Transport Policy 36 (2014) 1–9

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Main drivers for local tax incentives to promote electric vehicles: The Spanish case

Antonio Sánchez-Braza*, José M. Cansino, Enrique Lerma

University of Seville, Department of Economic Analysis and Political Economy, Avda. Ramón y Cajal, 1, 41018 Seville, Spain

ARTICLE INFO

Keywords:
Electric vehicle
Local government in Spain
Road tax
Local policies
Probit model

ABSTRACT

Cities are one of the main agents behind the introduction of electric vehicles. In Spain, cities could establish up to a 75% deduction on vehicle tax based on environmental issues. This paper analyzes those variables affecting the establishment of such a measure using the Probit model on a sample of 395 Spanish municipalities. The results show that the urban population, its dispersion, and the municipalities' environmental commitment positively affect the establishment of such incentives, while the rural nature of the population and unemployment do exactly the opposite.

1. Introduction

The 27 countries making up the European Union (EU27) heavily dependent on imported oil for mobility and transportation (European Commission, 2013). In 2011, the energy dependence was estimated at 53.84% (Eurostat, 2013). A quarter of all CO2 emissions is generates by transportation, which also worsens air quality due to the emission of particulate matter (PM10 and PM2.5), NO_x, HC and CO, as well as other related health problems, more specifically in urban areas (European Commission, 2010).

Transportation provides the physical lubrication that allows industry to grow and trade to flourish, but it also is responsible for local atmospheric pollution, noise and soil and water contamination, as well as being a major and growing contributor to greenhouse gas emissions (Button, 2009). Electric vehicles (EVs) could contribute to mitigating this excessive urban traffic pollution. Thus, this paper is addressed in the literature versing on the political economy of transportation (Button, 1993). The base cause behind the problem is that road users are essentially receiving the wrong signal from prices, regulations, and controls; consequently, they undertake excessive numbers of trips, frequently using environmentally sub-optimal modes and in inappropriately engineered vehicles (Button, 2002). This in turn produces the local pollution cocktail and other forms of environmental damage ultimately leading to ill-health, social disruption, noise, etc. In fact, environmental pollutants from transport have adverse effects on health (including cardiovascular and respiratory diseases). Human exposed to high levels of traffic noise suffer not only serious annoyance and sleep loss but it may also cause communication problems and even learning problems in children (Stead, 2008).

Within the transportation sector, there are increasing calls for better horizontal management between transportation and other sectorial policies such as health and environment (EU Joint Expert Group on Transport and the Environment, 1999; Banister et al., 2000; Stead and Banister, 2001; Geerlings and Stead, 2003; Stead et al., 2004; Stead, 2008). Sustainability requires that urban travel policy-making be viewed from a holistic standpoint so that when planning for transportation and the environment, these are no longer be undertaken as isolated matters, independently one from another (Stead, 2008). Consequently, linking transportation and environmental policies are important factors.

Recently, EVs have gained increased worldwide interest as a component of the search for alternative solutions to sustainable personal mobility (Ma et al., 2012; Zheng et al., 2012). EVs could reduce fossil fuel consumption, greenhouse gas emissions and other pollutants (Perujo and Ciuffo, 2010; Camus et al., 2011; He and Chen, 2013). Nevertheless, some authors have criticized this finding (see Sioshansi and Miller, 2011; Prud'homme and Koning, 2012).

Ewing and Sarigöllü (1998) examined those factors that are likely to influence the demand for lower and zero emission vehicles. Each of the vehicle types considered were characterized by varying vehicle costs and performance measures, range and refueling rates, as well as commuting costs and times. This allowed the authors to research how political tools could influence consumer preference. Some governments have taken measures to promote electric mobility (Hans et al., 2012; Shepherd et al., 2012). For example, the US has proposed to development an

* Corresponding author.
E-mail address: asb@us.es (A. Sánchez-Braza).

http://dx.doi.org/10.1016/j.tranpol.2014.06.010
0967-070X/

affordable plug-in EV for the average American family by 2022 as efficient and/or handy as today's gasoline-powered vehicles (US Department of Energy, 2013). The relationship of consumer financial incentives for the adoption of EVs is analyzed by Sierzchula et al. (2014). Furthermore to this political measure, fiscal instruments like command-and-control are widely used in road transport, because they are relatively cheap and simple to implement (Santos et al., 2010). The effectiveness of tax incentives for EVs has been analyzed by Hong et al. (2012) in South Korea, and Jones et al. (2013) in Vietnam. Hong et al. (2012) showed evidence that tax incentives for EVs are effective even more than a lump-sum incentive. Jones et al. (2013) provided proof that economic incentives, particularly sales tax, have significant effects on the adoption of electric motorcycles.

For EU27, an electric mobility promotional strategy has been included in the European Green Cars' Initiative, which is part of the European Economic Recovery Plan. Both initiatives note the importance of cooperation between public and private organizations. One essential element is local government, whose cities are in a position to reduce both air and noise pollution.

In the case of Spain, one of the measures that local governments could implement to promote the use of EVs is the establishment of a deduction on vehicle tax EVs, which could be up 75% of the gross tax and work as a tax credit. For Spain, this would be road tax (or IVTM, its acronym in Spanish). It is direct tax paid annually for owning a motor vehicle that travels on public roads. This tax is established by local governments, who are the responsible for handling, verifying and collecting this specific tax. As mentioned, the tax falls upon the ownership of any vehicle that is roadworthy and that is listed on any official record, usually the Traffic Department or other regulated vehicle registration.

The aim of this paper is to analyze the main drivers affecting deductions established by local governments on the road tax for EVs. To date and to the best of our knowledge, there has been no prior research on this issue for the case of Spain.

Specifically, we perform an empirical model to describe the behavior of local governments in Spain with regards to adopting this measure. This model is a binary choice model which is a function of various economic, political and technical factors. A cross-section Probit model is used with a database specifically gathered for this research.

Previous studies have analyzed the main drivers leading national (Matisoff, 2008; Lyon and Yin, 2010) and local (Zahran et al., 2008; Feiock et al., 2009; Lubell et al., 2009a,b; Sharp et al., 2011; Wang, 2012) governments to adopt environmental measures. Matisoff (2008) highlighted the importance of the population's political ideology, the carbon intensity of the economy, renewable energy potential and the unemployment rate when adopting renewable portfolio standards. Lyon and Yin (2010) studied the size of local government, its budget, political ideology, administrative capacity, the general tax burden, environmental stress, actions of stakeholders, the neighboring effect and environmental predisposition.

In Spain, González-Limón et al. (2013) analyzed the establishment of tax credits for Property Tax upon installing of solar energy systems, granted by local governments. The main drivers analyzed were solar radiation, type of housing, local government income and debt, local productive structure and neighboring effect. Moreover, Sánchez-Braza and Pablo-Romero (2014) evaluate the effects of property tax deductions to promote the installation of solar thermal energy systems on rooftops.

The rest of the paper proceeds as follows. Section 2 describes the data and the main motivations analyzed. Section 3 presents our empirical model while Section 4 shows the results. The paper concludes with Section 5 which offers a summary of the mayor finds.

2. Data and variables

2.1. Preliminary

A binary decision model has been used to analyze the main motivations that lead to the establishment of a local government road tax deduction for EVs. The dependent variable is *Deduction* EV. Its value is 1, when an EV tax credit has been established in the municipality, whatever the percentage, and 0 otherwise.

The mean reason for selecting this model is that although the deduction could be up to 75%, the vast majority of local governments that decided to apply this measure finally chose the maximum of 75%, or close to that amount. In the end, the decision of local governments focuses more on whether or not to adopt this tax deduction than in the setting a higher or lower percentage level. In other words, it is a matter of whether or not local governments are in favor of promoting this type of vehicle, with all that EVs imply in terms of environmental policies and sustainable urban transport.

The information to construct this variable has been taken from the road tax ordinance. The data base has been built specifically for this research. Due to the lack of a central registry for environmental road tax deductions, data have been taken from provincial and local government gazettes.

The sample includes the 395 municipalities in Spain with over 20,000 inhabitants. The three municipalities in province of Navarre have not included as this process was delegated to the regional government rather than the local government.

Previous research by authors such as Lubell et al. (2009b), and Lyon and Yin (2010) used a similar size. According to the aforementioned studies, independent variables have been clustered in five groups.

2.2. Local features

The first set includes variables such as *Population*, *Surface* and *Population centers*.

The available literature has considered the population both in absolute values (Wang, 2012), or its logarithm (Lubell et al., 2009a; Feiock et al., 2010) and population density (Lubell et al., 2009b; Sharp et al., 2011), measure the stress climate (Zahran et al., 2008).

The collinearity makes impossible the analysis overall of surface and density, so this paper considers the population as an absolute value. Following Wang (2012), population size indicates a city's overall administrative capacity, because this is highly correlated with the City Hall's budget. A larger budget makes the recruitment of specialist in environmental tasks much easier. Data for the *Population* variable have been taken from 2011 municipal register published by Spain's National Institute of Statistics (INE, 2013) and expressed in thousands.

To calculate surface, the considerations by Lubell et al. (2009a, b), who found a positive relationship between the surface and environmental policies and the environmental land-use, have been used; and Lyon and Yin (2010) analyzed agricultural land use. Moreover, Zahran et al. (2008) assert that higher population density leads a greater efficiency of public transport. Consequently, for the same population, larger municipalities with the lower densities will be more interested in promoting individual transport solutions, such as EVs instead of public transport or non-mechanized, such as walking and cycling. The *Surface* variable data were obtained from INE (2013), expressed in square kilometers.

The variable for *Population centers* is the number of population centers existing in the municipality. Broadly, a population center is considered a set of at least ten buildings that are made up of streets, squares and other urban roads. An exception would be less than 10 buildings, if and when the population living in that area