

Using Information to Improve the Effectiveness of Nonlinear Pricing: Evidence from a Field Experiment

Matthew E. Kahn

UCLA and NBER

Frank A. Wolak

Stanford and NBER

Introduction

- Do California households who live in single family homes understand how they pay for electricity?
- Do they understand how their day to day actions such as turning on a light bulb or a plasma television maps into increased electricity consumption?

Our Contribution

- By partnering with two California utilities, we enrolled 2000 households to participate in a 20 minute Internet Educational course
- During this interaction session, we taught the households;
- The basics of an Increasing Block Tariff rate structure and what marginal price they pay for electricity
- We conduct a “before/after” comparison of KWH consumed to test for our treatment effect

An Example of the IBT and the Rising Marginal Price of a Kwh

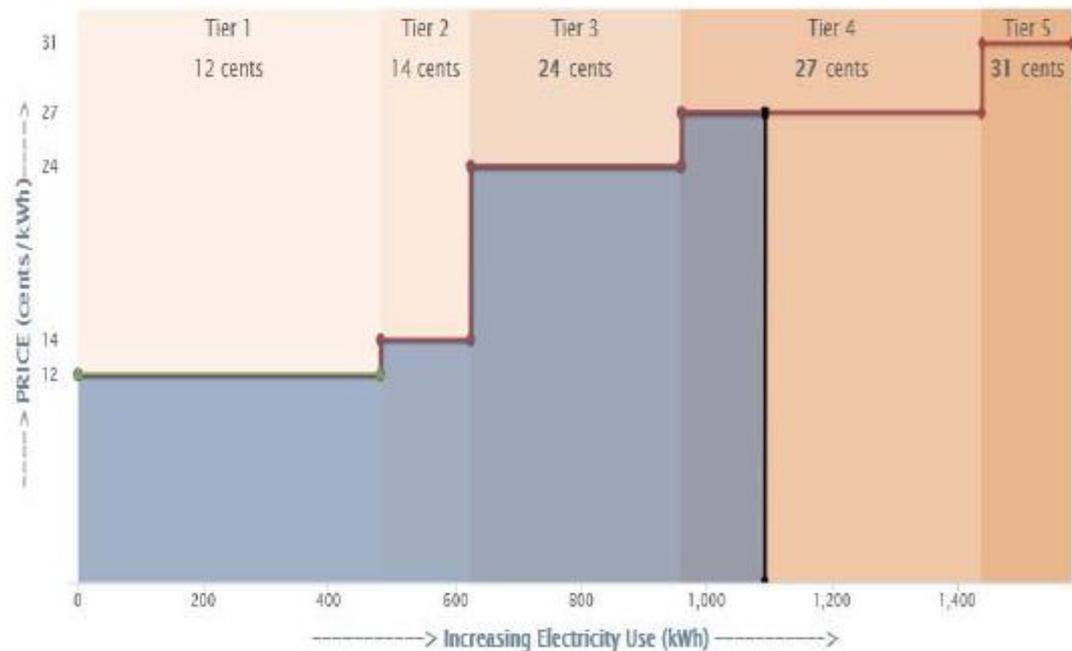
Visualizing Tiered Pricing

- Part 1: Tiers of Electricity Use
- Part 2: Prices in Each Tier
- **Part 3: Your Home's Electricity Use**
- Part 4: Possible Money Savings

Your typical summer month's usage: **1093 kWh**

Your typical summer month's bill: **\$194**

Your bill amount (*the blue area*) is smaller in the low tiers (like Tier 1), but it quickly gets bigger in higher tiers.



Details About Our Field Experiment

- 1. An invitation letter was sent out at random to thousands of households who live in single family homes
- 2. The letter included a \$ value of an Amazon Gift card that invited households would receive if they took the course.
- 3. Households who accepted this offer took our 20 minute course and received their gift card
- 4. We track such “treated” households consumption relative to control groups

The Invitation Letter

- Dear [insert name], Utility A is partnering with researchers from Stanford University and UCLA to develop a home energy savings workshop. Your valuable input will help Utility A create similar educational tools in the future. This online workshop is a 15-20 minute tutorial that could help you save money on your next electricity bill. For completing the workshop, you will receive a **\$50 gift card to Amazon.com.**

The workshop starts by showing how your electricity use affects your electricity bill. Then, using a brief survey of your customer's characteristics, the workshop generates the customized suggestions you can use to reduce your customer's electricity bills.

To begin the workshop simply click the link below or paste it into your browser.

The Participation Rate

Utility A Gift Card Amounts and Response Rates				
Amazon Amount (\$)	Number Offered	Cards Sent	Sent/Offered %	Standard Error %
10	700	34	4.90%	0.82%
20	3437	283	8.20%	0.47%
25	3161	291	9.20%	0.51%
30	3053	298	9.70%	0.54%
35	2949	299	10.10%	0.55%
50	200	22	11.00%	2.21%
Overall	13500	1227	9.10%	0.25%

The Other Participation Rate

Utility B Gift Card Amounts and Response Rates				
Amazon Amount (\$)	Number Offered	Cards Sent	Sent/Offered %	Standard Error %
0	1800	108	6.00%	0.56%
10	1500	181	12.10%	0.84%
20	1100	142	12.90%	1.01%
30	900	150	16.70%	1.24%
40	700	121	17.30%	1.43%
50	500	83	16.60%	1.66%
Overall	6500	785	12.10%	0.40%

Concern About Selection Bias?

- Who chooses to accept our invitation?
- Recall that we have three sets of individuals
 - 1. The control group who were chosen at random to not receive an invite
 - 2. The invited group who accepted our offer
 - 3. The invited group who declined our offer
- At the baseline, the empirical distribution of KWH is identical for these three groups

Why Could Our Treatment Change Behavior?

- In economics today, there is a debate about whether households respond to marginal prices or average prices (Borenstein, Ito)
- Intuitively, demand curves slope down!
- If you face a high marginal price for electricity but you assume that you face the average price for electricity, then you should **reduce** your consumption when we teach you about non-linear pricing.

Our Main Empirical Findings

**Table 5-1: Overall and Tier-Specific Treatment Effects
Estimates for Utility A**

Overall Treatment Effect		
Variable	Estimate	Standard Error
Treat	-0.723	0.082
Constant	-0.668	0.019
Tier 1 Treatment Effect		
Treat	0.136	0.060
Constant	-0.184	0.040
Tier 2 Treatment Effect		
Treat	-0.483	0.175
Constant	-0.291	0.046
Tier 3 Treatment Effect		
Treat	-0.461	0.134
Constant	-0.528	0.032
Tier 4 Treatment Effect		
Treat	-0.912	0.155
Constant	-0.786	0.378
Tier 5 Treatment Effect		
Treat	-1.201	0.220
Constant	-1.200	0.052

Next Steps?

- We now have the software developed
- Must partner with an electric utility to scale up our treatment
- Rollout of the Smart Meters and how people will use them to be “smarter” electricity consumers
- Crucial for how they respond to Critical Peak Pricing and other forms of dynamic pricing