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An Extended Planned Behavior Model to Explain the Willingness to Pay to Reduce Noise Pollution in Road Transportation

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ABSTRACT

The increased standard of living in our society has raised the level of concern regarding ecosystemic degradation of natural resources due to a greater demand for goods and services. In fact, noise, air pollution and traffic congestion are the main environmental concerns when we consider transportation externalities. Thus, in the European Union, 30% of the population is exposed to noise levels greater than 55 dB, being road transportation responsible for 93% of the environmental costs produced by transport. Similarly, European Commission has calculated that the costs from road and rail traffic reach the amount of €40 billion per year in Europe. Sometimes this collective distress is not translated into individual actions for the reduction of environmental impact. Therefore, there has been an increasing use of social and psychological models to explain individual behavior towards the environment. Specifically, this study makes use of an extended Theory of Planned Behavior (TPB) which includes personal values to determine the influential variables in willingness to pay (WTP) for the reduction of noise pollution generated by road transportation. Thus, we have applied a Structural Equation Model (SEM) in the European Pyrenees region (located between Spain and France), an area with high traffic pollution due to road transport. The results highlight the importance of psychological aspects in contamination actions and show that positive attitudes towards the environment and adequate perceived behavioral influence can increase WTP. Moreover, there is an indirect effect of biospheric and altruistic values on WTP by means of other variables such as the perceived behavioral control. Therefore, public performances and educational policies that improve environmental sensitivity and reduce environmental impact could help to achieve a collective effect on the environment and a unified struggle in favor of environmental protection.

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1. Introduction

Road transportation is responsible for 93% of the environmental costs produced by transport in Europe, which represent approximately the 4% of the Gross Domestic Product (GDP) in the area (CE/INFRAS/ISI, 2011). Among the negative effects produced by transportation, noise pollution is emphasized by different studies (Lera-Lopez et al., 2014; European Commission, 2014). Noise pollution has a highly negative impact on population health and quality of life (del Saz, 2004; Barreiro et al., 2005); it causes hearing damage, increases cardiovascular disease risks and produces nervous stress reactions (CE/INFRAS/ISI, 2011; European Commission, 2014; European Environment Agency, EEA, 2014). Moreover, in the European Union the number of people exposed to noise levels greater than 55 dB (A) is more than 30% (CE/INFRAS/ISI, 2011), with 125 million European citizens suffering 55 dB or more of noise associated with road transportation (EEA, 2014). According to the Noise Observation and Information Service for Europe (NOISE), road traffic noise clearly contributes the greatest level of exposure in Europe both inside and outside urban agglomerations when compared to the other means of transport (EEA, 2015). As EEA (2014) has estimated, almost 90% of the health impact caused by noise exposure is associated with road traffic noise. The importance

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of noise pollution led the European Union to develop the Environmental Noise Directive in 2002 (European Union, 2002) to fight against this externality. As the European Commission (2011) had previously calculated, in terms of economic impact, noise from road and rail traffic costs €40 billion per year in the European Union.

This environmental externality is particularly important in areas with a high density of road traffic such as the Pyrenees, the natural border between Spain and France. More than 140,000 vehicles a day cross the Pyrenees, 30,000 of them freight trucks (Spanish-French Observatory of Pyrenees Traffic (2013)). In spite of this, empirical evidence on the impact of noise pollution has been traditionally focused on big cities (Yoo and Chae, 2001; Bjorner, 2004; Wardman and Bristow, 2004; Lopez-Mosquera and Sanchez, 2012b; Liu et al., 2016) and medium sized cities (Barreiro et al., 2005; Martín et al., 2006; Valeri et al., 2016) and has overlooked the impact on rural areas (Scarpa et al., 2000; del Saz, 2004), particularly mountainous regions with high environmental value (Lambert et al., 2001; Lera-Lopez et al., 2014). Regional and national authorities should pay special attention to these areas and protect their environmental values (biodiversity, forests, etc.) in a context of an increasing awareness of environmental protection by the population.

In this context, there exists a growing general interest in understanding how people perceive these environmental problems and how these perceptions determine their behavior with regard to the environment (Dunlap et al., 2000). Hence, sociologists, psychologists and economists have developed various psycho-social approaches to explain environmental behavior in order to encourage greater public involvement in these problems of social concern (Hines et al., 1987; Liebe et al., 2011; and Diedrich et al., 2013; among others). Two of the most popular approaches are the Theory of Planned Behavior (TPB) models developed by Ajzen (1988, 1991) and the Value-Belief-Norm Theory (VBN) model proposed by Stern et al. (1999). While the TPB is grounded in self-interest and rational choice-based deliberation (factors reflecting attitudes and perceived possibilities), the VBN focuses on values and moral norms (factors reflecting environmental values, beliefs and norms) (Kaiser et al., 2005).

Having the purpose of continuing the research line developed by the aforementioned authors, the current study aims to improve our understanding of the psycho-social factors which determine pro-environmental economic behavior. More specifically, we seek to determine whether the environmental profile of individuals determines their willingness to pay (WTP) values to reduce the noise pollution released by road traffic in areas where this environmental problem has a strong impact. Through the combination of different TPB and VBN components, our work aims to determine whether individuals are willing to pay for noise reduction related to transportation. An additional goal is centered on the analysis of the problem in the rural context, which has hardly been studied in the previous literature. In order to achieve these objectives, this study uses data from a survey carried out with 1612 residents in 74 localities located in the Spanish Pyrenees: Navarre, the Basque Country and Catalonia (Spain). The survey was carried out in December 2012 and covered the main routes crossing the Pyrenees (national roads and motorways) between France and Spain.

Thus, we contribute to the literature in two ways. First, we provide empirical evidence to explain WTP combining two different theoretical perspectives, TPB and VBN. Second, we apply for the first time this framework to explain noise externality of road transportation—one of the most important environmental costs — in rural areas with high environmental values. This is an important contribution given the growing interest in including the role of people's attitudes and responses towards specific environmental impacts (Kaltenborn and Bjerke, 2002) within their personal values. This inclusion will produce a distinctive analysis of the decision-making processes related to road transportation (Perugini and Bagozzi, 2001) and might provide useful practical proposals for reducing environmental externalities.

Likewise, we can include this work in the current literature with make a conjoint use of the TPB and VBN theories in order to explain the human behavior towards natural environment. Therefore, our work, apart of using an innovative methodological analysis as Yadav and Pathak (2017) and Goh et al. (2017) recently did, also applies it to better depict the noise externality of road transportation. This analysis has been focused in the explanation of the noise impact performed by the road traffic crossing the Pyrenees between Spain and France.

The whole paper is organised in five sections. Section 2 presents a review of the literature on the environmental psychosocial models, especially on TPB and its extensions, and develops the theoretical framework. Section 3 describes the methodological details of our procedure along with the environmental problem to be tested. Section 4 presents the main findings. The discussion and the main conclusions and limitations of this study along with suggestions of research lines are set out in Section 5.

2. Theoretical framework

When transportation externalities are studied with regard to noise pollution outlook, the close relationship between the real WTP associated with those externalities and the internal feelings, beliefs, and concerns of the people suffering from the noise impact is clearly observed (Pouta and Rekola, 2010; Soliño and Farizo, 2014). This study combines the sociological and psychological theoretical models with economic measures (obtained by the WTP approach, explained in Section 3) and proposes the conceptual model presented in Fig. 1. This model is based on TPB and includes an extension covering three different relevant values in VBN theory: biospheric, egoistic and altruistic values, to explain an individual's reaction to the noise pollution generated by road transportation. Our model is based on the premise that an individual's behavior towards the environment is influenced by what they feel and think in relation to nature and to pro-environmental action (Oreg and Katz-Gerro, 2006; Ojea and Loureiro, 2007; Arı and Yılmaz, 2016).

Some environmental studies have analyzed the TPB and VBN models, pinpointing the suitability of those psycho-social models in the measurements of some pro-environmental behaviors

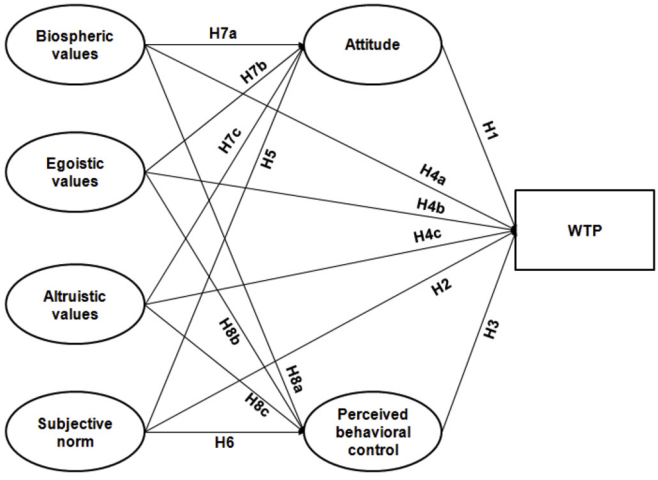

Fig. 1. Conceptual model.

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