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Valuing Automobile Fuel Economy Over Time

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Abstract

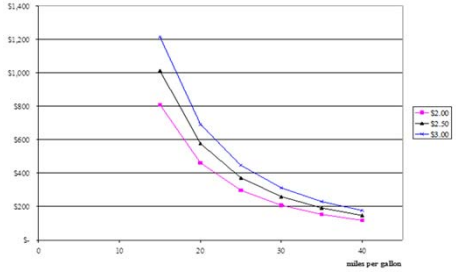
Many aspects of automobile markets have changed significantly over the past decade, from vehicle weigh and power to technology for improvements in fuel economy, fundamentally altering tradeoffs among vehicle characteristics. Further, several significant laws were passed mandating increases in vehicle fuel economy. To understand the impact of such legislation, it is critical to know how consumers value fuel economy and other vehicle characteristics. While previous research has estimated the value of automobile fuel economy using hedonic analysis, this research adds to this literature by examining how this value changes over time, in particular in light of changing fuel prices over time, and highlights the significance of uncertainty in fuel economy measures in making such as estimation.

Valuation of Fuel Economy

Consumers should be willing to pay for improved fuel economy up to the discounted stream of fuel savings, where fuel savings over T years are $\sum_{t=1}^{T} P_{gas}$*miles driven per year*gallons per mile *e^{-rt}

However, this value will be affect by several sources of uncertainty:

- Expected future fuel prices
- Mileage to be driven
- Discount rate
- Fuel economy



Savings versus fuel economy for a 5% discount rate and average vehicle lifetime

Hedonic Model

$$P_{vehicle} = \alpha + \beta_0 X + \varepsilon$$

where X is a linear function of:

- Size (curb weight in pounds)
- Power (0 to 60 acceleration time in seconds)
- Performance (turning circle in feet)
- Safety (60 to 0 braking distance in feet and NHTSA crash test rating)
- Comfort (1-5 rating by Consumer Reports)
- Fuel efficiency (gallons per mile)
- Indicator variables for vans, SUVs, and luxury vehicles

Changing Tradeoffs Over Time

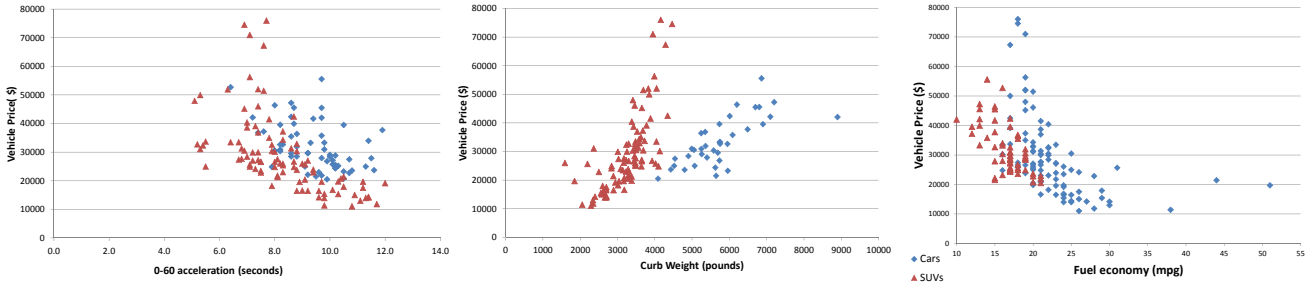
Between 1988 and 2000:

- Vehicle weight increased 13 percent
- Horsepower increased 44 percent
- Zero to 60 acceleration increased 20 percent
- Fuel economy decreased 7 percent

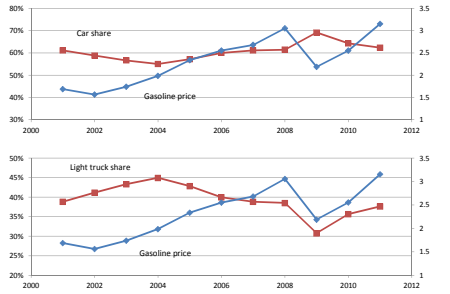
Between 2000 and 2011:

- Vehicle weight increased 8 percent
- Horsepower increased 28 percent
- Zero to 60 acceleration increased 10 percent
- Fuel economy increased 14 percent

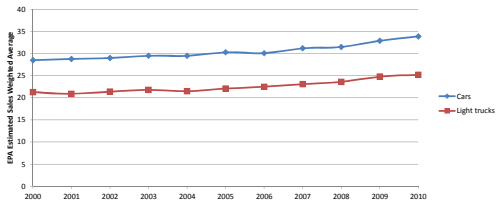
Paying for vehicle characteristics in 2005: curb weight, acceleration, and MPG



Passenger Vehicle Market Shares and the Real Price of Gasoline



Sales Weighted EPA Fuel Economy Estimates



Work to be done: The base model described above will be estimated for each year. Coefficient estimates will be compared across the decade in relation to fuel prices and the degree to which hedonic estimates reflect actual potential fuel savings of higher fuel economy under varying assumptions about future fuel prices, actual fuel economy, and discount rates will be determined.

Conclusions

If consumers accurately value improved fuel economy, regulations shouldn't be necessary and may force inefficiency in the marketplace, raising the cost of providing fuel economy above the value and limiting consumer choice and skewing market prices in order to achieve the mandated fuel economy targets. A particular challenge for consumers, however, is estimating how much to pay for improved fuel economy in light of uncertainty about future fuel prices. This research will estimate the value of consumers for automobile fuel economy in light of such uncertainty, as well as taking into account advertised fuel economy (EPA figures) that are often higher than actual on-road fuel economy achieved.