Do Car Buyers Undervalue Future Fuel Savings? Post-Purchase Evidence

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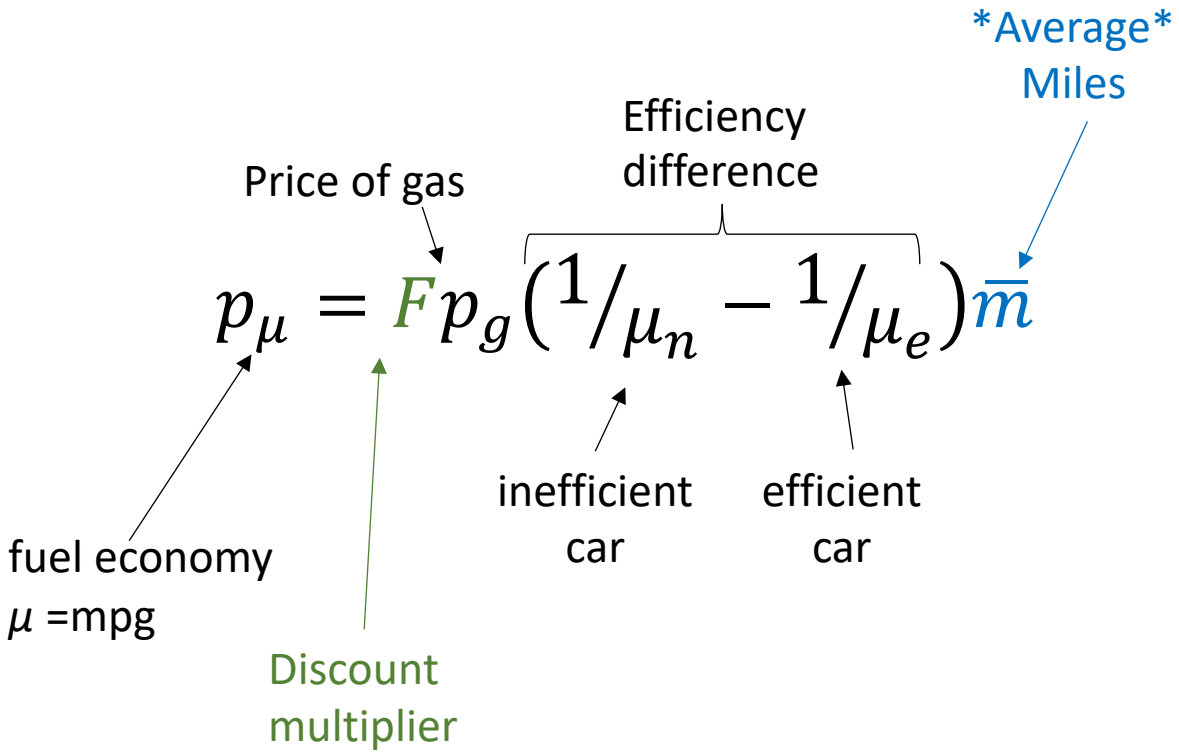
2017 – 2025 CAFE Standards

- Add **$1,800** to the cost of a new car in 2025
- Save **$5,700 to $7,400** in fuel

Research to date

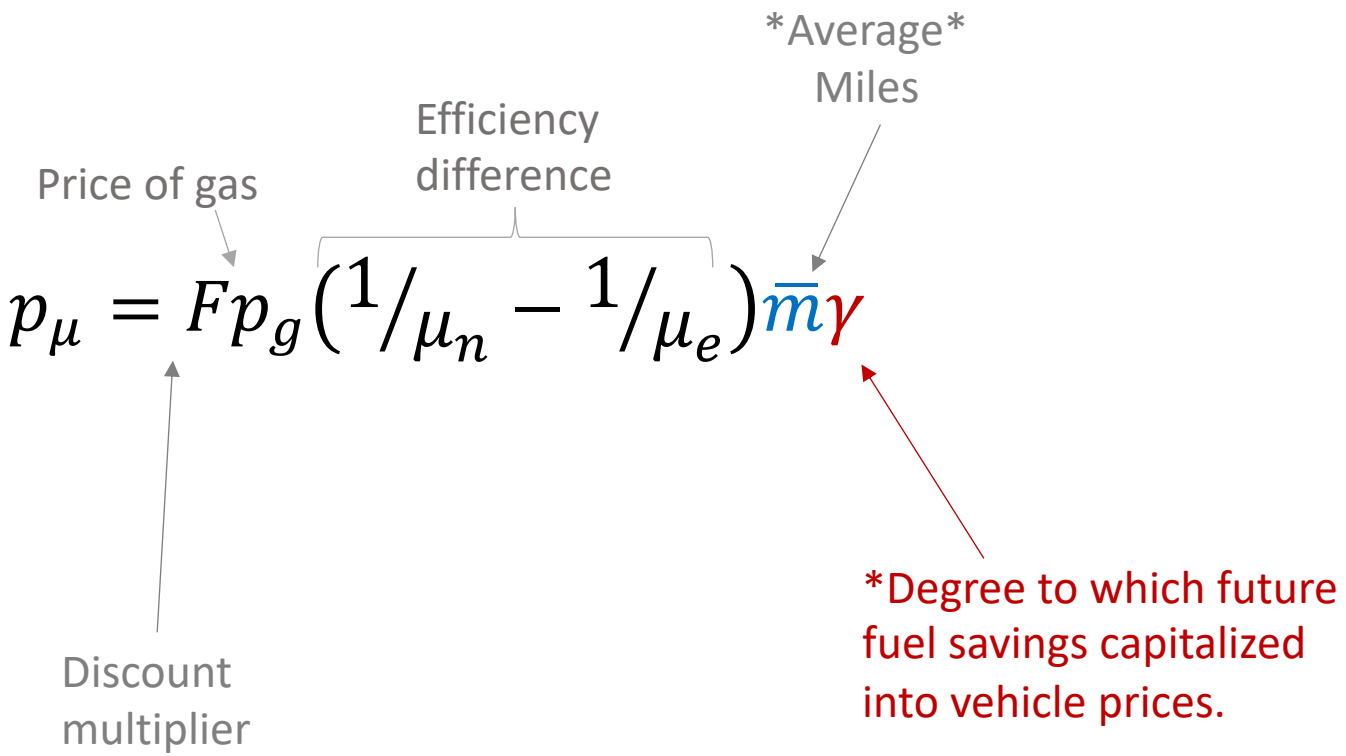


Cost of incremental fuel economy

Cumulative discounted lifetime savings

Allcott and Greenstone, 2012

Research to date



Cost of incremental fuel economy

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Allcott and Greenstone, 2012

Research to date

$$p_\mu = F p_g \left({}^{1}/_{\mu_n} - {}^{1}/_{\mu_e} \right) \bar{m}\gamma$$

Full valuation

- Busse, Knittel, Zettelmeyer (2013)
  US new and used car prices + gas price variation ⇒ $\hat{\gamma} \approx 1$
- Sallee, West, Fan (2016)
  US used car auctions + remaining miles variation ⇒ $\hat{\gamma} \approx 1$

Undervaluation

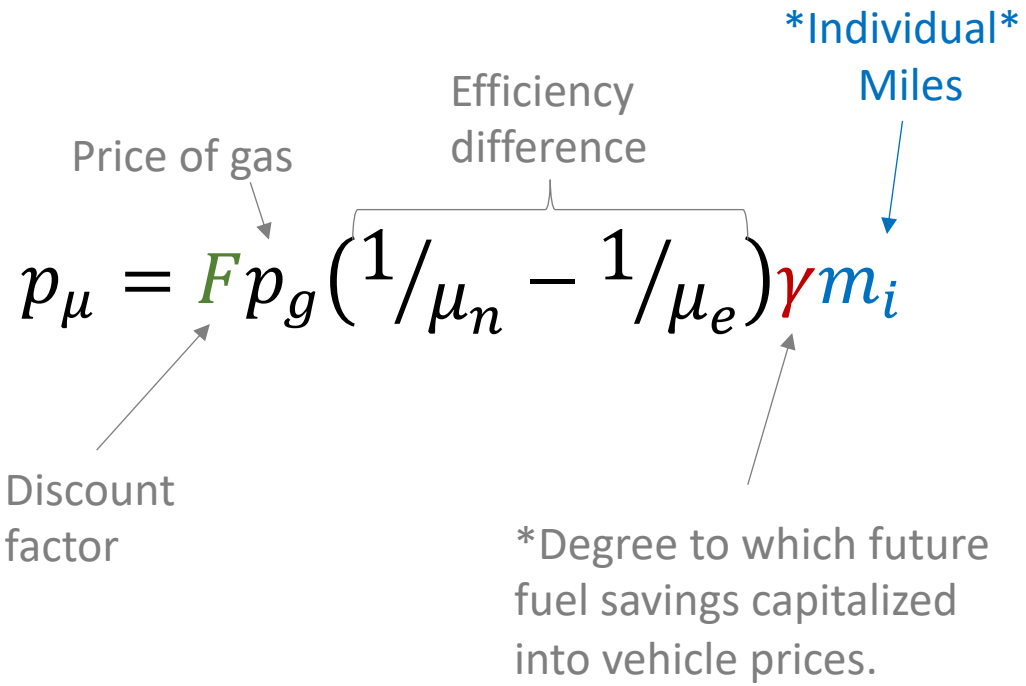
- Allcott & Wozny (2014)
  US new vehicle registration + gas price variation ⇒ $\hat{\gamma} = 0.76$
- Grigolon, Reynaert, Verboven (2018)
  UK new vehicle market + within-model variation ⇒ $\hat{\gamma} = 0.91$
- Gillingham, Houde, and van Benthem (2019)
  Honda and Kia restate mpg on vehicle label ⇒ $\hat{\gamma} = 0.16\text{-}0.39$

Our paper: Car choice & post-purchase fuel expenses

Previous individual-level evidence

- Allcott & Knittel (2019): Experiment -> Weak response to $\Delta\mu$
- Banzhaf & Kasim (2019): Ownership -> $cov(\mu, m)$ is small

Our approach



Cost of incremental fuel economy

Cumulative discounted lifetime savings

Data

1. U.S. National Household Travel Survey (NHTS) 2009 & 2017
   - Car ownership and travel behavior
   - Household characteristics

2. Vehicle prices and characteristics (Wards Automotive)

3. Fuel economy (EPA) & Gasoline prices (EIA)

4. Expected driving and purchase prices (MaritzCX)

5. Used car listing prices (TrueCar.com)

Sample
   - **183,196 owners (2005-2017 model years)**

Two approaches

1. **Comparing similar hybrid and gas powered vehicles**
    - Sample: 24,592 with one of 108 hybrid / gas model pairs
2. **Use all cars, control statistically for other car characteristics**
    - Sample: 183,196 owners (2005-2017 model years)

Honda Civic 2008

$21,584

29.6 mpg

Honda Civic 2008 Hybrid

$23,732

49.9 mpg

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Honda Civic 2008 Hybrid

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Albert

Age: 50s

Income: $40-45k

Annual Miles: 25,000

Gas Price: $2.30

Foregone annual savings
$790

Source: NHTS 2009

Honda Civic 2008

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29.6 mpg

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$790

Honda Civic 2008 Hybrid

$23,732

49.9 mpg

Betty

50s

$45-50k

Annual miles: 4,600
Gas price: $2.61

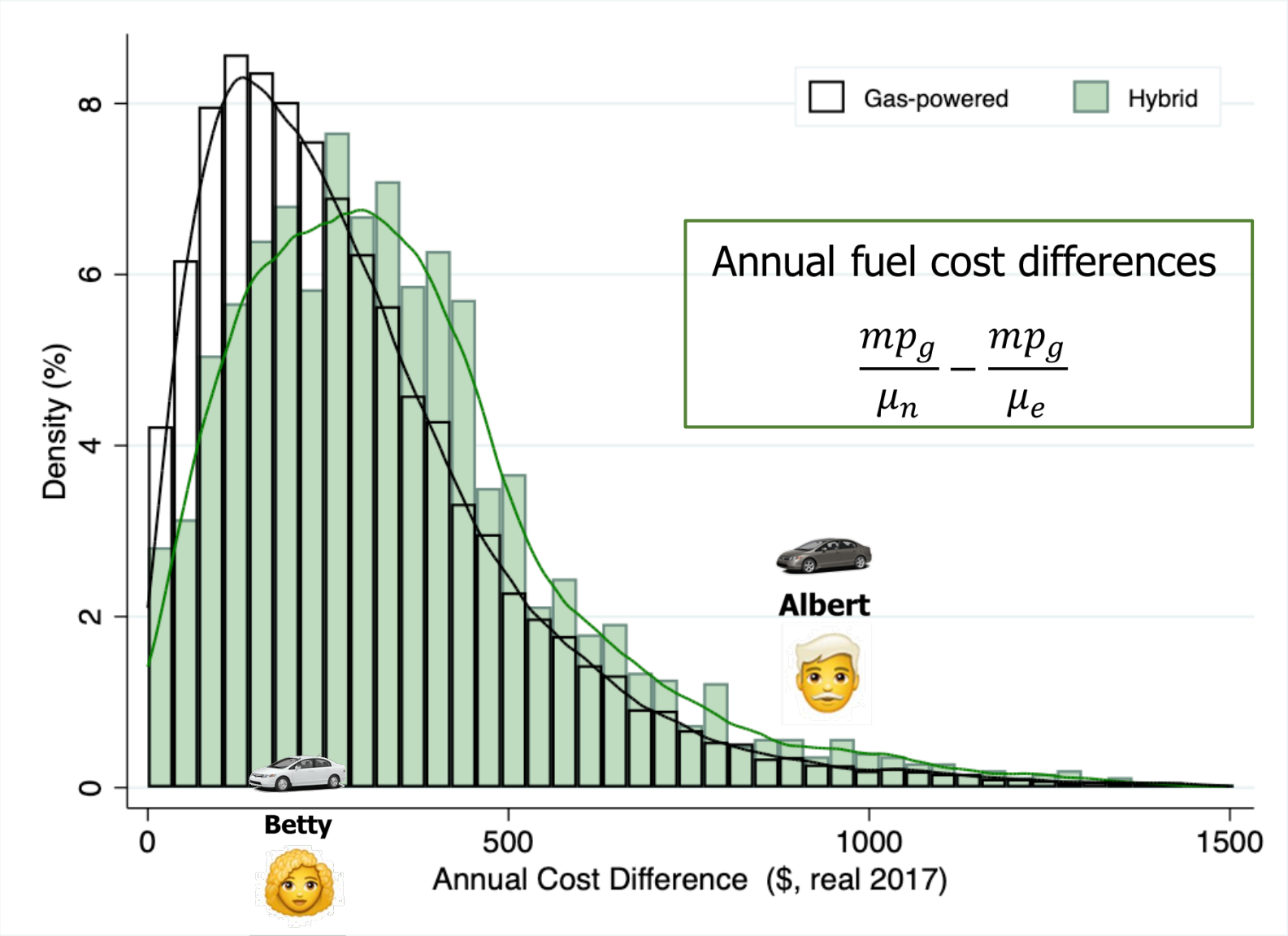
Realized annual savings
$165

Source: NHTS 2009

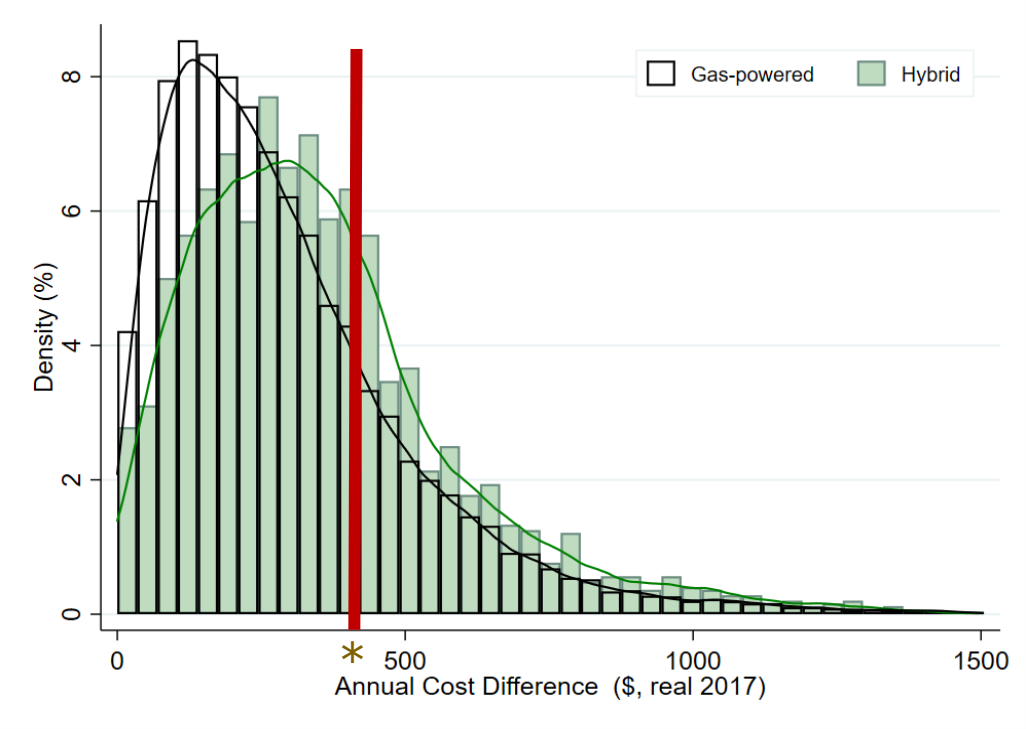
Purely Personal, Ex Post, Financial Mistakes

(PPEPFMs)

All hybrid-gas car pairs



Defining "mistakes"



Calculate the threshold (*) using

- MSRP
- 14 year vehicle life
- 3% and 7% discount rates

	Actual vehicle	Optimal vehicle (discount rate 3%, lifetime 14 years)	
	Total	Gasoline	Hybrid
	(1)	(2)	(3)
Total	**24,592**	**20,379**	**4,213**
Gas-powered (*% of column*)	**22,124**	**18,465** (91%)	**3,659** (87%)
Hybrids (*% of column*)	**2,468**	**1,914** (9%)	**554** (13%)

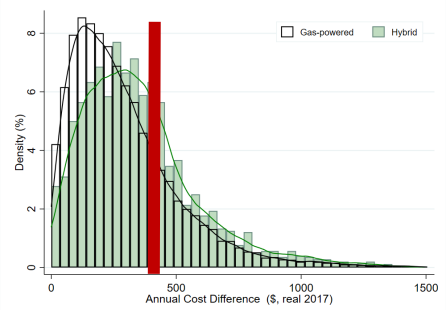
Albert

Betty

What's γ ?

- 4,213 *should* be in hybrids
- 2,468 *are* in hybrids.

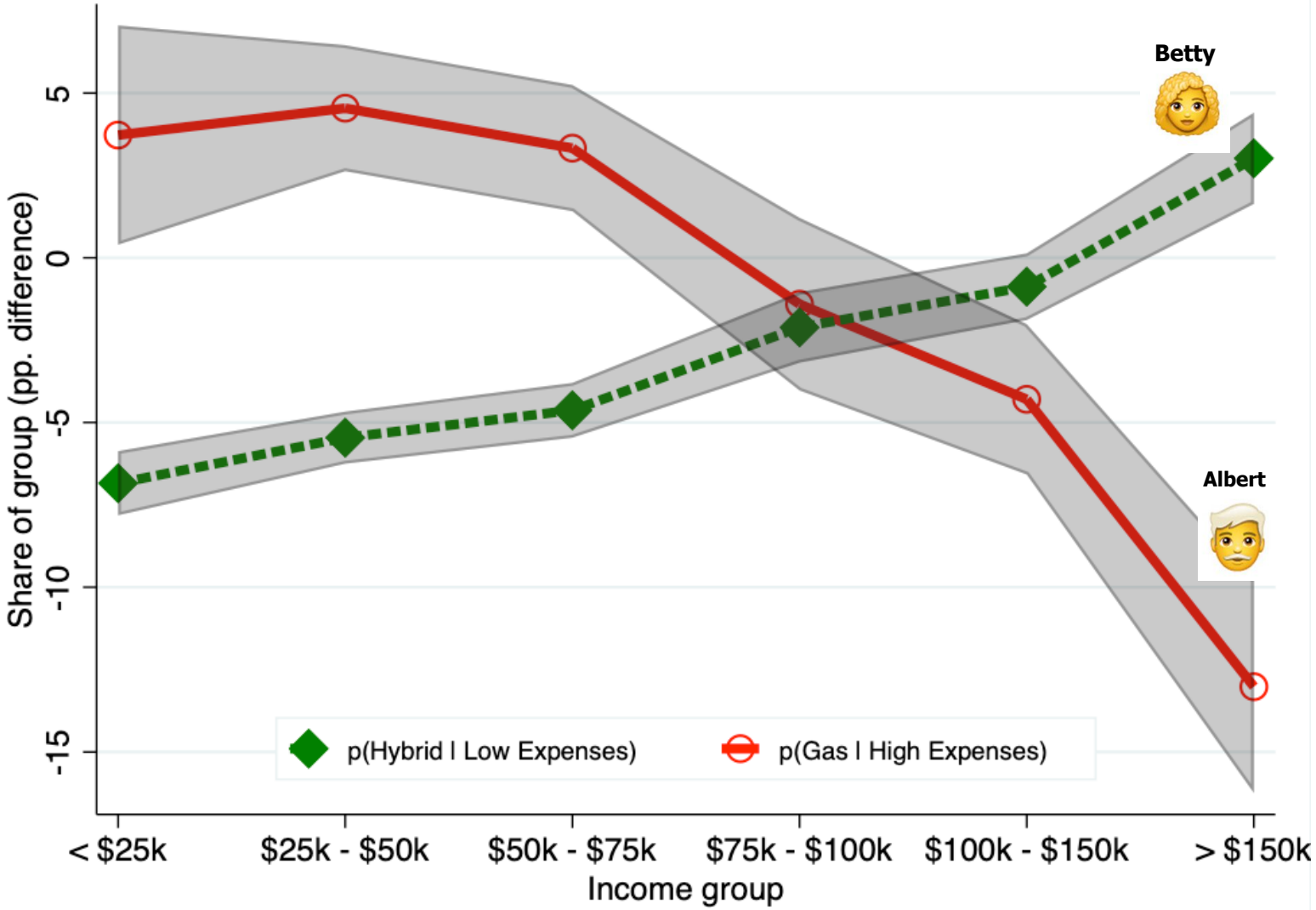
	Actual vehicle	Optimal vehicle (discount rate 3%, lifetime 14 years)		Optimal vehicle (discount rate 7%, lifetime 14 years)	
	Total	Gasoline	Hybrid	Gasoline	Hybrid
	(1)	(2)	(3)	(4)	(5)
Total	**24,592**	**20,379**	**4,213**	**22,099**	**2,493**
Gas-powered (*% of column*)	**22,124**	**18,465** (91%)	**3,659** (87%)	**19,977** (90%)	**2,147** (86%)
Hybrids (*% of column*)	**2,468**	**1,914** (9%)	**554** (13%)	**2,122** (10%)	**346** (14%)



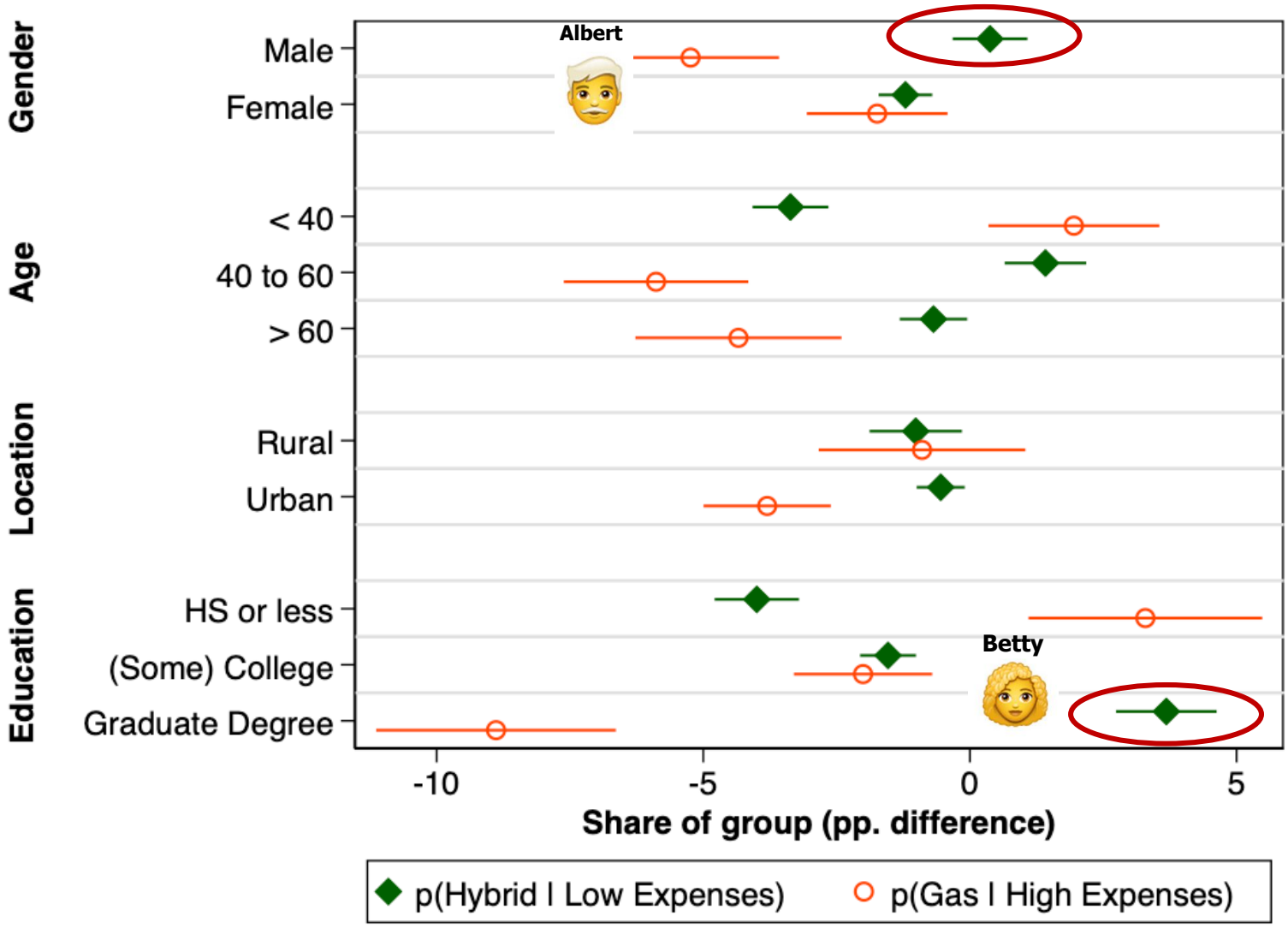
What's γ ?

- 2,493 *should* be in hybrids
- 2,468 *are* in hybrids.

Car buying mistakes by income (difference from mean)



Other Demographics



A regression approach

		"Low" Cut-Off(discount rate 3% 50% MSRP)
Dependent variable = 1 if hybrid		**(1)**
Cumulative fuel savings ($1000)		0.00428*
		(0.00050)
Upfront investment cost ($1000)		-0.0215*
		(0.00104)
Income:	$100k – $150k	0.0490*
		(0.00696)
	over $150k	0.0867*
		(0.00747)
Education:	Graduate	0.0343*
		(0.00544)
Age:	40 – 60 years	0.0174*
		(0.00435)
	over 60 years	0.0301*
		(0.0237)
Male, rural, car specs, make FE, year-by-type FE		
Implied $\hat{\gamma}$		0.20
Observations		17,586
R-squared		0.365

A regression approach

		"Low" Cut-Off(discount rate 3% 50% MSRP)	
Dependent variable = 1 if hybrid		**(1)**	**(2)**
Cumulative fuel savings ($1000)		0.00428*	0.00355*
		(0.00050)	(0.00076)
Fuel savings×(Income>$100,000)			0.00124
			(0.000975)
Upfront investment cost ($1000)		-0.0215*	-0.0215*
		(0.00104)	(0.00104)
Income:	$100k – $150k	0.0490*	0.0449*
		(0.00696)	(0.00768)
	over $150k	0.0867*	0.0825*
		(0.00747)	(0.00816)
Education:	Graduate	0.0343*	0.0344*
		(0.00544)	(0.00545)
Age:	40 – 60 years	0.0174*	0.0173*
		(0.00435)	(0.00435)
	over 60 years	0.0301*	0.0298*
		(0.0237)	(0.00426)
Male, rural, car specs, make FE, year-by-type FE			
Implied $\hat{\gamma}$		0.20	
($\hat{\gamma}$ for income < $100,000)			0.16
($\hat{\gamma}$ for income > $100,000)			0.22
Observations		17,586	17,586
R-squared		0.365	0.365

A regression approach

		"Low" Cut-Off(discount rate 3% 50% MSRP)	
Dependent variable = 1 if hybrid		**(1)**	**(2)**
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Fuel savings×(Income>$100,000)			0.00124
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Education:	Graduate	0.0343*	0.0344*
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More in the paper

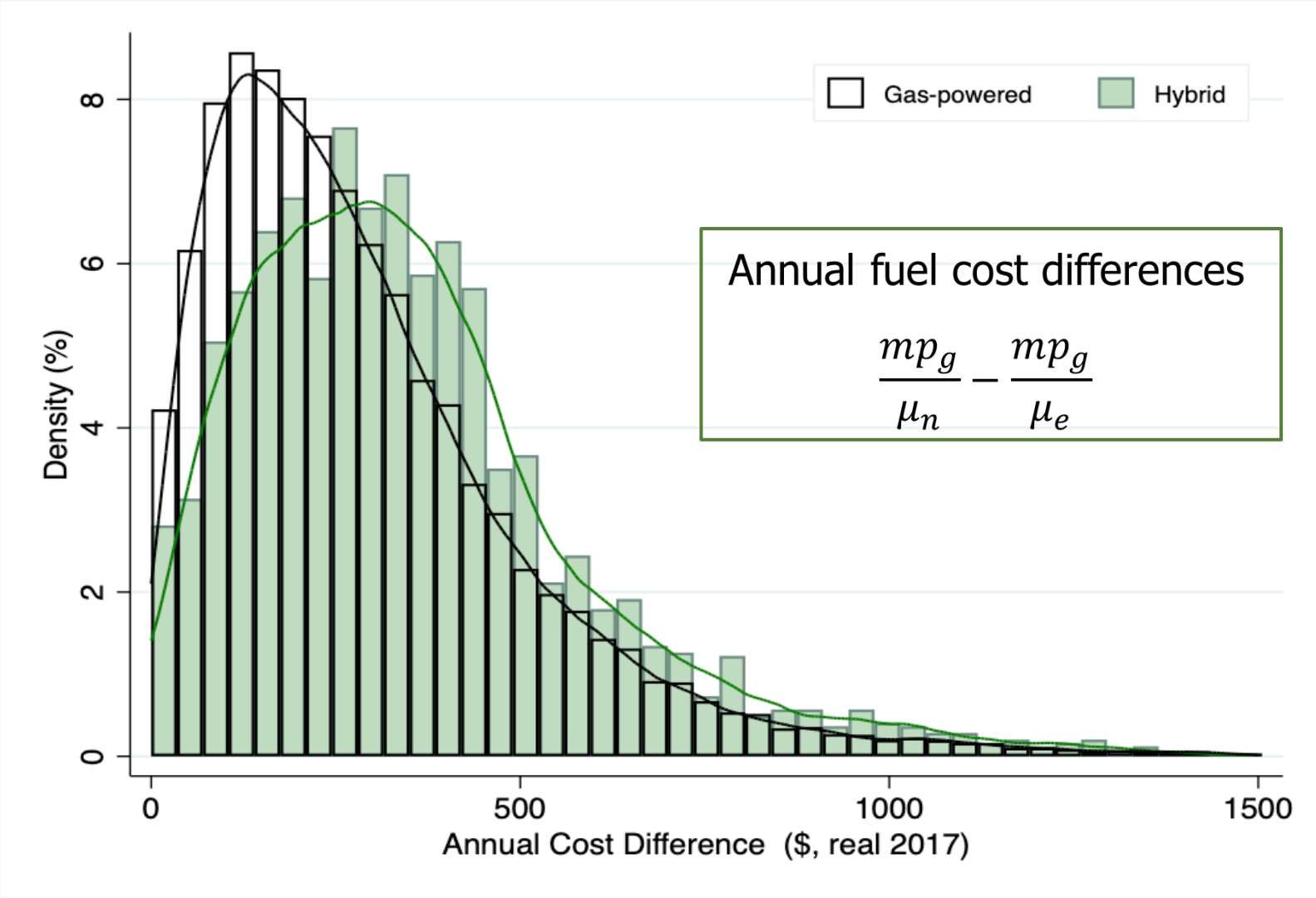
1. Comparing similar hybrid and gas powered vehicles

2. Use all cars, control statistically for other car characteristics

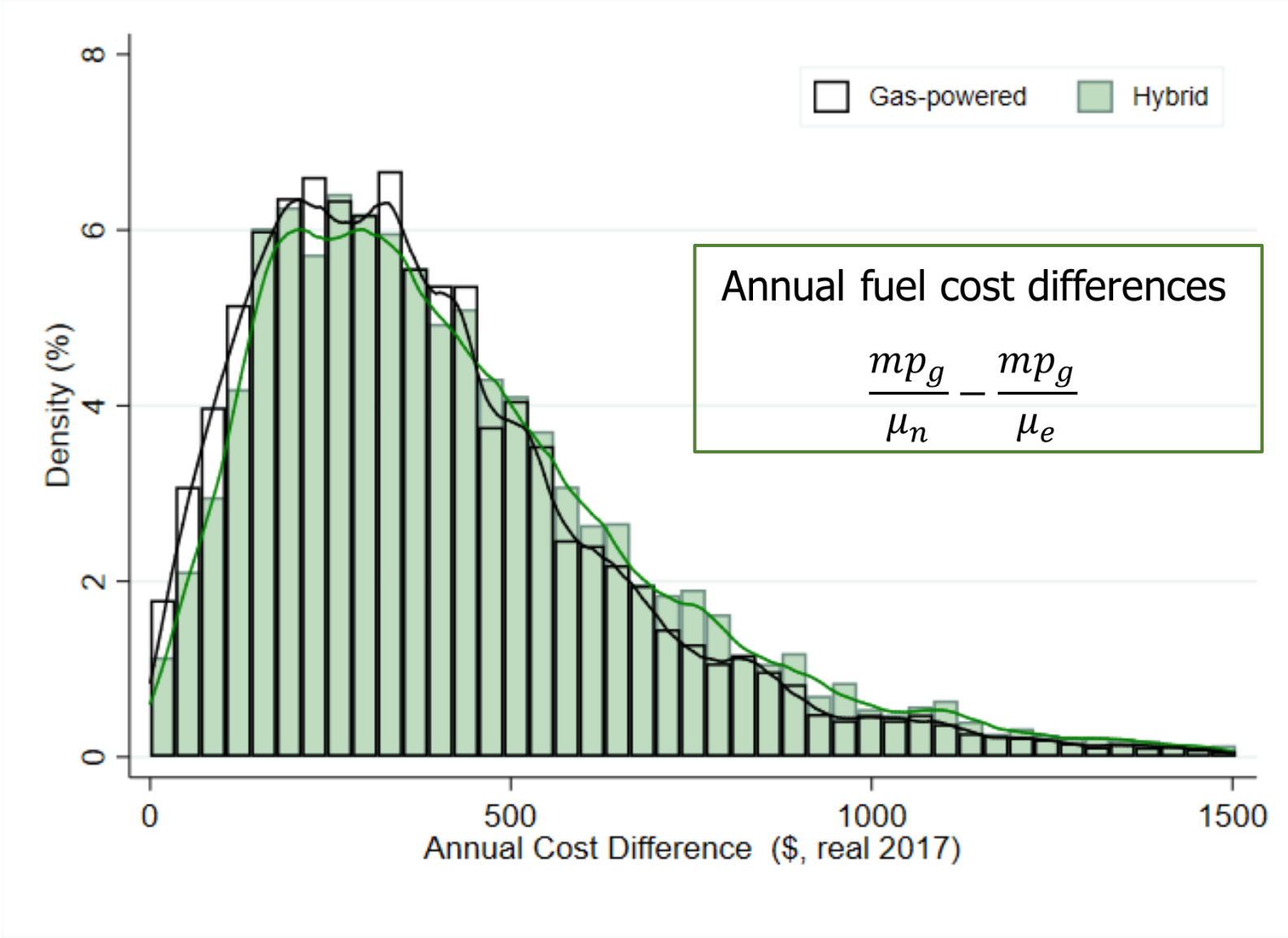
Robustness

- Alternative cutoff for mistakes (”mistake-equalizing”)
- **Realized vs. expected miles**
- MSRP vs. purchase price vs. used car price

All hybrid-gas car pairs: **Actual Miles** (NHTS)



All hybrid-gas car pairs: **Expected Miles** (MaritzCX)



Conclusions:

- Vehicle fuel efficiency hardly correlated with individuals' annual driving costs (demographics more important)
- Curious that people would respond to $\bar{m}$, but not to = m_i
- Nearly as many overinvest as underinvest
  $\Rightarrow$ Regulations might be Kaldor-Hicks, not Pareto