table 3 and Appendix Table 3 are in large part qualitatively similar. Thus, no matter how we address the issue of differences in telework eligibility across workers, the variation in daily time allocations by worksite is similar across workers who work from and away from home.

5 Discussion and implications for future research

Drawing on data from the 2017–18 LJFM-ATUS, this paper demonstrates that, even after controlling for a wide variety of demographic and employment characteristics, there is sizeable and significant variation in the amount of time prime working-age adults spend on food-related time use by worksite. Our findings complement studies showing that labor supply is an important determinant of FAH production and consumption activity (Nayga 1996; Dunn 2015; Kohara and Kamiya 2016; Etilé and Plessz 2018) by showing that the location where work is performed also matters. A possible interpretation of this study's results is that, among workers in their prime working years, working from home may allow for more time to purchase food from grocery stores, cook meals at home, eat, and then clean up afterward. Given that foods prepared at home tend to be healthier than foods prepared away from home (Todd et al. 2010; Monsivais et al. 2014; Wolfson and Bleich 2015; Saksena et al. 2018; Wolfson et al. 2020), working from home may enable health-promoting dietary behaviors.

It is important to note, however, that since we use all rather than only plausibly exogenous variation in the data, which could be achieved via random assignment of

workers (Bloom et al. 2015), we cannot ascertain whether there is a causal relationship running from remote work to food-related activities. Research on this nexus is warranted since telecommuting behavior has grown in popularity over the last decade (FlexJobs 2017; SHRM 2019), the latest available data from the BLS indicate that one-quarter of wage and salary workers worked from home at least occasionally over 2017–18 (BLS 2019), and FAH tends to be healthier than FAFH (Todd et al. 2010; Monsivais et al. 2014; Wolfson and Bleich 2015; Saksena et al. 2018; Wolfson et al. 2020). It would be of particular interest to policymakers and the broader community to learn from future research whether greater telework participation has the potential to improve the healthfulness of daily dietary intake and better align American workers' daily intake with those outlined in the *Dietary Guidelines for Americans*.

The primary focus of this study was on food-related activities since food production and consumption represent frequent and ubiquitous human activities (Davis 2014) and recent research suggests that greater work-related stress may be contributing to less healthy eating practices (Escoto et al. 2012; Jabs and Devine 2006; Welch et al. 2009). However, we investigated other major uses of time and found that working from home affects daily time allocation more broadly, which may have productivity and quality of life implications. Our analysis indicates that individuals who worked from home spent more time per day engaged in leisure and sleeping, but less time per day on personal care and working. Clearly, there are different health benefits associated with each of these time-use differences. The overall effect of working from home on a worker's health is unclear without a full accounting of how each daily activity maps onto health outcomes. The substantially smaller amount of time devoted to work among individuals who work from home generates a particularly interesting question: is this driven by greater productivity while working from home or is the lower amount of time spent working from home compensated by teleworkers when they are in the office later in the week? If time allocations change across the week according to a worker's schedule, time allocation differences in a one-day time diary between workers who work from and away from home may be larger or smaller than the differences observed over a one-week period. Such investigations are beyond the scope of this study, but certainly worthy as future research endeavors.

We conclude with an insight from our analysis that is relevant to today's widespread and extraordinary circumstances. In response to the arrival of COVID-19, many employers across the U.S. have encouraged their employees to work from home to protect the health of their workers and to prevent the spread of COVID-19. Our analysis of pre-pandemic data from 2017–18 clearly demonstrates that daily time allocation varies by worksite. As the nation grapples with the pandemic, it will be important for researchers to continue investigating Americans' responses to COVID-19, including how time-use patterns are changing as well as the health and non-health implications of those changes.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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6 Appendix

Table 4

Table 4 Activity codes used in the analysis

Main work
050101: work, main job
Personal care
010201: Washing, dressing, and grooming oneself
010299: Grooming, n.e.c.
010301: Health-related self-care
010399: Self-care, n.e.c.
019999: Personal care, n.e.c.
Leisure
120301: Relaxing, thinking
120302: Tobacco and drug use
120305: Listening to the radio
120306: Listening to/playing music (not radio)
120307: Playing games
120308: Computer use for leisure (exc. Games)
120309: Arts and crafts as a hobby
120310: Collecting as a hobby
120311: Hobbies, except arts and crafts and collecting
120312: Reading for personal interest
120313: Writing for personal interest
120399: Relaxing and leisure, n.e.c.
120303: Television and movies (not religious)
120304: Television (religious)
Sleeping
010101: Sleeping
010102: Sleeplessness
010199: Sleeping, n.e.c.
Food preparation
020201: Food and drink preparation
020299: Food and drink preparation, presentation, and clean-up, n.e.c.
020202: Food presentation
020203: Kitchen and food clean-up
070101: Grocery shopping
180701: Travel related to grocery shopping
Eating at home
110101: Eating and drinking
110199: Eating and drinking, n.e.c.
050202: Eating and drinking as part of job

Source: Bureau of Labor Statistics' American Time Use Activity Lexicon

Table 5

Table 5 Percentage of prime working-age American adults engaged and time spent in major activities on an average day in 2017–18, overall and by worker type

	All	Worked from home	Worked away from home	Difference
Labor market work				
Main work				
% engage in activity	100.0 0.000	100.0 0.000	100.0 0.000	0.0
Minutes	478.8 (3.426)	307.1 (15.141)	500.4 (3.207)	−193.3
Leisure-related time use				
Personal care				
% engage in activity	92.3 (0.589)	74.9 (2.633)	94.5 (0.540)	−19.6
Minutes	47.6 (0.730)	30.2 (1.584)	49.8 (0.785)	−19.6
Leisure				
% engage in activity	85.3 (0.840)	89.2 (2.381)	84.8 (0.921)	4.4
Minutes	120.0 (2.627)	168.9 (9.121)	113.8 (2.681)	55.1
Sleeping				
% engage in activity	100.0 (0.031)	100.0 0.000	100.0 (0.035)	0.0
Minutes	468.7 (2.249)	509.6 (7.367)	463.6 (2.368)	46.0
Food-related time use				
Food preparation				
% engage in activity	64.2 (1.249)	76.1 (3.142)	62.7 (1.330)	13.4
Minutes	32.6 (1.192)	50.1 (4.109)	30.4 (1.143)	19.7
Eating at home				
% engage in activity	77.6 (1.014)	88.9 (2.068)	76.2 (1.128)	12.7
Minutes	29.5 (0.612)	52.4 (2.511)	26.7 (0.623)	25.8
Number of observations	2253	355	1898	

Survey weights were used to compute nationally representative coefficient estimates and appropriate standard errors. Standard errors in parentheses. The difference between individuals who worked from home and individuals who worked away from home the day before their ATUS interview is bolded if it is statistically significantly different from zero (p -value < 0.10). Food production includes food and drink preparation, food presentation, kitchen and food clean-up, grocery shopping, and travel to the grocery store

Source: Authors' calculations, using data from the Bureau of Labor Statistics' 2017–18 LFJM-ATUS

Table 6

Table 6 Coefficients and standard errors from seemingly unrelated regressions of time spent in major activities on worked from home dummy and other worker characteristics, only telework-eligible workers

Dep Var [<i>IHST</i> (Time spent in minutes)]	(1)	(2)	(3)	(4)	(5)	(6)
	Main work	Personal care	Leisure	Sleeping	Food production	Eating and drinking at home
Spousal or partner present						
Worked from home	-0.580*** (0.129)	-1.181*** (0.297)	0.636*** (0.208)	0.082*** (0.026)	0.588** (0.264)	1.073*** (0.164)
Calculated effect in minutes	-217.0	-30.0	92.8	40.1	23.8	61.1
Average minutes spent in the activity	492.4	43.2	104.5	467.8	29.7	31.8
Number of observations	613					
Spousal or partner NOT present						
Worked from home	-0.206** (0.105)	-1.053*** (0.278)	0.438 (0.353)	0.039 (0.051)	-0.068 (0.372)	0.830** (0.374)
Calculated effect in minutes	-92.4	-27.9	77.9	18.5	-1.7	35.7
Average minutes spent in the activity	496.0	42.8	141.8	460.2	26.3	27.6
Number of observations	218					
All covariates included	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Note: *IHST* Inverse hyperbolic sine transformation. Estimates from seemingly unrelated regressions. Robust standard errors adjusted for clustering at the state level and for the survey design appear in parentheses below coefficient estimates. Individuals who worked away from home the day before their ATUS interview is the omitted category. Food production includes food and drink preparation, food presentation, kitchen and food clean-up, grocery shopping, and travel to the grocery store. All dependent variables are mutually exclusive. Covariates include age, age squared, gender, presence of household children dummy, education level, race/ethnicity, hourly worker dummy, full-time worker dummy, logarithm of hourly wage, number of hours worked by the spouse or partner, occupation dummies, the state-level unemployment rate, metropolitan area, day-of-week dummies, month dummies, year dummies, and state dummies. *, **, and *** denote statistical significance at the 10, 5, and 1% level, respectively

Source: Authors' calculations, using data from the Bureau of Labor Statistics' 2017–18 LFIM-ATUS

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