



ELSEVIER

Contents lists available at [ScienceDirect](#)

Transportation Research Part A

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

The effect of incentives and technology on the adoption of electric motorcycles: A stated choice experiment in Vietnam



Luke R. Jones^{a,*}, Christopher R. Cherry^{b,1}, Tuan A. Vu^{c,2}, Quang N. Nguyen^{d,3}

^a Marketing and Economics, Valdosta State University, 111 Pound Hall, Valdosta, GA 31698, United States

^b Civil and Environmental Engineering, University of Tennessee, 321 John D. Tickle Building, Knoxville, TN 37996, United States

^c Vietnamese-German Transport Research Center, Vietnamese-German University, Le Lai Str., Hoa Phu Ward, Binh Duong New City, Binh Duong Province, Viet Nam

^d Hanoi University of Transport and Communications, Room 304, A8 Building, Lang Thuong-Dong Da District, Hanoi City, Viet Nam

ARTICLE INFO

Article history:

Received 8 September 2012

Received in revised form 21 May 2013

Accepted 16 September 2013

Available online 18 October 2013

Keywords:

Electric scooter

Motorcycle

Stated preference

Vehicle choice

Technology adoption

Economic incentives

ABSTRACT

Many Asian cities are experiencing rapid growth in the ownership of personal gasoline-powered motorcycles, a shift away from relatively low-emitting modes of transportation that is contributing to deteriorated air quality. Electric two-wheelers have the potential for significant air pollution reductions as an alternative to gasoline-powered motorcycles; however, they have yet to penetrate many Asian markets. While previous research has examined the adoption of cleaner alternatives to gasoline-powered automobiles (e.g., hybrid electric cars), similar work on motorcycle alternatives is lacking. This study uses a stated preference survey of households in Hanoi, Vietnam to analyze adoption of electric two-wheelers, while focusing on the effects of economic incentives (e.g., differential sales taxes and fuel prices) and technological improvements (e.g., more efficient batteries). A choice model is estimated and market shares are calculated for scenarios involving different levels of electric two-wheeler technology, gasoline prices, and sales tax rates. Results indicate that technological improvements and economic incentives, particularly sales taxes, have significant effects on adoption.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Air pollution and greenhouse gas emissions from fossil fuel combustion have led to the innovation of less polluting and more energy efficient modes of personal transportation, such as electric and other alternative fuel vehicles. Efforts to encourage consumer adoption of these vehicles include technological improvements (e.g., developing electric cars with greater ranges and speeds) and economic incentives. Economic incentives for alternative vehicle adoption have been used in a number of nations, at different levels of government, and in a variety of forms, including free parking, access to high-occupancy vehicle lanes, subsidized fuel, income tax deductions and credits, and sales tax waivers. A growing literature focuses on gauging the effectiveness of these approaches to stimulate demand for low-emission alternative vehicles. However, this work almost exclusively focuses on alternatives to gasoline-powered cars, even though motorcycles are an important and even dominant mode of transportation in some of the world's fastest motorizing and most populated areas.

* Corresponding author. Tel.: +1 229 245 3774.

E-mail addresses: lukjones@valdosta.edu (L.R. Jones), cherry@utk.edu (C.R. Cherry), drtuan@vgtc.vgu.edu.vn (T.A. Vu), nnquang_gtv@yahoo.com (Q.N. Nguyen).

¹ Tel.: +1 865 974 7710.

² Tel.: +84 650 222 1080

³ Tel.: +84 (0)98 751 2591.

In many Asian countries for example, motorcycles are a fundamental mode of transportation with substantial environmental impact. Asia has the world's largest motorcycle population (~200 million) and accounts for almost 85% of world motorcycle sales (Meszler, 2007). Moreover, the Asian motorcycle market is growing rapidly as Asia's developing areas experience higher incomes. From 1989 to 2002, motorcycle populations grew at over 10% annually in seven Asian countries, including Vietnam (Meszler, 2007). Motorcycles contribute a substantial share of Asia's air pollution due to sheer numbers and relatively high emission rates compared with automobiles. Their environmental significance continues to rise as they displace lower-emitting modes such as walking, cycling, and public transportation.

In this paper, we provide empirical evidence on the potential adoption of electric motorcycles as a cleaner alternative to gasoline-powered motorcycles. Electric motorcycles are similar in function to gasoline-powered motorcycles but have zero local tailpipe emissions and operate solely on battery power. As an alternative to gasoline-powered motorcycles, electric motorcycles offer potential air pollution reductions and energy efficiency gains and can be a strategy to improve environmental performance of the transportation sector (Cherry et al., 2009; Trappey et al., 2012). There are different styles of electric motorcycles; some for example resemble bicycles. In our study, we examine the electric-scooter (e-scooter) style, which closely resembles the standard scooter-style motorcycle that is commonly driven in many Asian cities. We estimate the effects of price, technological factors, household characteristics and economic incentives on e-scooter demand, and estimate market shares under a number of different scenarios.

While there is a sizeable literature addressing the effects of technological improvements and economic incentives on the adoption of low-emission automobiles, including recent stated preference studies on the individual effects or effect of environmental charges (Beck et al., 2013; Ziegler, 2012), there is almost no comparable research on the demand for low-emission alternatives to gasoline-powered motorcycles. To the best of our knowledge, the only such study is by Chiu and Tzeng (1999), who use a choice experiment to investigate e-scooter adoption in Taiwan, but do not explicitly examine the role of economic incentives to encourage adoption. A more recent study investigates joint vehicle ownership and use models between motorcycles and cars in Taiwan, focusing on the role of fuel prices in inducing shifts between modes (Chiou et al., 2009). In this paper, we directly investigate the effects of approaches to stimulate adoption, including technological improvements, license requirements and sales tax incentives. Sales tax is of particular interest, as studies on alternatives to gasoline-powered cars have shown this to be more effective at stimulating demand than other common incentives, including exemption from road access and parking fees, access to high-occupancy vehicle lanes and income tax credits (Ewing and Sarigollu, 2000; Gallagher and Muehlegger, 2011; Potoglou and Kanaroglou, 2007).

We conduct our analysis using data from a stated choice experiment administered to households in Hanoi, Vietnam. Hanoi is a prime location for studying the potential for e-scooters, as motorcycles account for >90% of all motorized vehicles in Hanoi (Hung, 2010; Schipper et al., 2008), about 65% of vehicular trips (World Bank, 2006), and are estimated as the primary source of Hanoi's exhaust emissions of nitrogen oxides, sulfur dioxide, carbon monoxide, volatile organic compounds, and particulate matter (Hung, 2010). The market for electric motorcycles in Hanoi is extremely small, as in many Asian cities (with the exception of most Chinese cities, where motorcycles are heavily regulated) (Yang, 2010). Of the electric two-wheelers that are present in Hanoi, most are bicycle-style, and e-scooters are exceedingly rare.

Our use of a stated choice experiment is in line with the majority of research on the demand for alternative vehicles. The absence of a market, as we have for e-scooters in Hanoi, is a common issue in the assessment of potential demand for new technology. Stated preference methods are often used in these circumstances of limited market data to facilitate demand analysis and the evaluation of proposed policies (Louviere and Hensher, 1983). With few exceptions, the studies that examine the potential demand for alternatives to gasoline-powered cars utilize stated preference methods (e.g., Brownstone and Train, 1999; Bunch et al., 1993; Calfee, 1985; Dagsvik et al., 2002; Ewing and Sarigollu, 1998; Hensher, 1982). Only recently have market data for hybrid electric cars become rich enough to allow the assessment of economic incentives (e.g., tax breaks in the US) that have been in place for years (Beresteanu and Li, 2011; Chandra et al., 2010; Diamond, 2009; Gallagher and Muehlegger, 2011). A stated choice experiment allows us to investigate the factors affecting e-scooter adoption despite the limited market in Hanoi.

2. Choice experiment

2.1. Choice and attributes

In each choice question, respondents were presented with three alternatives: e-scooter; standard gasoline-powered motorcycle; and large gasoline-powered motorcycle.¹ E-scooters are defined as scooter-style plug-in battery electric two-wheelers that operate solely on electric power. Standard and large gasoline motorcycles are defined as those with gasoline engine displacement around 100 cc and 250 cc, respectively. These alternatives were described in terms of nine experimental attributes: purchase price, range, refuel/recharge time, operating cost, maintenance cost, acceleration, speed, license requirement

¹ We did not include a no-purchase option. Though this is a weakness of the design, with the rapid growth in motorcycle ownership in Hanoi at the time of the study, it is likely that the majority of individuals in our sample were, to some degree, in the market. We found that more than 94% of 323 households responding to a vehicle purchase plan question stated at least some likelihood of purchasing a two-wheeled motorized vehicle, and more than 80% indicated that a purchase was 'likely', 'very likely', or 'definite' in the next five years. Models were estimated on these restricted samples, and there are no substantial differences from the results presented in the paper. These additional analyses are available upon request.

Download English Version:

<https://daneshyari.com/en/article/310775>

Download Persian Version:

<https://daneshyari.com/article/310775>

[Daneshyari.com](https://daneshyari.com)