Policy Issues for a Global Fuel Economy Initiative

DR DAVID L GREENE
UNIVERSITY OF CALIFORNIA AT DAVIS
OAK RIDGE NATIONAL LABORATORY

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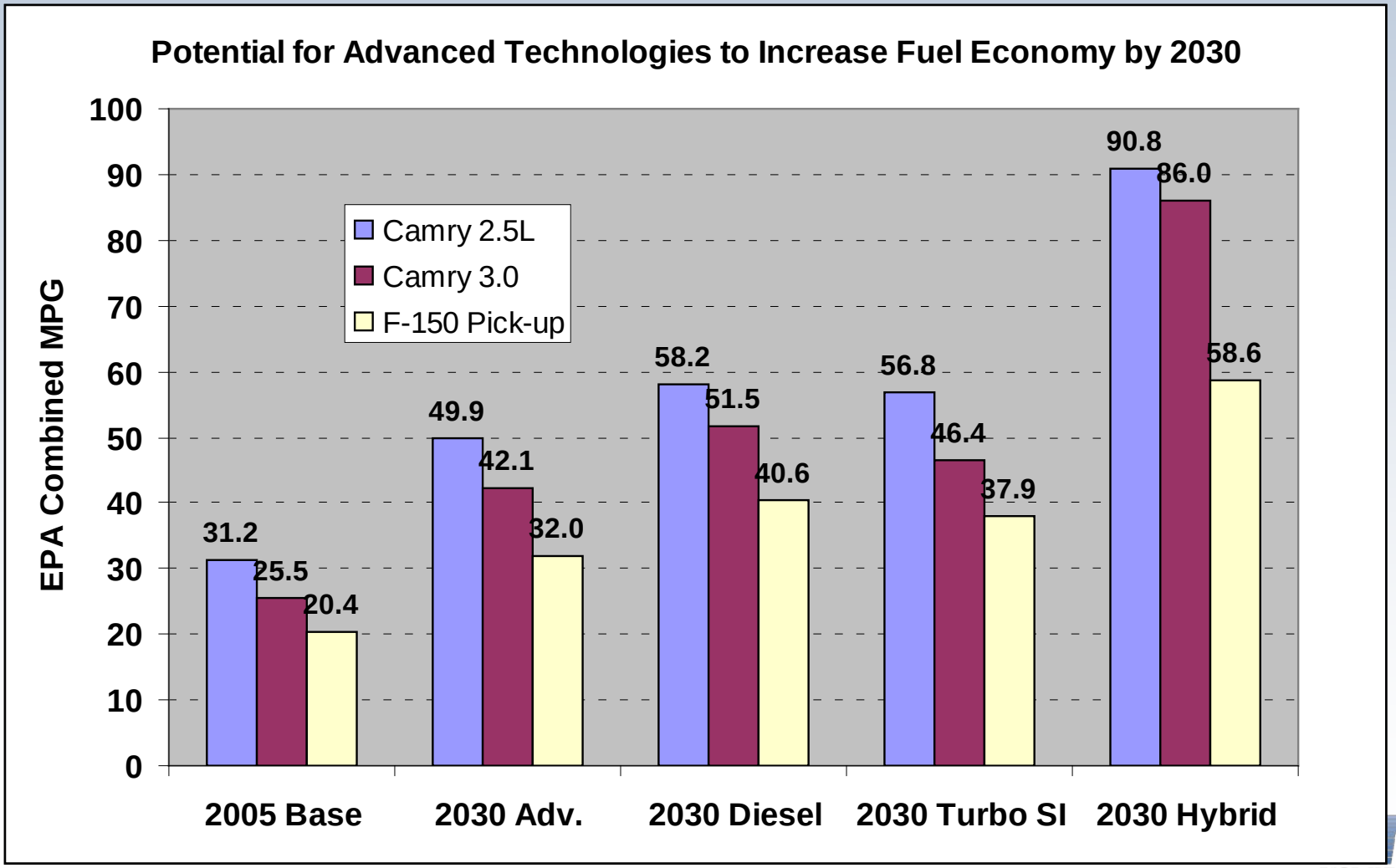
Why fuel economy policies?

- To obtain public goods:
  - Greenhouse gas mitigation:
    - Gt CO2 eq per year from onward
  - Improved energy security:
    - Billion barrels per year less oil use by
  - Contribute to achieving sustainable energy use
    - One third of global conventional oil resources to be used in the next years
- To address market "failure" and first cost bias due to

Since the 1970s numerous studies have shown large technological potential for cost-effective fuel economy improvement at constant vehicle size and performance. Why have standards been needed to realize these improvements?



Source: Kasseris & Heywood, SAE Technical Paper 2007-01-1605, April, 2007.

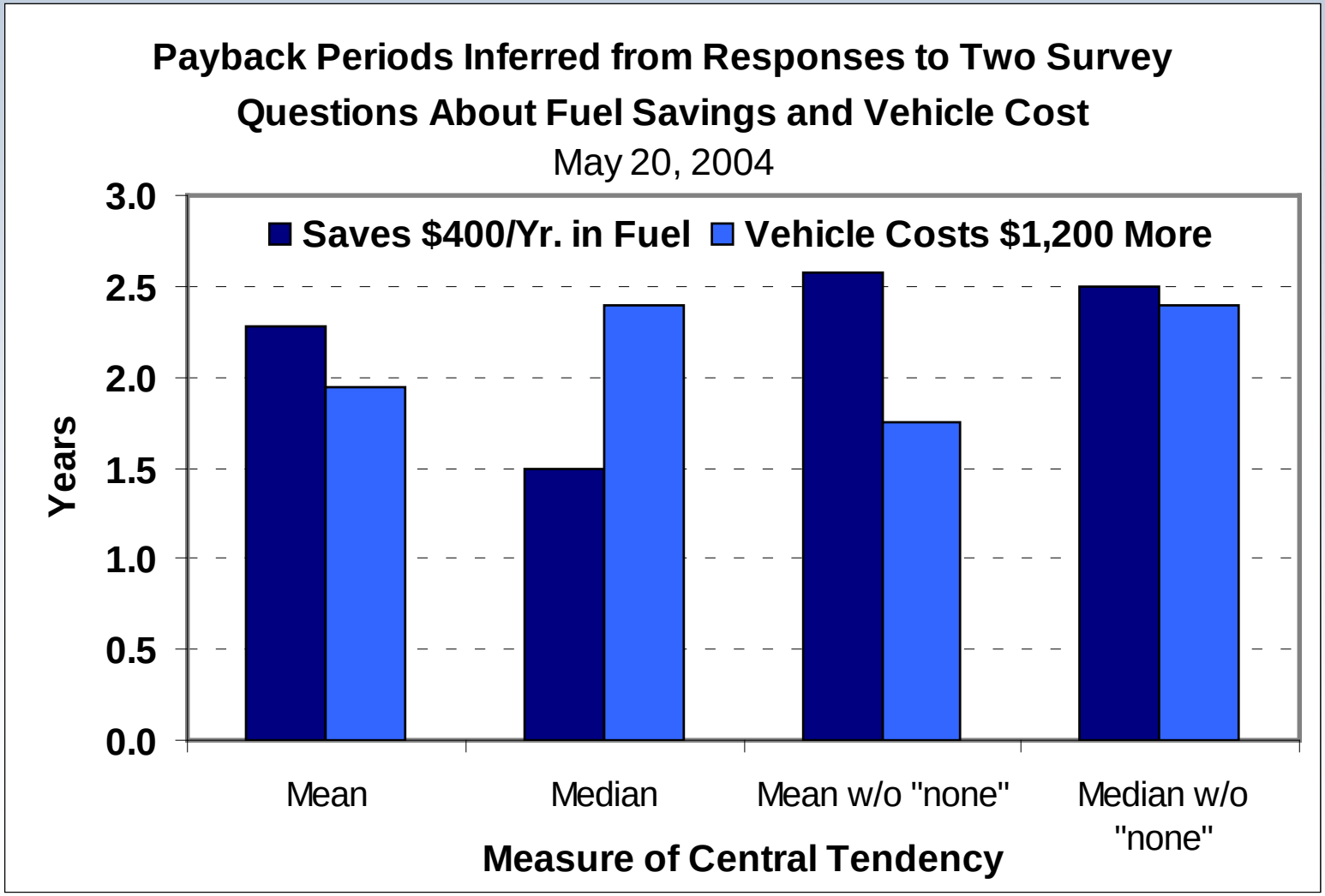
There are many flaws in the market for fuel economy. First cost bias due to uncertainty and loss-aversion may be the most important.

- Principal Agent Issues
- Information Asymmetry
- Transaction Costs
- Bounded Rationality
- External Costs
  - GHG Emissions
  - Energy Security
  - Mass Advantage in Collisions
- Relative Utility of Performance Size

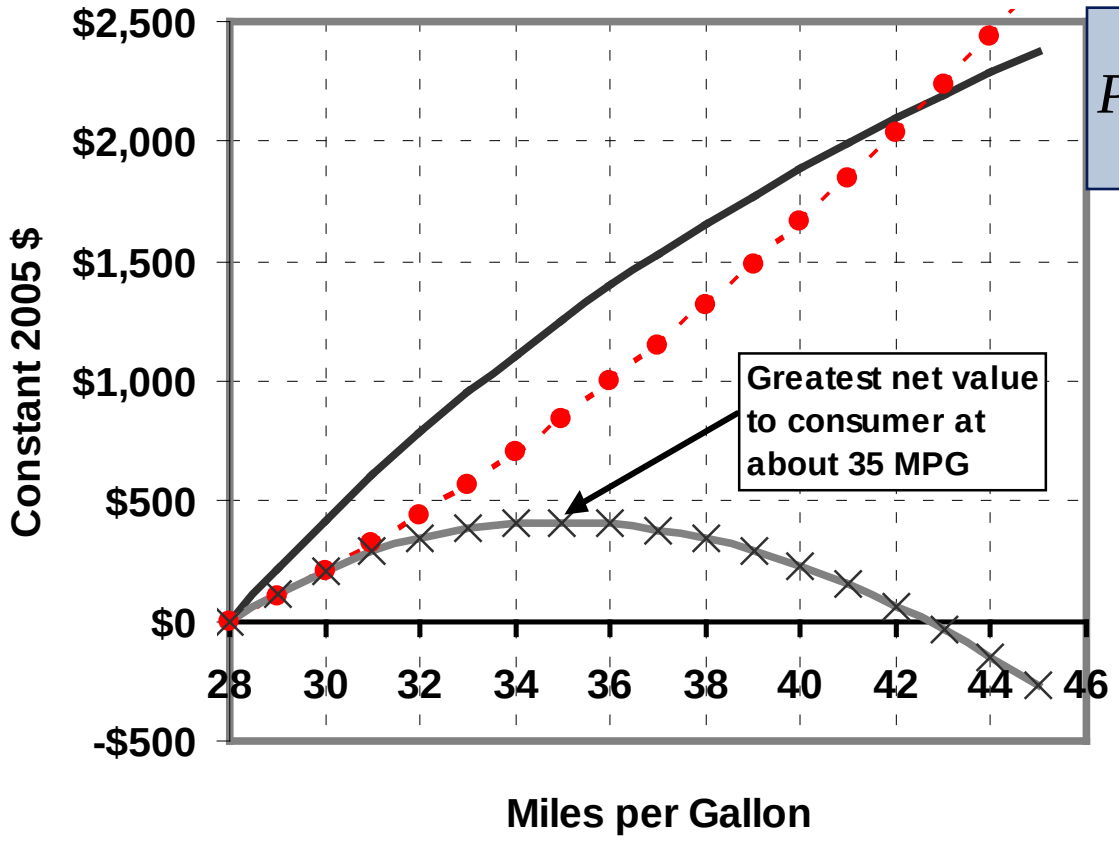
Acting on the car buyer's behalf (agent), manufacturers decide whether to:

- Decline to adopt fuel economy technology
- Adopt and use to increase mpg
- Adopt but use for other attributes
  - Horsepower
  - Size and weight
  - Off cycle accessories
- Manufacturers believe

Asked about fuel economy payback, consumers respond with short payback periods. But few actually think about gas mileage in financial terms as Turrentine & Kurani's study (*Energy Policy 2007)* demonstrated.



Rational economic model: NAS (2002) estimates implied that a 25% increase in MPG would be optimal. (No uncertainty.)



$$PV = \int_{t=0}^{L} P_t M_o e^{-\delta t} \left(\frac{1}{E_o} - \frac{1}{E_1} \right) e^{-rt} dt$$

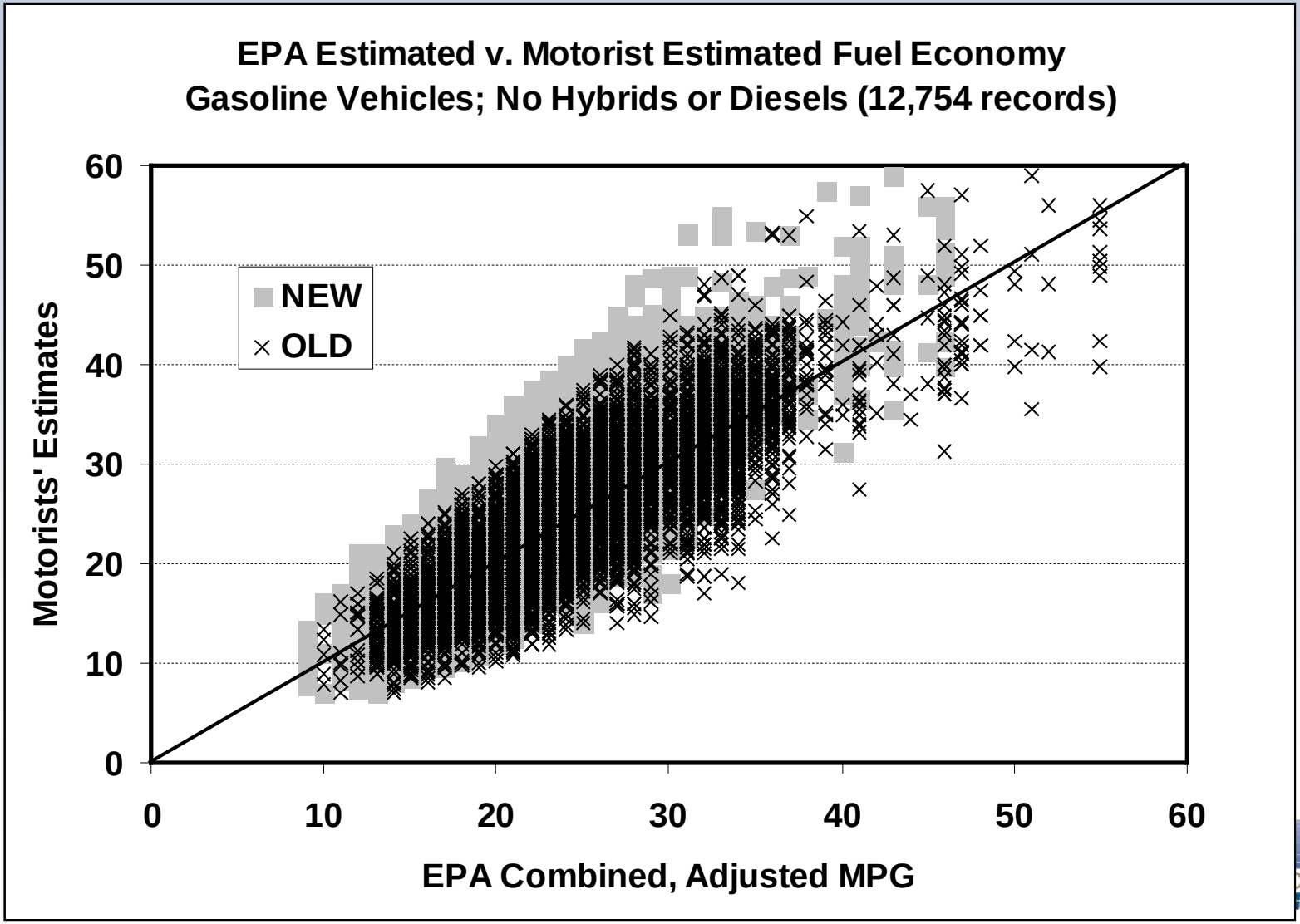
Assumes cars driven 15,600 miles/year when new, decreasing at 4.5%/year, 12% discount rate, 14 year vehicle life, $2.00/gallon gasoline, 15% shortfall between EPA test and on-road fuel economy.

In reality, uncertainty makes higher fuel economy a *risky bet*.

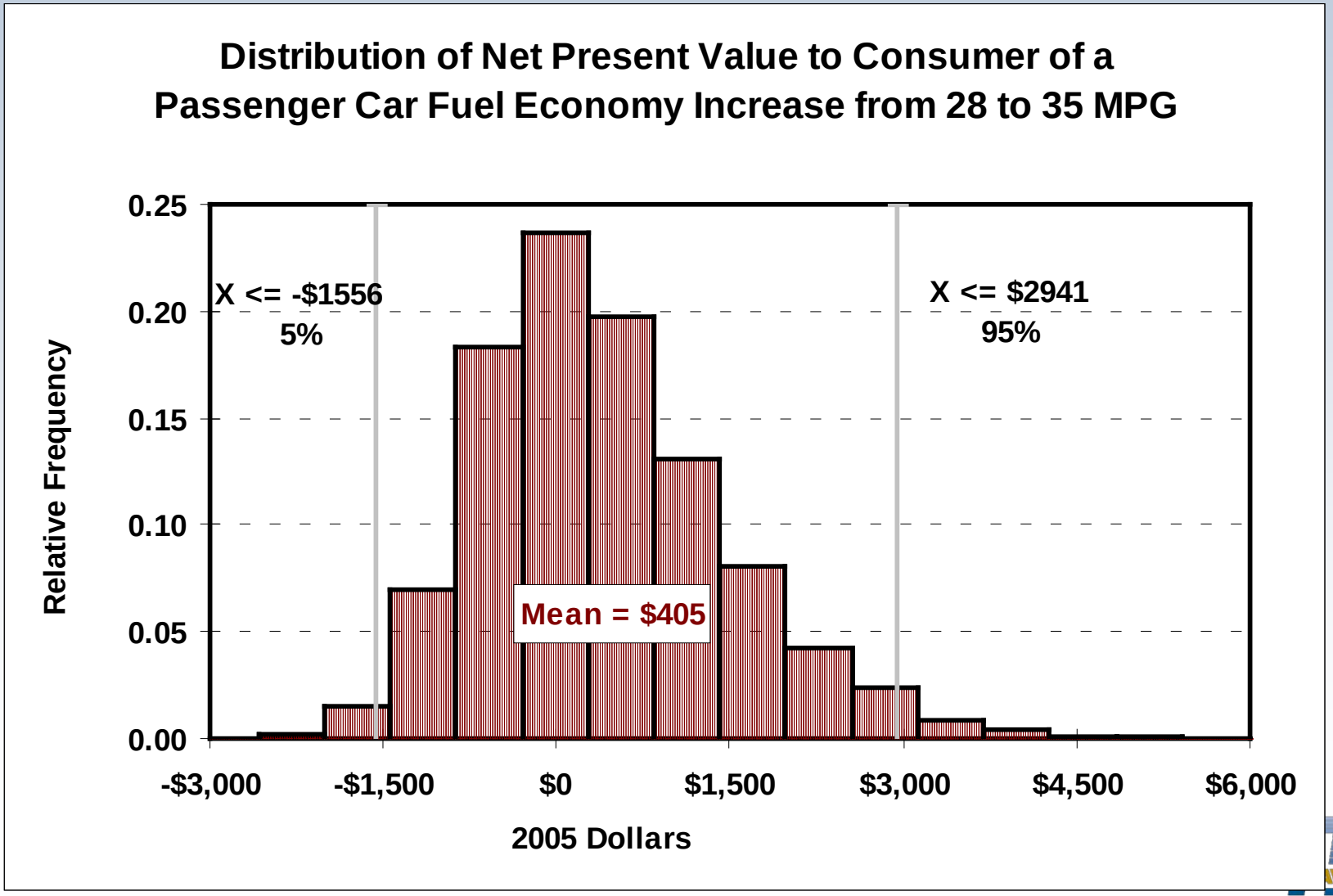
- "Yes, there's a fuel economy label but what will I get?"
- "What will gasoline cost (over 10-15 years)?"
- "How much driving will I do?"
- "How long will my car last?"
- "How long will I last?"
- "What will I have to give up to get better fuel economy?" (cost performance weight

Unlike test fuel economy, on road fuel economy is highly uncertain.

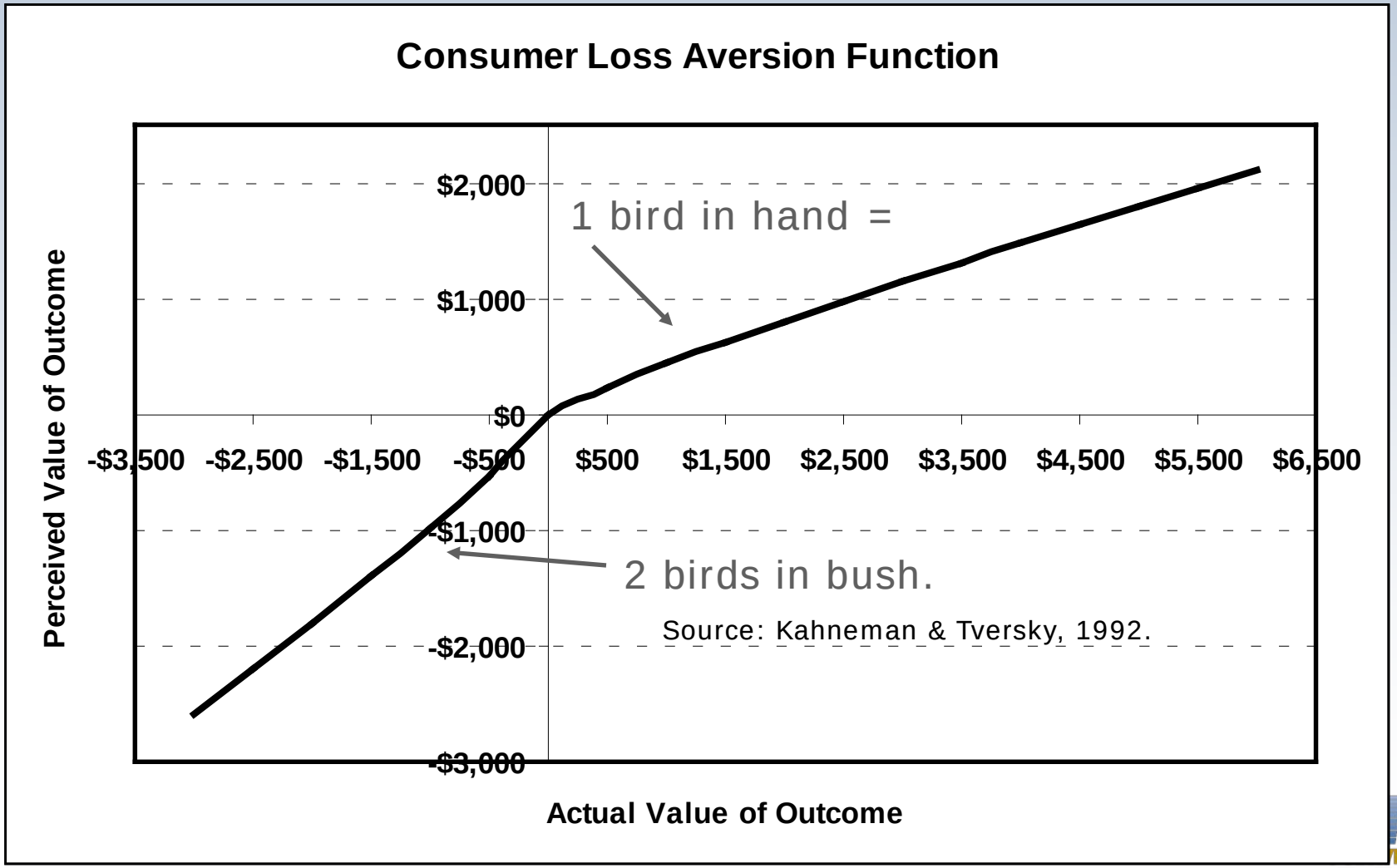
(Based on MPG data from15,000 motorists, 2 std. dev. around the EPA estimate is +/- 7.4 MPG.



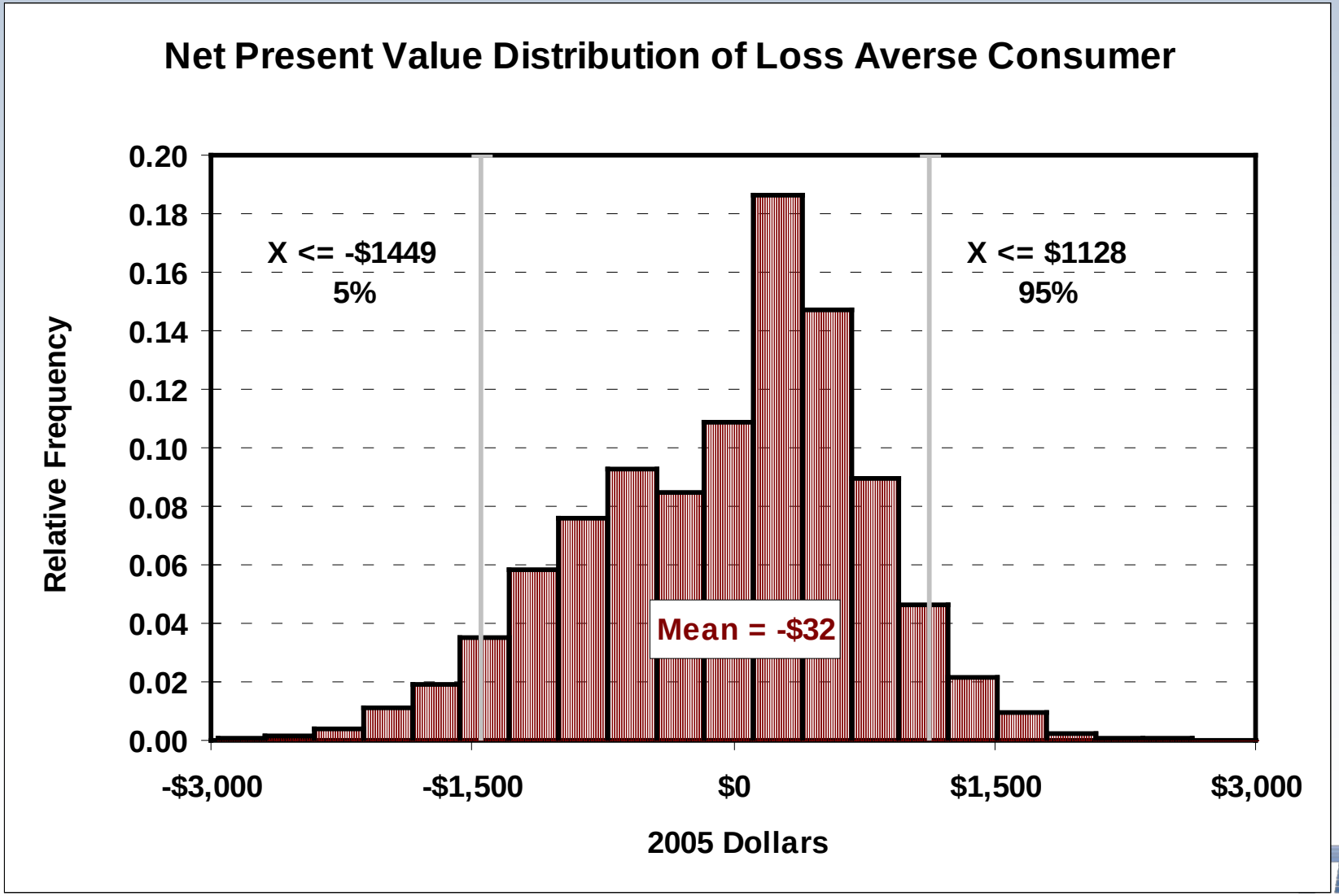
A simulation with uncertainties indicates that the fuel economy bet (28 to 35 MPG) has an *expected present value* of $405. (Other assumptions same as rational model above)



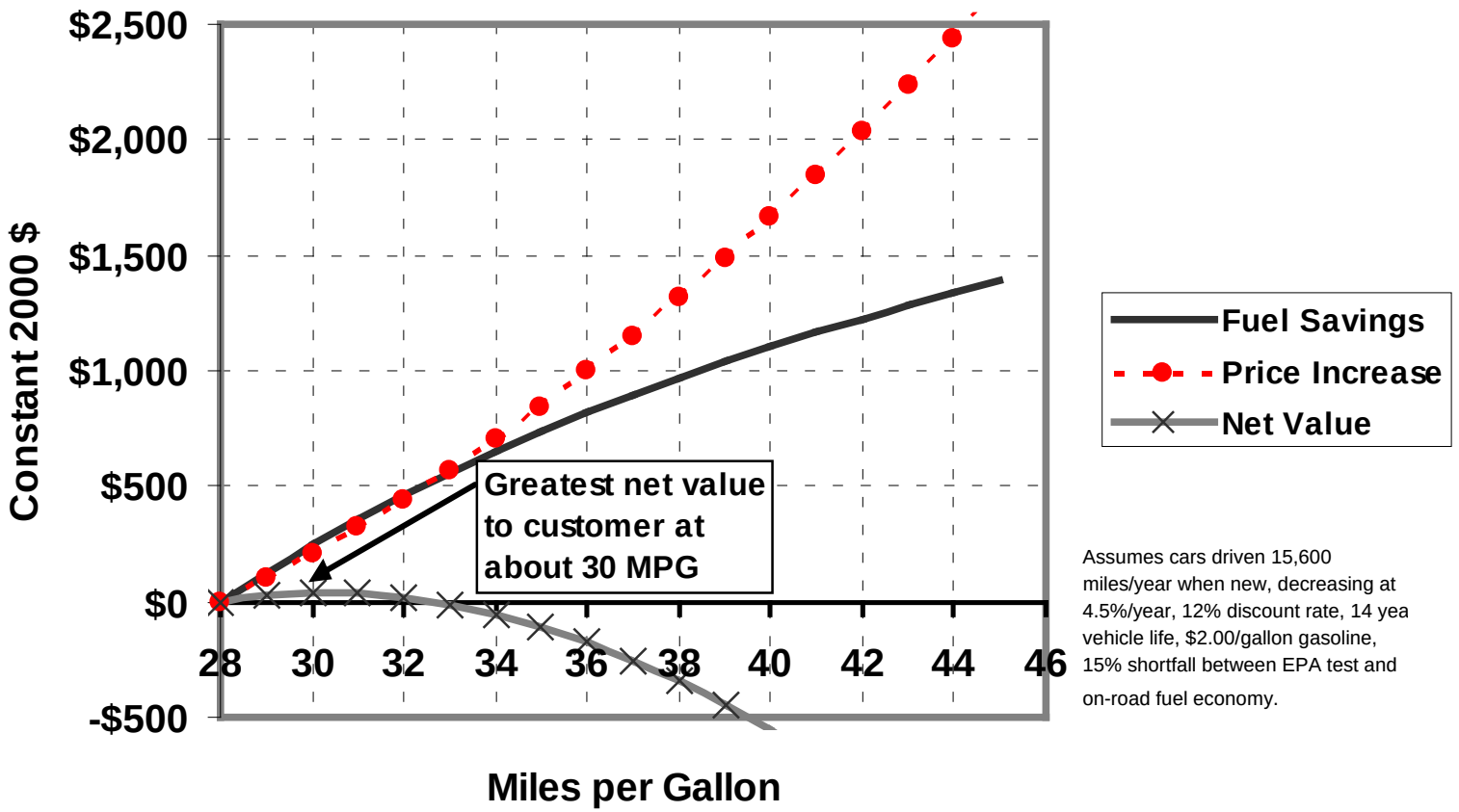
Nobel prize-winning economic research has shown that consumers are loss-averse: perceived value of (loss of $X > gain of $X).



Applying typical consumer loss-aversion changes the perceived value of the fuel economy bet to -$32.



The practical effect of a 3-year payback vs. loss aversion & uncertainty are essentially the same.



The implications of this theory are profound.

- Consumers are not irrational
  Manufacturers are not anti social
- It's just that benefits are in the future and uncertain and consumers are loss averse
- Consumers *probably* fully value fuel economy savings when they are received.
  Policy conclusions based on simplistic perfect market assumptions will be…wrong
- Governments US EU Japan China Korea Australia etc are rational in adopting fuel economy and GHG emission standards
- *All market decisions about the energy efficiency of consumer durable goods share this structure*
  - Future energy savings and cost too uncertain
  - Net value = PV savings – cost which increases ratio of noise signal
  - Manufacturers are consumers' agents

There is much for a Global Fuel Economy Initiative to do.

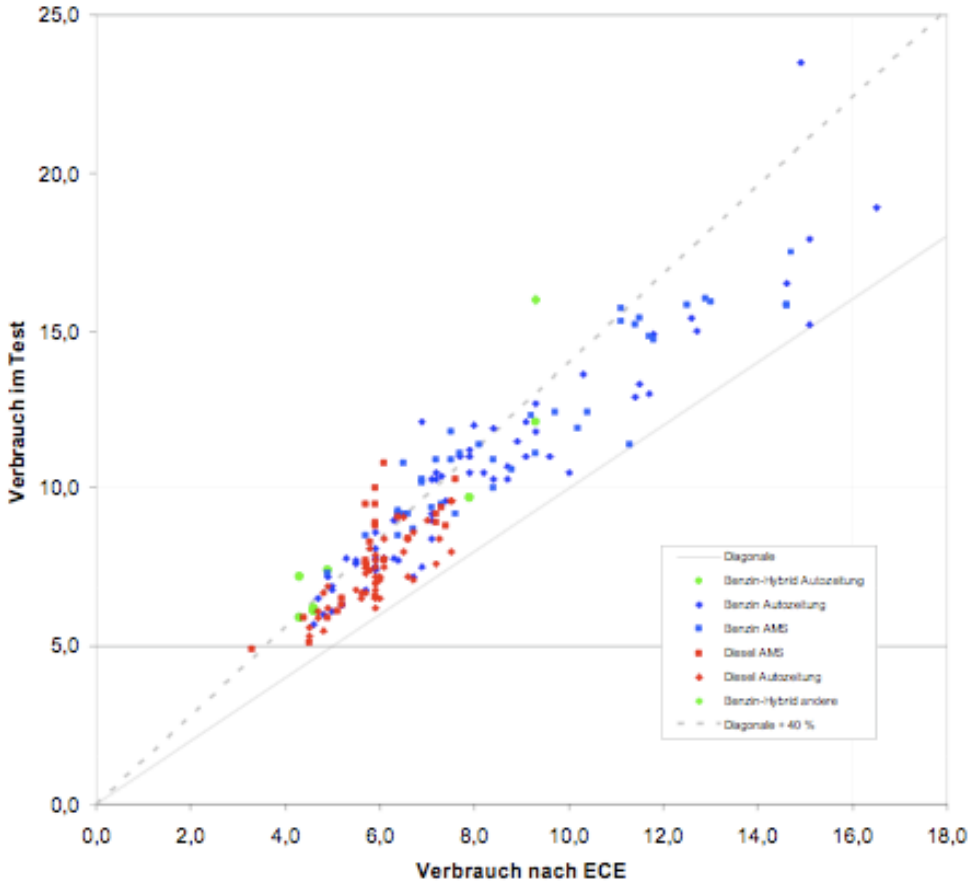
- Stringency: How to improve information on fuel economy technical potential and cost for OECD and non OECD countries
- Fiscal policy: should it complement or replace fuel economy standards
- Consumer information: do we need to correct bias or accuracy
- The world has moved to attribute standards: where is the theory of what makes a good attribute standard

Thank you very much.

Dziękuję bardzo.

Bias is *perceived* to be the problem.

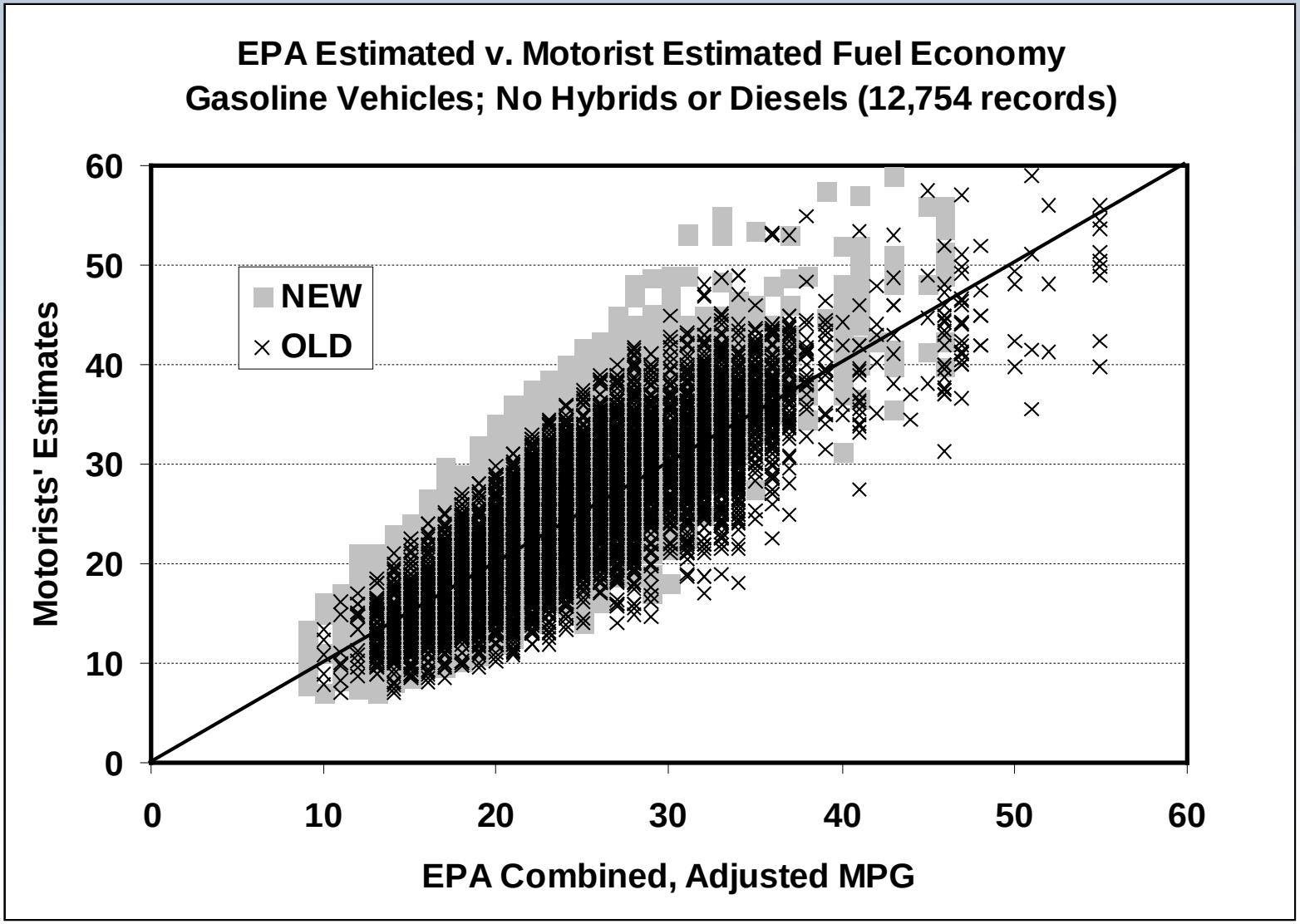
What does ECE-fuel consumption say about real mileage ?



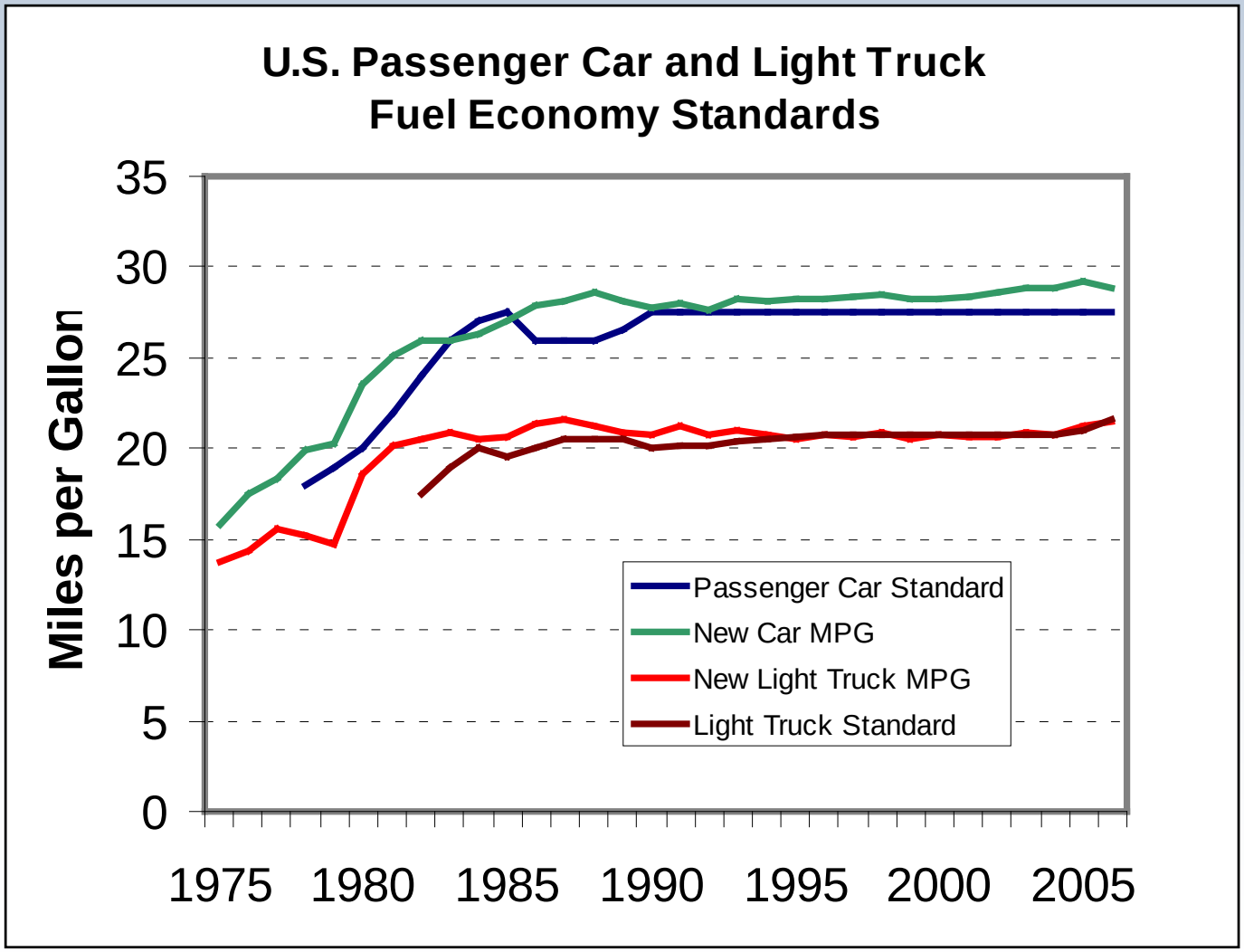
Ruling based on test procedures inevitably becomes an objective of engineering optimisation.

Real life effectiveness can very much be questioned.

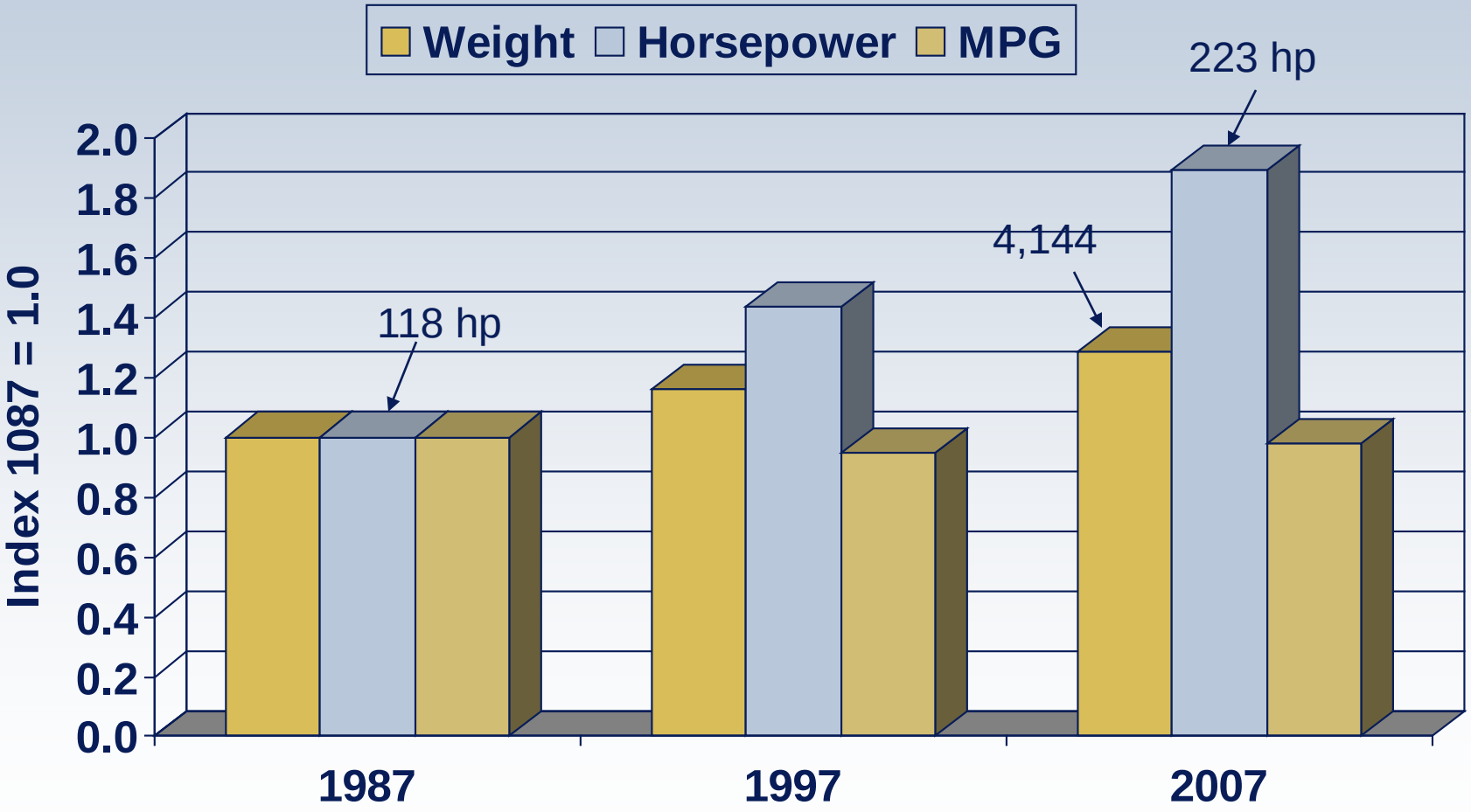
But the more important problem is accuracy. Innovation is needed to create personal fuel economy estimates.



Fiscal incentives such as feebates are a way to get around the difficulty of raising fuel economy standards. But will this be a problem in the future?



Fiscal incentives are also a way to direct interest to fuel economy and away from weight and power races, harmonizing standards with the market.

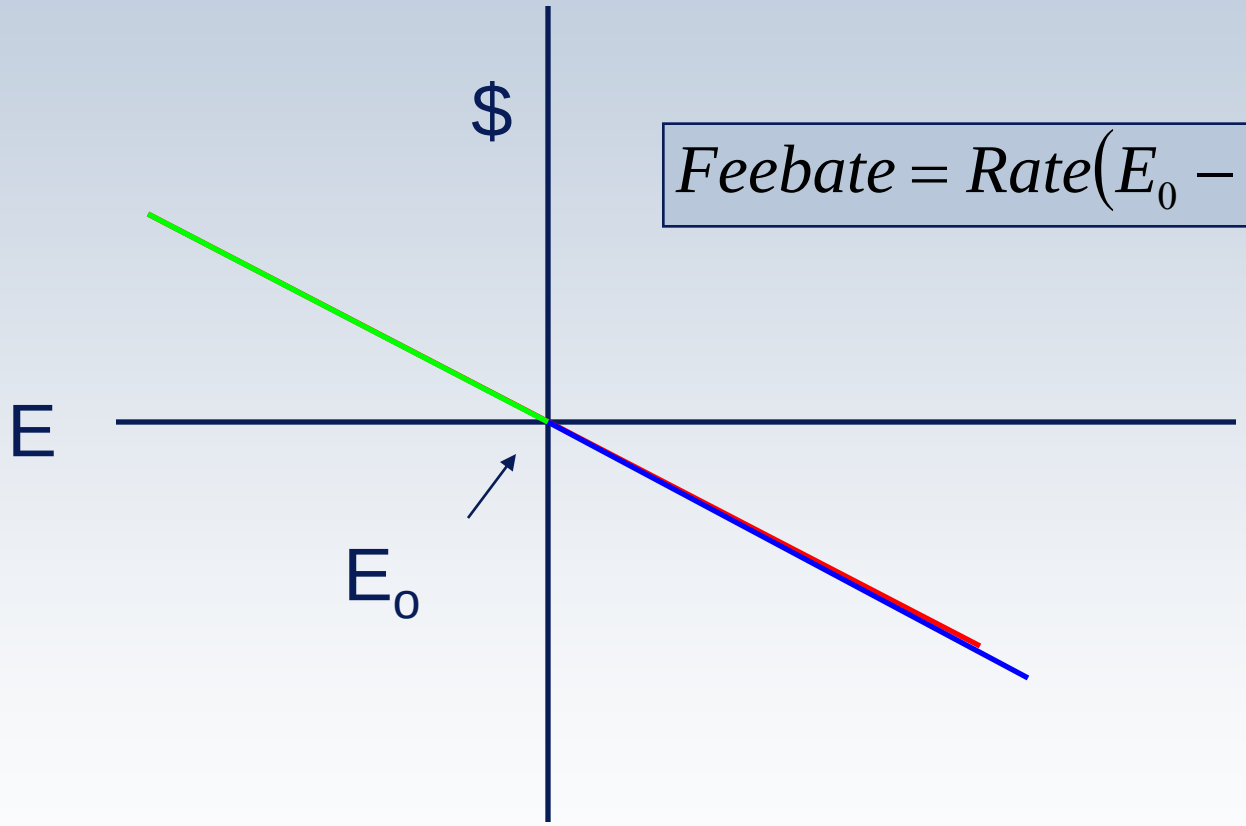


Source: U.S. EPA, Light-Duty Automotive Technology and Fuel Economy Trends: 1975-2007, p. ii.

Like fuel economy standards feebates can solve the first cost bias problem.

- A fiscal policy combining
  - A fee on inefficient vehicles
  - A rebate on efficient vehicles
- A "benchmark" defines who pays and who receives distribution
- A "rate" determines the marginal costs and benefits efficient solution
- Rate represents an additional charge for future emissions or oil use but paid at the time of vehicle purchase

Simplest feebate is linear in GHG emissions per mile.
Here, benchmark is origin, rate, R, is slope of the line.
System is *revenue neutral* if right benchmark chosen.



$$Feebate = Rate\left(E_0 - E\right)$$

A feebate can be viewed as a capitalized tax on future GHG emissions.

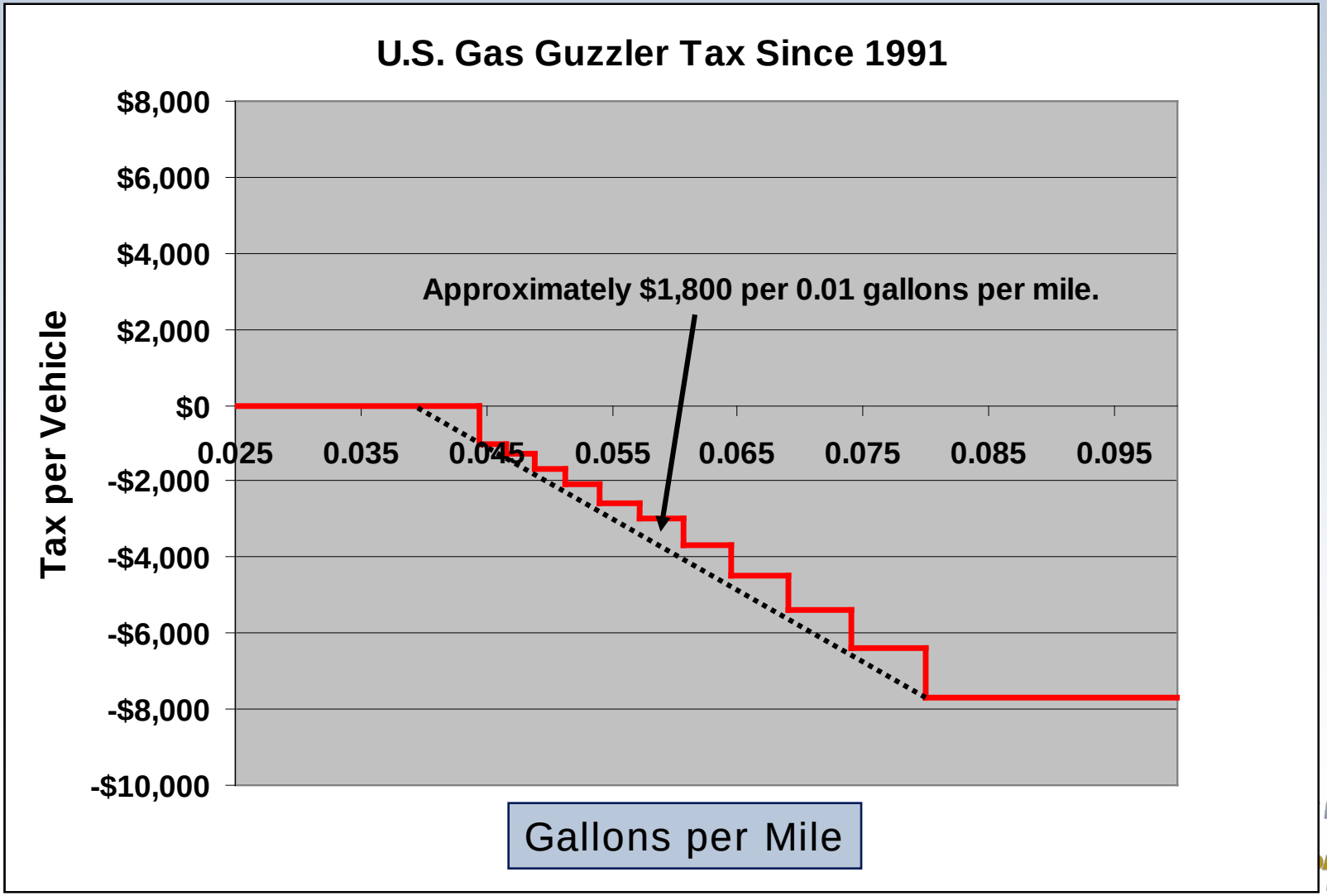
$$PV = \int_{t=0}^{L} C(E_0 - E) M_o e^{-\delta t} e^{-rt} dt$$

- Assuming:
  - miles year when new
  - decreasing at year
  - discount rate of year
  - expected life of years

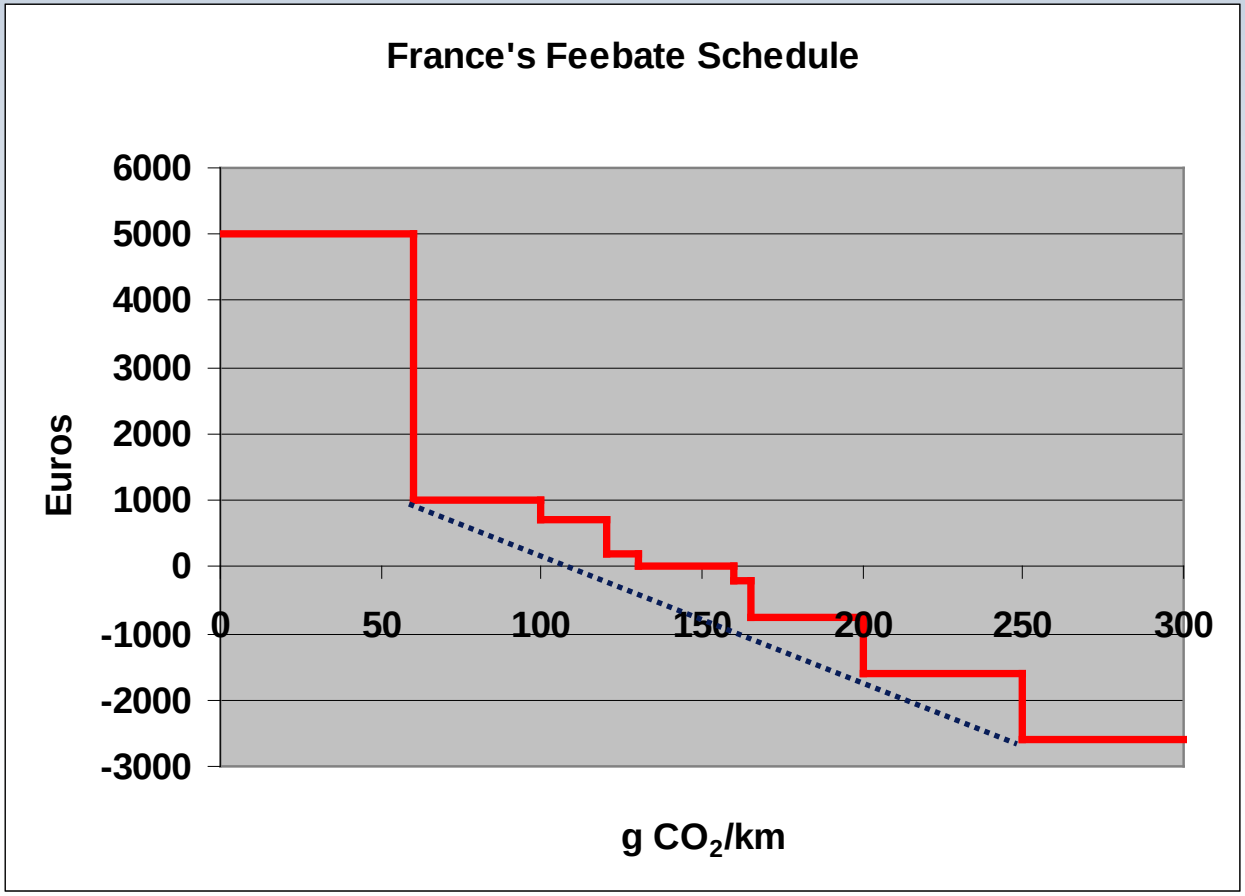
$$PV = C(E_0 - E)100{,}000$$

$$PV = \frac{\$100}{tC}\left(\frac{1g}{mi}\right)100{,}000mi \Rightarrow R = \frac{\$10}{g/mi}$$

The U.S. Gas Guzzler Tax (for passenger cars only, not light trucks and still on the books) is half a feebate system. $1,800/0.01gal/mi = approx. $20/g/mi



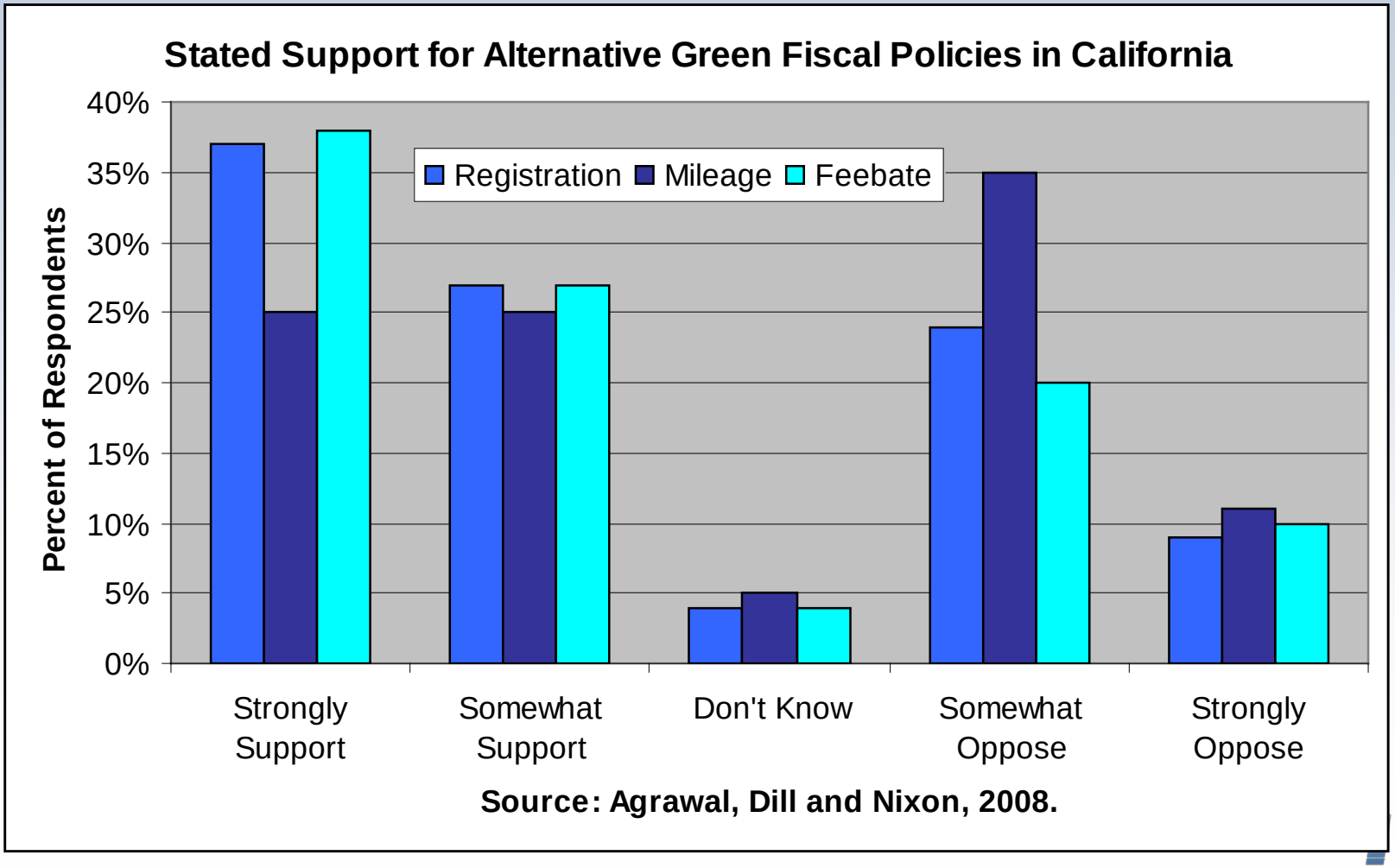
France's Bonus/Malus feebate step function is approximately equivalent to $16.50 per g/mi ($1,500 per 0.01 gal/mi), a significant rate.



Feebate systems have potential advantages but have rarely been tried.

- Like regulatory standards can address the fuel economy market failure or uncertainty loss aversion problem
- Provide a continuing incentive for energy efficiency improvement
- Can be designed to be revenue neutral
- Can be harmonized with economy wide carbon prices
- Guarantee cost not performance
- Standards have a proven track record feebates do not
- It's a *tax*
- California Air Resources Board is considering feebates as a complement to its Pavley standards or as a replacement

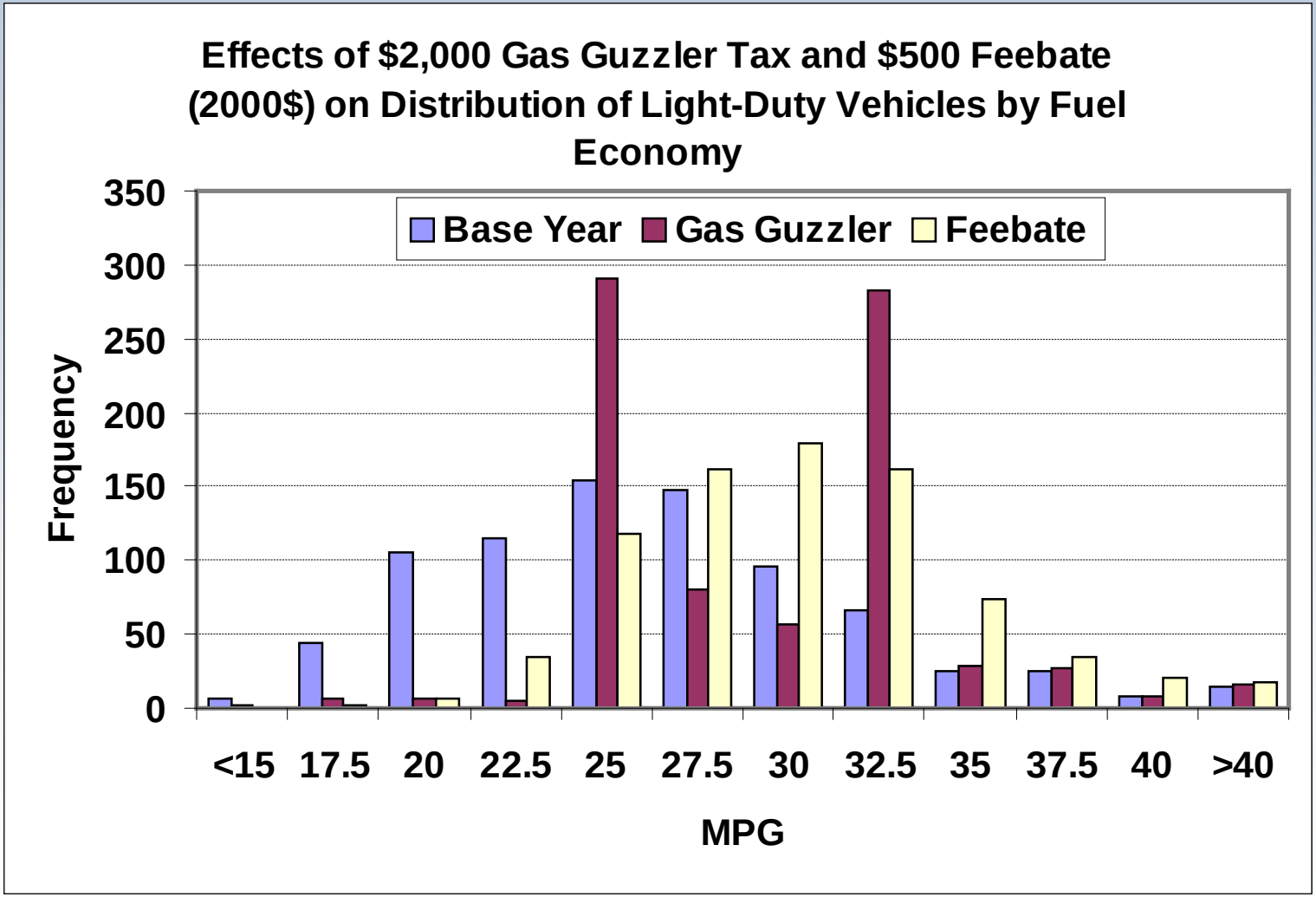
Recent survey evidence indicates that Californians will support GHG emissions taxes.



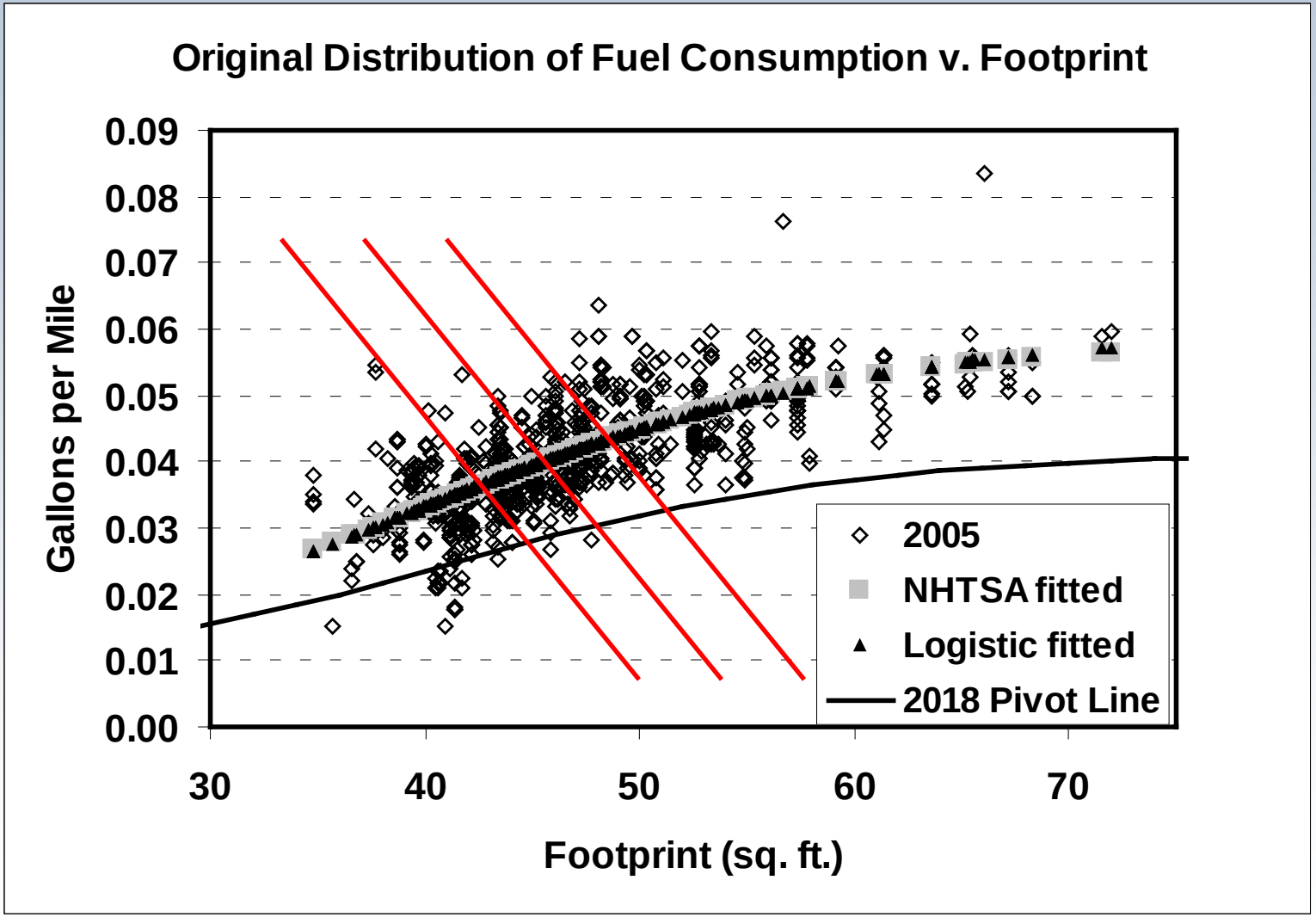
The UC Davis-led California study will develop comprehensive information for ARB's decision making on feebates.

- Lessons learned France Canada etc
- Focus groups dealer and manufacturer interviews
- Policy formulation with formal public input
- California feebate analysis model
- Policy analysis
- Assessment of policy impacts
- Statewide survey of consumers

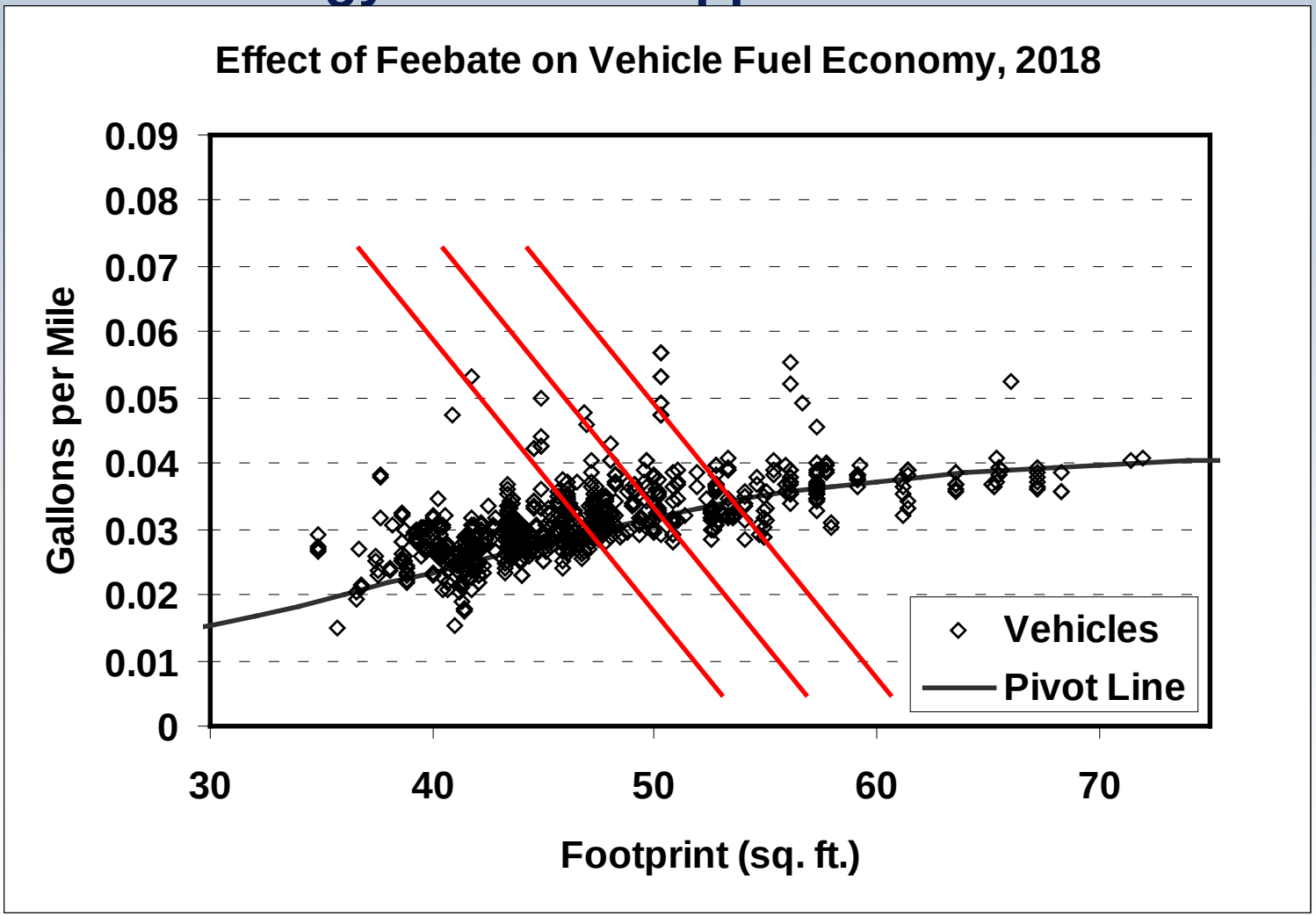
The gas-guzzler tax provides evidence that feebates will work.



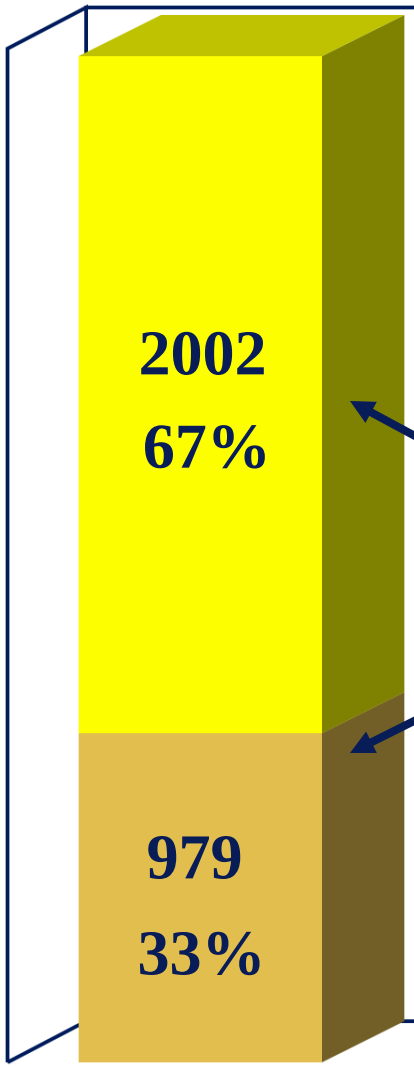
The feebate "pivot point" could be a function of footprint, like the new CAFE footprint



A simulation based on the U.S. National Academy of Sciences fuel economy cost curves shows how technology would be applied to reduce fuel



The RATE of world oil use is alarming!



The 2007 NPC report expects 1.1 trillion barrels of oil production over the next 25 years. More than consumed in in all of human history.

Remaining recoverable crude oil*

Cumulative Production to end of 2005

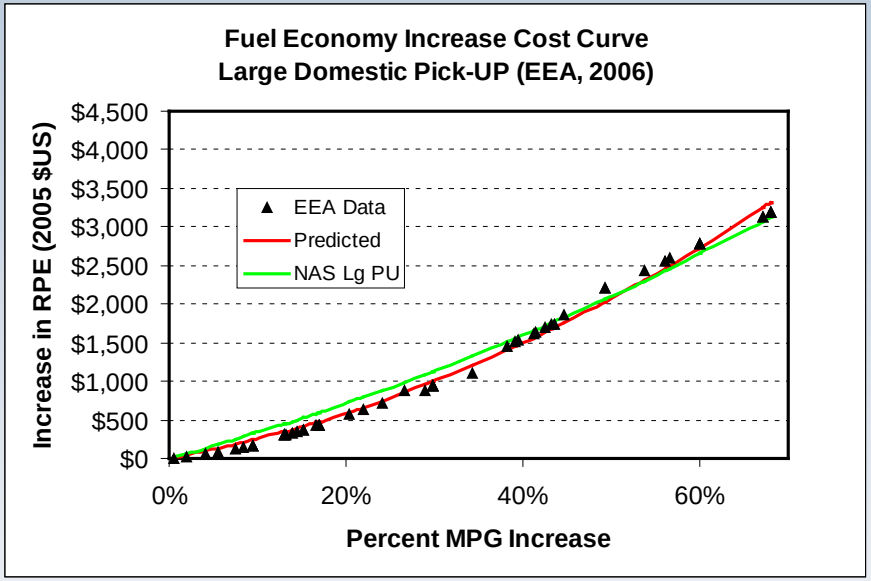
Cumulative Production to the end of 1995 was 710! Over ¼ of all oil ever consumed was consumed in the last 10 years.

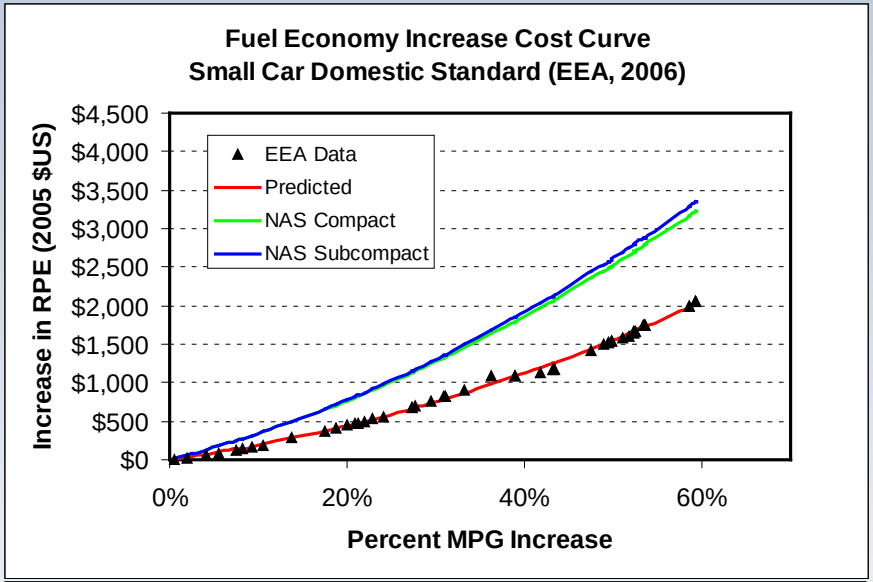
* From USGS 2000, USGS 1995, and MMS 1996

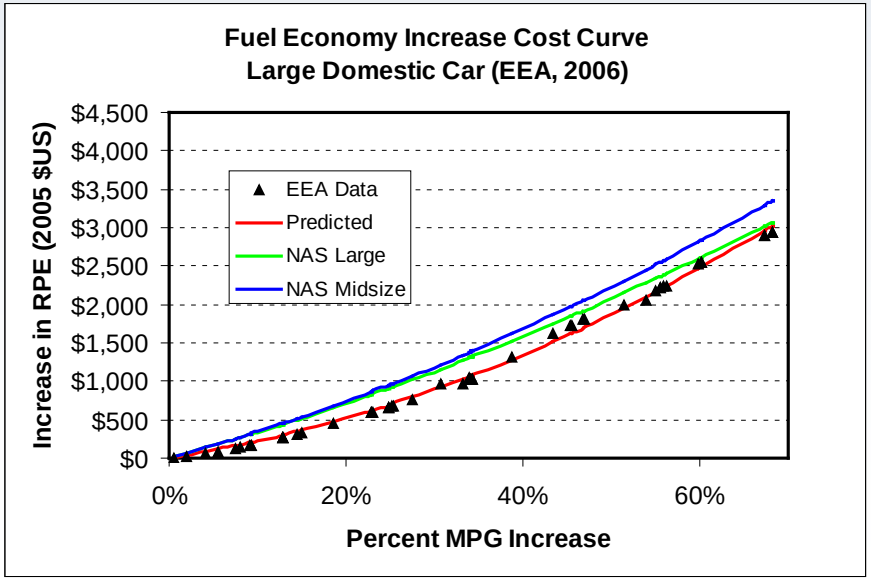
USGS

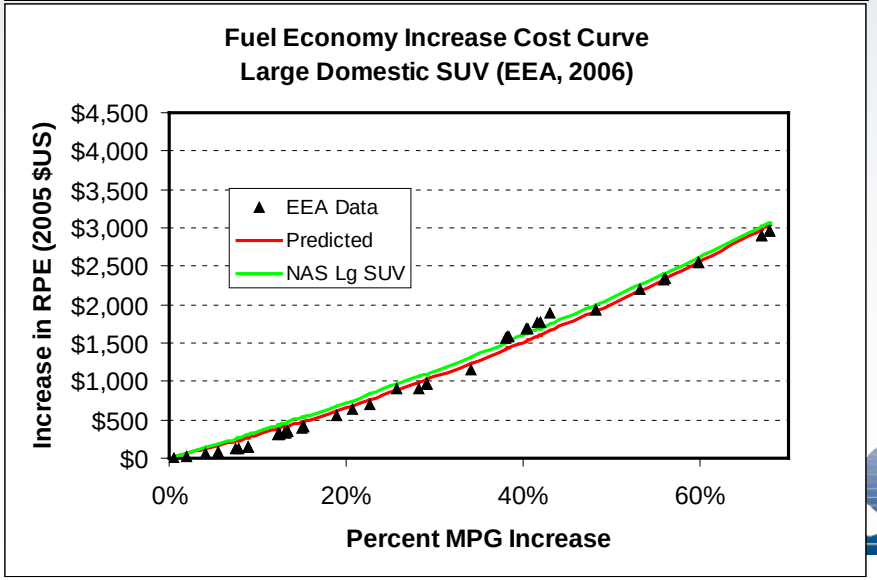
ITS UCDAVIS

Since the 1970s, fuel economy technology and cost assessments have indicated a large potential for cost-effective fuel economy improvements. Why are they not realized?









The key policy options and international experience have been addressed in an IEA report.

- T. Onoda, “Review of International Policies for Vehicle Fuel Efficiency”, OECD/IEA, August, 2008.
- Efficiency Standards: Voluntary or Mandatory
- Fuel Economy Information: Vehicle Labeling
  - Bias?
  - Accuracy?
- Fiscal Incentives and Standards
  - Complement standards?
  - Replace standards?
- Fuel/Carbon Taxes