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# ABSTRACT

## Two-Way Commuting: Asymmetries from Time Use Surveys*

Daily commuting of workers is a complex phenomenon that has attracted research attention for many years and, despite the significant literature acknowledging differences between morning and evening commuting, commuting to and from work are considered symmetric trips in much of the prior research. We explore the asymmetries in time spent commuting to and from work, in seven countries, using detailed time use records from the Multinational Time Use Study (MTUS). We focus on the duration, mode of transport, and timing of commuting trips, and we provide evidence on what socio-demographic characteristics are related to such asymmetries. We find that commutes to work (usually in the morning) last longer than commutes from work (usually in the afternoon or evening), although there are quantitative differences among countries. The timing of commuting also differs across countries, although commutes to work are more concentrated at certain hours in the morning than commutes from work. Our results may serve for a better design of public policies that take this heterogeneity into account in the commuting behavior of different population groups.

**JEL Classification:** R40, O57

**Keywords:** two-way commuting, commuting symmetries, time use survey, Multinational Time Use Study

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# 1. Introduction

The daily commuting of workers is a complex phenomenon that has attracted researchers' attention for many years, as commuting is very important in the daily lives of workers – in Europe, one out of five workers commute more than 90 minutes per day, and commuting times are increasing in many developed economies (Susilo and Maat, 2007; Kirby and LeSage, 2009; McKenzie and Rapino, 2009; Gimenez-Nadal, Molina and Velilla, 2018a).[1] Longer commutes have been related to decreased worker health outcomes (Hansson et al., 2011; Kunn-Nelen, 2016), lower subjective and psychological wellbeing (Kahneman et al., 2004; Kahneman and Krueger, 2006; Roberts, Hodgson and Dolan, 2011; Dickerson, Hole and Munford, 2014), increased sickness absenteeism (van Ommeren and Gutierrez-i-Puigarnau, 2011), increased stress (Wener et al., 2003; Frey and Stutzer, 2008; Gottholmseder et al., 2009; Novaco and Gonzalez, 2009), lower worker productivity (Gimenez-Nadal, Molina and Velilla, 2018b, 2020b; Grinza and Rycx 2020), and to significant effects on wages (Leigh, 1986; Crane, 2007; Ross and Zenou, 2008; Ruppert et al., 2009; Mulalic, Van Ommeren and Pilegaard, 2014; Le Barbanchon, Rathelot and Roulet, 2019).

Prior literature has identified a complex relationship between the commuting behavior of workers, and urban forms and geographic characteristics (Cropper and Gordon, 1991; Naess and Sandberg, 1996; Manning, 2003; Rouwendal and Nijkamp, 2004; Susilo and Maat, 2007; Deding, Filges and van Ommeren, 2009; Sandow and Westin, 2010; McQuaid and Chen, 2012, Naess et al., 2019, 2019b). There is a connection between the commuting behavior of workers and personal characteristics, including gender (Sandow, 2008; Dargay and Clark, 2012; Gimenez-Nadal and Molina, 2016), education (Rouwendal and Nijkamp, 2004; Dargay and Van Ommeren, 2005; Sandow and Westin, 2010), car ownership (Dargay and Clark, 2012; McQuaid and Chen, 2012), and employment type (van Ommeren and van der Straaten, 2008; McQuaid, 2009; McQuaid and Chen, 2012; Walks, 2014; Gimenez-Nadal, Molina and Velilla, 2018a, 2020a; Albert, Casado-Díaz and Simón, 2019).

Moreover, several authors have studied the environmental impact of commuting, with a focus on sustainable commuting modes, such as active commuting, the use of public

[1] https://www.sdworx.com/en/press/2018/2018-09-20-more-than-20percent-of-europeans-commute-at-least-90-minutes-daily

transport, carpooling (Chapman, 2007; Holian and Kahn, 2015; Gallo and Marinelly, 2020; Molina, Giménez-Nadal and Velilla, 2020), and road pricing as a way to alleviate traffic congestion and pollution during the morning (Coria and Zhang, 2015, 2017; Long and Szeto, 2019; Vosough, Poorzahedy and Lindsey, 2020). But with very few exceptions, such as the literature on road pricing for morning commutes, and despite studies acknowledging significant differences between morning and evening commuting (Coria and Zhang, 2017), commuting to and from work has been considered symmetric in much existing research, both in terms of distance travelled and time spent. Thus, this paper explores whether the time spent commuting to and from work is, in fact, symmetric, with a focus on the timing of these activities, the means of transport used, and the differences in duration of such trips. To the best of our knowledge, the asymmetry of commuting trips, and for a group of countries, has not previously been analyzed.

Within this framework, we explore the time spent commuting to and from work in seven countries (Canada, Finland, France, South Korea, Spain, the UK, and the US), using detailed time use records from the Multinational Time Use Study (MTUS). We focus on duration, mode of transport, and timing of commuting trips. We find that, in general terms, commutes to work last longer than commutes from work, for both women and men, but with quantitative differences among countries. The timing of commuting also differs across countries, but generally commutes to work are more concentrated at certain hours than commutes from work. Furthermore, there appear to be some differences in commuting to work, and commuting from work times, that are partially explained by worker characteristics. Finally, we find a significant connection between the differences in the commuting to/from work, and the mode of transport, although this correlation is not heterogeneous between countries. The use of public transport generates longer times of commuting to work, and shorter times of commuting from work, in all the countries but France. However, commuting by private vehicle has mixed effects on commuting differences, which can largely be explained by variations in transport infrastructures.

We provide evidence on what socio-demographic characteristics are more related to such differences (e.g., what groups of workers are more likely to have different commuting trips from and to work), which can serve for a better design of public policies that take into account this heterogeneity in the commuting behavior of different population groups. Furthermore, this heterogeneity may have implications for the conclusions previously

obtained in studies of the effects of commuting on workers, and therefore some prior conclusions may needto be revised.

The remainder of the paper is structured as follows. Section 2 presents the MTUS data and describes the main variables. Section 3 describes the timing of commuting to and from work, that is to say, at which hours of the day do workers in the analyzed countries commute. Section 4 shows descriptive evidence on the time devoted to commuting, together with the modes of transport used in these trips. Section 5 empirically analyzes the socio-demographic factors related to differences in the time spent commuting to and from work. Section 6 draws conclusions.

## 2. Data and variables

We use data from the Multinational Time Use Study (MTUS), which is sponsored by the Centre for Time Use Research (CTUR) and 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 (Fisher et al., 2019). The MTUS includes detailed time use diaries for a range of countries, along with a series of demographic, economic, and geographic characteristics of respondents. The MTUS provides us with detailed 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 diaries include harmonized information about activity location, the mode of transport, and who else was present during the activities. The advantage of 24-hour self-reported diary data over other types of survey collecting transport times based on stylized questionnaires, is that diaries produce more reliable and accurate estimates (Gimenez-Nadal, Molina and Velilla, 2018). Thus, time use diaries have become the gold standard in the analysis of worker daily behaviors (Aguiar and Hurst, 2007; Guryan et al., 2008; Harms, Berrigan and Gershuny, 2019).

Given that we want to analyze episodes of commuting by workers, we restrict the sample to those between 16 and 65 years old (Aguiar and Hurst,2007; Gimenez-Nadal and Sevilla, 2012; Gimenez-Nadal, Molina and Velilla, 2018a, 2018b, 2020).[2] Respondents who

[2] Given that retirement age may differ across countries, we select the age limit of 65 years to be consistent with prior studies.

are not in paid work are omitted from the sample, as well as workers who filled their diaries during holidays, to avoid a potential source of bias arising from atypical days. Furthermore, we restrict the analysis to working days, defined as days where respondents devote at least 60 minutes to market work activities, excluding commuting (Gimenez-Nadal, Molina and Velilla, 2018a, 2018b). For the individuals in the sample, we focus on commuting episodes, identified in the MTUS diaries by the code 63 ("travel to/from work"). These restrictions provide a sample of 203,079 commuting episodes, corresponding to 94,517 individuals from seven countries: Canada, Finland, France, South Korea, Spain, the UK, and the US.[3] (See Table A1 in the Appendix for details on the available years for each of the analyzed countries, the number of individuals, and the number of commuting episodes by country.)

We distinguish between episodes of commuting to work, and episodes of commuting from work, considering the location of respondents before these commuting trips. In this sense, *commuting to work* is defined as those trips where the respondent is at home at the beginning of the trip and arrives at the workplace. Conversely, *commuting from work* is defined as those trips where the respondent is at work at the beginning of the trip and arrives home.[4] We must emphasise that some commuting journeys may be combined with non-commuting episodes in between (e.g., commuting followed by picking up children from school, and followed by commuting home), we concatenate these episodes of commuting in order to obtain the complete commuting journey of respondents. (See Table A2 in the Appendix for examples of commuting to work and commuting from work episodes that may be combined with other non-commuting episodes.) In such cases, the commuting trip would include all the commuting episodes but not the time spent in the intermediate activity.

For the trips of commuting to and from work, the following characteristics are analyzed. First, we compute the time of day of the commute, in order to analyze the timing of commuting over the working day. Given that there is information on the start time (clock hour) of the trip, and its duration, we know when the trip begins and ends. Second, the

[3] Sample restrictions left 277 (292) episodes of female (male) workers in Hungary. Due to the reduced sample size, Hungary has also been removed from the sample.

[4] We must note that the identification of commuting to and from work using location at the beginning and end of the trip may be subject to measurement error, as some trips never started/ended at respondents' workplace/home. However, this measurement error represents less than 0.14% of the episodes in our sample, indicating that such measurement errors are a minor concern in our analysis. Furthermore, all the analysis refers to commuting trips, which may comprise several commuting episodes.

duration of commuting trips, measured in minutes per day. Third, we analyze the mode of transport used in the commuting trip. For transport modes, the MTUS includes the following categories: "by car, etc.", "public transport", "walking/on foot", "other physical transport", and "other/unspecified transport". We then classify the episodes of commuting as episodes by private vehicle ("by car, etc."), in public transport mode ("public transport"), active commuting episodes ("walking/on foot", "other physical transport"), and other transport modes. Our fourth dimension of interest refers to the presence of others while commuting to/from work. The presence of others during commuting can be classified as follows: alone, with a child, and with the spouse/partner. Finally, for each individual, we compute the number of episodes that add up to a complete trip to/from work.

The MTUS allows us to consider several sociodemographic characteristics of respondents. The first gender, defined as a dummy that takes value 1 for males, and 0 for females. Given the existing research documenting significant differences in the commuting behaviors of men and women (White, 1986; Crane, 2007; Mok, 2007; Sandow and Westin, 2010; Gimenez-Nadal and Molina, 2016), all the analyses and empirical evidence shown here will be done separately by gender.

We also consider several socio-demographic characteristics that are classical controls when studying individual commuting behaviors (Aguiar and Hurst, 2007; van Ommeren and van der Straaten, 2008; Sevilla, Gimenez-Nadal and Gershuny, 2012; McQuaid and Chen, 2012; Gimenez-Nadal, Molina and Velilla, 2018a, 2018b; Albert, Casado-Díaz and Simón, 2019). Respondents' age is defined as a continuous variable. The maximum level of formal education achieved by respondents is defined by three dummy variables, identifying individuals who have completed primary education, secondary education, and University education, respectively. The marital status of respondents is defined as a dummy variable that takes value 1 for those who cohabit with a (married or unmarried) partner, and 0 otherwise. Household composition, which has been found to be an important determinant of travel times, especially for women (Hanson and Johnston, 1985; Johnston, 1992; Lee and McDonald, 2003; McQuaid and Chen, 2012; Gimenez-Nadal and Molina, 2016) is defined by two variables that consider household composition: the number of individuals in the family unit, and the number of children (aged 17 or under) in the family unit. The hours usually worked per week by respondents is also important, given that some authors have found a positive link between work hours and commuting (Gutierrez-i-Puigarnau and van

Ommeren, 2010). Finally, we define a dummy variable that identifies part-time workers (value 1, 0 otherwise). (The summary statistics of these variables are shown in Tables A3 and A4 in the Appendix.)

## 3. The timing of commuting to and from work

This Section presents evidence on the timing of commuting trips to and from work. Figure 1 shows, by gender and country, the proportion of individuals commuting during the day, which has twenty-four 1-hour time bands. For each hour on the X-axis, the Y-axis shows the proportion of workers commuting at that time. Figure 1 shows clear differences in the timing of commuting to and from work, consistent with the road pricing and traffic congestion literature (Coria and Zhang, 2015,2017; Long and Szeto, 2019; Vosough, Poorzahedy and Lindsey, 2020). Furthermore, there are differences across countries, despite that men and women show similar patterns in the timing of commuting. In Canada, about 35% of male and female workers commute to work between 7am and 8am, while the rate of workers commuting to work in the rest of the day is small (below 5%, except at noon, with about 5.8% of males and females commuting to work). On the other hand, most workers commute from work between 4pm and 6pm, and these trips seem less concentrated at particular hours, with about 25% of the workers reporting commuting from work at these hours.

The timing of commuting to work in Finland is different between women and men, as women commuters are highly concentrated between 7am and 8am, with 33.9% of women commuting at this hour (vs less than 20% commuting between 8am and 9am). Male commutes to work, however, are concentrated between 6am and 8am, with more than 25% of men commuting to work at these hours. Despite that, the timing of commuting from work is similar, with about 20% of both women and men commuting from work between 3pm and 5pm. The timing of commuting to work in South Korea is similar to the figures for Finland, as women commuters are highly concentrated between 8am and 9am (41% of females), while for men these trips fall between 7am and 9am (with about 38% of men commuting at these hours). Korean commuters from work are less concentrated at certain hours; women are concentrated between 5pm and 8pm, with a maximum between 6pm and

7pm, when 27.6% of women leave work. The commutes from work of Korean men are roughly the same.

In the UK and the US, the timing of commuting to and from work is qualitatively similar to the timings shown for Finland and South Korea but showing slight differences. For instance, 40.9% of UK women commute to work between 8am and 9am, while women in the US commute to work slightly earlier, and more homogeneously between 7am and 9am (30.5% commute to work between 7am and 8am, and 20.8% between 8am and 9am). Furthermore, commutes from work among women in both the UK and the US are less concentrated, taking place mostly between 4pm and 7pm, with the maximum being reached between 5pm and 6pm (when 20.4% of UK women, and 14.4% of US women are leaving work). Among UK and US men, commutes to work take place essentially between 6am and 9am. In the UK (US), 17.0% (21.7%) of men commute to work between 6am and 7am, 34.1% (25.7%) between 7am and 8am, and 28.9% (15.0%) between 8am and 9am. Despite the qualitative similarities, the quantitative differences between the UK and the US suggest that commutes to work are more flexible in the US than in the UK. This is supported by the fact that more workers (both men and women) commute to work during the day in the US than in the UK. Regarding commutes from work by men, these are concentrated between 4pm and 7pm, though the maximum percentage of  is reached between 5pm and 6pm (when 26.3% of UK men and 18.4% of US men are commuting from work).

Spain and France show certain differences in the timing of commuting to and from work, when compared to the other countries. In these countries, commuting episodes to work, and from work, are concentrated during two periods of the day. Between 30% and 40% of workers go to work between 7am and 9am, but about 15% also commute to work at 1pm in France, and between 2pm and 3pm in Spain. This is also reflected by the timing of commuting from work, as a similar percentage of French workers commute from work at noon, while about 25% commute from work between 5pm and 7pm. In Spain, the timing of commuting from work is different from France, as about 25% of workers commute from work between 1pm and 3pm, and between 15% and 20% of workers commute from work between 7pm and 9pm. These differences arise from different job schedules in the countries in the sample, as workdays in France and Spain tend to be split, and Figure 1 suggests that some workers commute from/to work, to have lunch at home, at midday (about 15% in

France, and between 20 and 25% in Spain), whereas this is not the case in the other countries analyzed.

These analyses may be useful for the design of road-pricing policies aimed at decreasing traffic congestion or reducing pollution. In Canada, Norway, South Korea, the UK, and the US, road pricing could be designed to affect morning commutes, given that traffic flows are highly concentrated at this time of the day, while road-pricing policies in France and Spain could consider both morning and afternoon commutes to work as being worth including in a congestion and environmental toll (CET) scheme.

# 4. The time devoted to commuting to and from work

In this Section, we focus on the time devoted to commuting to and from work, with a focus on the asymmetries between morning and evening commutes. Table 1 shows average commuting times of workers in the seven countries included in the sample, distinguishing between the times of commuting to work, and commuting from work. We also show differences between women and men, and between the times of commuting to and from work. In Canada, women (men) spend about 45.1 (58.2) minutes per day commuting to/from work, of which 25.9 (29.9) are spent commuting to work, and 22.2 (28.2) commuting from work. This produces gender differences (men spend more time than women commuting to work, and commuting from work), and differences between commutes to and from work (commutes to work last longer than commutes from work, for both women and men), with all the difference being statistically significant at standard levels.[5] In Finland, women (men) commute about 25.5 (26.3) minutes to work, and 22.9 (24.0) minutes from work, which produces statistically significant differences between commutes, while the raw differences between women and men are not significant (except for commutes from work, which differ between women and men at the 90% level). French female (male) workers spend about 33.7 (37.6) minutes commuting to work, and 31.9 (35.6) minutes commuting from work. Differences in France are qualitatively similar to those in Canada, as men spend more time than women commuting to and from work, and commutes to work last longer than commutes from work.

[5] Statistically significant differences are based on t-type tests on the equality of sample means.

Average commuting times in the UK and the US are similar to those in Canada and France, as men commute longer than do women, and the times spent commuting to work are longer than the times commuting from work, for both women and men. The average female (male) worker in the UK spends 28.8 (37.1) minutes commuting to work, and 20.7 (30.6) minutes commuting from work, for a total of 49.5 (67.8) minutes per day. In the US, women (men) spend on average 39.9 (50.4) minutes commuting to/from work, of which 23.4 (27.0) minutes are commutes to work, and 16.4 (23.4) minutes from work. All the differences between women and men are statistically significant at standard levels in the UK and the US.

Commutes in South Korea exhibit differences, compared to the other countries, as we do not find statistically significant variations between the times of commuting to and from work, although we do find that men spend more time commuting to work (36.0 minutes), and from work (36.0), than do women (33.9 and 33.2 minutes, respectively). Results in Spain also present some differences compared to the other countries, in the sense that despite men commuting for longer than women, Spanish workers spend more time commuting from work (29.4 minutes for women, 31.6 minutes for men), than they spend commuting to work (29.6 and 33.3 minutes, respectively), with these differences being statistically significant at standard levels for men.

In summary, we find that, in most countries, men devote more time to commuting trips than do women. Furthermore, the time devoted to commuting to work is longer than the time devoted to commuting from work in Canada, Finland, France, the UK, and the US, which reveals asymmetries in the duration of morning and evening commuting trips. We next explore whether such asymmetries are related to the mode of transport used.

*Differences by mode of transport*

Table 2 shows the average time spent commuting to work, and from work, by mode of transport, along with the differences between commutes to/from work, and the statistical significance of such differences.[6]

[6] Detailed summary statistics of the commuting episodes are shown in Table A5 in the Appendix.

In Canada, the average female worker spends 19.6 (16.8) minutes commuting to (from) work in private vehicle, 4.4 (4.0) minutes commuting in public transport, and 1.7 (1.2) minutes commuting actively. The differences between commutes to and from work are statistically significant in the times of both private vehicle, and active mode of transport, but not in the times spent in public transport. Among males, 24.9 (23.6) minutes are spent in commuting to (from) work in private vehicle, 3.2 (3.0) in public transport, and 1.6 (1.4) actively, with the differences being non-statistically significant except for the time in private vehicle, which is significant at the 90% level.

In Finland, the times spent in the different modes of transport considered are not statistically different between to and from work, for all workers. The average female (male) worker commutes to work 14.6 (18.9) minutes in private vehicle, 1.4 (0.4) minutes in public transport, and 8.4 (4.1) minutes actively; and the trips from work are about 13.2 (16.9) minutes in private vehicle, 1.4 (1.0) minutes in public transport, and 7.6 (4.2) minutes actively.

Female (male) workers in France spend 23.6 (27.9) minutes commuting to work in private vehicle, 4.1 (3.9) minutes in public transport, and 4.7 (3.8) minutes actively. The commute from work is 21.1 (25.3) minutes in private vehicle, 4.8 (5.0) minutes in public transport, and 4.5 (3.0) minutes actively. The differences among females are found to be statistically significant only for the commuting time in private vehicle, while among male workers all the differences, in all modes, are significant at standard levels. Furthermore, these differences suggest that commutes to work in private vehicle and active means of transport last longer than similar commutes from work, while the opposite is found for commuting times in public transport mode.

Korean females spend 11.9 (12.3) minutes commuting to (from) work in private vehicle, 7.6 (7.4) minutes in public transport, and 13.8 (13.0) minutes commuting actively, with this country presenting the longest commutes in active means of transport among the countries analyzed. Furthermore, differences in the times of commuting to/from work are statistically significant only for the time spent commuting actively. For men, on the other hand, the average time of commuting to (from) work in private vehicle is 22.9 (24.2) minutes, with the difference being statistically significant; 3.4 (3.4) minutes in public transport, with the difference not being significant; and 8.1 (6.5) minutes actively, with the

difference being significant at standard levels. Thus, despite that overall differences are not significant for South Korea, Table 2 shows differences depending on the mode of transport, revealing the importance of considering this information when available.

Results in Spain suggest that the times spent commuting to and from work by mode of transport are not statistically different. Women commute to work, on average, about 10.8 minutes by private vehicle, 6.4 minutes in public transport, and 5.6 minutes actively, while their commutes from work are 10.7 minutes in private vehicle, 6.0 minutes in public transport, and 5.2 minutes actively (with the only statistically significant difference being the difference in active commuting to/from work). Among men, the average times of commuting to (from) work are 16.0 (16.1) minutes in private vehicle, 3.4 (3.3) minutes in public transport, and 3.0 (3.1) minutes actively. No significant differences between times to and from work by mode of transport are found among men in Spain.

In the UK, the average female (male) worker commutes to work 17.8 (25.4) minutes in private vehicle, 4.0 (4.8) minutes in public transport, and 5.5 (4.9) minutes actively, while the return commute is 12.2 (20.4) minutes in private vehicle, 3.1 (4.4) minutes in public transport and 4.2 (4.2) minutes actively from work. Differences between the times of commuting to and from work are statistically significant for all workers in both private vehicle and active transport, while differences in public transport are significant for women but not for men.

Finally, in the US, females spend 20.6 (14.2) minutes commuting to (from) work in private vehicle, 1.5 (1.3) in public transport, and 0.6 (0.5) actively, with differences between commuting times being statistically significant for private vehicle and active commuting times, but not for public transport mode. On the other hand, the average male commutes 24.0 (20.7) minutes to (from) work in private vehicle, 1.5 (1.6) minutes in public transport, and 0.7 (0.6) minutes actively, with the differences being statistically significant only for the times in private vehicle and active means of transport.

In summary, we find that the differences between the duration of commutes to and from work seem concentrated in commutes by private vehicle (car, truck, motorcycle), where the commutes to work last longer than the commutes from work, among both women and men. There are also similar differences in commutes by active means of transport, whereas commuting to and from work by public transport are similar in terms of the time spent. On

the other hand, Table 2 suggests that the gender difference in commuting time, where male workers spend more time commuting than do their female counterparts, is congregated in commutes by private vehicle, but not in commutes in public transport or active commuting trips.

# 5. Personal factors associated to asymmetries in commuting time

All the differences reported in Section 4 represent raw differences between commuting to work and commuting from work. In this section, we examine the socio-demographic characteristics (e.g., education, gender) related to asymmetries in the time devoted to commuting to and from work; that is, we aim to partially isolate the impact of workers observed attributes on the difference in worker commuting behavior to and from work.[7] To that end, we estimate Ordinary Least Squares (OLS) models as follows:

$$\log(Dif_{ic} + 1) = \beta_{c0} + \beta_{c1} X'_{ic} + \alpha_{ct} + \varepsilon_{ic}, \quad (1)$$

where, for each individual "$i$" in country "$c$", $Dif_{ic}$ represents the difference in commuting, defined as the time of commuting to work, minus the time of commuting from work. A positive value of this variable indicates that the individual devotes more time to commuting to work than to commuting from work, and a positive coefficient regarding any individual characteristic indicates that this characteristic is related to an asymmetry, in that more time is devoted to commuting to work – in comparison to commuting from work. $X_{ic}$ represents a vector of worker sociodemographic characteristics, $\alpha_{ct}$ represents year and country fixed effects for country "$c$", and $\varepsilon_{ic}$ represents unmeasured factors. We pool all the countries to explore whether there are systematic cross-country differences in commuting asymmetries net of the effect of socio-demographic characteristics.[8] All the estimates include sample weights provided by the MTUS data, and robust standard errors clustered at the country

[7] Prior research has documented a variety of unobserved characteristics (e.g., traffic congestion, urban structure, road infrastructure, or the availability of different modes of public transport, among others), along with stochastic factors (e.g., the weather) affecting worker transport behavior and, thus, commuting time. We acknowledge that our analysis may potentially suffer from omitted variable bias.

[8] The guidelines developed by the Center for Time Use Research to harmonize time use surveys makes variables included in the MTUS highly comparable, allowing cross-country comparison on similar sets of socio-demographic characteristics.

level. The set of socio-demographic characteristics included in $X_{ic}$ includes those described in Section 2.

Columns (1) and (2) of Table 3 show estimation results for Equation (1), estimated separately for women and men. We observe a statistically significant correlation between worker age and the difference in commuting to/from work time, which follows an inverted-U shape. The results also reveal a positive and statistically significant correlation between worker education and the commuting difference, which is about 10.5 (10.9) percent larger for female (male) workers with secondary education than for similar respondents with primary education, while for those with University education this difference increases to about 28.6 (24.4) percent. This suggests that there is a greater asymmetry in commuting to/from work behaviors among workers with higher formal education levels. Regarding household composition, individuals who cohabit as a (married or unmarried) couple show shorter commuting differences, while family size is not statistically significant for women or men. However, women's commuting differences are correlated with the number of children in the household in a statistically significant way, since the more children there are in the household, the larger the difference in the times devoted to commuting to and from work.

Regarding labor attributes, the results show that the number of hours worked per week is not correlated with commuting differences, even when prior research has found that commuting behaviors are linked to labor supply (Gutierrez-i-Puigarnau and van Ommeren, 2010). This suggests that the link between commuting time and paid work hours is similar for commutes both to and from work, thus making the correlation with the commuting difference not statistically significant at standard levels. On the other hand, the commuting asymmetry among female part-time workers is smaller than among female full-time workers, while that correlation is not statistically significant for males.

For the modes of transport used to commute to/from work, estimates show that for men who commute by private vehicle or actively, the difference tends to be smaller. Those who commute by public transport report larger differences, net of observed heterogeneity, in commuting to/from work times.

We now estimate Equation (1) omitting country fixed effects and including instead a set of indices, defined at the country-year level, related to factors associated with commuting

behavior. These indices, obtained from the World Bank Database, serve as proxies for transport infrastructure, road security, travel behavior, economic growth, and urban distribution, all of which have been identified as determinants of commuting time (Naess, 2003, 2006, 2009; Santos et al., 2013; Mitra and Saphores, 2019; Gimenez-Nadal, Molina and Velilla, 2020a). Specifically, we consider the number of passengers carried by railway, multiplied by kilometers traveled (divided by 1,000), and the length of railway routes available for train service (divided by 1,000), as national indices for transport infrastructure availability. We also include the mortality caused by road traffic injury, defined as deaths per 100,000 population. We consider the percentage growth of per capita GDP, as a proxy for national income, and also the CO2 emissions from liquid fuel consumption (measured in kt), as prior research has found a link between travel behaviors and CO2 emissions. For urban distribution at the country level, we include the percentage of people living in urban areas, as defined by national statistical offices.

Columns (3) and (4) of Table 3 show estimates of Equation (1) when we include this set of national indices. We observe that the main coefficients associated with the set of worker attributes (coefficients $\beta_{c1}$) are similar (both qualitative and quantitatively) in Columns (1-2), and Columns (3-4), and we conclude that the impact of these national indices in the main estimates does not affect the conditional correlation between the commuting differences and worker socioeconomic observable factors. Furthermore, we observe that better transport infrastructure, measured by the number of railway passengers, is correlated with greater differences in commuting to/from work. Similarly, countries with more of their population living in urban areas are correlated with greater commuting differences. Similar results are found for the amount of CO2 emissions, and the rates of GDP growth (with the latter being statistically significant only for women). Traffic mortality is correlated with shorter differences in commuting to/from work times.

Finally, we estimate Equation (1) separately for each of the countries in the sample, in order to determine whether there are differences among countries in the conditional correlations between the dependent variable and the set of explanatory variables. Again, robust standard errors are computed. These estimates are shown in Table 4. Columns (1) and (2) show the main coefficients for women and men in Canada, respectively. Estimates show a non-statistically significant correlation between age and the commuting difference among women, while the correlation is significant for men, in an inverted-U shaped

relationship. Individuals with University education, both women and men, report more time to work (relative to time from work), compared to those with only primary or secondary education. On the other hand, workers who cohabit with a partner report smaller commuting differences. Women part-time workers report shorter differences, and differences are larger among women on weekdays than on working-weekend days. The corresponding coefficients are not statistically significant among men. Regarding transport modes, both women and men who commute more by either private vehicle or public transport report larger commuting to/from work gaps than those who commute more actively or by other means of transport.

Columns (3) and (4) show the results for Finnish workers. No sociodemographic variables are found to be statistically significant among women, while for men only age is significant at standard levels, revealing an inverted-U shaped relationship with the commuting to/from work difference. Nevertheless, the results reveal a significant increase in the commuting difference among individuals who commute by public transport. Columns (5) and (6) show the results for France, and none of the sociodemographic and transport mode variables are found to be statistically significant, with the only exception of women's weekly work hours, suggesting that women who work longer have a greater commuting to/from work difference.

Columns (7) and (8) show the estimates for South Korea. Age is not significant for women, but is correlated with the commuting to/from work difference following an inverted-U shape. Education, on the other hand, is not significant among men, but shows a positive correlation with the commuting difference among women. Family size is also positively correlated with commuting to/from work differences for both women and men, while the number of children shows a negative correlation, which is only significant at standard levels for men. Women's work hours are negatively correlated with the commuting difference. Women who commute by private vehicle or active commuting report more time from work, relative to the time of commuting to work, while the opposite is true for men who commute by public transport.

Results for Spain are shown in Columns (9) and (10). Among women, no sociodemographic variables are estimated to be statistically significant. Among men, on the other hand, results show that those with University education report a smaller commuting

to/from work gap. Family size, the number of children, and being a part-time worker are positively correlated with the commuting difference to/from work. Regarding transport modes, commuting by private vehicle or public transport is correlated with a larger commuting difference. On the other hand, more active commuting is oppositely correlated to the difference in commuting.

Results for UK workers are shown in Columns (11) and (12). Age is again correlated with the commuting to/from work difference, following an inverted-U shape, but that is statistically significant at standard levels only among women. Household composition is correlated with commuting to/from work differences, but only among women, with the number of household members showing a negative correlation, but the number of children a positive correlation. Regarding labor attributes, being a part-time worker is correlated with smaller differences in commuting to/from work, with the corresponding coefficient being statistically significant for men but not for women. In terms of transport modes, results show that both men and women who commute by public transport report greater differences in their commuting times to/from work.

Columns (13) and (14) of Table 4 show the results for the US. Age shows an inverted-U shaped correlation with the difference in commuting to/from work, with coefficients being significant at standard levels for both women and men. Education is positively correlated with the commuting difference, for both females and males, and cohabiting in a couple is negatively correlated, with the coefficients being highly significant. Family size and the number of children are negative, and positively correlated with the commuting difference, but with the former only being significant for women. The number of working hours and the part-/full-time status are not significant at standard levels, and differences in the commuting to/from work are greater on weekdays than during weekend working days. Those who commute by private vehicle, or actively, report smaller differences in commuting to/from work (although the coefficient associated with private vehicle commuting is only significant for men), while the opposite happens for those who commute by public transport.

All in all, Table 4 shows a mixture of results, and some conclusions can be only tentatively derived. First, estimates reveal different correlations between the set of explanatory variables, and the differences in commuting times, which appear both across and within countries (e.g., different coefficients for men and women in each country). This

result is in line with prior research documenting commuting to be a complex transport phenomenon, where unobservable and/or stochastic characteristics have a strong impact on worker commuting trips (Burger et al., 2011; van Acker and Witlox, 2011; Ma et al., 2017; Gimenez-Nadal, Molina and Velilla, 2018a, 2020a). This is also reflected by the $R^2$ associated with the estimates, which is low and in line with research analyzing commuting (van Ommeren and van der Straaten, 2008; Ross and Zenou, 2008). The results are also consistent with authors documenting gender differences in commuting time (Gimenez-Nadal and Molina, 2016). Second, there appear to be differences in commuting to work, and commuting from work, that are partially explained by worker characteristics. Table 4 suggests the existence of a significant connection between the differences in commuting to/from work, and the mode of transport, a connection that is non-robust across countries. The use of public transport generates longer times of commuting to work, relative to shorter times from work, in all the countries but France. However, commuting by private vehicle has mixed effects on commuting differences, which may be explained by transport infrastructures. This particular connection is left for future research, using alternative data sources.

# 5. Conclusions

This paper analyzes asymmetries in the commuting behavior of individuals when they commute from home to work, and from work to home. These journeys are often considered identical in both applied research and theoretical models, but the topic has received little attention in the combination of the dimensions of timing and mode of transport. Using detailed time use diaries from the MTUS data, for the last two decades and seven countries we find that, in general terms, commutes to work last longer than commutes from work, for both women and men, but with quantitative country differences. In general terms, commutes to work are more concentrated at certain hours than commutes from work. Furthermore, there appear to be differences in commuting times that are partially explained by worker characteristics. We find a significant connection between the differences in commuting to/from work, and the mode of transport, although this correlation is not heterogeneous across countries. The use of public transport generates longer times of commuting to work, relative to times of commuting from work, in all the countries but France. However,

commuting by private vehicle has mixed effects on commuting differences, which may be explained by differences in transport infrastructures.

Our results for the timing of commuting to and from work may help in the design of road pricing policies. In Canada, Norway, South Korea, the UK, and the US, road pricing could be designed to affect morning commutes, given that traffic flows are highly concentrated at this time of the day, but road-pricing policies in France and Spain should consider both morning and afternoon commutes, to and from work, to be included in a congestion and environmental toll (CET) scheme. Similarly, the reported differences in the times of commuting to and from work, and the moderating role of transport modes in those differences, should also be taken into account by applied researchers and planners. If the use of public transport is associated with more asymmetries in commuting to and from work, this may indicate a component of public transport unpredictability that may be detrimental. In addition, the results presented here can serve as a basis to ask whether the results reported in prior literature should be reviewed, both at the theoretical and empirical level.

The analysis has certain limitations. For instance, this represents a first exploration of the differences between commuting to work and from work, using detailed time use diaries. These databases are cross-sectional, thus preventing us from analyzing any kind of causal links (i.e., the results must be understood as conditional correlations). Similarly, we cannot deal with potential endogeneity. Finally, commuting times are a complex phenomenon that has been linked to stochastic and non-controllable factors, such as traffic congestion and weather conditions (see van Ommeren and van der Straaten, 2008, for a summary), and thus our results may serve as a starting point for future research on this topic.

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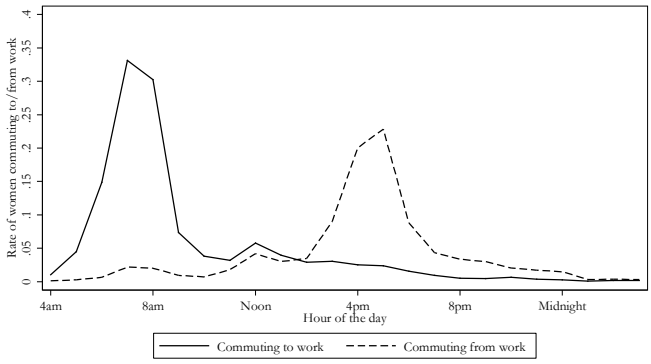
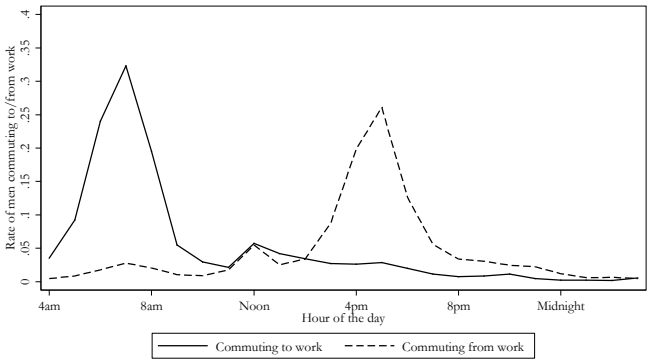
**Figure 1. The timing of commuting to/from work**

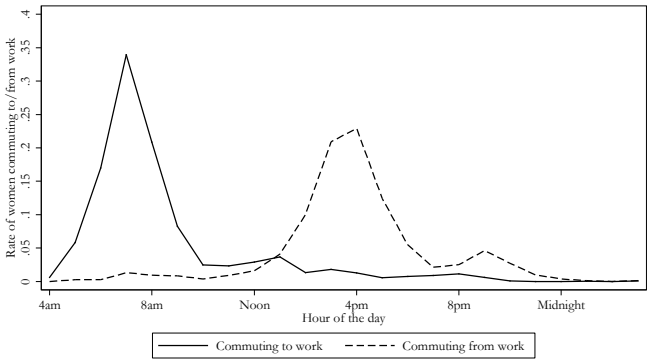
Canada - women



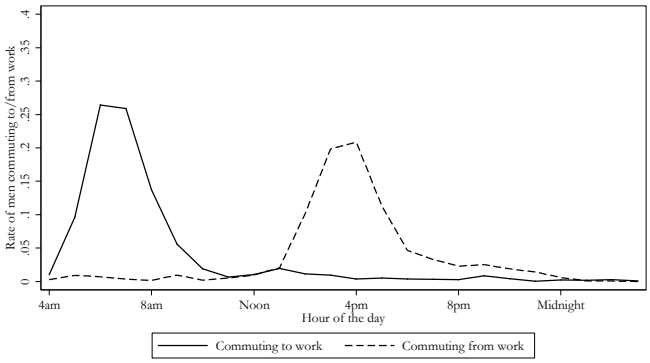

Canada - men



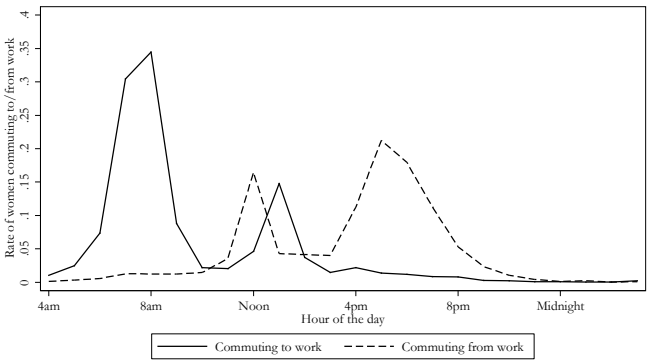

Finland - women



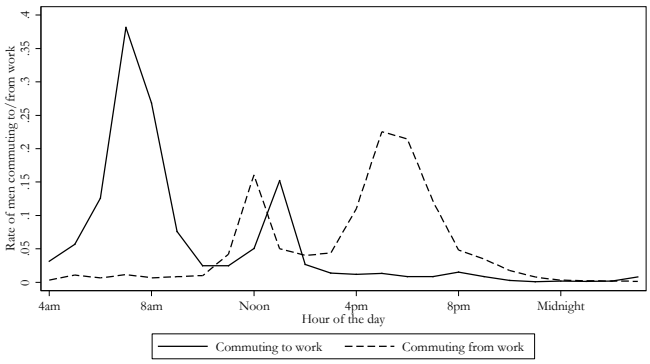

Finland - men



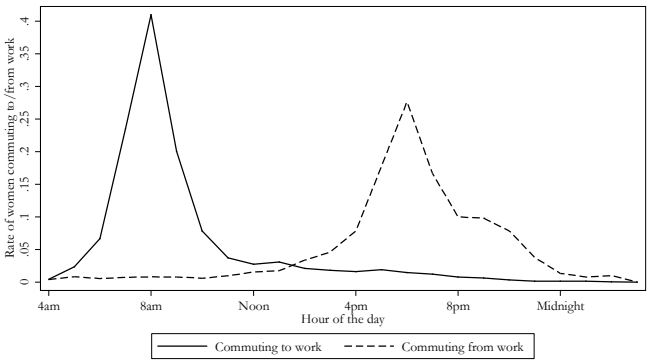

France - women




France - men




South Korea - women




South Korea - men

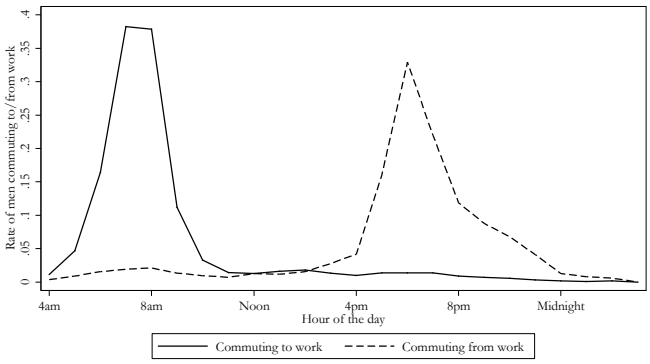
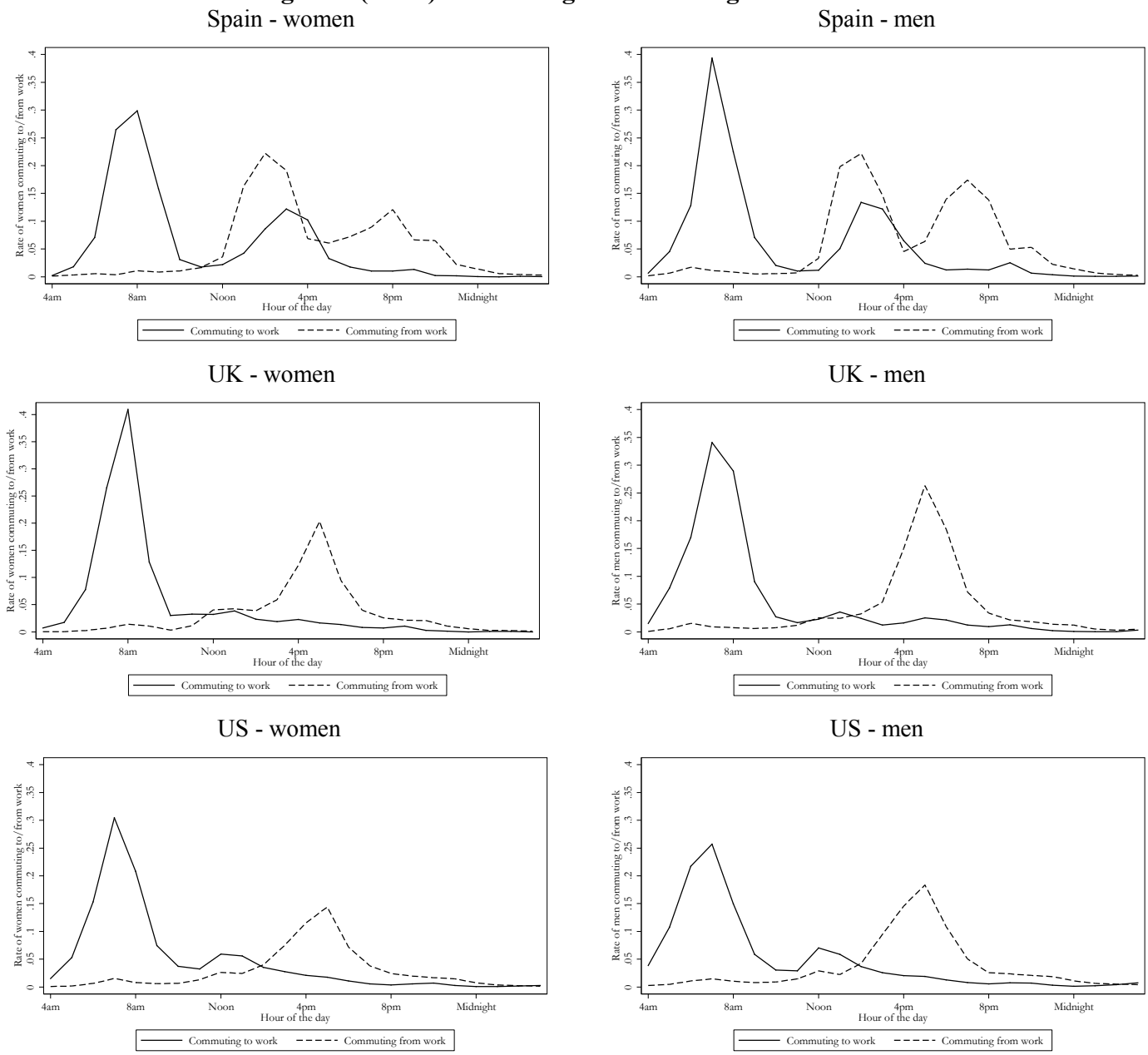


**Figure 1 (*Cont.*). The timing of commuting to/from work**




Note: The sample (MTUS 2000-2018) has been restricted to the countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. The commuting time for the whole sample, and detailed information on the percentage of male and female individuals commuting to/from work is shown in Table A6 in the Appendix.

## Table 1. Average time of commuting to and from work

| Country | Sex | Commuting time | | | | No. Individuals |
|---|---|---|---|---|---|---|
| | | Total | To work | From work | Difference | |
| Canada | Women | 48.055 | 25.883 | 22.172 | 3.711*** | 4,913 |
| | Men | 58.164 | 29.936 | 28.229 | 1.707** | 4,999 |
| | Gender diff. | -10.109*** | -4.053*** | -6.057*** | | |
| Finland | Women | 48.390 | 25.460 | 22.930 | 2.530*** | 722 |
| | Men | 50.319 | 26.270 | 24.049 | 2.221* | 609 |
| | Gender diff. | -1.929 | -0.810 | -1.119* | | |
| France | Women | 65.563 | 33.704 | 31.859 | 1.845** | 2,466 |
| | Men | 73.190 | 37.552 | 35.638 | 1.914* | 2,599 |
| | Gender diff. | -7.627*** | -3.848*** | -3.779*** | | |
| South Korea | Women | 67.117 | 33.888 | 33.229 | 0.659 | 5,440 |
| | Men | 71.989 | 35.996 | 35.993 | 0.003 | 8,137 |
| | Gender diff. | -4.872*** | -2.108*** | -2.764*** | | |
| Spain | Women | 59.048 | 29.409 | 29.639 | -0.230 | 4,994 |
| | Men | 64.861 | 31.573 | 33.289 | -1.716*** | 6,823 |
| | Gender diff. | -5.813*** | -2.164*** | -3.650*** | | |
| UK | Women | 49.525 | 28.828 | 20.697 | 8.131*** | 2,652 |
| | Men | 67.761 | 37.128 | 30.633 | 6.495*** | 2,817 |
| | Gender diff. | -18.236*** | -8.300*** | -9.936*** | | |
| US | Women | 39.892 | 23.448 | 16.444 | 7.004*** | 22,603 |
| | Men | 50.369 | 26.999 | 23.370 | 3.629*** | 24,743 |
| | Gender diff. | -10.477*** | -3.551*** | -6.926*** | | |

Note: Standard deviations available upon request. The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. Commuting time is measured in minutes. Differences in commuting time to/from work are computed as the time of commuting to work, minus the time of commuting from work. Differences between women and men are computed as the average time of women, minus the average time of men. * Significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level; all computed according to *t*-type tests.

**Table 2. Average time of commuting to and from work, by mode of transport**

| | | Women | | | Men | | |
|---|---|---|---|---|---|---|---|
| Country | Mode | To work | From work | Difference | To work | From work | Difference |
| Canada | Private vehicle | 19.617 | 16.817 | 2.800*** | 24.911 | 23.612 | 1.299* |
| | Public transport | 4.370 | 4.020 | 0.350 | 3.155 | 2.962 | 0.193 |
| | Active | 1.699 | 1.225 | 0.474*** | 1.605 | 1.382 | 0.223 |
| Finland | Private vehicle | 14.556 | 13.151 | 1.405 | 18.866 | 16.870 | 1.996 |
| | Public transport | 1.402 | 1.396 | 0.006 | 0.447 | 0.960 | -0.513 |
| | Active | 8.361 | 7.590 | 0.771 | 4.123 | 4.208 | -0.085 |
| France | Private vehicle | 23.638 | 21.131 | 2.507*** | 27.935 | 25.312 | 2.623*** |
| | Public transport | 4.076 | 4.767 | -0.691 | 3.942 | 4.984 | -1.042** |
| | Active | 4.670 | 4.503 | 0.167 | 3.830 | 3.010 | 0.820** |
| South Korea | Private vehicle | 11.939 | 12.349 | -0.410 | 22.911 | 24.182 | -1.271*** |
| | Public transport | 7.642 | 7.423 | 0.219 | 3.443 | 3.449 | -0.006 |
| | Active | 13.845 | 13.006 | 0.839** | 8.054 | 6.524 | 1.530*** |
| Spain | Private vehicle | 10.756 | 10.748 | 0.008 | 16.043 | 16.062 | -0.019 |
| | Public transport | 6.387 | 6.036 | 0.351 | 3.379 | 3.314 | 0.065 |
| | Active | 5.633 | 5.229 | 0.404* | 3.006 | 3.098 | -0.092 |
| UK | Private vehicle | 17.829 | 12.196 | 5.633*** | 25.397 | 20.415 | 4.982*** |
| | Public transport | 3.979 | 3.119 | 0.860** | 4.767 | 4.425 | 0.342 |
| | Active | 5.501 | 4.154 | 1.347*** | 4.936 | 4.167 | 0.769** |
| US | Private vehicle | 20.636 | 14.191 | 6.445*** | 24.026 | 20.658 | 3.368*** |
| | Public transport | 1.473 | 1.341 | 0.132 | 1.512 | 1.580 | -0.068 |
| | Active | 0.639 | 0.451 | 0.188*** | 0.744 | 0.574 | 0.170*** |

Note: Standard deviations available upon request. The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. Commuting time is measured in minutes. Private vehicle includes car, truck, or motorcycle. Active commuting includes walk/on foot, and physical modes of transport. Other trips are classified as "unspecified". Differences in commuting time to/from work are computed as the time of commuting to work, minus the time of commuting from work. * Significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level; all computed according to *t*-type tests.

## Table 3. Estimates on the differences in commuting to/from work

| | FIXED EFFECTS | | NATIONAL INDICES | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| VARIABLES | Women | Men | Women | Men |
| *Sociodemographics* | | | | |
| Age | 0.020*** | 0.031*** | 0.020*** | 0.032*** |
| | (0.006) | (0.006) | (0.006) | (0.006) |
| Age squared | -0.026*** | -0.035*** | -0.027*** | -0.036*** |
| | (0.007) | (0.007) | (0.007) | (0.007) |
| Education: secondary | 0.105*** | 0.108*** | 0.105*** | 0.109*** |
| | (0.031) | (0.029) | (0.031) | (0.030) |
| Education: University | 0.289*** | 0.245*** | 0.286*** | 0.244*** |
| | (0.031) | (0.029) | (0.031) | (0.029) |
| Married/cohabiting | -0.116*** | -0.141*** | -0.116*** | -0.136*** |
| | (0.023) | (0.026) | (0.023) | (0.026) |
| Family size | -0.011 | 0.003 | -0.006 | 0.009 |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| Number of children | 0.052*** | 0.026* | 0.045*** | 0.020 |
| | (0.015) | (0.014) | (0.015) | (0.014) |
| Weekly work hours | 0.001 | 0.001 | 0.001 | 0.001 |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| Part-time worker | -0.067** | 0.016 | -0.053* | 0.027 |
| | (0.028) | (0.044) | (0.028) | (0.044) |
| Weekday | 0.226*** | 0.157*** | 0.224*** | 0.154*** |
| | (0.022) | (0.021) | (0.022) | (0.021) |
| *Transport mode* | | | | |
| Rate: private vehicle | -0.006 | -0.070* | -0.018 | -0.083** |
| | (0.034) | (0.038) | (0.033) | (0.038) |
| Rate: public transport | 0.571*** | 0.532*** | 0.573*** | 0.526*** |
| | (0.054) | (0.065) | (0.054) | (0.065) |
| Rate: actively | -0.098*** | -0.207*** | -0.094*** | -0.201*** |
| | (0.035) | (0.047) | (0.033) | (0.047) |
| *National indices* | | | | |
| Passenger railways | - | - | 0.033*** | 0.031*** |
| | | | (0.005) | (0.005) |
| Railways length (km) | - | - | -0.006 | -0.004 |
| | | | (0.010) | (0.010) |
| Perc. urban population | - | - | 0.055*** | 0.034*** |
| | | | (0.012) | (0.013) |
| Traffic mortality | - | - | -0.081*** | -0.041*** |
| | | | (0.013) | (0.013) |
| GDP growth | - | - | 0.063*** | 0.023 |
| | | | (0.016) | (0.017) |
| CO2 transport emission | - | - | 0.043*** | 0.024** |
| | | | (0.010) | (0.010) |
| Constant | 0.429*** | 0.279* | -3.372*** | -1.870* |
| | (0.160) | (0.167) | (0.984) | (1.039) |
| Country F.E. | Yes | Yes | No | No |
| Year F.E. | Yes | Yes | Yes | Yes |
| Observations | 33,103 | 35,920 | 33,103 | 35,920 |
| R-squared | 0.048 | 0.031 | 0.047 | 0.030 |

Note: The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. The dependent variable is the log-of-minutes of difference between commuting to and from work. * Significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level.

## Table 4. Results by country

| | CANADA | | FINLAND | | FRANCE | | SOUTH KOREA | | SPAIN | | UK | | US | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| VARIABLES | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men |
| *Sociodemographics* | | | | | | | | | | | | | | |
| Age | 0.000 | 0.040** | -0.033 | 0.108** | 0.020 | 0.001 | -0.022 | 0.030* | 0.009 | -0.008 | 0.046* | 0.012 | 0.027*** | 0.039*** |
| | (0.015) | (0.016) | (0.049) | (0.053) | (0.031) | (0.030) | (0.018) | (0.018) | (0.018) | (0.016) | (0.025) | (0.027) | (0.008) | (0.009) |
| Age squared | 0.003 | -0.046** | 0.041 | -0.110* | -0.018 | 0.004 | 0.024 | -0.036* | -0.015 | 0.007 | -0.061* | -0.017 | -0.036*** | -0.043*** |
| | (0.018) | (0.019) | (0.057) | (0.064) | (0.037) | (0.037) | (0.022) | (0.021) | (0.023) | (0.019) | (0.031) | (0.033) | (0.009) | (0.010) |
| Education: secondary | 0.122 | 0.086 | 0.245 | 0.323 | 0.164 | 0.054 | 0.128* | 0.076 | -0.012 | -0.049 | -0.056 | -0.032 | 0.239*** | 0.216*** |
| | (0.106) | (0.093) | (0.233) | (0.269) | (0.106) | (0.110) | (0.072) | (0.071) | (0.087) | (0.068) | (0.107) | (0.109) | (0.055) | (0.050) |
| Education: University | 0.369*** | 0.223*** | 0.280 | 0.182 | 0.111 | 0.110 | 0.295*** | 0.074 | 0.054 | -0.117* | -0.026 | 0.056 | 0.454*** | 0.450*** |
| | (0.094) | (0.078) | (0.226) | (0.268) | (0.119) | (0.126) | (0.096) | (0.079) | (0.087) | (0.070) | (0.115) | (0.114) | (0.052) | (0.046) |
| Married/cohabiting | -0.113* | -0.159** | 0.019 | 0.229 | -0.113 | 0.026 | -0.122 | -0.001 | 0.039 | -0.014 | -0.110 | -0.233 | -0.120*** | -0.191*** |
| | (0.058) | (0.067) | (0.221) | (0.260) | (0.106) | (0.121) | (0.074) | (0.078) | (0.073) | (0.082) | (0.126) | (0.159) | (0.031) | (0.037) |
| Family size | 0.036 | 0.017 | -0.006 | -0.139 | 0.005 | -0.086 | 0.062** | 0.063** | 0.003 | -0.012 | -0.127** | -0.029 | -0.055*** | -0.009 |
| | (0.031) | (0.033) | (0.118) | (0.134) | (0.062) | (0.067) | (0.030) | (0.029) | (0.027) | (0.024) | (0.050) | (0.057) | (0.019) | (0.020) |
| Number of children | 0.045 | -0.004 | -0.078 | 0.084 | 0.072 | 0.114 | -0.057 | -0.058* | -0.048 | 0.067** | 0.121** | 0.102 | 0.121*** | 0.048** |
| | (0.043) | (0.044) | (0.144) | (0.147) | (0.073) | (0.078) | (0.037) | (0.034) | (0.038) | (0.032) | (0.061) | (0.067) | (0.023) | (0.024) |
| Weekly work hours | 0.000 | 0.004 | -0.002 | -0.005 | 0.011** | 0.003 | -0.004*** | 0.000 | 0.001 | 0.006* | 0.000 | -0.001 | 0.002 | -0.001 |
| | (0.003) | (0.003) | (0.013) | (0.011) | (0.005) | (0.005) | (0.002) | (0.002) | (0.004) | (0.003) | (0.003) | (0.003) | (0.002) | (0.001) |
| Part-time worker | -0.190* | 0.153 | -0.110 | 0.436 | 0.034 | 0.193 | -0.100 | 0.072 | 0.126 | 0.418*** | -0.030 | -0.305* | -0.063 | -0.054 |
| | (0.097) | (0.164) | (0.312) | (0.432) | (0.107) | (0.226) | (0.073) | (0.095) | (0.090) | (0.147) | (0.092) | (0.183) | (0.043) | (0.060) |
| Weekday | 0.238*** | 0.068 | 0.002 | 0.108 | 0.017 | -0.083 | 0.087 | 0.066 | 0.081 | 0.015 | 0.284*** | 0.032 | 0.300*** | 0.265*** |
| | (0.078) | (0.081) | (0.189) | (0.240) | (0.104) | (0.124) | (0.055) | (0.047) | (0.074) | (0.067) | (0.086) | (0.089) | (0.029) | (0.029) |
| *Transport mode* | | | | | | | | | | | | | | |
| Rate: private vehicle | 0.285*** | 0.442* | 0.004 | -0.286 | -0.154 | -0.261 | -0.426** | 0.034 | 0.052 | 0.131** | -0.072 | 0.060 | -0.083 | -0.170** |
| | (0.079) | (0.227) | (0.305) | (0.229) | (0.209) | (0.213) | (0.176) | (0.086) | (0.080) | (0.065) | (0.157) | (0.195) | (0.058) | (0.077) |
| Rate: public transport | 0.611*** | 0.924*** | 1.271** | 1.111** | 0.117 | 0.043 | 0.101 | 0.625*** | 0.650*** | 0.505*** | 0.586*** | 0.627* | 0.722*** | 0.664*** |
| | (0.136) | (0.267) | (0.494) | (0.473) | (0.259) | (0.279) | (0.186) | (0.139) | (0.106) | (0.117) | (0.204) | (0.359) | (0.121) | (0.127) |
| Rate: actively | -0.012 | 0.143 | 0.156 | -0.234 | -0.173 | -0.150 | -0.370** | 0.150 | -0.193** | -0.181** | -0.199 | -0.318 | -0.438*** | -0.501*** |
| | (0.026) | (0.245) | (0.321) | (0.311) | (0.229) | (0.249) | (0.175) | (0.097) | (0.087) | (0.084) | (0.177) | (0.210) | (0.093) | (0.098) |
| Constant | 0.541 | -0.335 | 1.540 | -0.974 | 0.530 | 1.547** | 2.020*** | 0.412 | 0.958** | 1.166*** | 1.243** | 1.854*** | 0.777*** | 0.302 |
| | (0.330) | (0.408) | (1.118) | (1.192) | (0.647) | (0.670) | (0.400) | (0.395) | (0.405) | (0.375) | (0.528) | (0.589) | (0.272) | (0.276) |
| Year F.E. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 3,798 | 3,706 | 564 | 464 | 1,808 | 1,876 | 3,784 | 5,426 | 3,324 | 4,342 | 2,033 | 2,044 | 17,792 | 18,062 |
| R-squared | 0.024 | 0.020 | 0.034 | 0.043 | 0.011 | 0.006 | 0.026 | 0.011 | 0.030 | 0.014 | 0.032 | 0.021 | 0.030 | 0.030 |

Note: The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. The dependent variable is the log-of-minutes of difference between commuting to and from work. * Significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level.

# Appendix A. Additional tables

**Table A1. Sample composition**

| Country | Years | N. Individuals | N. Episodes |
|---|---|---|---|
| Canada | 2005, 2010 | 9,912 | 20,883 |
| Finland | 2009, 2010 | 1,331 | 2,614 |
| France | 2010 | 5,065 | 11,595 |
| Korea | 2009 | 13,577 | 27,750 |
| Spain | 2002, 2003, 2009, 2010 | 11,817 | 32,310 |
| UK | 2000, 2001, 2014, 2015 | 5,469 | 13,970 |
| US | 2003-2018 | 43,346 | 93,957 |

Note: The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day.

**Table A2. Examples of commuting to/from work**

| Sequence examples | Episode classification |
|---|---|
| Any activity (where: at home)<br>Commuting episode<br>Paid work episode (where: at work) | Commuting to work |
| Any activity (where: at home)<br>Commuting episode<br>Any activity (not paid work, not at work, not at home)<br>Commuting episode<br>Any activity (not paid work, not at work, not at home)<br>Commuting episode<br>Paid work episode (where: at work) | Commuting to work<br>Commuting to work<br>Commuting to work |
| Paid work episode (where: at work)<br>Commuting episode<br>Any activity (where: at home) | Commuting from work |
| Paid work episode (where: at work)<br>Commuting episode<br>Any activity (not paid work, not at work, not at home)<br>Commuting episode<br>Any activity (not paid work, not at work, not at home)<br>Commuting episode<br>Any activity (where: at home) | Commuting from work<br>Commuting from work<br>Commuting from work |

Note: Author's elaboration.

## Table A3. Additional descriptives

| | Women | | Men | |
|---|---|---|---|---|
| Variables | Mean | S. Dev. | Mean | S. Dev |
| Commuter | 0.998 | 0.042 | 0.998 | 0.040 |
| Commuting time | 47.908 | 40.471 | 58.540 | 49.889 |
| Commuting to work | 26.437 | 22.659 | 30.399 | 28.084 |
| Commuting from work | 21.472 | 24.036 | 28.141 | 30.081 |
| Age | 41.600 | 11.370 | 41.707 | 11.054 |
| Education: basic | 0.100 | 0.300 | 0.119 | 0.324 |
| Education: secondary | 0.311 | 0.463 | 0.351 | 0.477 |
| Education: University | 0.588 | 0.492 | 0.530 | 0.499 |
| Married/cohabiting | 0.661 | 0.473 | 0.767 | 0.423 |
| Family size | 2.923 | 1.362 | 3.110 | 1.418 |
| Presence of children | 0.488 | 0.500 | 0.503 | 0.500 |
| Number of children | 0.835 | 1.026 | 0.911 | 1.094 |
| Weekly work hours | 39.389 | 12.192 | 45.678 | 12.114 |
| Paid work time | 458.741 | 136.278 | 509.427 | 139.988 |
| Part-time worker | 0.194 | 0.395 | 0.052 | 0.223 |
| No. Individuals | 43,790 | | 50,727 | |

Note: The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. Commuting times are measured in minutes. Paid work time is measured in minutes per day.

**Table A4. Additional descriptives, by country**

| | CANADA | | FINLAND | | FRANCE | | KOREA | | SPAIN | | UK | | US | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VARIABLES | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men | Women | Men |
| Age | 40.119 | 40.284 | 43.402 | 43.449 | 42.420 | 41.772 | 40.466 | 42.108 | 38.117 | 39.806 | 40.192 | 41.018 | 42.706 | 42.363 |
| Education: basic | 0.074 | 0.109 | 0.099 | 0.149 | 0.164 | 0.155 | 0.218 | 0.131 | 0.125 | 0.173 | 0.160 | 0.196 | 0.060 | 0.085 |
| Education: sec. | 0.156 | 0.173 | 0.345 | 0.422 | 0.535 | 0.593 | 0.593 | 0.584 | 0.391 | 0.448 | 0.364 | 0.369 | 0.238 | 0.260 |
| Education: Univ. | 0.770 | 0.718 | 0.555 | 0.429 | 0.301 | 0.252 | 0.189 | 0.285 | 0.484 | 0.379 | 0.476 | 0.435 | 0.701 | 0.655 |
| Married/cohabiting | 0.564 | 0.666 | 0.861 | 0.868 | 0.730 | 0.782 | 0.829 | 0.875 | 0.809 | 0.883 | 0.871 | 0.930 | 0.580 | 0.701 |
| Family size | 2.548 | 2.742 | 2.883 | 2.951 | 2.715 | 2.869 | 3.325 | 3.357 | 3.392 | 3.520 | 3.073 | 3.203 | 2.825 | 3.013 |
| Presence of children | 0.343 | 0.383 | 0.418 | 0.482 | 0.452 | 0.471 | 0.460 | 0.522 | 0.465 | 0.477 | 0.467 | 0.510 | 0.531 | 0.528 |
| Number of children | 0.519 | 0.618 | 0.779 | 0.883 | 0.755 | 0.851 | 0.780 | 0.905 | 0.711 | 0.757 | 0.794 | 0.909 | 0.938 | 1.013 |
| Weekly work hours | 39.473 | 45.706 | 36.270 | 40.629 | 32.685 | 37.970 | 48.561 | 53.254 | 36.211 | 41.039 | 32.859 | 44.156 | 39.626 | 45.718 |
| Part-time worker | 0.103 | 0.032 | 0.103 | 0.025 | 0.245 | 0.044 | 0.174 | 0.066 | 0.197 | 0.029 | 0.384 | 0.047 | 0.190 | 0.060 |
| No. Episodes | 4,913 | 4,999 | 722 | 609 | 2,466 | 25,99 | 5,440 | 8,137 | 4,994 | 6,823 | 2,652 | 2,817 | 22,603 | 24,743 |

Note: Standard deviations available upon request. The sample (MTUS 2000-2018) has been restricted to the countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day. Commuting times are measured in minutes. Paid work time is measured in minutes per day.

## Table A5. Averages of commuting episode variables, by country

| | CANADA | | | FINLAND | | | FRANCE | | |
|---|---|---|---|---|---|---|---|---|---|
| VARIABLES | To work | From work | Diff. | To work | From work | Diff. | To work | From work | Diff. |
| A. Women | | | | | | | | | |
| Episode duration | 21.964 | 23.318 | -1.354*** | 25.022 | 24.067 | 0.955 | 27.128 | 27.596 | -0.468 |
| Episode: private vehicle | 0.813 | 0.815 | -0.002 | 0.622 | 0.616 | 0.006 | 0.748 | 0.734 | 0.014 |
| Episode: public transport | 0.083 | 0.087 | -0.004 | 0.042 | 0.043 | -0.001 | 0.071 | 0.080 | -0.009 |
| Episode: active | 0.101 | 0.096 | 0.005 | 0.282 | 0.301 | -0.019 | 0.147 | 0.147 | 0.000 |
| Episode: other mode | 0.006 | 0.006 | 0.000 | 0.157 | 0.144 | 0.013 | 0.052 | 0.058 | -0.006 |
| With whom: alone | 0.851 | 0.827 | 0.024*** | 0.735 | 0.751 | -0.016 | 0.870 | 0.873 | -0.003 |
| With whom: child | 0.023 | 0.038 | -0.015*** | 0.004 | 0.010 | -0.006 | 0.057 | 0.042 | 0.015** |
| With whom: partner | 0.060 | 0.065 | -0.005 | 0.115 | 0.067 | 0.048*** | 0.041 | 0.038 | 0.003 |
| Episodes per trip | 1.385 | 1.225 | 0.160*** | 1.070 | 1.023 | 0.047*** | 1.414 | 1.355 | 0.059*** |
| No. Episodes | 5,806 | 4,678 | | 737 | 685 | | 3,007 | 2,759 | |
| B. Men | | | | | | | | | |
| Episode duration | 25.251 | 26.788 | -1.537*** | 26.238 | 25.685 | 0.553 | 30.589 | 31.078 | -0.489 |
| Episode: private vehicle | 0.840 | 0.844 | -0.004 | 0.696 | 0.707 | -0.011 | 0.780 | 0.772 | 0.008 |
| Episode: public transport | 0.061 | 0.059 | 0.002 | 0.012 | 0.022 | -0.010 | 0.064 | 0.075 | -0.011 |
| Episode: active | 0.093 | 0.091 | 0.002 | 0.170 | 0.167 | 0.003 | 0.109 | 0.101 | 0.008 |
| Episode: other mode | 0.022 | 0.022 | 0.000 | 0.183 | 0.163 | 0.020 | 0.077 | 0.083 | -0.006 |
| With whom: alone | 0.870 | 0.866 | 0.004 | 0.821 | 0.819 | 0.002 | 0.897 | 0.897 | 0.000 |
| With whom: child | 0.009 | 0.013 | -0.004** | 0.006 | 0.003 | 0.003 | 0.025 | 0.017 | 0.008** |
| With whom: partner | 0.038 | 0.035 | 0.003 | 0.055 | 0.041 | 0.014 | 0.031 | 0.025 | 0.006 |
| Episodes per trip | 1.390 | 1.291 | 0.099*** | 1.100 | 1.063 | 0.037 | 1.421 | 1.355 | 0.066*** |
| No. Episodes | 5,907 | 5,254 | | 610 | 585 | | 3,121 | 2,881 | |

Note: Standard deviations available upon request. The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes commuting episodes of employed individuals who worked the diary day. Episode duration is measured in minutes. Start time is measured in hours. Private vehicle includes car, truck, or motorcycle. Active commuting includes walk/on foot, and physical modes of transport. Other trips are classified as "unspecified". Differences in commuting time to/from work are computed as the time of commuting to work, minus the time of commuting from work. * Significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level; all computed according to *t*-type tests.

**Table A5 (*Cont.*). Averages of commuting episode variables, by country**

| | KOREA | | | SPAIN | | | UK | | | US | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VARIABLES | To work | From work | Diff. | To work | From work | Diff. | To work | From work | Diff. | To work | From work | Diff. |
| A. Women | | | | | | | | | | | | |
| Episode duration | 31.893 | 31.376 | 0.517 | 21.060 | 21.925 | -0.865*** | 19.218 | 20.921 | -1.703*** | 19.515 | 21.945 | -2.430*** |
| Episode: private vehicle | 0.380 | 0.399 | -0.019** | 0.365 | 0.360 | 0.005 | 0.595 | 0.597 | -0.002 | 0.852 | 0.848 | 0.004 |
| Episode: public transport | 0.173 | 0.168 | 0.005 | 0.150 | 0.136 | 0.014** | 0.134 | 0.124 | 0.010 | 0.037 | 0.049 | -0.012*** |
| Episode: active | 0.430 | 0.415 | 0.015* | 0.255 | 0.242 | 0.013* | 0.207 | 0.206 | 0.001 | 0.062 | 0.058 | 0.004 |
| Episode: other mode | 0.017 | 0.018 | -0.001 | 0.232 | 0.263 | -0.031*** | 0.079 | 0.092 | -0.013* | 0.051 | 0.047 | 0.004** |
| With whom: alone | 0.866 | 0.787 | 0.079*** | 0.770 | 0.714 | 0.056*** | 0.637 | 0.636 | 0.001 | 0.873 | 0.880 | -0.007*** |
| With whom: child | 0.002 | 0.002 | 0.000 | 0.017 | 0.020 | -0.003 | 0.042 | 0.030 | 0.012** | 0.031 | 0.033 | -0.002 |
| With whom: partner | 0.063 | 0.074 | -0.011** | 0.045 | 0.051 | -0.006* | 0.087 | 0.090 | -0.003 | 0.033 | 0.031 | 0.002 |
| Episodes per trip | 1.110 | 1.106 | 0.004 | 1.724 | 1.691 | 0.033*** | 2.050 | 1.513 | 0.537*** | 1.537 | 1.108 | 0.429*** |
| No. Episodes | 5,774 | 5,766 | | 6,906 | 6,685 | | 3,959 | 2,636 | | 26,758 | 17,025 | |
| B. Men | | | | | | | | | | | | |
| Episode duration | 35.904 | 35.130 | 0.774** | 22.428 | 23.757 | -1.329*** | 24.872 | 26.617 | -1.745*** | 22.561 | 26.169 | -3.608*** |
| Episode: private vehicle | 0.662 | 0.681 | -0.019** | 0.503 | 0.478 | 0.025*** | 0.651 | 0.647 | 0.004 | 0.852 | 0.864 | -0.012*** |
| Episode: public transport | 0.066 | 0.066 | 0.000 | 0.072 | 0.065 | 0.007* | 0.115 | 0.121 | -0.006 | 0.034 | 0.040 | -0.006*** |
| Episode: active | 0.223 | 0.200 | 0.023*** | 0.137 | 0.133 | 0.004 | 0.167 | 0.165 | 0.002 | 0.068 | 0.058 | 0.010*** |
| Episode: other mode | 0.050 | 0.054 | -0.004 | 0.294 | 0.330 | -0.036*** | 0.108 | 0.111 | -0.003 | 0.052 | 0.047 | 0.005*** |
| With whom: alone | 0.898 | 0.841 | 0.057*** | 0.785 | 0.746 | 0.039*** | 0.681 | 0.686 | -0.005 | 0.882 | 0.905 | -0.023*** |
| With whom: child | 0.000 | 0.000 | 0.000 | 0.006 | 0.013 | -0.007*** | 0.022 | 0.016 | 0.006* | 0.010 | 0.012 | -0.002 |
| With whom: partner | 0.036 | 0.040 | -0.004 | 0.024 | 0.031 | -0.007*** | 0.076 | 0.071 | 0.005 | 0.022 | 0.020 | 0.002* |
| Episodes per trip | 1.048 | 1.067 | -0.019*** | 1.692 | 1.694 | -0.002* | 2.057 | 1.742 | 0.315*** | 1.532 | 1.212 | 0.320*** |
| No. Episodes | 8,131 | 8,334 | | 9,493 | 9,515 | | 4,148 | 3,223 | | 29,163 | 22,057 | |

Note: Standard deviations available upon request. The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes commuting episodes of employed individuals who worked the diary day. Episode duration is measured in minutes. Start time is measured in hours. Private vehicle includes car, truck, or motorcycle. Active commuting includes walk/on foot, and physical ways of transport. Other trips are classified as "unspecified". Differences in commuting time to/from work are computed as the time of commuting to work, minus the time of commuting from work. * Significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level; all computed according to *t*-type tests.

## Table A6. Details on the timing of commuting

| | CANADA | | | | FINLAND | | | | FRANCE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Women | | Men | | Women | | Men | | Women | | Men | |
| Hour of the day | To work | From work | To work | From work | To work | From work | To work | From work | To work | From work | To work | From work |
| 4am | 0.010 | 0.001 | 0.035 | 0.004 | 0.006 | 0.000 | 0.010 | 0.003 | 0.010 | 0.001 | 0.031 | 0.003 |
| 5am | 0.045 | 0.003 | 0.092 | 0.009 | 0.058 | 0.002 | 0.096 | 0.009 | 0.025 | 0.003 | 0.057 | 0.011 |
| 6am | 0.149 | 0.006 | 0.240 | 0.018 | 0.170 | 0.003 | 0.264 | 0.007 | 0.074 | 0.006 | 0.126 | 0.007 |
| 7am | 0.331 | 0.022 | 0.323 | 0.028 | 0.339 | 0.013 | 0.259 | 0.003 | 0.305 | 0.013 | 0.382 | 0.011 |
| 8am | 0.302 | 0.020 | 0.195 | 0.020 | 0.209 | 0.009 | 0.137 | 0.002 | 0.345 | 0.012 | 0.269 | 0.007 |
| 9am | 0.074 | 0.009 | 0.055 | 0.010 | 0.083 | 0.008 | 0.056 | 0.010 | 0.088 | 0.012 | 0.076 | 0.008 |
| 10am | 0.038 | 0.007 | 0.029 | 0.009 | 0.025 | 0.004 | 0.019 | 0.002 | 0.022 | 0.015 | 0.024 | 0.010 |
| 11am | 0.032 | 0.018 | 0.021 | 0.017 | 0.023 | 0.009 | 0.007 | 0.005 | 0.020 | 0.036 | 0.025 | 0.042 |
| Noon | 0.058 | 0.042 | 0.057 | 0.055 | 0.029 | 0.016 | 0.010 | 0.010 | 0.046 | 0.165 | 0.051 | 0.161 |
| 1pm | 0.040 | 0.030 | 0.042 | 0.025 | 0.037 | 0.041 | 0.020 | 0.020 | 0.148 | 0.043 | 0.152 | 0.050 |
| 2pm | 0.029 | 0.035 | 0.034 | 0.034 | 0.013 | 0.100 | 0.011 | 0.101 | 0.037 | 0.041 | 0.026 | 0.040 |
| 3pm | 0.031 | 0.090 | 0.027 | 0.087 | 0.018 | 0.209 | 0.010 | 0.199 | 0.015 | 0.040 | 0.014 | 0.044 |
| 4pm | 0.025 | 0.201 | 0.026 | 0.199 | 0.013 | 0.229 | 0.003 | 0.208 | 0.022 | 0.112 | 0.012 | 0.110 |
| 5pm | 0.024 | 0.228 | 0.028 | 0.261 | 0.006 | 0.124 | 0.005 | 0.113 | 0.014 | 0.212 | 0.013 | 0.225 |
| 6pm | 0.015 | 0.088 | 0.020 | 0.127 | 0.007 | 0.055 | 0.004 | 0.046 | 0.012 | 0.179 | 0.009 | 0.214 |
| 7pm | 0.010 | 0.044 | 0.011 | 0.056 | 0.009 | 0.021 | 0.003 | 0.033 | 0.008 | 0.112 | 0.009 | 0.121 |
| 8pm | 0.005 | 0.034 | 0.007 | 0.034 | 0.012 | 0.025 | 0.002 | 0.023 | 0.008 | 0.053 | 0.015 | 0.048 |
| 9pm | 0.005 | 0.030 | 0.008 | 0.031 | 0.006 | 0.046 | 0.009 | 0.025 | 0.003 | 0.023 | 0.009 | 0.035 |
| 10pm | 0.006 | 0.020 | 0.011 | 0.025 | 0.001 | 0.027 | 0.004 | 0.019 | 0.002 | 0.010 | 0.003 | 0.017 |
| 11pm | 0.004 | 0.017 | 0.004 | 0.022 | 0.000 | 0.010 | 0.000 | 0.014 | 0.001 | 0.004 | 0.001 | 0.008 |
| Midnight | 0.002 | 0.015 | 0.002 | 0.012 | 0.000 | 0.004 | 0.002 | 0.006 | 0.001 | 0.001 | 0.002 | 0.003 |
| 1am | 0.001 | 0.003 | 0.002 | 0.006 | 0.000 | 0.001 | 0.002 | 0.001 | 0.000 | 0.002 | 0.001 | 0.002 |
| 2am | 0.002 | 0.004 | 0.002 | 0.006 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 |
| 3am | 0.002 | 0.003 | 0.006 | 0.005 | 0.001 | 0.001 | 0.001 | 0.000 | 0.002 | 0.001 | 0.008 | 0.001 |

Note: The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day.

**Table A6 (*Cont.*). Details on the timing of commuting**

| | KOREA | | | | SPAIN | | | | UK | | | | US | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Women | | Men | | Women | | Men | | Women | | Men | | Women | | Men | |
| Hour of the day | To work | From work | To work | From work | To work | From work | To work | From work | To work | From work | To work | From work | To work | From work | To work | From work |
| 4am | 0.004 | 0.004 | 0.012 | 0.004 | 0.002 | 0.001 | 0.007 | 0.002 | 0.007 | 0.000 | 0.015 | 0.001 | 0.015 | 0.001 | 0.039 | 0.002 |
| 5am | 0.023 | 0.008 | 0.047 | 0.009 | 0.018 | 0.003 | 0.045 | 0.006 | 0.017 | 0.001 | 0.079 | 0.006 | 0.053 | 0.002 | 0.107 | 0.005 |
| 6am | 0.066 | 0.005 | 0.164 | 0.016 | 0.070 | 0.006 | 0.128 | 0.017 | 0.078 | 0.002 | 0.170 | 0.015 | 0.153 | 0.006 | 0.217 | 0.011 |
| 7am | 0.235 | 0.007 | 0.382 | 0.019 | 0.265 | 0.004 | 0.394 | 0.011 | 0.266 | 0.007 | 0.341 | 0.009 | 0.305 | 0.015 | 0.257 | 0.015 |
| 8am | 0.410 | 0.008 | 0.379 | 0.021 | 0.299 | 0.011 | 0.225 | 0.009 | 0.409 | 0.014 | 0.289 | 0.008 | 0.208 | 0.008 | 0.150 | 0.010 |
| 9am | 0.200 | 0.008 | 0.112 | 0.013 | 0.158 | 0.009 | 0.071 | 0.005 | 0.129 | 0.011 | 0.090 | 0.006 | 0.075 | 0.006 | 0.059 | 0.008 |
| 10am | 0.078 | 0.006 | 0.033 | 0.009 | 0.031 | 0.010 | 0.020 | 0.006 | 0.030 | 0.003 | 0.027 | 0.007 | 0.037 | 0.007 | 0.030 | 0.009 |
| 11am | 0.037 | 0.009 | 0.014 | 0.007 | 0.018 | 0.017 | 0.010 | 0.007 | 0.033 | 0.011 | 0.017 | 0.012 | 0.032 | 0.013 | 0.029 | 0.014 |
| Noon | 0.027 | 0.015 | 0.013 | 0.013 | 0.022 | 0.036 | 0.012 | 0.033 | 0.032 | 0.040 | 0.023 | 0.025 | 0.059 | 0.026 | 0.070 | 0.029 |
| 1pm | 0.031 | 0.017 | 0.016 | 0.012 | 0.042 | 0.163 | 0.051 | 0.198 | 0.038 | 0.042 | 0.036 | 0.024 | 0.056 | 0.024 | 0.059 | 0.022 |
| 2pm | 0.021 | 0.033 | 0.018 | 0.015 | 0.086 | 0.222 | 0.134 | 0.222 | 0.023 | 0.039 | 0.024 | 0.033 | 0.035 | 0.040 | 0.037 | 0.042 |
| 3pm | 0.018 | 0.046 | 0.013 | 0.028 | 0.122 | 0.191 | 0.122 | 0.147 | 0.019 | 0.059 | 0.012 | 0.053 | 0.028 | 0.075 | 0.026 | 0.095 |
| 4pm | 0.016 | 0.078 | 0.010 | 0.042 | 0.102 | 0.069 | 0.065 | 0.045 | 0.023 | 0.122 | 0.016 | 0.150 | 0.021 | 0.115 | 0.020 | 0.145 |
| 5pm | 0.019 | 0.177 | 0.014 | 0.160 | 0.033 | 0.061 | 0.024 | 0.063 | 0.017 | 0.204 | 0.025 | 0.263 | 0.017 | 0.144 | 0.019 | 0.184 |
| 6pm | 0.015 | 0.276 | 0.014 | 0.329 | 0.017 | 0.072 | 0.012 | 0.140 | 0.013 | 0.095 | 0.021 | 0.185 | 0.011 | 0.072 | 0.013 | 0.109 |
| 7pm | 0.012 | 0.166 | 0.014 | 0.220 | 0.010 | 0.089 | 0.014 | 0.174 | 0.008 | 0.040 | 0.012 | 0.072 | 0.005 | 0.038 | 0.008 | 0.051 |
| 8pm | 0.008 | 0.100 | 0.009 | 0.119 | 0.010 | 0.121 | 0.012 | 0.138 | 0.007 | 0.026 | 0.009 | 0.034 | 0.004 | 0.024 | 0.006 | 0.026 |
| 9pm | 0.006 | 0.098 | 0.007 | 0.088 | 0.013 | 0.066 | 0.025 | 0.049 | 0.011 | 0.022 | 0.013 | 0.021 | 0.005 | 0.020 | 0.007 | 0.024 |
| 10pm | 0.003 | 0.078 | 0.005 | 0.068 | 0.002 | 0.065 | 0.006 | 0.053 | 0.003 | 0.021 | 0.006 | 0.018 | 0.007 | 0.017 | 0.007 | 0.021 |
| 11pm | 0.001 | 0.037 | 0.003 | 0.041 | 0.002 | 0.022 | 0.003 | 0.022 | 0.001 | 0.011 | 0.002 | 0.014 | 0.003 | 0.015 | 0.003 | 0.019 |
| Midnight | 0.001 | 0.013 | 0.002 | 0.013 | 0.000 | 0.014 | 0.001 | 0.014 | 0.000 | 0.006 | 0.001 | 0.012 | 0.001 | 0.007 | 0.001 | 0.011 |
| 1am | 0.001 | 0.008 | 0.001 | 0.008 | 0.000 | 0.006 | 0.001 | 0.007 | 0.001 | 0.003 | 0.000 | 0.005 | 0.001 | 0.003 | 0.002 | 0.006 |
| 2am | 0.001 | 0.010 | 0.002 | 0.006 | 0.001 | 0.004 | 0.001 | 0.004 | 0.001 | 0.002 | 0.000 | 0.003 | 0.002 | 0.002 | 0.004 | 0.005 |
| 3am | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.001 | 0.003 | 0.000 | 0.001 | 0.003 | 0.005 | 0.003 | 0.001 | 0.007 | 0.004 |

Note: The sample (MTUS 2000-2018) has been restricted to countries with non-missing information on the main variables. The sample includes employed individuals who worked the diary day.