CONSUMER CHOICE AND THE WELFARE IMPACTS OF CAFE STANDARDS

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2010 CAFE FRILA
Total Benefits:
$146 billion
Externalities:
$18 billion
"Internalities":
$128 billion
Net Benefits:
$94 billion
Net Benefits (w/o Internalities):
$ -33 billion
NHTSA’s Introduction

"Although the economy-wide or "social" benefits from requiring higher fuel economy represent an important share of the total economic benefits from raising CAFE standards, NHTSA estimates that benefits to vehicle buyers themselves [original emphasis] will significantly exceed the costs of complying with the stricter fuel economy standards this rule establishes . . . However, this raises the question of why current purchasing patterns do not result in higher average fuel economy, and why stricter fuel efficiency standards should be necessary to achieve that goal. To address this issue, the analysis examines possible explanations for this apparent paradox, including discrepancies between the consumers` perceptions of the value of fuel savings and those calculated by the agency . . . “

Observations

- Many people think that CAFE standards are about reducing externalities.
- CAFE Regulatory Impact Analysis: the paternalistic rationale for CAFE is potentially much more important from a welfare perspective.
- Basic intuition/calibration:
  - At $21 per ton CO2 (US Gov’t 2010): Uninternalized externality from climate change is $0.18 per gallon, or 5-10% of gas price
  - “Some analysts” think that consumers undervalue gasoline costs by 20-30%.
  - Both externalities and “internalities” cause consumers to purchase too many gas guzzlers relative to the social optimum
  - But the internality effect could be 2-6 times larger!
- Takeaway: There is a lot of work on climate change and “traditional” externalities. Need more on internalities.
Two Basic Questions

1. Empirical: Do consumers indeed buy vehicles that are less energy efficient than their *private* optimum?
   1. If not, we should only count *externalities* in cost-benefit calculations.
   2. And we should favor Pigouvian taxes (Jacobsen 2011).

2. Theory/simulations: If so, what are the policy implications and welfare effects?

   • This presentation draws on joint work with Sendhil Mullainathan (Harvard), Rich Sweeney (Harvard), Todd Rogers (Harvard), Nathan Wozny (Mathematica), Dmitry Taubinisky (Harvard), and Michael Greenstone (MIT).

   • Thanks to the Sloan Foundation and MacArthur Foundation for financial support.
Question 1: Estimating Inattention

• Empirical: Do consumers buy vehicles that are less energy efficient than their private optimum?

• Example: Hybrid car saves you $5000 in NPV. Are you willing to pay $5000 more for it?

• Empirical challenges:
  • Measurement error
  • NPV calculation parameters: discount rates, expected gas prices, time horizons, survival probabilities, etc.
  • Unobserved costs.
Estimating $\gamma$ for the U.S. Auto Market

![Graph showing Price vs. MPG for the years 1984-2008. The graph plots MSRP (Real 2005 $/000's) against Fuel Economy (MPG). The data points are represented by blue dots, and a linear fit is shown as a black line. There is also a shaded area representing the 90% confidence interval.](image-url)
Using Time-Series Variation in Gas Prices
How Auto Prices Adjust

High-Low MPG Price and Gas Cost

- 1999-2003
- 2004-March 2008
- April-December 2008

Price Difference (Real 2005 $)

Gas Cost Difference (Real 2005 $)
Variation Net of Controls

Conditional Variation Over Time

- Price: High-Low MPG
- G: Low-High MPG
Partial Regression Plot

Double Residual: Base Specification

Price Residual (Real 2005 $)

Gas Cost Residual (Real 2005 $)
Takeaways

• Preferred specification: $\gamma = 0.72$.
  • Emphasize that alternative specifications make a difference.
    • E.g. discount rates, time period analyzed

• Other related empirical projects:
  • Sallee, West, and Fan (2011).
    • Empirical estimates in process.
  • Busse, Knittel, and Zettelmeyer (2011).
    • Corrected results (for used car market) now consistent with Allcott/Wozny preferred specification.
    • New car market results not consistent with used car market.

• Is this from inattention or biased beliefs?
Perceptions and Misperceptions of Energy Costs

• Vehicle Ownership and Alternatives Survey
  • Funded by NSF and Sloan Foundation

• Nationally-representative survey collecting demographics, auto ownership, and beliefs about potential savings/costs from higher/lower fuel economy vehicles.
People don’t think hard about gas costs

**Fuel Cost Calculations at Time of Choice**

- I did not think about fuel costs at all when making my decision.
- I did think some about fuel costs when making my decision, but I did not do any calculations at all.
- I calculated some, but not as precisely as I did just now in this survey.
- I calculated about the same as I did just now in this survey.
- I calculated more precisely than I did just now during this survey.

![Bar chart showing the percent of respondents for different levels of thought about fuel costs at the time of choice.](chart.png)
People are very confused about gas costs
No robust evidence on systematic bias

Table 5: Systematic Overestimation or Underestimation

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>All $\phi_R$</th>
<th>P3</th>
<th>P4</th>
<th>Low Outliers</th>
<th>All Outliers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>Const.</td>
<td>1.14</td>
<td>1.12</td>
<td>0.88</td>
<td>1.33</td>
<td>1.42</td>
<td>1.14</td>
</tr>
<tr>
<td></td>
<td>(0.06)**</td>
<td>(0.06)*</td>
<td>(0.12)</td>
<td>(0.06)**</td>
<td>(0.05)**</td>
<td>(0.03)**</td>
</tr>
<tr>
<td>Obs.</td>
<td>3290</td>
<td>3290</td>
<td>1415</td>
<td>1875</td>
<td>3076</td>
<td>2971</td>
</tr>
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</table>

Quantile Regression at the Median

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>All $\phi_R$</th>
<th>P3</th>
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<th>Low Outliers</th>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
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<td>(6)</td>
</tr>
<tr>
<td>Const.</td>
<td>0.94</td>
<td>1.00</td>
<td>0.7</td>
<td>1.00</td>
<td>1.00</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>(0.02)**</td>
<td>(4.34e-11)</td>
<td>(0.07)**</td>
<td>(0.009)</td>
<td>(0.01)</td>
<td>(0.02)*</td>
</tr>
<tr>
<td>Obs.</td>
<td>3290</td>
<td>3290</td>
<td>1415</td>
<td>1875</td>
<td>3076</td>
<td>2971</td>
</tr>
</tbody>
</table>

*Dependent Variable: Column (2): $\phi_{Ria}$. All other columns: $\phi_{ia}$.

Notes: Excludes flagged observations. Weighted for national representativeness. OLS regression standard errors robust and clustered by $i$. *, **, ***: Statistically different from unity with 90, 95, and 99 percent confidence, respectively.
Question 2: Welfare Effects

• If we think that consumers are inattentive to gas costs, what are the welfare implications?
  • i.e., how to think rigorously about the “internality benefits” from paternalistic policies such as hybrid vehicle subsidies, CAFE standards, and gas guzzler taxes?

• Approach builds on Bernheim and Rangel (2009)
• See Allcott and Wozny (2011) or Allcott, Mullainathan, and Taubinsky (2011) for technical details.

• Stylized intuition on next few slides.
Willingness to Pay for a Gas Guzzler

\[ P \quad \text{Total WTP} \]

\[ p+G \]

\[ p \]

\[ Q \]
Rational Model: Effect of Tax

Total WTP

\[ \text{Total WTP} \]

\[ p+G \]

\[ \tau \]
Equilibrium Under Inattention

\[ \text{Total WTP} = p + \gamma \cdot G \]

\[ p + G \]

\[ p + \gamma \cdot G \]
Effect of Gas Guzzler Tax Policy

\[ \text{Total WTP} = p + \gamma \cdot G \]

\[ p + (1 - \gamma) \cdot G \]

\[ p \]
Welfare Implications
Welfare Implications

Total WTP

Hedonic CS Loss
Welfare Implications

- Total WTP
- Welfare Gain
Additional Modeling Results

• CAFE standards may be more aggressive than merited.
  • Allcott/Wozny optimum: 1 MPG higher than baseline equilibrium
  • New CAFE standard: 7 MPG above previous CAFE standard!

• The model of inattention matters for what policies we advocate.
  • 72% of customers fully attentive, 28% fully inattentive?
  • All consumers 72% attentive?

• Heterogeneity in $\gamma$ means that targeting is important.
  • Examples: landlords/tenants, greens/inattentives, liquidity constrained/liquid.
Additional Policy Questions

- EPA/DOE are now in the business of regulating internalities, instead of externalities. Are they equipped for this?

- Many of the investment inefficiencies (inattention, credit constraints, imperfect information, landlord-tenant) affect many goods other than energy. Why devote so much extra attention to energy?
Unanswered Questions

• Measuring $\gamma$ in different settings
  • How do consumers (and businesses) actually value energy efficiency? Cars? Factories? Universities? Toaster ovens?

• If $\gamma < 1$, understanding why.
  • Inattention, beliefs, credit constraints?
  • Policy choices depend on the specific model of inattention (Allcott, Mullainathan, and Taubinsky 2011).

• What is the role of the firm?
  • Manufacturers and retailers can nudge consumers toward or away from the energy efficient product. How well are they doing this? What are their incentives? How can we change them?
Takeaways

• It may be correct that consumers are inattentive to energy costs when they buy energy-using durables.
  • We are still cautious with the empirical results. Yet our government is betting $128 billion on it!

• Suggests that correctly-calibrated standards and subsidies/taxes might improve welfare.
  • Allcott/Wozny calibration suggests that CAFE is far too aggressive
  • Ideally energy efficiency policies would be targeted toward consumers that are misoptimizing, without distorting consumers that are not.