Time Use and City Size*

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Abstract

We study how time use varies with city size. Residents of big cities spend more time traveling and less time on leisure and socializing, and there is substantial heterogeneity by gender, marital status, presence of children, income, and education. These differences are driven by city size rather than sorting on observables. We find that time allocation in big cities is associated with lower well-being and that accounting for time use differences lowers the city-size wage premium by one-quarter. We also find that time use variation by city size has fallen since 2020, partly due to remote work.

Key Words: time use, cities, urban, inequality, well-being.
JEL Codes: D13, J22, R20, R41.

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1 Introduction

Large cities offer many benefits, but at the same time have various disadvantages. Even though benefits and costs associated with city size have long been a primary topic of research in urban economics and related fields, little is known about how large city dwellers spend their time compared to those who live in smaller cities, and how these differences contribute to the benefits and costs of city size.

This paper offers the first systematic descriptive study of time use differences by city size. We use the American Time Use Survey (ATUS) and, after controlling for individual characteristics, find that for an average person a tenfold increase in the population of a metropolitan area is associated with a 12.9 minutes more time spent on travel to work and non-work destinations and 7.4 minutes less time spent on leisure and socializing per day. Residents of larger cities also spend more time on eating and less time on home chores. While the extra amount of time spent on traveling does not differ much across socioeconomic types, there are sizable differences in how individuals substitute for the time lost to traveling. In big cities, men spend less time on home chores, while women socialize less and have less leisure than in smaller cities. Unmarried individual sleep less, while individuals with children, and especially women, spend more time on childcare in big cities than their counterparts in smaller cities. High-income individuals work less in big cities, whereas the low-income have less leisure and sleep less.

Since some activities may bring more satisfaction than others, these results suggest that large cities may offer different levels of well-being. To learn more, we turn to the Well-being Module of the ATUS that asks respondents whether they feel happy, meaningful, painful, sad, stressful, and tired during each of the time-use activities. For example, commuting is associated with less happiness and greater stress, while leisure and socializing are among the least stressful activities. We find that, for an average individual, big cities offer time allocation that is associated with lower well-being, as residents of big cities spend more time on activities that are associated with feeling less happy and more stressed.

The time-use differences between large and small cities allow us to put in perspective the well-established relationship between city size and income. Using existing estimates of the value of time, we find that accounting for the fact that people spend more time on travel and less time on leisure and socializing in big cities, reduces the city-size wage premium by as much as 26%.

Finally, we examine how the relationship between time use and city size has changed since the onset of the Covid-19 pandemic. Before 2020, an important distinguishing feature of big cities was longer commute time. However, as many individuals started working

from home, and especially so in big cities, the relationship between commute time and city size has weakened. Similarly, differences in most other time use categories between large and small cities have become negligible. At the same time, low-income individuals and those without a college degree still commute substantially more in big cities even after 2020, arguably because they often hold jobs that do not allow remote work.

Related Literature. While there is a sizable literature on time use in the United States (Aguiar, Hurst, and Karabarbounis, 2012), to the best of our knowledge, ours is the first systematic study of how time use depends on city size. Our work is most related to the following four studies. Murphy (2018) shows that residents of large metro areas spend less time on home production activities, such as food preparation and house work (a finding that we confirm in our study), but does not look at how time spent on other activities differs by city size. Morris (2019) examines time use differences between central cities and suburbs (i.e., the largest municipality versus other municipalities in the metropolitan area) and finds no significant differences between the two types of locations, however does not look at differences by city size.[1] Su (2022) uses the ATUS to study differences in access to amenities due to socioeconomic segregation within cities. Albouy and Faberman (2024) examine location choices of different types of households over the life cycle. One pattern that emerges from their analysis of the ATUS data is that time spent on leisure activities in cities with high estimated quality of life, which tend to be large cities, varies with education, age, and especially with the presence of children.

Our paper also contributes to the vast literature on the costs and benefits of large cities. This literature is surveyed by Ahlfeldt and Pietrostefani (2019) and Duranton and Puga (2020), and typically finds net benefits associated with city size. Our finding that accounting for time use differences substantially lowers the real city-size wage premium resonates with that of Diamond and Moretti (2021) who estimate that consumption does not increases with city size only for the majority of U.S. households. While most papers in this literature evaluate the costs and benefits using price differences across cities, we focus on the differences in time use.

The remainder of the paper is organized as follows. In Section 2, we describe the data. In Section 3, we estimate the relationship between city size and time use, examine the implied differences in well-being, look at the implications for the city-size wage premium, and investigate how time use patterns changed after 2020. We present our conclusions in Section 4.

[1] We have revisited this analysis using our ATUS sample and found the same result.

2 Data

We use the data from the 2005–2019 annual samples of the American Time Use Survey (ATUS). The ATUS is the first ongoing federally-administered survey on time use in the United States. Each respondent provides detailed information on their activities during a designated 24-hour period. We aggregate reported activities into 12 time use categories: (1) working, (2) childcare, (3) home chores, (4) shopping, (5) leisure, (6) socializing, (7) sleeping, (8) eating, (9) personal care, (10) other activities, (11) work-related travel, and (12) other travel.[2] Appendix Section A.1.1 provides more details about activities within each of these categories.

We aggregate the duration of each activity into minutes per day at the person level. In the survey, about half of respondents answered on weekdays and another half on weekends. In our calculation of the average time use per day, we use multi-year weights that are provided by the ATUS to reduce the bias in estimates from sampling across subgroups and days of the week. After this, we separately look at time use patterns during workdays and non-workdays. We define workday as a day when a respondent spent at least one minute on work-related activities, regardless of the actual day of the week. Other days are non-workdays.

Table 1 reports the weighted average minutes per day spent on each time use category in the full sample, the workday sample, and the non-workday sample. Sleeping, working, leisure, and home chores are the most time-consuming activities. On a workday, an average individual sleeps 7.8 hours, works 7.8 hours, spends 2.6 hours on leisure, and 59 minutes on home chores. We separate travel for work and travel for other purposes. Jointly they account for 84 minutes a day on a workday, or 5.8% of time. Looking at the workday and non-workday sample separately, the main difference is that individuals do not spend time on working and commuting in the non-workday sample and this time gets distributed among other activities. Because a key difference between small and large cities is how much time is spent on commuting to work, most of the analysis that follows will focus on the workday sample.

The final sample has 66,891 observations across 306 metropolitan areas that are defined as Core-Based Statistical Areas (CBSA).[3] We link the ATUS to the Current Population Survey (CPS) in order to obtain information about the socioeconomic and geographic

[2]Note that "working" includes actual work, other work-related and income-generating activities except commuting, as well as job search. "Home chores" includes care for other adults, in the household or not, in addition to household management. "Shopping" includes both shopping for goods and services and their consumption (excluding food consumption).

[3]We use the terms "metropolitan area," "CBSA," and "city" interchangeably. We use the 2013 definition of Core-Based Statistical Area (CBSA) by the Office of Management and Budget.

Table 1: Time use in the sample (minutes a day)

	Total		Workday		Non-workday	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Sleeping	499	124	468	105	571	134
Working	328	260	468	175	0	0
Leisure	195	159	155	118	288	200
Home chores	88	119	59	80	158	159
Eating	66	49	62	44	74	58
Other travel	54	73	42	54	83	100
Socializing	48	93	33	67	83	128
Personal care	44	36	47	34	36	39
Childcare	31	73	26	59	43	98
Shopping	25	51	16	35	46	71
Work-related travel	29	41	42	43	0	14
Other activities	33	86	23	62	57	123
N	66,891		39,335		27,556	

Note: The table reports average time spent on each of the 12 time use categories in minutes per day for the entire sample, workday sample, and non-workday sample. See the text for more details.

characteristics of respondents. Our sample only includes employed individuals of prime working age (25 to 64 years old). The CPS provides the geographic location of respondents at the CBSA level. In some cases it only provides the state and the county of residence, and we use this information to infer the CBSA. We exclude observations for which the CBSA of residence cannot be identified.

To measure CBSA population in each year, we aggregate the total population estimates of each county in the CBSA, as reported by the Census Bureau. Since sample sizes for each medium and small CBSA are too small to be representative, we cannot look at time use patterns separately for each individual CBSA.[4] However, we can still examine the relationship between time use and city size by using the CBSA population as an explanatory variable.

3 Results

In order to study the relationship between city size and time use, we estimate

$$T^u_{imy} = \alpha^u + \beta^u \ln N_{my} + \gamma^u X_i + \varphi_y + \varepsilon^u_{imy}, \tag{3.1}$$

where T^u_{imy} is time spent on time use category u, in minutes a day, by individual i in metropolitan area m and year y; N_{my} is the metropolitan area population in year y; and

[4]Among 306 metropolitan areas, 179 have less than 100 observations between 2005 and 2019.

X_i is a vector of individual characteristics which includes age, gender, race, education, marital status, number of children in the household, number of adults in the household, industry of work, and occupation of work. Since we estimate the relationship using the data for years 2005 to 2019, we also include year-fixed effects φ_y.

Our main coefficient of interest is β^u, the semi-elasticity of time spent on a certain activity with respect to city size. For greater interpretability, instead of reporting the values of β^u, we report the values of $2.3\beta^u$. These values represent the relationship between a tenfold increase in city size and minutes per day spent on an activity.[5] The tenfold difference in city size is equivalent to the difference between the largest CBSA in the U.S. (New York with 18.9 million residents in 2010) and a medium-sized CBSA (Columbus or Indianapolis, each with about 1.9 million), or the difference between a large CBSA such as Philadelphia (6 million) and small CBSA such as Madison, WI (0.6 million).

3.1 Time use and city size

First, we estimate regression (3.1) without individual controls X_i using the workday sample. The results are shown in panel A of Figure 1, where each row reports the estimated value of $2.3\beta^u$ for activity u. The standard errors are clustered at the CBSA level and used to calculate 95% confidence intervals.

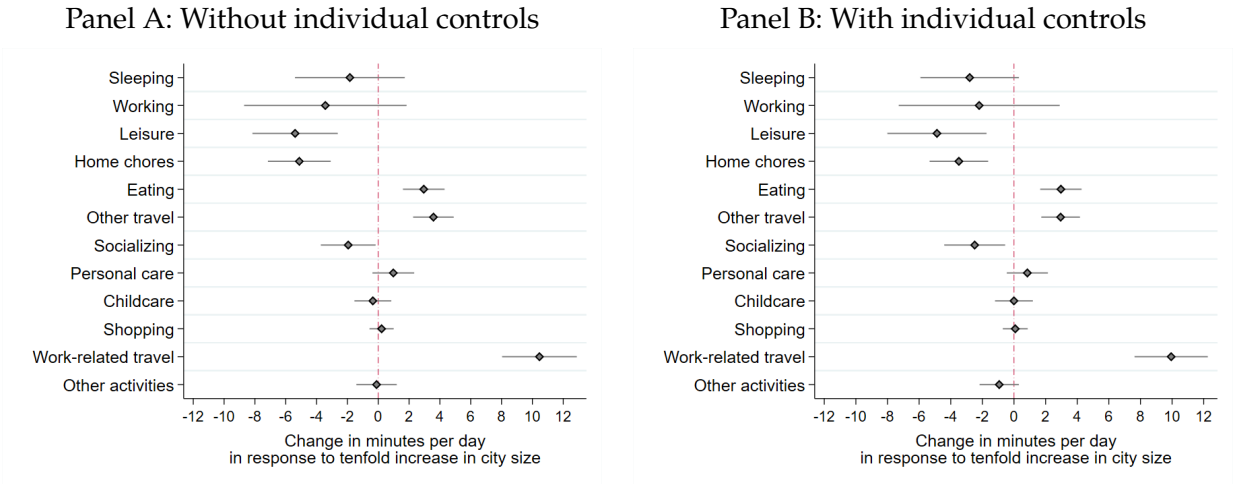
The time use differences by city size reported in panel A can arise because the size of a city determines time use patterns of individuals living there (the city-size effect), or because individuals who live in larger cities differ in observable characteristics that affect time use (sorting). To distinguish the city-size effect from sorting on observables, we now run regression (3.1) with individual controls X_i. The results are displayed in panel B of Figure 1. The coefficients on most activities do not change much when we add controls, which suggests that the observed differences in time use by city size are largely the result of the city-size effect, and not sorting.

Residents of larger cities spend more time traveling and eating, and this time is carved from leisure, socializing, and home chores. There is no statistically significant relationship (using the 95% confidence interval) between city size and the time spent on sleeping, personal care, childcare, shopping, and other activities.

A tenfold increase in city size is associated with 10 more minutes a day spent on commuting to work and 2.9 more minutes spent on other travel. These numbers are economically significant and imply that a resident of a city with about 10 million inhab-

[5] If time spent on activity u in city of size N is $T^u = \beta^u \ln N$ and time spent on this activity in a ten times larger city is $\tilde{T}^u = \beta^u \ln(10N)$, then $\tilde{T}^u - T^u = \beta^u \ln(10)$, and $\ln(10) \approx 2.3$.

Figure 1: City size and time use



Note: The figure reports coefficients β^u from regression (3.1) multiplied by 2.3. Panel A reports the coefficients from a regression where individual controls X_i are not included. Panel B reports the coefficients from a regression where the individual controls are included. Horizontal bars represent 95% confidence intervals. Standard errors are clustered at the CBSA level. See the text for more details.

itants (e.g., Chicago) will spend 12.9 minutes more per day, or over one hour more per week, on traveling than a resident of a city with 1 million inhabitants (e.g., Tulsa). The positive relationship between the length of the work commute and city size has been previously documented (Angel and Blei, 2016), but it is less obvious that non-work trips take more time in large cities. On the one hand, the average distance between residence and non-work destinations in big cities is larger. But, on the other hand, big cities have larger population density (Duranton and Puga, 2020) and are likely to have greater density of non-work destinations too, although traveling in large cities is slower (Duranton and Turner, 2018).

Longer travel times in big cities eat into leisure and socializing in big cities. We find that a tenfold increase in city size is associated with 4.9 minutes per day less time spent on leisure and 2.5 minutes less time spent on socializing. This finding resonates with Putnam (2000)'s argument that longer commutes reduce community participation.[6] At the same time, residents of ten-times larger cities spend 3.5 minutes a day less on home chores, which may reflect the fact that homes in large cities tend to be smaller and, therefore, require less maintenance. Those who live in ten-times larger cities also allocated 3 more minutes a day to eating.[7]

[6]More recent work by Atalay (2024) documents that time spent alone has increased since 2003, and our results suggest that the increase has been more pronounced in big cities.

[7]It is not entirely clear why time spent on eating goes up with city size. Bencsik, Lusher, and Taylor (2023) use smartphone foot traffic data and find a positive relationship between traffic congestion, which is

Despite the popular perception that people in big cities work longer hours, we find a slightly negative but not statistically significant relationship between city size and working time. How robust is this finding? While the ATUS is arguably the most precise source of time use data, it has a relatively small sample. Thus, we turn to the 2012–2016 five-year sample of the American Community Survey (ACS) which is a 5% sample of population and has millions of observations. We then estimate the relationship between log hours worked for full-time employed individuals aged 25 to 64 and log population of a metropolitan area.[8] In Appendix Table A.1, we demonstrate that there is no statistically significant relationship between metro area size and working hours, whether we include individual controls or not.

3.2 Differences across types of individuals

Do any of the city-size time use differences reported above vary across types of individuals? In what follows, we look at differences by gender, marital status, presence of children, education, and income. We estimate (3.1) separately for each category and continue controlling for individual characteristics (age, gender, race, education, marital status, number of children, number of adults, industry, and occupation).

Gender. Panel A of Figure 2 shows that there are no significant differences in the amount of time that both men and women spend on sleeping, working, personal care, and childcare between large and small cities. At the same time, we can see that the lower time expenditure on home chores in big cities that we found before is entirely driven by men. While men spend 6.6 minutes a day less on home chores in ten-times larger cities, women do not experience any time savings. Moreover, while women socialize 4 minutes a day less, the effect for men is zero. Finally, women in big cities have less leisure than women in smaller cities.

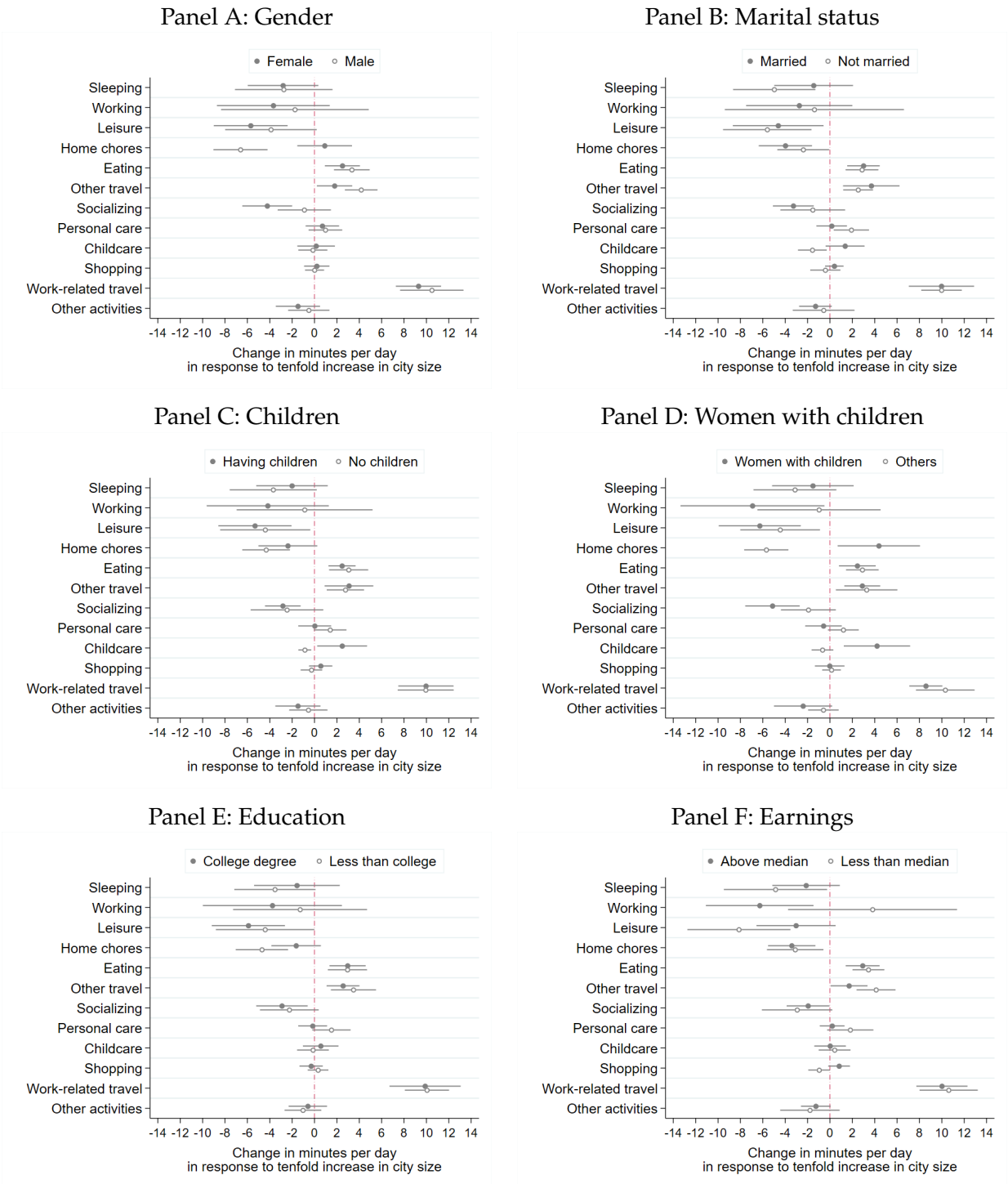
Marital status. Differences by marital status are shown in panel B. Unmarried individuals sleep less and spend more time on personal care in big cities, while the married spend less time socializing. These patterns are consistent with empirical findings by Gautier, Svarer, and Teulings (2010) that suggest that one of the reasons why the singles locate in big cities is to find a marriage partner.

Presence of children. Differences between those with and without children are shown in panel C of Figure 2. There are no significant differences for most activities, except child-

more common in big cities, and propensity to eat out, which may take more time than eating at home.

[8]While the ACS has a much larger sample than the ATUS, its measurement of working hours is less precise. In the ACS, respondents are asked about *usual* hours they work per week and many of them report their hours approximately. For example, about 45% respondents report working *exactly* 40 hours.

Figure 2: City size and time use, heterogeneity



Note: The figure reports coefficients β^u from regression (3.1) multiplied by 2.3, by gender (panel A), by marital status (panel B), by presence of children (panel C), separately for women with children and others (panel D), by education (panel E), and by earnings (panel F). Horizontal bars represent 95% confidence intervals. Standard errors are clustered at the CBSA level. See the text for more details.

care: individuals with children spend 2.5 minutes a day more on childcare than those with children in ten-times smaller cities. However, as panel D shows, the city-size differences are more pronounced for women with children. Employed women with children in ten-times larger cities work a full 6.9 minutes less per day than their counterparts in smaller cities.[9] They also spend 6.3 minutes less on leisure and 8.6 minutes more on home chores and childcare combined. These results suggest that women with children face a non-trivial tradeoff when choosing to live in large cities: they sacrifice work and leisure time in order to spend more time on home chores, childcare, as well as commuting.

Education and income. Differences by education are reported in panel E of Figure 2. The relationship between city size and time use is quite similar for individuals with and without a college degree. Since education is correlated with income, many of these similarities remain when we split our sample into those with above and below the median CBSA hourly earnings. However, as panel F suggests, income differences result in a non-trivial leisure-working tradeoff. While high-income individuals work less in big cities than their counterparts in small cities, the low-income have less leisure and sleep less.

3.3 Time use and well-being

The results discussed above highlight many differences in time use between large and small cities. Given that activities differ in how much satisfaction they bring, an interesting question is whether the time-use differences reported above result in a more or less enjoyable time allocation in big cities. And, if so, are different types of individuals affected in the same way or not?

To answer these questions, we turn to the Well-being Module of the ATUS that was administered in 2010, 2012, and 2013. All ATUS respondents were selected for the Module. Three activities from the diary of each respondent were randomly selected, and respondents were asked to report how they felt during each activity in terms of happiness, meaning, pain, sadness, stressfulness, and tiredness, on a scale from 0 to 6. Sleeping and most activities that belong to the personal care category were excluded. We calculate average responses on each of these aspects for each of our time use categories, except sleeping and personal care, and report them in Table 2. For example, childcare and socializing are the activities that bring the most happiness, while working and traveling for work are among the most stressful ones.

[9] While this result is conditional on being employed, it aligns with Moreno-Maldonado (2022)'s finding that women with children in big cities have lower labor force participation.

Table 2: Well-being by type of time use

	happy	meaningful	painful	sad	stressful	tired
Working	3.90	4.39	0.83	0.72	2.52	2.40
Leisure	4.41	4.02	0.73	0.54	0.88	2.71
Home chores	4.16	4.29	0.87	0.54	1.31	2.32
Eating	4.71	4.65	0.65	0.44	1.09	2.13
Other travel	4.44	4.11	0.64	0.57	1.40	2.38
Socializing	4.90	4.87	0.58	0.42	0.91	2.16
Childcare	4.99	5.41	0.53	0.31	1.24	2.67
Shopping	4.38	4.15	0.65	0.46	1.45	1.90
Work-related travel	4.07	3.63	0.68	0.60	1.74	2.43
Other activities	4.21	4.89	1.21	0.79	1.71	2.53
All activities, average	4.26	4.36	0.76	0.59	1.65	2.42

Note: The table reports average responses for each well-being aspect and each time use category. Responses were given on a scale from 0 to 6.

To examine how differences in time use across city sizes change well-being, we calculate:

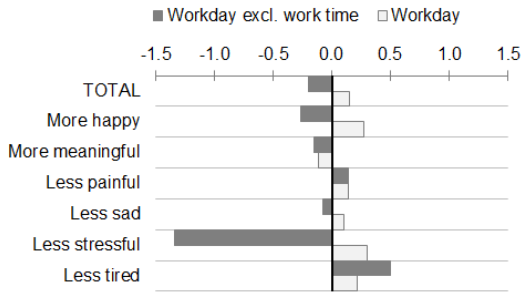
$$\Delta W = \sum_u 2.3 \beta^u s^u \left(W^u - \overline{W} \right), \tag{3.2}$$

where β^u is the coefficient of time spent on activity u on city size from regression (3.1), s^u is the share of time spent on activity u on workdays for the entire sample from Table 1, W is one of the six feelings in the Well-being Module, W^u is the average self-reported assessment of one's feeling during activity u, and $\overline{W}$ is the weighted-average assessment of feeling W across all activities. As before, we multiply coefficient β^u by 2.3 to interpret the results as the effect of increasing city size tenfold. The sign of ΔW indicates whether time allocation in larger cities is associated with the improvement of an average individual's feeling W, and its magnitude measures the size of the improvement on the 0 to 6 scale.

Recall that working is the activity that takes half of non-sleeping time on workdays (Table 1) and that the coefficient of city-size on working time is negative but not statistically significant (Figure 1). Thus, we calculate ΔW for all activities reported in the Well-being Module and then we re-calculate ΔW after excluding working time.

In Figure 3, we report the results for each of the six feelings. Also, in row "TOTAL" we calculate the simple average of ΔW of the six feelings to gauge the overall relationship between city size and well-being. The figure shows that, when we include working time, an average individual in a large city has time allocation that is associated with feeling happier, less painful, less sad, less stressful, and less tired, but at the same time, less meaningful. However, recalculating ΔW after excluding working time partly reverses

Figure 3: City size and implied well-being

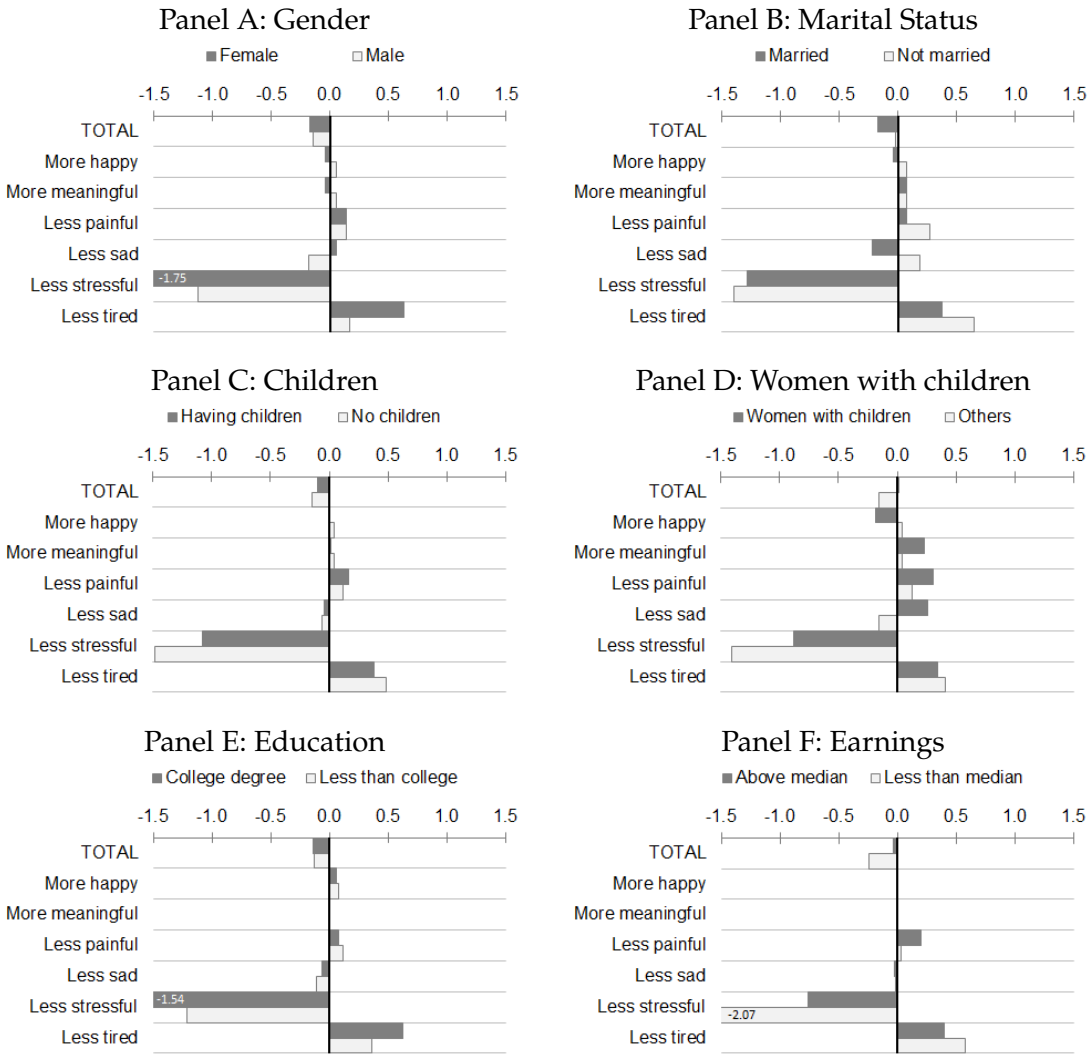


Note: The figure shows the values of ΔW for the six feelings in the Well-being module and the simple average across the six values in row "TOTAL". Dark-gray bars show the results for all activities, light-gray bars show the results excluding working time. See the text for more details.

the picture. Because working is an activity with low self-reported happiness and high stress, the non-working hours in big cities are associated with less happiness and more stress. Residents of ten-times larger cities have time allocation that implies a 0.17 standard deviations lower happiness and a 0.83 standard deviations higher stress. Averaging across the six feelings, these results suggest that time allocation in large cities is associated with somewhat lower well-being. Given that the negative relationship between city size and working time is not statistically significant and, as discussed above, was not found in the ACS data, in the heterogeneity analysis that follows we focus on the results excluding working time.

How does the relationship between city size and subjective well-being differ across types of individuals? To answer this question, we re-calculate self-assessed well-being for each time use category and each type of individual, and then recalculate ΔW excluding working time. Panel A of Figure 4 shows that women have a more stressful but less tiresome and less sad time allocation in big cities compared to men. The total implied well-being of both men and women is lower in big cities. Panel B shows no substantial differences between married and non-married individuals, with the exception that time allocation in big cities is associated with more sadness for the married and less sadness for the non-married. Panel C shows no sizable differences between individuals with and without children, but panel D shows that women with children do not experience a big-city well-being penalty. Panel E shows that individuals with a college degree have a more stressful time allocation in big cities, than those without college education. But both types exhibit a big-city well-being penalty. Finally, in panel F we see that the well-being penalty is absent for high-income individuals but present for the low-income, primarily due to high stress. Notably, lower implied well-being in big cities across different types of

Figure 4: City size and implied well-being (excl. working time), heterogeneity



Note: The figure shows the values of ΔW, excluding working time, for the six feelings in the Well-being module and the simple average across the six values in row "TOTAL". Panel A reports the values for men and women. Panel B reports the values for married and non-married individuals. Panel C reports the values for individuals with and without children. Panel D reports the values for women with children and others. Panel E reports the values for those with and without a college degree. Panel F reports the values for individuals above and below the median CBSA hourly earnings. See the text for more details.

individuals is primarily the result of higher stress levels of activities that take more time in big cities, e.g., commuting.

Interestingly, the only two socioeconomic types whose implied well-being does not fall in big cities are high-income individuals and women with children. The former may be less sensitive to high costs of big cities and be able to use their income to attain a more pleasant time use. The latter spend particularly long hours on childcare, which ranks among activities with highest self-reported happiness and meaning, albeit high stress and

tiredness.

Though we do not measure well-being directly and infer it from time use, our findings are consistent with previous research. Glaeser, Gottlieb, and Ziv (2016) study differences in happiness across U.S. cities and find no statistically significant relationship between self-reported happiness and city size. At the same time, Loschiavo (2021) finds that residents of large cities report lower happiness, primarily due to longer commutes.

3.4 Time use and the city-size wage premium

A large empirical literature documents that large cities offer higher wages.[10] At the same time, this wage premium is partly offset by the higher cost of living. However, if residents of large cities also have a less satisfactory time allocation, the benefit of living in a large city could be even lower.

To evaluate the importance of time use differences by city size in a way that is comparable with existing estimates of net benefits of city size, we perform the following back-of-the-envelope calculation. First, we take the estimate of the city-size wage premium from Duranton and Puga (2023). They estimate the elasticity of income with respect to city size of 0.0451.[11] Second, we take the estimates of value of time. Goldszmidt, List, Metcalfe, Muir, Smith, and Wang (2020) estimate the value of travel time equal to 75% of the average wage using the data on Lyft trips. Using the ATUS data, Aguiar, Bils, Charles, and Hurst (2021) estimate the elasticity of leisure time with respect to wage equal to 1.19, which can be interpreted as the value of leisure time equal to 119% of average wage. Given the absence of available estimates of the value of time spent socializing, we assume that it is equal to the value of leisure time. Third, we use our estimates of time use differences from Section 3.1. We convert the coefficients associated with a tenfold increase in city size into those that describe a doubling of city size and calculate that doubling city size is associated with 3.9 minutes more per day of traveling and 2.2 minutes more per day on leisure and socializing.[12] Assuming an eight-hour workday, these numbers mean that the extra time that residents of twice larger cities spend on traveling is equivalent to $3.9/(8 \times 60) = 0.81\%$ of their workday, and the time that they underspend on leisure and

[10] See reviews by Ahlfeldt and Pietrostefani (2019) and Duranton and Puga (2020).

[11] We re-estimate this elasticity using our ATUS sample and the same controls we use in the rest of our analysis, and obtain the value of 0.046. See Appendix Table A.2 for details.

[12] In Section 3.1, we multiplied coefficients β^u from regression (3.1) by $\ln(10) \approx 2.3$ so that they can be interpreted as describing the effect of a *tenfold* increase in city size, as explained in footnote 5. To describe the effect of *doubling* city size, we multiply the coefficients by $\ln(2) \approx 0.69$. Therefore, if a tenfold increase in city size is associated with 12.9 more minutes of traveling and 7.4 fewer minutes of leisure and socializing, then doubling the size is associated with $12.9 \times (0.69/2.3) = 3.9$ more minutes of traveling and $7.4 \times (0.69/2.3) = 2.2$ less minutes of leisure and socializing.

socializing is equivalent to $2.2/(8 \times 60) = 0.46\%$.

Then, we combine these estimates and calculate that a person who lives in a twice larger city would be willing to give up $75\% \times 0.81\% = 0.61\%$ to avoid the longer commute and $119\% \times 0.46\% = 0.55\%$ to avoid the shorter leisure and socializing time. Comparing these numbers with the city-size wage premium of 4.51% implies that accounting for the difference in time spent on travel lowers the city-size premium by $0.61/4.51 = 14\%$ and accounting for the differences in leisure and socializing time lowers it by $0.55/4.51 = 12\%$. Taken together, these two channels reduce the city-size premium by 26%.

Of course, this finding depends on the estimates of wage and housing cost elasticities, as well as the estimates of the value of time. The literature that estimates wage and housing cost elasticities with respect to city size is well-developed and the numbers we use are consistent with the estimates from numerous other studies too. The literature on value of time is much smaller, however our estimate of the value of travel time is consistent with other studies.[13] Yet, even if we used the value of travel time equal to 50% of the wage and a twice lower value of leisure and socializing time, we would find that accounting for the differences in time allocation lowers the real city size wage premium by 15%, a smaller but still sizable effect.[14]

3.5 Time use during Covid-19 and work from home

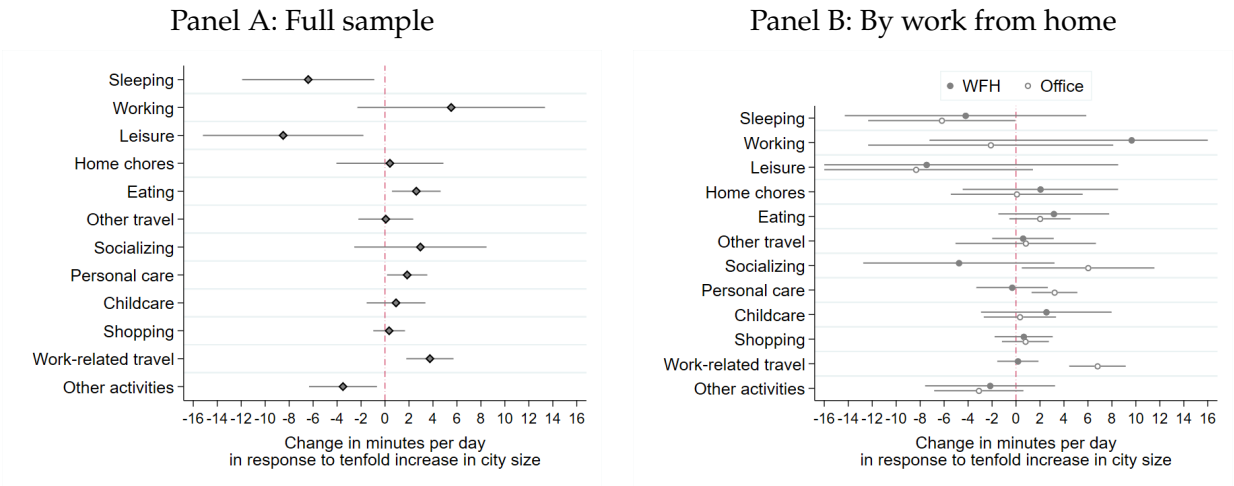
Looking at the results in Figures 1 and 2, it is evident that an important aspect of time use differences by city size is that big cities have longer travel times which eat into the time spent on other activities. However, as a result of Covid-19, many workers started working from home and, even though pandemic-related concerns have largely abated, a significant fraction of workers keep working from home.[15] At the same time, large cities have more people who work in occupations that allow telecommuting (Dingel and Neiman, 2020) and large cities have experienced a larger drop in commuting to the central business district since 2020 (Monte, Porcher, and Rossi-Hansberg, 2023), which happened partly because longer commutes create stronger incentives to work from home (Delventhal and Parkhomenko, 2023). As work from home is more frequent and commuting less common, especially in big cities, how does the relationship between city size and time use change?

[13] According to a survey of earlier literature by Small (2012), the value of time for commute trips is around one-half of the gross wage rate. At the same time, Kreindler (2023) estimates the value of time equal to 370% of hourly wage in a developing country setting.

[14] We calculate $50\% \times 0.81\% + 119\%/2 \times 0.46\% = 0.68\%$, and then $0.68/4.51 = 15\%$.

[15] Barrero, Bloom, and Davis (2021) report that the fraction of full paid days worked from home jumped from less than 10% before the pandemic to 60% in May 2020. Then it went down to about 30% by mid-2022 and has stayed at this level throughout early 2024.

Figure 5: City size and time use (2020–2022)



Note: The figure reports coefficients β^u from regression (3.1) multiplied by 2.3 estimated using the 2020–2022 sample. Panel A reports coefficients from a regression where the individual controls are included. Panel B reports coefficients for those who work from home and those who do not. Horizontal bars represent 95% confidence intervals. Standard errors are clustered at the CBSA level. See the text for more details.

We re-run the regression (3.1) using the ATUS samples from 2020 to 2022.[16] Panel A in Figure 5 shows that nearly all of the significant effects of city size on time use vanish.[17] There is small positive relationship between city size and time spent on eating and personal care. And, increasing city size tenfold is associated with a 4-minute longer commute to work, a much smaller effect than before the pandemic. But overall, the differences in time use by city size have become much smaller or disappeared completely since 2020.

Is work from home responsible for these smaller differences? To answer this question, we split the post-2020 sample into those who commuted to worksite and those worked from home at least 4 hours on a given day and did not commute to worksite. The results are shown in panel B of Figure 5. The main difference between those who work from home and those who do not is that remote workers do not spend more time on commuting in big cities. Thus, the massive increase in the amount of work from home since 2020 has contributed to smaller differences in time use across city sizes. Some of the time savings from less frequent commutes were used to work a bit more, although the coefficient on working time is not statistically significant.[18] Interestingly, those who do not work from home spend more time on socializing in big cities. However, most of the city-size differences between remote and on-site workers are not statistically significant.

[16]Because Covid-19 restrictions started in March 2020, in the 2020 sample we drop observations from January to April. The 2022 sample is the most recently available.

[17]The coefficients in regressions without individual controls are nearly identical.

[18]Makridis (2024) also finds that since 2020 time saved on commuting was partly used to work longer.

This suggests that, while work from home has changed time allocation of individuals who can work remotely, it had a similar effect in cities of all sizes.[19]

4 Conclusions

In this paper, we investigated how time use varies with city size in the United States. Using the ATUS, we found that residents of big cities spend more time traveling and less time on leisure and socializing, and that there are significant differences in how they make up for the time lost to traveling. While men in big cities dedicate less time to home chores, women have less leisure and socializing. Unmarried individuals sleep less in big cities. Individuals with children spend more time on childcare in large cities, while women with children work less and have less leisure. Low-income workers in big cities spend less time on leisure and sleep less than their counterparts in smaller cities, whereas the high-income work less.

Using the ATUS Well-being Module, we found that large cities offer time allocation that is associated with lower well-being. This result is largely driven by higher stress levels of activities that take more time in big cities, such as commuting. We also found that accounting for longer commutes and less time spent on leisure and socializing lowers the city-size wage premium by one-quarter. At the same time, we found that since 2020 time use disparities by city size have become much smaller. While it is not yet clear to which extent this is the result of the increase in the prevalence of work from home or other reasons, time use differences between large and small cities may diminish in the future.

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[19]Changes in time use due to work from home have been studied in Dam, Melcangi, Pilossoph, and Toner-Rodgers (2022), Aksoy, Barrero, Bloom, Davis, Dolls, and Zarate (2023), and Pabilonia and Vernon (2023), among others.

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A Appendix

A.1 Data

A.1.1 Time use categories

We aggregate activities reported in ATUS into 12 time use categories as follows:

1. Sleeping:
    - Sleeping
2. Working:
    - Work-related Activities
    - Other Income-Generating Activities
    - Job Search and Interviewing
    - Work and Work-related Activities, n.e.c.
3. Leisure:
    - Animals and Pets
    - HH personal mail, messages, and e-mail
    - Relaxing and Leisure (except playing games)
    - Arts and Entertainment (other than sports)
    - Waiting associated with Relaxing and Leisure
    - Sports, Exercise, and Recreation
    - Socializing, Relaxing, and Leisure, n.e.c.
4. Home Chores:
    - Housework
    - Food Drink Preparation, Presentation, Clean-up
    - Interior Maintenance, Repair Decoration
    - Exterior Maintenance, Repair Decoration
    - Lawn, Garden, and Houseplants
    - Household Management (except HH Personal mail, messages, and e-mail)
    - Caring for Household Adults
    - Helping Household Adults
    - Caring For Helping Non-HH Members
    - Caring For Non-HH Adults
    - Helping Non-HH Adults
    - Caring For Helping Non-HH Adults, n.e.c.
5. Eating:
    - Eating and Drinking

- Waiting associated with Eating and Drinking
- Eating and Drinking, n.e.c.

6. Other Travel:
    - Travel Related to Personal Care
    - Travel Related to Household Activities
    - Travel Related to Caring For Helping HH Members
    - Travel Related to Caring For Helping NonHH Members
    - Travel Related to Education
    - Travel Related to Consumer Purchases
    - Travel Related to Using Professional and Personal Care Services
    - Travel Related to Using HH Services
    - Travel Related to Government Services Civic Obligations
    - Travel Related to Eating and Drinking
    - Travel Related to Socializing, Relaxing, and Leisure
    - Travel Related to Sports, Exercise, and Recreation
    - Travel Related to Religious/Spiritual Activities
    - Travel Related to Volunteer Activities
    - Travel Related to Telephone Calls
    - Security Procedures Related to Traveling
    - Traveling, n.e.c.
7. Socializing:
    - Socializing and Communicating
    - Attending or Hosting Social Events
    - Playing games
    - Waiting associated with Socializing Communicating
    - Waiting associated with Attending/Hosting Social Events
    - Telephone Calls (to of from)
    - Telephone Calls, n.e.c.
8. Personal Care:
    - Grooming
    - Personal Activities
    - Personal Care Emergencies
    - Personal Care, n.e.c.
9. Childcare:
    - Caring For Helping HH Children
    - Activities Related to HH Children's Education

- Activities Related to HH Children's Health
- Caring For Helping Non-HH Children
- Activities Related to Non-HH Children's Education
- Activities Related to Non-HH Children's Health

10. Shopping:
    - Shopping (Store, Telephone, Internet)
    - Researching Purchases
    - Security Procedures Related to Consumer Purchases
    - Consumer Purchases, n.e.c.
    - Professional Personal Care Services
    - Financial Services and Banking
    - Legal Services
    - Personal Care Services
    - REal Estate
    - Veterinary Services (Excluding grooming)
    - Security Procedures Related to Professional/Personal Services
    - Professional Personal Care Services, n.e.c.
    - HH Services (Not done by self)
    - Home Maintenance/Repair/Decor/Construction (not done by self)
    - Using Government Services
    - Civic Obligations Participation
    - Waiting Associated with Government Services or Civic Obligations
    - Security Procedures Related to Government Services or Civic Obligations
    - Government Services, n.e.c.
11. Work-related Travel:
    - Travel Related to Work
12. Other Activities:
    - Taking Class
    - Extracurricular School Activities (Except Sports)
    - Research/Homework
    - Registration/Administrative Activities
    - Education, n.e.c.
    - Religious/Spiritual Practices
    - Religious and Spiritual Practices, n.e.c.
    - Administrative Support Activities
    - Social Service Care Activities (Except Medical)

- Indoor Outdoor Maintenance, Building, Clean-up Activities
- Participating in Performance Cultural Activities
- Attending Meetings, Conferences, Training
- Public Health Safety Activities
- Volunteer Activities, n.e.c.
- Medical and Care Services
- Health-related self-care
- Unable to Code
- Data codes, n.e.c.

A.2 Additional Figures and Tables

Table A.1: Relationship between hours worked and city size in the ACS

	(1)	(2)
Log population	0.000205	-0.0000608
	(0.00122)	(0.000970)
Observations	3740842	3740842
R-squared	0.00000192	0.0794

Note: The table reports regression coefficients and standard errors from regressions of log hours worked per week on log metropolitan area population from the ACS. Column (1) reports the coefficient from a regression without controls. Column (2) reports the coefficient from a regression that controls for gender, race, education, age, age squared, occupation, and industry. Standard errors are clustered by metropolitan area. See the text for more details.

Table A.2: Relationship between wage and city size in the ATUS sample

	(1)
Log population	0.046
	(0.006)
Observations	37,648
R-squared	0.371

Note: The table reports regression coefficients and standard errors from regressions of log hourly wages on log metropolitan area population from the ATUS. The regression includes the same set of control variables from the main regression equation, including gender, race, education, age, age squared, occupation, and industry. Standard errors are clustered by metropolitan area. See the text for more details.