Consumer Responses to Fuel Economy/GHG Standards

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Topics I Will Address Today

• Some thinking on the “rebound effect”
  – Microeconomic
  – Macroeconomic

• Relevant work-in-progress

Time permitting:
• Vehicle choice modeling results on vehicle price and cross-price elasticities
Rebound Effect

These thoughts are primarily from a paper co-authored with David Rapson and Gernot Wagner (in review at REEP)

Key questions:

• When we increase fuel economy...
  – How much more will people drive?
  – How much will they spend on other goods and services?
  – How much will other countries increase oil consumption?
  – How much substitution to vehicles will there be?
Microeconomic Rebound Effect

This is just the substitution and income effect

• Lower the cost per mi of driving and consumers substitute towards more driving
• If they spend less on driving, they may spend more on other energy-using goods or services

Both will reduce energy and GHG savings...

...question is “how much?”
Microeconomic Rebound Effect

To quantify:

• Use price elasticities of demand for the substitution effect and “a slice” of the income effect (direct effect)
  – Not perfect, several caveats
  – Estimates range widely
  – Our view: most reliable estimates range from -0.05 to -0.3

• Ideally use estimates of where the next marginal dollar is spent for the remaining income effect (indirect effect)
  – Estimates using average spending tend to hover around 0.1

Note a higher direct effect means a lower indirect effect
What We Want to Know

• Can we use a fuel price elasticity of driving demand?
  – Or do consumers respond differently to fuel prices than to changes in fuel economy?

• How does this effect vary...
  – Across states?
  – Across different income groups?
  – Across different geographic areas?
  – Across different types of vehicles (Chris’ work)

• Will the increase in vehicle cost from standards eliminate the income/indirect effect?
Macroeconomic Leakage Rebound

Consider the global oil market

• If we reduce oil use in the US, what happens?
  – Oil demand shifts in and the global price drops
  – Other countries demand more oil as the market re-equilibrates

• This effect *could* be large and should be examined more carefully
Macroeconomic Growth Rebound

1. Sectoral Reallocation
   - Substitution effects at a macro level
   - Size depends on whether energy services and other goods/services are complements or substitutes

2. Induced Innovation
   - Is there induced innovation that leads to more energy use?
   - No solid evidence currently, also depends on counterfactual
   - Note clearly welfare-improving

3. Fiscal Multiplier effect
   - Exacerbates above effects when there are “idle resources”
   - Debate in macro literature as to magnitude
Macroeconomic Growth Rebound

One key point:

*If the energy efficiency policy has a significant cost, we should not worry about the macro growth rebound effect*

But unanswered questions with little to guide us:

- How large is the sectoral reallocation?
- Do we really see induced innovation leading to more energy use?
Work-in-Progress on the Elasticity of Driving

• Heterogeneity by demographics (CA data)
  – Distributional consequences of policy
• Difference in fuel price and fuel economy elasticity
  – Plan to examine across several states (CA/CT/MA)
• Heterogeneity in the elasticity of driving (PA data)
• Prius Fallacy
  – MA annual inspection data
• Driving elasticity and access to public transport
  – Data from Denmark
Other Relevant Work-in-Progress

• Dynamic modeling of fleet turnover and utilization
  – Modeling the purchase, use, and scrappage decision in CA
• Dynamic modeling of the diffusion of EVs
  – Modeling the buy-or-wait decision of EV purchasers in CA
• Theoretical work on feebates versus CAFE standards
  – A feebate can be designed to exactly match any CAFE standard
  – A parallel distinction between feebates versus CAFE and a carbon tax versus a cap-and-trade under uncertainty
Price Elasticities of Demand for Cars

Two components

1. Own-price elasticity: how will the sales of vehicles change?
2. Cross-price elasticities: how will the sales of different vehicles change when prices of other vehicles change?

Useful for understanding how the fleet will evolve under CAFE/GHG standards.

– Of course, complicated by other attribute changes
Price Elasticities of Demand for Cars

Gillingham (2012) estimates a vehicle choice model for new vehicles in California

These estimates are updated preliminary estimates based on the latest estimation:
- Own-price elasticity: varies by make/model, but is largely in the range of 1
- Cross-price elasticity: again varies by make/model. Key point is that it is small across classes and large within classes

These estimates are consistent with older estimates (e.g., BLP)