The Economics of Automobile Fuel Economy Standards

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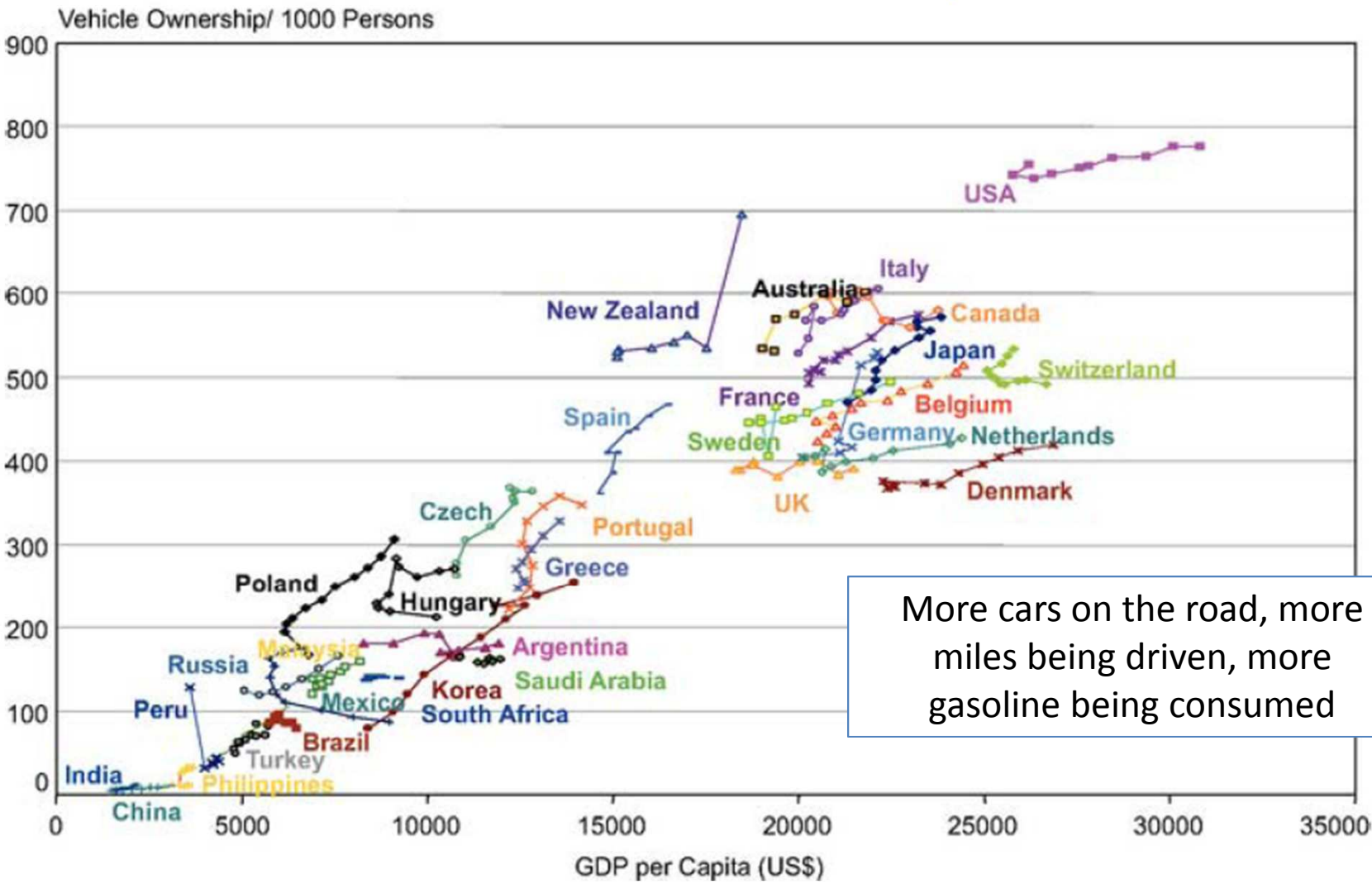
Agenda for today's talk

- How do economists view fuel conservation?
- How do fuel economy standards work in theory and in practice?
- How do consumers respond to gas prices?

An economist’s view of fuel use and fuel conservation

Lots of cars, and more to come



More cars on the road, more miles being driven, more gasoline being consumed

Fuel consumption has side-effects

- **Greenhouse gas emissions** (proportional to gallons)
- Local pollutants (e.g., VOCs, NOx, CO, and PM)
- Traffic congestion
- Accident risks
- Road noise
- Highway maintenance
- Urban sprawl

Mainly related to miles

- *Side-effects should contribute to overall cost*

Side-effects lead to over-use

- You only pay price at the pump, which does not include many side effects
- Market price too low, overconsumption of fuel
- *Economists overwhelmingly favor charging a per-gallon fee that reflects social side-effects*

There are many ways to save fuel

- New technologies (e.g., hybrid)
- Engine size and power
- Smaller vehicles
- Drive less (e.g., walk or bus)

There are many ways to save fuel

- New technologies (e.g., hybrid) [vehicle cost]
- Engine size and power [towing, acceleration]
- Smaller vehicles [personal safety, cargo space]
- Drive less (e.g., walk or bus) [convenience]

- *All of these approaches involve a tradeoff for consumers and/or automakers*

Two implications

- To save fuel, we must give up other things we value (e.g., money, time, miles, attributes)

- We should do stuff that saves fuel at low cost
- For example, …

- Same thinking applies to reducing CO2 (or SO2 or NOx) across different sources and sectors

So which actions make sense?

- Best approach varies greatly across consumers
- Per-gallon fees optimal because consumers decide which actions are best for them
- "Taxes hurt working families"
  - We can use tax revenue to reduce income taxes and/or expand aid to low-income families

Fuel economy standards in theory and in practice

What are fuel economy standards?

- Corporate Average Fuel Economy (CAFE) standards from about 1978-2010
  - Each automaker faces average MPG standard
  - Separate standards for cars and trucks
  - Banking and borrowing, $55/mpg penalty

- Recent reforms starting about 2011
  - Size-based standards
  - Credit trading across cars-trucks, automakers
  - CO2-per-mile standards very similar (AC changes)

Economics of CAFE standards

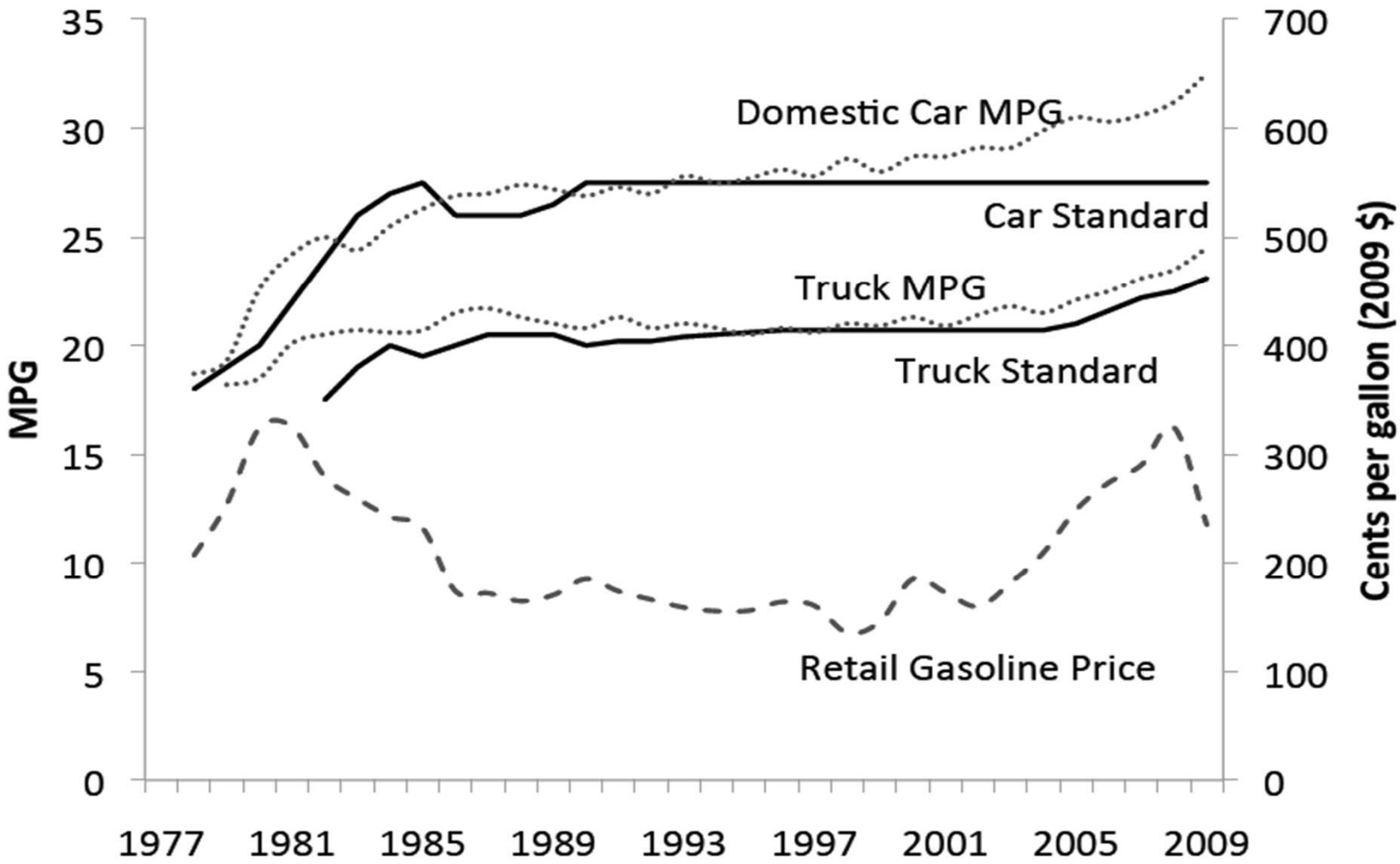
- Consumer choice: prices, attributes, gas price
- Automakers: prices, attributes, models
- Constraint: average MPG ≥ standard
- Three options
  1) Change prices / shift market shares (short-run)
  2) Modify attributes (medium-run)
  3) New models and technologies (long-run)
- Standards act like “tax” on inefficient vehicles and “subsidy” for efficient vehicles

Does CAFE give this incentive?

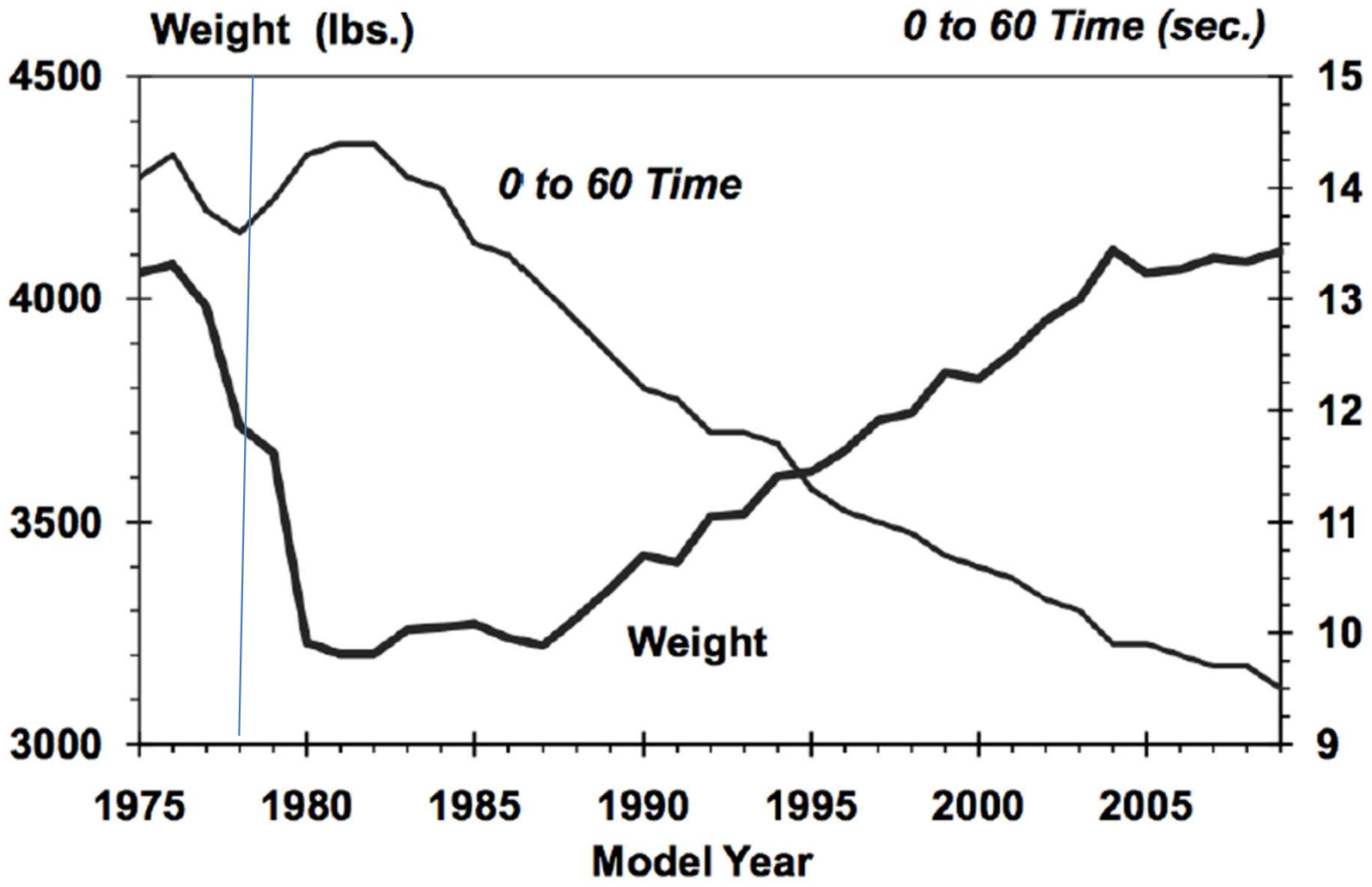
- New technologies (e.g., hybrid) – YES
- Engine size and power – YES
- Smaller vehicles – YES (until recent reforms)
- Drive less (e.g., walk or bus) – NO, drive more!

- Fuel taxes superior because they reduce miles
  - Saves fuel at low cost, mitigates other side-effects

Fuel economy standards in practice



Changes in vehicle attributes

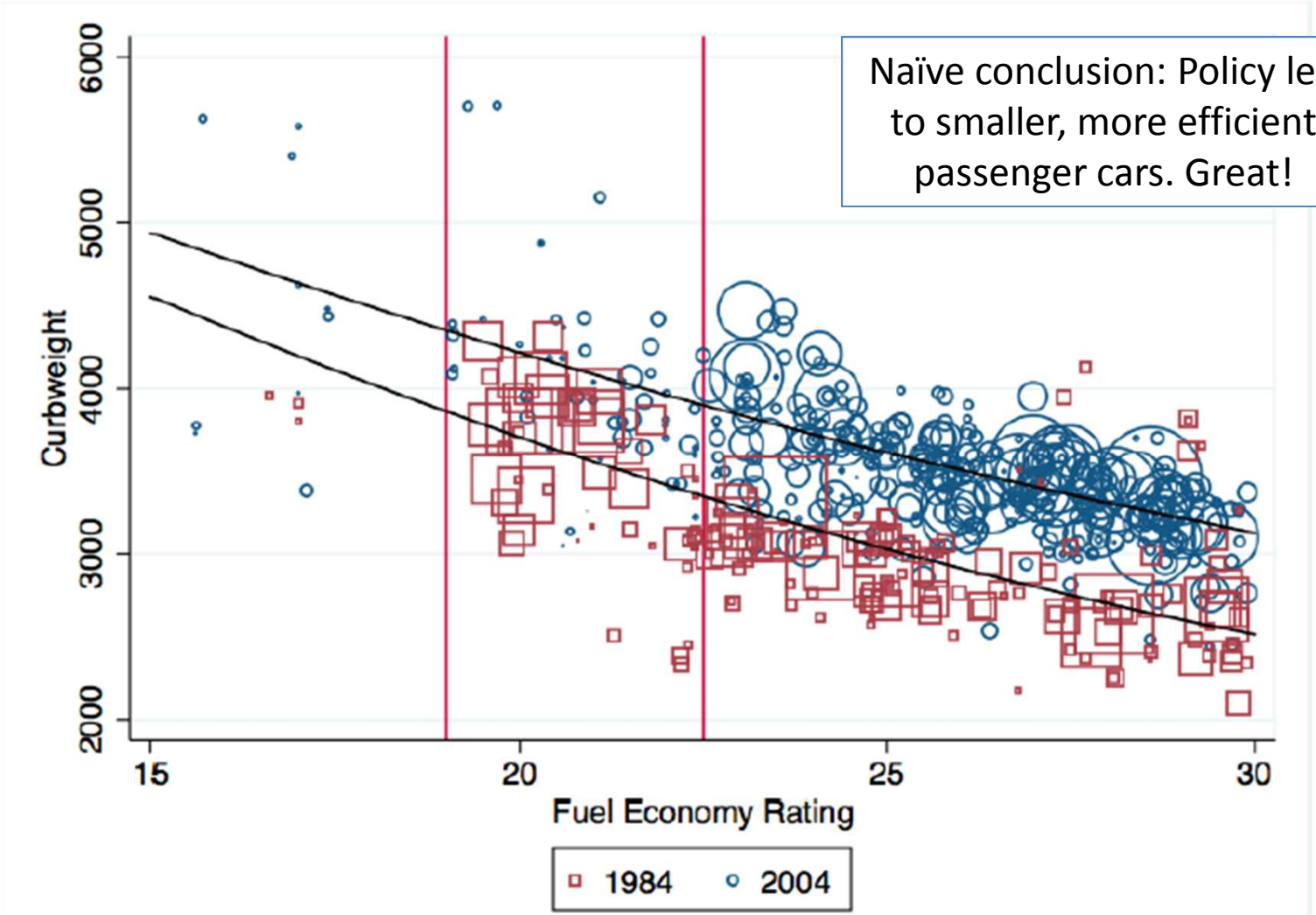


Five program design flaws

1) Separate standards for cars and trucks
2) Automakers face standards individually
3) Flexible-fuel incentive / loophole
4) Size-based standards
5) State vs. Federal standards?

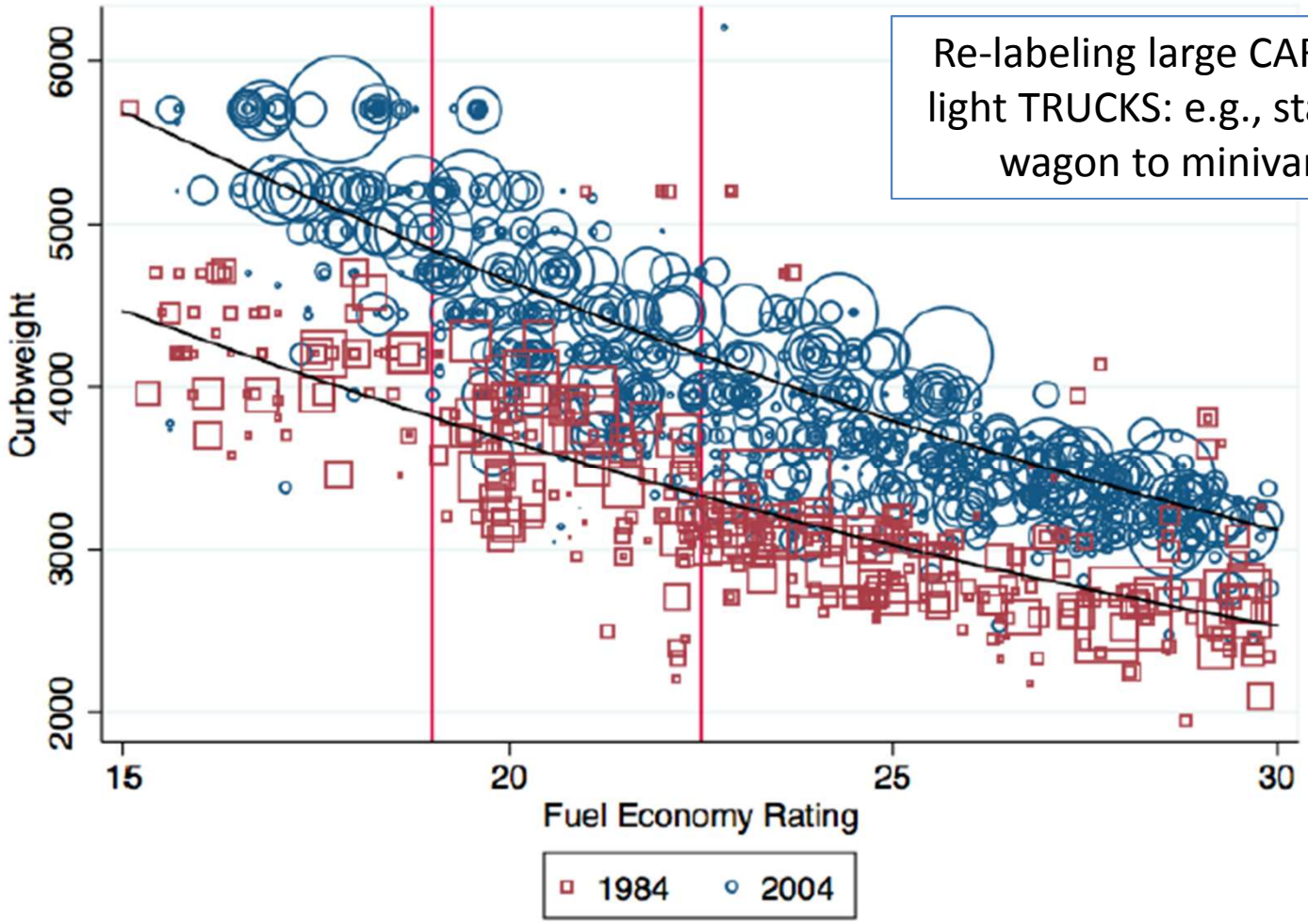
- *Some of these issues have been addressed in the most recent sets of reforms, others remain*

1) Passenger cars more efficient



Naïve conclusion: Policy led to smaller, more efficient passenger cars. Great!

1) Overall fleet not more efficient

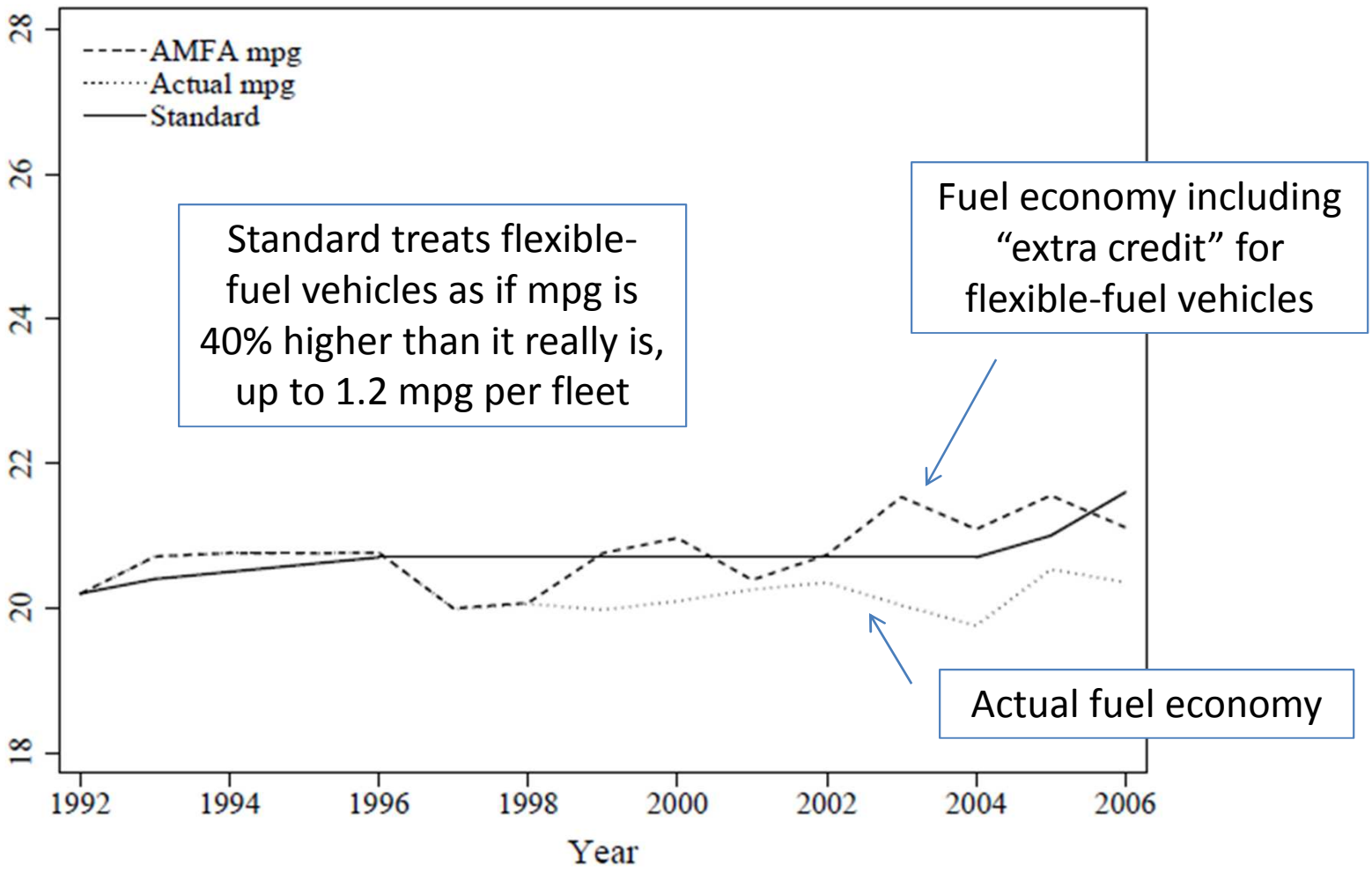


Re-labeling large CARS as light TRUCKS: e.g., station wagon to minivan

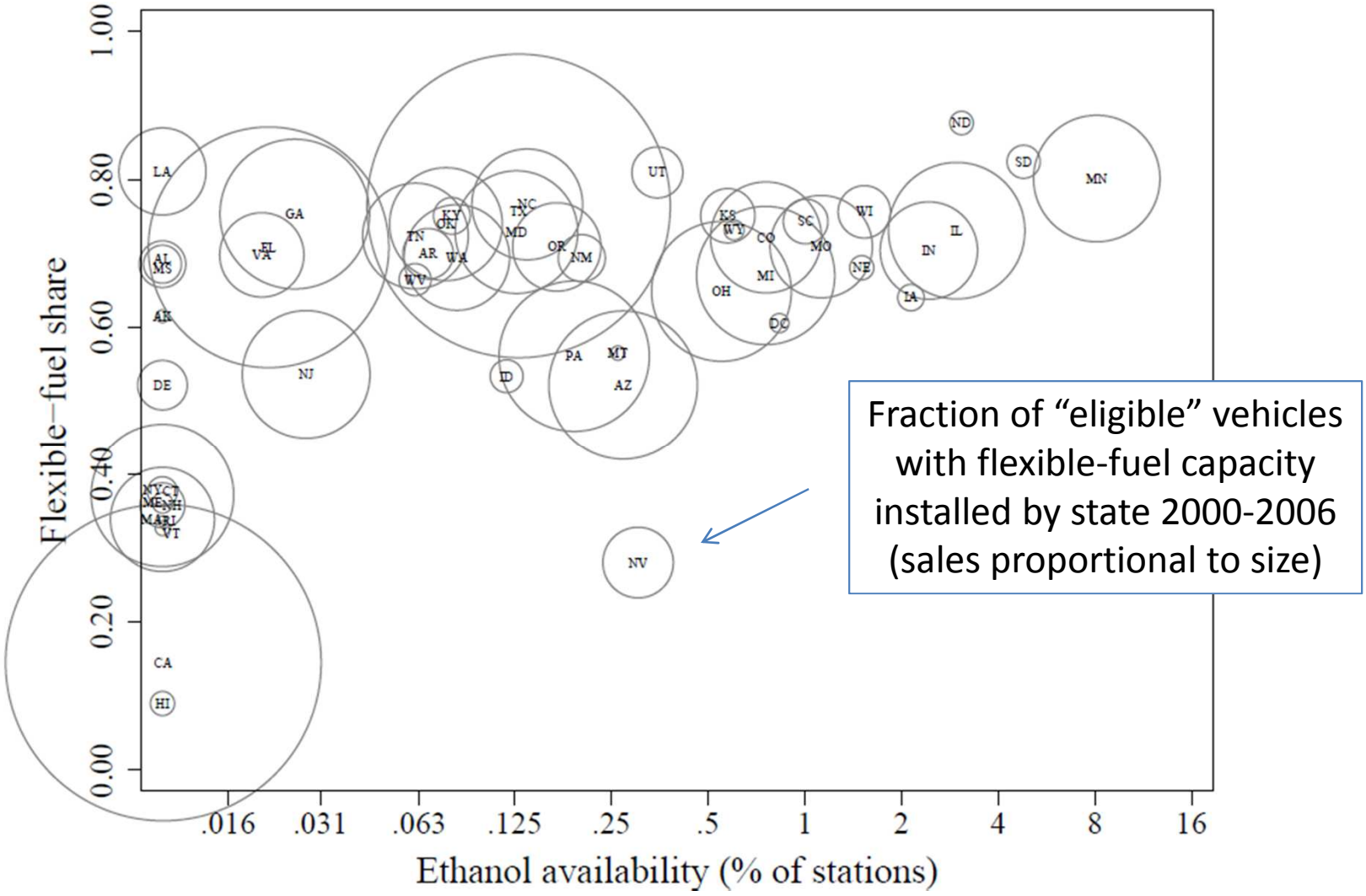
2) Individual standards

- Historically, domestic automakers constrained, while Japanese automakers not constrained
  - Japanese automakers had no incentives
  - Constraints on domestic firms allowed other firms to produce large cars and SUVs instead
- In theory credit trading should help, but credit trading works poorly with few firms

3) Generous flexible-fuel incentives



3) But few cars use ethanol (so far)



4) Size-based standards

- Smaller vehicles face more stringent standards

- Automakers share “burden” more equally
- Mitigates incentive to “re-label” cars as trucks
- Flexibility in face of shifting consumer demand

- But greatly reduces incentive to down-size, which is a really low-tech way to save fuel

4) What about safety?

- Smaller vehicles offer less protection in crashes
- But smaller cars much less dangerous to <u>others</u>
- We have an “arms race” in vehicle size / weight
- Anderson and Auffhammer (2011) calculate that $1 gas tax is appropriate counterbalance

5) State vs. Federal standards

- Presence of federal CAFE undermines state's ability to reduce CO2 emissions by setting stricter standards (Goulder et al. 2011)

- States should create incentives not found in federal CAFE (e.g., smaller cars, less driving)

So how much does CAFE cost?

- Estimate how much consumers value miles and attributes, estimate cost of improving mpg
- Then predict how consumers and firms respond to policy changes (prices, sales, attributes, miles)
- Qualitative results: CAFE is much costlier than tax
  - Tax improves efficiency AND reduces miles
  - Standard increases miles, exacerbates side-effects

Consumer responses to higher gasoline prices

Consumers drive less, buy less fuel

- Davis and Kilian (2010) estimate what happens when states increase fuel taxes
- A 10% increase in retail gasoline prices leads to an immediate 5% decline in fuel demand
- Thus, a $0.40 tax in CA saves 5% today

Consumers buy more efficient cars

- Busse, Knittel, and Zettlemeyer (2010) estimate what happens to sales shares

- A $1.00 increase in gasoline prices leads to a 7% increase in market share for efficient models, 5% decline for inefficient models

- Long-run effects will be larger after firms have time to adjust models, production

Consumers scrap big cars sooner

- Li, Timmins, and Von Haefen (2008) estimate what happens to vehicle scrappage
- Higher gasoline prices extend lives of efficient cars, hasten scrappage of inefficient cars
- This is a great “cash-for-clunkers” program!

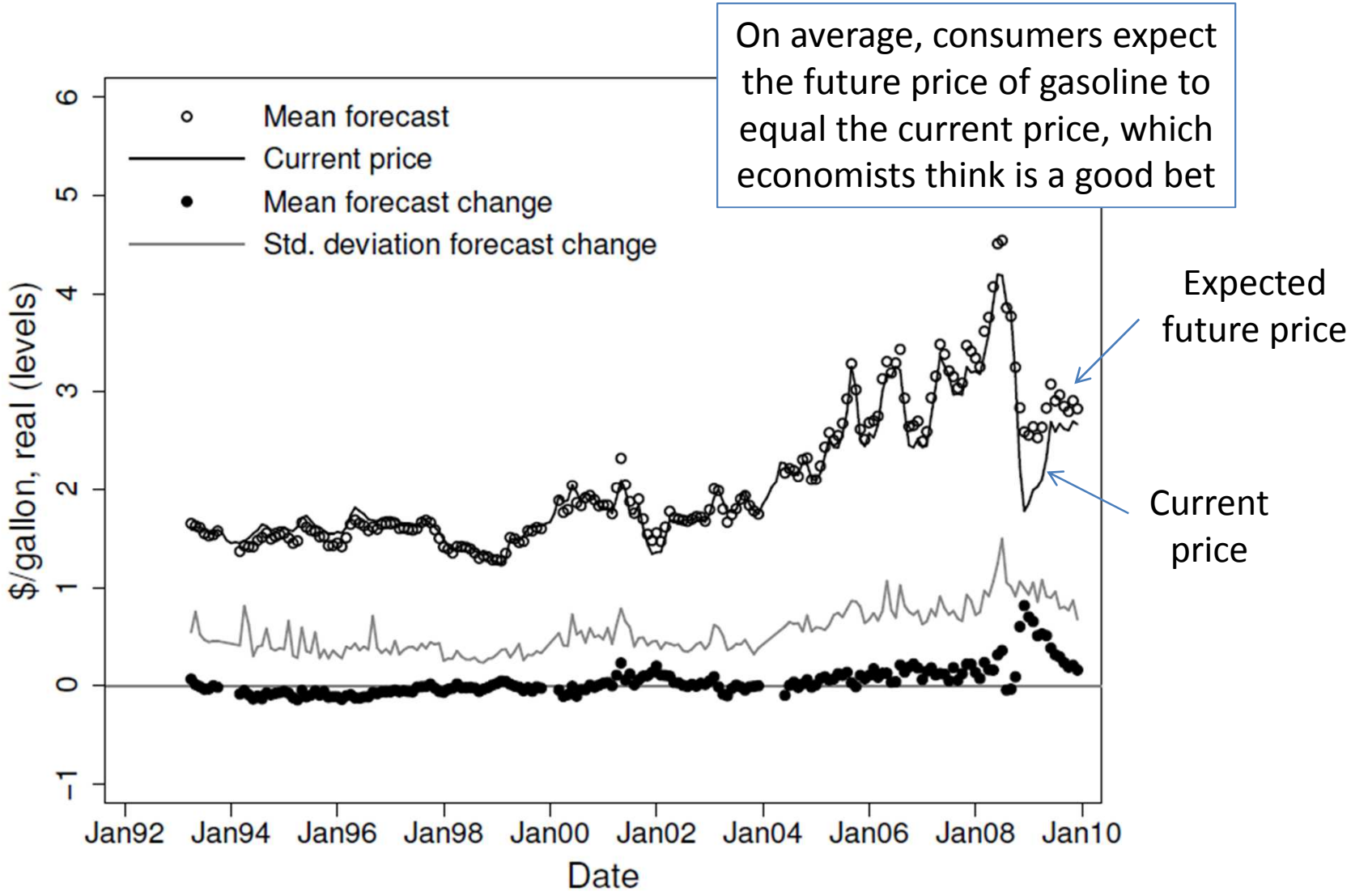
Evidence of undervaluation?

- Suggestion that consumers “undervalue” fuel economy, justifying CAFE (EPA-RIA 2010)
  - Fuel taxes still better policy (Anderson et al. 2011)

- Test: Do prices for used cars re-adjust enough?
  - Empirical evidence is mixed, inconclusive

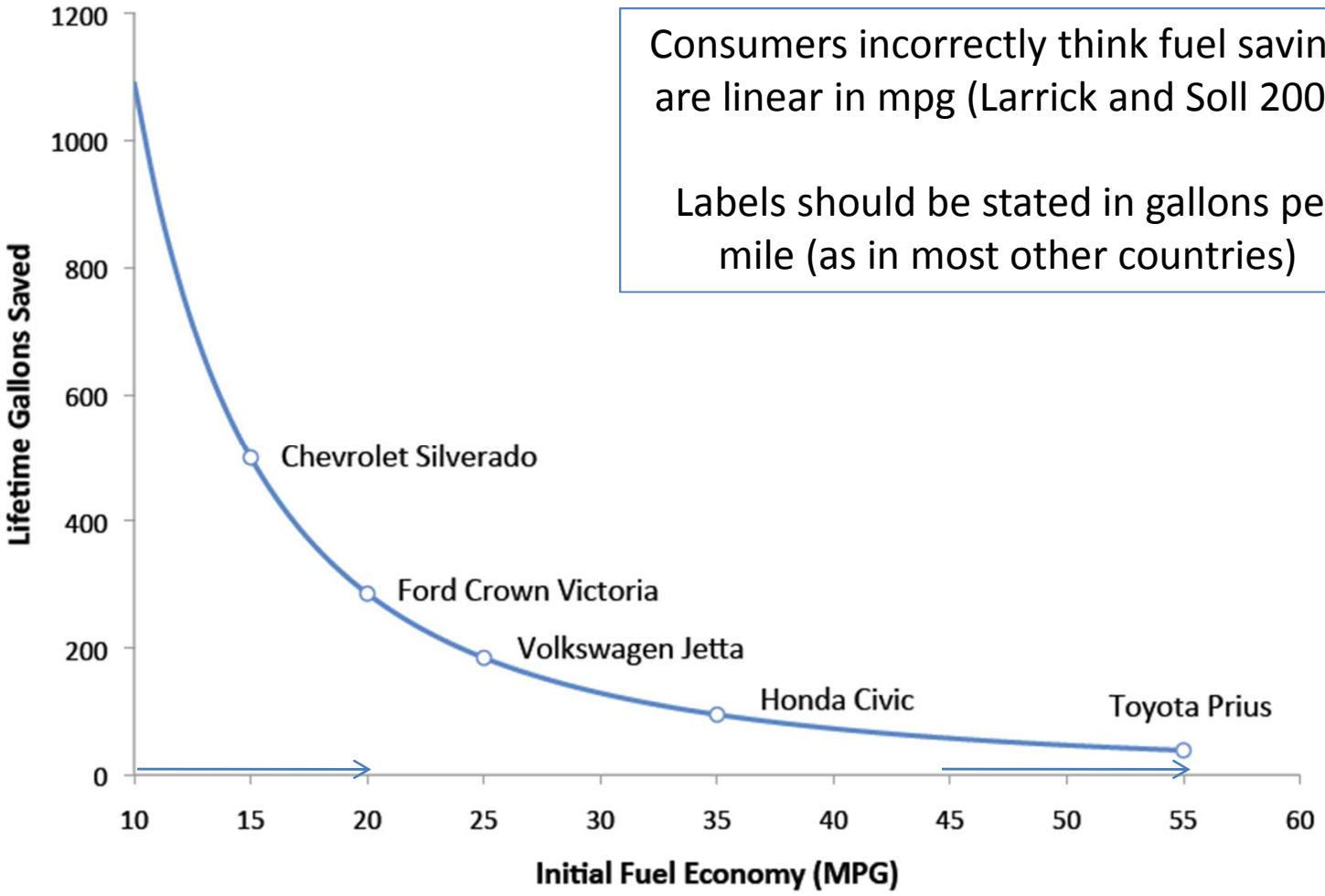
- Do consumers hold reasonable beliefs about future gasoline prices?

Consumers have reasonable beliefs



Policy recommendations

We need better labeling



Consumers incorrectly think fuel savings are linear in mpg (Larrick and Soll 2008)

Labels should be stated in gallons per mile (as in most other countries)

Feebates are similar to CAFE

- Direct “fees” and “rebates” for inefficient and efficient vehicles, mimics CAFE incentives

- Differences relate to uncertain car demand
  - CAFE sets backstop, only works when binding
  - Feebates are always working, but no backstop

- Neither feebates nor CAFE reduce miles driven

So what if gas tax is not possible?

We could better approximate incentives of tax:

1. Make the standards as broad as possible

2. Use feebates that give incentives for sales shifting, attributes, technology, and size

3. Mitigate increase in miles using fee on VMT (or fees on congestion, per-mile insurance)

Conclusions

- CAFE saves fuel but is relatively costly
- Fuel taxes superior because they reduce miles
- Strong evidence that firms and consumers respond as expected to higher gasoline prices
- Keep pushing taxes, while refining standards

Support empirical research!