

GASOLINE PRICES, GASOLINE CONSUMPTION, AND NEW-VEHICLE FUEL ECONOMY: EVIDENCE FOR A LARGE SAMPLE OF COUNTRIES

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Overview

Countries differ considerably in terms of the price drivers pay for gasoline. This paper uses data for a large sample of countries to provide new evidence on the implications of these differences for the consumption of gasoline for road transport and the fuel economy of new vehicles. To address the potential for simultaneity bias in ordinary least squares estimation, we use a country's oil reserves as an instrument for its average gasoline pump price. We obtain estimates of the long-run price elasticity of gasoline demand of between -0.2 and -0.4 , a smaller elasticity than most existing estimates. The results also indicate that higher gasoline prices induce consumers to substitute to vehicles that are more fuel-efficient, with an estimated elasticity of $+0.2$. While gasoline demand and fuel economy are both inelastic with respect to gasoline prices, there is considerable scope for low-price countries to achieve gasoline savings and vehicle fuel economy improvements via reducing gasoline subsidies and/or increasing gasoline taxes.

Road transport is an increasingly important sector, accounting for 14% of global energy use, 40% of global oil use, and 17% of global carbon dioxide emissions from energy in 2008 (International Energy Agency [IEA] 2010a, 2010b). Evidence on the responsiveness of consumers to gasoline price levels is of relevance to policymakers in light of heightening concerns about oil scarcity and the environmental impacts of oil use, including global climate change. Evidence on the importance of gasoline prices for gasoline use is of particular policy relevance because gasoline prices have traditionally been subject to substantial government influence. Indeed, taxes contribute a large share of the gasoline pump price in many countries, and differences in tax rates make up a sizeable share of cross-country differences in gasoline pump prices (Rietveld and van Woudenberg 2005). In other countries, such as Venezuela, Saudi Arabia, Iran, and Indonesia, gasoline price subsidies represent a large drain on the government budget. The results in this paper have implications for the potential efficacy of price-based approaches for managing energy use in the transport sector, and more broadly.

Methods

This paper presents estimates of the price elasticity of demand for both gasoline use and new-vehicle fuel economy for a large sample of countries. Both cross-sectional and pooled cross-section time-series models are estimated using data covering the period 1995-2008. To address the potential simultaneity bias present in ordinary least squares estimation, we present specifications that use a country's in-ground proved oil reserves as an instrument for the local gasoline price. Oil reserves are negatively correlated with the gasoline pump price across countries, and serve as a "supply-curve shifter" capable of allowing the identification of the parameters of the demand equations. As far as we are aware, this is the first time oil reserves have been used as an instrument for gasoline pump prices.

A strength of our analysis is that we use new data on new-vehicle fuel economy collated by the IEA (2011). The data are indicative country-level fuel economy averages based on test drive results for samples of new vehicles at the make-model-configuration level. Because the fuel economy averages use ratings by vehicle configuration (i.e. sub-model), the data provide a more accurate measure of average new-vehicle fuel economy than those used in some prior studies (e.g. Wheaton 1982). The IEA fuel economy data have not been used in prior regression analyses.

Estimations are for a larger sample of countries than used in prior contributions (132 in total for the gasoline consumption specifications, including countries rarely included in gasoline demand studies, such as Venezuela and Iran). The estimations cover

recent years (to 2008) and control for additional potential determinants of gasoline demand, such as vehicle fuel economy standards, vehicle import tariff rates, and a measure of the importance of other forms of transport.

Results

The results suggest a long-run price elasticity of gasoline demand of -0.2 to -0.4 , which is smaller than many of the estimates in the existing literature. The results also suggest that gasoline pump prices affect vehicle choice decisions: a country with gasoline prices 10% higher than an otherwise similar country is likely to have new vehicles of 2% higher fuel economy. Underlying country characteristics such as population density and income level are also found to have important implications for road-sector gasoline consumption and fuel economy.

Our estimates are consistent with recent meta-analysis evidence from Havranek et al. (2012), who estimate an average long-run price elasticity of gasoline demand of -0.3 after adjusting for publication bias. Our results thus serve to shore-up Havranek et al.'s inference that gasoline consumption is more price inelastic than is regularly believed. Our estimate of the elasticity of new-vehicle fuel economy with respect to the gasoline pump price is similar to that obtained in an eight-country study by Espey (1996), although Espey uses fleet-wide fuel economy generated using top-down data based on kilometers travelled and recorded fuel use.

Conclusions

While the estimated price elasticities of gasoline demand and fuel economy are relatively small, the large differences in fuel prices between countries account for an important share of the differences in gasoline consumption and fuel economy. A simple counterfactual is informative: the results indicate that a shift to Japan-level gasoline prices in the US would result in an improvement in the fuel economy of new vehicles in the US of around one-quarter, for instance (all else held constant). Because the US accounts for 40% of global road-sector gasoline consumption (IEA 2010a), the estimates also indicate that higher gasoline prices in the US would translate to a sizeable reduction in the quantity of global oil demand.

There are a number of countries with gasoline prices much lower than those in the US, and on a per capita basis these countries also tend to be relatively large consumers of gasoline. Increasing gasoline prices is politically challenging, and would likely reduce the welfare of some motorists. Nevertheless, the results in this study indicate that moves toward internationally-normal gasoline prices in countries such as Venezuela and Iran would result in substantial energy efficiency improvements in the transport sectors of these countries. Cutting fossil fuel subsidies would also free up resources that could be used for other purposes.

Several international agencies have joined together in a Global Fuel Economy Initiative, which has the aim of doubling new light-duty vehicle fuel economy (in terms of kilometers per liter) globally by 2050 (see www.globalfueleconomy.org). The results in this paper provide a timely reminder of the importance of price effects in stimulating the adoption of energy-efficient technologies. Upward pressure on fuel prices over time would create an impetus for vehicle fuel efficiency improvements and would complement other policy efforts aimed at improving the energy efficiency of the transport fleet.

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