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Optimal gasoline tax in developing, oil-producing countries: The case of Mexico ☆

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HIGHLIGHTS

- We estimate the optimal gasoline tax for a typical less-developed, oil-producing country like Mexico.
- The relevance of the estimation relies on the differences between less-developed and industrial countries.
- The optimal gasoline tax is $1.90 per gallon at 2011 prices.
- Distance-related pollution damages, accident costs and gas subsidies account for the major differences.
- Gasoline tax incidence may be progressive in less developed countries.

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ABSTRACT

This paper uses the methodology of Parry and Small (2005) to estimate the optimal gasoline tax for a less-developed oil-producing country. The relevance of the estimation relies on the differences between less-developed countries (LDCs) and industrial countries. We argue that lawless roads, general subsidies on gasoline, poor mass transportation systems, older vehicle fleets and unregulated city growth make the tax rates in LDCs differ substantially from the rates in the developed world. We find that the optimal gasoline tax is $1.90 per gallon at 2011 prices and show that the estimate differences are in line with the factors hypothesized. In contrast to the existing literature on industrial countries, we show that the relative gasoline tax incidence may be progressive in Mexico and, more generally, in LDCs.

1. Introduction

Optimal environmental taxation, particularly gasoline taxation, has received a great deal of attention in the academic literature (Sandmo, 1975; Bovenberg and de Mooij, 1994; Bovenberg and van der Ploeg, 1994; Bovenberg and Goulder, 1996; Parry and Small, 2005; West and Williams, 2007; Lin and Prince, 2009, among others). With a few exceptions (Parry and Timilsina, 2008; Parry and Strand, 2012), empirical estimates of the optimal gas tax rate are generally calculated for developed economies. However, in less-developed countries (LDCs) that produce oil, this natural resource is usually extracted by a state company, which makes governments believe that the oil yields should benefit people through subsidized, cheap gasoline, instead of believing that they should levy an optimal tax on this good.[1]

There are many factors that may lead to differences in the optimal tax rate between developing and advanced economies. First, the growth of cities in LDCs is often anarchic, with deficient, narrow, and pot-holed road systems; critical congestion areas; deficient intermodal passenger transport; and urban sprawl that provokes higher congestion costs (Gakenheimer, 1999).[2] Second, poor regulation and a lack of traffic rule enforcement increase the probability of accidents.[3] Finally, LDCs usually have a much older

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[1] The International Monetary Fund (IMF, 2013) reports that pre-tax petroleum subsidies are systematically higher in oil-exporting countries. Among these countries, Middle Eastern and North African countries allocate approximately 4.5% of GDP to petroleum subsidies. This rate is approximately 1.2% in sub-Saharan Africa and Latin America.

[2] Based on a study by the International Association of Public Transport, Parry and Timilsina (2008) report that 10 of 12 of the largest megacities with the lowest average travel speed are in developing countries. See also "Lawless Roads: Road Safety in Mexico," The Economist, Oct. 8, 2011.

[3] According to the World Health Organization (2013), middle-income countries have the highest annual road traffic fatality rates (20.1 per 100,000 population),

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motor vehicle fleet than advanced countries, which increases pollution (Harrington and McConnell, 2003). All of these features call for the calculation of an appropriate gasoline tax for LDCs.

The objective of this paper is to estimate the optimal gasoline tax for a representative middle-income country. For that purpose, we apply the methodology of Parry and Small (2005) to Mexico, a prominent oil-producing LDC that heavily subsidizes gasoline consumption. The advantage of this method is the decomposition of the second-best optimal fuel tax into several components, including those related to congestion, accidents, and air pollution. As previously mentioned, these negative externalities may in fact be more severe for the economies of LDCs than for developed economies.

Our results suggest an optimal gasoline tax of $1.90/gallon at 2011 prices. The (adjusted) Pigouvian tax is the largest portion of the tax, amounting to $1.62/gallon. The accident component explains approximately one-third of the Pigouvian tax, followed by distance-related pollution damage and congestion externalities. The Ramsey tax component, arising from a relatively inelastic fuel demand, contributes another $0.28/gallon.

The optimal gas tax in Mexico is larger than the estimate reported by PS (2005) for the US (even after updating their results at 2011 prices), and that of Lin and Prince (2009) for California, but lower than that estimated by Parry and Strand (2012) for Chile. In particular, PS (2005) report an optimal tax rate of $1.01/gallon for the US at 2000 prices. This estimate increases to $1.43/gallon at 2011 prices. Lin and Prince (2009) obtain a rate of $1.37/gallon for California at 2006 prices. Finally, Parry and Strand (2012) calculate a corrective fuel tax for Chile of $2.35 per gallon at 2006 prices.

To understand what accounts for the differences with respect to PS (2005), we change each one of the parameters that is different in Mexico than in the US, one at a time. We find that distance-related pollution damage and accident costs explain the majority of the differences. The presence of fuel subsidies (typical of oil-producing countries) explains approximately 20% of the differences. Perhaps surprisingly, the lower fuel efficiency attributed to an older vehicle fleet does not explain a significant proportion of the differences in tax estimates.

Using the optimal gas tax estimate, we address the effects of such a tax across income deciles in Mexico. Contrary to the conventional wisdom, we find that the fuel tax is progressive. The intuition is simple: only 9% of the poorest households demand fuel because the majority of these households (87%) do not own a car. Conversely, 85% of the wealthiest households demand fuel because 91% own at least one car.[4]

This paper is structured as follows. Section 2 briefly describes the fuel pricing policy in Mexico. Section 3 outlines the model, and Section 4 presents the results. Section 5 compares the results to those obtained for advanced economies and includes a sensitivity analysis. Section 6 provides concluding remarks.

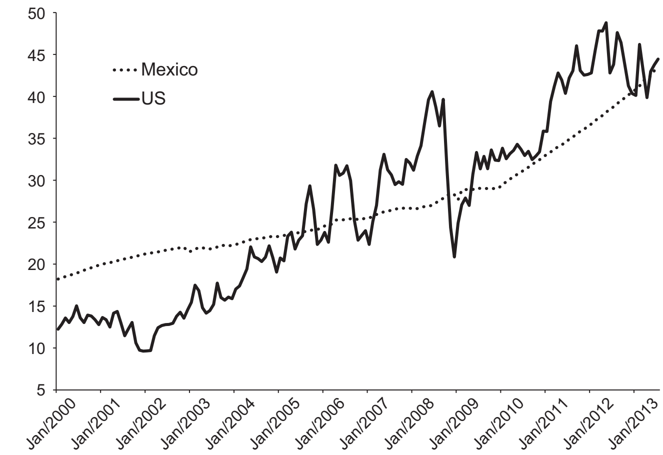

Fig. 1. Gasoline price, 2000–2013 (Mexican pesos per gallon).
Sources: US Energy Information Administration and Mexico's Energy Information System. The US price is the weekly Gulf Coast regular conventional retail price. The Mexican price is the regular conventional retail price.

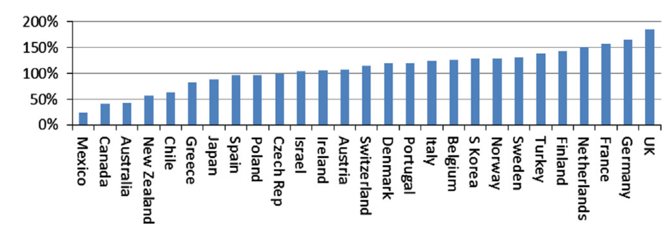

Fig. 2. Excise tax rate (pre-tax fuel price), average 2001–2011.
Source: Author calculations from OECD-IEA, Energy Price and Taxes, Quarterly Statistics (2012).

2. How is the gasoline price set in Mexico?

Mexico is an oil-producing country but currently imports about half of the gasoline demanded in the country, because of capacity constraints. Because of an inappropriate gasoline pricing policy (a pre-determined crawling gas price fixed by the government at the beginning of each year), a subsidy emerges when the international petroleum price is above its pre-determined level, as has been the case most of the time since 2006 (see Fig. 1).[5] This subvention, which may produce a final price below its market price, is frequently justified on political, i.e., populist, grounds.

On average, Mexico registers the second-lowest excise tax rate, after the USA, among a sample of representative OECD countries for the period 2001–2011 (see Fig. 2).[6] For the period 2007–2011, the tax is in fact negative (a subsidy). This subsidy has cost the government an average of 1.2% of GDP over the period 2007–2011, an amount equivalent to the expenditures on poverty alleviation and public health care programs in the country. These large fiscal subsidies merit careful re-evaluation, especially in this present time of fiscal

(*footnote continued*)
whereas the rate in high-income countries is the lowest (8.7 per 100,000). In addition, 80% of road traffic deaths occur in middle-income countries, which have 72% of the world population but only 52% of the world's registered vehicles. In fact, nearly 70% of road deaths occur in 13 countries, 12 of which are developing countries (including Mexico).

[4] The source is Mexico's Household Income and Expenditure Survey (2010). Unfortunately, the survey does not provide further information that would help to explain the gap between fuel consumption and car ownership across households. The survey only registers whether the household owns a vehicle and monthly total expenditures on fuel; it does not provide information on vehicle use or driving patterns. This gap might be due to a combination of statistical errors and to people either deciding not to use a car (car pooling) or not being able to use a car because it is not working. It is common, especially for people in lower deciles, to own old broken-down cars with the expectation of putting them back into service in the future.

[5] Since 2010, the Mexican government has increased the fuel price by $0.016/gallon every month, which corresponds to an increase of $0.19/gallon per year.

[6] US data are not included in Fig. 2 because the *OECD-IEA, Energy Price and Taxes, Quarterly Statistics* (2012) study does not report excise taxes for this country. Only total gasoline taxes (i.e., excise plus sales taxes) in the US of $0.11/l (the average for the period 2001–2011) are reported.