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Who uses green mobility? Exploring profiles in developed countries☆

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ABSTRACT

Mobility gives individuals access to different daily activities, facilities, and places, but at the cost of imposing environmental externalities. The sustainable growth of society is linked to green mobility (e.g., public transport, walking, cycling) as a way to alleviate individual carbon footprints. This study explores the socio-demographic profile of individuals performing green travel (public and active modes of transport) and identifies cross-country differences in green travel behavior. We rely on information from the Multinational Time Use Study, MTUS, for Bulgaria, Canada, Spain, France, Hungary, Italy, the Netherlands, the United Kingdom, and the United States, from 2000 to 2019. We estimate Ordinary Least Squares regressions modelling individual decisions regarding green mobility. Our results indicate that the socio-demographic and family profile of travelers is not homogenous across green modes of transport, with walking as a mode of travel exhibiting a much more consistent profile, across countries, in comparison to the use of public transport and cycling. Results indicate that some countries are more prone to green travel, and that transport infrastructure is a factor in the proportion of time spent on both public and active transport. Our findings help in understanding who is committed to green mobility, while revealing interesting systematic differences across countries.

1. Introduction

Mobility is an essential part of our daily lives. It provides access to many different activities, such as employment, education, and social, civic, and leisure events. Also, mobility allows for changes in location of individuals, and access to different facilities. However, an individual's mobility imposes significant environmental and health burdens. Because it is mainly based on the combustion of fossil fuels, transport is responsible for nearly one quarter of all energy-related greenhouse gas (GHG) emissions (UN, 2019), and forecasts indicate that by 2050, two-thirds of all humanity will be urban, leading to a doubling of motorized mobility and to a 60% increase in CO_2 emissions from transport (OECD, 2017). Furthermore, the rapid expansion of motorized transport has increased the incidence of respiratory and cardiovascular disease and has dramatically reduced individual lung function (WHO, 2006).

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International organizations have recognized that mobility is central to sustainable development. In this respect, one of the Sustainable Development Goals (SDGs) adopted by all United Nations Member States in 2015 established the need for sustainable transport systems for all by the year 2030. Sustainable mobility, including both public transit and active transport (walking and cycling), may contribute significantly to reduce greenhouse gases emissions, with active modes being characterized as 'zero carbon' (Stanley and Watkiss, 2003; Chapman, 2007; Gössling and Choi, 2015). However, there is still much to be done to extend the use of green modes of travel, and increasing such modes requires not only improving public transit services, and investing in and promoting walking/cycling behavior, but also understanding who is committed to green mobility.

The existing evidence indicates that the use of green modes of transport can vary substantially across cities and countries (Pucher et al., 2010; Gössling, 2013). Such variations are related to both individual characteristics of travelers and differences in transport infrastructure, services, and policies. On the one hand, studies of different countries have documented that socio-demographic characteristics affect active mobility (Plaut, 2005; Sener et al., 2009; Adams, 2010) and the use of public transit (Buehler and Pucher, 2012). Factors such as age, gender, education, the number of children in the household, and having access to a car are among the most frequent factors related to green mobility.

Prior research is largely based on single countries, with very few exceptions drawing cross-country comparisons of green mobility patterns (Buehler, 2011; Buehler et al., 2011; Buehler and Pucher, 2012; Panik et al., 2019); noteworthy studies of cross-country differences suggest that the relationship between green travel and individual characteristics is not necessarily generalizable. On the other hand, transportation infrastructure and services, reflecting policy interventions, may play a crucial role in boosting and promoting the use of green modes of travel, but the majority of the analysis comparing countries' infrastructure and strategies are focused on active modes of transport, especially cycling, for Germany, Denmark, the Netherlands and the UK (Pucher and Dijkstra, 2000; Pucher and Buehler, 2008) or for North America (Pucher et al., 1999; Pucher and Buehler, 2006), leaving aside the use of public transit.

Within this framework, we explore the socio-demographic profile of individuals committed to green mobility, and aim to identify cross-country differences in green travel behavior. In doing so, we assess the role of national transportation infrastructure and services in individual choices, via an analysis of several indicators that reflect infrastructure systems. We rely on time use information of 9 developed countries (Bulgaria, Canada, Spain, France, Hungary, Italy, the Netherlands, the United Kingdom, and the United States) from 2000 to 2019, based on the Multinational Time Use Study (MTUS) data sets. We estimate Ordinary Least Squares regressions, modelling individual decisions regarding green mobility captured by the proportion of daily time spent on green modes of transport (public transit, walking, and cycling).

We find that some countries are more prone to green travel, net of differences in individual socio-demographics characteristics. In addition, we observe that the socio-demographic and family profiles of travelers exhibit much more consistent cross-country relationships in the case of walking, in comparison to public transit and cycling. We also find that indicators of national transportation infrastructure and services, reflecting transport policies, are related to the proportion of time spent on both public and active transit. Factors such as the length of rail lines, the number of private vehicles, the proportion of people living in urban areas, population, and mortality caused by road traffic injury appear to be positively related to the fraction of time travelled by public transit, while the length of motorways, number of buses, and passengers carried by railways, the level of CO_2 emissions, and per-capita GDP growth rates are negatively correlated. In turn, the length of rail lines and the level of CO_2 emissions are negatively correlated with the fraction of time spent walking, while the number of private vehicles is positively related. In the case of cycling, the extent of motorways, the number of buses, the number of private vehicles, and the proportion of people living in urban areas are factors negatively related to the proportion of time spent cycling, while population size is positively related.

We complement the existing literature by focusing on public transit and active (i.e. walking and cycling) modes of transport during all types of travel (work and non-work related), and by considering a broad set of developed countries, including Europe and North America. To our knowledge, no prior research has studied the green travel behavior of individuals and the role of the national context, including transport infrastructures, travel choices, considering public and active modes. Our results reveal systematic differences in green mobility behavior across countries, and shed light on possible strategies to effectively enhance green travel. Furthermore, having evidence for several countries using homogeneous data may be helpful in understanding cross-country differences regarding the use of public transit and active modes of transport.

The remainder of the paper is as follows. Section 2 presents a review of the literature. Section 3 presents the data and variables, Section 4 describes the empirical strategy, and Section 5 describes the results. Section 6 sets out our main conclusions.

2. Related literature

Mobility by car is the preferred mode of travel worldwide. Private cars are currently used for nearly 75% of urban passenger transport in OECD countries, and over 60% in non-OECD countries (OECD, 2019). Despite that some countries have a relatively high proportion of people walking or cycling, the car generally remains the dominant mode of transport in Europe (EEA, 2015). Because the car contributes significantly to environmental pollution and global climate change, green modes of transport (public transit, cycling,

Table 1
Summary of Related Literature.

Study	Mode of travel	Countries	Main Results
Panel (A): socio-demographic characteristics associated with green mobility			
Adams (2010)	Active (walking/cycling)	UK	- Age, access to a car, employment, social class and education
Sener et al. (2009)	Active (cycling)	US	- Gender, age, education, number of automobiles, of bicycles, and of children, location and weather
Plaut (2005)	Active (walking/cycling)	US	- Salaries, housing, education, location, race and gender
Heinen et al. (2010)	Active (cycling)	overview of the literature	- Differences across countries in the relationship between socio-economic factors and travelling to work by bicycle
Buehler and Pucher (2012)	Public transportation	Germany and the US	- Age, high density or metropolitan areas, having a car - Cross-country differences in the magnitude of the likelihood of riding public transport
Aldred et al. (2016)	Active (cycling)	the UK	- Increases of cycling are observed in areas where there is no increase (decrease) in the representation of females (older adults)
Buehler et al. (2011)	Active (walking/cycling)	Germany and the US	- Age, education, income, number of cars, and location - Cross-country differences: a) in walking by gender and employment, and b) in cycling according to income, employment, and number of cars
Buehler (2011)	Public transportation	Germany and the US	- Income, population, and closeness to public transport - Cross-country differences in gender, cars and income
Panik et al. (2019)	Active (walking/cycling)	the US and the Netherlands	- Education, marital status, and level of urbanization - Cross-country differences in gender, employment, income, and disability
Sá et al. (2018)	Active (walking/cycling)	Argentina, Brazil and Colombia	- Cross country similarities in gender and age
ELANS (2020)	Active (walking/cycling)	Latin America	- Cross country differences in age and educational level
Goel et al. (2022)	Active (cycling)	17 countries	- Cross-country differences in cycling behavior - Demographic patterns in different cycling clusters
Haustein et al. (2019)	Active (cycling)	overview of the literature	- Women and older people are under-represented among cyclists in low-cycling countries, such as US and UK
Panel (B): transport infrastructure and services associated with green mobility			
Pucher et al., (2010)	Active (cycling)	*meta*-analysis of 139 studies	- Bicycle lanes, bicycle boulevards, maintenance of infrastructure, car-free zones, bicycle parking
Pucher et al. (1999)	Active (cycling)	Canada and the US	- Importance of guiding transportation policy and infrastructure towards cycling
Pucher and Buehler (2006)	Active (cycling)	Canada and the US	- Higher costs of owning, driving and parking a car, safer cycling conditions, and more extensive cycling infrastructure and training programs
Pucher and Dijkstra (2000)	Active (walking/cycling)	Germany and the Netherlands	- Better facilities, restrictions on motor vehicles, traffic education, and strict enforcement of traffic laws as measures to improve safety
Pucher and Buehler (2008)	Active (cycling)	Denmark, Germany, and the Netherlands	- Provision of facilities, traffic control, rights, parking, integration with public transport, promotional events, and taxes and restrictions on car ownership
Taylor at al. (2009)	Public transportation	the US (city-level)	- Highway system, economy and population
Santos et al. (2013)	Active (cycling) and public	Europe (city-level)	- Length of the bicycle network, population, GDP per capita, the number of buses, and public transport fares

and walking) are being promoted as alternative mobility.[1] OECD (2019) projections suggest that the shares of travel by car will decrease to 46% in OECD countries and to 39% in non-OECD countries, by 2050. In turn, it is expected that travel modes in cities will shift towards public transit.

Evidence in the literature indicates that the share of trips made by bicycle is highly variable across cities of different countries, from 1% in London to 40% in Groningen (The Netherlands) (Pucher et al., 2010). Even though there has been considerable growth in bicycle use in recent decades, many cities in the world still exhibit low levels of bicycle use (Gilbert and Perl, 2008). In comparison, car use range from 16% in Hong Kong to 88% in Chicago (Gössling, 2013). Such variations in the use of green modes of mobility can be related

[1] Other modes of transport, such as scooters, moto sharing, car sharing, or carpooling represent alternative modes of transport, and are increasing in importance. For instance, Molina et al. (2020) analyze the role of socio-demographics in the carpooling behavior of individual commuters in Bulgaria, Canada, Spain, Finland, France, Hungary, Italy, South Korea, the United Kingdom, and the United States. The authors find that age, gender, education, being native, and household composition may have similar cross-country relationships to carpooling participation. The analysis of these specific modes of transport is beyond the scope of our analysis.

to individual characteristics of travelers, and to cultural factors, as well as to differences in transport infrastructure, services, policies, and weather conditions (Haustein and Nielsen, 2016).

The literature has documented that socio-demographic characteristics of individuals are indeed associated with the use of green modes of transport (see Panel (A) of Table 1) (see Haustein et al. (2019) for an overview). In the case of active modes of travel, prior evidence indicates that walking and cycling are significantly related to age, gender, employment status, education, income, and having access to a car, in the US (Plaut, 2005; Sener et al., 2009) and in the UK (Adams, 201). However, Heinen et al. (2010), in an overview of the literature, highlight the lack of clarity in the connection between socio-economic factors and travelling to work by bicycle, finding large differences across studies from different countries. Regarding the characteristics of public transit users, Buehler and Pucher (2012) find that in the US and Germany individuals aged between 16 and 24 years, living in high density or metropolitan areas, and not having a car, are more likely to ride public transport, although there are striking differences between the two countries in the magnitude of the likelihood of riding public transport. Focusing on the relationship between observed increases in cycling and the demographic profile of cyclists in the UK, Aldred et al. (2016) find that in the areas where cycling has increased, there has been no increase in the representation of females, and a decrease in the representation of older adults.

On a related line of literature, many studies have focused on comparing the role of socio-demographic characteristics in green travel behavior across countries, finding significant differences. Buehler et al. (2011) analyze active travel in Germany and the US, finding differences in the walking behavior of individuals that depend on gender and employment status, and differences in cycling according to income level, employment status, and the number of cars. In a related study, Buehler (2011) includes public transport in the comparative analysis between Germany and the US, finding differences across countries by gender, number of cars, and income level. More recently, Panik et al. (2019) study active travel in the US and the Netherlands and document a dissimilar relationship in the Dutch and American data between time spent on active travel, by gender, employment, income, and disability. Sá et al. (2018) look at cities in Argentina, Brazil, and Colombia, and find similarities in the use of active transport according to gender and age. In turn, ELANS (2020) finds consistent patterns of active travel across Latin American countries regarding gender, but differences regarding age and educational level. Additionally, Goel et al. (2022) study cycling behavior in seventeen countries, from 2009 to 2019, and show that The Netherlands, Japan, and Germany are among the most enthusiastic cycling countries. The authors create clusters of high- and low-cycling geographies, analyzing socio-demographic patterns in each of them.

A related strand of the literature has compared transport infrastructure and services across countries with the aim of analyzing how policy interventions can boost the use of green modes of travel (see Panel (B) of Table 1). However, the majority of these analyses focuses only on active modes of transport. For instance, Pucher et al. (2010) in a *meta*-analysis of 139 studies indicate that on-road bicycle lanes, shared bus/bike lanes, signed bicycle routes, bicycle boulevards, maintenance of infrastructure, car-free zones, bicycle parking and stations, among other factors, all have positive impacts on the levels of bicycling. Pucher et al. (1999) study Canada and the United States and highlight that, even though cycling is growing in North America, its mode share still remains far lower than levels in northern Europe, because transportation policy remains guided by motoring, and infrastructure is primarily car-based. Also for Canada and the US, Pucher and Buehler (2006) identify factors explaining the differences across countries, including greater urban densities, higher costs of owning, driving, and parking a car, safer cycling conditions, and more extensive cycling infrastructure and training programs. These authors show that such factors are a result of transport and land-use policies that effectively promote active mobility, and do not arise from intrinsic cultural or historical differences.

Another important element of transport policy to increase active mobility is related to safety. Pucher and Dijkstra (2000) analyze pedestrian and cyclist safety in the Netherlands and Germany, finding that better facilities for walking and cycling, an urban design sensitive to the needs of active travelers, restrictions on motor vehicles, traffic education, and strict enforcement of traffic laws, are all among the measures that can be applied. In line with this, Pucher and Buehler (2008) analyze cycling behavior in Denmark, Germany, and the Netherlands, noting that these countries have made cycling a safe, convenient, and practical way to get around in cities. The authors highlight the coordinated nature of a mutually reinforcing set of policies to best explain how these countries promote cycling. The strategies rely on a combination of the provision of separate cycling facilities, traffic control in most residential neighborhoods, cycling rights, ample bike parking, full integration with public transport, promotional events to motivate cycling, and taxes and restrictions on car ownership.

Additionally, aggregate city-level studies highlight the importance of infrastructure and specific characteristics of the economy. For instance, most variations in transit ridership in the US can be explained by highway system characteristics, along with regional geography, the metropolitan economy, and population characteristics (Taylor at al., 2009). In the case of Europe, bicycle share increases with the length of the bicycle network in a given city, while public transport share increases with resident population, GDP per capita, and the number of buses in operation, and decreases with public transport fares (Santos et al., 2013).

3. Data and variables

We use the Multinational Time Use Study (MTUS) data set, coordinated by the Centre for Time Use Research (CTUR) at University College, London, and included in 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 contains randomly selected time-diary samples from 25 countries over 5 decades. It includes harmonized information on 69 activities performed by individuals during the day, in addition to location, mode of transport, and presence of others during the activity, as well as individual and family-level socio-demographic and geographic characteristics. Information is gathered by completion of personal diaries and household and individual questionnaires.

The use of time-use surveys in transportation research has become common (Gimenez-Nadal and Molina, 2014; 2016; Jara-Díaz and Rosales-Salas, 2015; Gimenez-Nadal, Molina and Velilla, 2018a, 2018b), in the same way that these surveys have become the

Table 2
Descriptive Statistics by Country.

	all countries		Bulgaria		Canada		Spain		France	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
travelling information										
travelling duration (minutes)	84.3	72.6	71.1	54.4	81.1	76.0	75.2	59.3	93.4	78.7
proportion of time travelled by public	5.1	19.3	7.1	21.2	6.4	22.2	10.8	28.0	5.8	21.1
proportion of time travelled by walking	17.9	34.4	78.2	36.5	10.6	27.2	40.7	44.0	20.4	36.3
proportion of time travelled by cycling	2.8	15.2	0.5	6.6	0.7	7.9	0.5	6.6	1.7	11.5
% of individuals not using public	92.3		87.8		91.4		84.9		91.9	
% of individuals not walking	70.0		12.6		79.2		43.3		70.1	
% of individuals not cycling	96.0		99.3		99.0		99.2		97.4	
socio-demographic characteristics										
age	44.61	18.01	44.17	17.65	46.48	17.24	42.92	18.17	48.98	16.75
male	0.46	0.50	0.51	0.50	0.45	0.50	0.49	0.50	0.47	0.50
uncompleted secondary or less	0.25	0.43	0.35	0.48	0.17	0.38	0.30	0.46	0.29	0.45
completed secondary	0.33	0.47	0.48	0.50	0.15	0.36	0.36	0.48	0.48	0.50
above secondary	0.42	0.49	0.17	0.38	0.67	0.47	0.34	0.47	0.23	0.42
employee	0.59	0.49	0.48	0.50	0.63	0.48	0.51	0.50	0.51	0.50
presence of a partner	0.57	0.50	0.66	0.47	0.56	0.50	0.60	0.49	0.63	0.48
household size	2.93	1.44	3.37	1.59	2.51	1.29	3.35	1.33	2.54	1.31
number of children	0.78	1.06	0.71	0.93	0.49	0.83	0.69	0.93	0.61	1.00
Number of individuals	396,959		10,450		28,384		34,652		20,366	

	Hungary		Italy		Netherlands		UK		US	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
travelling information										
travelling duration (minutes)	70.9	58.0	91.0	72.5	93.1	72.4	87.0	72.9	82.1	74.3
proportion of time travelled by public	11.1	26.9	4.7	17.7	7.3	22.2	9.1	24.9	2.7	14.1
proportion of time travelled by walking	36.7	43.4	31.9	40.1	10.5	25.6	18.5	34.0	4.9	18.4
proportion of time travelled by cycling	16.1	35.2	2.6	14.0	29.8	41.4	1.4	11.0	0.4	5.3
% of individuals not using public	83.4		92.1		88.5	86.0		96.0		
% of individuals not walking	49.1		46.6		79.8	69.2		87.2		
% of individuals not cycling	81.0		95.8		59.5	98.0		99.4		
socio-demographic characteristics										
age	49.00	13.43	42.65	20.15	40.66	17.34	42.26	18.51	45.84	17.03
male	0.50	0.50	0.50	0.50	0.44	0.50	0.46	0.50	0.45	0.50
uncompleted secondary or less	0.56	0.50	0.43	0.49	0.27	0.45	0.30	0.46	0.14	0.35
completed secondary	0.23	0.42	0.49	0.50	0.39	0.49	0.34	0.47	0.25	0.43
above secondary	0.21	0.41	0.08	0.27	0.33	0.47	0.36	0.48	0.61	0.49
employee	0.57	0.49	0.45	0.50	0.56	0.50	0.61	0.49	0.68	0.47
presence of a partner	1.00	0.00	0.53	0.50	0.61	0.49	0.61	0.49	0.54	0.50
household size	3.18	1.21	3.18	1.28	2.88	1.41	2.96	1.41	2.81	1.52
number of children	0.64	0.97	0.68	0.94	0.83	1.11	0.84	1.13	0.90	1.15
number of individuals	3,467		76,640		22,538	28,581		171,881		

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix.

"gold standard" in the analysis of paid and (specially) unpaid work of individuals (Aguiar and Hurst, 2007; Gimenez-Nadal and Sevilla, 2012). Prior evidence indicates that analysis derived from the use of diary data produce more reliable and accurate estimates, compared to time-use surveys relying on stylized questions and on information on a 'typical day' (e.g., Robinson and Godbey 1985; Juster and Stafford 1985). The caveat is that travel distance cannot be used to analyze travel behavior because information is, a priori, not available in this surveys.

We select countries with time surveys from 2000 to the present, containing comparable information on travelling activities. Our sample is composed of 9 countries (see Table A1 for a description of the countries included in the analysis). We restrict our analysis to episodes coded as travelling, with non-missing information on the mode of travel. Travel activities include travel to/from work, educational, voluntary, civic, and religious-related travel, child- or adult-care travel, as well as shopping, personal or household care travel, and other travel. Because we are interested in green modes of transport, we construct three variables containing information on travel made by public transport, walking, and cycling. Specifically, we compute the proportion of time spent on each green mode of transport (public, walking, and cycling). To that end, we sum the time travelled (in minutes) by public transport/walking/cycling mode by the individual in his/her diary, and divide it by the total time spent in all travelling episodes. These three proportions are the dependent variables in our empirical analysis. The final sample consists of 396,959 individuals.

Table 2 shows the time devoted to daily travel by individuals in our sample, and the proportion of travel that is done by public transport, by walking, and by cycling. We observe that the longest average duration of travel is for the Netherlands (93.1 min) and Italy (91 min), followed by the UK (87 min), the US (82.1 min) and Canada (81.1 min), while the shortest corresponds to Bulgaria (71.1 min) and Hungary (70.9 min). Considering all countries, individuals devote an average of 84.3 min during the day to travelling. Hungary, Spain, and the UK present the largest proportion of time on public transport (11.1%, 10.8% and 9.1%, respectively), while Italy and the US shows the smallest proportions (4.7% and 2.7%). Bulgaria presents the largest proportion of time spent walking (78.2%), followed by Spain and Hungary (40.7% and 31.9%), while Canada, the Netherlands, and the US have the smallest proportion (10.6%, 10.5% and 4.9%, respectively). Regarding cycling as a mode of transport, the Netherlands presents the largest proportion of time travelled by this mode (29.8%), followed by Hungary (16.1%), while Canada, Bulgaria, Spain, and the US exhibit the smallest proportion (0.7%, 0.5%, 0.5% and 0.4%, respectively). The magnitude of average proportions of green travel reflects outstanding differences across countries, particularly in the case of active modes of transport, with even larger differences in cycling. In addition, the US is well below the average proportions of green travel.

To explore the socio-demographic profile of travelers choosing a green mode of transportation, we consider age, gender, the highest level of formal education achieved (uncompleted secondary or less, completed secondary or above secondary education), and employment status (employed or unemployed), as well as household composition, captured by the presence of a partner (either married or cohabitating), family size and the number of children under 18 years old. Prior evidence indicates that age, gender, education (Plaut, 2005; Sener et al., 2009; Adams, 2010; Buehler and Pucher, 2012), and household composition are important determinants of travel behavior (McQuaid and Chen, 2012; Gimenez-Nadal and Molina, 2016).[2]

Table 2 shows summary statistics of the socio-demographic characteristics of individuals in our sample. We observe that the average age of individuals is between 40.66 (the Netherlands) and 49 (Hungary) years old, and around 46% of the sample are men. Hungary and Italy have larger proportions of individuals with less than secondary education (56% and 43%, respectively), while Italy, Bulgaria and France have larger proportions of individuals with secondary education (49%, 48% and 48%), and Canada and the US have larger proportions with education above secondary level (67% and 61%). In addition, 59% of the pool sample are employed, with Italy and Bulgaria being the countries with lower percentages of employed individuals (45% and 48%). Regarding family composition, 57% of the pool sample lives with a partner. In Italy, the US, and Canada about half of the individuals live in couple, while all individuals interviewed in Hungary do. The smallest average family sizes are observed in Canada and France (2.5 members) and the largest in Bulgaria and Spain (3.3 members). Considering the number of children, individuals in the Netherlands, the UK, and the US have, on average, a higher number of children (almost 1 child), while in Canada we observe the opposite (about 0.5 of a child). In general, the distribution of socio-demographics characteristics is relatively similar across countries, with major differences in education levels and family composition.

4. Empirical strategy

We aim to characterize individuals performing green travel and to identify cross-country differences in the green travel behavior of individuals, conditional on socio-demographic characteristics. To that end, we estimate Ordinary Least Squares (OLS) models at the individual-level, considering three alternative dependent variables: a) the proportion of time spent on public transit; b) the proportion of time spent walking; c) the proportion of time spent cycling. We estimate the following specification for the pool sample of countries, including country fixed effects that allow us to assess which countries are more prone to green travel, net of differences in socio-demographic characteristics of individuals, as follows:

$$\log(P_{it}+1) = \alpha + \beta X_{it} + \eta H_{it} + \delta W_{it} + \varphi FE_{ct} + \gamma FE_t + \varepsilon_{it} \quad (1)$$

where P_{it} is the proportion of travel time by public transit, walking, or cycling by individual "*i*" in year "*t*". We transform dependent variables to their logarithm form in order to interpret the estimated coefficients as elasticities.[3] X_{it} is a vector of socio-demographic variables, including age (and its square), gender, education level, and employment status. H_{it} is a vector of household composition variables, including the presence of a partner (either married or cohabitating), household size, and number of children. W_{it} controls whether the person's diary corresponds to a weekday or weekend. Continuous variables are also transformed to their logarithmic form. FE_{ct} are country fixed effects, where the US is the reference country. FE_t are year fixed effects and ε_{it} are unmeasured factors. Standard errors are robust, and the error term is clustered at the country level. Observations are weighted at the individual-level using the survey weights.

To further investigate differences across countries, we explore the role that transport infrastructure may have on the green travel behavior of individuals. To this end, we estimate Eq. (1), omitting country fixed effects but including instead a set of 10 relevant indicators defined at the country-year level, matching the composition of our MTUS sample (see Table A.1 of the Appendix). These indicators control for factors related to transport infrastructure and services, road security, and country characteristics, such as

[2] Some of these studies have identified car/automobile ownership as a key variable in the analysis of mode choice (e.g. Buehler, 2011). However, we cannot include this variable in our analysis because the information is not available for all countries. We have, as an alternative, analyzed a sample of countries with information on car ownership, and we first find that our results and conclusions are robust to the inclusion of car ownership. Furthermore, car ownership is negatively related to the use of public transport, walking, and cycling in most countries. Results are available upon request.

[3] We sum 1 to our dependent variables in order to avoid problems computing logarithms for individuals reporting no travel time by public transit or active mode.

economic growth and urban distribution, that are likely to be correlated with green travel choices.[4]

We include the length of railway route available for train service in km (divided by 1,000), the length of motorways in km (divided by 1,000), the number of buses available for services (divided by 1,000), the number of private vehicles, including cars and motorcycles (divided by 10,000), the number of passengers transported by railways times km traveled (divided by 1,000), mortality caused by road traffic injury (per 100,000 population), carbon dioxide emissions from liquid fuel consumption in kt (divided by 10,000), the proportion of individuals living in urban areas, GDP per capita growth (annual %) and population size. The length of rail lines, passengers, mortality, CO2 emissions, proportion of urban population, GDP per capita growth and population indicators are taken from the World Development Indicators of the World Bank Database, while the length of motorways, the number of buses, and the number of private vehicles are taken from Eurostat, in the case of European countries, from the Bureau of Transportation Statistics of the United States, and from Statistics Canada. All country indicators are from the same years as the MTUS sample, thus indicators are defined by country and year in order to match the MTUS.

Average values of country indicators are presented in Table 3. United States and Canada are the countries with the most extensive rail line routes and motorways, followed by France, the UK, and Italy in the case of rail lines, and by Spain and France in the case of motorways. The US also has the largest number of buses, while the UK stands out among European countries. However, when accounting for the size of the population, the infrastructure of buses is relatively similar across countries, but is considerably higher in Bulgaria. In addition, Italy and France have the highest number of vehicles per inhabitant, while Hungary and Bulgaria have the lowest. Mortality rates are the highest in Bulgaria and the US, followed by Italy. Regarding CO2 emissions from liquid fuel consumption, the US records the largest figures. In the years under consideration for each country, Bulgaria presents the highest GDP per capita growth and Hungary the lowest.

To explore cross-country heterogeneities in the socio-demographic characteristics of individuals engaging in green travel, we estimate a similar specification to Eq. (1) but for each country "c":

$$\log(P_{itc}+1) = \alpha_c + \beta_c X_{itc} + \eta_c H_{itc} + \delta_c W_{itc} + \gamma_c FE_{tc} + \varepsilon_{itc} \quad (2)$$

In this case, the error term is clustered at the individual level. National indicators included in FE_{tc} are also defined in logarithms, with the exception of the GDP per capita growth, which contains negative values.

It is important to note that our sample includes a considerable number of individuals not travelling by either public or active modes of transport (see Table 2). This may indicate that a Tobit model could be implemented to account for the censoring. However, prior studies have found similar results when comparing OLS models to Tobit models in the study of time-allocation decisions (Frazis and Stewart, 2012; Gershuny, 2012; Foster and Kalenkoski, 2013; Gimenez-Nadal and Molina, 2014, 2016). As a consequence, and for the sake of simplicity, we rely on OLS regressions, but we have estimated Tobit regressions for the three specifications of interest, with results that are robust to the estimation method (see Tables A2 to A5 in the Appendix).

5. Results

We explore the characteristics of individuals performing green travel and identify cross-country differences in green travel behavior, using the pooled sample of countries. We present OLS regressions modelling individual decisions regarding green mobility, captured by the proportion of time spent by different modes of transport: public transit, walking, and cycling. Regressions are performed at the individual-level. In all Tables, estimated coefficients are interpreted as changes in percentage levels of the time proportion of green travel.[5]

Table 4 reports the estimates of Eq. (1) for the pooled sample of countries. We find that all socio-demographic and household composition variables are significantly associated with the proportion of time spent by public transport, walking, and cycling (with the exception of age and number of children in the case of cycling). However, we find that socio-demographic and family profiles of travelers are not homogenous across green modes of transport. When comparing public and walking modes of travel, only in the cases of age, gender, and living in a couple do the estimated correlations have the same sign. In turn, when comparing public transit and cycling, only the estimates of the variables of completed secondary, being an employee, and household size have the same sign. When we compare both active modes, we observe that only the estimate of the higher education variable is consistent in sign across modes. In addition, our estimates reveal that the associations between mode of transport and socio-demographic and family variables are much smaller in magnitude in the case of cycling. In all estimations, individuals travelling on a weekday are more likely to choose a green mode of transport.

We observe a U-shaped correlation between age and the proportion by public transit. Being male, older, living with a partner, and family size are negatively related to the proportion of public transit travel, while having a secondary or higher level of education, being employed, and having more children are positively related. The largest average percentage changes in the proportion of public transport are associated with age (19.2% smaller when age increases by 1%), followed by employment status (4.2% larger if employed) and education level (1.8% larger if the individual has secondary education and 2.6% larger in the case of higher education).

[4] It would be relevant in our context to include indicators regarding cycling infrastructures, like those shown in Oke et al. (2019). However, their data cannot be used in our analysis because it is defined at the city level. Further, cross-country harmonized statistics on cycling infrastructure and investment are not available.

[5] Note that the R-squared statistics in the pool estimation and in all estimations by country, the proportion of time travelled by public transit, and to a lesser extent cycling, are low. This suggests that green travel behavior is probably conditioned by non-observable characteristics.

Table 3
Average National Indicators by Country.

	Bulgaria	Canada	Spain	France	Hungary	Italy	Netherlands	UK	US
length of rail lines [a]	4,320	47,041	14,719	29,929	7,897	16,615	2,808	16,658	174,098
length of motorways [b]	328	38,010	12,080	11,392	1,375	6,566	2,433	3,666	350,468
number of buses [b]	37,000	62,257	60,027	91,451	17,681	95,139	11,182	172,728	850,506
number of vehicles [b]	2,965,300	18,941,271	27,691,419	41,027,848	3,624,475	44,648,337	8,321,370	35,318,830	131,693,645
passengers by railways[a]	3,231	1,441	21,983	10,2167	7,883	47,207	15,065	59,278	31,533
mortality[a]	13.1	8.4	9.6	6.5	9.8	10.5	6.3	5.3	13.2
CO_2 emissions[a]	10,550	251,707	164,749	201,538	15,946	221,500	68,996	181,132	2,206,394
prop. urban population[a]	69.0	80.5	77.5	78.4	68.7	67.8	79.7	80.5	81.0
GDP per capita growth[a]	5.6	1.9	−0.6	1.4	−2.6	−1.9	2.6	2.3	1.3
population [a]	8,089,657	33,124,321	44,139,762	65,027,507	10,011,337	58,073,577	16,122,691	61,626,382	310,670,573

Note: Indicators are defined by country and year in order to match our MTUS sample.
[a] indicators taken from the World Development Indicators of the World Bank Database, [b] taken from Eurostat in the case of European countries, and from the Bureau of Transportation Statistics of the United States and from Statistics Canada.

Table 4
Socio-demographic determinants of the proportions of public, walking and cycling mode of transport, all countries.

	Prop. by public	Prop. by walking	Prop. by cycling
(log of) age	−0.192***	−0.090***	−0.030
	(0.008)	(0.026)	(0.021)
(log of) age squared	0.023***	0.016***	0.004
	(0.001)	(0.004)	(0.003)
male	−0.003***	−0.051***	0.004***
	(0.001)	(0.003)	(0.000)
completed secondary	0.018***	−0.035***	0.001**
	(0.000)	(0.001)	(0.000)
above secondary	0.026***	−0.056***	−0.002***
	(0.002)	(0.002)	(0.000)
employee	0.042***	−0.064***	0.003***
	(0.004)	(0.001)	(0.000)
presence of a partner	−0.011***	−0.015***	0.002***
	(0.001)	(0.001)	(0.000)
household size	−0.005***	0.003***	−0.000***
	(0.000)	(0.001)	(0.000)
number of children	0.005***	−0.004***	0.000
	(0.001)	(0.001)	(0.000)
weekday	0.024***	0.032***	0.002***
	(0.000)	(0.002)	(0.001)
Bulgaria	0.057***	0.488***	−0.001
	(0.008)	(0.008)	(0.002)
Canada	0.032***	0.033***	0.002**
	(0.004)	(0.007)	(0.001)
Spain	0.074***	0.226***	0.001***
	(0.002)	(0.002)	(0.000)
France	0.050***	0.068***	0.009***
	(0.008)	(0.011)	(0.001)
Hungary	0.094***	0.185***	0.111***
	(0.007)	(0.011)	(0.001)
Italy	0.038***	0.170***	0.015***
	(0.006)	(0.007)	(0.001)
Netherlands	0.037***	0.026***	0.217***
	(0.003)	(0.004)	(0.003)
United Kingdom	0.044***	0.094***	0.010***
	(0.002)	(0.003)	(0.002)
constant	0.363***	0.235***	0.041
	(0.012)	(0.044)	(0.034)
Year FE	Yes	Yes	Yes
R-squared	0.037	0.235	0.064
Number of individuals	396,959	396,959	396,959

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variables are the proportion of time travelled by public, walking and cycling mode of transport, respectively (in logs). All regressions include year fixed effects. Country fixed effects with United States as the reference country. Robust standard errors clustered at the country level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Being male, older, having more formal education, being employed, living with a partner, and having more children are all negatively associated with the proportion of walking as a travel mode. In the case of walking, there is also a U-shaped correlation with age. Further, a positive correlation is found for household size and travel during the week. The largest average percentage changes in the proportion of walking are driven by age (9.0% smaller when age increases by 1%), employment status (6.4% lower if employed), being male (5.1% lower), education level (3.5% lower if the individual has secondary education and 5.6% lower for higher education).

Being male, having completed secondary education, being employed, and living with a partner are all positively associated with the proportion of cycling as a travel mode. In contrast, a negative correlation is found for having higher education and living in a larger family, while no relationship is found for the age of individuals and the number of children in the family. The largest average percentage changes in the proportion of cycling are related to being male (0.4% larger) and employment status (0.3% larger if employed).

Table 4 reveals statistically significant cross-country differences in the green travel behavior of individuals. Considering the US as the reference country, and net of cross-individual differences in socio-demographic and family characteristics, we observe that individuals in all the other countries are more likely to travel a larger fraction of their time by a green mode of transport, compared to individuals in the US. In particular, in Hungary, Spain, Bulgaria, and France, the proportion of time travelled by public transit is 9.4%, 7.4%, 5.7%, and 5.0% larger, respectively, than in the US. However, more pronounced differences are found when analyzing the proportion of travel by walking, where differences with respect to the US reach 48.8% in Bulgaria, 22.6% in Spain, 18.5% in Hungary, and 17% in Italy. In the case of cycling, the largest differences with respect to the US are found for the Netherlands (21.7%) and Hungary (11.1%), while for the other countries differences are significant but much smaller (e.g., 1% larger in the UK with respect to the US).

Table 5
Socio-demographic determinants of the proportions of public, walking and cycling mode of transport, all countries with national indicators.

	Prop. by public	Prop. by walking	Prop. by cycling
(log of) age	−0.191***	−0.089***	−0.031
	(0.008)	(0.026)	(0.021)
(log of) age squared	0.023***	0.016***	0.004
	(0.001)	(0.004)	(0.003)
male	−0.003***	−0.051***	0.004***
	(0.001)	(0.003)	(0.000)
completed secondary	0.018***	−0.035***	0.001**
	(0.001)	(0.001)	(0.000)
above secondary	0.026***	−0.055***	−0.002***
	(0.002)	(0.002)	(0.000)
employee	0.041***	−0.064***	0.003***
	(0.004)	(0.001)	(0.000)
presence of a partner	−0.010***	−0.015***	0.002***
	(0.001)	(0.001)	(0.000)
household size	−0.005***	0.003***	−0.001***
	(0.000)	(0.001)	(0.000)
number of children	0.005***	−0.004***	0.000
	(0.001)	(0.001)	(0.000)
weekday	0.024***	0.032***	0.002***
	(0.000)	(0.002)	(0.001)
(log of) length of rail lines (km)	0.035***	−0.209*	0.011
	(0.006)	(0.101)	(0.018)
(log of) length of motorways (km)	−0.051**	0.242	−0.088**
	(0.019)	(0.136)	(0.033)
(log of) number of buses	−0.076**	0.277	−0.181**
	(0.028)	(0.277)	(0.056)
(log of) number of private vehicles	0.076***	0.386***	−0.356***
	(0.016)	(0.082)	(0.022)
(log of) passengers by railways	−0.039**	0.019	−0.037
	(0.016)	(0.129)	(0.028)
(log of) mortality	0.090***	0.060	−0.098***
	(0.014)	(0.037)	(0.016)
(log of) CO_2 emissions	−0.098***	−0.373*	0.097**
	(0.017)	(0.189)	(0.039)
(log of) proportion of urban population	0.516***	−0.142	−0.413***
	(0.081)	(0.224)	(0.082)
GDP per capita growth	−0.012***	−0.000	0.000
	(0.002)	(0.011)	(0.002)
(log of) population	0.160*	−0.470	0.590***
	(0.080)	(0.792)	(0.160)
constant	−3.192***	1.640	0.695
	(0.673)	(4.824)	(1.115)
Year FE	Yes	Yes	Yes
R-squared	0.037	0.234	0.063
Number of individuals	396,959	396,959	396,959

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variables are the proportion of time travelled by public, walking and cycling mode of transport, respectively (in logs). All regressions include year fixed effects. Robust standard errors clustered at the country level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

To further examine cross-country differences in green travel behavior, we now include indicators at the country level. Table 5 reports estimates of Eq. (1) without country fixed effects but including national-level indicators related to transport infrastructure and country characteristics. We find that the length of rail lines, the number of private vehicles, the proportion of people living in urban areas, population, and mortality caused by road traffic injury are significantly and positively related to the fraction of time travelled by public transit, while the length of motorways, the number of buses, passengers carried by railways, the level of CO2 emissions, and per-capita GDP growth rates are negatively correlated. Regarding walking as a mode of travel, we observe that the length of rail lines and the level of CO2 emissions are negatively correlated with the fraction of time spent walking, while the number of private vehicles is positively related. The extent of motorways, the number of buses, the number of private vehicles, and the proportion of people living in urban areas are all negatively related to the proportion of time spent cycling, while population size is positively related. Note also that the inclusion of national indicators does not change our results regarding the conditional correlations between observable individual or family characteristics and green travel choices.

We now explore cross-country differences in the relationship between green travel, on the one hand, and socio-demographic and household characteristics, on the other. To that end, in Tables 6 and 7 we show estimates of Eq. (2) for our two dependent variables, by country.

Table 6
Socio-demographic determinants of the proportion of time travelled by public transport, by country.

	Bulgaria	Canada	Spain	France	Hungary	Italy	NL	UK	US
(log of) age	−0.192**	−0.407***	−0.173***	−0.638***	−0.712**	0.085***	0.033	0.245***	−0.161***
	(0.090)	(0.056)	(0.038)	(0.096)	(0.299)	(0.015)	(0.076)	(0.033)	(0.020)
(log of) age squared	0.024*	0.049***	0.021***	0.080***	0.096**	−0.017***	−0.010	−0.037***	0.019***
	(0.012)	(0.008)	(0.005)	(0.013)	(0.040)	(0.002)	(0.011)	(0.005)	(0.003)
male	−0.003	−0.005**	−0.030***	−0.003	−0.023***	−0.006***	−0.008*	−0.002	0.003***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.007)	(0.001)	(0.004)	(0.003)	(0.001)
completed second.	0.019***	−0.015***	0.017***	−0.008***	0.009	0.004**	0.036***	−0.016***	−0.022***
	(0.005)	(0.003)	(0.003)	(0.003)	(0.009)	(0.002)	(0.005)	(0.004)	(0.001)
above secondary	0.028***	−0.000	0.017***	0.030***	0.010	0.012***	0.048***	−0.007**	−0.018***
	(0.007)	(0.003)	(0.003)	(0.004)	(0.010)	(0.003)	(0.005)	(0.004)	(0.001)
employee	0.045***	−0.005*	−0.003	0.008**	0.054***	−0.025***	−0.014***	−0.030***	−0.001*
	(0.005)	(0.003)	(0.003)	(0.003)	(0.008)	(0.002)	(0.005)	(0.003)	(0.001)
presence of partner	−0.010*	−0.025***	−0.033***	−0.036***	–	−0.026***	−0.057***	−0.056***	−0.015***
	(0.005)	(0.002)	(0.003)	(0.004)	–	(0.002)	(0.006)	(0.003)	(0.001)
household size	−0.005***	−0.001	0.004***	−0.003	0.001	0.000	0.012***	0.007***	−0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.001)	(0.004)	(0.002)	(0.001)
number of children	0.006*	−0.003*	−0.013***	0.001	−0.008	0.001	−0.022***	−0.013***	−0.000
	(0.004)	(0.002)	(0.002)	(0.003)	(0.005)	(0.001)	(0.004)	(0.002)	(0.001)
weekday	0.024***	0.033***	0.040***	0.019***	0.016**	0.026***	0.021***	0.019***	0.013***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.008)	(0.001)	(0.003)	(0.002)	(0.001)
constant	0.435***	0.880***	0.436***	1.316***	1.353**	−0.029	0.052	−0.291***	0.368***
	(0.161)	(0.100)	(0.064)	(0.178)	(0.554)	(0.024)	(0.132)	(0.053)	(0.036)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.038	0.051	0.047	0.059	0.020	0.051	0.067	0.035	0.028
N. individuals	10,450	28,384	34,652	20,366	3,467	76,640	22,538	28,581	171,881

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variable is the proportion of time travelled by public transport (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7
Socio-demographic determinants of the proportion of time travelled by walking, by country.

	Bulgaria	Canada	Spain	France	Hungary	Italy	NL	UK	US
(log of) age	−0.106	−0.015	−0.465***	−0.719***	−1.235**	−0.294***	0.384***	0.331***	0.272***
	(0.118)	(0.067)	(0.055)	(0.131)	(0.497)	(0.025)	(0.090)	(0.050)	(0.021)
(log of) age squared	0.019	−0.002	0.078***	0.101***	0.163**	0.060***	−0.048***	−0.053***	−0.039***
	(0.016)	(0.009)	(0.008)	(0.018)	(0.067)	(0.004)	(0.013)	(0.007)	(0.003)
male	−0.053***	−0.004	−0.069***	−0.034***	−0.096***	−0.048***	−0.024***	−0.026***	0.004***
	(0.006)	(0.002)	(0.003)	(0.004)	(0.011)	(0.002)	(0.004)	(0.003)	(0.001)
completed second.	−0.034***	−0.025***	−0.028***	−0.047***	−0.042***	−0.040***	−0.013**	−0.025***	−0.028***
	(0.007)	(0.005)	(0.005)	(0.006)	(0.013)	(0.003)	(0.006)	(0.005)	(0.002)
above secondary	−0.057***	−0.027***	−0.051***	−0.041***	−0.037***	−0.045***	−0.020***	−0.029***	−0.029***
	(0.009)	(0.004)	(0.005)	(0.006)	(0.014)	(0.005)	(0.006)	(0.005)	(0.002)
employee	−0.064***	−0.049***	−0.127***	−0.064***	−0.127***	−0.138***	−0.038***	−0.084***	−0.034***
	(0.007)	(0.003)	(0.004)	(0.005)	(0.013)	(0.003)	(0.005)	(0.005)	(0.001)
presence of partner	−0.014**	−0.040***	−0.030***	−0.058***	–	−0.058***	−0.029***	−0.051***	−0.022***
	(0.007)	(0.003)	(0.004)	(0.006)	–	(0.003)	(0.006)	(0.004)	(0.001)
household size	0.004	−0.010***	−0.011***	−0.014***	−0.003	−0.005***	−0.009***	−0.000	−0.001**
	(0.003)	(0.001)	(0.001)	(0.004)	(0.006)	(0.001)	(0.003)	(0.002)	(0.001)
number of children	−0.005	0.009***	0.017***	0.024***	−0.003	0.014***	0.011***	0.005**	−0.000
	(0.005)	(0.002)	(0.002)	(0.004)	(0.008)	(0.002)	(0.003)	(0.003)	(0.001)
weekday	0.034***	0.011***	0.027***	0.014***	−0.010	0.014***	−0.009***	0.043***	0.002***
	(0.005)	(0.003)	(0.003)	(0.003)	(0.012)	(0.002)	(0.003)	(0.002)	(0.001)
constant	0.745***	0.253**	1.074***	1.531***	2.741***	0.647***	−0.582***	−0.254***	−0.362***
	(0.208)	(0.118)	(0.093)	(0.235)	(0.919)	(0.040)	(0.152)	(0.083)	(0.038)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.061	0.045	0.135	0.071	0.097	0.168	0.032	0.075	0.029
N. individuals	10,450	28,384	34,652	20,366	3,467	76,640	22,538	28,581	171,881

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variable is the proportion of time travelled by walking (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 8
Socio-demographic determinants of the proportion of time travelled by cycling, by country.

	Bulgaria	Canada	Spain	France	Hungary	Italy	NL	UK	US
(log of) age	−0.015	−0.014	−0.014	−0.045	0.543	−0.006	−1.237***	0.018	0.010
	(0.025)	(0.020)	(0.011)	(0.040)	(0.374)	(0.009)	(0.134)	(0.013)	(0.006)
(log of) age squared	0.002	0.001	0.002	0.006	−0.068	0.002	0.164***	−0.003*	−0.002**
	(0.004)	(0.003)	(0.002)	(0.005)	(0.050)	(0.001)	(0.019)	(0.002)	(0.001)
male	0.004***	0.006***	0.005***	0.006***	−0.027***	0.004***	−0.029***	0.011***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.009)	(0.001)	(0.007)	(0.001)	(0.000)
completed second.	0.001	0.001	−0.002**	−0.002	−0.077***	−0.008***	−0.022**	−0.005***	−0.001***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.010)	(0.001)	(0.009)	(0.002)	(0.000)
above secondary	−0.002	0.003***	−0.001	0.004*	−0.112***	−0.006***	−0.005	−0.004**	−0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.010)	(0.002)	(0.010)	(0.002)	(0.000)
employee	0.003*	−0.001	−0.001*	0.003	−0.001	−0.009***	−0.030***	0.004***	−0.001**
	(0.002)	(0.001)	(0.001)	(0.002)	(0.011)	(0.001)	(0.009)	(0.001)	(0.000)
presence of partner	0.002	−0.002**	0.000	−0.002	–	0.000	−0.024**	−0.002	−0.002***
	(0.001)	(0.001)	(0.001)	(0.002)	–	(0.001)	(0.010)	(0.002)	(0.000)
household size	−0.000	0.000	−0.001***	0.000	−0.000	−0.002***	−0.014***	0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.005)	(0.000)	(0.005)	(0.001)	(0.000)
number of children	−0.000	−0.001	0.000	−0.001	0.005	−0.000	0.035***	−0.001	−0.001**
	(0.001)	(0.001)	(0.000)	(0.001)	(0.007)	(0.001)	(0.006)	(0.001)	(0.000)
weekday	0.001*	0.003***	0.000	0.002*	0.012	0.004***	0.077***	0.006***	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.010)	(0.001)	(0.004)	(0.001)	(0.000)
constant	0.021	0.036	0.034*	0.089	−0.912	0.031**	2.515***	−0.017	−0.011
	(0.044)	(0.035)	(0.019)	(0.072)	(0.693)	(0.013)	(0.228)	(0.021)	(0.012)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.005	0.006	0.004	0.003	0.041	0.007	0.117	0.008	0.004
N. individuals	10,450	28,384	34,652	20,366	3,467	76,640	22,538	28,581	171,881

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variable is the proportion of time travelled by cycling (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Regarding the proportion of time on public transport, we find interesting cross-country heterogeneities (Table 6). We observe a U-shaped relationship between age and the proportion of travel by public transport for Bulgaria, Canada, Spain, France, Hungary and the US. In turn, there is an inverted U-shaped association in the case of Italy and the UK, while no relationship is found for the Netherlands. Being male is negatively associated with the proportion of public transit in Canada, Spain, Hungary, Italy and the Netherlands, but positively associated in the US, while no relationship is found for Bulgaria, France, and the UK. Individuals with different levels of education also exhibit differences in their time proportion of green travel via public transit, depending on the country. More educated travelers spend more time on public transit in Bulgaria, Spain, Italy, and the Netherlands, but less time in the US and the UK, while no associations are found in Hungary. In France and Canada, results are mixed; in Canada the relationship is not significant for individuals with education above secondary, and in France the association is negative for travelers with secondary education but positive for those with higher education.

\Travelers who are employed spend more time on public transit in Bulgaria, France and Hungary, but less time in Canada, Italy, the Netherlands, the UK, and the US. No association is observed for travelers in Spain. Regarding family composition, the presence of a partner is negatively associated with the fraction of travel time by public transit in all countries. In addition, correlations with household size are positive for Spain, Hungary, Italy, the Netherlands, and the UK, but negative for Bulgaria. No association is observed for travelers in Canada, France, Hungary, and the US. The number of children is negatively related to the time on public transit in Canada, Spain, the Netherlands, and the UK, while positively associated in Bulgaria, France, Hungary, and Italy. No relationship is observed in the US.

Regarding the proportion of time travelled by walking (Table 7), we observe a U-shaped relationship in Spain, France, Hungary, and Italy, an inverted U-shaped association in the Netherlands, the US, and the UK, and no associations with age in Bulgaria and Canada. Being male is negatively associated with the proportion of walking in all countries, with the exceptions of Canada (no relationship) and the US (positive relationship). More employed and educated travelers spend a lower fraction of time walking in all countries. Regarding family composition, the presence of a partner is negatively associated with the fraction of time spent walking in all countries. In addition, correlations with household size are negative, and correlations with the number of children are positive in all countries, with the exceptions of Bulgaria and Hungary, while results are mixed in the UK and the US (no relationship with family size in the UK, and no relationship with number of children in the US). Individuals spend a larger proportion of time walking during the week, in all countries, except for individuals in Hungary.

Regarding the proportion of time spent cycling (Table 8), we observe that the explanatory power of socio-demographic and family characteristics is relatively lower, with the exception of the Netherlands where cycling is much more common. Results show a U-shaped relationship with age in the Netherlands, while no effect is found in the rest of the countries. In addition, being male is positively associated with the proportion of cycling in all countries, except in Hungary and the Netherlands, where the association is negative. Having secondary education is negatively related in Hungary, Italy, the Netherlands, the UK, and the US, while having above-secondary education is positively (negatively) related in Canada and France (Hungary, Italy, and the UK). Employed travelers spend a lower proportion of time cycling in Spain, Italy, the Netherlands, and the US, with a larger fraction in Bulgaria and the UK. Associations with the presence of a partner are negative for Canada, the Netherlands, and the UK, while associations with household size are negative in Spain, Italy, and the Netherlands. In contrast, the number of children in the family is negatively related to the fraction of time spent cycling in the Netherlands, and positively related in the US. In Bulgaria, Canada, France, Italy, the Netherlands, the UK, and the US individuals spend a larger proportion of their time cycling during the week.

In sum, the socio-demographic and family profile of green travelers is robust across countries in the case of walking as a travel mode, in comparison to public transit and cycling. In addition, our results present interesting regularities regarding green travel behavior, when comparing different countries.[6]

6. Conclusions

This paper analyses the green behavior of individuals in nine developed countries, analyzing the proportion of travel by public transit and/or active mode, in Bulgaria, Canada, Spain, France, Hungary, Italy, the Netherlands, the United Kingdom, and the United States, from 2000 to 2019. Our results indicate that the socio-demographic and family profile of travelers is not homogenous across green modes of transport, with walking as a mode of travel exhibiting a much more consistent cross-country profile in comparison to the use of public transit and cycling. Factors such as gender, education, employment status, marital status, and the presence of children are related to the proportion of travel by public transit and both active modes, but in different magnitudes and sign according to the mode of travel.

Our results shed light on which groups in the population are more or less likely to use green modes, and may guide specific actions and public policies, with the aim of increasing the use of green modes of transport. Our results may be of interest to policymakers in the design of efficient strategies aimed at decreasing energy consumption and GHG emissions through the increased use of green modes. For instance, being male, older, married, with no children, or having a low level of education, are all related to lower use of public transit, and one may question whether this lower use of public transit is due to higher costs that keep these people from choosing public transport, or is due to other factors, such as lower levels of well-being experienced during public transit trips. In this sense, older individuals may face problems of access to public transit infrastructures, which could explain their lower use.

Furthermore, the use of public transit and active modes is more frequent during weekends, in comparison to working days, which contrasts with the design of road-pricing policies at certain hours of working days as a way to alleviate pollution (Coria and Zhang, 2017) and increase the use of public transit (Kilani, Proost and van der Loo, 2014). On the other hand, our results show that the appropriate planning and design of infrastructures and services (e.g., extent of motorways; number of buses) may boost the use of green modes. The length of rail lines, the extent of motorways, and the number of buses are related to the use of public transit, walking, and cycling, which sheds light on the importance of planning infrastructure on travel behavior. However, cross-country differences are not fully explained by our results, and factors such as cross-individual heterogeneity, which may include "green culture" or "attitudes towards the environment", also affect the use of green modes of transport.

One limitation of our analysis is that we cannot control for the unobserved heterogeneity of individuals, which is important in this context, since unobserved factors (e.g., preferences, previous experience, parents' background) may condition decisions about what kind of transport individuals use, and how much time is spent in travel. One way to overcome this limitation is to use data with a panel structure. Furthermore, we have not found a consistent cross-country dataset with information about structures and services for cycling (e.g., bike lanes, bike stations), which would be helpful in analyzing how the availability of these factors is related to the use of active modes. Institutions and National Statistical Offices should consider the need to collect this type of data in order to make international comparisons. Finally, an extension of the current research could be related to how the COVID-19 pandemic has changed the behavior of individuals regarding the use of public transport. Social distancing is likely to limit public transport capacity, which opens an opportunity to boost active transport as the main alternative to the use of the private car. In this context, governments and policy makers are obliged to carry out the necessary policies to increase the use of active transport in the daily life of the population. Otherwise, the post-pandemic situation may represent a backward step in the use of sustainable means of transport, since the distrust associated with the use of public transport may lead to a much greater use of private cars.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

[6] Our analysis also permits us to explore whether living in urban areas is related to larger proportions of time in public transit, walking, and cycling as travel modes. Tables A.7, A.8 and A.9 report estimates of Eq. (2), including an indicator variable that takes value 1 if the respondent lives in an urban area, and 0 otherwise, for the set of countries reporting this information. Results indicate a cross-country positive relationship between living in urban areas and the time proportion of green travel (with the exception of Hungary in all green modes, Italy in walking as a travel mode, and the UK in cycling), but estimates by country differ in magnitude and depend on the mode. However, it is important to note that this analysis may be biased if one does not consider that urban transport is structurally distinct from non-urban transport, and that urban transport is directly linked to urban form (residential locations and work, and other activities and locations).

Appendix A

See Tables A1-A9.

Table A1
Sample Composition.

country	survey years	number of individuals	number of travel episodes
Bulgaria	2001–2002	10,450	31,358
Canada	2005 and 2010	28,384	108,505
Spain	2002–2003 and 2009–2010	34,652	122,540
France	2010	20,366	59,539
Hungary	2009–2010	3,467	12,230
Italy	2002–2003 and 2008–2009	76,640	348,651
Netherlands	2000 and 2005	22,538	75,032
UK	2000–2001; 2005 and 2014–2015	28,581	105,199
US	2003 to 2019	171,881	764,128
All countries	2000 to 2019	396,959	1,627,182

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel.

Table A2
Socio-demographic determinants of the proportions of public, walking and cycling mode of transport, all countries (Tobit estimation).

	Prop. by public	**Prop. by walking**	**Prop. by cycling**
(log of) age	−0.237***	−0.106***	−0.020***
	(0.021)	(0.027)	(0.004)
(log of) age squared	0.029***	0.018***	0.003***
	(0.003)	(0.004)	(0.001)
male	−0.003***	−0.055***	0.004***
	(0.001)	(0.001)	(0.001)
completed secondary	0.027***	−0.036***	0.001**
	(0.001)	(0.001)	(0.000)
above secondary	0.034***	−0.058***	−0.001***
	(0.002)	(0.000)	(0.000)
employee	0.046***	−0.068***	0.002***
	(0.003)	(0.003)	(0.001)
presence of a partner	−0.014***	−0.018***	0.002***
	(0.001)	(0.002)	(0.001)
household size	−0.005***	0.003***	−0.001***
	(0.000)	(0.001)	(0.000)
number of children	0.005***	−0.004***	0.000
	(0.001)	(0.001)	(0.000)
weekday	0.027***	0.037***	0.002***
	(0.001)	(0.001)	(0.000)
Bulgaria	0.080***	0.715***	−0.001
	(0.006)	(0.014)	(0.001)
Canada	0.041***	0.093***	0.003***
	(0.003)	(0.013)	(0.000)
Spain	0.086***	0.413***	0.001***
	(0.002)	(0.006)	(0.000)
France	0.060***	0.171***	0.007***
	(0.005)	(0.014)	(0.001)
Hungary	0.114***	0.354***	0.020***
	(0.005)	(0.015)	(0.002)
Italy	0.054***	0.356***	0.008***
	(0.005)	(0.012)	(0.001)
Netherlands	0.053***	0.088***	0.028***
	(0.004)	(0.011)	(0.003)
United Kingdom	0.064***	0.223***	0.006***
	(0.002)	(0.008)	(0.001)
Year FE	Yes	Yes	Yes
Pseudo R2	0.057	0.377	0.121
Number of individuals	396,959	396,959	396,959

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variables are the proportion of time travelled by public, walking and cycling mode of transport, respectively (in logs). All regressions include year fixed effects. Country fixed effects with United States as the reference country. Robust standard errors clustered at the country level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A3
Socio-demographic determinants of the proportions of public, walking and cycling mode of transport, all countries with national indicators (Tobit estimation).

	Prop. by public	Prop. by walking	Prop. by cycling
(log of) age	−0.237***	−0.106***	−0.020***
	(0.021)	(0.027)	(0.004)
(log of) age squared	0.029***	0.018***	0.003***
	(0.003)	(0.004)	(0.001)
male	−0.003***	−0.055***	0.004***
	(0.001)	(0.001)	(0.001)
completed secondary	0.027***	−0.035***	0.001**
	(0.001)	(0.001)	(0.000)
above secondary	0.034***	−0.058***	−0.001***
	(0.002)	(0.001)	(0.000)
employee	0.046***	−0.068***	0.002***
	(0.003)	(0.003)	(0.001)
presence of a partner	−0.014***	−0.018***	0.002***
	(0.001)	(0.002)	(0.001)
household size	−0.005***	0.003***	−0.001***
	(0.000)	(0.001)	(0.000)
number of children	0.005***	−0.004***	0.000
	(0.001)	(0.001)	(0.000)
weekday	0.027***	0.037***	0.002***
	(0.001)	(0.001)	(0.000)
(log of) length of rail lines (km)	0.019**	−0.263**	0.007***
	(0.008)	(0.128)	(0.002)
(log of) length of motorways (km)	−0.019	0.333*	−0.013***
	(0.024)	(0.188)	(0.004)
(log of) number of buses	−0.023	0.372	−0.020***
	(0.037)	(0.369)	(0.006)
(log of) number of private vehicles	0.087***	0.705***	−0.047***
	(0.014)	(0.079)	(0.006)
(log of) passengers by railways	−0.016	0.025	−0.001
	(0.020)	(0.174)	(0.003)
(log of) mortality	0.065***	0.098	−0.015***
	(0.013)	(0.066)	(0.004)
(log of) CO2 emissions	−0.081***	−0.574**	0.021***
	(0.019)	(0.248)	(0.004)
(log of) proportion of urban population	0.433***	−0.093	−0.072***
	(0.069)	(0.334)	(0.014)
GDP per capita growth	−0.012***	−0.010	−0.001***
	(0.002)	(0.011)	(0.000)
(log of) population	0.020	−0.781	0.057***
	(0.105)	(1.046)	(0.016)
Year FE	Yes	Yes	Yes
Pseudo R2	0.051	0.205	0.113
Number of individuals	396,959	396,959	396,959

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variables are the proportion of time travelled by public, walking and cycling mode of transport, respectively (in logs). All regressions include year fixed effects. Robust standard errors clustered at the country level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A4
Socio-demographic determinants of the proportion of time travelled by public transport, by country (Tobit estimation).

	Bulgaria	Canada	Spain	France	Hungary	Italy	NL	UK	US
(log of) age	−0.260**	−0.222***	−0.156***	−0.383***	−0.825***	0.091***	−0.032	0.219***	−0.039***
	(0.103)	(0.044)	(0.036)	(0.062)	(0.296)	(0.012)	(0.070)	(0.031)	(0.013)
(log of) age squared	0.032**	0.024***	0.018***	0.048***	0.111***	−0.018***	−0.001	−0.034***	0.003*
	(0.014)	(0.006)	(0.005)	(0.009)	(0.040)	(0.002)	(0.010)	(0.005)	(0.002)
male	−0.002	−0.006***	−0.034***	−0.004*	−0.025***	−0.008***	−0.010***	−0.004*	0.002***
	(0.004)	(0.002)	(0.002)	(0.003)	(0.007)	(0.001)	(0.004)	(0.003)	(0.001)
completed second.	0.028***	−0.015***	0.017***	−0.007**	0.012	0.006***	0.036***	−0.015***	−0.018***
	(0.006)	(0.004)	(0.003)	(0.003)	(0.009)	(0.002)	(0.006)	(0.004)	(0.001)
above secondary	0.037***	0.004	0.023***	0.027***	0.008	0.017***	0.053***	−0.004	−0.012***
	(0.007)	(0.003)	(0.004)	(0.004)	(0.009)	(0.003)	(0.006)	(0.004)	(0.001)
employee	0.050***	−0.003	−0.002	0.009***	0.064***	−0.021***	−0.008*	−0.026***	0.000
	(0.005)	(0.002)	(0.003)	(0.003)	(0.009)	(0.002)	(0.004)	(0.003)	(0.001)
presence of partner	−0.013**	−0.026***	−0.034***	−0.037***	–	−0.028***	−0.051***	−0.052***	−0.017***
	(0.005)	(0.002)	(0.003)	(0.004)	–	(0.002)	(0.005)	(0.003)	(0.001)
household size	−0.006***	−0.002	0.003**	−0.003	−0.001	−0.001*	0.006***	0.006***	−0.000
	(0.002)	(0.001)	(0.001)	(0.002)	(0.004)	(0.001)	(0.002)	(0.001)	(0.000)
number of children	0.006*	−0.004**	−0.012***	0.003	−0.007	0.002**	−0.016***	−0.012***	−0.001**
	(0.003)	(0.002)	(0.002)	(0.002)	(0.006)	(0.001)	(0.003)	(0.002)	(0.000)
weekday	0.027***	0.037***	0.047***	0.020***	0.019**	0.029***	0.020***	0.023***	0.014***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.008)	(0.001)	(0.003)	(0.002)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.056	0.075	0.050	0.086	0.027	0.085	0.090	0.035	0.058
N. individuals	10,450	28,384	34,652	20,366	3,467	76,640	22,538	28,581	171,881

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variable is the proportion of time travelled by public transport (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A5
Socio-demographic determinants of the proportion of time travelled by walking, by country (Tobit estimation).

	Bulgaria	Canada	Spain	France	Hungary	Italy	NL	UK	US
(log of) age	−0.118	−0.049	−0.413***	−0.533***	−1.144**	−0.217***	0.402***	0.346***	0.189***
	(0.127)	(0.052)	(0.053)	(0.107)	(0.483)	(0.024)	(0.082)	(0.043)	(0.015)
(log of) age squared	0.020	0.003	0.068***	0.074***	0.149**	0.045***	−0.053***	−0.054***	−0.028***
	(0.018)	(0.007)	(0.008)	(0.015)	(0.065)	(0.004)	(0.012)	(0.006)	(0.002)
male	−0.058***	−0.008***	−0.075***	−0.034***	−0.103***	−0.044***	−0.026***	−0.028***	0.001
	(0.006)	(0.002)	(0.003)	(0.004)	(0.011)	(0.002)	(0.004)	(0.003)	(0.001)
completed second.	−0.036***	−0.014***	−0.024***	−0.041***	−0.037***	−0.031***	−0.002	−0.020***	−0.019***
	(0.007)	(0.004)	(0.005)	(0.005)	(0.014)	(0.003)	(0.006)	(0.005)	(0.001)
above secondary	−0.061***	−0.010***	−0.039***	−0.026***	−0.035**	−0.026***	−0.003	−0.019***	−0.015***
	(0.010)	(0.003)	(0.005)	(0.006)	(0.015)	(0.005)	(0.006)	(0.005)	(0.001)
employee	−0.069***	−0.039***	−0.129***	−0.067***	−0.115***	−0.141***	−0.034***	−0.073***	−0.022***
	(0.008)	(0.003)	(0.004)	(0.005)	(0.013)	(0.003)	(0.005)	(0.004)	(0.001)
presence of partner	−0.017**	−0.040***	−0.029***	−0.052***	–	−0.056***	−0.031***	−0.052***	−0.018***
	(0.007)	(0.003)	(0.004)	(0.006)	–	(0.003)	(0.006)	(0.004)	(0.001)
household size	0.004	−0.008***	−0.011***	−0.016***	−0.006	−0.005***	−0.005*	−0.001	−0.002***
	(0.003)	(0.001)	(0.002)	(0.004)	(0.006)	(0.001)	(0.003)	(0.002)	(0.000)
number of children	−0.005	0.007***	0.017***	0.022***	−0.005	0.013***	0.006	0.004*	0.001
	(0.005)	(0.002)	(0.002)	(0.004)	(0.009)	(0.002)	(0.004)	(0.002)	(0.001)
weekday	0.039***	0.013***	0.027***	0.014***	−0.007	0.011***	−0.004	0.049***	0.005***
	(0.005)	(0.002)	(0.004)	(0.003)	(0.013)	(0.002)	(0.003)	(0.003)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.119	0.076	0.089	0.048	0.057	0.109	0.025	0.048	0.031
N. individuals	10,450	28,384	34,652	20,366	3,467	76,640	22,538	28,581	171,881

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variable is the proportion of time travelled by walking (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A6
Socio-demographic determinants of the proportion of time travelled by cycling, by country (Tobit estimation).

	Bulgaria	Canada	Spain	France	Hungary	Italy	NL	UK	US
(log of) age	−0.011	−0.015	−0.007	−0.042	0.486	−0.001	−0.896***	0.011	0.009*
	(0.037)	(0.017)	(0.007)	(0.036)	(0.419)	(0.008)	(0.130)	(0.014)	(0.005)
(log of) age squared	0.002	0.001	0.001	0.006	−0.062	0.001	0.117***	−0.002	−0.002**
	(0.005)	(0.002)	(0.001)	(0.005)	(0.056)	(0.001)	(0.019)	(0.002)	(0.001)
male	0.004***	0.007***	0.005***	0.006***	−0.028***	0.005***	−0.034***	0.011***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.009)	(0.001)	(0.007)	(0.001)	(0.000)
completed second.	0.001	0.000	−0.001	−0.001	−0.078***	−0.007***	−0.012	−0.006***	−0.001***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.012)	(0.001)	(0.010)	(0.002)	(0.000)
above secondary	−0.001	0.003**	−0.001	0.005**	−0.138***	−0.003*	0.011	−0.003*	−0.000
	(0.002)	(0.001)	(0.001)	(0.002)	(0.014)	(0.002)	(0.011)	(0.002)	(0.000)
employee	0.002	−0.000	−0.001	0.002	−0.001	−0.008***	−0.034***	0.005***	−0.000
	(0.002)	(0.001)	(0.001)	(0.002)	(0.011)	(0.001)	(0.009)	(0.002)	(0.000)
presence of partner	0.002	−0.002**	−0.000	−0.002	–	0.001	−0.037***	−0.002	−0.001***
	(0.002)	(0.001)	(0.001)	(0.002)	–	(0.001)	(0.011)	(0.002)	(0.000)
household size	−0.001	−0.000	−0.001***	0.000	0.001	−0.002***	−0.010*	0.000	−0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.005)	(0.000)	(0.005)	(0.001)	(0.000)
number of children	−0.000	−0.000	0.001	−0.002	0.005	−0.000	0.030***	−0.000	−0.000
	(0.001)	(0.001)	(0.000)	(0.001)	(0.007)	(0.001)	(0.006)	(0.001)	(0.000)
weekday	0.002*	0.003***	0.000	0.002*	0.016	0.003***	0.084***	0.007***	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.010)	(0.001)	(0.005)	(0.001)	(0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R2	0.045	0.054	0.039	0.011	0.042	0.017	0.072	0.037	0.049
N. individuals	10,450	28,384	34,652	20,366	3,467	76,640	22,538	28,581	171,881

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel. Composition of the sample by country is detailed in Table A.1 of Appendix. Dependent variable is the proportion of time travelled by cycling (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A7
Urban determinant of the proportion of time travelled by public transport, by country.

	Canada	Spain	Hungary	Italy	NL	UK	US
urban	0.041***	0.043***	0.011	0.009***	0.012**	0.027***	0.017***
	(0.002)	(0.002)	(0.007)	(0.001)	(0.005)	(0.005)	(0.001)
(log of) age	−0.399***	−0.167***	−0.694**	0.087***	0.032	0.251***	−0.169***
	(0.055)	(0.038)	(0.300)	(0.015)	(0.076)	(0.040)	(0.020)
(log of) age squared	0.048***	0.020***	0.094**	−0.017***	−0.010	−0.036***	0.021***
	(0.008)	(0.005)	(0.040)	(0.002)	(0.011)	(0.006)	(0.003)
male	−0.005**	−0.029***	−0.023***	−0.006***	−0.008*	−0.003	0.003***
	(0.002)	(0.002)	(0.007)	(0.001)	(0.004)	(0.003)	(0.001)
completed secondary	−0.019***	0.014***	0.008	0.004**	0.036***	−0.014***	−0.022***
	(0.003)	(0.003)	(0.009)	(0.002)	(0.005)	(0.004)	(0.001)
above secondary	−0.007**	0.011***	0.007	0.011***	0.047***	−0.009**	−0.019***
	(0.003)	(0.003)	(0.010)	(0.003)	(0.005)	(0.004)	(0.001)
employee	−0.006**	−0.002	0.053***	−0.025***	−0.014***	−0.031***	−0.001
	(0.003)	(0.003)	(0.008)	(0.002)	(0.005)	(0.005)	(0.001)
presence of partner	−0.022***	−0.032***	–	−0.026***	−0.057***	−0.057***	−0.014***
	(0.002)	(0.003)	–	(0.002)	(0.006)	(0.005)	(0.001)
household size	−0.001	0.005***	0.001	0.001	0.012***	0.007***	−0.001*
	(0.001)	(0.001)	(0.004)	(0.001)	(0.004)	(0.002)	(0.001)
number of children	−0.003	−0.013***	−0.008	0.001	−0.022***	−0.012***	−0.000
	(0.002)	(0.002)	(0.005)	(0.001)	(0.004)	(0.003)	(0.001)
weekday	0.033***	0.039***	0.016**	0.026***	0.022***	0.013***	0.013***
	(0.002)	(0.002)	(0.008)	(0.001)	(0.003)	(0.002)	(0.001)
constant	0.837***	0.396***	1.311**	−0.038	0.044	−0.344***	0.368***
	(0.100)	(0.064)	(0.556)	(0.024)	(0.132)	(0.064)	(0.036)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.062	0.056	0.021	0.052	0.067	0.034	0.031
N. individuals	28,384	34,652	3,467	76,640	22,538	15,051	170,645

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel and urban location. Bulgaria, France and the UK (2005; 2014–2015) do not have urban/rural information. Dependent variable is the proportion of time travelled by public transport (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A8
Urban determinant of the proportion of time travelled by walking, by country.

	Canada	Spain	Hungary	Italy	NL	UK	US
urban	0.006**	0.036***	0.006	−0.014***	0.016***	0.061***	0.015***
	(0.003)	(0.003)	(0.012)	(0.002)	(0.005)	(0.008)	(0.001)
(log of) age	−0.014	−0.461***	−1.225**	−0.296***	0.382***	0.315***	0.266***
	(0.067)	(0.055)	(0.497)	(0.025)	(0.090)	(0.064)	(0.021)
(log of) age squared	−0.002	0.077***	0.161**	0.060***	−0.048***	−0.048***	−0.039***
	(0.009)	(0.008)	(0.067)	(0.004)	(0.013)	(0.009)	(0.003)
male	−0.004	−0.069***	−0.096***	−0.048***	−0.024***	−0.033***	0.004***
	(0.002)	(0.003)	(0.011)	(0.002)	(0.004)	(0.005)	(0.001)
completed secondary	−0.025***	−0.030***	−0.042***	−0.039***	−0.013**	−0.017***	−0.027***
	(0.005)	(0.005)	(0.013)	(0.003)	(0.006)	(0.006)	(0.002)
above secondary	−0.028***	−0.056***	−0.039***	−0.044***	−0.022***	−0.038***	−0.031***
	(0.004)	(0.005)	(0.014)	(0.005)	(0.006)	(0.007)	(0.002)
employee	−0.049***	−0.126***	−0.127***	−0.138***	−0.038***	−0.087***	−0.034***
	(0.003)	(0.004)	(0.013)	(0.003)	(0.005)	(0.007)	(0.001)
presence of partner	−0.039***	−0.030***	–	−0.057***	−0.029***	−0.069***	−0.021***
	(0.003)	(0.004)	–	(0.003)	(0.006)	(0.007)	(0.001)
household size	−0.010***	−0.011***	−0.003	−0.005***	−0.009***	0.003	−0.002***
	(0.001)	(0.001)	(0.006)	(0.001)	(0.003)	(0.003)	(0.001)
number of children	0.009***	0.017***	−0.003	0.014***	0.010***	0.007*	0.000
	(0.002)	(0.002)	(0.008)	(0.002)	(0.003)	(0.004)	(0.001)
weekday	0.011***	0.026***	−0.010	0.014***	−0.009***	0.063***	0.002***
	(0.003)	(0.003)	(0.012)	(0.002)	(0.003)	(0.003)	(0.001)
constant	0.247**	1.041***	2.720***	0.661***	−0.593***	−0.327***	−0.363***
	(0.118)	(0.093)	(0.918)	(0.040)	(0.153)	(0.103)	(0.038)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.045	0.138	0.097	0.168	0.033	0.087	0.031
N. individuals	28,384	34,652	3,467	76,640	22,538	15,051	170,645

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel and urban location. Dependent variable is the proportion of time travelled by walking (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table A9
Urban determinant of the proportion of time travelled by cycling, by country.

	Canada	Spain	Hungary	Italy	NL	UK	US
urban	0.003***	−0.002***	−0.008	0.007***	0.035***	0.000	0.001**
	(0.001)	(0.001)	(0.010)	(0.001)	(0.008)	(0.003)	(0.000)
(log of) age	−0.013	−0.014	0.529	−0.004	−1.241***	0.006	0.010
	(0.020)	(0.011)	(0.375)	(0.009)	(0.133)	(0.016)	(0.006)
(log of) age squared	0.001	0.002	−0.066	0.001	0.164***	−0.001	−0.002**
	(0.003)	(0.002)	(0.050)	(0.001)	(0.019)	(0.002)	(0.001)
male	0.006***	0.005***	−0.027***	0.004***	−0.028***	0.013***	0.004***
	(0.001)	(0.001)	(0.009)	(0.001)	(0.007)	(0.002)	(0.000)
completed secondary	0.001	−0.002**	−0.075***	−0.008***	−0.023**	−0.004*	−0.001***
	(0.001)	(0.001)	(0.011)	(0.001)	(0.009)	(0.002)	(0.000)
above secondary	0.003***	−0.001	−0.109***	−0.006***	−0.008	−0.008***	−0.001
	(0.001)	(0.001)	(0.010)	(0.002)	(0.010)	(0.002)	(0.000)
employee	−0.001	−0.001*	−0.001	−0.009***	−0.029***	0.003	−0.001**
	(0.001)	(0.001)	(0.011)	(0.001)	(0.009)	(0.002)	(0.000)
presence of partner	−0.002*	0.000	–	0.000	−0.024**	−0.001	−0.002***
	(0.001)	(0.001)	–	(0.001)	(0.010)	(0.002)	(0.000)
household size	0.000	−0.001***	−0.001	−0.001***	−0.013***	−0.001	0.000
	(0.001)	(0.000)	(0.005)	(0.000)	(0.005)	(0.001)	(0.000)
number of children	−0.001	0.001	0.005	−0.000	0.034***	0.001	−0.001**
	(0.001)	(0.000)	(0.007)	(0.001)	(0.006)	(0.001)	(0.000)
weekday	0.003***	0.000	0.012	0.004***	0.077***	0.005***	0.001***
	(0.001)	(0.001)	(0.010)	(0.001)	(0.004)	(0.001)	(0.000)
constant	0.034	0.036*	−0.881	0.024*	2.490***	−0.000	−0.011
	(0.036)	(0.019)	(0.695)	(0.013)	(0.228)	(0.025)	(0.012)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.007	0.004	0.041	0.008	0.119	0.008	0.004
N. individuals	28,384	34,652	3,467	76,640	22,538	15,051	170,645

Note: Sample consists of individuals from the Multinational Time Use Study (MTUS) from 2000 to 2019, including all travel episodes with non-missing information on mode of travel and urban location. Dependent variable is the proportion of time travelled by cycling (in logs). All regressions include year fixed effects. Robust standard errors clustered at the individual level in parentheses.
* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

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