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ABSTRACT

Elderly's Mobility to and from Work in the US: Metropolitan Status and Population Size*

This paper explores the mobility patterns of elder workers in the United States, with a focus on mobility to and from work (e.g., commuting) across metropolitan areas and metropolitan population sizes. Using detailed time diaries from the American Time Use Survey for the years 2003-2018, estimates reveal a positive correlation between the time spent commuting and residing in metropolitan areas, which is also driven by longer commutes in more populated metropolitan areas. Furthermore, elder workers in metropolitan areas of more than 2.5 million inhabitants use more public transports in their commuting trips than similar workers in less-populated or non-metropolitan areas. The analysis presented here may allow policy makers to identify which elder workers may be more affected by the negative consequences of commuting, and also which groups of elder workers have more limitations in their commuting behaviors.

JEL Classification: R40, J14

Keywords: commuting time, elder workers, metropolitan areas, population size, American Time Use Survey

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1. Introduction

Millions of workers commute to/from work as part of daily routines, with commuting being among the most important trips in workers' daily activity. For instance, in the US workers spend on average 27.1 minutes per working day in commuting travel[1], and one out of five workers in Europe spend more than 90 minutes commuting each day, equivalent to a distance of about 29 km (SD Worx 2018). Furthermore, commuting time has been linked to several negative outcomes for workers. For instance, previous research has shown links between longer commutes and decreased health outcomes (Hansson et al., 2011; van Ommeren and Gutierrez-i-Puigarnau, 2011; Kunn-Nelen, 2016; Goerke and Lorenz, 2018), lower subjective and psychological wellbeing (Kahneman et al., 2004; Kahneman and Krueger, 2006; Roberts, Hodgson and Dolan, 2011; Dickerson, Hole and Munford, 2014;) and increased stress (Gottholmseder et al., 2009; Wener et al., 2003; Frey and Stutzer, 2008; Novaco and Gonzalez, 2009). Given its importance, commuting to/from work plays a central role in daily mobility planning, and the analysis of commuting behavior is important for the correct design of mobility policies.

Demographic ageing has become a generalized phenomenon in most developed countries, and one important (among others) aspect of ageing is the ability to satisfy the mobility necessities, which includes commuting when workers are close to retirement. Apart from the aforementioned general negative consequences of commuting, ageing often implies some loss of functional abilities and thus stricter capacity constraints for mobility, and the physical constraints that come into play in commuting (e.g., Hägerstrand, 1970; Schwanen and Dijst 2002; Gimenez-Nadal and Molina, 2014; Beige and Axhausen, 2017) may affect differently to different groups of elder workers (e.g., males vs females, rural vs rural workers). Thus, the analysis of commuting patterns of elder workers is relevant in order to identify which elder workers may be more affected by the negative consequences of commuting, and also which groups of elder workers have more limitations in their commuting behavior.

Under this framework, we aim to analyze the commuting patterns of elder workers in the US, with a focus on differences in these patterns across metropolitan areas and population sizes of the area of residence. Urban/rural status, metropolitan size, and geographical characteristics

[1] https://www.census.gov/library/visualizations/interactive/work-travel-time.html

of the areas of residence have been found to shape commuting patterns of workers, though these relationships have been found to be complex (van Acker and Witlox, 2011). The dynamics of urban forms have been found to have an impact on home and work location, income, and job access, leading to differences in worker commuting behaviors (Manaugh et al., 2010; Burger et al., 2011; Hu and Schneider, 2017; Ma et al., 2017). Integration policies and infrastructures in rural areas have also been found to produce changes in worker commutes (Cavallaro and Dianin, 2019). Furthermore, housing prices, urban and geographical characteristics, and availability of public transport have also been found to have an impact on commuting times (Cropper and Gordon, 1991; Manning, 2003; Rouwendal and Nijkamp, 2004; Naess, 2006; Susilo and Maat, 2007; Deding, Filges and Van Ommeren, 2009; Sandow and Westin, 2010; McQuaid and Chen, 2012; Santos et al., 2013; Gimenez-Nadal, Molina and Velilla, 2018a; Mitra and Saphores, 2019; Gimenez-Nadal, Molina and Velilla, 2020).

We analyze the different relationships emerging among commuting time, transport mode, and metropolitan characteristics for US workers aged 55 years or more, using the American Time Use Survey data from years 2003-2018. The results suggest that workers in metropolitan areas commute longer than workers in non-metropolitan areas, with further differences emerging within metropolitan areas, with a positive dependence on population sizes. Furthermore, elder workers in largely populated metropolitan areas commute more by public transport than similar workers in less-populated areas. We contribute to the study of commuting behaviors of elder workers, by analyzing the relevance of metropolitan status and the metropolitan population size, on the one hand, and the daily minutes spent commuting and the mode of transport chosen for daily commutes, on the other. The results reveal significant differences in commuting times, but only small differences in commuting modes, mostly driven by public modes of transport, between workers in metropolitan and non-metropolitan areas.

The remaining of the paper is structured as follows. Section 2 introduces the ATUS data, the sample, and the variables used in the analysis. Section 3 describes the empirical strategy, and Section 4 shows the main results. Finally, Section 5 concludes.

2. Data and variables

We use data from the American Time Use Survey (ATUS), for the years 2003 to 2018. The ATUS data provides us with socioeconomic variables about respondents, but also with 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 collecting transport times, such as National Travel Surveys based on stylized questionnaires, is that diaries produce more reliable and accurate estimates (Bonke, 2005; Yee-Kan, 2008). Thus, time use diaries have become the gold standard in the analysis of worker daily behaviors (e.g., Aguiar and Hurst, 2007, 2009; Guryan et al., 2008; Harms et al., 2019). 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 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).[2]

We select elder workers, defined as those who report to be employed or self-employed at the time of the diary and are 55 years old or elder (Velilla, Molina and Ortega, 2018). Furthermore, given that commuting is inherently associated to working days, we restrict the sample to workers who filled their diaries on working days, defined as those days in which workers spend more than 60 minutes in paid work activities excluding commuting (Gimenez-Nadal, Molina and Velilla, 2018a, 2018b). Individuals with missing information on the variables used in the analysis are omitted, and we also exclude workers who filled their diaries during holidays, to avoid a potential source of bias arising from atypical days. These restrictions leave a sample of 11,112 individuals, of whom 5,697 are males, and 5,415 are females. From those workers, 4,514 male and 4,401 female workers report positive time in commuting in the time of the survey, with the remaining workers reporting zero commuting.

The main dependent variable is the commuting time of workers, which is defined at the diary level in terms of the activity code 180501 ("commuting to/from work"). In the way the variable is computed, the commuting time represents two-way commuting, measured in minutes per day. The variables of interest in the analysis are the metropolitan status where workers reside,

[2] Despite the fact that the ATUS survey has been conducted since 2003, it constitutes a cross-sectional database, where the same respondents are not interviewed every year. Therefore, it is not a panel database.

and the population size of the Metropolitan Statistical Area (MSA) of residence.[3] The ATUS data allows us to identify whether individuals reside in metropolitan areas or non-metropolitan areas, using the 1990 Census of Population and Housing classification. Furthermore, the ATUS data includes information about the population size of the MSA where respondents reside, or "the population size of the metropolitan area in which a household is located", conditional on residing on a metropolitan area. This variable is defined as "MSA size", and takes the following values: 0) not identified or non-metropolitan; 2) 100,000-249,999; 3) 250,000-499,999; 4) 500,000-999,999; 5) 1,000,000-2,499,999; 6) 2,500,000-4,999,999; 7) 5,000,000+.

Figure 1 shows the evolution of average commuting time in the period covered by the sample, considering elder workers living in metropolitan or non-metropolitan areas. The evolution of average commuting time in metropolitan areas follows an increasing "inverted-U" shape, varying between 35 and 45 minutes per day throughout the period. In non-metropolitan areas, average commutes are shorter than in metropolitan areas (except for 2009 and 2010), and also follow a "inverted-U" shape. Furthermore, Figure 1 suggests that average commutes of elder workers in non-metropolitan areas have decreased during the last decade, while decrease is not so clear in metropolitan areas. Specifically, in metropolitan areas, the average commuting in 2003 was 37.8 minutes per day, vs 40.7 minutes in 2010, with the raw difference being not significant at standard levels ($p = 0.166$), and vs 38.6 minutes in 2018, with neither the difference respect 2003, nor respect 2010, being statistically significant ($p = 0.731$, $p = 0.415$, respectively).[4] For workers in non-metropolitan areas, on the other hand, the respective average commutes are estimated to be 25.6 minutes in 2003, 44.6 minutes in 2010, and 23.5 minutes in 2018. Differences between 2003 and 2010, and between 2010 and 2018 are significant at standard levels ($p < 0.001$, and $p = 0.008$, respectively), while the difference between 2003 and 2018 is not significant at standard levels ($p = 0.533$).

[3] Metropolitan areas are defined as "counties or groups of counties centering on a substantial urban area. While the Census Bureau's terminology for metropolitan areas and the classification of specific areas changes over time, the general concept is consistent: a metropolitan area consists of a large population center and adjacent communities that have a high degree of economic and social interaction. Metropolitan areas often cross state lines." This information is not directly collected by the ATUS survey, but added to the data by the US Census Bureau. Information about the specific MSA in which respondents reside is not available in the full ATUS data (only for the period 2003-2015), but information about MSA sizes is available for the full sample period.

[4] For some individuals included in the 2003 ATUS, the information refers to the year 2002. However, given the limited sample size for this year (e.g., 209 respondents), we use 2003 as reference year for statistical comparisons.

Table 1 shows the average commuting time of workers aged 55 years or more, by non-metropolitan/metropolitan area.[5] Previous research has shown that male and female workers have different commuting behaviors, with women having shorter commutes in terms of both distance and time (Giuliano, 1979; White, 1986; Crane, 2007; Mok, 2007; Sandow and Westin, 2010; Gimenez-Nadal and Molina, 2016), and thus all the analyses are done by gender. The average commuting time of female elder workers residing in non-metropolitan areas is 24.7 minutes per day, while their counterparts have ana average commuting time of 36.3 minutes per day. The difference in the time devoted to commuting by female elder workers by metropolitan status is 11.6 minutes per day, and statistically significant at standard levels, according to a t-type test. In the case of male elder workers, the average commuting time is 36.0 and 42.5 minutes in non-metropolitan and metropolitan areas, respectively, with a statistically significant (at standard levels) difference of 6.5 minutes. These average values suggest that male workers in metropolitan areas face the longest daily commutes, followed by female workers in metropolitan areas, and by males and females in non-metropolitan areas.

If we analyze the proportion of workers who commute in a daily basis (e.g., proportion of elder workers that report positive commuting time), Table 1 shows that the 81.6 (79.3) percent of females (males) in non-metropolitan areas report positive commuting time, while the 84.5 (82.9) percent of elder workers commute in metropolitan areas. Differences are not significant among females, while they are significant at the 95% for males, which suggests that male workers aged 55 years or more telework more in metropolitan areas than in non-metropolitan areas.

Furthermore, the ATUS data allows us to compute the mode of transport of commuting episodes.[6] We consider the following modes of transport: by private vehicle ("Car, truck, or motorcycle"), active mode of transport ("walking" and "bicycle"), by public transport ("bus", "subway/train", "boat/ferry" and "taxi/limousine"), and by other/non-identified modes of transport. Given that all commuting episodes of workers in the sample has information on the mode of transport, we can compute the total time commuting in each mode of transport, out of total commuting time, obtaining the proportion of commuting that is done by car, public transport, active mode of transport, or other/non-identified mode of transport. Panel B of Table 1 shows the average rates of transport modes for those who report positive commuting time in

[5] All the statistics and estimates are computed using sample weights provided by the ATUS data.

[6] See https://www.atusdata.org/atus/ for a description of the available categories.

the day of the survey. According to the sample, the most common commuting mode is by private vehicle, as more the 90 percent of the commuting time is done by car, truck or motorcycle, which is consistent with previous analysis (Gimenez-Nadal and Molina, 2019). In this sense, among females in (non) metropolitan areas, the (93.5) 91.1 percent of the commuting time is spend in a private vehicle, (3.7) 3.0 percent in active modes of transport, and (0.6) 3.2 percent in public transport modes. These figures indicate that females in non-metropolitan areas use their private vehicles more than their counterparts in metropolitan areas, while the latter use more the public transport, according to t-type tests.[7] For males, on the other hand, trends are similar. The (94.0) (92.1) percent of the commuting time of males in (non) metropolitan areas is by private vehicle, vs the (2.8) (3.1) percent in active modes of transport, and the (0.5) 2.4 percent in public transport, with differences between the two not being statistically significant at standard levels.

Table 2 shows the differences, and its statistical significance, in average commuting time among the different MSA sizes. Specifically, taking as reference the MSA indicated in each column, we display the raw difference in the average commuting between the MSA size of the column, and the MSA size of the corresponding row. For example, and considering as reference the average commuting time in MSAs of less than 249,999 inhabitants, among women there is a difference of -1.4 minutes per day respect women in MSAs between 250,000 and 499,999 inhabitants, with such difference being not statistically significant at standard levels. However, the difference in average commuting time between women in MSAs of less than 249,999 inhabitants, and in MSAs of more than 5,000,000 inhabitants, is of 17.5 minutes per day, with this difference being statistically significant at standard levels. All in all, and focusing on elder female workers (Panel A), the results suggest the existence of a positive correlation between commuting times and MSA sizes, as not only differences become larger when the difference in MSA population increases, but also the p-values decrease, then increasing the significance of such differences. Furthermore, Table 2 suggests that the larger differences for women emerge in densely populated MSAs, as the largest differences, and also the most significant, are found between female workers in MSAs of more than 5,000,000 inhabitants, and the remaining MSAs. Despite of that, the differences between other MSAs sizes are also statistically significant, but quantitatively smaller.

[7] The percentage of individuals commuting walking or cycling is not different at statistical standard levels.

Panel B of Table 2 shows similar statistics on elder male workers. Consistent with elder female workers, the differences suggest the existence of a positive and highly significant correlation between commuting time and MSA sizes. However, in the case of males, such correlation seems more homogeneous, oppositely to the case of female workers. The smaller differences are estimated to emerge between males in MSAs of less than 249,999 inhabitants, and 250,000-499.999 inhabitants, for whom the difference is statistically null. For the remaining MSA sizes, there seems to be gradually increases in average commuting time of about 3-4 minutes per day, with the largest difference being found between workers in MSAs of less than 249,999 inhabitants, and workers in MSAs of more than 5,000,000 inhabitants, with a raw difference of 16.7 minutes per day.

Despite such differences in commuting behavior between metropolitan and non-metropolitan elder workers are interesting, such differences are only raw differences, and there may be a wide range of factors driving them. Thus, we define several socio-economic variables from the ATUS data, at the individual level, which are classical controls when studying individuals' time allocations and commuting times (e.g., Aguiar and Hurst, 2007; Sevilla, Gimenez-Nadal and Gershuny, 2012; Gimenez-Nadal, Molina and Velilla, 2018a), and that will be taken into account in next Sections. At the individual level, we define workers age, measured in years. For education, we consider three dummy variables in terms of the maximum level of formal education achieved by respondents: primary education, secondary education, and University education. We also define a dummy variable identifying individuals who are white (vs non-white), and Spanish/Hispanic/Latin respondents. We also consider whether respondents are native citizens born in the US (value 1) or immigrants (value 0).

The composition of the household has also been found to be an important determinant of commuting time, especially for women (Hanson and Johnston, 1985; Johnston, 1992; Lee and McDonald, 2003; McQuaid and Chen, 2012; Gimenez-Nadal and Molina, 2016). We define a dummy variable that identifies individuals cohabiting with a partner (vs singles), a dummy that identifies whether the partner is employed (as dual-earner households are positively related to commuting, Mok, 2007; McQuaid and Chen, 2012), the number of children, and the number of individuals in the family unit. We also identify respondents who work as employees in the public sector, and workers who are self-employed (vs private sector employees), and a dummy that identifies full-time workers, as labor characteristics may have an impact on commuting behaviors of workers (van Ommeren and van der Straaten, 2008; McQuaid and Chen, 2012; Gimenez-Nadal, Molina and Velilla, 2018a; Albert, Casado-Díaz and Simón, 2019). We additionally define whether respondents' residence is a house/apartment/flat (value 1, 0 otherwise), and whether it is owned (value 1) or not, as housing and tenure may be correlated to daily commutes (Naess, 2006; Ross and Zenou, 2008; Deding, Filges, and Van Ommeren, 2009; Mitra and Saphores, 2019). Summary statistics of these variables, by gender and metropolitan status, are shown in Table A1 in the Appendix.

We must highlight that workers in different occupations may show different commuting behaviors (e.g., Hanson and Johnston, 1985; Gordon, Kumar and Richardson, 1989), so it is important to take into account workers' occupation when studying commuting times. The ATUS data allows us to identify the occupation in which individuals work, including the following (original) categories: 1) Management, business and financial occupations. 2) Professional and related occupations. 3) Service occupations. 4) Sales and related occupations. 5) Office and administrative support occupations. 6) Farming, fishing and forestry occupations. 7) Construction and extraction occupations. 8) Installation, maintenance and repair occupations. 9) Production occupations. 10) Transport and material moving occupations. The distribution of workers across occupations is shown in Table A2 in the Appendix.[8]

3. Empirical strategy

We aim to explore the existence of different commuting behaviors among elder workers according to their metropolitan status and the MSA size. To that end, we first focus on commuting times, and estimate a linear regression model using the Ordinary Least Squares (OLS) method, on the log-of-commuting time, as follows:

$$\log(1 + C_i) = \beta_0 + \beta_M M_i + \beta_X X_i + \alpha + \varepsilon_i, \quad (1)$$

where C_i represents the minutes of commuting of worker "*i*"; M_i the dummy that identifies workers in metropolitan areas (value 1; 0 otherwise). X_i is a vector of socio-demographics, housing and labor attributes characteristics, α is a vector of year, state and occupation fixed

[8] Despite the range of socioeconomic factors collected in the ATUS survey, we must acknowledge some omitted variable bias, as some factors that may affect worker daily commuting trips cannot be captured from time use survey (e.g., workers' objective health, weather and road conditions, or transport infrastructure).

effects; and ε_i the error term. Equation (1) is estimated by OLS, and separately for elder male and female workers. The vector X_i includes the following controls: ages, education, race, being a native worker, the cohabiting status, the employment status of the partner, the number of children, the number of individuals in the family unit, family income, dummies for being a public sector worker, a self-employed, and a full-time worker, the number of agreed work hours per week, whether the residence is a house/apartment/flat, and the tenure status (owned or bought). For education, the reference category is "primary education". We also control for the day of the week in which diaries are filled in as commuting may be different in weekdays and weekends. All the estimates include robust standard errors to account for potential heteroskedasticity, and are computed using sample weights. We have analyzed potential multicollinearity among the variables included as control regressors; variance inflation factors (VIFs) reveal no multicollinearity, with the overall VIF = 1.94, and no VIF greater than 5, which is often chosen as the standard threshold together with 10 (Kutner, Nachtsheim and Neter, 2004; Sheather, 2009).

Equation (1) may reveal differences between workers in metropolitan and non-metropolitan areas. However, prior research has documented that population density is related with worker's commute behavior in general terms (e.g., Gimenez-Nadal, Molina and Velilla, 2018a; 2020). Therefore, we estimate the following equation:

$$\log(1 + C_i) = \beta_0 + \beta_S S_i + \beta_X X_i + \alpha + \varepsilon_i, \qquad (2)$$

where, now, S_i represents a vector of MSA size category dummies, where the category "0) not identified or non-metropolitan" is taken as the reference category. It is important to remark that we could not include the dummy M_i and the vector S_i in the same equation, as MSA sizes are defined as "not identified or non-metropolitan" for those workers in non-metropolitan areas (e.g., for whom $M_i = 0$), thus leading to a multicollinearity issue.[9] Again, all the estimates include robust standard errors to account for potential heteroskedasticity, and are computed using sample weights.

[9] Commuting time may be zero for some workers, and then censored regression models, such as the Tobit model (Tobin, 1958), may be preferable over OLS estimates. However, prior applied research on commuting time and time use has documented that OLS and Tobit estimates provide similar results and equivalent conclusions (Frazis and Stewart, 2012; Gershuny, 2012; Foster and Kalenkoski, 2013). For the shake of consistency, we use OLS estimates for the analyses shown in this paper. Table A3 in the Appendix shows the main estimates of Equations (1) and (2) using Tobit models. The results are robust to the main estimates.

The second objective of the analysis is to explore the modes of transport for commuting (Murphy, 2009; Habib, 2012), with a focus on the differences between metropolitan and non-metropolitan areas, and in terms of population sizes for workers in metropolitan areas. In doing so, we estimate Equations (3) and (4):

$$R_i = \beta_0 + \beta_M M_i + \beta_X X_i + \alpha + \varepsilon_i, \tag{3}$$

$$R_i = \beta_0 + \beta_M S_i + \beta_X X_i + \alpha + \varepsilon_i, \tag{4}$$

where R_i represents the rate of commuting mode of worker "*i*" by private vehicle, the rate of active commuting, and the rate of commuting by public transport. The remaining variables are defined analogously to Equations (1) and (2), and equations are estimated separately for each of the commuting modes analyzed. Again, all the estimates include robust standard errors to account for potential heteroskedasticity, and are computed using sample weights.

4. Results

4.1 Commuting time and metropolitan status

Table 2 shows the main estimates of Equations (1) and (2). Columns (1) and (3) show estimates of Equation (1) for women and men, respectively, while Columns (2) and (4) show analogous estimates of Equation (2). Focusing on the main explanatory variables, among elder female workers, living in a metropolitan area is positive and statistically significantly correlated with commuting time at the 99% level of confidence. In particular, those who live in metropolitan areas commute about 26.9 percent more than similar workers in non-metropolitan areas, net of observable characteristics. Among males, the coefficient is also positive and statistically significant at the 99% level of confidence, and indicates that elder male workers in metropolitan areas commute, on average, about 20.5 percent more than their counterparts in non-metropolitan areas. These coefficients are not different between women and men, according to a t-type test ($p = 0.495$), which suggests that the correlation between daily commuting time and metropolitan status is similar for both female and male workers aged 55 or more.

If we analyze differences in commuting times arising from different MSA sizes across metropolitan areas, Columns (3) shows that, for elder female workers, and considering that the reference group are women in non-metropolitan areas, residing in a MSA with a population size between 100,000 and 249,999 inhabitants is not correlated to commuting time in a significant way. Then, non-metropolitan areas and MSAs with a low population size do not differ in the commuting behavior of their inhabitants. However, estimates for the remaining set of dummy variables are all positive and statistically significant at standard levels. For instance, with differences ranging between +24.3 percent among workers in areas with 250,000-499,999 inhabitants, and +42.1 percent among workers in MSAs with more than 5 million inhabitants, relative to elder female workers in non-metropolitan areas. These coefficients suggest the existence of a positive and highly significant correlation between commuting times and MSA sizes.

Among elder male workers, results are similar, but the correlation seems smaller than among females. For instance, results suggest a non-statistically significant difference in commuting times among elder male workers in non-metropolitan areas, and elder male workers in MSAs of 100,000-249,999 and 250,000-499,999 inhabitants. However, males in MSAs of 500,000-999,999 inhabitants commute about 20 percent more than workers in non-metropolitan areas, with differences increasing to about 30 percent for workers in MSAs between 1 million and 5 million inhabitants, and 35.6 percent more for workers in MSAs of more than 5 million inhabitants. Again, these coefficients suggest the existence of a positive and highly significant correlation between commuting times and MSA sizes.

Taking together, these results are consistent with prior analyses showing differences in commuting patterns according to the urban characteristics of the place of residence (e.g., Cropper and Gordon, 1991; Manning, 2003; Rouwendal and Nijkamp, 2004; Naess, 2006; Susilo and Maat, 2007; Deding, Filges and Van Ommeren, 2009; Manaugh, Miranda-Moreno and El-Geneidy, 2010; Sandow and Westin, 2010; McQuaid and Chen, 2012; Gimenez-Nadal, Molina and Velilla, 2018a; Mitra and Saphores, 2019; Jin, 2019).

For the remaining set of explanatory variables, estimates show a negative and statistically significant correlation between ages and commuting time, which especially significant for males, while for females it marginally significant at the 90% confidence level. Educations and race are not statistically significant. However, being a native US citizen shows a negative and statistically significant correlation with commuting times, only for male workers, while it is not statistically significant for females. Regarding the family composition, most of the coefficients are not statistically significant at standard levels, except for the number of children and the number of family unit members, who are negative and positive correlated with commuting time, respectively, and significant at the 90% only among females. Household income, and working in the public sector are not statistically significant at standard levels, while self-employed workers seem to commute shorter times than their employee counterparts, consistent with van Ommeren and van der Straaten (2008) and Gimenez-Nadal, Molina and Velilla (2018a,2020). Furthermore, elder full-time male workers appear to commute more than their part-time counterparts, while the associated coefficient is not statistically significant for females. Weekly work hours are correlated positively to commuting times for both male and female old workers, while housing stock variables are not statistically significant among females, while males who own a home (relative to individuals who live in rented residences) commute longer.

We have conducted some robustness checks. For instance, estimates using censored regressions (e.g., Tobit estimates) are shown in Table A3, in the Appendix, and results are consistent to results in Table 3. Table A4 shows estimates of the main coefficients when the sample is restricted to commuter workers only (e.g., workers reporting zero commuting time are omitted), and Table A5 shows estimates restricted to workers who commute by private vehicle (car, truck or motorcycle). All the results are robust to the main estimates shown in Table 2.

Table A6 shows equivalent estimates to Table 3, but controlling for the mode of transport. Additional coefficients are available upon request. The results suggest that controlling for the mode of transport has a moderating impact on the relationship between commuting times and metropolitan characteristics, especially for elder male workers, although the correlations between metropolitan status, MSA sizes, and commuting times are still positive and statistically significant. Furthermore, the more commuting by private vehicle, public transport mode, or active mode of transport, the longer commuting time, relative to commutes by other or unidentified means of transport. Nevertheless, as there may be reverse causality between commuting times and the mode of transport chosen for those commutes, these results should be interpreted cautiously due to potential endogeneity.

Finally, to compute potential differences between metropolitan and non-metropolitan areas, in terms of the commuting mode, we interact the metropolitan dummy and the rates of commuting by transport mode. That way, these interactions report the differences in commuting time by metropolitan and non-metropolitan areas arising from different transport modes, beyond the raw differences in commuting between workers in metropolitan and non-metropolitan areas, and the direct impact of transport modes on commuting times. These estimates are shown in Table A7 in the Appendix, and suggest that the correlation between commuting time and metropolitan status of the area of residence differs by transport modes, as for males there is an additional positive correlation between private vehicle commutes, active commutes, and commuting times in metropolitan areas, relative to the commuting time of similar commuters in non-metropolitan areas, net of observed heterogeneity, metropolitan status, and commuting mode. For females, only the interaction between the metropolitan status and the rate of private vehicle commuting is statistically significant at standard levels. In summary, we find suggestive evidence that private vehicle commuters (and male active commuters) of metropolitan areas commute longer than similar commuters in non-metropolitan areas.

4.2 Modes of transport and metropolitan characteristics

Table 4 shows the main estimates of Equation (3), where we analyze the relationship between metropolitan status and the choice of commuting mode. Columns (1), (2), and (3) show the results for elder female workers regarding rates of commuting in private vehicle, active commuting, and public transport, respectively. Columns (4), (5), and (6) show analogous estimates for elder male workers. The main coefficients of interest, those associated to the dummy that identifies workers in metropolitan areas (relative to workers in non-metropolitan areas), are all not statistically significant at standard levels, except for that corresponding to the rate of commuting by public transport of male workers. Specifically, this suggests that the rate of commuting by public transport among male elder workers is about 0.7% higher in metropolitan areas than the correspondent rate in non-metropolitan areas, net of worker observable attributes, although this coefficient is marginally statistically significant and thus we cannot assert that there is a robust correlation between metropolitan status and mode of transport.

Considering the rest of explanatory variables, estimates indicate that white female (male) workers tend to commute more by private vehicle (active commute) than non-whites, while both white male and female old workers commute less by public transport than their non-white counterparts. Similarly, native elder workers tend to commute more by car, while native elder female workers do less active commute or commute less by public transport than the similar non-native female worker. Among elder female workers, cohabitation status seems also relevant as female workers cohabiting with a couple tend to commute more by private vehicle, and less by public transport, while these coefficients are all not statistically significant among elder female workers. However, if the couple is employed, that seems to be significant only for elder male workers, as those whose partner is employed commute less by private vehicle, and more actively. Transport modes appear not to depend on the self-employment status of individuals, contrarily to commuting times which were highly dependent on the labor force status. The only statistically significant correlation is for elder male self-employed workers commuting less by public transport than their employee counterparts. Similarly, full-time employment status is not statistically significant at standard levels in all columns except for females' rate of active commuting, as estimate suggest that elder full-time female workers commute less actively than their part-time counterparts. Working hours and the type of housing unit seem not being statistically significant, while living in an owned or bought home (relative to living in a rented house) is statistically significant, and positively correlated to private vehicle commuting, but negatively correlated to active commuting and commuting by public transport, for both elder male and female workers.

Table 5 shows the main estimates of Equation (4), where we analyze the relationship between MSA sizes and the choice of commuting mode. The coefficients associated to sociodemographic controls are similar to those estimated in Table 4 and, for the shake of brevity, such coefficients are omitted from the main results. Coefficients for the additional explanatory variables are available upon request. Oppositely to estimates in Table 3, Table 4 points to some highly significant differences in the choice of commuting model across the population size of the corresponding MSA.

Among elder female workers we observe that there is a lower use of private vehicles for commuting in metropolitan areas of 2,500,000-4,999,999, and 5,000,000 or more inhabitants, relative to other metropolitan areas and non-metropolitan areas. However, this seems not to impact the rates of active commuting, as the metropolitan size dummies are all not significant in Column (2) where the rate of active commuting is analyzed. Instead, elder female workers in metropolitan areas of more than 2,500,000 inhabitants commute more by public transport, given the positive and statistically significant coefficients associated to those two dummies in Column (3). This evidence suggests that among elder female workers, private vehicle is more used as transport mode to/from work in non-metropolitan areas, and medium and small metropolitan areas, while elder female workers in densely populated metropolitan areas tend to commute more by public transport than their counterparts in non-densely populated metropolitan areas.

Regarding the modes of transport of elder male workers, estimated do not suggest any clear pattern between transport modes and MSA population sizes. For instance, the only significant coefficient in the estimates on males' rate of commuting by private vehicle is that associated to MSAs between 5,000,000 and 999,999 inhabitants, which is positive and statistically significant at the 95%. Similarly, this is the only significant (and negative) coefficient in Column (5). Finally, estimates on the rate of public transport are equivalent to the same estimates on elder female workers, as the results indicate that elder male workers in MSAs of more than 2,500,000 inhabitants commute more by public transport than similar male workers in less populated metropolitan areas, or in non-metropolitan areas.

5. Conclusions

This paper addresses the relationships among commuting time, transport mode, and metropolitan characteristics of elder workers in the US. Using unique information on time diaries from the American Time Use Survey for the period 2003-2018, we compute the minutes per day spent commuting, the rate of commuting done by private vehicle (car, truck, or motorcycle), active mode of transport (walking or cycling), or by public transport, and the metropolitan status of the place where workers reside, along with the population size of the corresponding MSA. The results suggest that elder workers in metropolitan areas commute longer times than their counterparts in non-metropolitan areas. Furthermore, there are differences across MSAs depending on the population sizes, which are estimated to be positively correlated to commuting times. Regarding transport modes, elder workers in metropolitan areas of more 2,500,000 inhabitants seem to commute more by public transport than the similar workers in less-populated or non-metropolitan areas.

The results shown here may be relevant for urban planners and policy makers, as we present evidence of the impact of living environment on older people as drivers, pedestrians/cyclists, and public transit riders. Given the negative consequences of commuting travel on elder's health and psychological outcomes, those who live in metropolitan and densely-populated area devote more time to commuting and such differences may lead to health inequalities among older workers. Furthermore, policy makers should target densely populated regions, as elder workers in those areas appear to be subject to longer commutes, with a corresponding impact on their daily lives. For instance, reduction of housing costs or policies favoring housing rentals may help to improve workers' residence location and, consequently, reduce their commuting trips. Moreover, MSA sizes are positively related to the use of public transport, but no differences are found in driving or active commuting, which may indicate that newer modality styles (e.g. car/bike-sharing schemes and Mobility as a Service (MaaS)) may have a limited impact on commuting patterns of older workers.

The analysis has certain limitations. First, as time use surveys are cross-sectional, the empirical analysis is limited to conditional correlations, as estimates may suffer from reverse causality and endogeneity. Thus, all the results should be interpreted as correlations, and not as causal links. Second, commuting time is a process that has been found to depend on non-observable and stochastic factors, thus the accuracy of the estimated models is limited, yet in line with a number of previous studies on commuting times (e.g., White, 1986; Rouwendal and Rietveld, 1994; Benito and Oswald, 1999; Van Ommeren, Rietveld and Nijkamp, 1999; Ross and Zenou, 2008; Van Ommeren and Van der Straaten, 2008; Gimenez-Nadal, Molina and Velilla, 2018a, 2020). See a detailed discussion about commuting and model accuracy in van Ommeren and van der Straaten (2008).

References

Aguiar, M., & Hurst, E. (2007). Measuring trends in leisure: The allocation of time over five decades. The Quarterly Journal of Economics, 122(3), 969-1006.

Aguiar, M., & Hurst, E. (2009). A summary of trends in American time allocation: 1965–2005. Social Indicators Research, 93(1), 57-64.

Albert, J. F., Casado‐ Díaz, J. M., & Simón, H. (2019). The commuting behaviour of self‐employed workers: Evidence for Spain. Papers in Regional Science, 98(6), 2455-2477.

Beige, S., & Axhausen, K. W. (2017). The dynamics of commuting over the life course: Swiss experiences. Transportation Research Part A: Policy and Practice, 104, 179-194.

Benito, A., & Oswald, A.J. (1999). Commuting in Great Britain in the 1990s. University of Warwick.

Bonke, J. (2005). Paid work and unpaid work: Diary information versus questionnaire information. Social Indicators Research, 70(3), 349-368.

Burger, M. J., de Goei, B., Van der Laan, L., & Huisman, F. J. (2011). Heterogeneous development of metropolitan spatial structure: Evidence from commuting patterns in English and Welsh city-regions, 1981–2001. Cities, 28(2), 160-170.

Cavallaro, F., & Dianin, A. (2019). Cross-border commuting in Central Europe: features, trends and policies. Transport Policy, 78, 86-104.

Crane, R. (2007). Is there a quiet revolution in women's travel? Revisiting the gender gap in commuting. Journal of the American Planning Association, 73(3), 298-316.

Cropper, M. L., & Gordon, P. L. (1991). Wasteful commuting: A re-examination. Journal of Urban Economics, 29(1), 2-13.

Deding, M., Filges, T., & Van Ommeren, J. (2009). Spatial mobility and commuting: The case of two- earner households. Journal of Regional Science, 49(1), 113-147.

Dickerson, A., Hole, A. R., & Munford, L. A. (2014). The relationship between well-being and commuting revisited: Does the choice of methodology matter? Regional Science and Urban Economics, 49, 321-329.

Foster, G., & Kalenkoski, C. M. (2013). Tobit or OLS? An empirical evaluation under different diary window lengths. Applied Economics, 45(20), 2994-3010.

Frazis, H., & Stewart, J. (2012). How to think about time-use data: What inferences can we make about long-and short-run time use from time diaries? Annals of Economics and Statistics, 105/106, 231-245.

Frey, B. S., & Stutzer, A. (2008). Stress that doesn't pay: The commuting paradox. Scandinavian Journal of Economics, 110, 339–366.

Gershuny, J. (2012). Too many zeros: A method for estimating long-term time-use from short diaries. Annals of Economics and Statistics, 105/106, 247-270.

Gimenez-Nadal, J. I., & Molina, J. A. (2014). Commuting time and labour supply in the Netherlands: A time use study. Journal of Transport Economics and Policy, 48(3), 409-426.

Gimenez-Nadal, J. I., & Molina, J. A. (2016). Commuting time and household responsibilities: Evidence using propensity score matching. Journal of Regional Science, 56(2), 332–359.

Gimenez-Nadal, J. I., & Molina, J. A. (2019). Daily feelings of US workers and commuting time. Journal of Transport & Health, 12, 21-33.

Gimenez-Nadal, J. I., Molina, J. A., & Velilla, J. (2018a). The commuting behavior of workers in the United States: Differences between the employed and the self-employed. Journal of Transport Geography, 66(1), 19-29.

Gimenez- Nadal, J. I., Molina, J. A., & Velilla, J. (2018b). Spatial distribution of US employment in an urban efficiency wage setting. Journal of Regional Science, 58(1), 141-158.

Gimenez-Nadal, J. A., Molina, J. A., & Velilla, J. (2020). Commuting and self-employment in Western Europe. Journal of Transport Geography, forthcoming.

Giuliano, G. (1979). Public transportation and the travel needs of women. Traffic Quarterly, 33(4), 607-616.

Goerke, L., & Lorenz, O. (2018). Commuting and sickness absence. IZA Discussion Paper No. 11183.

Gordon, P., Kumar, A., & Richardson, H. W. (1989). Gender differences in metropolitan travel behaviour. Regional Studies, 23(6), 499-510.

Gottholmseder, G., Nowotny, K., Pruckner, G. J., & Theurl, E. (2009). Stress perception and commuting. Health Economics, 18, 559-576.

Guryan, J., Hurst, E., & Kearney, M. (2008). Parental education and parental time with children. Journal of Economic Perspectives, 22(3), 23-46.

Habib, K. M. N. (2012). Modeling commuting mode choice jointly with work start time and work duration. Transportation research part A: Policy and practice, 46(1), 33-47.

Hägerstrand, T. (1970). Tidsanvändning och omgivningsstruktur. Statens offentliga utredningar, 14, 4.

Hanson, S. & Johnston, I. (1985). Gender differences in work trip lengths: Implications and explanations. Urban Geography, 6(3), 193-219.

Hansson, E., Mattisson, K., Björk, J., Östergren, P. O., & Jakobsson, K. (2011). Relationship between commuting and health outcomes in a cross-sectional population survey in southern Sweden. BMC public health, 11(1), 834.

Harms, T., Berrigan, D., & Gershuny, J. (2019). Daily metabolic expenditures: estimates from US, UK and polish time-use data. BMC Public Health, 19(2), 453.

Hofferth, S.L., Flood, S.M., Sobek, M., & Backman, D. (2020) American Time Use Survey Data Extract Builder: Version 2.8. College Park, MD: University of Maryland and Minneapolis, MN: IPUMS.

Hu, L., & Schneider, R. J. (2017). Different ways to get to the same workplace: How does workplace location relate to commuting by different income groups? Transport Policy, 59, 106-115.

Jin, J. (2019). The effects of labor market spatial structure and the built environment on commuting behavior: considering spatial effects and self-selection. Cities, 95, 102392.

Johnston, I. (1992). The influence of household type on gender differences in work trip distance. The Professional Geographer, 44(2), 161-169.

Kahneman, D., & Krueger, A. B. (2006). Developments in the measurement of subjective well-being. Journal of Economic Perspectives, 20(1), 3-24.

Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The day reconstruction method. Science, 306(5702), 1776-1780.

Kunn‐ Nelen, A. (2016). Does commuting affect health? Health Economics, 25(8), 984-1004.

Kutner, M. H., Nachtsheim, C. J., & Neter, J. (2004). *Applied Linear Regression Models* (4th ed.). McGraw-Hill Irwin.

Lee, B. S., & McDonald, J. F. (2003). Determinants of commuting time and distance for Seoul residents: The impact of family status on the commuting of women. Urban Studies, 40(7), 1283-1302.

Ma, X., Liu, C., Wen, H., Wang, Y., & Wu, Y. J. (2017). Understanding commuting patterns using transit smart card data. Journal of Transport Geography, 58, 135-145.

Manaugh, K., Miranda-Moreno, L.F., & El-Geneidy, A.M. (2010). The effect of neighbourhood characteristics, accessibility, home–work location, and demographics on commuting distances. Transportation, 37(4), 627–646

Manning, A. (2003). The real thin theory: monopsony in modern labour markets. Labour economics, 10(2), 105-131.

McQuaid, R. W., & Chen, T. (2012). Commuting times: The role of gender, children and part-time work. Research in Transportation Economics, 34(1), 66-73.

Mitra, S. K., & Saphores, J. D. M. (2019). Why do they live so far from work? Determinants of long-distance commuting in California. Journal of Transport Geography, 80, 102489.

Mok, D. (2007). Do two-earner household base their choice of residential location on both incomes? Urban Studies, 44(4), 723-750.

Murphy, E. (2009). Excess commuting and modal choice. Transportation Research Part A: Policy and Practice, 43(8), 735-743.

Naess, P. (2006). Urban structure matters: residential location, car dependence and travel behaviour. Routledge.

Novaco, R. W., & Gonzalez, O. I (2009). Commuting and well-being. In: Amichai-Hamburger, Y. (Ed.), Technology and Psychological Well-Being. Cambridge University Press, Cambridge, U.K., pp. 174–205.

Roberts, J., Hodgson, R., & Dolan, P. (2011). It's driving her mad: Gender differences in the effects of commuting on psychological health. Journal of Health Economics, 30(5), 1064–1076.

Ross, S. L., & Zenou, Y. (2008). Are shirking and leisure substitutable? An empirical test of efficiency wages based on urban economic theory. Regional Science and Urban Economics, 38(5), 498-517.

Rouwendal, J., & Nijkamp, P. (2004). Living in two worlds: A review of home‐ to‐ work decisions. Growth and Change, 35(3), 287-303.

Sandow, E., & Westin, K. (2010). Preferences for commuting in sparsely populated areas: The case of Sweden. Journal of Transport and Land Use, 2(3/4), 87-107.

Santos, G., Maoh, H., Potoglou, D., & von Brunn, T. (2013). Factors influencing modal split of commuting journeys in medium-size European cities. Journal of Transport Geography, 30(1), 127-137.

Schwanen, T., & Dijst, M. (2002). Travel-time ratios for visits to the workplace: the relationship between commuting time and work duration. Transportation Research Part A: Policy and Practice, 36(7), 573-592.

SD Worx (2018). More than 20% of Europeans Commute at Least 90 Minutes Daily. Available at https://www.sdworx.com/en/press/2018/2018-09-20-more-than-20percent-of-europeans-commute-at-least-90-minutes-daily.

Sevilla, A., Gimenez-Nadal, J. I., & Gershuny, J. (2012). Leisure inequality in the United States: 1965–2003. Demography, 49(3), 939-964.

Sheather, S. (2009). *A modern approach to regression with* R. New York, NY: Springer.

Susilo, Y. O., & Maat, K. (2007). The influence of built environment to the trends in commuting journeys in the Netherlands. Transportation, 34(5), 589-609.

Tobin, J. (1958). Estimation of relationships for limited dependent variables. Econometrica, 26(1), 24-36.

Van Acker, V., & Witlox, F. (2011). Commuting trips within tours: how is commuting related to land use? Transportation, 38(3), 465-486.

Van Ommeren, J. N., & Gutiérrez-i-Puigarnau, E. (2011). Are workers with a long commute less productive? An empirical analysis of absenteeism. Regional Science and Urban Economics, 41(1), 1-8.

Van Ommeren, J., Rietveld, P., & Nijkamp, P. (1999). Job moving, residential moving and commuting: A search perspective. Journal of Urban Economics, 46, 230-253.

Van Ommeren, J. N., & Van der Straaten, J. W. (2008). The effect of search imperfections on commuting behavior: Evidence from employed and self-employed workers. Regional Science and Urban Economics, 38(2), 127-147.

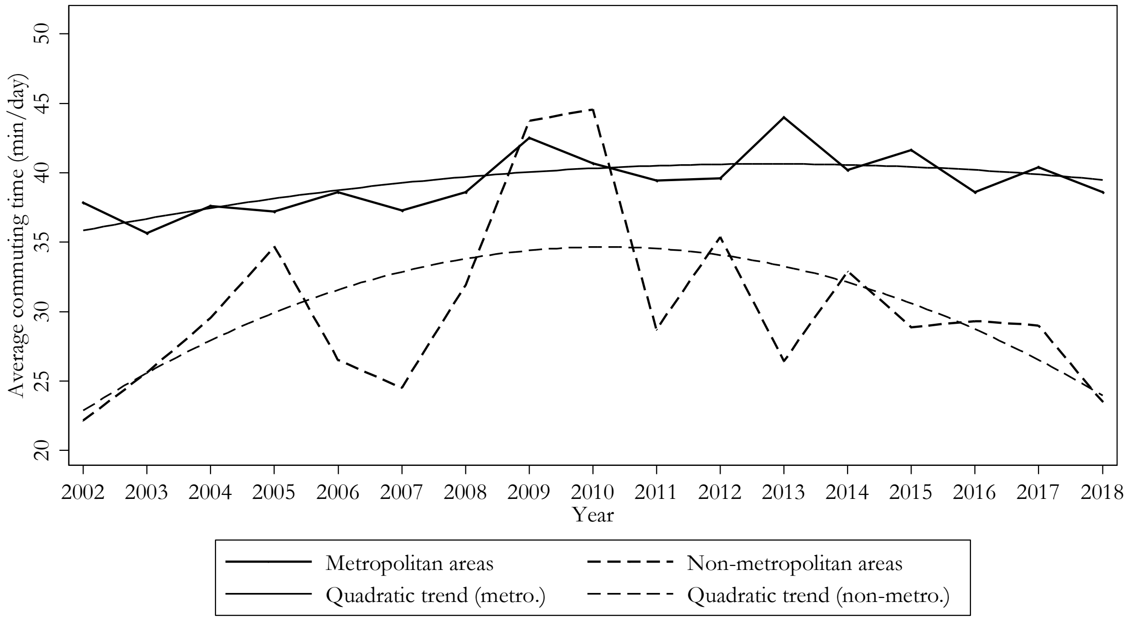
Velilla, J., Molina, J. A., & Ortega, R. (2018). Why elder workers become entrepreneurs? International evidence using fuzzy set methods. The Journal of the Economics of Ageing, 12(1), 88-95.

Wener, R. E., Evans, G. W., Phillips, D., Nadler, N. (2003). Running for the 7:45: The effects of public transit improvements on commuter stress. Transportation, 30, 203–220.

White, M. J. (1986). Sex differences in urban commuting patterns. American Economic Review, 76(2), 368-372.

Yee-Kan, M. (2008). Measuring housework participation: The gap between "stylised" questionnaire estimates and diary-based estimates. Social Indicators Research, 86(3), 381-400.

Figure 1: Evolution of commuting time



Note: The sample (ATUS 2003-2018) is restricted to employed workers and working days. Commuting time represents two-way commuting, measured in minutes per day. Averages computed using sample weights.

Table 1. Commuting time and mode of transport by metropolitan status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	FEMALES WORKERS						MALE WORKERS					
	Non-metropolitan		Metropolitan		Difference		Non-metropolitan		Metropolitan		Difference	
	Mean	S.D.	Mean	S.D.	Diff.	p-value	Mean	S.D.	Mean	S.D.	Diff.	p-value
A. *COMMUTING TIME*												
Commuting time	24.696	29.975	36.264	37.262	11.568	(<0.001)	35.997	49.626	42.454	44.017	6.457	(<0.001)
Commuter	0.816	0.388	0.845	0.362	0.029	(0.394)	0.793	0.405	0.829	0.376	0.036	(0.012)
Observations	996		4419				1024		4673			
B. *MODE OF TRANSPORT*												
By private vehicle	0.935	0.223	0.911	0.259	-0.024	(<0.001)	0.94	0.207	0.921	0.242	-0.019	(0.105)
Active commuting	0.037	0.179	0.03	0.146	-0.007	(0.452)	0.028	0.154	0.031	0.149	0.003	(0.615)
By public transport	0.006	0.067	0.032	0.151	0.026	(<0.001)	0.005	0.062	0.024	0.133	0.019	(<0.001)
By other transport mode	0.022	0.119	0.027	0.126	0.005	(0.422)	0.027	0.129	0.024	0.123	-0.003	(0.121)
Observations	800		3601				782		3732			

Note: The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. The rates of commuting by transport mode are defined only for workers reporting positive commuting time. Averages computed using sample weights. Commuting time is measured in minutes per day. Age is measured in years. Family income is measured in US dollars per year, divided by 1,000. Differences represent the raw difference, by gender, between averages in metropolitan areas and non-metropolitan areas; p-values in parentheses for the statistical significance of differences are computed using t-type tests.

Table 2. Differences in commuting time, by MSA size

MSA SIZES:	(1) 100,000- 249,999	(2) 250,000- 499,999	(3) 500,000- 999,999	(4) 1,000,000- 2,499,999	(5) 2,500,000- 4,999,999	(6) 5,000,000+
A) WOMEN						
100,000-249,999	0.000					
250,000-499,999	-1.412	0.000				
500,000-999,999	-3.491	-2.080	0.000			
1,000,000-2,499,999	-3.941**	-2.529	-0.449	0.000		
2,500,000-4,999,999	-6.916***	-5.504***	-3.424	-2.975*	0.000	
5,000,000+	-17.454***	-16.042***	-13.962***	-13.513***	-10.538***	0.000
B) MEN						
100,000-249,999	0.000					
250,000-499,999	-0.571	0.000				
500,000-999,999	-4.432**	-3.861*	0.000			
1,000,000-2,499,999	-7.910***	-7.339***	-3.478*	0.000		
2,500,000-4,999,999	-11.325***	-10.754***	-6.893***	-3.415*	0.000	
5,000,000+	-16.696***	-16.125***	-12.264***	-8.786***	-5.371**	0.000

Note: The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Statistics computed using sample weights. Differences represent the raw differences, by gender, between the average commuting time in the larger MSA size minus the average commuting time in the smaller MSA size. The statistical significance of differences are computed using t-type tests. *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table 3. Estimates on commuting time

	(1)	(2)	(3)	(4)
	WOMEN		MEN	
VARIABLES	Metrop.	MSA size	Metrop.	MSA size
Metropolitan area	0.269***	--	0.205***	-
	(0.064)		(0.068)	
MSA sizes:				
100,000-249,999	-	0.068	-	0.147
		(0.094)		(0.101)
250,000-499,999	-	0.243***	-	0.027
		(0.089)		(0.095)
500,000-999,999	-	0.233***	-	0.190**
		(0.087)		(0.095)
1,000,000-2,499,999	-	0.290***	-	0.332***
		(0.080)		(0.082)
2,500,000-4,999,999	-	0.261***	-	0.284***
		(0.092)		(0.094)
5,000,000+	-	0.421***	-	0.356***
		(0.095)		(0.098)
Age	-0.008	-0.008*	-0.013***	-0.013***
	(0.005)	(0.005)	(0.004)	(0.004)
Secondary ed.	-0.133	-0.122	-0.009	-0.012
	(0.116)	(0.116)	(0.099)	(0.099)
University ed.	-0.095	-0.093	-0.035	-0.045
	(0.117)	(0.117)	(0.102)	(0.102)
Race: white only	-0.119*	-0.100	-0.066	-0.048
	(0.063)	(0.063)	(0.073)	(0.073)
Spanish, Hispanic or Latino	0.126	0.119	0.124	0.109
	(0.099)	(0.097)	(0.089)	(0.090)
Native citizen born in US	-0.073	-0.056	-0.250***	-0.229***
	(0.079)	(0.080)	(0.081)	(0.081)
Cohabiting with a partner	-0.029	-0.024	0.057	0.063
	(0.071)	(0.071)	(0.073)	(0.073)
Partner employed	0.059	0.056	-0.063	-0.059
	(0.070)	(0.070)	(0.061)	(0.060)
Number of children	-0.127*	-0.128*	-0.093	-0.089
	(0.076)	(0.076)	(0.061)	(0.060)
Family size	0.068*	0.068*	0.038	0.033
	(0.039)	(0.039)	(0.040)	(0.040)
Family income	0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Public sector employee	-0.007	-0.001	0.045	0.058
	(0.056)	(0.057)	(0.062)	(0.061)
Self-employed worker	-1.071***	-1.070***	-0.612***	-0.612***
	(0.090)	(0.090)	(0.069)	(0.069)
Full time worker	0.064	0.064	0.172***	0.171***
	(0.056)	(0.056)	(0.062)	(0.062)
Weekly work hours	0.004*	0.004*	0.004*	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)
House, appartment, flat	0.037	0.035	0.017	0.007
	(0.123)	(0.123)	(0.136)	(0.137)
Tenure: owned or bought	0.007	0.018	0.149**	0.156**
	(0.069)	(0.069)	(0.075)	(0.075)
Constant	2.219***	2.269***	2.302***	2.336***
	(0.459)	(0.457)	(0.449)	(0.449)
Year F.E.	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes

Observations	5,415	5,415	5,697	5,697
R-squared	0.136	0.138	0.129	0.133

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Estimates computed using sample weights. The dependent variable is the log-of-commuting time. *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table 4. Estimates on transport mode

	(1)	(2)	(3)	(4)	(5)	(6)
		WOMEN			MEN	
VARIABLES	Rate private	Rate active	Rate public	Rate private	Rate active	Rate public
Metropolitan area	0.001	-0.008	0.006	0.005	-0.008	0.007*
	(0.011)	(0.009)	(0.004)	(0.011)	(0.008)	(0.004)
Age	-0.001	0.000	0.000	0.000	-0.001**	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Secondary ed.	0.021	-0.003	-0.011	0.022	-0.005	-0.013
	(0.024)	(0.015)	(0.014)	(0.020)	(0.011)	(0.013)
University ed.	0.021	-0.005	-0.010	0.011	0.007	-0.014
	(0.024)	(0.015)	(0.014)	(0.020)	(0.011)	(0.013)
Race: white only	0.045***	0.004	-0.048***	0.011	0.015**	-0.019**
	(0.015)	(0.008)	(0.010)	(0.013)	(0.006)	(0.008)
Spanish, Hispanic or Latino	-0.016	0.001	0.019	0.007	-0.002	-0.017
	(0.019)	(0.012)	(0.013)	(0.021)	(0.012)	(0.012)
Native citizen born in US	0.063***	-0.026**	-0.032**	0.033**	0.001	-0.018*
	(0.021)	(0.012)	(0.014)	(0.016)	(0.009)	(0.009)
Cohabiting with a partner	0.044***	-0.011	-0.017**	0.017	-0.011	0.001
	(0.013)	(0.008)	(0.008)	(0.014)	(0.009)	(0.007)
Partner employed	-0.003	0.007	-0.008	-0.018*	0.012*	-0.001
	(0.012)	(0.007)	(0.007)	(0.010)	(0.007)	(0.005)
Number of children	0.003	-0.002	0.000	0.015	-0.006	-0.004
	(0.015)	(0.010)	(0.010)	(0.013)	(0.006)	(0.006)
Family size	-0.006	-0.000	0.008	-0.004	-0.003	0.001
	(0.008)	(0.005)	(0.005)	(0.009)	(0.004)	(0.004)
Family income	-0.000	-0.000	0.000**	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Public sector employee	0.000	-0.000	-0.006	0.004	-0.003	0.003
	(0.011)	(0.007)	(0.006)	(0.012)	(0.007)	(0.007)
Self-employed worker	0.002	0.009	-0.006	0.004	0.006	-0.014***
	(0.016)	(0.011)	(0.007)	(0.011)	(0.008)	(0.004)
Full time worker	0.014	-0.020***	0.002	0.004	-0.005	0.010*
	(0.010)	(0.007)	(0.006)	(0.011)	(0.008)	(0.006)
Weekly work hours	-0.000	0.000	-0.000	0.000	0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
House, appartment, flat	-0.014	0.004	0.005	0.006	-0.013	0.004
	(0.021)	(0.016)	(0.005)	(0.023)	(0.019)	(0.010)
Tenure: owned or bought	0.065***	-0.023**	-0.031***	0.129***	-0.052***	-0.047***
	(0.016)	(0.010)	(0.009)	(0.020)	(0.013)	(0.013)
Constant	0.839***	0.043	0.081*	0.757***	0.145***	0.075
	(0.085)	(0.052)	(0.047)	(0.083)	(0.052)	(0.046)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,401	4,401	4,401	4,514	4,514	4,514
R-squared	0.098	0.056	0.120	0.079	0.051	0.075

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Workers who report zero commuting are excluded. Estimates computed using sample weights. The dependent variables are the rates of commuting by private vehicle (Columns (1) and (4)), active commuting (Columns (2) and (5)), and by public transport (Columns (3) and (6)). *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table 5. MSA size and transport mode

	(1)	(2)	(3)	(4)	(5)	(6)
		WOMEN			MEN	
VARIABLES	Rate private	Rate active	Rate public	Rate private	Rate active	Rate public
MSA sizes:						
100,000-249,999	0.015	-0.005	-0.002	0.023	-0.010	-0.000
	(0.016)	(0.013)	(0.004)	(0.015)	(0.012)	(0.005)
250,000-499,999	0.004	-0.009	0.006	-0.001	0.011	-0.004
	(0.014)	(0.009)	(0.006)	(0.018)	(0.014)	(0.006)
500,000-999,999	0.024*	-0.010	-0.007	0.026**	-0.015*	-0.003
	(0.014)	(0.011)	(0.006)	(0.012)	(0.008)	(0.005)
1,000,000-2,499,999	0.012	-0.011	-0.000	-0.004	0.005	0.003
	(0.014)	(0.010)	(0.006)	(0.013)	(0.010)	(0.006)
2,500,000-4,999,999	-0.035**	0.001	0.028***	-0.022	-0.012	0.021**
	(0.016)	(0.011)	(0.008)	(0.017)	(0.009)	(0.009)
5,000,000+	-0.086***	0.018	0.055***	-0.009	-0.010	0.035***
	(0.019)	(0.013)	(0.009)	(0.017)	(0.010)	(0.010)
Constant	0.817***	0.048	0.094**	0.759***	0.134**	0.086*
	(0.085)	(0.052)	(0.046)	(0.083)	(0.052)	(0.046)
Sociodemographics	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,401	4,401	4,401	4,514	4,514	4,514
R-squared	0.112	0.058	0.135	0.082	0.053	0.083

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Workers who report zero commuting are excluded. Estimates computed using sample weights. The dependent variables are the rates of commuting by private vehicle (Columns (1) and (4)), active commuting (Columns (2) and (5)), and by public transport (Columns (3) and (6)). *** Significant at the 99; ** significant at the 95; * significant at the 90.

Appendix A: Additional results

Table A1. Summary statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	FEMALES WORKERS						MALE WORKERS					
	Non-metropolitan		Metropolitan		Difference		Non-metropolitan		Metropolitan		Difference	
	Mean	S.D.	Mean	S.D.	Diff.	p-value	Mean	S.D.	S.D.	sd	Diff.	p-value
Age	60.783	5.344	60.689	5.161	-0.094	(0.040)	61.327	5.868	61.096	5.652	-0.231	(0.059)
Primary ed.	0.069	0.254	0.043	0.202	-0.026	(<0.001)	0.083	0.277	0.066	0.249	-0.017	(<0.001)
Secondary ed.	0.430	0.495	0.298	0.458	-0.132	(<0.001)	0.402	0.491	0.260	0.439	-0.142	(<0.001)
University ed.	0.500	0.500	0.659	0.474	0.159	(<0.001)	0.515	0.500	0.674	0.469	0.159	(<0.001)
Race: white only	0.903	0.296	0.837	0.370	-0.066	(<0.001)	0.925	0.264	0.865	0.341	-0.06	(<0.001)
Spanish, Hispanic, Latino	0.028	0.165	0.077	0.267	0.049	(<0.001)	0.041	0.199	0.095	0.293	0.054	(<0.001)
Native citizen born in US	0.966	0.181	0.863	0.344	-0.103	(<0.001)	0.956	0.205	0.847	0.360	-0.109	(<0.001)
Cohabiting with a partner	0.668	0.471	0.605	0.489	-0.063	(<0.001)	0.819	0.385	0.791	0.406	-0.028	(0.022)
Partner employed	0.425	0.495	0.404	0.491	-0.021	(0.095)	0.491	0.500	0.493	0.500	0.002	(0.359)
Number of children	0.101	0.447	0.122	0.453	0.021	(0.896)	0.161	0.579	0.192	0.578	0.031	(0.536)
Family size	2.022	0.894	2.186	1.055	0.164	(0.125)	2.227	0.979	2.407	1.137	0.18	(0.056)
Family income	56.402	37.050	75.544	42.746	19.142	(<0.001)	66.971	37.746	85.194	44.244	18.223	(<0.001)
Self-employed worker	0.172	0.378	0.112	0.315	-0.06	(<0.001)	0.272	0.445	0.217	0.412	-0.055	(<0.001)
Public sector employee	0.228	0.419	0.201	0.401	-0.027	(0.659)	0.152	0.359	0.144	0.352	-0.008	(0.553)
Full time worker	0.622	0.485	0.654	0.476	0.032	(0.024)	0.741	0.438	0.749	0.434	0.008	(0.380)
Housing: house, app., flat	0.906	0.291	0.974	0.160	0.068	(<0.001)	0.948	0.222	0.979	0.143	0.031	(<0.001)
Tenure: owned or bought	0.893	0.309	0.863	0.344	-0.03	(<0.001)	0.927	0.261	0.880	0.325	-0.047	(<0.001)
Observations	996		4419				1024		4673			

Note: The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. The rates of commuting by transport mode are defined only for workers reporting positive commuting time. Averages computed using sample weights. Commuting time is measured in minutes per day. Age is measured in years. Family income is measured in US dollars per year, divided by 1,000. Differences represent the raw difference, by gender, between averages in metropolitan areas and non-metropolitan areas; p-values in parentheses for the statistical significance of differences are computed using t-type tests.

Table A2. Percentage of individuals in occupation groups

	(1)	(2)	(3)	(4)
	WOMEN		MEN	
OCCUPATIONS	Non-metrop.	Metrop.	Non-metrop.	Metrop.
Management, business and financial occupations	16.2	17.9	22.6	23.7
Professional and related occupations	19.2	28.9	13.0	22.0
Service occupations	19.2	13.2	9.4	10.7
Sales and related occupations	11.7	10.0	9.3	10.3
Office and administrative support occupations	24.1	23.9	4.9	5.5
Farming, fishing and forestry occupations	1.0	0.1	0.9	0.5
Construction and extraction occupations	0.1	0.1	10.2	6.4
Installation, maintenance and repair occupations	0.2	0.2	8.5	5.7
Production occupations	6.4	4.0	10.8	7.0
Transport and material moving occupations	1.8	1.7	10.4	8.3

Note: The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Estimates computed using sample weights.

Table A3. Tobit main estimates

	(1)	(2)	(3)	(4)
	WOMEN		MEN	
VARIABLES	Metrop.	MSA size	Metrop.	MSA size
Metropolitan area	0.279***	-	0.245***	-
	(0.077)		(0.083)	
MSA sizes:				
100,000-249,999	-	0.062	-	0.183
		(0.112)		(0.121)
250,000-499,999	-	0.253**	-	0.030
		(0.105)		(0.115)
500,000-999,999	-	0.256**	-	0.230**
		(0.103)		(0.115)
1,000,000-2,499,999	-	0.304***	-	0.385***
		(0.094)		(0.098)
2,500,000-4,999,999	-	0.263**	-	0.296***
		(0.109)		(0.113)
5,000,000+	-	0.439***	-	0.370***
		(0.112)		(0.117)
Constant	1.541***	1.591***	1.587***	1.619***
	(0.552)	(0.550)	(0.546)	(0.546)
Sociodemographics	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes
Observations	5,415	5,415	5,697	5,697

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Workers who report zero commuting are omitted. Estimates computed using sample weights. The dependent variable is the log-of-commuting time. *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table A4. Main estimates on commuters

	(1)	(2)	(3)	(4)
	WOMEN		MEN	
VARIABLES	Metrop.	MSA size	Metrop.	MSA size
Metropolitan area	0.274***	-	0.113**	-
	(0.043)		(0.046)	
MSA sizes:				
100,000-249,999	-	0.073	-	0.037
		(0.066)		(0.068)
250,000-499,999	-	0.248***	-	-0.063
		(0.056)		(0.063)
500,000-999,999	-	0.186***	-	0.077
		(0.055)		(0.058)
1,000,000-2,499,999	-	0.288***	-	0.163***
		(0.052)		(0.052)
2,500,000-4,999,999	-	0.315***	-	0.262***
		(0.057)		(0.060)
5,000,000+	-	0.471***	-	0.346***
		(0.063)		(0.061)
Constant	3.307***	3.366***	3.470***	3.535***
	(0.284)	(0.281)	(0.286)	(0.285)
Sociodemographics	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes
Observations	4,401	4,401	4,514	4,514
R-squared	0.087	0.098	0.102	0.117

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Workers who report zero commuting are omitted. Estimates computed using sample weights. The dependent variable is the log-of-commuting time. *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table A5. Main estimates on private vehicle commuters

	(1)	(2)	(3)	(4)
	WOMEN		MEN	
VARIABLES	Metrop.	MSA size	Metrop.	MSA size
Metropolitan area	0.220***	-	0.096**	-
	(0.042)		(0.047)	
MSA sizes:				
100,000-249,999	-	0.080	-	0.064
		(0.066)		(0.070)
250,000-499,999	-	0.223***	-	-0.042
		(0.059)		(0.064)
500,000-999,999	-	0.160***	-	0.062
		(0.055)		(0.060)
1,000,000-2,499,999	-	0.278***	-	0.155***
		(0.052)		(0.053)
2,500,000-4,999,999	-	0.279***	-	0.260***
		(0.057)		(0.063)
5,000,000+	-	0.385***	-	0.283***
		(0.065)		(0.065)
Constant	3.016***	3.066***	3.448***	3.501***
	(0.297)	(0.294)	(0.288)	(0.288)
Sociodemographics	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes
Observations	3,762	3,762	3,901	3,901
R-squared	0.082	0.089	0.103	0.115

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Workers who do not commute by private vehicle are omitted. Estimates computed using sample weights. The dependent variable is the log-of-commuting time. *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table A6.: Estimates controlling for commuting mode

	(1)	(2)	(3)	(4)
	WOMEN		MEN	
VARIABLES	Metrop.	MSA size	Metrop.	MSA size
Metropolitan area	0.220***	-	0.071*	-
	(0.036)		(0.040)	
MSA sizes:				
100,000-249,999	-	0.038	-	-0.012
		(0.058)		(0.058)
250,000-499,999	-	0.196***	-	-0.052
		(0.051)		(0.055)
500,000-999,999	-	0.144***	-	0.048
		(0.051)		(0.052)
1,000,000-2,499,999	-	0.232***	-	0.138***
		(0.045)		(0.046)
2,500,000-4,999,999	-	0.240***	-	0.231***
		(0.051)		(0.057)
5,000,000+	-	0.376***	-	0.201***
		(0.057)		(0.055)
Rate of commuting by:				
Private vehicle	3.107***	3.112***	3.339***	3.340***
	(0.037)	(0.037)	(0.035)	(0.035)
Active commuting	2.343***	2.326***	2.585***	2.595***
	(0.109)	(0.108)	(0.111)	(0.112)
Public transport	4.568***	4.513***	4.691***	4.647***
	(0.121)	(0.121)	(0.123)	(0.121)
Constant	0.145	0.205	0.089	0.132
	(0.250)	(0.250)	(0.251)	(0.251)
Sociodemographics	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes
Occupation F.E.	Yes	Yes	Yes	Yes
Diary day F.E.	Yes	Yes	Yes	Yes
Observations	5,415	5,415	5,697	5,697
R-squared	0.710	0.711	0.744	0.747

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Estimates computed using sample weights. The dependent variable is the log-of-commuting time. *** Significant at the 99; ** significant at the 95; * significant at the 90.

Table A7. Interaction estimates

VARIABLES	(1) Women	(2) Men
Metropolitan area	0.007	-0.077
	(0.060)	(0.066)
Rate of commuting by:		
Private vehicle	2.903***	3.196***
	(0.060)	(0.069)
Active commuting	1.909***	2.196***
	(0.250)	(0.322)
Public transport	4.624***	4.048***
	(0.373)	(0.635)
Metropolitan *		
Private vehicle	0.257***	0.178**
	(0.069)	(0.076)
Active commuting	0.563**	0.477
	(0.275)	(0.338)
Public transport	-0.028	0.689
	(0.389)	(0.647)
Constant	0.321	0.234
	(0.251)	(0.256)
Sociodemographics	Yes	Yes
Year F.E.	Yes	Yes
State F.E.	Yes	Yes
Occupation F.E.	Yes	Yes
Diary day F.E.	Yes	Yes
Observations	5,415	5,697
R-squared	0.710	0.745

Note: Robust standard errors in parentheses. The sample (ATUS 2003-2018) is restricted to employed workers aged 55 or more, and working days. Estimates computed using sample weights. The dependent variable is the log-of-commuting time. *** Significant at the 99; ** significant at the 95; * significant at the 90.