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Analyses of Topical Policy Issues

Pro-environment attitudes and worker commuting behavior

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ABSTRACT

The private vehicle is, for most developed countries, the prevalent commuting mode of workers, and one of the main sources of CO2 emissions. The choice of the mode of transport for commuting trips clearly depends on individual preferences, and it may be that pro-environmental attitudes and values are related to environmental awareness and minimization of harm to the environment. This paper explores how pro-environmental attitudes and values relate to commuting behaviors, using data from the American Time Use Survey for the period 2003–2019. We focus on the time spent commuting, and on commuting modes. The results show that, net of observable factors, regions in which social attitudes are more pro-environmental are related to longer commuting times, but also to a higher percentage of active commuters and public transit commuters. These results suggest that policies aimed at shifting pro-environmental social values may help in reducing the use of private vehicles and encourage green means of transport, in order to reduce the environmental costs of commuting.

1. Introduction

Millions of individuals travel every day, and commuting to and from work is one of the most important activities (Prakash et al., 2020). For instance, in the US, approximately 20 % of all daily journeys are commuting trips, and more than 45 % of workers travel to and from their workplaces. According to the American Time Use Survey (ATUS), the time devoted to commuting has increased considerably in recent decades in the US, from an average of 39 min per day in 2003 to 45 min per day in 2019. The percentage of commutes under 10 min has declined, from 10 % in 2003 to 6 % in 2019, while the percentage of workers who commute more than 30 min has risen from 42 % to 51 %, over the same period.[1] Commuting to/from work has also increased in recent years in several developed economies (Susilo and Maat, 2007; Kirby and LeSage, 2009; McKenzie and Rapino, 2009; Le Barbanchon et al., 2021), and it plays a central role in daily mobility planning (Gimenez-Nadal et al., 2022).

How workers travel to their workplaces (mode of transport) has important consequences for the environment, including pollution, congestion, and traffic accidents (Chapman, 2007; Buehler, 2011; Morris and Zhou, 2018). Most US workers commute by private vehicle (Gimenez-Nadal et al., 2021), and this extends to several other developed countries, as the private vehicle is the preferred mode of travel for about 75 % of the OECD population (OECD, 2019; Echeverría et al., 2022). The expansion of motorized transport for daily trips has consequences for workers (Comerford, 2011), such as decreased health, but also to negative social and environmental consequences, including increased congestion, pollution, and CO2 and greenhouse gas emissions (e.g., Plaut, 2005; Shephard, 2008;

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[1] Own calculations using a sample of employed workers (no telecommuters) from the ATUS 2003-2019.

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Bopp et al., 2012; Long and Szeto, 2019; Vosough et al., 2020).

Thus, the analysis of commuting behavior of workers in the US, including the mode choice for these travels, is important for policy makers, to design policies aimed at mitigating the negative consequences of commuting on the environment. How individuals commute depends on their preferences and/or attitudes, and one such attitude is that of being pro-environment. Pro-environmental attitudes and values are often defined as people's concern for the environment (Hawcroft and Milfont, 2010; Bissing-Olson et al., 2013), or as acts that seek to cause minimal damage to the environment, and that relate to environmental awareness (Steg and Vlek, 2009; Liu et al., 2020).

Pro-environmental attitudes and behaviors have been heavily analyzed in recent years in fields such as environmental science, psychology, and economic psychology (Lange and Dewitte, 2020). There is a certain consensus on the existence of a relationship between pro-environmental attitudes and happiness and wellbeing (e.g., Millner et al., 2013; Schmitt et al., 2018), and several authors have documented specific pro-environmental attitudes at work such as recycling paper, printing double-sided, and making a conserving use of water and electricity resources while working (Bissing-Olson et al., 2013), and have focused on studying potential drivers of these actions, as within- and between-person attributes (Ohly et al., 2010). For example, Nilsson and Küller (2000) investigated travel behavior and environmental concern in Sweden on a broader scale; Abrahamse et al. (2009) explored morality and the use of cars for commuting in Canada; Clark et al. (2016) examined commuting modes, life events, and environmental attitudes in England; Lanzini and Khan (2017) conducted a literature review on the behavioral determinants of travel modes; Tran et al. (2020) analyzed environmentalism and physical activity in Japan; Ababio-Donkor et al. (2020) studied personal norms and commuting modes in Scotland; and Gravert and Collentine (2021) analyzed public transport usage, social norms, and habit formation in Sweden.

However, the link between pro-environmental attitudes and worker commuting behaviors has not been explored so far, despite that some existing research has analyzed how pro-environmental values relate to certain work behaviors. For instance, Ones and Dilchert (2012, 2013) proposed the concept of "employee green behavior", referring to those work behaviors driven by pro-environmental attitudes that are beneficial to the environment. However, the link between pro-environmental attitudes and green behaviors is not straightforward, given cognitive, psychological, or physical barriers (Kormos and Gifford, 2014), and some authors have distinguished between voluntary and non-voluntary green behaviors (Norton et al., 2015). Most of the research on pro-environmental attitudes and employee behaviors has emerged in disciplines related to environmental sciences and psychology (e.g., Suárez-Varela and Dinar, 2020, Tian et al., 2020), and the link between worker economic behaviors and pro-environmental attitudes remains relatively unexplored, including analysis of pro-environmental behaviors related to household consumption (Grunert and Juhl, 1995; Welsch and Kühling, 2010), subjective wellbeing (Suárez-Varela et al., 2016), the use of ICT while working (Freire-González and Vivanco, 2020), and entrepreneurial intentions (Wijbenga and Witteloostuijn, 2007). See Farrow et al. (2017) and Tian et al. (2020) for recent reviews.

Within this framework, we explore how commuting behavior relates to pro-environmental values in the US.[2] To do so, we use data from the ATUS for the period 2003–2019, which allows us to define the time spent commuting by workers, and also the means of transport used by workers while commuting to/from work. We define several pro-environmental attitudes using ancillary data from the American Values Survey and the General Social Survey over the analyzed period, which we match to the ATUS sample by gender, year, and geographical location. The results reveal a robust and positive correlation between pro-environmental values and commuting time, suggesting that regions in which social values are more environmentally friendly are regions in which workers spend more time commuting to/from work. The results also show that pro-environmental factors are related to a decreased use of private vehicles for daily commutes, and at the same time they relate to an increased use of both public transit services, and active means of transport (e.g., walking and cycling). Despite quantitative differences, these results hold in general terms for the various pro-environmental values considered in the analysis. We also report some degree of heterogeneity in how pro-environmental values relate to commuting behaviors, as these correlations seem stronger for older and more highly educated workers who do not have children, and for non-US native workers.

The contributions of the paper are twofold. First, we contribute to the literature on pro-environmental values and their relation to worker and household behaviors. Our results indicate that workers with values and attitudes that are more pro-environment are willing to spend more time commuting by greener means of transport, evidence of the relationship between attitudes and worker behaviors. To the best of our knowledge, such a link has not been explored in the past, and we complement existing research on how commuting relates to culture and social values in general terms (e.g., Ababio-Donkor et al., 2020). Second, we contribute to the growing literature on commuting behavior, focusing on how commuting time and transport modes relate to pro-environmental values. Further research should build on our empirical exploration by analyzing causal links between pro-environmental attitudes and commuting behaviors, to disentangle the potential mechanisms behind the correlations reported by our empirical exercise.

The remainder of the paper is structured as follows. Section 2 summarizes the theoretical setting, and Section 3 describes the data, sample and variables. Section 4 shows the empirical strategy and our main results. Finally, Section 5 concludes.

[2] While this analysis constitutes an empirical exploration, it aligns with certain theoretical frameworks. For instance, consider the Value-Belief-Norm Theory (Stern et al., 1999; Stern, 2000), which delineates various environmentally significant behaviors and explores the factors influencing environmentalism—defined as the inclination to undertake actions with pro-environmental intentions. This theory operates within a framework where values shape beliefs, beliefs shape personal norms and pro-environmental actions, and these personal norms subsequently influence behaviors. Refer to Figure 1 in Stern (2000) for a visual representation.

2. Conceptual framework

Commuting is a complex phenomenon influenced by a wide range of factors, including other time allocations by workers, subjective well-being, employment characteristics, gender roles, and the business cycle, among others (e.g., van Ommeren and van der Straaten, 2008; Dickerson et al., 2014; Gimenez-Nadal et al., 2018a; Kim and Horner, 2021; Oreffice and Sansone, 2023). Furthermore, commuting is often analyzed through the lenses of urban economics, geography, urban planning, and engineering. It is frequently viewed as a cost factor, with workers facing trade-offs between commuting and housing. Longer commutes are often weighed against the benefits of living in suburban areas that offer desirable amenities (Brueckner et al., 1999). However, the relationship between commuting time and social norms—particularly pro-environmental attitudes—remains understudied. Nevertheless, the interaction between pro-environmental attitudes and commuting behavior can be examined through several theoretical frameworks.

A key perspective is the theory of planned behavior (Ajzen, 1991), a psychological theory that explains how individuals' intentions are formed and translated into behavior. According to this theory, workers' perceived green attitudes, along with their perceived control over the infrastructure needed to act on those attitudes, shape commuting decisions. For instance, individuals with strong pro-environmental attitudes may prefer sustainable commuting modes, such as public transport, cycling, or walking, provided they perceive these options as feasible, socially endorsed, and consistent with their values. This theory, therefore, provides a lens to understand how pro-environmental attitudes influence commuting time through the perceived control over commuting modes or infrastructure.

The value-belief-norm theory offers another perspective, emphasizing the role of environmental values in shaping behavior (Stern et al., 1999; Stern, 2000). This framework posits that pro-environmental values influence individuals' beliefs about the potential environmental consequences of unsustainable commuting modes. These beliefs, in turn, lead individuals with pro-environmental attitudes to choose environmentally friendly commuting alternatives. In other words, commuters with strong pro-environmental beliefs feel a moral obligation to minimize their environmental impact, prompting them to opt for active commuting modes even when these choices require greater effort or involve inconvenience.

These psychological theories align with certain economic theories, such as rational choice theory and time allocation theory (Becker, 1965, 1976). Rational choice theory examines how individuals weigh the costs and benefits of commuting, while time allocation theory conceptualizes time as a constrained resource that must be balanced with other activities. Pro-environmental attitudes can influence and moderate these decision-making processes by encouraging sustainable options. For example, individuals with strong pro-environmental attitudes might accept higher costs or longer commuting times if such choices align with their values. Conversely, individuals without these attitudes may prioritize shorter and less costly commutes, even if they rely on environmentally unfriendly travel modes.

Social and identity-based theories also provide valuable insights into the relationship between pro-environmental attitudes and commuting. For example, environmental identity theory suggests that individuals with strong pro-environmental identities are more likely to engage in behaviors that reinforce their self-concept (Clayton, 2003). Consequently, pro-environmental attitudes may lead individuals to choose environmentally friendly commuting modes, which serve to reinforce their self-perception and identity. This behavior can also influence others, as individuals who observe pro-environmental attitudes within their social networks are more likely to adopt behaviors that align with those attitudes.

These theoretical perspectives integrate with the commuting literature in economics, geography, and urban studies. For instance, research on commuting and the built environment highlights how access to eco-friendly infrastructure, such as public transit, bike lanes, and walkable neighborhoods, enables the use of sustainable commuting modes (Lunke et al., 2023). Similarly, studies on commuting and life events indicate significant changes in commuting behavior during major transitions, such as residential relocation or job changes (Clark et al., 2016). In these contexts, pro-environmental attitudes and preferences for sustainable commuting modes play a pivotal role, as individuals with such attitudes may be more willing to accept longer commute times or choose active commuting modes and public transit, provided these options are available. This intersection underscores the importance of integrating urban theories with psychological preferences and values to achieve a comprehensive understanding of commuting behavior.

3. Data and variables

3.1. American time use survey data

We use data from the American Time Use Survey (ATUS) for the period 2003–2019.[3] The ATUS data provides us with questionnaires, including socioeconomic variables, about respondents, but also with information on individual time use based on diaries, where respondents report their activities during the 24 h of the day, from 4 am to 4 am of the next day. Several authors have reported the advantage of self-reported diary data over other types of survey based on stylized questionnaires (Bonke, 2005; Yee-Kan, 2008), such as more reliable and accurate estimates. Thus, time use surveys have become the "gold-standard" in the study of worker daily behaviors (Aguiar and Hurst, 2007; Harms et al., 2019) and have been used to study commuting time and travel behaviors during recent years (e.g., Gerike et al., 2015; Rosales-Salas and Jara-Díaz, 2017; Gimenez-Nadal et al., 2018a, 2018b, 2021). The ATUS is the official time use survey of the US, conducted as part of the Current Population Survey (CPS) by the US Census Bureau, sponsored by the Bureau

[3] The data comprises repeated cross-sections, and the samples are nationally representative, supported by the sample weights provided in the database.

of Labor Statistics. Furthermore, the ATUS is included as part of the Integrated Public Use Microdata Series (IPUMS) of the Institute for Social Research and Data Innovation of the University of Minnesota (Hofferth et al., 2020).

To mitigate the impact of time-allocation choices across different life stages, we begin with an initial sample of 210,586 individuals. We narrow this down to 157,438 individuals aged between 21 and 65 years old (Gimenez-Nadal and Sevilla, 2012). Further refinement includes retaining solely employed individuals, resulting in 101,846 individuals. Additionally, we exclude individuals who recorded their time use on holidays or weekends, reducing the sample to 49,940 individuals. Recognizing distinct commuting patterns between self-employed and employed individuals (van Ommeren and van der Straaten, 2008; Gimenez-Nadal et al., 2018a; Albert et al., 2019), we focus solely on the 45,014 employed workers who provide complete data.

Moreover, our analysis concentrates on weekdays, defined as days where respondents dedicate at least 60 min to market work activities, excluding commuting (Gimenez-Nadal et al., 2021), resulting in a subset of 39,035 individuals. Finally, we exclude 3684 employees who worked from home on the diary day, reporting zero commuting in their time use diaries, culminating in a final sample size of 35,351 respondents. Within this group, 17,694 are women and 17,657 are men.[4]

The ATUS diaries allow us to define the time spent commuting. To that end, we identify the episodes of "travel to/from work", and the time spent commuting is then defined as the duration of these episodes, in minutes per day. The ATUS diaries also include information on the mode of transport, and we distinguish between three main means of transport: 1) private vehicle (episodes by car, truck, or motorcycle), 2) public transit (episodes on a bus, subway/train, boat/ferry, taxi/limousine, or airplane), and 3) active commuting (walking, bicycle).[5] We thus define, for each worker in the sample, the time spent commuting in each of these means of transport, and the rate of time commuting in each mode of transport (i.e., the time commuting in that specific mode of transport, over the time commuting to/from work). We also identify the preferred mode of transport, and then classify individuals as private vehicle commuters, public transit commuters, and active commuters, depending on the main mode of transport used.[6]

The ATUS data allows us to define several worker demographic variables that may be related to worker commuting behaviors. First, several studies have documented gender gaps in commuting time, as men spend on average more time commuting than women.[7] Then, we define a dummy variable that takes value 1 for men, 0 for women. We define respondents' age, measured in years, as commuting time has been related to worker age (van Ommeren and van der Straaten, 2008; McQuaid and Chen, 2012). Worker race and citizenship status have also been related to commuting (van Ommeren and van der Straaten, 2008; McQuaid and Chen, 2012; Gimenez-Nadal et al., 2018a; Albert et al., 2019), and we thus define dummy variables that identify for white workers, black workers, US native workers, and workers of Hispanic origin. We also control for worker education, as higher formal education is often related to longer commutes (Sandow and Westin, 2010; Dargay and Clark, 2012). In doing so, we define three dummy variables: primary education (value 1 for those who have not completed secondary education, 0 otherwise), secondary education (value 1 for those who have completed secondary education but have not completed college, 0 otherwise), and University education (1 for those who have completed college or have a University degree, 0 otherwise).

We also follow existing studies (e.g., Lee and McDonald, 2003; Carta and De Philippis, 2018; Hong et al., 2018), and define certain household attributes, namely the number of individuals in the family unit, the number of children, living in couple (a dummy variable that takes value 1 for those who cohabit with a married or unmarried partner, 0 otherwise), a dummy that identifies those living in a house/apartment/flat, and a dummy that identifies those who live in an owned home. Because worker characteristics are also related to commuting behavior (Ross and Zenou, 2008; Gutiérrez-i-Puigarnau and van Ommeren, 2010; Gimenez-Nadal et al., 2018b), we control for the usual hours of work per week, for household income, and for the full-/part-time status (a dummy taking value 1 for full-time workers, 0 for part-time workers). We also control for worker occupation (McQuaid and Chen, 2012; O'Kelly et al., 2012), and for the geographic location of respondents, as the ATUS data allows us to define the State of residence, and the urban location of respondents' residence (Manning, 2003; Naess et al., 2019). Specifically, we distinguish between those living in the center of a metropolitan areas, those living on the fringe of a metropolitan area, and those living in non-metropolitan areas.

An important dimension of worker commuting behavior is commuting direction, which refers to the routes, orientations, or destinations that workers take when traveling to or from work. This encompasses aspects such as distance, geographic orientation, access to transportation services, and the social or economic characteristics of origins and destinations. For example, whether the commute is toward the city center or the outskirts may reflect differences in access to transportation infrastructure: workers commuting to the city center might prefer public transit due to traffic congestion or parking constraints, while those traveling to peripheral areas might prefer driving. Similarly, commuting patterns may differ significantly between urban-to-rural routes and rural-to-urban routes, depending on the availability and suitability of travel modes such as transit or cycling. Unfortunately, the ATUS database does not include information to identify commuting directions, as it provides data on respondents' places of residence but not on the characteristics or locations of their workplaces. Consequently, we are unable to examine whether commuting direction moderates the relationship between pro-environmental attitudes and commuting behavior, which we acknowledge as a limitation of our analysis.

[4] We have additionally checked for and deleted outliers using the blocked adaptive computationally efficient outlier nominators (BACON) algorithm, to detect outliers in multivariate data on the main variables (Billor et al., 2000).

[5] The 3.16% of "travel to/from work" episodes are associated with unknown means of transport, so that commuting time is not exactly equal to the times spent commuting in private vehicle, public transit, and active modes.

[6] The preferred means of transport is the private vehicle, or public transit. If workers commute actively to/from work, then the preferred mean of transport is active (walking, bicycle).

[7] See, for instance, Mok (2007), Roberts et al. (2011), McQuaid and Chen (2012), Oakil et al. (2016), Le Barbanchon et al. (2021), Gimenez-Nadal et al. (2022).

3.2. Pro-environmental values

We use two data sets to analyze pro-environmental values. First, we use data from the American Values Survey (AVS), included as part of the World Values Survey (WVS), a large-scale, cross-national research program on basic human values, ideas, beliefs, preferences, attitudes, and opinions of citizens across the world.[8] Second, we use data from the General Social Survey (GSS), a US nationally representative survey that for five decades has studied changes in attitudes, opinions, and behaviors of US individuals.[9] A characteristic of both surveys is that they repeat periodically over the period covered by the ATUS sample. The AVS has been conducted in four waves (1999–2004, 2005–2009, 2010–2014, and 2017–2020), while the GSS has been conducted biennially between 2002 and 2018 (both inclusive). Another common characteristic of both the AVS and the GSS is that certain questions about values and attitudes are not the same across waves of the databases. This represents a limitation, since we need to use survey questions that represent pro-environmental values, and that repeat in questionnaires over the analyzed period of time. Because we are interested in studying how pro-environmental values of the population relate to worker commuting behaviors, we do not impose specific sample requirements on the AVS and GSS samples, other than excluding individuals with missing information in the key variables.[10]

From the AVS, we define the following pro-environmental values. Value 1: "belong/participate in environmental organization". Value 2: "protecting the environment is more important than the economy". Value 3: "confidence in environmental protection plans". And Value 4: "the environment is a global problem". These values are defined from the respective survey questions: "Belong/membership/participate/donate to conservation, the environment, ecology, animal rights organization", "protecting environment vs. economic growth", "confidence in: the environmental protection movements", and "most serious problem of the world". Survey questions have been recoded for the sake of simplicity, so that value 1 represents an answer "yes", while value 0 represents an answer "no". Averages of these values close to 1 represent more environmentally friendly, or pro-environmental values, while averages close to 0 represent less pro-environmental values.

In the GSS there are two values that repeat over the analyzed period, and then define the following pro-environmental values. Value 5 is defined as "more expenditure in protecting environment is required", from survey question "are we spending too much, too little, or about the right amount on improving and protecting the environment?". Finally, value 6 is defined as "more expenditure in alternative energy sources is required", from survey question "are we spending too much, too little, or about the right amount on developing alternative energy sources?". We recode these values as 1 if the answer is "too little", 0 otherwise ("about right" or "too much"), and follow the same strategy for matching averaged values by gender, year, and geographic division, to the ATUS sample of employee workers.

Next, we use the common classification of US regions in the AVS and the GSS, the geographic divisions (New England, Middle Atlantic, South Atlantic, East North Central, West North Central, East South Central, West South Central, Rocky Mountain), and define, separately for males and females, the average value of each item in each geographic division and each time period included in the AVS and the GSS. We then match each averaged pro-environmental value with the ATUS sample, in terms of ATUS respondents' gender, survey year (using the closest calendar year to the AVS or GSS questionnaire), and State of residence (which we aggregate to geographic divisions for the matching process).[11] See Appendix Table A2 for details. (This identification is specifically analyzed using a "placebo test" as part of the main analysis.)

3.3. Descriptive statistics

Table 1 shows descriptive statistics of the main variables (for the sake of simplicity, descriptives of demographics are shown in Table A1 in Appendix A). All summary statistics are computed using sample weights, aimed at providing "average day" effects.[12] The average female employee in the sample spends about 41.0 min per day commuting, whereas the average male spends about 51.1 min commuting, making a gender difference of about 10.1 min per day, which is statistically significant. Furthermore, the average female employee commutes 35.6 min in private vehicle (86.8 % of her commuting journey), 3.1 min in public transit (7.6 %), and 1.5 min actively (3.7 %). On the other hand, the average male spends 44.9 min commuting in private vehicle, 3.3 min in public transit, and 1.8 min actively (87.9 %, 6.5 %, and 3.5 %) of his commuting journey.[13] Gender differences in commuting times by transport mode are all statistically significant, although the gender difference in the percentage of the commuting journeys done by transport mode are not significant ($p = 0.117$, $p = 0.989$, and $p = 0.275$, respectively).

Focusing on the type of commuter, in terms of the preferred mode of transport, about 93.7 % of the females and the same proportion of males use a private vehicle as their main means of commuting, with the gender difference being not statistically significant.

[8] See https://www.worldvaluessurvey.org/wvs.jsp.

[9] See https://gss.norc.org/About-The-GSS.

[10] The AVS and GSS data have already been used to analyze how social values relate to socioeconomic behaviors. See for instance Alesina and Giuliano (2010), Giuliano and Spilimbergo (2014), Ko et al. (2019), Campaña et al. (2023).

[11] We have repeated the analysis but matching averaged values by gender, geographic division, calendar year, age cohort, race, marital status, and presence of children. Baseline results provide similar conclusions. However, as these demographic attributes are control variables in our commuting behavior econometric model, we cannot define values by these demographic groups (otherwise the source of variation of values is overseen by the control variables). As a consequence, we define values only by gender and by geographic division.

[12] See https://www.atusdata.org/atus-action/variables/WT06#description_section.

[13] The remaining 1.9% (2.1%) of the average female (male) employee's commuting journey is done in unknown or unidentified modes of transport.

Table 1
Summary statistics of main variables.

	(1) Women	(2)	(3) Men	(4)	(5) Difference	(6)
VARIABLES	Mean	St. Dev.	Mean	St. Dev.	Diff.	*p*-value
Commuting variables						
Commuting time	41.007	35.710	51.063	44.141	10.056	(<0.001)
In private vehicle	35.583	31.576	44.928	40.145	9.345	(<0.001)
In public transit	3.127	17.932	3.288	19.708	0.161	(0.006)
Actively	1.476	7.209	1.786	8.418	0.310	(<0.001)
Private vehicle commuter	0.937	0.242	0.937	0.243	0.000	(0.275)
Public transit commuter	0.033	0.179	0.029	0.169	−0.004	(0.281)
Active commuter	0.029	0.169	0.033	0.180	0.004	(0.010)
Values						
Value 1 (AVS)	0.214	0.026	0.207	0.026	−0.007	(<0.001)
Environmental organization						
Value 2 (AVS)	0.497	0.043	0.492	0.053	−0.005	(<0.001)
Protecting the environment						
Value 3 (AVS)	0.567	0.031	0.510	0.032	−0.057	(<0.001)
Confidence in protection plans						
Value 4 (AVS)	0.062	0.018	0.069	0.019	0.007	(<0.001)
Environment global problem						
Value 5 (GSS)	0.650	0.033	0.623	0.032	−0.027	(<0.001)
Expenditure in protecting env.						
Value 6 (GSS)	0.587	0.042	0.612	0.045	0.025	(<0.001)
Expenditure in alternative energies						
Observations	17,694		17,657			

Note: The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Commuting times are measured in minutes per day. Private vehicle commuter takes value 1 if the main commuting mode is the private vehicle, 0 otherwise. Public transit commuter takes value 1 if the main commuting mode is public transit, 0 otherwise. Active commuter takes value 1 if the main commuting mode is active (walking/bike), 0 otherwise. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Differences computed as the average value of men, minus the average value of women; *t*-test *p*-values in parentheses.

Additionally, 3.3 % of the females and 2.9 % of the males use public modes of transport as their main commuting mode, with the gender difference not being statistically significant, and 2.9 % of the females and 3.3 % of the males commute mainly actively (with the gender difference being significant at standard levels). Thus, descriptive results suggest that, despite gender differences in commuting time, the use of private vehicle and public transit is no different between female and male employees, although males seem to show a higher preference for commuting actively than do females (with the gender difference being significant but quantitatively low). Descriptives also reveal that the private vehicle is the preferred mode of transport of US female and male employee workers, in line with existing research (e.g., Yang et al., 2015; Gimenez-Nadal et al., 2021).

Regarding pro-environment values, Table 1 shows some degree of heterogeneity in terms of female and male attitudes.[14] For instance, females are more likely to participate or be linked to environmental organization than males, are relatively more interested in protecting the environment than the economy, and have a higher confidence than males in environmental protection plans. A higher proportion of females than males also think that more expenditure is required to protect the environment. On the other hand, a higher proportion of males than females think that more expenditure is required to develop new and alternative energies, and a higher proportion of males than females think that the environment is a global problem. All these differences are statistically significant at standard levels.

4. Empirical strategy and results

4.1. Strategy

To study how pro-environment values relate to worker commuting behaviors, we estimate the following equation:

$$Y_{igt} = \beta_0 + \beta_1 V_g^s + \beta_2 X'_{igt} + \alpha_g^s + \gamma_t^s + \varepsilon_{igt}^s, \quad (1)$$

[14] Since these pro-environment values are defined from ancillary surveys, matched to the ATUS sample by gender and geographic divisions, they do not provide a clear quantitative picture. However, they allow us to derive qualitative differences in how females and males value the different dimensions of the environment captured by survey items. Table A2 in Appendix A shows the averages of the six pro-environment values considered in the analysis, by geographic divisions.

where Y_{igt} represents the dependent variable for respondent i living in region g and year t, V_g^s is the corresponding pro-environment value associated with region g for gender s, and X'_{igt} is a vector of socio-demographic characteristics (including respondent gender, age, race and native status, education, household size, number of children, living in couple, work hours, household income, full-time status, tenure and home type, metropolitan status, size of the metropolitan area of residence, and worker occupation and diary day fixed effects, to account for potential differences in commuting driven by occupation, or weekdays/weekends). α_g^s represents State fixed effects, γ_t^s represents year fixed effects, and ε_{igt}^s is the error term.[15] All estimates are computed using sample weights.

The coefficient of interest is β_1, which represents how pro-environment values relate to the dependent variable Y_{igt}, net of worker observables, and region and time differences in the dependent variable. We first consider that the dependent variable Y_{igt} is the commuting time of worker i. That way, we study how pro-environmental values relate to increased or decreased commuting time. Next, we study how these values relate to commuting modes. To do so, we first consider the rates of commuting time done by transport mode as dependent variables in Eq. (1). (Estimates using time rather than by transport mode provide similar conclusions and are available upon request.) We also study the type of commuter, by transport mode, as our dependent variables. We thus examine how values relate to higher ratios of commuting journeys by transport mode, but also how these ratios relate to the main commuting mode used by US female and male employees.

To avoid collinearity issues, since the six values are highly correlated (all pairwise correlations between values are highly significant, with $p < 0.001$; see Table A3 in Appendix A), we include them one-by-one in the estimating equation (1).[16] Variance inflation factors (VIF) larger than 5 for the six values also prevent us from including all the values together in a single equation. The average VIF for the remaining set of dependent variables included in our estimating equations is 4.12, and the only explanatory variables with VIF greater than 5 are education categories. Thus, we conclude that collinearity between control variables is not an issue in our econometric strategy.

Finally, we examine whether the relationship between pro-environment values and commuting modes is heterogeneous for different demographic cells. To do so, we estimate Eq. (2), as follows:

$$Y_{igt} = \beta_0 + \beta_1 V_g^s + \delta_1 V_g^s male_{igt} + \delta_2 V_g^s age_{igt} + \delta_3 V_g^s Univ_{igt} + \delta_4 V_g^s nat_{igt} + \delta_5 V_g^s kids_{igt} + \beta_2 X'_{igt} + \alpha_g^s + \gamma_t^s + \varepsilon_{igt}^s, \quad (2)$$

where $male_{igt}$ is a dummy identifying males, age_{igt} represents respondent age (in years), $Univ_{igt}$ is a dummy identifying individuals with University education, nat_{igt} is a dummy identifying US native workers, and $kids_{igt}$ is a dummy identifying respondents with children. The remaining terms are defined as in Eq. (1).

The coefficients of interest in Eq. (2) are β_1, but also $\delta_j, j = 1,2,3,4,5$. For instance, β_1 now captures the baseline relation between pro-environment values and the dependent variable, while δ_1 represents an additional correlation between values and the dependent variable among males (relative to females), δ_2 an additional correlation driven by age, δ_3 an additional correlation driven by having University education (relative to lower formal education categories), δ_4 an additional correlation driven by being a US native citizen, and δ_5 an additional correlation driven by having children.[17]

4.2. Baseline results on commuting time

Table 2 shows OLS estimates of Eq. (1) on commuting time.[18] Columns (1) to (6) show results for each of the pro-environment values separately. The results indicate that, in general terms, more pro-environment values relate to increased commuting times, compared to workers in regions in which social attitudes are less pro-environment, and net of worker observable characteristics, and occupation, State and year effects. However, this result does not hold for all the values analyzed, and results differ quantitatively across values. For instance, the largest correlation between values and commuting times is found for value 1 ("belong/participate in environmental organizations"), followed by value 5 ("More expenditure in protecting environment req."), value 3 ("confidence in environmental protection plans"). On the other hand, the correlation is not significant for value 2 ("protecting the environment is more important than the economy").

These results suggest that regions in which commuting times last longer are where workers have a greater environmental awareness. Despite that, our estimates only allow us to find conditional correlations, and not causal results. As such, we cannot conclude that policies aiming at increasing the awareness of workers of environmental problems have a positive effect on commuting

[15] By controlling for year fixed effects, we net out potential time effects of pro-environmental values on commuting behaviors.

[16] Alternatively, we could have constructed a single pro-environmental factor through factor analysis or principal components analysis (PCA). However, due to the KMO measure for sample adequacy falling below the threshold for suitability in the GSS data (KMO below 0.5) and only moderately meeting adequacy in the AVS data (KMO = 0.583), such an analysis was not deemed suitable. Consequently, we opt to focus on individual values in our primary analysis. Although PCA outcomes and the use of a PCA factor in the AVS data are presented in Appendix B, the PCA analysis is not entirely suitable. Nevertheless, the conclusions drawn largely align with those derived from analyzing values individually in the main analysis, various robustness checks, and additional analyses.

[17] We selected these demographics for the heterogeneity analysis based on an exploration of how commuting changes with worker demographic attributes.

[18] An alternative path to estimating equations is using censored regression models, such as the Tobit model (Tobin, 1958). However, prior research has compared Tobit models and OLS models when studying time allocations, and conclusions are similar (Frazis and Stewart, 2012; Gershuny, 2012; Foster and Kalenkoski, 2013; Gimenez-Nadal et al., 2022). For the sake of simplicity, we follow Gimenez-Nadal et al. (2022) and rely on OLS.

Table 2
Estimates on commuting time.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
Value	64.264***	−0.183	44.867***	23.263*	59.518***	23.871***
	(10.542)	(5.554)	(8.413)	(14.103)	(8.524)	(6.058)
Being male	6.735***	6.307***	8.838***	6.140***	6.866***	7.880***
	(0.600)	(0.596)	(0.793)	(0.603)	(0.625)	(0.640)
Age	0.085***	0.092***	0.088***	0.091***	0.088***	0.088***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Being white	−1.519	−1.936	−1.939	−1.806	−1.678	−2.265*
	(1.317)	(1.322)	(1.323)	(1.318)	(1.320)	(1.320)
Being black	3.357**	2.849*	3.240**	3.042**	3.380**	2.662*
	(1.470)	(1.480)	(1.477)	(1.473)	(1.478)	(1.470)
Being US native	−5.203***	−5.402***	−5.212***	−5.409***	−5.330***	−4.916***
	(0.963)	(0.964)	(0.964)	(0.964)	(0.964)	(0.965)
Hispanic origin	2.392**	2.739***	2.906***	2.602***	2.562***	3.522***
	(0.974)	(0.978)	(0.973)	(0.981)	(0.977)	(0.983)
Secondary education	−1.970	−2.097	−2.007	−2.053	−1.997	−2.298
	(2.137)	(2.151)	(2.143)	(2.149)	(2.143)	(2.145)
University education	1.103	0.997	1.083	1.041	1.104	0.700
	(2.249)	(2.263)	(2.256)	(2.261)	(2.256)	(2.256)
Household unit size	0.966**	1.061***	1.012**	1.054***	1.018**	1.004**
	(0.399)	(0.398)	(0.398)	(0.398)	(0.399)	(0.397)
Number of kids	−1.411***	−1.474***	−1.438***	−1.476***	−1.453***	−1.407***
	(0.471)	(0.470)	(0.470)	(0.470)	(0.470)	(0.469)
Living in couple	0.873	0.705	0.800	0.713	0.777	0.809
	(0.656)	(0.656)	(0.656)	(0.655)	(0.656)	(0.656)
Weekly work hours	0.206***	0.200***	0.205***	0.201***	0.204***	0.208***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Household income	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Full-time worker	0.256	0.338	0.364	0.303	0.303	0.317
	(1.080)	(1.081)	(1.081)	(1.080)	(1.080)	(1.080)
Home: owned	0.646	0.313	0.476	0.377	0.501	0.497
	(0.673)	(0.675)	(0.673)	(0.675)	(0.675)	(0.673)
Home type: house	−2.678*	−2.619*	−3.001**	−2.620*	−2.763*	−3.127**
	(1.483)	(1.479)	(1.485)	(1.480)	(1.482)	(1.485)
Metropolitan center	0.233	0.563	0.588	0.520	0.486	0.906
	(0.901)	(0.901)	(0.902)	(0.901)	(0.900)	(0.904)
Metropolitan fringe	2.911***	3.132***	3.093***	3.134***	3.121***	2.981***
	(0.776)	(0.775)	(0.774)	(0.774)	(0.774)	(0.773)
Size of MSA	3.341***	3.465***	3.364***	3.433***	3.360***	3.367***
	(0.245)	(0.247)	(0.246)	(0.247)	(0.247)	(0.246)
Constant	14.131***	28.055***	2.783	26.433***	27.604***	14.120***
	(4.223)	(4.479)	(5.928)	(3.706)	(3.661)	(4.993)
Year, region, day, occupation FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.074	0.073	0.074	0.073	0.073	0.075

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.."

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

time. Nevertheless, the positive correlation may indicate that in regions where these values are more pro-environment, workers may prefer to use alternative transport modes to the private vehicle, such as green or active modes (e.g., walking and cycling) or public transit services, even if that induces an increase in their daily commuting time. We dive deeper into the relationship between pro-environment values and commuting modes below.

Regarding the remaining set of explanatory variables, all columns show a significant gender gap in commuting time, net of observable factors. Age is also related to commuting time, as longer commutes are reported among older workers than among younger workers. Race is also related to commuting in a statistically significant way, as black and Hispanic workers systematically report longer commutes than their counterparts, in line with Gimenez-Nadal et al. (2018a). On the other hand, US native workers show shorter commutes (van Ommeren and van der Straaten, 2008; McQuaid and Chen, 2012; Gimenez-Nadal et al., 2018a; Albert et al., 2019). Education, however, seems to be unrelated to commuting in a statistically significant way. Household attributes are also significant, as

commuting seems to increase with the number of individuals in the family unit, but decreases in the presence of children. Work hours are also positively related to commuting time, and the same is found for household income (in line with Ross and Zenou, 2008; Gutiérrez-i-Puigarnau and van Ommeren, 2010). Finally, workers on the fringe of metropolitan areas seem to commute longer times than their counterparts in the center of metropolitan areas, or in non-metropolitan areas, and workers in densely populated areas also commute longer times than their counterparts in less populated metropolitan areas (Kahn, 2000; McQuaid and Chen, 2012; Gimenez-Nadal et al., 2018a).[19]

4.3. Robustness checks

We conduct several robustness checks to assess the sensitivity of the results to various factors, including the estimation method (as commuting time is censored and cannot have negative values), the allocation of values to individuals based on geographical divisions and time periods, and the definition of commuting time. The primary findings are presented in Table 3, while additional coefficients, provided for completeness, are excluded for simplicity's sake and are available upon request.

Initially, we present the primary outcomes of estimating Eq. (1) using the Tobit model (Tobin, 1958). The estimates, displayed in Panel A of Table 3, closely mirror those in the main results presented in Table 2, affirming the independence of the results from the chosen estimation method.

We re-estimate Eq. (1) by randomly aligning individuals in the ATUS sample with values defined from the AVS and GSS. This serves as a placebo test, allowing us to examine whether the established relationships in the main findings persist when the alignment between commuting behaviors and pro-environmental values is not based on geographical divisions and time periods, but is randomized instead. The primary coefficients are shown in Panel B of Table 3, lacking statistical significance at conventional levels. This outcome suggests that the assumption of pro-environmental values within specific geographical divisions influencing workers' commuting behaviors in those areas remains valid.

Third, we look into potential disparities between trips to work and trips from work, as recent studies have highlighted their asymmetry (Gimenez-Nadal et al., 2021). While the ATUS data distinguishes commuting to and from work, other surveys typically define commuting times as unidirectional. Consequently, it is crucial to assess whether this definition affects the outcomes.

Estimates presented in Panel C and Panel D of Table 3 reveal that the relationship between pro-environmental values and commuting behaviors exhibits a similar qualitative pattern for both commuting to work and commuting from work. Hence, despite that these trips are not necessarily symmetrical, the correlation examined in this study holds for both, indicating that the main findings remain robust regardless of the definition of commuting time.

4.4. Baseline results for transport modes

Table 4 shows estimates on the rate of commuting time done in each transport mode. Panel A shows main estimates on the rate of commuting done in private vehicle, panel B shows the main estimates on the rate by public transit, and panel C shows estimates on the rate of commuting done actively. For the sake of brevity, we only show the main coefficients; the remainder of control variables are the same as those shown in Table 2, and estimated coefficients are available upon request.

Results for the rate of commuting done in private vehicle provide the solid conclusion that regions in which values are more pro-environment are consistently associated with lower worker commuting time done in private vehicle. This result holds for all the values considered in the analysis, as all the coefficients in Columns (1) to (6), corresponding to values 1 to 6, are negative and highly significant. Despite that these estimates do not reveal any causal link (they represent only conditional correlations), results provide suggestive evidence that promoting pro-environment values may help to reduce the use of private vehicles in daily commuting behaviors of workers in the US.

Focusing on panels B and C of Table 4, the conclusions are robust to those in panel A. Regions in which values are more pro-environment are robustly related to a higher rate of worker commuting time done on public transit and actively (i.e., walking or cycling). The former result is true for all the values, but for value 2 ("protecting the environment is more important than the economy"), whereas the second result holds for all the pro-environment values analyzed. These estimates are in line with the suggestive evidence provided by panel A, as they suggest that promoting social values that are more pro-environment may help in increasing public transit services or green modes of transport (walking and cycling), while reducing the use of private vehicles for daily travel to/from work.

Table 5 shows similar estimates, but focusing on the type of commuter (private vehicle commuter in panel A, public transit commuter in panel B, and active commuter in panel C). The conclusions are robust to those derived from Table 4. Regions in which values and attitudes are more pro-environment are consistently related to a decreased rate of workers who are private vehicle commuters, and at the same time with an increase in the rate of workers who are public transit commuters and active commuters.

Though these results should be confirmed by further analysis using additional data that allows for causal empirical strategy, it is important to highlight that commutes in private vehicle are more linked to decreased wellbeing (Roberts et al., 2011; Dickerson et al., 2014; Gimenez-Nadal and Molina, 2019), and increased stress (Wener et al., 2003; Frey and Stutzer, 2008; Gottholmseder et al., 2009;

[19] An appealing notion is that R-squared are relatively low for all estimates. This is a commonality of empirical approaches to commuting behaviors, since commuting depends on stochastic non-observables, such as congestion, road infrastructures, or the weather. See van Ommeren and van der Straaten (2008) for a detailed discussion.

Table 3
Robustness checks.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Tobit estimates						
Value	64.264***	−0.183	44.867***	23.263*	59.518***	23.871***
	(10.533)	(5.549)	(8.406)	(14.091)	(8.516)	(6.053)
Constant	14.131***	28.055***	2.783	26.433***	−10.083	14.120***
	(4.220)	(4.475)	(5.923)	(3.702)	(6.492)	(4.989)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
B. Placebo test						
Value	4.555	4.630	−0.596	3.674	−9.051	−5.582
	(10.181)	(5.587)	(5.994)	(13.562)	(7.552)	(5.825)
Constant	26.993***	25.652***	28.288***	27.720***	33.768***	31.333***
	(4.337)	(4.722)	(4.845)	(3.851)	(6.037)	(5.083)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.073	0.073	0.073	0.073	0.073	0.073
C. Time to work						
Value	38.979***	0.956	22.396***	10.414	32.978***	11.394***
	(6.356)	(3.381)	(5.167)	(8.345)	(5.072)	(3.605)
Constant	9.459***	17.367***	5.280	17.164***	−3.232	11.241***
	(2.615)	(2.742)	(3.645)	(2.256)	(3.952)	(3.032)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.056	0.055	0.056	0.055	0.057	0.055
D. Time from work						
Value	25.285***	−1.138	22.471***	12.848	26.540***	12.477***
	(6.741)	(3.640)	(5.313)	(9.114)	(5.427)	(3.838)
Constant	4.672*	10.688***	−2.496	9.270***	−6.851*	2.879
	(2.697)	(2.920)	(3.746)	(2.373)	(4.129)	(3.170)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.052	0.051	0.052	0.051	0.052	0.051

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.".

*** $p < 0.01$

** $p < 0.05$.

* $p < 0.1$.

Novaco and Gonzalez, 2009), while active commutes are more linked to positive outcomes, such as increased health status (Tajalli and Hajbabaie, 2017). Therefore, promoting pro-environmental values may be beneficial for society by reducing private vehicle commutes (i.e., decreasing congestion and CO2 emissions), but also for workers (improving their health and reducing the negative impact of commuting on wellbeing).

4.5. Heterogeneity

Although estimates in Tables 4 and 5 show the mean relationship between pro-environment values and commuting modes, it may be the case that such an average relation is masking some degree of heterogeneity. That is to say, there may be specific groups of workers whose commuting mode is unrelated to social values, for whatever reason, e.g., they are blue collar workers who need to commute by public transit for necessity, or workers who, due to household responsibilities, need to commute by private vehicle, or older adults with reduced mobility skills who cannot commute actively. For this reason, we next examine whether the correlation between pro-environment values and commuting modes is heterogeneous across demographic groups, in terms of gender, age, education, native status, and having kids; i.e., we estimate Eq. (2) on the rate of commuting done by transport mode, and on the type of commuter. The main results for the rate of commuting done by transport mode are shown in Table 6, while Table 7 shows similar results for the type of commuter. In both tables, panel A focuses on private vehicle, panel B focuses on public transit, and panel C focuses on active modes of transport. Tables 6 and 7 provide similar conclusions.

Estimates show that there are gender differences in how certain pro-environment values relate to the use of private vehicle for daily commutes. For instance, beyond the baseline negative relation between values and the rate of commuting done by private vehicle, we report an additional negative correlation operating only for women, for values 2 ("protecting the environment is more important than the economy") and 3 ("confidence in environmental protection plans"). However, we also report a positive correlation for value 4 ("the

Table 4
Estimates on the rate of commuting by transport mode.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Rate in private vehicle						
Value	−0.837***	−0.112***	−0.748***	−0.583***	−1.120***	−0.669***
	(0.073)	(0.037)	(0.057)	(0.096)	(0.058)	(0.037)
Constant	0.969***	0.845***	1.208***	0.827***	1.505***	1.176***
	(0.030)	(0.031)	(0.040)	(0.026)	(0.045)	(0.033)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.083	0.077	0.084	0.078	0.094	0.088
B. Rate in public transit						
Value	0.469***	0.008	0.420***	0.272***	0.676***	0.364***
	(0.043)	(0.020)	(0.035)	(0.054)	(0.040)	(0.024)
Constant	−0.045***	0.052***	−0.180***	0.038***	−0.377***	−0.155***
	(0.016)	(0.016)	(0.023)	(0.014)	(0.030)	(0.020)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.065	0.059	0.066	0.060	0.078	0.069
C. Rate actively						
Value	0.348***	0.098***	0.304***	0.274***	0.402***	0.269***
	(0.051)	(0.027)	(0.039)	(0.067)	(0.037)	(0.025)
Constant	0.054**	0.079***	−0.042	0.111***	−0.128***	−0.027
	(0.021)	(0.023)	(0.027)	(0.019)	(0.029)	(0.022)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.052	0.051	0.053	0.051	0.055	0.054

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Additional coefficients are available under request.

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$.

environment is a global problem"). These results are in line with how pro-environment values relate to the rate of commuting done by public transit and actively, as we find additional positive correlations operating only for women between values 2 and 3, and the use of public transit and active modes of transport, and additional negative correlations between value 4 and the use of these modes of transport.

Regarding age, the heterogeneity analysis shows that, only for some values, older individuals tend to display a stronger correlation between pro-environment values and modes of transport, with the sign of the correlation being the same as in the general case (i.e., more pro-environment values relate negatively to the use of private vehicle, and positively to the use of public transit and active mans of transport, and these correlations are slightly larger for older workers). As for having University education, the results indicate that highly educated individuals are more sensitive in terms of pro-environment values. That is to say, the negative correlations among several of the values and the use of private vehicle, and positive correlations between values and the use of public transit and active modes of transport, are relatively stronger for individuals who have attended University, relative to less educated workers.

Our results also indicate that being a US native worker relates to a reduced correlation between pro-environment values and commuting modes. For instance, non-native workers seem to be more concerned about the environment, and the correlations are stronger for non-natives than for natives. In other words, the negative (positive) correlations between values and the use of private vehicle (public transit and active modes of transport) for commuting trips are greater for non-natives than for natives, net of observable factors. Having children displays the same mechanisms, as the negative (positive) correlations between values and the use of private vehicle (public transit and active modes of transport) decrease for commuting trips when workers have children.

In summary, heterogeneity results indicate that certain pro-environment values are more important for males than for females, but others are more important for females than for males. Furthermore, older workers may be slightly more willing to change their commuting behavior under changing pro-environment values. Highly educated individuals (e.g., those with some University or college degree) are also more sensitive to changing their commuting behaviors when their values are more pro-environment. Despite the overall estimated correlations, our results suggest that US native citizens and workers with children tend to display quantitatively smaller correlations between commuting modes and pro-environment values. These results may help policy makers to understand whose behavior is more subject to change under policies aiming at raising awareness on environmental issues.

Table 5
Estimates on the main mode of commuting.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Private vehicle commuter						
Value	−0.654***	−0.055	−0.596***	−0.406***	−0.963***	−0.568***
	(0.068)	(0.034)	(0.052)	(0.089)	(0.055)	(0.035)
Constant	0.957***	0.844***	1.150***	0.843***	1.432***	1.146***
	(0.028)	(0.029)	(0.037)	(0.025)	(0.043)	(0.031)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.081	0.077	0.083	0.078	0.093	0.087
B. Public transit commuter						
Value	0.433***	−0.020	0.405***	0.227***	0.719***	0.394***
	(0.049)	(0.023)	(0.037)	(0.063)	(0.045)	(0.026)
Constant	−0.033*	0.070***	−0.168***	0.045***	−0.400***	−0.169***
	(0.020)	(0.019)	(0.026)	(0.017)	(0.034)	(0.023)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.066	0.063	0.068	0.063	0.080	0.072
C. Active commuter						
Value	0.221***	0.075***	0.191***	0.179***	0.244***	0.174***
	(0.051)	(0.027)	(0.040)	(0.068)	(0.038)	(0.025)
Constant	0.076***	0.086***	0.017	0.112***	−0.032	0.023
	(0.022)	(0.023)	(0.028)	(0.019)	(0.030)	(0.023)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.030	0.029	0.030	0.029	0.031	0.031

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Additional coefficients are available under request.

*** $p < 0.01$
** $p < 0.05$
* $p < 0.1$.

5. Conclusions

This paper explores how pro-environment attitudes relate to worker commuting behaviors, using data from the ATUS for the period 2003–2019, and ancillary data from the AVS and the GSS for the same time period. We define six pro-environment attitudes related to environmental organizations, awareness of environmental issues, confidence in environmental protection plans, valuations of the environment (relative to the economy), and valuation of expenditures to protect the environment. We then match these variables to ATUS respondents by gender, year, and geographic division. Our empirical analysis shows that regions in which social values are more pro-environment relate to longer commuting times but, at the same time, to a reduced use of private vehicles for daily commuting trips, and to a more intense use of greener modes of transport (e.g., public transit, and commutes by active modes of transport), net of worker observable factors, and net of region and year effects. The results hold in general terms for the six pro-environment attitudes considered, and also reveal some degree of heterogeneity across workers. Specifically, these correlations seem stronger for older and more highly educated workers who do not have children, and for non-US native workers.

Our analysis has certain limitations. First, we use cross-sectional data, so our results are limited to conditional correlations, as we cannot estimate causal links. Second, the ATUS data does not include information on pro-environment attitudes, which are taken from ancillary surveys and matched to the ATUS samples by region, year, and gender. Similarly, the database lacks data on crucial variables influencing commuting, such as the presence, regularity, and ease of access to public transportation. Consequently, the analysis is confined to unobserved variations. Additionally, our scope is confined to specific aspects of pro-environmental attitudes addressed by the AVS and GSS surveys, encompassing respondents' trust in environmental strategies, and backing for investments in novel or alternative energies. Furthermore, values are amalgamated at the geographic division level due to the constraints of available information within the AVS and GSS surveys. Further research should focus on addressing these limitations by exploring alternative dimensions of pro-environment attitudes and behaviors, and by using alternative samples of workers that allow for causality analysis, such as panel surveys. Another limitation of this study is the lack of data on commuting directions, which prevents us from capturing potential heterogeneity in commuting mode choices based on geographic or directional factors. This represents an avenue for future research, where alternative datasets containing detailed origin-destination information could be used to explore the connections between pro-environmental attitudes, commuting directions, and mode choices.

Despite these limitations, this paper opens doors for further analyses on how pro-environment attitudes relate to worker economic behaviors, such as paid work, unpaid work, leisure, childcare, or other transport behaviors. Subsequent investigations should prioritize

Table 6
Heterogeneity and the rate of commuting by transport mode.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Rate in private vehicle						
Value	−1.967***	0.065	−1.172***	−2.047***	−2.361***	−1.214***
Value X						
Being male	0.031	−0.408***	−0.531***	0.696***	0.072	0.034
Age	0.011*	0.004	0.006*	0.008	0.008*	0.007**
University ed.	−0.516***	−0.164**	−0.276***	−0.515**	−0.436***	−0.522***
Being native	1.002***	−0.057	0.690***	0.996***	1.257***	0.514***
Having kids	0.086***	0.035***	0.034***	0.220**	0.028***	0.031***
Constant	Yes	Yes	Yes	Yes	Yes	Yes
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.085	0.079	0.087	0.080	0.099	0.091
B. Rate in public transit						
Value	1.289***	−0.126	0.763***	0.862***	1.451***	0.624***
Value X						
Being male	−0.130	0.216***	0.291***	−0.452***	−0.008	−0.049
Age	−0.006	−0.002	−0.005**	0.001	−0.005*	−0.002
University ed.	0.144	0.031	0.140***	0.129	0.308***	0.330***
Being native	−0.688***	0.064	−0.431***	−0.454***	−0.844***	−0.322***
Having kids	−0.029	−0.010	−0.012	−0.068	−0.010	−0.011
Constant	Yes	Yes	Yes	Yes	Yes	Yes
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.067	0.061	0.069	0.061	0.084	0.072
C. Rate actively						
Value	0.772***	0.125	0.444***	1.082***	0.872***	0.493***
Value X						
Being male	0.070	0.159***	0.232***	−0.264**	−0.040	0.028
Age	−0.007	−0.003	−0.001	−0.008	−0.003	−0.004*
University ed.	0.319***	0.110*	0.079	0.331**	0.093	0.183***
Being native	−0.360***	−0.029	−0.293***	−0.471**	−0.431***	−0.151**
Having kids	−0.049***	−0.021***	−0.018***	−0.147***	−0.015***	−0.018***
Constant	Yes	Yes	Yes	Yes	Yes	Yes
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.054	0.052	0.054	0.052	0.057	0.056

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Additional coefficients are available under request.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

examining residential sorting. Itis plausible that individuals with stronger environmental values opt to reside in regions boasting superior public transportation infrastructure or more active transportation choices. Regrettably, our data doesn't enable us to untangle the potential influence of residential sorting on the connection between commuting behaviors and pro-environmental attitudes.

Furthermore, planners and policy makers should consider these results when designing policies to encourage environmental awareness and pro-environment behaviors. The promotion of these behaviors is likely to relate to changes in transport modes towards a more intense use of public transit services, and active modes of transport. For instance, given our discovery of varying connections between distinct aspects of pro-environmental values and commuting behaviors, planners could leverage these differences. Specifically, they could increase efforts in specific domains—such as encouraging involvement in environmental organizations, promoting protective initiatives effectively, or raising awareness of alternative energies—that are more prone to instigating shifts in transportation modes and cutting down commuting duration (Gravert and Collentine, 2021). These measures could go hand-in-hand with measures to improve public transit services, or to improvements in bicycle lanes and greenways that may help workers with more environmentally friendly values to translate such values into pro-environment behaviors.

CRediT authorship contribution statement

José Ignacio Giménez-Nadal: Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Writing – original draft, Writing – review & editing, Validation, Visualization, Data curation, Software. **José Alberto Molina:** Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing,

Table 7
Heterogeneity and type of commuter.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Private vehicle commuter						
Value	−1.964***	−0.008	−0.971***	−2.110***	−2.172***	−1.153***
Value X						
Being male	0.061	−0.363***	−0.513***	0.719***	0.025	0.028
Age	0.016**	0.006*	0.008**	0.010	0.013***	0.009***
University ed.	−0.264*	−0.087	−0.211***	−0.206	−0.307***	−0.366***
Being native	0.847***	−0.031	0.483***	1.026***	0.955***	0.406***
Having kids	0.097***	0.039***	0.036***	0.275***	0.031***	0.035***
Constant	Yes	Yes	Yes	Yes	Yes	Yes
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.084	0.079	0.086	0.080	0.097	0.090
B. Public transit commuter						
Value	1.426***	−0.140	0.706***	1.288***	1.604***	0.783***
Value X						
Being male	−0.124	0.258***	0.358***	−0.546***	0.017	−0.049
Age	−0.009**	−0.002	−0.005***	−0.003	−0.008**	−0.004**
University ed.	0.005	−0.028	0.091*	−0.056	0.246***	0.290***
Being native	−0.647***	0.054	−0.363***	−0.640***	−0.809***	−0.353***
Having kids	−0.049**	−0.020**	−0.019**	−0.141**	−0.016**	−0.019**
Constant	Yes	Yes	Yes	Yes	Yes	Yes
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.068	0.064	0.070	0.065	0.085	0.075
C. Active commuter						
Value	0.538**	0.148	0.265*	0.822**	0.568***	0.370***
Value X						
Being male	0.063	0.105*	0.155**	−0.173	−0.042	0.021
Age	−0.007	−0.004	−0.003	−0.006	−0.005	−0.005**
University ed.	0.258**	0.115**	0.120**	0.262*	0.060	0.076
Being native	−0.200	−0.023	−0.119*	−0.386**	−0.146	−0.052
Having kids	−0.048***	−0.020***	−0.017**	−0.133**	−0.014**	−0.016***
Constant	Yes	Yes	Yes	Yes	Yes	Yes
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.031	0.030	0.031	0.030	0.031	0.031

Note: Robust standard errors not shown for the sake of brevity. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Additional coefficients are available under request.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

Methodology, Validation, Visualization. **Jorge Velilla:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declarations 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.

Appendix A. Additional results

Table A1,A2,A3,A4,A5

Table A1
Additional summary statistics.

	(1)	(2)	(3)	(4)	(5)	(6)

(*continued on next page*)

Table A1 (*continued*)

	(1) Women	(2)	(3) Men	(4)	(5) Difference	(6)
VARIABLES	Mean	St. Dev.	Mean	St. Dev.	Diff.	*p*-value
	Women		Men		Difference	
VARIABLES	Mean	St. Dev.	Mean	St. Dev.	Diff.	*p*-value
Demographics						
Age	41.322	12.100	40.598	11.779	−0.724	(0.001)
Being white	0.805	0.396	0.838	0.369	0.033	(<0.001)
Being black	0.129	0.335	0.093	0.291	−0.036	(<0.001)
Being US native	0.847	0.360	0.800	0.400	−0.047	(<0.001)
Hispanic origin	0.138	0.345	0.175	0.380	0.037	(<0.001)
Basic education	0.011	0.103	0.024	0.152	0.013	(<0.001)
Secondary education	0.583	0.493	0.605	0.489	0.022	(0.880)
University education	0.406	0.491	0.371	0.483	−0.035	(0.112)
Household unit size	2.949	1.415	3.110	1.490	0.161	(<0.001)
Number of kids	0.762	1.071	0.828	1.130	0.066	(<0.001)
Living in couple	0.617	0.486	0.679	0.467	0.062	(<0.001)
Weekly work hours	39.581	10.199	44.508	10.519	4.927	(<0.001)
Household income (/1000)	71.462	42.320	73.548	42.305	2.085	(<0.001)
Full-time worker	0.822	0.383	0.937	0.243	0.115	(<0.001)
Home: owned	0.719	0.449	0.705	0.456	−0.014	(0.265)
Home type: house	0.965	0.183	0.964	0.186	−0.001	(0.610)
Metropolitan center	0.267	0.442	0.265	0.442	−0.002	(0.301)
Metropolitan fringe	0.580	0.494	0.584	0.493	0.004	(0.069)
Non-metropolitan	0.153	0.360	0.150	0.357	−0.003	(0.224)
Observations	17,694		17,657			

Note: The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Age is measured in years. Household income represents annual income, measured in $1000. Differences computed as the average value of men, minus the average value of women; *t*-test *p*-values in parentheses.

Table A2
Average pro-environment values by geographic division.

REGIONS	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
New England	0.250	0.565	0.616	0.053	0.665	0.636
Middle Atlantic	0.239	0.497	0.562	0.079	0.685	0.640
East North Central	0.182	0.450	0.539	0.043	0.635	0.612
West North Central	0.187	0.532	0.528	0.070	0.643	0.642
South Atlantic	0.194	0.458	0.508	0.058	0.639	0.594
East South Central	0.191	0.442	0.500	0.050	0.585	0.565
West South Central	0.215	0.495	0.515	0.065	0.577	0.496
Rocky Mountain	0.202	0.473	0.534	0.091	0.646	0.607
Pacific	0.239	0.568	0.548	0.083	0.622	0.609

Note: The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.".

Table A3
Correlation matrix between pro-environment values.

VALUES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
Value 1	1.000					
Value 2	0.584	1.000				
	(<0.001)	–				
Value 3	0.382	0.459	1.000			
	(<0.001)	(<0.001)	–			
Value 4	0.482	0.457	−0.053	1.000		
	(<0.001)	(<0.001)	(<0.001)	–		
Value 5	0.276	0.035	0.561	0.157	1.000	
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	–	
Value 6	0.082	0.133	0.143	0.153	0.621	1.000
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	–

Note: χ^2-test *p*-values in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents

"Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.".

Table A4

Placebo test on the rate of commuting by transport mode.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Rate in private vehicle						
Value	−0.033	0.032	0.077*	−0.112	−0.013	−0.003
	(0.068)	(0.036)	(0.042)	(0.089)	(0.051)	(0.039)
Constant	0.796***	0.772***	0.747***	0.796***	0.797***	0.790***
	(0.029)	(0.031)	(0.034)	(0.026)	(0.042)	(0.035)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.077	0.077	0.077	0.077	0.076	0.076
B. Rate in public transit						
Value	0.044	0.006	−0.023	0.018	−0.026	−0.006
	(0.040)	(0.022)	(0.024)	(0.054)	(0.029)	(0.023)
Constant	0.046***	0.053***	0.068***	0.055***	0.072***	0.059***
	(0.016)	(0.018)	(0.019)	(0.014)	(0.024)	(0.019)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.059	0.059	0.059	0.059	0.059	0.059
C. Rate actively						
Value	0.005	−0.019	−0.023	0.053	0.049	0.017
	(0.046)	(0.024)	(0.030)	(0.060)	(0.035)	(0.026)
Constant	0.128***	0.139***	0.141***	0.125***	0.097***	0.119***
	(0.021)	(0.022)	(0.024)	(0.018)	(0.030)	(0.025)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.050	0.050	0.050	0.050	0.050	0.050

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Additional coefficients are available under request.

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$.

Table A5

Placebo test on the main mode of commuting.

VARIABLES	(1) Value 1	(2) Value 2	(3) Value 3	(4) Value 4	(5) Value 5	(6) Value 6
A. Private vehicle commuter						
Value	−0.027	0.021	0.054	−0.062	−0.007	0.005
	(0.063)	(0.033)	(0.039)	(0.082)	(0.047)	(0.037)
Constant	0.822***	0.805***	0.786***	0.820***	0.820***	0.813***
	(0.027)	(0.029)	(0.032)	(0.024)	(0.039)	(0.033)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.077	0.077	0.077	0.077	0.077	0.077
B. Public transit commuter						
Value	0.054	0.009	−0.024	0.012	−0.019	0.005
	(0.046)	(0.025)	(0.027)	(0.061)	(0.033)	(0.026)
Constant	0.049**	0.055***	0.073***	0.059***	0.072***	0.057**
	(0.019)	(0.021)	(0.022)	(0.017)	(0.027)	(0.023)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.063	0.063	0.063	0.063	0.063	0.063
C. Active commuter						
Value	−0.027	−0.031	−0.030	0.050	0.026	−0.009
	(0.047)	(0.024)	(0.030)	(0.059)	(0.037)	(0.027)
Constant	0.130***	0.139***	0.140***	0.121***	0.107***	0.130***
	(0.021)	(0.022)	(0.025)	(0.019)	(0.031)	(0.026)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.029	0.029	0.029	0.029	0.029	0.029

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Value 1 represents "Belong/participate environment organization". Value 2 represents "Protecting environment

more important than economy". Value 3 represents "Confidence in environmental protection plans". Value 4 represents "The environment is a global problem". Value 5 represents "More expenditure in protecting environment req.". Value 6 represents "More expenditure in alternative energy sources req.". Additional coefficients are available under request.

*** $p < 0.01$.

** $p < 0.05$

* $p < 0.1$.

Appendix B. PCA results

Fig B1,Table B1,Table B2,Table B3

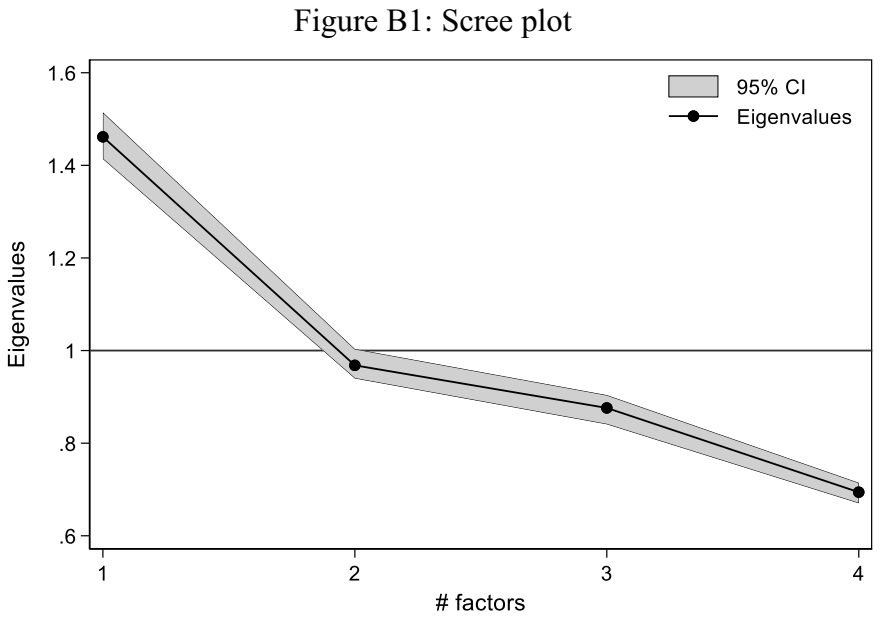

Fig. B1. Scree plot.
Note: The sample (AVS 1999–2020) is restricted to respondents with non-missing information on key survey items.

Table B1
Principal components analysis.

	(1)
COMPONENTS	Loadings
Value 1: Belong/participate environment organization	0.457
Value 2: Protecting environment more important than economy	0.592
Value 3: Confidence in environmental protection plans	0.586
Value 4: The environment is a global problem	0.312
Bartlett sphericity test *p*-value	<0.001
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.583
Varianze explained	36.54 %
Eigenvalue	1.461
Observations	42,682

Note: The sample (AVS 1999–2020) is restricted to respondents with non-missing information on key survey items.

Table B2
Main estimates using the PCA index.

VARIABLES	(1) Baseline	(2) Tobit	(3) Placebo	(4) To work	(5) From work
Value	8.108***	8.108***	1.129	4.593***	3.515**
	(2.358)	(2.356)	(2.193)	(1.449)	(1.528)
Constant	27.604***	27.604***	27.943***	17.645***	9.959***
	(3.661)	(3.658)	(3.669)	(2.228)	(2.299)
All controls	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351
R-squared	0.073	–	0.073	0.055	0.051

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Additional coefficients are available under request.

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$.

Table B3

Estimates on rates and commuting modes using the PCA index.

	(1)	(2)	(3)	(4)	(5)	(6)
	Rate of commuting by:			Main commuting mode:		
VARIABLES	Private v.	Public tr.	Actively	Private v.	Public tr.	Actively
Value	−0.152***	0.072***	0.074***	−0.112***	0.062***	0.050***
	(0.016)	(0.009)	(0.011)	(0.014)	(0.010)	(0.011)
Constant	0.795***	0.053***	0.126***	0.821***	0.057***	0.122***
	(0.025)	(0.014)	(0.018)	(0.024)	(0.017)	(0.018)
All controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,351	35,351	35,351	35,351	35,351	35,351
R-squared	0.081	0.062	0.052	0.080	0.064	0.030

Note: Robust standard errors in parentheses. The sample (ATUS 2003–2019) is restricted to employees who worked the diary day. Telecommuters and self-employed workers are excluded. Additional coefficients are available under request.

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$.

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