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Willingness to pay for carbon tax: A study of Indian road passenger transport

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ABSTRACT

Transport plays an important role in everybody's life; but transport, specifically road transport contributes highly to the emissions of CO_2 and other Green House Gases. Road transport bears 73% share of total CO_2 emissions from transport sector. High concentration of these gases leads to air pollution in terms of poor air quality and health related risks. Many countries have adopted carbon tax as a cost effective measure to correct environmental externality and reduce CO_2 emissions since early 1990s. But before adopting carbon tax as a policy measure, it is important to determine people's willingness to pay (WTP) for effective implementation of the same. In order to know the effectiveness of carbon tax in Indian road passenger transport, this study presents the contingent valuation analysis of people's willingness to pay with the help of primary data collected from three different metropolitan cities – Delhi, Mumbai and Bangalore. Probit and tobit regression models are used to analyse the data. Findings show that people of India are willing to pay. Environmental awareness in terms of people's interest in environment, their environmental activities, education, income and age have significant role in determining WTP. The study suggests macro level policy recommendations in terms of utilizing fiscal instruments (such as tax) for environmental externalities. It also helps to analyse sustainability oriented behaviour in terms of society's willingness to pay to avoid environmental risks through contingent valuation method.

1. Introduction

Tackling environmental problem has become a major challenge for many countries in order to have sustainable economic development. Among the major environmental problems, emissions of Green House Gases (GHG) have contributed significantly to air pollution and affected climate change by increasing temperature of the atmosphere. The primary source of GHG emissions is burning of fossil fuels. Intergovernmental Panel on Climate Change (2007) report states that after industry, energy supply, forestry and agriculture, transport contributes around 13% in world's total GHG emissions. Within transport sector, road transport bears 73% share of total CO_2 emissions. Huge consumption of fossil fuels by various vehicles leads to increase in GHG emissions and other pollutants, specifically particulate matter. Worldwide more deaths per year are linked to air pollution due to vehicular emissions than to automobile accidents (Krzyzanowski et al., 2005). Jacobson (2008) establishes a direct link between increase in CO_2 emissions due to local air pollution and health related problems such as morbidity. Therefore, local pollution from transport and sustainable transport development has become an emerging issue.

Badami (2005) describes that rapid growth in motor vehicle activities in India not only contributes to high level of urban pollution but also has an adverse socio-economic, environmental, health, and welfare impacts. The vehicular population in India comprises of a very large proportion (nearly 70%) of two and three-wheelers, which are mostly driven by inefficient two-stroke engines. The energy demand and CO_2 emissions of road based passenger transport are expected to increase at the rate of 6.1% per year from 2010–11 to 2020–21, and 4.7% per year from 2020–21 to 2030–31 (Singh, 2006). Apart from the heavy concentration of vehicles in urban areas, factors like types of engine used, age of the vehicle, congested traffic, poor road conditions and outdated automotive technology also accentuate the problem of traffic and pollution which has made the situation worse (Ramanathan and Parikh, 1999).

In order to combat GHG emissions, carbon pricing has become a very important tool. Setting a price for transport activities such as congestion charges, carbon tax, vehicle ownership duty, etc. would help to mitigate this problem and make people aware towards the utilization of green transport. It is interesting to note that regional schemes to combat CO_2 emissions are getting more effective and popular as compared to global strategies and agreements. Moreover, among other measures, tax system has direct effect in reducing GHG emissions.

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To design and levy a tax instrument, policy maker needs much attention. Emission tax/carbon tax is potentially cost-effective (Baumol and Oates, 1988; Mankiw, 2006) in order to reduce GHG emissions and correct negative externality. In economic theory, tax on negative externality should be equal to the marginal social cost or damage. It is assumed that tax on polluting goods reduces the consumption or shift it to non-polluting substitute such as CNG and electric vehicles. Carbon taxes can be designed as revenue neutral. In this way, it will help to improve the total welfare regardless of environmental gain. Through revenue recycling, money earned from taxes can be applied for motivating use of non-polluting vehicles in terms of subsidy or investing in public transport infrastructure and making it more efficient.

In a country like India, design and implementation of carbon tax on transport could be difficult, because of the diversity in population and their awareness about transport related environmental problems. Sometime they would not be interested in paying taxes. Therefore, as a carbon tax only tax on coal is levied. On July 1, 2010 India introduced a nationwide carbon tax as Clean Energy Cess of rupees 50 per metric ton of coal both produced and imported. But there is no carbon tax on transport sector. Taxes on polluting industries such as cement, fertilizers, iron and steel, motor vehicle, heavy chemicals, etc. are other forms of indirect carbon tax. As against to Indian carbon tax rate system which started in 2010, many countries have started levying carbon tax since early 1990s with comparatively high rate. For example, Finland and Netherland started carbon tax in 1990 and Sweden in 1991. Among the highest carbon tax rates, Sweden and Norway started imposing carbon tax with $27 and $15 per ton of CO_2, accordingly. Data shows that these countries have annual revenue up to $1.7 on from carbon tax (Muller, 1996; OECD, 1996).

In order to evaluate the effectiveness of a carbon tax, the objective of the paper is to determine people's WTP for carbon tax to reduce CO_2 emission from Indian road passenger transport. WTP is derived through Contingent Valuation Method (CVM). CVM and choice experiment are two non-market based techniques that help to elicit stated environmental preferences from the people. On the basis of time, cost and complexity, CVM is preferable to choice experiment method. CVM is very popular in literature and helpful in deriving people's perception and WTP for any environmental protection programme.

The article is structured as follows: Section 2 outlines the literature review of carbon tax and CVM. Section 3 presents the model development and methodology used for data analysis. Section 4 is related to data description and Section 5 presents the empirical analysis and results. Finally, Section 6 concludes the study with the implications for policy makers and future research problems.

2. Literature review

The literature broadly supports the view that any monetary value such as carbon tax works as an incentive for people towards the use of sustainable transport. Michaelis and Davidson (1996) find that fuel taxes and other government policies, including fee bates can help to reduce transport energy intensity and traffic levels. Fee bates is an instrument of revenue recycling where a combination of "carrot and stick" i.e. charges and compensation together are used in order to get a net economic benefit (double dividend). Double Dividend depends on the balance between economic losses caused by the ecological taxes and the benefits accruing from the revenue recycling sometime in the form of subsidy (Ben-Elia and Ettema, 2009). It works as an incentive to effectively reduce CO_2 emissions and eliminate polluting vehicles. It is designed for revenue neutralization and helps to balance the regressive and distributional effects of a carbon tax. It will lead to fairness in CO_2 emission reduction (Hammar and Jagers, 2007; Proost and Van Dender, 2012).

Schipper et al. (1997) emphasise on technological innovation and behavioural adoption to reduce carbon content from energy. Stanley et al. (2011) also suggest some behavioural and technical changes which can directly reduce the CO_2 emission such as travel behaviour change, fuel substitution, reduce urban car travel kilometre and improve fuel efficiency. But behavioural adoption needs a strong motivation. Awareness and any monetary charge can motivate them. Therefore, it is important to know how much people are willing to pay if any compensation imposed on them.

2.1. Carbon tax as a cost-effective way to reduce CO_2 emissions

Many economists agree that carbon taxes are a cost-effective way to reduce GHG emissions (see, e.g., Baumol and Oates, 1988; Mankiw, 2006). But to implement carbon taxes as an effective policy option, environmental awareness is important (Oberhofer and Furst, 2012). Researchers such as Stern (2007), Metcalf (2007), Shapiro (2007) and Nordhaus (2008) advocate steeper carbon pricing policies to avoid generating irreversible tipping points in the climate system. The literature shows various ways through which developed countries have successfully adopted carbon taxes. Carbon taxes are most prevalent and widely acceptable in the culture of Scandinavian countries. But in developing countries like India, it is yet to be popular. Even if it is in practice, it is not very effective. Furthermore, there are people who believe that government will misspend the tax proceeds collected from carbon tax.

The decision to launch a monetary valuation of external effects is based on the identification of the physical effects. Among them taxation are, politically, the most sensitive. One of the prominent advocates of carbon taxation, Nordhaus (2008) estimates the optimal tax structure for U.S. and discusses the specific case of automobiles. Estimated total social cost or discounted damages from driving 10,000 miles is estimated $30 assuming the cost of 1 t of carbon is $30. Driving a car to 10,000 miles would emit 1 t of carbon.

Chatterjee et al. (2007) present some methods to estimate pollution abatement cost in terms of physical and monetary accounts of air pollution from road transport in India. The pollution abatement cost of each vehicle includes cost of upgrading vehicular technology and cost of improving fuel quality. The study shows that annual pollution abatement costs for Andhra Pradesh and Himachal Pradesh are Rs 7,190 and Rs 6,624, respectively for a passenger car complying with Euro III norms. Fisher-Vanden et al. (1997) suggest different tax rates for India to stabilize CO_2 emissions at the level of 1990. Different carbon tax rates start with $2 per ton of CO_2 emission and reaching up to $40 per ton depending upon different cases of CO_2 emission level increase.

Hsu et al. (2008) explain that people resist any green tax because of the suspicion that government will not use tax revenue rationally. They suggest that "revenue recycling" can improve public acceptability of fuel tax increase. People will support such tax if the funding is used for, say, technological research. However, there is a possibility if technology improves, people may desire to travel more which will lead to increase in fuel consumption rather than decrease in the consumption. As people's disposable income is constant, fuel efficiency and reduction in the cost might partially offset the benefits. This situation is termed as Jevons paradox (Hymel et al., 2010). Moreover, demographic features such as age, level of education, household income level, etc. are also found to be important factors in people's willingness to pay for carbon tax. Brouwer et al. (2008) show that free riders problem has a negative influence on passengers′ willingness to participate in voluntary