

# Why Don't Economists Like the CAFE Standard?

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# Options for Carbon Dioxide Regulation

- Federal regulation of carbon dioxide/greenhouse gas emissions is likely
  - All three Presidential candidates support regulation
  - EPA is now permitted to study and design regulations
  - Let's assume there will be some regulation in the future
  - Policy makers, environmental and industry groups have all put forward different plans
  - What would the best (least costly) policy be?
- There are many possible approaches
  - Economy-wide carbon tax or cap-and-trade with auctioning
  - Economy-wide cap-and-trade without auctioning
  - Sector-wide tax or cap-and-trade (transportation or power)
  - CAFE standard or the gas tax
  - Can we rank the policies?
  - Economists can't control the political process, but maybe they can advise which policy is best

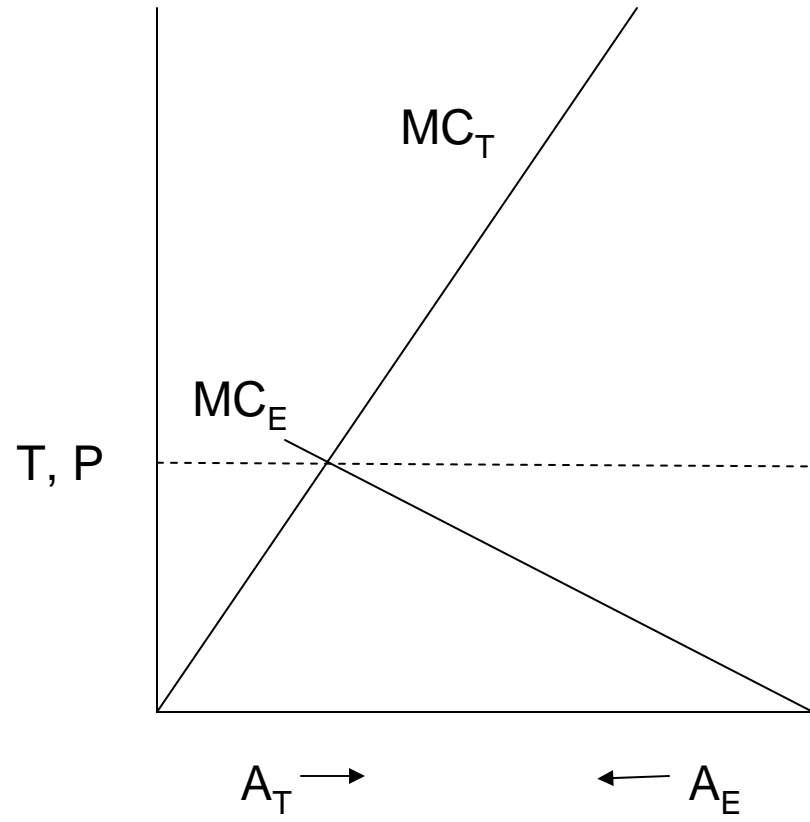
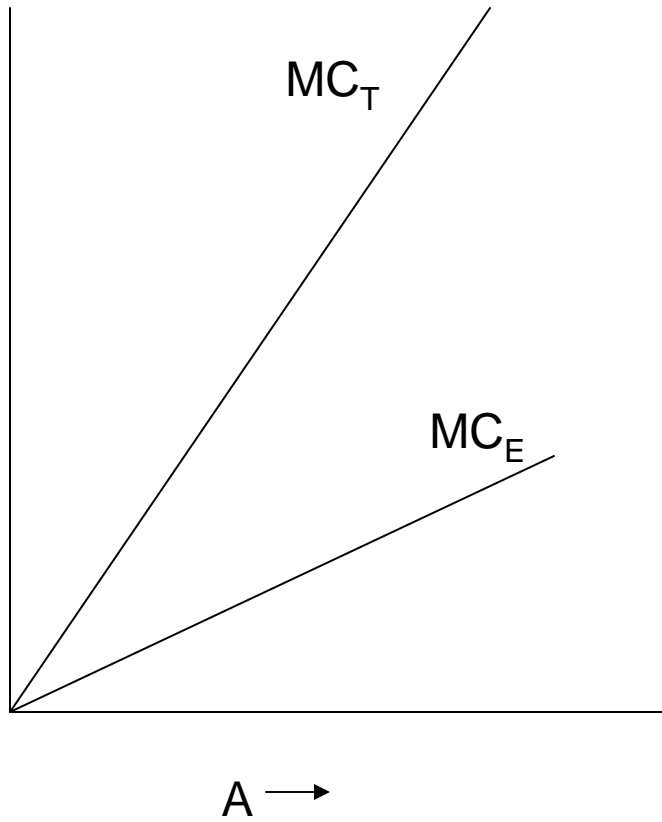
# Problems with the CAFE Standard

- Minimize total compliance costs by meeting three objectives
  - Increase the cost of emitting carbon dioxide
  - Equalize marginal costs across all firms and consumers
  - Encourage innovation and technology adoption
- Market-based policies are the gold standard
  - Either tax emissions or impose a cap
  - These policies achieve all three objectives
- CAFE (Corporate Average Fuel Economy) standard
  - Automobile manufacturers must reach a certain average fuel efficiency
  - Passed in 1975, 20-22 MPG for light trucks and 27 for cars
  - Congress just increased the standard to 35 by 2020
  - The policy is incredibly popular, reducing oil consumption and emissions
- Most economists view the CAFE standard as the worst among available options
  - The policy does not meet the three objectives
  - Cost of using CAFE would be several times higher than market-based

# A Brief Introduction to Market-Based Policies

- How do they work?
  - Tax: firm pays a tax,  $T$ , for each unit of pollution
  - Cap-and-trade: allocate permits that give the right to emit one unit and allow trading
  - In both cases, the cost of emitting pollution increases
  - Permit price,  $P$  is the cost in cap-and-trade and  $T$  is the cost with a tax
- A firm's optimization: abate until  $MC = MB$ 
  - Abatement is the reduction in emissions
  - With a tax, the benefit of abating is the tax you avoid,  $T$
  - In cap-and-trade, the benefit of abating is  $P$ , because you don't have to buy a permit
  - Firms equate marginal abatement costs and marginal benefits (see figure)
- Market equilibrium: marginal costs are equal across firms
  - Two regulated sectors: electricity and transportation
  - Suppose marginal cost of decreasing emissions is increasing in abatement in each sector
  - Example:  $MC_E = A_E$  and  $MC_T = 2A_T$
  - Firm's abate until  $MC = P$  or  $T$
  - Since firms face the same permit price or tax, marginal costs are equated across firms

# Abatement Costs in Electricity and Transportation



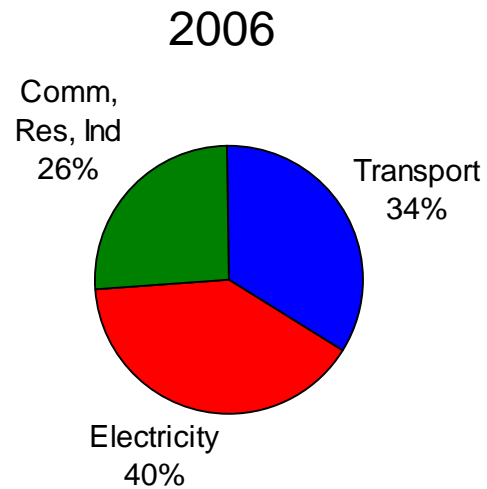
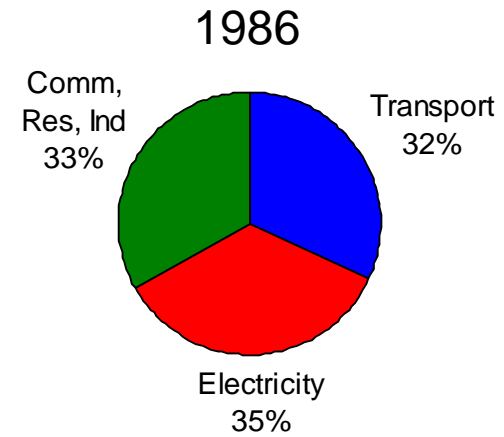
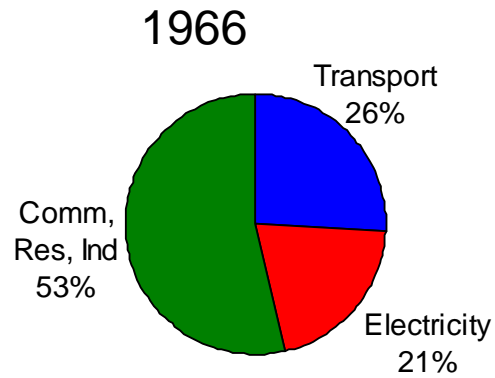
# Why Are Market-Based Policies So Good?

- Objective #1: increase the cost of emitting carbon dioxide
  - Whether the policy targets firms or households, the goal is the same
  - The basic idea is that people and firms do less of something that is more expensive
  - Both a tax and cap-and-trade increase the cost of emissions (compare with CAFE or low carbon fuel standard)
- Objective #2: equate costs across firms
  - Suppose it is very easy for power plants to reduce emissions
  - Should we only regulate power plants?
  - No, it's better to regulate both because we don't have to go as far up the marginal cost curve for power plants
  - If they're not equal, we could reduce costs by having the low-cost sector abate more
- Objective #3: encourage technology
  - Different policies create different technology incentives
  - Example: tax emissions and use the revenue for R&D
  - Little experience with power plant technology, CCS, and huge uncertainty

# Alternative Market-Based Policies

- Cap-and-trade vs. tax
  - The major decision for a cap-and-trade program: auction or give away (grandfathering)
  - A full auction is the same as a tax
  - Firms prefer grandfathering, which could actually lead to greater profits than without regulation
  - Response: fuel switching, CCS, miles traveled
- Economy-wide vs. sector-specific
  - Wouldn't it be easier to only regulate electricity? (share has doubled over past 40 years)
  - Perhaps, but that could be more expensive than regulating everyone (higher electricity prices vs. higher gasoline prices)
- Summary: broad, market-based, policies are best
  - Key result: low cost firms abate more
  - What if we knew who the low-cost firms are?
  - The advantage of market-based policies is that we don't need to know who is lowest cost
  - A broad policy allows us to hedge our bets
  - Safety valves also offer a bit of insurance

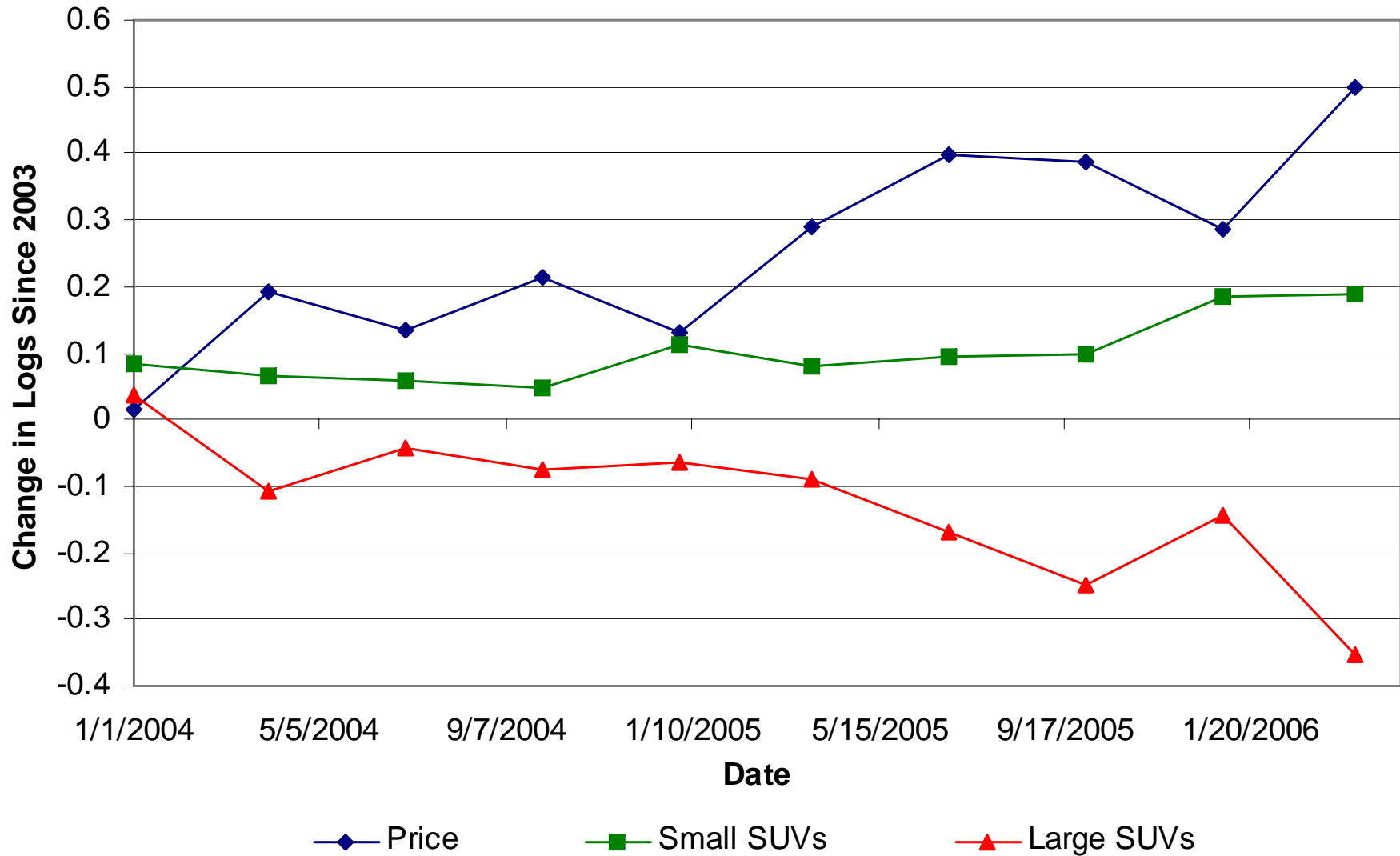
# Share of Carbon Dioxide Emissions by Sector



# Automobile Policy

- We don't have to regulate everyone, or even power plants
  - Currently, no federal power plant regulation, but autos are regulated
  - Gasoline tax and CAFE, but objectives aren't carbon dioxide
  - What if we strengthen either of these policies?
- An increase in the gasoline tax would reduce carbon dioxide emissions
  - Works the same way as an emissions tax (market-based but sector specific)
  - Decrease miles traveled
  - Purchase more fuel efficient vehicles
- Consumers respond, but not by much
  - Recent research suggests that a \$1 gasoline tax would reduce emissions by no more than 5 percent
  - New vehicles purchases have recently responded to gasoline prices, which explains much of the changes in SUV market shares
  - Average fuel efficiency of new vehicles purchased would increase by about 0.5-1 MPG

## Gasoline Price and SUV Market Shares, 2004-2006



# CAFE vs. Gas Tax

- If the gas tax has such a small effect, why is CAFE worse?
  - Both policies focus on the transportation sector
  - The gasoline tax is market-based, increasing the cost of emitting
  - CAFE is indirect, acting through new vehicles prices:
    - Firms raise prices of gas guzzlers
    - Firms adopt new technology (e.g., hybrids), and pass some costs to consumers
- Inefficiencies of CAFE
  - The gas tax affects all margins in the right direction: people drive less and purchase more fuel efficient vehicles
  - But CAFE has many negative features
    - People drive more (rebound effect)
    - Consumers purchase used vehicles instead of new
    - It takes a long time to replace the entire vehicle stock
  - A large increase in CAFE would be required
  - Prices of new vehicles increase a lot, harming consumers
  - Upshot: CAFE is probably much more expensive than an economy-wide cap and trade program or an increase in the gas tax

## But What If We're Stuck With CAFE?

- Congress has already increased the standard without considering raising the gas tax
  - Tax is a dirty word, so raising the gas tax seems unlikely
  - A further increase could complement a cap-and-trade program for power plants
- How costly will new technology be?
  - Improvements to conventional gasoline engines may improve fuel efficiency 25% and cost \$2000 per vehicle
  - Hybrid technology may be more effective but costs more
- Hybrids are slowly gaining market share, but have improved a lot
  - Mixed sales performance: Prius vs. Accord; total sales about 2%
  - More recent models also add power, and may be almost as attractive as models with conventional gasoline engines
  - Perhaps a small improvement in technology would have big effect

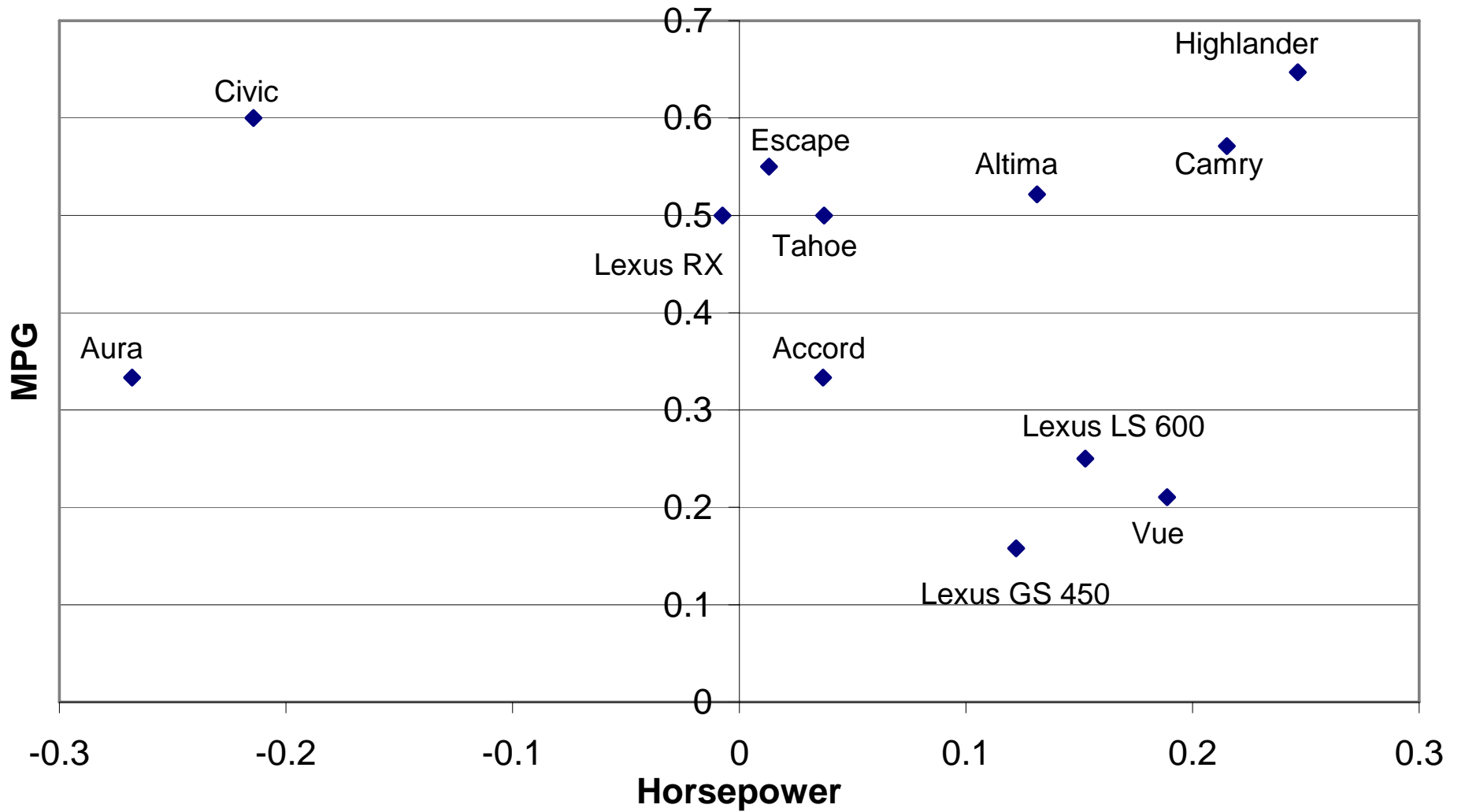
## How Long Until You Recapture Your Investment?

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### Number of Years Before Fuel Savings Equal Price Gap

| <u>Model</u> | <u>15,000 Miles Per Year</u> | <u>25,000 Miles Per Year</u> |
|--------------|------------------------------|------------------------------|
| ESCAPE       | 9.2                          | 5.5                          |
| VUE          | 13.3                         | 8.0                          |
| ACCORD       | 6.4                          | 3.9                          |
| CIVIC        | 5.3                          | 3.2                          |
| ALTIMA       | 12.3                         | 7.3                          |
| LEXUS GS     | 48.9                         | 29.0                         |
| LEXUS LS     | 20.2                         | 12.0                         |
| LEXUS RX     | 5.7                          | 3.4                          |
| CAMRY        | 9.6                          | 5.7                          |
| HIGHLANDER   | 7.8                          | 4.6                          |
| AURA         | 4.1                          | 2.5                          |
| TAHOE        | 11.0                         | 6.6                          |

# Hybrids vs. Twins: Percent Change in City MPG and Percent Change in Horsepower



# Conclusions

- There are many policy options available for reducing carbon dioxide emissions
  - Market-based policies (tax or cap-and-trade) cause low-cost firms to reduce the most, minimizing compliance costs
  - We don't know how much technologies will cost, so we should hedge our bets with a broad policy
  - Power plants can probably abate at lower cost, but plenty of uncertainty
- CAFE leaves a lot to be desired, but may be a major part of the final set of policies implemented
  - Several features of CAFE undermine its efficacy
  - But the public supports it, there is a history of using it, and it does reduce gasoline consumption
- In that case, hybrid technology will be key
  - Hybrids have had limited success so far
  - But the technology has improved over the past 10 years; it may improve further

# Broader Implications and Considerations

- Not all policies are created equal
  - There are meaningful differences among the policy options
  - The stakes are very high
- Distributional issues
  - Economists tend to focus on cost-effectiveness and try to identify the ideal policy (the real world doesn't always comply)
  - But poor people may be harmed more by an energy tax or its equivalent
  - It is generally possible to undo any distributional effects via the tax code, but that doesn't always happen
  - CAFE may be less regressive than the others
- Technological change
  - Different policies also have different effects on technological change
  - Taxes and cap-and-trade with an auction are best
  - Firms are clever and technology has improved more quickly than expected in past cap-and-trade programs
  - Still, these technologies are completely unproven and risky