Energy Policy 38 (2010) 2208–2215

Contents lists available at ScienceDirect

Energy Policy

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

Fuel tax incidence in developing countries: The case of Costa Rica

Allen Blackman [a,b,*], Rebecca Osakwe [b], Francisco Alpizar [b]

[a] Resources for the Future, 1616 P Street, N.W. Washington, DC, USA
[b] Environment for Development Center for Central America, Turriabla, Costa Rica

ARTICLE INFO

Article history:
Received 13 October 2009
Accepted 1 December 2009
Available online 27 January 2010

JEL classifications:
Q52
Q56
Q48
R48
H23

Keywords:
Fuel tax incidence
Transportation
Costa Rica

ABSTRACT

Although fuel taxes are a practical means of curbing vehicular air pollution, congestion, and accidents in developing countries—all of which are typically major problems—they are often opposed on distributional grounds. Yet few studies have investigated fuel tax incidence in a developing country context. We use household survey data and income–outcome coefficients to analyze fuel tax incidence in Costa Rica. We find that the effect of a 10% fuel price hike through direct spending on gasoline would be progressive, its effect through spending on diesel—both directly and via bus transportation—would be regressive (mainly because poorer households rely heavily on buses), and its effect through spending on goods other than fuel and bus transportation would be relatively small, albeit regressive. Finally, we find that the overall effect of a 10% fuel price hike through all types of direct and indirect spending would be neutral and the magnitude of this combined effect would be modest. We conclude that distributional concerns need not rule out using fuel taxes to address pressing public health and safety problems, particularly if gasoline and diesel taxes can be differentiated.

1. Introduction

Over the past four decades, vehicle fleets in developing countries have grown at 6% per year, double the rate for developed countries (Dargay et al., 2007). As cars, trucks and buses have proliferated, so too have attendant negative externalities, including air pollution, traffic congestion, and accidents. Today, vehicles are a leading source of local air pollution in developing countries, contributing more than 90% of emissions in some cases (Timilsina and Dulal, 2009). In addition, they generate 13% of global emissions of greenhouse gases (Pachauri and Reisinger, 2007). And annual deaths from accidents in developing countries average almost 1 per 100 vehicles, a rate three times higher than that for industrialized countries (Sterner, 2003).

Unfortunately, a number of factors limit policymakers' ability to curb these problems using conventional command-and-control measures, such as maintenance and inspection programs, fuel economy standards, driving restrictions, and technology mandates. Mobile sources are exceptionally plentiful while regulatory institutions are typically undermanned and underfunded. Just as important, political will for such regulation is often inadequate (Sterner, 2003; Russell and Vaughan, 2003).

An often-discussed means of sidestepping these institutional constraints is to impose a tax on vehicular fuel: higher taxes can spur cuts in driving, substitution out of fuel-inefficient vehicles, and consequently a reduction in polluting emissions, congestion, and traffic accidents (Sterner, 2007; Timilsina and Dulal, 2008). Although fuel taxes have the potential to generate deadweight welfare losses, welfare analyses for both industrialized and developing countries have found that given the large negative externalities associated with driving (and the potential for offsetting distorting labor taxes with fuel tax revenue) the net effect of fuel taxes on welfare is generally positive and substantial (Parry and Small, 2005; West and Williams, 2007; Parry and Timilsina, 2008).

Notwithstanding that evidence, a common argument against raising fuel taxes is that it would be regressive—poor households would bear an unfair burden. Studies of fuel tax incidence in industrialized countries, where vehicle ownership is widespread in all socioeconomic classes, have generated mixed results (Parry et al., 2007; Poterba, 1991; Santos and Catchesides, 2005; West and Williams, 2004). Intuitively, one might expect fuel taxes to be less regressive in developing countries where vehicle ownership is concentrated in higher socioeconomic brackets (Sterner, 2007). Some emerging research provides support for this hypothesis (Datta, 2008; Sterner and Lozada, in press; Ziramba et al., 2009). To our knowledge, this question has yet to be addressed in the case of Central or South America.

To help fill this gap, we use data from a 2005 household income and expenditure survey and a 2002 input–output matrix

* Corresponding author at: Resources for the Future, 1616 P Street, N.W. Washington, DC, USA. Tel.: +1 202 328 5073.
E-mail address: blackman@rff.org (A. Blackman).

0301-4215/$ - see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enpol.2009.12.007

Table 1
Economic, transport, and fuel statistics for Costa Rica, 1999–2007.

Year	Population[a] (millions)	GDP per capita[a] ('91 col.)	Vehicles[b] (no.)	Price, diesel[c] ('91 col./liter)	Price, regular gasoline[c] ('91 col./liter)	Sales, regular gasoline[d] (barrels)	Sales, diesel[d] (barrels)	Traffic accidents[e] (no.)
1999	3.838	1398	612,300	29	42	179,722	415,052	48,983
2000	3.810	1423	641,302	39	56	229,768	394,918	50,358
2001	3.907	1439	664,563	37	53	251,806	423,255	53,208
2002	3.998	1480	689,763	34	49	259,584	430,905	58,380
2003	4.089	1575	728,421	39	55	257,762	443,723	53,668
2004	4.179	1642	705,975	43	60	265,521	460,323	52,362
2005	4.266	1739	705,546	53	72	282,415	503,681	57,127
2006	4.354	1892	729,487	57	82	299,301	587,228	68,627
2007	4.443	2039	797,902	64	84	311,997	650,535	69,761
Avg. annual percentage change	1.85	4.86	2.94	14.25	9.58	7.43	5.95	4.82

[a] International Monetary Fund (IMF), World Economic Outlook Database.
[b] Ministerio de Obras Públicas (MOPT), Dirección de Planificación Sectorial.
[c] Refinadora Costarricense de Petróleo (RECOPE).
[d] Refinadora Costarricense de Petróleo (RECOPE).
[e] Ministerio de Obras Públicas (MOPT), Dirección de Planificación Sectorial, using data from Consejo de Seguridad Vial.

Table 2
Mean annual concentrations of air pollutants in San José, Costa Rica in 2000 and World Health Organization and European Union guidelines (ug/m^3).
(*Source*: Baldasano et al., 2003)

	TSP[a]	PM10[b]	SO_2[c]	NO_2[d]
Concentration	101	18	160	31
WHO[e] guideline	60	–	50	40
EU[f] limit	–	40	20	30

[a] Total suspended particulate matter.
[b] Particulate matter smaller than 10 microns.
[c] Sulfur dioxide.
[d] Nitrogen dioxide.
[e] World Health Organization.
[f] European Union.

to analyze the incidence of fuel taxes in Costa Rica. Costa Rica is a particularly interesting case study because it is classified as an "upper middle income country" (World Bank, 2009)—if fuel taxes are not regressive in Costa Rica, they are unlikely to be regressive in poorer countries where vehicle ownership is even more concentrated in higher socioeconomic brackets.

We find that the effect of a 10% price hike through direct spending on gasoline would be progressive, its effect through spending on diesel—both directly and via bus transportation—would be regressive (mainly because poorer households rely heavily on buses), and its effect through spending on goods other than fuel and bus transportation would be relatively small, albeit regressive. Finally, we find that the overall effect of a 10% fuel price hike through all types of direct and indirect spending would be neutral and the magnitude of this combined effect would be modest. We conclude that distributional concerns need not rule out using fuel taxes to address pressing public health and safety problems, particularly if gasoline and diesel taxes can be differentiated.

The remainder of the paper proceeds as follows. The second section presents background information on Costa Rica—specifically, its vehicle fleet, vehicular air pollution, congestion, and traffic accident problems and its public discourse about distributional effects of fuel taxes. The third section presents our incidence analysis, with discussions of our methods, data, and results. The last section presents a summary and conclusion.

2. Background

2.1. Vehicle fleet

Between 1999 and 2007, Costa Rica's vehicle fleet grew at 3% per year, spurred by robust economic and population growth (Table 1). By 2007, roughly 800,000 cars, trucks and buses were registered in Costa Rica, one for every six citizens (Table 1). Seventy percent of these vehicles were in the greater metropolitan area (GMA) of San José, which is home to 60% of the country's population (Herrera and Rodríguez, 2008).

2.2. Negative externalities

Costa Rica's vehicle fleet contributes to severe air pollution, congestion, and traffic accidents. It generates approximately three-quarters of polluting emissions in the GMA (Herrera and Rodríguez, 2005), where average annual levels of total suspended particulates, nitrogen oxides, and especially sulfur dioxide, all exceed national or international norms (Table 2).[1] A contingent valuation survey conducted in the mid-1990s found that GMA residents viewed mobile source air pollution as their single most

[1] Carbon monoxide levels also regularly exceed national limits (Alfaro and Ferrer, 2001).