Research Briefs
IN ECONOMIC POLICY
CATO INSTITUTE

November 2015 | Number 38

Do Consumers Recognize the Value of Fuel Economy?

Evidence from Used Car Prices and Gasoline Price Fluctuations

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One of the great questions facing policymakers in the 21st century is whether and how to mitigate greenhouse gas emissions so as to limit climate change. Automobiles are a critical part of this policy problem—in the United States, personal transportation accounts for 28 percent of greenhouse gas emissions. Gasoline consumption maps neatly into greenhouse gas emissions. This means that a tax on emissions (in the form of a gasoline tax) is feasible. Such a tax can fully restore market efficiency, and alternative policies, such as fuel economy standards, will have inferior welfare properties provided that the environmental externality is the only market failure leading to inefficiencies.

Many have argued, however, that another market failure exists, which is that consumers undervalue energy efficiency in a variety of choice situations, including automobile markets. This hypothesis arises from the observation that engineering estimates of the cost of deploying fuel-saving technologies suggest that privately cost-effective technologies are often not adopted: the "energy paradox." If markets substantially undervalue energy efficiency, then the dominance of a gasoline tax over regulatory approaches may be broken because alternative policies may be better able to correct for inefficiencies from consumer undervaluation of energy efficiency.

Motivated by these policy considerations, researchers have sought to determine whether consumers, in fact, undervalue fuel economy. We add to this literature by developing a unique strategy that utilizes data on used-vehicle transactions to test whether used-vehicle prices change by the amount predicted by a fully rational asset pricing model. We interpret our results as a test of whether consumers fully value fuel economy, and our results provide the parameters necessary for informed policymaking.

Intuitively, our approach is to first compare the prices of two used cars which are identical except in their current odometer readings—and therefore in remaining future operating costs—and second to repeat this comparison when different gasoline prices prevail. We repeat this comparison across many vehicle types and many months, during which changes in the price of gasoline drive changes in fuel costs, to estimate the relationship between vehicle prices and a measure of present discounted fuel costs. For example, we calculate the price and fuel cost of a 2000 Ford Taurus SE six-cylinder 3.0L vehicle with automatic transmission and front-wheel drive that has 50,000 miles as of July 2005 to another 2000 Ford Taurus SE six-cylinder 3.0L vehicle with

Editor, Jeffrey Miron, Harvard University and Cato Institute

automatic transmission and front-wheel drive that has 60,000 miles as of July 2005. We then calculate the price and fuel cost of two different cars with the exact same configuration and mileages in July 2006. Changes in the gasoline price between July 2005 and July 2006 will cause changes in the difference in expected fuel costs between the higher- and lower-mileage vehicles. We test whether the change in the price difference between the high- and low-mileage vehicle over time corresponds to the change in the cost difference.

The fact that our comparison is across vehicles of the same type that differ only in their current mileage allows us to provide an exceptionally rich set of controls. To execute our research design, we employ used-vehicle price data that include actual transaction prices, date of sale, vehicle identification numbers, and odometer readings for a large sample of vehicles sold at wholesale auctions between July 1993 and June 2008.

In our baseline specification, we find that vehicle prices do move one-for-one with future fuel costs. This conclusion is robust to a number of specification checks. Given some simplifying assumptions about the structure of the used car market, this result implies that consumers do value fuel economy properly. This finding casts doubt on the idea that regulatory policies, such as fuel economy standards, might be more efficient than fuel taxation because they correct both the environmental externality and private misoptimization due to limited rationality.

Our data come from wholesale auctions, but we are interested in what consumers pay in the retail market. Using an auxiliary data set from used-car guidebooks, we demonstrate that price changes in the retail market appear to pass one-to-one into retail prices. This is consistent with a competitive used-car market, and it allows us to interpret our wholesale price results as directly reflecting consumer willingness to pay in the retail used-car market.

We are not the first to ask whether consumers value fuel economy properly. Earlier work uses a different empirical strategy that leverages the fact that common gasoline price shocks translate into different fuel cost shocks for different vehicles based on their fuel economies. Compared to these papers, we relax a number of restrictive assumptions. Earlier work finds a range of estimates of consumer valuation across specifications that overlap with each other; some find modest undervaluation while other work cannot consistently reject full valuation.

We interpret our estimates as consistent with these earlier results. Moreover, we believe that our procedure presents a more difficult test because we identify consumer valuation off variation in odometers within a set of otherwise identical vehicles, which may not be salient to consumers. If consumers have limited attention, then we might expect them to ignore the type of within-model variation in fuel costs that we leverage. That is, one could imagine consumers recognizing the fuel cost differences across categories of automobiles, but not "noticing" the difference in implied fuel costs across high- and low-mileage versions of the same model.

Our baseline model produces precise estimates consistent with full valuation. Our procedure yields statistical precision, and our results are robust across a number of dimensions. But, we emphasize that our procedure can be made to yield different results because it relies on assumptions about underlying parameters that we use to construct our estimate of the future fuel costs, including future fuel price forecasts, on-road fuel economy performance, and typical patterns of vehicle utilization and scrappage. We have empirical support for each of our assumptions, but reasonable alternatives could shift our coefficient estimate in either direction.

Thus, while the literature fails to consistently reject the hypothesis of full valuation, the data cannot consistently rule out modest undervaluation. What is clear from our results, in conjunction with the existing literature, is that the assumption that consumers place a zero value on fuel economy is indefensible. Nevertheless, this assumption is still employed, implicitly, in regulatory impact analyses that credit the entire fuel savings of consumers as a benefit of programs such as the Corporate Average Fuel Economy (CAFE) standards. If consumers value fuel economy properly and automakers deploy fuel-saving technologies whenever their cost lies below consumer willingness to pay, then fuel economy improvements forced upon the market by regulation must be causing a trade-off in vehicle characteristics or market shares that lowers consumer surplus. This crediting of fuel savings as a program benefit is often pivotal to the cost-benefit analysis. For example, pollution abatement represents only about 20 percent of the total benefits of the 2017–2025 CAFE standards, while fuel savings make up nearly 80 percent of the total benefits. Those fuel savings are estimated to be significantly greater than the total costs of adopting the requisite fuel-saving technologies. But, if consumers rationally value fuel economy, then this cannot be so, and some fraction of the benefits are, in fact, being offset by unaccounted for costs related to changes in vehicle design.

Our empirical evidence, combined with the previous literature, implies that consumers at worst undervalue fuel economy modestly. If energy efficient technologies are not being deployed, then researchers and regulators should perhaps shift their attention to supply-side explanations, like competitive failures, technological spillovers, or other hold ups within the automobile industry.

NOTE

This research brief is based on James M. Sallee, Sarah West, and Wei Fan, "Do Consumers Recognize the Value of Fuel Economy? Evidence from Used Car Prices and Gasoline Price Fluctuations," National Bureau of Economic Research Working Paper no. 21441, July 2015, http://www.nber.org/papers/w21441.