

# Retail Behavior in the E10 Market

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# Motivation: The Blend Wall

- Obviously, we all like Ethanol
  - US Mandates 30 Billion gallons of biofuels by 2022
  - US Gasoline demand about 130 Billion gallons
  - Most common product, E10, not sufficient to absorb all that biofuel
- For market to absorb 25-30 Billion gallons will need some combination of
  - Rapid expansion of E85 infrastructure (pumps, flex-fuel cars)
  - Adoption of higher blends (E15) in conventional cars
  - Deployment of drop-in fuels

# The Iowa Retail Fuel Market

- What are customer & producer preferences?
  - Hypothesis: Producers can earn higher profits selling large quantities of E10 or E15 than smaller quantities of E85. Customers will price the energy differential in E85 but not in lower blends.
  - Do customers value biofuels according to energy difference or have some other preferences at play?
  - Not any empirical evidence for this because demand for E10 hard to identify relative to other blends
- In Iowa E10 is marketed and labelled distinctly from “clear” gasoline
  - in ‘most’ places 89 octane E10 priced and sold next to 87 ‘clear’

## Iowa Retail Ethanol



## Iowa Labeling Law

- Original Iowa labeling requirement is contained in 1982 State Acts, c. 1170, § 2, Senate File 2091
- As of April 29, 1982, all retailers selling gasoline with ethanol were required to post a notice on the pump stating "ethanol blend"
- Current law is in the Iowa Administrative Code, c. 85, Rule 21.85.48
- Any fuel containing over 1% of a renewable fuel, such as ethanol-blended gas or certain types of biodiesel, must have a pump decal
- There are at least two distinct decals approved for use by the Renewable Fuels and Coproducts Advisory Committee

# Possible Demand Models

- Rod Williamson model
  - Customers divided into ethanol 'haters', ethanol 'lovers,' and price-arbitragers
- Bruce Babcock (energy-arbitrage) rule
  - Energy content of E10 about 97% of clear
  - Standard difference in Iowa is 10 cents
  - Buy gasoline whenever price is over \$3.00/gallon

## More Formal Demand Model

- Based upon Anderson (JEEM, 2012)

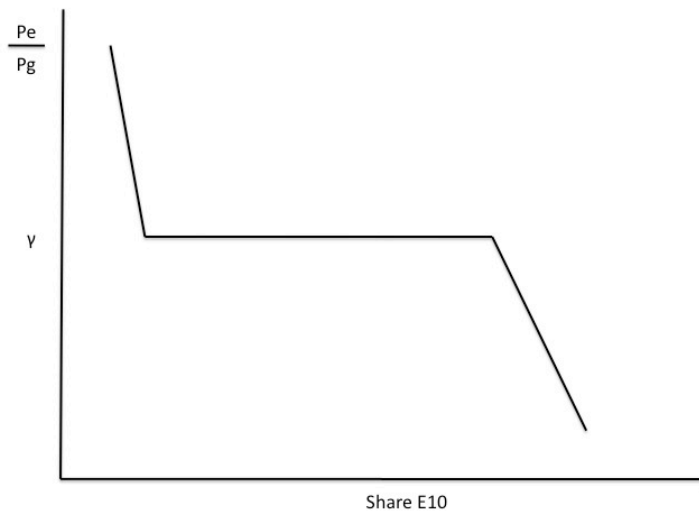
$$u(q_e, q_g) = v(\text{mpg}_e q_e + \text{mpg}_g q_g) + \theta(q_e > 0) + x$$

- where  $q_e, q_g$  is quantity of ethanol and gasoline consumed
- $\theta$  is a (non-mileage) preference parameter
- let  $\gamma = \frac{\text{mpg}_e}{\text{mpg}_g}$  be perceived mileage differential
- Customer  $i$  chooses e10 if

$$\theta^i \geq p_e - \gamma p_g$$

$$\gamma \geq \frac{p_e}{p_g} - \frac{\theta^i}{p_g}$$

# Price Ratio and Shares





# Retail Prices

- Monthly gross retail price data are from the Oil Price Information Service (OPIS)
- Sample period is 02/1996 - 09/2010 (14 years, 8 months)
- Prices are for gasoline sold as regular, midgrade, and premium, usually corresponding to 87, 89, 91 octane
- Price data do not indicate ethanol content

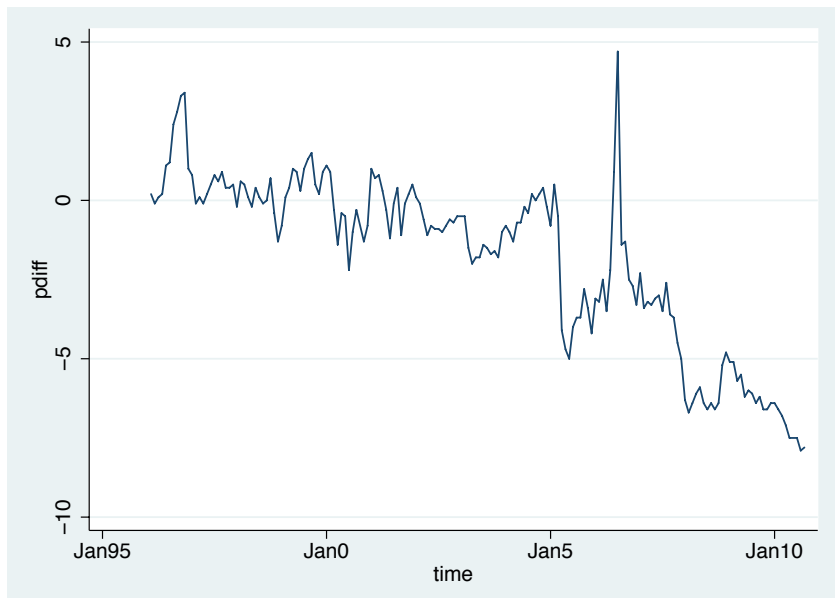
## Iowa Sales Volume Data

- Monthly retail sales volumes are from the Iowa Dept. of Revenue
- Retailers are required to remit motor fuel taxes electronically each month
- Volumes indicate gallons sold of clear gasoline, E10, E85, and other fuels
- Data exist for taxed quantities and gross (of exports, spillage) quantities
- Gas and E10 tax rates changed 10, 3 times over sample period, respectively

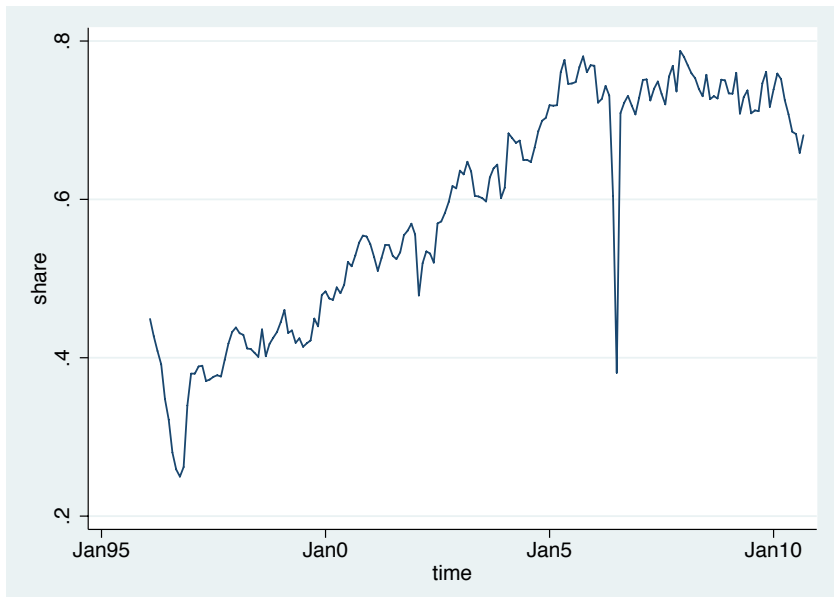
## Retail Prices &amp; Volumes

Year	E10 (\$/gal.)	Clear (\$/gal.)	E10 Gal.	Clear Gal.	E85 Gal.
1996	122.15	120.74	41.60	81.61	
1997	120.56	120.14	48.61	76.61	
1998	101.72	101.71	53.93	74.61	
1999	108.79	108.18	56.40	73.00	
2000	145.09	145.68	65.22	62.60	
2001	141.26	141.17	68.97	59.05	
2002	131.32	131.98	73.99	58.32	
2003	149.17	150.59	83.18	50.63	
2004	176.75	177.12	91.52	45.36	
2005	214.85	217.88	101.28	33.49	
2006	245.39	247.07	94.32	42.81	0.14
2007	272.96	276.39	101.37	34.68	0.19
2008	307.48	313.63	99.49	33.64	0.32
2009	222.49	228.48	98.73	36.61	0.12
2010	261.41	268.64	98.40	40.67	0.19

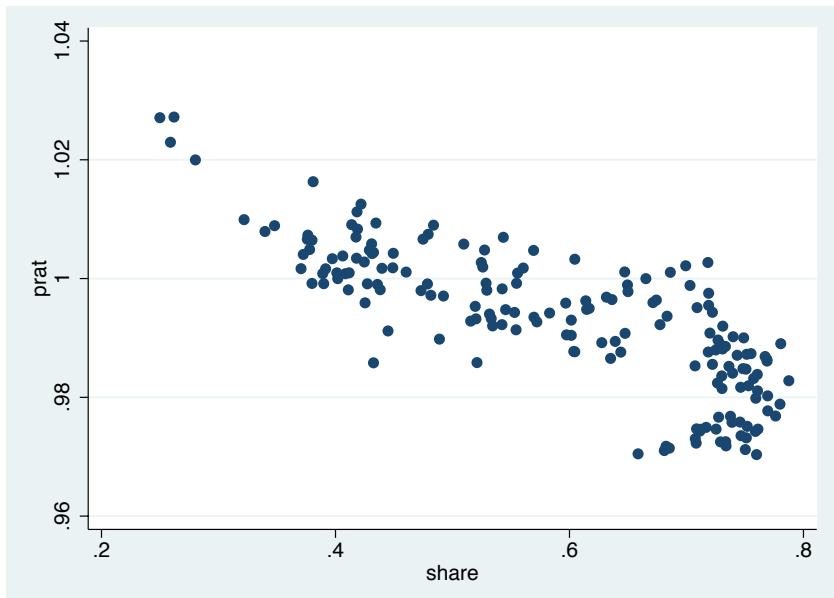
## Price Difference (E10 - Regular 'clear')



## Share E10



# Price Ratio and Shares



# Demand Model

- Share of e10

$$share_t = \alpha + \beta \frac{p_{et}}{p_{gt}} + \eta p_{gt} + \sigma \left[ \frac{p_{et}}{p_{gt}} > \gamma \right] + \omega t + \epsilon_t$$

- where  $p_e, p_g$  is price of ethanol and gasoline

# Preliminary Analysis

	<b>Linear</b>	<b>Quadratic</b>	$\theta_i$	<b>Price Parity</b>
$\ln(p_e/p_g)$	-4.011 (1.296)	-8.42 (.878)	-4.12 (2.42)	-17.80 (17.52)
$\ln(p_e/p_g)^2$		-471.16 (29.93)		
$\ln(p_g)$			.0216 (.0405)	.0040 (.0413)
$(p_e/p_g) > 1$				-.1043 (.0246)
Time Trend	.0040 (.0003)	.0046 (.0002)	.0038 (.0005)	.0039 (.0005)



# Confounding Issues

- Premium (91 Octane) is marketed as both clear and E10 in differing places
  - Kind of screwed with this data set on this point
  - 91 a small share of Iowa market - make assumptions about E10 content to bound elasticities
- Distinguishing octane preferences from ethanol preferences
  - One should be a constant value while energy difference is felt as % of price
  - Learn something about octane preferences from neighboring states?
- Interpretations
  - Customers are 'fooled' and are paying too much
  - Energy difference not noticeable at 10% levels
  - Energy difference exactly offset by octane gains??