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## How does environmental concern influence mode choice habits? A mediation analysis

Hélène Bouscasse<sup>a</sup>, Iragaël Joly<sup>b</sup>, Patrick Bonnel<sup>a,\*</sup><sup>a</sup> *Transport, Urban Planning and Economics Laboratory, ENTPE, University of Lyon, Vaulx-en-Velin, France*<sup>b</sup> *GAEI, University Grenoble Alpes, France*

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### ABSTRACT

Starting from the intuition that people with high environmental concern have a better perception of public transport and therefore a better perception of the utility of public transport, we construct a theoretical model in which the effect of environmental concern on mode choice habits is mediated by the indirect utility of travel. Travel procures the direct utility of providing access to activities, but it also offers an indirect utility that is inherently personal and perceptual. We approach the indirect utility of public transport by measuring perceptions of time and feelings. The indirect utility of the car is approached by measuring affective and symbolic motives. Taking into account car use habits and habits of public transport use, the results show that people who have a high environmental concern perceive public transport use as easier, more useful and more pleasurable than people who do not have that environmental motivation. Such positive attitudes foster public transport use. Conversely, low environmental concern generates non-instrumental motives for car use, such as affective and symbolic motives. However, the relationship between affective and symbolic motives and car use habits is not robust. We can conclude that environmental concern influences mode choice habits and that the effect is partially mediated by perceptions and feelings towards public transport but not significantly by affective and symbolic motives for car use.

### 1. Introduction

In the European Union, the car continues to be the most popular mode of transport. In 2013, passenger cars accounted for 83.2% of inland passenger transport<sup>1</sup> (Eurostat, 2016) despite the negative external costs involved (air pollution, noise, space usage, and so on). In response to these issues, a growing awareness of the ecological challenges associated with car use is informing the public debate and promoting more sustainable mobility. Yet, the relationship between environmental concern and travel behavior is still a challenging question to which contradictory answers have been given. While a correlation between environmental concern and environmentally-friendly behavior is observed in other fields, such as waste management (Barr, 2007), energy efficiency (Ramos et al., 2016) or water conservation (Millock and Nauges, 2010), the link seems to be more nuanced in the field of transportation. In some studies, the relationship between environmental concern and public transport use, or intention to use, is positive and thus confirms intuition (e.g., OECD, 2014; Garvill, 1999; Nilsson and Küller, 2000). However, other studies do not find a significant relationship (e.g., Walton et al., 2004; De Groot and Steg, 2007), which suggests a potential inconsistency between attitudes towards the environment and mode choice behavior.

\* Corresponding author.

E-mail address: [patrick.bonnel@entpe.fr](mailto:patrick.bonnel@entpe.fr) (P. Bonnel).<sup>1</sup> As measured by the number of passenger-kilometers traveled by each mode.

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An explanation for this cognitive dissonance (Festinger, 1954) is that pro-environmental motivation is not enough for most people to engage in behavior that replaces or reduces private car use to the benefit of sustainable travel modes. In other words, modal shift is not easy enough. This is supported by the theory of planned behavior (Ajzen, 1991), which, through the concept of Perceived Behavioral Control (PBC), states that people are more likely to perform a behavior when they perceive it as easy to perform. To better understand the link between environmental concern and travel behavior, attitudes to travel modes need to be explored as well as the extent to which their use is perceived as easy, pleasant and useful by passengers.

In the theory of planned behavior, the traveler's attitude towards a behavior is portrayed as a cognition process where the rational consumer evaluates pros (positive utility) and cons (disutility) associated with the behavior in question. According to Mokhtarian and Salomon (2001), the positive utility associated with traveling with a specific mode is gained from (1) accessing the activities conducted at destination; (2) activities that can be conducted while traveling, and (3) the activity of traveling itself. The second and third elements reflect an indirect utility arising from traveling, which may explain "excess travel" and unexpected choices of travel modes. An illustration is given by Morris (2015), who finds that travel time generally exhibits a positive relationship with life satisfaction. One of his explanations is that the act of travel itself is fulfilling.

To our knowledge, previous works concerned with the relationship between environmental concern and mode choice do not take into account the influence of the indirect utility of travel on mode choice. However, individuals with a higher environmental concern may be more sensitive to the indirect utility provided by public transport and less sensitive to the indirect utility provided by the car. Thus, indirect utility, as well as PBC, may act as a mediator between environmental concern and mode choice habits.

Moreover, previous works (e.g., Walton et al., 2004; Nilsson and Küller, 2000; De Groot and Steg, 2007) mainly focus on single measures (e.g., intention to use a single mode, one-off choice or mode choice for a single purpose), which depend on the journey characteristic indicators such as travel cost or travel time. However, environmental concern and attitudes towards travel modes are not specific to a particular journey. Furthermore, some people use diversified modes of transport and adapt their choice to the context of the trip. In their literature review on the definition and measurement of multimodality, Molin et al. (2016) emphasize the advantage of choosing a wide time window (a year) to capture the multimodal dimension of mobility. An individual may indeed travel by car for commuting purposes but regularly use train for leisure or business trips. The impact of environmental concern on travel behavior thus has to be approached with a general measure, such as mode choice habits, to take into account three dimensions of mode choice: repetitiveness, intensity of travel (excess travel) and trade-off between modes.

The aim of this article is thus to extend previous research by means of an integrative tool (Structural Equation Modeling; SEM). SEM makes it possible to explain a multiple output, car use and public transport habits, with a mediation structure between environmental concern, PBC and the indirect utility of traveling.

The rest of the article is arranged in five sections. Section 2 sets out the background and defines the theoretical model and concepts. Section 3 proposes a number of hypotheses and suggests a theoretical model to test them. The collected data and the estimation method by SEM are presented in Section 4. The results of the estimations are discussed in Section 5. Section 6 offers conclusions.

## 2. Literature review

A growing body of literature lies at the interface between environmental and behavioral economics (Croson and Treich, 2014) and is based on psychological concepts and theories that focus directly on environmental issues, including travel mode choice.

### 2.1. Environmental psychology

Two behavioral theories, the theory of planned behavior and value-belief-norm theory, are critical to explain pro-environmental behavior, including transportation behavior. They are based on the idea that behavior is driven by internal mental states rather than external conditions, with the assumption that behavior is the outcome of a deliberative conscious process (Savage et al., 2011).

The theory of planned behavior, an extension of the theory of reasoned action (Fishbein and Ajzen, 1975), assumes that individuals behave strategically, evaluating the information they have access to and the implications of those actions. Individuals thus choose alternatives with lowest costs against highest benefits. The theory of planned behavior involves attitudinal dimensions (the degree to which engagement in behavior is positively valued), subjective norms (social pressure from important others to engage in a particular behavior) and PBC, and relates them to the intended behavior that precedes actual behavior. The theory of planned behavior is generally successful in explaining mobility behavior (Heath and Gifford, 2002; Bamberg et al., 2003; De Groot and Steg, 2007).

Pro-environmental behavior is often associated with higher costs. Individuals are therefore more likely to act pro-environmentally when they subscribe to altruistic or biospheric values beyond their own immediate interests. These values are integrated in value-belief-norm theory developed by Stern et al. (1999) based on a major study on the psychological determinants of pro-environmental behaviors (Stern, 1992). Value-belief-norm theory is based on Schwartz's norm-activation-model (Schwartz, 1977), which stipulates that a behavior is performed by individuals who feel a moral obligation to do so. These personal norms depend on the extent to which individuals are aware of the problems caused by their behavior and feel responsible for the problems and solutions. Value-belief norm theory further proposes that problem awareness is rooted in an ecological worldview, itself determined by personal values.<sup>2</sup> Low-cost

<sup>2</sup> Social-altruistic value: the environment is valued for what it brings society. Egoistic value: the environment is valued for what it brings me. Biospheric value: the environment is valued for itself, independently of its value for humankind.

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