Are Consumers or Fuel Economy Policies Efficient?

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Fuel Economy Policy

- Since the first oil crisis in the 1970s our main policy addressing oil consumption has been CAFE standards
- Separate car and light truck standards
- Fleet-weighted harmonic average for each manufacturer’s cars and light trucks
  - Trading across fleets and manufacturers is not allowed

Reasons CAFE may be inefficient

- Incentives vary across manufacturers and vehicle types
- No ongoing incentive for improvement
- Does not discourage driving as a means of conservation
- Fuel taxes may already internalize externalities related to consumption (?)
- Inefficiently constrains consumer choices (?)

Consumers

- Since the oil crises, consumers have not demanded fuel economy beyond CAFE regs
- Vehicle purchase decision involves many attributes
- Consumers are willing to pay for better fuel economy, since they save in operating costs
  - But how much?
- But they may prefer other features that run counter to fuel economy.
  - In which case, CAFE regulation creates “opportunity costs”

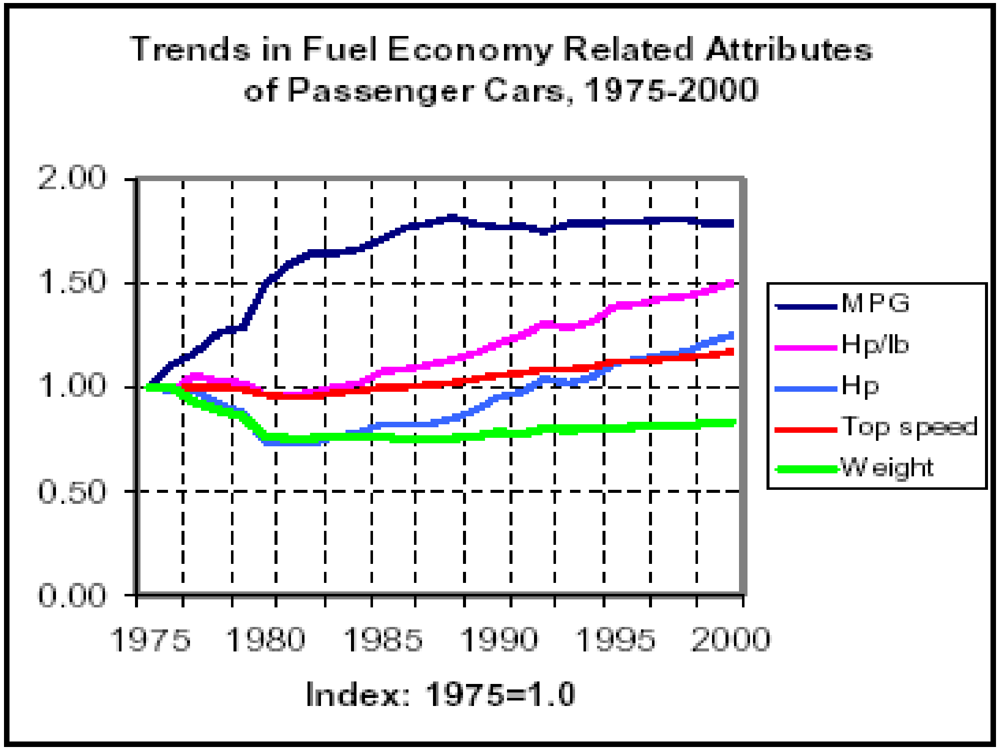

FIGURE 2-6 Trends in Fuel Economy Related Attributes of Passenger Cars, 1975–2000.
SOURCE: EPA, 2000.

- does not include trend toward SUVs

Another View of the Trend…

Vehicle	1918 Model T	2006 Explorer 4WD
Power plant	V8	V8
Weight (lbs)	2198	5983
MPG	18	16
Source	 Smithsonian (1913) www.carfax.com	 Fueleconomy.gov

Reasons Consumers may be Inefficient

- Limited or poor information
  - About their own fuel consumption,
  - how long they will hold the car,
  - reliability of the test data…
- Limited ability to recapture costs at resale
- Lots of other things go into vehicle choice, and fuel costs relatively small part
- High discount rates / can't do PV calculations

The Calculation We Expect Them to Do

$$\text{Lifetime Fuel Costs} = \underbrace{\frac{\text{Annual VMT}}{\text{MPG} \cdot (\underbrace{0.85}_{\substack{\text{On-road shortfall} \\ \text{adjustment}}})}}_{\text{Annual Gallons}} \cdot \sum_{j=1}^{\overbrace{14}^{\substack{\text{vehicle} \\ \text{lifetime}}}} \frac{(\text{Retail Gas Price})_j}{(1 + \underbrace{r^S}_{\substack{\text{discount} \\ \text{rate} \\ \text{(social)}}} + \underbrace{.045}_{\substack{\text{annual} \\ \text{decline} \\ \text{in use}}})^{j-1}}$$

- or, really, act “as if” they do

Wide-Ranging Evidence on Consumer Valuation

- Fully value (100%)
  - Espey and Nair *CEP* 2005; (hedonic)
- 3-year payback (35%)
  - Greene and others; automakers rule of thumb
- In between: high discounters / short payback
  - Dreyfus and Viscusi *JLE* (1995) *r*=11-17% (hedonic)
  - Goldberg *JIE* (1998) like 5% discount rate and 7-yr holding period (structural model of vehicle choice) (~66%)
- Few studies look at this directly
- Variation in valuation
  - Berry Levinsohn & Pakes *Econometrica* (1995) find elasticity of demand w.r.t. MP$ declines monotonically with car's MP$

Why it Matters

- NAS panel found cost-effective technologies are available
- If the market does not choose them, the reason why determines whether fuel economy regulation enhances social welfare

➢ RFF study "**Should Automobile Fuel Economy Standards be Tightened?**" (Fischer, Harrington, and Parry *EJ* 2007)

CAFE Policy Scenarios

- 4 MPG increase across the board
- Bring light truck standards up to car standards
- Unify standards and allow trading

Valuing Net Costs

- Estimated costs of improving fuel economy from engineering cost data in NRC (2002)
- Estimated cross vehicle price elasticities from an internal General Motors model
  - Adjusted for long-run behavior using dynamic model of vehicle choice from Harrington et al. (2003)
- Discounted fuel savings (NRC assumptions)
  - 14-yr lifetime, 5% discount rate, on-road FE loss of 15%, annual VMT declines 4.5% from 15,600 miles in 1st year, $1.80 gas price
- External costs of driving and fuel consumption

Benchmark Values for External Costs

Fuel Related		**source**
carbon	12 cents/gal.	NRC (2002)
oil dependency	16 cents/gal.	Leiby et al. (1997)
gasoline tax (fed+state)	40 cents/gal.	
Mileage-related (averaged across vehicles)		
congestion	6.5 cents/mile	own estimate
accidents	4.4 cents/mile	own estimate
local pollution	1.5 cents/mile	own estimate
sum	**12.4 cents/mile or $2.48/gal**.	

Assumptions about consumer response

- Time preference
  - Farsighted consumers (value 100%)
  - High-discount rate consumers (75%)
  - Short-horizon consumers (35%)
- Opportunity costs of fuel economy technologies
  - Yes – technology could be used for other vehicle attributes
  - No – technology can only conribute to fuel economy

Consumer Responses and Surplus from New Sales

Assumption about consumer preferences	**Baseline with emerging technologies**	**4mpg CAFE increase**
Consumers willing to pay for all fuel savings	Market provides 4mpg increase	Little or no change in surplus
Consumers willing to pay for 1/3 of fuel savings	Market provides some increase	Raises car prices but consumers gain from fuel savings
Consumers prefer power and other amenities	Market does not increase MPG	Consumers significantly worse off

Some Results with All Costs

Welfare change (cents/gallon saved)	Far sighted	High discount	Short horizon
+4 mpg, no Opp. Cost	0	0	55
+4 mpg, Opp. Cost	-65	-22	54
+4 mpg & Trade, Opp. Cost	-57	-21	58
Comb. Stds, no Opp. Cost	0	0	58
Comb. Stds, Opp. Cost	-54	-19	53
Comb. & Trade, Opp. Cost	-44	-10	57

Conclusions

- Increasing CAFE standards only improves welfare if consumers are myopic
- Restrictions on trading across vehicle types reduces efficiency, but not by as much
- Fuel and mileage externalities are relatively unimportant in justifying CAFE

Who's Inefficient?

- If consumers do not fully value FE improvements in vehicle purchases, then regulation can improve efficiency (in the economic sense)
  - And improve the effectiveness of carbon pricing
- CAFE as a regulation can be made more efficient
- If consumers value most fuel cost savings, then FE regulation is inefficient and gas tax / carbon price alone will do the job

Thanks!

Please visit **http//www.rff.org**

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More Details

Fischer, Carolyn, Winston Harrington, and Ian Parry (2007) “Do Market Failures Justify Tightening Corporate Average Fuel Economy (CAFE) Standards?” *The Energy Journal* 28 (4): 1-30.

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  - on-road fuel economy loss of 15%
  - $1.80 gas price

Valuing Reduced Fuel Consumption

- Energy security costs = \$0.20/gal
  - Estimates range from \$0-\$14/barrel oil or \$0-\$0.33/gal
- Global warming = \$50/ton or \$0.12/gal for damages
  - Tol et al. (2000) and Pearce (2003)
- Less pollution from refineries, spill hazards = \$0.019/gal
  - From on VOC emissions costs
- Total = \$0.34/gal …but
- Current (federal and state) fuel tax = \$0.40/gal
  - May be overcharging for fuel-related externalities already
  - Fed. tax earmarked for highway spending, so we assume initially that marginal social value of \$1 spent is \$1

Valuing Additional Driving

- Marginal congestion costs = $0.065 /mi
  - $0.077 in Washington, DC (Safirova et al. 2004)
  - Inferred values for 75 cities with mileage/pavement ratio data and attributed to remaining 273 according to population
- Accident costs = $0.044 /mi
  - Converted from NHTSA (2002) estimates
  - Deaths & injuries to pedestrians & cyclists (18%), other drivers (37%); property damage (7%); travel delay (4%), productivity costs (10%), and miscellaneous (24%)
- Conventional pollutants = $0.015 /mi
  - regulated on a per-mile basis, so they may increase, even with less fuel consumption
  - $0.011/mi for cars, $0.02 for trucks