U.S. Fuel Economy Standards: Economics and Efficiency

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U.S. Fuel Economy (New Vehicles)

Source: NHTSA CAFE compliance, EPA rules to 2025
Externalities

- Related to gasoline use per mile
  - Climate change
  - Oil dependence, security

- Related to miles driven
  - Congestion
  - Accidents
  - Local air pollution

33 cents/gallon at $37/ton CO₂

Unintended consequences?
Co-benefits?

Corporate Average Fuel Economy

- Average MPG targets for vehicle manufacturers (weighted by quantity sold in the U.S.)
  - 1978 - 2012: separate targets for sedans and light trucks (pickups, SUVs, minivans)
  - 2013 - 2025: separate targets based on vehicle “footprint”
- Mandates an increase in the fuel economy of new vehicles sold in the U.S.
- Increasing usage internationally
CAFE and Efficiency

• Least-cost way to conserve gasoline?
  • Combines many things: live close to work, smaller cars, combine trips, carpool, bicycle, electric cars, hybrids, ......

• What combination of these is efficient?
  • Gasoline tax lets the market choose which strategies to use
  • CAFE uses a small subset of strategies (and therefore often misses the cheapest)
CAFE and Efficiency

- Strategies used under CAFE
  - Technology (hybrid etc.), lighter weight, lower horsepower

- Strategies missed by CAFE
  - Fewer miles driven (likely most important)
  - Smaller and fewer vehicles
  - Lower fraction of pickups and SUVs

Cost Comparison

- CAFE standards 3 to 5 times more costly than a gasoline tax
  - Missing incentive on miles
  - Missing incentive to switch away from SUVs
  - New footprint-based standards even more costly than old CAFE
  - Why? They don’t use smaller vehicles, almost all gains must come from technology, weight, and power
Beyond the New Car Market

- CAFE has important effects outside new cars:
  - Increased retention of low-MPG vehicles in the used market
  - Changes in safety as the fleet evolves
  - Attribute changes (rise of SUVs in the 1990s, now width and long wheelbase?)

Leakage

- Key source of concern for CAFE
- Incomplete regulation leads to leakage
- Some manufacturers constrained more than others (addressed in new rules)
- CAFE applies only when cars are new: vehicle scrappage later on can create leakage
Scrappage

- Current project looking at CAFE and the used market
- Sub-model level data on all U.S. registrations
- Matched to used car prices, characteristics, and fuel economy

Scrap Rates by Brand

![Graph showing scrap rates by brand over age with lines for various brands including BMW, Chevrolet, Chrysler, Dodge, Ford, Honda, Hyundai, Toyota, and Volkswagen.](image)
Scrap Rates by Fuel Economy

- How do scrap rates change under CAFE?
- *Gruenspecht effect:* Scrap rates for high-MPG cars grow even larger
  Scrap rates for low-MPG vehicles get smaller
- All vehicles are kept longer (greater capital value relative to operating cost)
Estimate of Scrappage Effect

Average leakage through 2025: 13-16%

CAFE and Safety

- Large engineering and economics literature on safety
- Two opposing effects:
  - Protection small vs. large vehicles offer their occupants
  - An arms race in vehicle choice
- Overarching problem in estimation: selection
  - Population density, age, education, income, substance abuse are all correlated with car choice
CAFE and Safety: Summary

<table>
<thead>
<tr>
<th>Efficiency in car markets</th>
<th>Gasoline tax</th>
<th>Single fuel economy standard</th>
<th>Original CAFE standards</th>
<th>New footprint-based CAFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency in car markets</td>
<td>Most efficient</td>
<td>Neutral</td>
<td>Increase</td>
<td>Neutral</td>
</tr>
<tr>
<td>Decrease</td>
<td>Neutral</td>
<td>Increase</td>
<td>Neutral</td>
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<tr>
<td>Effect on accident fatalities</td>
<td>Decrease (neutral on composition, with benefits through reduction in miles driven)</td>
<td>Neutral (mismatched and single-car accident risks are worsened)</td>
<td>Neutral (new standards intentionally keep vehicle classes about the same)</td>
<td></td>
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</tbody>
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Value of Fuel Savings

- Energy efficiency paradox in vehicle choice?
- If so, CAFE can help people choose better cars
- Gasoline savings can exceed technology costs
- Subject of several studies
- Used cars are again an interesting place to look
Effect of $1 Increase in Gas Price

Quartile averages range from 15.4 to 26.7 MPG
Least efficient vehicles (quartile 1) omitted
Effect of $1 Increase in Gas Price

- When translating future fuel savings (relative to the average car) the change almost exactly equals the change in used value
- Gasoline savings appear to be accounted for in the used market
- What about in the new market?
  - More difficult to study: imperfect competition, uncertainty, actors within the firm

Key Points

- CAFE misses miles-driven and so is 3 to 5 times more costly than a gasoline tax
- Further reductions in efficiency due to incomplete regulation: used car leakage 13-16%
- Safety effects depend on the specific rules: simplified CAFE or gasoline taxes are best
- Used car prices suggest drivers do consider fuel cost
Policy Questions

• Can we focus complementary policy directly on congestion and accident externalities?

• Ways to incentivize all efficient cars, not just new ones: registration rebates or fees

• Important co-benefits for local pollution

• Possible to reduce miles without raising the price of fuel?