Intermediate activities while commuting: chain trips and bulk commuting*

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Abstract

Recent analyses have shown that commutes to and from work are not symmetric, suggesting that intermediate activities are at the root of the asymmetries. However, to model how these activities accumulate and interact within trips to and from work is a methodologically unexplored issue. We analyze the intermediate activities done while commuting, using data from the American Time Use Survey for the period 2003-2019. We show that commuting as defined from Time Use Survey lexicons is underestimated, with significant differences depending on whether intermediate activities are considered. Such differences are especially relevant in commuting from work. Our results contribute to the analysis of commuting behavior, by proposing new identification strategies based on intermediate non-trip episodes, and by showing how commuting interacts with other non-commuting activities. We also explore intermediate episodes while commuting, which may partially explain gender differences in commuting time.

Keywords: Commuting time; Trip behavior; Intermediate activity; Time use data; American Time Use Survey.

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1. Introduction

The time spent commuting to work and back again has been considered symmetric in most studies, but recent evidence has shown that commutes are not equal, which has implications on theoretical, methodological and policy grounds (Gimenez-Nadal, Molina and Velilla, 2021). Intermediate activities - that is, activities that concatenate within the trips to and from work - may drive such asymmetries, but no evidence has been shown to date. The analysis of how activities accumulate within trips to and from work is methodologically important, as it may help to explain gender differences in commuting times. If mothers, who are normally in charge of household responsibilities (Gimenez-Nadal and Molina, 2016), go to pick up their children from school on their return trip from work, they may report that as travel related to childcare and not as a return from work, although it may still be exactly that. If this travel is considered as commuting, perhaps the previously reported gender differences in commuting time (Gimenez-Nadal and Molina, 2016; Gimenez-Nadal, Molina and Velilla, 2022) would decrease, disappear, or even reverse.

The analysis of intermediate activities has implications at the methodological level. Several authors have used Time Use Surveys (TUS) to analyze the commuting behavior of workers (Gimenez-Nadal and Molina, 2016; Gimenez-Nadal, Molina and Velilla, 2018a, 2018b, 2020), given the rich information that TUS provide. But TUS generally identify commuting episodes as trips to work and from work, based on respondents' perceptions, but not based on the initial and final location. Following the previous example, if a given individual drives their child to school and then commutes to work, the first travel behavior (from home to the child's school) is not identified as commuting to work but as a trip related to childcare. Furthermore, non-trip activities done while commuting (i.e. those intermediate activities) should not be considered as part of the commute. How this identification affects the analysis of commuting times has barely been analyzed (Kimbrough, 2019).

Within this framework, this paper explores commuting times, with a focus on the intermediate activities done while commuting, using data from the American Time Use Survey (ATUS) for the period 2003-2019. We differentiate among the identification of commutes, computed commutes (all trip episodes from home to work, and from work to home), and "bulk" commutes (i.e., computed commutes and intermediate activities done

while commuting). We also address potential differences between commutes to work and commutes from work (Coria and Zhang, 2017; Gimenez-Nadal, Molina and Velilla, 2021), differences in male and female workers' commuting (Gimenez-Nadal and Molina, 2016), and show how intermediate activities partially explain such differences. We find that the computed time of commuting is about 15.0 minutes longer than the TUS lexicon time, while commuting bulk time is about 18.7 minutes longer than the computed time excluding intermediate activities. Furthermore, the three definitions seem to be correlated differentially to worker characteristics, indicating that the definition of commuting is crucial. Contrarily, it appears not to affect the relationships between commuting and metropolitan forms. Our results also reveal asymmetries in intermediate activities, driven by leisure and shopping activities, which are concentrated while commuting from work in the evening, rather than while commuting to work in the morning. Regarding gender differences in commuting times and intermediate activities, we find that the differences are sensitive to the definition of commuting.

From a methodological perspective, we contribute to the literature by showing that TUS lexicons tend to underestimate the time spent by workers commuting to/from work, as 24.5% of the time travelling from home (work) to work (home) is not identified as commuting. The inclusion of intermediate activities has a further impact on the estimation of commuting times. The correlation between commuting time and worker characteristics is found to be sensitive to the definition of commuting, so different identifications of commuting are likely to lead to different research results and conclusions. We report asymmetries in commuting times depending on the definition of commuting, and also in intermediate activities while commuting. Workers tend to do more intermediate activities while commuting from work, than while commuting to work, and thus analyses of worker daily activities should carefully consider these activities either as intermediate activities or as part of commuting behaviors.

Furthermore, the previously reported gender gap in commuting time is sensitive to the definition of commuting. Women spend more time than men doing intermediate activities while commuting from work, which compensates for their shorter commuting times, and then the overall difference in the time spent going from work between women and men becomes non-significant. However, men still spend more time commuting to work than women, even when intermediate activities are considered.

The rest of the paper is organized as follows. Section 2 describes the data and variables. Section 3 shows differences in commuting times, how the times correlate with worker characteristics, and the main intermediate activities done while commuting. Section 4 studies gender differences in commuting times and intermediate activities to and from work. Section 5 concludes.

2. Data and variables

We use data from the American Time Use Survey (ATUS) for the period 2003-2019. The ATUS data provides us with socioeconomic variables about respondents, but also information on individual time use based on diaries, where respondents report their activities during the 24 hours of the day, from 4 am to 4 am of the next day. The advantage of 24-hour self-reported diary data over other types of survey based on stylized questionnaires, is that diaries produce more reliable and accurate estimates (Bonke, 2005; Yee-Kan, 2008). The ATUS is considered the official time use survey of the US, it is sponsored by the Bureau of Labor Statistics, and conducted as part of the Current Population Survey (CPS) by the US Census Bureau. Furthermore, the ATUS data is included as part of the Integrated Public Use Microdata Series (IPUMS) of the Institute for Social Research and Data Innovation of the University of Minnesota (Hofferth et al., 2020).[1]

Information in diaries is coded according to the ATUS activity coding procedures, which classify respondents' activities in different categories, namely personal care, household activities, caring, work activities, education, consumer purchases, professional and household services, government and civic obligations, eating and drinking, leisure, sports and recreation, religious activities, volunteer activities, calls, and travel. The diaries include other useful information, such as where and with whom activities are done, which allows us to distinguish between activities done at home and at the workplace, and the mode of transport of trip episodes.

[1] Information for the 2020 wave of the ATUS is available both in the US Bureau of Labor Statistics and in the IPUMS, but as the ATUS methodology was greatly affected by the coronavirus (COVID-19) pandemic, the 2020 wave is not representative. See https://www.bls.gov/tus/covid19.htm#2 for more information. Note that despite the ATUS has been conducted since 2003, it constitutes a cross-sectional database.

We restrict the ATUS sample to employed individuals between 16 and 65 years old, who worked the diary day, and whose diary day was not conducted during "strange" days (self-reported), to avoid potential bias arising from atypical daily behaviors. Furthermore, we follow Gimenez-Nadal, Molina and Velilla (2018a, 2018b, 2021), and retain respondents who spent more than 60 minutes working during the diary day. Since we are interested in studying commuting behaviors and the time spent in intermediate activities while commuting, we omit from the sample those employees who do not commute to/from work (i.e., teleworkers or telecommuters). We discard observations that can be considered outliers in multivariate data, using Billor, Hadi and Velleman's (2000) blocked adaptive computationally efficient outlier nominators (BACON) algorithm. These restrictions leave a sample of 42,682 individuals, of whom 21,860 are men and 20,822 are women. Furthermore, 34,058 of the respondents filled in their diaries during weekdays, with the remaining 8,624 workers filling the diaries in during the weekend.

Socio-demographic information of respondents can be obtained from the ATUS. We define the respondent's gender, age, race, native status, Hispanic origin, education level, living in couple, the labor status of the couple, family size and number of children, the age of the youngest child, and housing attributes (tenure and housing unit). Economic and labor information is also collected in the ATUS, and we define variables for household annual income (reported in income brackets, recoded as the mid-point of the brackets, taking values from 5,000 to 150,000 US dollars per year), weekly working hours, type of worker (private sector, public sector, self-employed), full/part-time status, and occupations.[2] The ATUS data includes certain variables collecting geographic and metropolitan information on respondents, such as the State of residence, the size of the MSA (divided by 1,000,000 inhabitants, and taking values from 0 for non-metropolitan areas, to 5), and whether respondents reside in metropolitan center areas, metropolitan fringe areas, or non-metropolitan areas.

[2] Occupation categories in the ATUS data include: 110) "Management", 111) "Business, financial", 120) "Computer and math science", 121) "Architecture and engineering", 122) "Life, physica, social science", 123) "Community, social service", 124) "Legal occ.", 125) "Education, training, and library", 126) "Arts, entertainment, sports, media", 127) "Healthcare practitioner, technical", 130) "Healthcare support", 131) "Protective service", 132) "Food preparation, serving", 133) "Building, cleaning, maintenance", 134) "Personal care service", 140) "Sales and related", 150) "Office and admin support", 160) "Farming, fishing, forestry", 170) "Construction, extraction", 180) "Installation, maintenance, repair", 190) "Production", and 200) "Transport". Occupations at a more disaggregated level are also available in the ATUS data.

All the socio-demographic and metropolitan variables have been found to be correlated with workers' commuting, and thus we consider them in the empirical analysis; summary statistics for all these variables are shown in Table A1 of the Appendix.

Commuting time is identified in the ATUS with the code 180501 ("commuting to/from work"), and represents those travel episodes to/from work. Several authors have analyzed commuting times using this code (see Gimenez-Nadal, Molina and Velilla (2021) for a review). One limitation of TUS is that, as highlighted by Kimbrough (2019), extracting trip behaviors from the survey may imply some degree of bias, as the surveys do not consider activities done while commuting as commuting, such as stops for shopping, for taking kids to or from school, or for using services, among others. Thus, part of commuting trips may be coded not as commuting but as other kind of trips related to secondary activities. Prior research has questioned whether these intermediate activities should be considered as part of commuting trips, or not (Horner, 2004; Gimenez-Nadal, Molina and Velilla, 2021), and results are sensitive to the definition of commuting.

To analyze how the time devoted to commuting varies with the consideration of intermediate activities, we use two alternative definitions of commuting time, following Gimenez-Nadal, Molina and Velilla (2021) and taking into account the place where trips begin and end. We first consider that every trip episode, or combination of episodes, that begins at home and ends at work (or vice versa) is a commuting trip, regardless of whether those trip episodes are defined as "commuting to/from work" in the ATUS lexicon (*Commuting and intermediate trips*). In the following series of episodes: 1) any activity at respondents' home; 2) trip episode; 3) grocery shopping; 4) trip episode; 5) using service; 6) trip episode; 7) paid work at respondent's workplace, regardless of whether the ATUS lexicon identifies episodes 2), 4), and 6) as commutes or other type of trips, we identify the three travel episodes as commuting to work. Similarly, consider the following series of episodes: 1) Paid work at respondents' workplace; 2) trip episode; 3) picking up child from school; 4) trip episodes; 5) any activity at respondents' home. We identify episodes 2) and 4) as commuting episodes, regardless of whether they are coded as commuting in the ATUS lexicon. Thus, our definition of commuting times (i.e., *Commuting and intermediate trips*) is expected to differ from *Commuting ATUS*.

To define the *Commuting and intermediate trips* variable, we make sure that the same trip episode is not identified as commuting both to and from work. We make sure that no intermediate activity is done at respondents' home or workplace. For example, consider the following series of episodes: 1) Any activity at respondent's home; 2) trip episode; 3) any activity not at home; 4) trip episode; 5) any activity at respondent's home; 6) trip episode; 7) paid work at respondent's workplace. Our identification of commuting episodes excludes trip episodes 2) and 4) from the definition of commuting, and in this example only trip episode 6) would be identified as commuting.

We define *Bulk commuting* as the time that passes from when the worker leaves his home/work until he arrives at his work/home. This definition includes both commuting, and trip and non-trip intermediate activities, and it is the less restrictive definition of commuting.

Given that the variables *Commuting and intermediate trips* and *Bulk commuting* include non-commuting activities while commuting to/from work, we follow prior research (Aguiar and Hurst, 2007, 2009; Guryan, Hurst and Kearney, 2008; Gimenez-Nadal and Sevilla, 2011, 2012) and compute the total time workers spend in intermediate activities in the following categories: paid work, leisure, childcare, unpaid work, purchasing products, using services, and personal care.

3. Differences by the definition of commuting

Figure 1 shows the evolution of the three measures of commuting time over the analyzed period, measured in minutes per day: *Commuting ATUS*, *Commuting and intermediate trips*, and *Bulk commuting*, leading to three takeaways. First, all three measures of commuting display a slightly increased trend over the last two decades, with linear trends around 0.04. The increase in the commuting time over the analyzed period in the US is consistent with prior studies (Kirby and LeSage, 2009; McKenzie and Rapino, 2009; Gimenez-Nadal, Molina and Velilla, 2018a; Burd, Burrows and McKenzie, 2021). Second, *Commuting ATUS* gives the lowest values of commuting time, which may indicate that commuting time based on TUS activity codes may be underestimating commuting times. For the analyzed period the time devoted to *Commuting and intermediate trips* is about 15 minutes longer in comparison to *Commuting ATUS*. Third, the time devoted to *Bulk commuting* is about 19

minutes longer than the time devoted to *Commuting and intermediate trips* for the analyzed years. Hence, Figure 1 shows that TUS lexicons tend to produce biased commuting times (Kimbrough, 2019; Gimenez-Nadal, Molina and Velilla, 2021), and that commuting times are sensitive to the inclusion of intermediate activities in the definition of commuting (Horner, 2004; Gimenez-Nadal, Molina and Velilla, 2021).

Table 1 shows the average time spent commuting by workers for the three definitions of commuting. The average time devoted to *Commuting ATUS* is 46.07 minutes per day, while the average time devoted to *Commuting and intermediate trips is* 61.03 minutes per day. This means that about 24.51% of the travel that elapses between home/work and work/home is not captured by the TUS lexicon. The average time devoted to *Bulk commuting* is about 79.73 minutes per day, indicating that intermediate non-trip activities represent, on average, 30.64% of the time spent commuting to/from work. The differences between the three commuting time definitions are statistically significant at standard levels ($p < 0.01$).[3] The figures obtained from *Commuting and intermediate trips* are closer to other official statistics for the US, such as the American Community Survey, according to which one-way commutes last about 27.6 minutes per day (Burd, Burrows and McKenzie, 2021).

Figure 2 shows the map of commuting time in the US, by State, representing both *Commuting and intermediate trips* and *Bulk commuting*. Despite the difference in the average time spent in commuting, the areas with relatively higher average time in *Commuting and intermediate trips* are the same areas where the time devoted to *Bulk commuting* is also higher. This suggests that, even when research results may be sensitive to the definition of commuting, there is some degree of spatial correlation and then studies of commuting, urban forms, regions, and metropolitan characteristics may not suffer from such sensitivity.

The correlates of commuting time

Given that differences in commuting times are quantitatively meaningful, we now analyze whether the differences across alternative definitions of commuting time, regarding how

[3] K-density estimates of commuting times, shown in Figure A1 in the Appendix, lead to the same conclusions.

they relate to worker characteristics, have been linked to commuting behaviors in prior studies. In doing so, for each individual *i*, we estimate the following equation:

$$C_i^k = \beta_0 + \beta_S S_i + \beta_L L_i + \beta_M M_i + \delta + \varepsilon_i, \quad (1)$$

where C_i^k represents the time spent commuting by worker *i*, and *k* represents the type of commuting (*Commuting ATUS*, *Commuting and intermediate trips*, *Bulk commuting*). S_i is a vector of sociodemographics, including respondents' gender, age, age squared, race, native and Hispanic status, education, living in couple, the couple's labor status, family size, number of children and age of the youngest child, tenure status, and the type of housing. L_i represents a vector of labor and income variables, namely household income, weekly usual work hours, the type of worker (private sector workers being the reference category), and part-time status. M_i represents metropolitan characteristics (i.e., living in a metropolitan center or metropolitan fringe area, with non-metropolitan areas being the reference category), and the population size of the MSA of residence, and δ represents occupation, year, and state fixed effects Finally, ε_i is the error term. Equation (1) is estimated including sample weights, and robust standard errors.

Estimation results are shown in Table 2. Column (1) shows the main coefficients for *Commuting ATUS*, Column (2) shows the coefficients for *Commuting and intermediate trips*, and Column (3) shows estimates for *Bulk commuting*. Focusing first on worker sociodemographics, we observe that men spend more time commuting than women if no non-trip intermediate activities are considered, net of observed heterogeneity, although the coefficients are quantitatively different in Columns (1) and (2). According to *Commuting ATUS*, men commute about 5.7 more minutes per day than similar women, but the difference shrinks to 2.1 minutes when analyzing *Commuting and intermediate trips*. Column (3) shows that the commuting time gender gap becomes non-significant when intermediate activities are considered as part of commuting time (*Bulk commuting)*.

The age of workers seems to be correlated similarly with commuting time, independently of the definition used for commuting, following an inverted U-shaped correlation. Being white is also consistently correlated to commuting time across commuting definitions, and white workers commute between 2.6 and 4.4 fewer minutes per day than

their non-white counterparts. However, the native and Hispanic status of individuals is correlated differently with commuting times in Columns (1), (2) and (3), suggesting that intermediate activities and the definition of commuting times play a role in these correlations. Coefficients associated with workers' education are also different in Columns (1), and (2) and (3). For instance, University educated workers seem to commute similarly to their counterparts when commuting time is measured by *Commuting ATUS*, but they commute about 6.4 more minutes per day when commuting time is measured by *Commuting and intermediate trips*, and 13.3 more minutes when commuting time is measured by *Bulk commuting*. Thus, it seems that highly educated individuals tend to spend more time doing non-trip intermediate activities during their commuting journeys than do their less educated counterparts.

Household composition is also correlated with commuting, differentially, depending on the definition, as individuals cohabiting in a couple spend about 4.3 more minutes *Commuting ATUS*, relative to single workers, whereas they spend 3.1 fewer minutes in *Bulk commuting*. This variable is not significant at standard levels when *Commuting and intermediate trips* is used. Thus, the results indicate that single individuals tend to spend more time doing intermediate activities than their non-single counterparts. This result could be explained by cohabiting individuals preferring scheduled joint time with their partners, rather than solo activities (Cosaert, Theloudis and Verheyden, 2021). Family size displays the same results as living in couple, as it is positively correlated with *Commuting ATUS*, uncorrelated with *Commuting and intermediate trips*, and negatively correlated with *Bulk commuting*. The labor status of the couple, and the number of kids also differ, as both regressors are only statistically significant when we study commuting times using *Bulk commuting*. The age of the youngest kid, on the other hand, is not significant. The type of tenure and housing unit also differ across definitions of commuting time.

Focusing on the labor and income variables, household income is positively correlated to commuting time and this correlation is robust to the definition of commuting (Zax, 1991; White, 1999; Ross and Zenou, 2008; Fu and Ross, 2013; Mulalic, van Ommeren and Pileggard, 2014; Gutiérrez-i-Puigarnau, Mulalic and van Ommeren, 2016; Ruppert, Stancanelli and Wasmer, 2016; Gimenez-Nadal, Molina and Velilla, 2018b). Conversely, work hours, which have been found to be related to worker commuting behaviors (Gutiérrez-

i-Puigarnau and van Ommeren, 2010), are significant only when we use *Commuting ATUS*, while this variable is not significant at standard levels for *Commuting and intermediate trips* and *Bulk commuting*. Relative to private sector employees, public sector workers spend less time in commuting, independently of the definition used. However, the results show that self-employed workers (excluding self-employed teleworkers) spend about 14.6 more minutes commuting than their employee counterparts, when we use *Bulk commuting*, indicating that the difference corresponds to non-trip intermediate activities. Since prior research has documented that self-employed workers tend to commute for shorter times than employees, the evidence presented here indicates that prior results should be revised using alternative definitions of commuting time (van Ommeren and van der Straaten, 2008; Gimenez-Nadal, Molina and Velilla, 2018a, 2020).

When we focus on the metropolitan characteristics of the area of residence of workers, results indicate that workers in densely populated areas spend more time commuting than their counterparts, robust to existing research (Hamilton, 1989; Kahn, 2000; Manning, 2003; Rodríguez, 2004; Gobillon, Selod and Zenou, 2007; Connolly, 2008; van Ommeren and van der Straaten, 2008; van Acker and Witlox, 2011; Gutiérrez-i-Puigarnau, Mulalic and van Ommeren., 2016; Gimenez-Nadal, Molina and Velilla, 2020). It seems that the correlation between commuting behaviors and urban or metropolitan forms does not depend on the identification of commuting times. An important note from Table 2 is that R-squared values are relatively low. Van Ommeren and van der Straaten (2008) and Gimenez-Nadal, Molina and Velilla (2020) discuss this issue in detail, and find that most of the empirical analyses of commuting times report quite low R-squared (below 0.10). However, we find that the R-squared numbers decrease when we analyze commuting time and intermediate activities, highlighting the complexity linked to worker commuting behaviors, as previously reported in other studies (e.g., Cropper and Gordon, 1991; Small and Song, 1992; Manning, 2003; Rodríguez, 2004; Gimenez-Nadal, Molina and Velilla, 2021).

Intermediate activities to and from work

Empirical evidence has shown that commuting time is not symmetrical, in the sense that morning and evening commutes differ in their duration (Giménez-Nadal, Molina and Velilla,

2021). One possible explanation for this difference may reside in intermediate activities, as it may be well that workers do most of them in their trips back home, when they are not constrained by their work schedule.

Figure 3 shows the evolution of the time devoted to *Commuting and intermediate trips* and *Bulk commuting* during the analyzed period, distinguishing between trips to and from work. We observe that, for both directions, the time devoted to *Commuting and intermediate trips* and *Bulk commuting* has slightly increased over the analyzed period, suggesting that the time spent in intermediate activities has remained relatively constant over the period 2003-2019. Furthermore, we observe that the difference between *Commuting and intermediate trips* and *Bulk commuting* is around 4 minutes per day to work, and around 14 minutes per day from work, indicating that workers do more non-trip intermediate activities during the trips back home.

The prior evidence is confirmed in Table 3, showing the average time spent in *Commuting and intermediate trips* and *Bulk commuting*, in both the journeys to work and from work. It also shows the difference between *Commuting and intermediate trips* and *Bulk commuting* in both journeys. We observe that the average worker spends 28.5 minutes commuting to work, which increases to 32.5 minutes when intermediate activities are considered. This means that the worker spends 4.0 minutes doing intermediate activities while commuting to work, with this difference being statistically significant. The average time of commuting from work is 32.8 minutes, vs 46.9 minutes when intermediate activities are considered. Thus, workers spend 14.4 more minutes in non-trip intermediate activities while commuting from work. The evidence indicates that most non-trip intermediate activities are concentrated in the trips back home;the average worker spends 10.1 more minutes doing intermediate activities coming from work than going to work.

Table 4 shows the average times spent in leisure, childcare, unpaid work, personal care, purchasing goods, and using services while going to and from work. We also show the differences between the average time spent doing these activities. As previously reported, most of the time spent in these activities is concentrated coming from work. While going to work, workers spend, on average, 0.88 minutes doing leisure, 0.62 minutes purchasing goods, 0.59 minutes doing childcare, 0.27 minutes using services, 0.14 minutes doing unpaid

work, and 0.04 minutes in personal care. Workers spend 4.8 minutes doing leisure, 3.1 minutes purchasing goods, 0.87 minutes in childcare, 0.67 minutes using services, 0.53 minutes doing unpaid work, and 0.06 minutes in personal care, while commuting home. All the differences between the times spent doing these intermediate activities are statistically significant at standard levels ($p < 0.01$).

The results shown in Tables 3 and 4 are in line with the asymmetries in worker commuting behaviors described by Coria and Zhang (2017) and Gimenez-Nadal, Molina and Velilla (2021). Our results point to leisure and purchasing goods (shopping) as the most common activities done by workers while commuting and, specifically, while commuting from work to home.

Characterizing commuting trips and intermediate activities

We now characterize commuting trips, from and to work, according to the number of episodes, the percentage of each type of episode, and the duration of each episode. Given that TUS collects time use information of respondents using diaries, we can select from diaries the commuting and trip and non-trip intermediate activities. Table 5 shows that trips to work, on average, contain 2.41 episodes, while the average number for trips from work is 2.88 episodes, with the difference being significant at standard levels ($p < 0.01$). Regarding the composition of trips to work, 85.7% of the episodes of these trips are commuting. The remaining episodes are composed mainly by childcare episodes (5.1%), purchasing goods episodes (3.4%), and leisure episodes (1.4%). On the other hand, for trips from work to home, 80.2% of the episodes are commuting, and the remaining 19.8% are episodes of purchasing goods (6.7%), leisure (3.4%), childcare (3.1%), unpaid work (1.1%), personal care (1.0%), using services (0.02%), and other type of activities (4.3%). All these differences are statistically significant at standard levels ($p < 0.01$).

Our results indicate that the average commuting episode to work lasts 17.99 minutes, vs 17.30 minutes for commutes from work. That is to say, although workers spend more time commuting from work than commuting to work – according to *Bulk commuting* – the episodes last longer when commuting to work. The difference in the duration of these episodes is significant at standard levels ($p < 0.01$). Table 5 also shows that asymmetries in

commuting to and from work do not arise from the duration of commuting episodes, but from the composition of the trips. Regarding the rest of the activities, the average leisure episode to work lasts 0.56 minutes, vs 2.54 minutes for the average leisure episode coming from work. Childcare episodes also last longer coming from work than going to work (0.46 vs 0.37 minutes), and the same applies to personal care (0.36 vs 0.17 minutes), unpaid work (0.28 vs 0.09 minutes), purchases (1.6 vs 0.39 minutes), and services (0.03 vs 0.02 minutes). All the differences between the time spent in these activities to and from work are significant at standard levels.

We now study what individual characteristics are related to the time spent doing intermediate activities while commuting to/from work, net of other worker characteristics.[4] To that end, we estimate for each individual *i* the following equation using OLS:

$$Y_i = \beta_0 + \beta_S S_i + \beta_L L_i + \beta_M M_i + \delta + \varepsilon_i, \quad (2)$$

where Y_i represents the time spent in intermediate activities while commuting to/from work, and the remaining variables and coefficients are defined as in Equation (1).[5] Given that the dependent variable may take value 0 for workers who do not do intermediate activities, Tobit models may be preferred. However, prior research has compared Tobit and OLS when studying time use, and results are similar (Frazis and Stewart, 2012; Gershuny, 2012; Foster and Kalenkoski, 2013). We then focus on OLS for the sake of simplicity.

Results are shown in Table 7. Column (1) shows intermediate activities to and from work, while Columns (2) and (3) focus on intermediate activities to work, and from work, respectively. Estimates show that men in the sample spend about 2.4 fewer minutes per day in intermediate activities than women, net of observable heterogeneity. Furthermore, this difference is concentrated in intermediate activities while commuting from work, as estimates show that all workers spend the same amount of time doing intermediate activities

[4] This analysis resembles Gimenez-Nadal, Molina and Velilla (2021) study of asymmetries in the time of commutes to/from work.

[5] Worker time allocations are correlated with commuting, which is a shock to worker time endowments (Shapiro and Stiglitz, 1984; Ross and Zenou, 2008; Gimenez-Nadal, Molina and Velilla, 2018b). Thus, it is likely that the time spent by workers doing activities throughout the day determines the time spent in intermediate activities while commuting. For example, individuals who do more leisure in their spare time may be less likely to do leisure while commuting, compared to counterparts who have less time available for leisure. However, the impact of worker time allocations on the time spent in intermediate activities while commuting is likely to be endogenous, and lies beyond the scope of this analysis. We leave that analysis for future research.

while commuting to work. Age, on the other hand, appears not to be correlated with the time spent in intermediate activities while commuting. There seems to be an inverted U-shaped correlation between age and the time spent in intermediate activities while commuting to work, although coefficients are statistically significant only at the 90% level.

Being white, and being a native are factors correlated with intermediate activity time in a statistically significant way. Specifically, white workers spend 1.8 more minutes per day in intermediate activities than non-whites, and natives spend 1.7 more minutes in intermediate activities than do immigrants. Both correlations are affected by intermediate activities while commuting from work, but not during morning commutes to work. Hispanic respondents spend 1.6 fewer minutes in intermediate activities than non-Hispanic respondents, but this correlation is significant only for commutes to work, and not for commutes from work.

Regarding education, those with secondary education spend about 2.2 more minutes per day in intermediate activities, although the difference from the reference education group (basic education only) is not significant at standard levels. However, the difference in the time in intermediate activities while commuting to work is of 1.3 minutes, and significant at standard levels. The same difference while commuting from work is not statistically significant. Individuals with College education spend about 6.9 more minutes in intermediate activities than individuals with basic education only, and this difference corresponds to about 1.8 more minutes while commuting to work, and 5.1 more minutes while commuting from work (all the differences being highly significant). Thus, highly educated individuals spend more time in intermediate activities while commuting. Further research should analyze the composition of these intermediate activities, and potential differences by human capital, since education appears to be the main force underlying intermediate activities, regarding the estimated coefficients in Table 7.

Living in couple is correlated with decreased time in intermediate activities, since those who cohabit with a partner spend about 4.1 fewer minutes in intermediate activities while commuting than their single counterparts. Furthermore, most of that time (4.0 minutes) is concentrated in intermediate activities while commuting from work, with both coefficients being statistically significant. This result is consistent with two-member households

coordinating to schedule joint activities at home, which is preferable to solo activities (Hallberg, 2003; Jenkins and Osberg, 2005; Hamermesh, Myers and Pocock, 2008; Hamermesh, 2020; Cosaert, Theloudis and Verheyden, 2021), while single individuals have more incentives for solo activities. Similarly, family size is negatively related to the time spent in intermediate activities, with the difference being significant for trips from work, but not for trips to work. The number of kids, on the other hand, is associated with a small but statistically significant increased time in intermediate activities while going to work, possibly driven by taking the kids to school.

Regarding the labor and income variables in Equation (2), household income is positively correlated with intermediate activities from work, whereas the hours worked per week are positively correlated to the time in intermediate activities while commuting to work. Public sector employees spend less time in intermediate activities while commuting to work. The self-employed spend, on average, 9.7 more minutes per day in intermediate activities while commuting, and 7.4 of those minutes are intermediate activities while commuting from work. Both coefficients are statistically significant, but differences with respect to employees commuting to work are not significant at standard levels. Part-time workers spend about 1.7 more minutes per day in intermediate activities while commuting to work, relative to similar full-time workers, but the difference between full- and part-time workers in intermediate activity time while commuting from work is not significant.

Interestingly, all the metropolitan variables included in Equation (2) are estimated to be not statistically significant at standard levels, which may indicate that the complex relationships reported by prior research between commutes and urban forms (Manning, 2003; Rodríguez, 2004; van Acker and Witlox, 2011; Gimenez-Nadal, Molina and Velilla, 2018a, 2020) are independent of the definition of commuting, and whether or not that definition excludes or includes intermediate activities should not affect conclusions.

4. The role of intermediate activities in the gender gap in commuting

Prior research has shown that there are gender differences in commuting time, with working men devoting more time to commuting than working women (White, 1986; Sandow, 2008; Sandow and Westin, 2010; Roberts, Hodgson and Dolan, 2011; Dargay and Clark, 2012;

McQuaid and Chen, 2012; Gimenez-Nadal and Molina, 2016; Le Barbanchon, Rathelot and Roulet, 2021). However, existing analyses do not take into account the role that both trip and non-trip intermediate activities may have in shaping this difference. When we consider the complete sequence of activities of workers in their trips to and from work, the previously reported gap in commuting may expand, decrease, disappear, or even be reversed. We present the first analysis of how intermediate activities affect the gender gap in commuting. To that end, we look at gender differences in the time devoted to both *Commuting and intermediate trips* and *Bulk commuting,* we consider whether the trip is to work or from work, and we analyze gender differences in leisure and shopping, given that those activities constitute the greater portion of intermediate activities (in terms of time devoted).

Table 6 shows the time spent commuting by men and women in the sample. According to *Commuting and intermediate trips*, women spend an average of 58.1 minutes per day commuting to/from work, while men spend an average of 63.5 minutes per day, with the being statistically significant ($p < 0.01$). For trip intermediate activities while commuting to and from work, men 5.4 more minutes per day. For *Bulk commuting,* women spend an average of 78.6 minutes per day commuting to/from work while men spend an average of 80.67 minutes per day commuting to/from work, with the difference being statistically significant ($p < 0.01$). However, these estimated differences are smaller than in prior studies, indicating that the gender gap in commuting time is sensitive to the inclusion of intermediate activities. Men spend 17.20 minutes doing intermediate activities while commuting, while women spend 20.5 minutes in intermediate activities, which illustrates the smaller than expected gender gap in commuting time.

Focusing on differences in commutes to work, and commutes from work, results by gender show that most of the difference between women and men in the time spent in intermediate activities while commuting is concentrated in commuting from work, which is usually done in the evenings. Women spend 27.4 (31.6) minutes commuting to work when intermediate activities are excluded (included), vs the 29.4 (33.9) minutes spent by men. That is to say, both men and women spend about 4 minutes doing intermediate activities while going to work, and the gender difference in these trips remains about 2.1 minutes per day, regardless of the identification of commuting. On commutes from work, the results show that the average woman spends 30.7 minutes in commuting trips, and another 16.3

minutes in intermediate activities, vs the 34.0 minutes spent by men commuting from work, and the 12.8 minutes spent in intermediate activities. Thus, even when we find a gender difference in commuting times of about 3.3 minutes per day, which is significant at standard levels ($p < 0.01$), the difference becomes only 0.21 minutes per day - and is not statistically significant at standard levels - when intermediate activities are considered.

The results are important for gender comparisons in commuting, since prior research has documented a large gender difference in commuting time. Our results show that this gender difference is smaller when intermediate activities are included. Furthermore, the bulk of this gender difference in concentrated on commuting from work, which normally occurs in the evenings. As a consequence, gender differences in commuting time should be revisited in light of our results.

We next analyze the intermediate activities that are at the root of the gender difference in commuting, and for simplicity we focus on leisure and shopping episodes, given that these activities constitute the higher proportion of intermediate activities.[6]

Table 6 shows that the average woman spends 0.78 minutes doing leisure while commuting to work, and 4.9 minutes while commuting from work. The difference of 4.2 minutes per day is statistically significant ($p < 0.01$). The average man spends 0.97 minutes doing leisure while commuting to work, and 4.7 minutes doing leisure while commuting from work. The difference for men accounts for 3.7 minutes per day, and is also significant ($p < 0.01$). When comparing men and women, results show that men slightly surpass women in the time spent doing leisure while commuting to work, by 0.20 minutes per day, but this small difference is still significant ($p < 0.05$). However, the time spent in leisure while commuting from work does not appreciably differ between women and men at standard levels. Thus, it seems that intermediate leisure activities while commuting do not explain the overall commuting differences between women and men in terms of commuting trips and intermediate activities.

For the time spent shopping while commuting, we note that women (men) spend about 0.71 (0.55) minutes in these activities while commuting to work, and 4.4 (2.0) minutes when

[6] Similar statistics for the time spent in childcare, personal care, unpaid work, and using services intermediate activities while commuting are shown in Table A2 in the Appendix.

commuting from work. Specifically, women spend 2.3 more minutes per day than men in shopping as an intermediate activity while commuting from work. This difference accounts for 66.48% of the gender difference in intermediate activities when commuting from work, highlighting the importance of considering specific activities while commuting when analyzing gender differences.

5. Conclusions

The time spent commuting to and from work has been considered symmetric in most studies, but recent evidence has shown that commutes are not symmetric, which has implications on theoretical, methodological, and policy grounds (Gimenez-Nadal, Molina and Velilla, 2021). This paper contributes to the literature on commuting behavior by analyzing the time spent commuting and doing intermediate activities by workers in the US, using data from the American Time Use Survey for the period 2003-2019. We focus first on the identification of commuting in Time Use Surveys, identifying differences in the time use lexicon, computed commuting times, and computed times including intermediate activities. To the best of our knowledge, this paper is the first empirical exploration of the daily behaviors of workers focusing on what else workers do while commuting to work and from work. The main finding of the paper is methodological, as we propose an alternative way to identify commuting episodes, and we contribute to the empirical base, since we report differences in commuting time definitions, asymmetries in morning and evening commutes, and intermediate activities, and explore the individual attributes correlated with these intermediate activities.

The results report quantitative differences depending on the definition of commuting, as the computed time of commuting is about 24.5% longer than the TUS lexicon definition, whereas intermediate activities represent 30.6% of the time spent going from home to work and back. Furthermore, different definitions of commuting appear to be correlated differentially with worker characteristics, but not to urban forms. We also focus on the asymmetry of commuting behaviors and intermediate activities, and on gender differences. Results show that most of the intermediate activities done while commuting are concentrated during commuting from work to home - normally evening commutes - which has an impact

on gender differences. Leisure activities, and activities related to shopping are the most common activities done while commuting during the evening, and this produces a non-statistically significant gender difference in bulk commuting times. Despite that, men still spend more time commuting in the morning, and the overall commuting time gender gap, measured in minutes per day, depends on the definition of commuting. We also study the characteristics related to time in intermediate activities, net of observed heterogeneity.

The paper has certain limitations. First, the ATUS is a cross-sectional database, and so we cannot estimate any causal relationship, since results are subject to unobserved heterogeneity. Thus, all the results should be interpreted as conditional correlations. To date, no time use surveys are constructed as panel databases, and so this limitation cannot be addressed. Another limitation lies in the fact that we only consider the American Time Use Survey; future research should analyze different countries using national time use surveys, or data from the Multinational Time Use Study of the Centre for Time Use Research (Fisher et al., 2019). Finally, the ATUS data does not include time use information on secondary activities (i.e., activities done at the same time as the main activity). Thus, we cannot completely capture the intermediate activities, nor commuting times, and results should be interpreted as lower bounds for the actual times in both intermediate activities and commuting.

Despite these limitations, researchers and planners may consider the results to be of interest. From an academic point of view, it should be analyzed whether the negative consequences of commuting on worker outcomes (e.g., psychological wellbeing, health, productivity, etc.) remain robust to the definition of commuting. This represents a challenge, since surveys collecting commuting time from stylized questions (such as National Travel Surveys, the Panel Study of Income Dynamics, the European Working Conditions Surveys, the British Household Panel Survey, and the German Socio-Economic Panel study) are limited in this task. On the other hand, planners and policy makers should consider our results in the design of transport policies. Commutes seem sensitive to intermediate activities, especially during the evening, not so much in the morning. This could be applied to public transport infrastructure, or road policies. For instance, if stops are more likely at certain hours, policies related to parking rates, or temporary traffic control policies could be adopted, depending on the city requirements. Public services and shops could also consider

these results, as commuters seem more likely to stop and do chores in the evening rather than in the morning.

Further research should build on this work, as it opens doors for several contributions. In addition to studying commuting and intermediate activities using other time use databases, we report gender differences in commuting and intermediate activities. The genesis of these differences, including what activities drive them and how they contribute to individuals' welfare, however, remains unexplored. For instance, it is unclear whether intermediate activities represent an increase in worker satisfaction or, conversely, those activities are not enjoyable, which could create intrahousehold inequalities. The impact of intermediate activities during extreme commuting behaviors should also be studied, as these activities should be especially important in longer commuting trips. The composition of intermediate activities while commuting, and differences in terms of human capital should also be studied, as the results indicate that having attended College or University is among the main determinants of the time spent in intermediate activities.

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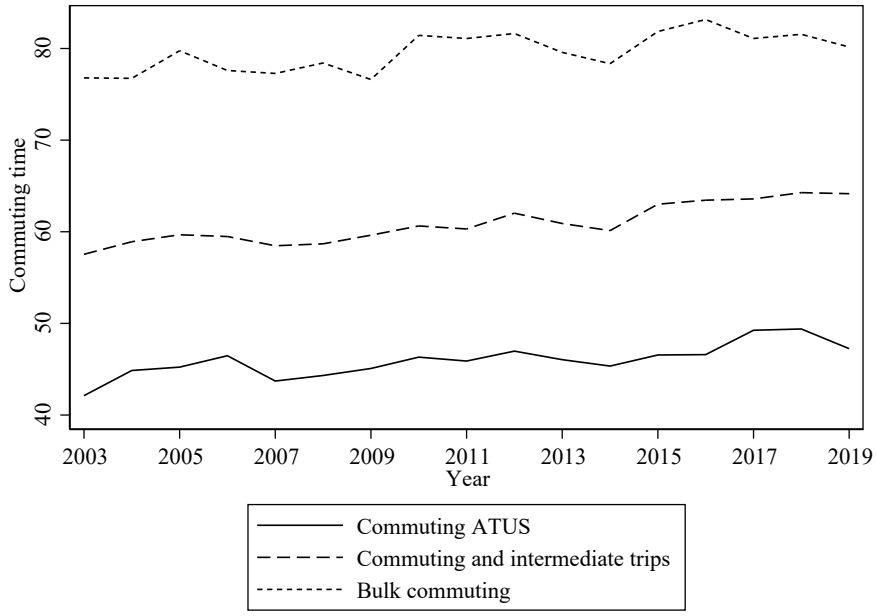
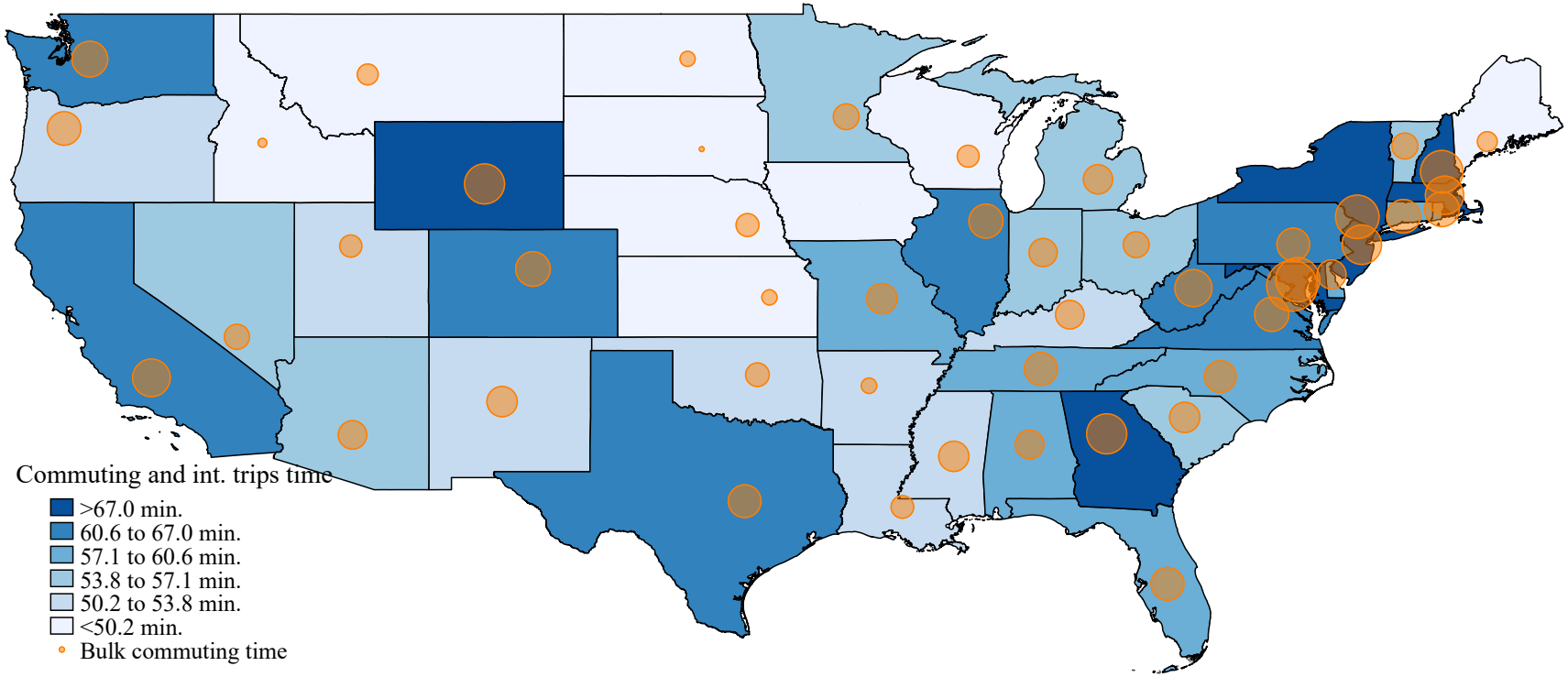
Figure 1. The evolution of commuting time



Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Commuting is measured in minutes per day. *Commuting ATUS* includes commuting episodes only. *Commuting and intermediate trips* includes all the trip intermediate activities. *Bulk commuting* includes trip and non-trip intermediate activities.

Figure 2. The map of average commuting time, by state



Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Commuting is measured in minutes per day. Commuting time represents *commuting and intermediate trips*, and is classified in six groups in terms of quantiles. Bulk commuting varies from 58.26 to 109.34 minutes per day, and symbol sizes are proportional to average state bulk commuting values. Alaska and Hawaii are omitted from the map for the sake of legibility.

Table 1. Commuting time, by definition

VARIABLES	(1) Mean	(2) S.Dev.
Commuting ATUS	46.071	(40.834)
Commuting and intermediate trips	61.033	(45.398)
Commuting bulk	79.734	(68.478)
N. Individuals	42,682	

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Commuting is measured in minutes per day *Commuting ATUS* includes commuting episodes only. *Commuting and intermediate trips* includes all the trip intermediate activities. *Bulk commuting* includes trip and non-trip intermediate activities.

Table 2. Estimates of commuting time

	(1)	(2)	(3)	(4)	(5)	(6)
	Commuting ATUS		*Commuting and intermediate trips*		*Bulk commuting*	
VARIABLES	Coeff.	S.Error	Coeff.	S.Error	Coeff.	S.Error
Sociodemographics						
Being male	5.671***	(0.551)	2.118***	(0.630)	-0.245	(1.009)
Age	0.370**	(0.165)	0.690***	(0.182)	0.664**	(0.281)
Age squared	-0.037*	(0.020)	-0.076***	(0.021)	-0.080**	(0.033)
Being white	-2.649***	(0.715)	-4.426***	(0.863)	-2.646**	(1.232)
Being native	-3.400***	(0.837)	-3.019***	(0.957)	-1.274	(1.357)
Being hispanic	1.583*	(0.927)	1.628	(1.020)	0.003	(1.490)
Education: high school	-1.910	(1.862)	1.409	(2.185)	3.627	(2.794)
Education: college	0.786	(1.973)	6.373***	(2.294)	13.268***	(2.996)
Living in couple	4.276***	(0.842)	0.998	(0.926)	-3.133**	(1.365)
Couple employed	-4.151***	(0.773)	-1.126	(0.856)	-0.276	(1.239)
Family size	0.714*	(0.380)	0.043	(0.428)	-1.271**	(0.640)
Number of kids	-1.529***	(0.458)	0.628	(0.509)	1.143	(0.746)
Age of youngest kid	0.054	(0.052)	0.025	(0.058)	-0.012	(0.087)
Tenure: owned	1.027	(0.643)	1.438*	(0.760)	2.455**	(1.124)
House/apartment	-2.175	(1.337)	-1.764	(1.390)	-1.165	(2.012)
Labor and income variables						
Household income	0.041***	(0.009)	0.048***	(0.010)	0.078***	(0.015)
Weekly work hours	0.199***	(0.033)	0.054	(0.044)	0.098	(0.060)
Public sector employee	-2.287***	(0.675)	-2.935***	(0.744)	-4.101***	(1.164)
Self-employed worker	6.515	(3.577)	4.964	(3.882)	14.649**	(5.893)
Part-time worker	-0.237	(0.978)	-2.988**	(1.179)	-2.092	(1.695)
Metropolitan information						
Metropolitan center	-2.484*	(1.370)	-1.103	(1.971)	-0.874	(2.827)
Metropolitan fringe	-0.315	(1.234)	0.720	(1.892)	-0.061	(2.676)
MSA size: 180K	0.505	(1.511)	-1.829	(2.069)	-1.542	(3.006)
MSA size: 330K	1.888	(1.356)	1.144	(2.063)	0.587	(2.904)
MSA size: 750K	3.205**	(1.334)	2.826	(1.977)	1.682	(2.784)
MSA size: 1750K	9.771***	(1.245)	9.258***	(1.933)	6.767**	(2.690)
MSA size: 3750K	10.362***	(1.362)	9.340***	(1.999)	9.010***	(2.818)
State fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Occupation fixed effects	Yes		Yes		Yes	
Constant	22.212***	(4.924)	41.948***	(5.825)	61.697***	(8.513)
N. Observations	42,682		42,682		42,682	
R-squared	0.084		0.079		0.048	

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. *Commuting ATUS* includes commuting episodes only. *Commuting and intermediate trips* includes all the trip intermediate activities. *Bulk commuting* includes trip and non-trip intermediate activities. *** Significant at the 99% level; ** significant at the 95% level; * significant at the 90% level.

Table 3. Time devoted to commuting to/from work

	(1)	(2)	(3)	(4)	(5)
	Commuting and intermediate trips		*Bulk commuting*		*Difference*
VARIABLES	Mean	S.Dev.	Mean	S.Dev.	Diff.
Commutes to work	28.503	(23.541)	32.818	(32.070)	4.315***
Commutes from work	32.530	(29.790)	46.916	(54.272)	14.386***
Difference from-to	4.027***		14.098***		10.071***
N. Individuals	42,682		42,682		

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Commutes are measures in minutes per day. *Commuting and intermediate trips* includes all the trip intermediate activities. *Bulk commuting* includes trip and non-trip intermediate activities.

Table 4. Time spent in intermediate activities while commuting

	(1)	(2)	(3)	(4)	(5)
	To work		*From work*		*Difference*
VARIABLES	Mean	S.Dev.	Mean	S.Dev.	Diff.
Leisure	0.884	(8.778)	4.785	(26.194)	3.901***
Childcare	0.588	(4.242)	0.866	(7.301)	0.278***
Unpaid work	0.136	(3.636)	0.531	(5.945)	0.395***
Personal care	0.271	(4.924)	0.673	(7.313)	0.402**
Purchasing goods	0.623	(5.560)	3.083	(12.765)	2.460***
Using services	0.037	(1.349)	0.062	(1.542)	0.025***
N. Individuals	42,682		42,682		

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Time use defined in minutes per day. Intermediate activities are those included in *Bulk commuting*.

Table 5. Characteristics of bulk commuting episodes

	(1)	(2)	(3)	(4)	(5)
	To work		*From work*		*Difference*
VARIABLES	Mean	S.Dev.	Mean	S.Dev.	Diff.
Episodes per trip	2.406	(1.543)	2.875	(1.641)	0.469***
Composition of commutes					
Commuting/trip episodes	0.857	(0.350)	0.802	(0.398)	-0.055***
Leisure episodes	0.014	(0.117)	0.034	(0.180)	0.020***
Childcare episodes	0.051	(0.219)	0.031	(0.173)	-0.020***
Personal care episodes	0.005	(0.068)	0.010	(0.101)	0.005***
Unpaid work episodes	0.004	(0.062)	0.011	(0.106)	0.007***
Purchasing episodes	0.034	(0.181)	0.067	(0.249)	0.033***
Services episodes	0.001	(0.036)	0.002	(0.043)	0.001***
Other type of episode	0.035	(0.183)	0.043	(0.204)	0.008***
Duration of episodes					
Commuting episode duration	17.989	(18.936)	17.302	(21.132)	-0.687***
Leisure episode duration	0.558	(6.728)	2.544	(18.306)	1.986***
Childcare episode duration	0.371	(3.262)	0.461	(5.141)	0.090***
Personal care episode duration	0.171	(3.679)	0.358	(5.003)	0.187***
Unpaid work episode duration	0.086	(2.886)	0.279	(4.207)	0.193***
Purchasing episode duration	0.393	(4.338)	1.640	(9.108)	1.247***
Services episode duration	0.023	(1.069)	0.033	(1.114)	0.010*
N. Episodes	69,909		82,116		

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Duration of episodes is measured in minutes per day.

Table 6. The determinants of time in intermediate activity

	(1)	(2)	(3)	(4)	(5)	(6)
	General		*To work*		*From work*	
VARIABLES	Coeff.	S.Error	Coeff.	S.Error	Coeff.	S.Error
Sociodemographics						
Being male	-2.363***	(0.692)	0.194	(0.274)	-2.557***	(0.633)
Age	-0.026	(0.179)	-0.154*	(0.087)	0.128	(0.155)
Age squared	-0.004	(0.021)	0.018*	(0.010)	-0.022	(0.018)
Being white	1.781**	(0.778)	0.057	(0.322)	1.724**	(0.709)
Being native	1.746**	(0.830)	-0.125	(0.377)	1.870**	(0.736)
Being hispanic	-1.625*	(0.942)	-0.699*	(0.393)	-0.925	(0.858)
Education: high school	2.217	(1.460)	1.296**	(0.573)	0.921	(1.326)
Education: college	6.896***	(1.644)	1.753***	(0.640)	5.142***	(1.505)
Living in couple	-4.131***	(0.864)	-0.115	(0.387)	-4.017***	(0.760)
Couple employed	0.850	(0.764)	-0.101	(0.375)	0.951	(0.645)
Family size	-1.314***	(0.424)	-0.267*	(0.154)	-1.048***	(0.400)
Number of kids	0.516	(0.481)	0.669***	(0.185)	-0.153	(0.446)
Age of youngest kid	-0.037	(0.056)	-0.009	(0.025)	-0.028	(0.049)
Tenure: owned	1.016	(0.702)	0.587**	(0.297)	0.429	(0.628)
House/apartment	0.599	(1.301)	-0.525	(0.617)	1.124	(1.140)
Labor and income variables						
Household income	0.030***	(0.009)	0.006	(0.004)	0.024***	(0.008)
Weekly work hours	0.044	(0.032)	0.041**	(0.017)	0.004	(0.027)
Public sector employee	-1.166	(0.795)	-0.923***	(0.290)	-0.244	(0.735)
Self-employed worker	9.685**	(3.906)	2.262	(1.400)	7.422**	(3.630)
Part-time worker	0.896	(1.057)	1.725***	(0.490)	-0.829	(0.919)
Metropolitan information						
Metropolitan center	0.229	(1.778)	0.721	(0.952)	-0.492	(1.502)
Metropolitan fringe	-0.781	(1.652)	0.292	(0.921)	-1.072	(1.373)
MSA size: 180K	0.287	(1.847)	-0.230	(0.975)	0.517	(1.563)
MSA size: 330K	-0.557	(1.779)	-1.427	(0.920)	0.870	(1.525)
MSA size: 750K	-1.144	(1.737)	-0.451	(0.959)	-0.693	(1.448)
MSA size: 1750K	-2.491	(1.638)	-1.256	(0.865)	-1.235	(1.396)
MSA size: 3750K	-0.330	(1.733)	-0.819	(0.892)	0.489	(1.489)
State fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Occupation fixed effects	Yes		Yes		Yes	
Constant	19.749***	(5.334)	5.429**	(2.314)	14.320***	(4.789)
N. Observations	42,682		42,682		42,682	
R-squared	0.021		0.007		0.021	

Note: Robust standard errors available upon request. The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. The dependent variable is the time spent in intermediate activities while commuting. *** Significant at the 99% level; ** significant at the 95% level; *significant at the 90% level.

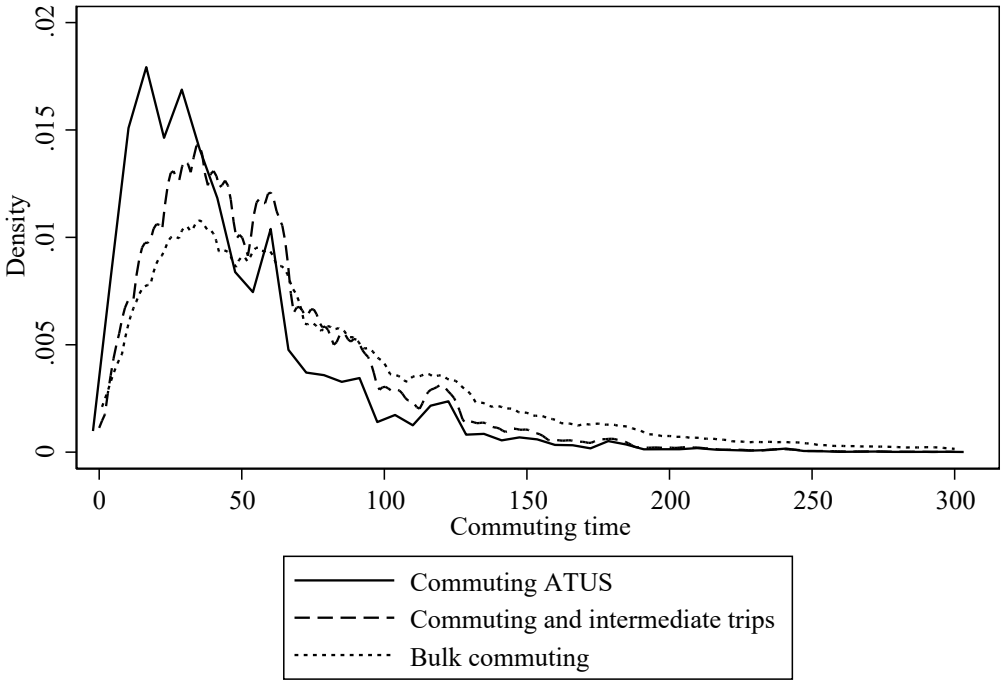
Table 7. Gender differences in commuting trips

	(1)	(2)	(3)	(4)	(5)
	Men		*Women*		*Gender diff.*
VARIABLES	Mean	S.Dev.	Mean	S.Dev.	Diff.
Commuting and intermediate trips	58.059	(41.597)	63.473	(48.157)	5.414***
Bulk Commuting	78.588	(65.638)	80.675	(70.710)	2.087***
Difference *Bulk commuting- Commuting and intermediate trips*	20.529***		17.202***		
Commuting and intermediate trips to work	27.352	(21.882)	29.448	(24.781)	2.096***
Bulk commuting to work	31.556	(29.798)	33.854	(33.786)	2.298***
Difference *Bulk commuting- Commuting and intermediate trips*	4.204***		4.406***		
Commuting and intermediate trips from work	30.707	(25.973)	34.025	(32.514)	3.318***
Bulk Commuting from work	47.032	(52.731)	46.821	(55.506)	-0.211
Difference *Bulk commuting- Commuting and intermediate trips*	16.325***		12.796***		
ACTIVITIES WHILE COMMUTING					
Leisure to work	0.777	(7.773)	0.973	(9.523)	0.196**
Leisure from work	4.938	(26.099)	4.660	(26.271)	-0.278
Difference *from-to*	4.161***		3.687***		
Purchasing goods to work	0.714	(6.154)	0.549	(5.019)	-0.165***
Purchasing goods from work	4.372	(15.670)	2.026	(9.630)	-2.346***
Difference *from-to*	3.658***		1.477***		
N. Individuals	20,822		21,860		

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Commutes are measured in minutes per day. *Commuting and intermediate trips* includes all the trip intermediate activities. *Bulk commuting* includes trip and non-trip intermediate activities.

Appendix A: Additional results

Figure A1: K-density estimates of commuting times



Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded.

Table A1: Summary statistics of individual characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Full sample		*Women*		*Men*		*Difference*
VARIABLES	Mean	S.Dev.	Mean	S.Dev.	Mean	S.Dev.	Diff.
Male	0.549	0.498	-	-	-	-	-
Age	40.848	12.255	41.430	12.361	40.371	12.146	-1.059***
White	0.823	0.382	0.807	0.394	0.836	0.370	0.029***
Black	0.110	0.312	0.127	0.333	0.096	0.294	-0.031***
Native	0.818	0.386	0.842	0.365	0.798	0.402	-0.044***
Hispanic	0.165	0.371	0.144	0.351	0.183	0.386	0.039***
Immigrant	0.182	0.386	0.158	0.365	0.202	0.402	0.044***
Education: school	0.019	0.137	0.012	0.107	0.025	0.157	0.013***
Education: high school	0.616	0.486	0.602	0.489	0.627	0.484	0.025***
Education: college	0.365	0.481	0.386	0.487	0.348	0.476	-0.038***
Living in couple	0.641	0.480	0.610	0.488	0.667	0.471	0.057***
Couple employed	0.486	0.500	0.518	0.500	0.460	0.498	-0.058***
Family size	3.064	1.473	2.979	1.442	3.134	1.494	0.155***
Number of kids	0.812	1.113	0.780	1.082	0.838	1.138	0.058***
Age of youngest kid	3.172	5.038	3.337	5.166	3.037	4.927	-0.300***
Tenure: owned	0.709	0.454	0.717	0.450	0.703	0.457	-0.014***
House/apartment	0.962	0.192	0.963	0.189	0.961	0.195	-0.002
Household income	71.678	42.352	70.652	42.392	72.519	42.302	1.867***
Weekly work hours	42.439	10.872	39.606	10.297	44.763	10.780	5.157***
Weekly earnings	9.242	6.467	7.809	5.611	10.418	6.873	2.609***
Private sector employee	0.826	0.379	0.791	0.407	0.855	0.352	0.064***
Public sector employee	0.166	0.372	0.204	0.403	0.134	0.341	-0.070***
Self-employed worker	0.008	0.090	0.006	0.076	0.010	0.101	0.004***
Part-time worker	0.119	0.324	0.184	0.388	0.066	0.247	-0.118***
Metropolitan center	0.262	0.440	0.261	0.439	0.262	0.440	0.001*
Metropolitan fringe	0.583	0.493	0.582	0.493	0.583	0.493	0.001
Non-metropolitan	0.156	0.362	0.156	0.363	0.155	0.362	-0.001
MSA size	1.390	1.260	1.378	1.259	1.399	1.262	0.021
N. Individuals	42,682		20,822		21,860		

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. Household income is defined in US dollars, divided by 1,000. Weekly earnings are defined in US dollars, divided by 100. T-type test p-values for the differences between women and men in parentheses. *** Significant at the 99% level; ** significant at the 95% level; * significant at the 90% level.

Table A2: Additional gender differences in intermediate activity times

	(1)	(2)	(3)	(4)	(5)
	Women		*Men*		*Gender diff.*
ACTIVITIES WHILE COMMUTING	Mean	S.Dev.	Mean	S.Dev.	Diff.
Childcare to work	0.909	5.012	0.325	3.465	-0.584***
Childcare from work	1.246	7.901	0.554	6.753	-0.692***
Difference from-to	0.337***		0.229***		
Personal care to work	0.322	5.191	0.229	4.694	-0.093*
Personal care from work	1.025	9.079	0.385	5.436	-0.640
Difference from-to	0.703***		0.156***		
Unpaid work to work	0.102	2.112	0.164	4.517	0.062*
Unpaid work from work	0.570	5.607	0.499	6.208	-0.071
Difference from-to	0.468***		0.335***		
Using services to work	0.030	1.141	0.043	1.498	0.013
Using services from work	0.074	1.635	0.051	1.462	-0.023
Difference from-to	0.044***		0.008		
N. Individuals	20,822		21,860		

Note: The sample (ATUS 2003-2019) is restricted to employees who worked the diary day. Telecommuters are excluded. T-type test p-values for the differences in parentheses.