Online Appendix for

Knowledge is (Less) Power: Experimental Evidence from Residential Energy Use

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A Survey Data and Practical Mechanisms

While this research project was designed to estimate the information gradient with respect to price elasticity, it is of interest both from an economic and policy perspective to understand the mechanisms driving this effect. Survey responses provide a starting point for this analysis. We gathered a rich dataset of household attributes and experiences during the experiment from responses to the pre- and post-surveys. The general strategy that we pursue is to interact survey responses with treatment indicators in the baseline ITT specifications. However, this is imperfect. First, the survey responses can themselves be interpreted as outcome variables. Second, nearly all households complete the pre-survey, but there is substantial non-compliance across all treatment groups in completing the post-survey. Despite these imperfections, how the survey responses (and confirmation of event notification) correlate with treatment outcomes may be interesting to some readers.

To explore possible asymmetries in survey compliance, we regress pre- and post-survey compliance indicators on observables; Table (A.4) presents results. Given the high rate of compliance in the pre-survey, as shown in columns 1 and 2 observables are not significant in explaining compliance. However, post-survey compliers in the price group differ from non-compliers in off-peak usage. This raises the possibility that compliers and non-compliers in the post-survey may also differ in unobservables. Fortunately, most of the analysis relying on survey data makes use of pre-survey data, where compliance is balanced.

A consumer's choice set and subsequently his ability to respond to prices will likely be related to certain household patterns or attributes. For example, differences in the frequency with which households are at home during the day or have central air conditioning could affect the ability to respond to price incentives. Below we present correlations between the treatment effect and (i) households tendency to be home during the day and (ii) the presence of central air conditioning.

A.1 Home During Daytime

All of the price events occurred at times that overlap with the traditional workday. Households with at least one person at home during these hours will have a broader range of activities with which to respond to price events. At the same time, one may be concerned that compliance is correlated with this household attribute. To remain in the study, households assigned to the information treatment needed to successfully schedule an appointment for the installation of the IHD. A technician-imposed constraint dictated that the installation needed to occur during business hours (9am-5pm). The risk is that households who are unable to have an IHD installed are also less likely to be home during events, and thus less able to respond to them.

To examine this, we rely on pre-survey data that asked households if someone was generally at home during the day, after school or after work.[1] The first two columns of Table (A.5) show that the information feedback group has fewer households with someone home during the day than the price-only group, both before and after accounting for attrition. Slightly over 50 percent of the households assigned to the price-only group have someone home during the day, as compared to just over 40 percent for the price+IHD treatment. Interestingly, when we restrict the sample to compliers this pattern remains, implying that we should not be too concerned that installation-related attrition is closely correlated with participants' schedules. If households with someone home during the day are more responsive to pricing events then the differential response attributable to information feedback will be, if anything, attenuated.

[1]This survey response pre-dates treatment assignment. However, it is also only an approximate measure of the probability with which households were home during the day during treatment events.

It is also of interest to see how the response to pricing events varies by how frequently an individual is at home. To do this, we create a vector of indicator variables indicating the tendency for someone to be home during the day and interact it with assignment to treatment. Household presence during events appears to have little correlation with treatment effects, providing evidence that the treatment gradient is not driven by this feature. Conditional on someone tending to be home during the day, households with an IHD are more responsive to price changes, where the difference in treatment effects ranges from 9 to 14 percentage points in the ITT specifications. The treatment differential is larger in the ToT specifications, ranging between 11 and 18 percentage points, and distinct with 90 percent confidence for day-ahead pricing events.

A.2 Central Air Conditioning

We investigate correlations with respect to central air conditioning for two reasons. First, an unfortunate sampling draw could have yielded unobservable (at the time of randomization) differences between the groups along this dimension. We would like to rule out the possibility that a narrative along these lines explains the information gradient. Also, given the importance of central air conditioning as part of the home-energy portfolio, we want to understand the extent to which consumers are using it to respond to price. It is a high usage activity that can easily account for large usage reductions when turned off (or down) during events.

Table (A.6) shows the percentage of households with central AC and reports treatment effects for households with and without it. Results are contrary to our initial expectations. Households *without* central AC in both treatment groups are on average more responsive to pricing events. The first implication of this result is that central AC is not necessary or sufficient for the information gradient to be present. Second, this result implies that households exhibiting large responses are doing so by adjusting along other, likely smaller, margins. We view this as a reflection of some underlying selection process such that non-AC household members are more price-responsive. For instance, younger households may be more interested in energy conservation and more likely to live in dwellings without central AC.

Appendix Figures and Tables

Figure A.1: In-Home Display (1)



Figure A.2: In-Home Display (2)



Table A.1: Treatment Effects (Balanced Panel)

Event Type:	All	All	All	All	Day Ahead (DA)	30min (TM)
Column:	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: ITT Balanced Panel						
Price Only	-0.009	-0.041	0.001	-0.025	-0.064	0.026
	(0.041)	(0.041)	(0.041)	(0.040)	(0.047)	(0.050)
Price + IHD	-0.109**	-0.132***	-0.105**	-0.124**	-0.153***	-0.079
	(0.050)	(0.050)	(0.049)	(0.048)	(0.052)	(0.058)
Prob(P = P+I)	0.070*	0.098*	0.051*	0.065*	0.126	0.100*
R-Square	0.00	0.06	0.51	0.56	0.56	0.56
Panel B: ToT Balanced Panel						
Price Only	-0.009	-0.042	0.001	-0.025	-0.066	0.026
	(0.041)	(0.042)	(0.041)	(0.041)	(0.048)	(0.051)
Price + IHD	-0.129**	-0.156***	-0.124**	-0.147***	-0.182***	-0.094
	(0.058)	(0.058)	(0.057)	(0.056)	(0.061)	(0.068)
Prob(P = P+I)	0.051*	0.062*	0.037**	0.042**	0.072*	0.091*
R-Square	0.00	0.06	0.51	0.56	0.56	0.56
Hour-by-day FEs	N	Y	N	Y	Y	Y
HH FEs	N	N	Y	Y	Y	Y
Number of Events	6	6	6	6	3	3
Number of HHs	339	339	339	339	339	339

*Notes: The dependent variable is ln(kwh) in 15-minute intervals. ITT results are reported from an OLS regression on usage on intial assignment to treatment. ToT results are reported from a 2SLS regression where initial treatment assignment is used as an instrument for receipt of treatment. The sample is comprised of households assigned to a treatment for which we observe usage data for ALL pricing events (ie. the balanced panel). All specifications include a treatment group indicator and an event window indicator (except where subsumed by time or household fixed effects). In columns 1-4 the treatment window indicator is set equal to 1 if any event (DA or TM) is occurring. Column 2 includes hour-by-day fixed effects; column 3 includes household fixed effects and column 4 includes both. Columns 5 and 6 present results separately from DA and TM events, respectively. Standard errors in parentheses are clustered at the household level. *,**,*** indicates significance at 0.10, 0.05, and 0.01.*

Table A.2: Notification Statistics

	Price Only				Price + IHD			
Event Date	Confirmed	Intermediate	Not Confirmed	Total	Confirmed	Intermediate	Not Confirmed	Total
07/21/11	45	29	27	101	34	29	17	80
	45%	29%	27%		43%	36%	21%	
07/22/11	37	36	30	103	28	37	15	80
	36%	35%	29%		35%	46%	19%	
08/04/11	42	58	25	125	26	44	15	85
	34%	46%	20%		31%	52%	18%	
08/10/11	49	45	30	124	23	45	18	86
	40%	36%	24%		27%	52%	21%	
08/17/11	45	52	30	127	21	49	17	87
	35%	41%	24%		24%	56%	20%	
08/26/11	49	48	32	129	24	46	30	100
	38%	37%	25%		24%	46%	30%	

Notes: A household is classified as "Confirmed" if it received text message confirmations, or if it actively confirmed the receipt of the event notification by phone or email. "Intermediate" households were recorded as having received a phone call or voicemail, but did not press the "confirm" button at the conclusion of the automated notification call/voicemail. All remaining households including households who did not confirm receipt of an email are classified as "Not Confirmed".

Table A.3: Treatment Effects (Restricted Sample)

Event Type:	All	Day Ahead (DA)	30min (TM)	All	Day Ahead (DA)	30min (TM)
Column:	(1)	(2)	(3)	(4)	(5)	(6)
		ITT Unbalanced Panel			**ToT Unbalanced Panel**	
Price Only	-0.067**	-0.098**	-0.015	-0.069**	-0.101**	-0.015
	(0.033)	(0.042)	(0.039)	(0.034)	(0.044)	(0.040)
Price + IHD	-0.163***	-0.188***	-0.097*	-0.198***	-0.233***	-0.116*
	(0.043)	(0.047)	(0.051)	(0.051)	(0.057)	(0.060)
Prob(P = P+I)	0.033**	0.080*	0.110	0.011**	0.024**	0.086*
Hour-by-day FEs	Y	Y	Y	Y	Y	Y
HH FEs	Y	Y	Y	Y	Y	Y
Number of Events	6	6	6	6	3	3
Number of HHs	437	437	437	437	437	401
R-Square	0.62	0.62	0.62	0.62	0.62	0.62

*Notes: The dependent variable is ln(kwh) in 15-minute intervals. ITT results are reported from an OLS regression on usage on intial assignment to treatment. ToT results are reported from a 2SLS regression where initial treatment assignment is used as an instrument for receipt of treatment. The sample is comprised of all days preceding the first pricing event, and the event days themselves; that is, all non-event days after July 21 (the first event) are dropped from the sample. All specifications include household and hour by calendar day fixed effects. treatment group indicator and an event window indicator (except where subsumed by time or household fixed effects). Columns 1 and 4 pool event types; columns 2-3 and 5-6 present results separately from DA and TM events, respectively. Standard errors in parentheses are clustered at the household level. *,**,*** indicates significance at 0.10, 0.05, and 0.01.*

Table A.4: Survey Compliance by Treatment and Control Group

	Pre-Survey		Post-Survey	
	Price	Price+IHD	Price	Price + IHD
Mean Off Peak kWh	0.003	-0.023	-0.111*	-0.043
	(0.012)	(0.028)	(0.060)	(0.071)
TOU Rate (1=yes)	0.007	-0.004	-0.006	0.021
	(0.022)	(0.043)	(0.110)	(0.108)
F-Statistic	0.159	0.406	2.338	0.187
P-Value	0.854	0.668	0.101	0.830
N	130	100	130	100

*Notes: Results for "Pre-Survey" and "Post-Survey" are from a LPM regressing observables on pre- and post-survey compliance indicator. P-Value corresponds to probability that coefficients are jointly equal to zero. Control group used as control in each specification. Standard errors in parentheses. *,**,*** denote significant at the 0.10, 0.05, and 0.01 level.*

Table A.5: Home During Daytime

	% of HHs: Initially Assigned	% of HHs: Compliers Only	Intention to Treat			Treatment on the Treated		
			All events	DA events	TM events	All events	DA events	TM events
Price*1[Home during day]	51%	52%	-0.036	-0.055	-0.009	-0.032	-0.050	-0.006
			(0.043)	(0.052)	(0.051)	(0.044)	(0.052)	(0.052)
Price*1[Home after school]	22%	20%	-0.047	-0.099*	0.023	-0.046	-0.103	0.029
			(0.055)	(0.058)	(0.083)	(0.061)	(0.065)	(0.089)
Price*1[Home after work]	27%	27%	-0.031	-0.068	0.017	-0.027	-0.064	0.021
			(0.067)	(0.080)	(0.079)	(0.069)	(0.082)	(0.082)
Price*1[Missing]	1%	0%	-0.426***	-0.957***	0.637***			
			(0.027)	(0.034)	(0.037)			
IHD+price*1[Home during day]	41%	44%	-0.153**	-0.190**	-0.096	-0.187**	-0.233**	-0.117
			(0.071)	(0.078)	(0.084)	(0.088)	(0.096)	(0.104)
IHD+price*1[Home after school]	21%	22%	-0.116*	-0.122	-0.1	-0.118	-0.13	-0.043
			(0.069)	(0.087)	(0.084)	(0.074)	(0.098)	(0.111)
IHD+price*1[Home after work]	35%	29%	-0.114*	-0.165**	-0.036	-0.151	-0.230**	-0.097
			(0.066)	(0.071)	(0.085)	(0.093)	(0.103)	(0.084)
IHD+price*1[Missing]	3%	4%	-0.262	-0.266	-0.236			
			(0.306)	(0.239)	(0.371)			
P-Value (PIHD*HDD = P*HDD)			0.131	0.118	0.328	0.089*	0.069*	0.297
HH FEs			Yes	Yes	Yes	Yes	Yes	Yes
Hour-by-day FEs			Yes	Yes	Yes	Yes	Yes	Yes
Number of obs			230	230	215	230	230	215
R-Square			0.583	0.583	0.583	0.583	0.583	0.583

*Notes: Treatment effects by pre-existing daily schedule. P-Value reports probability of equal treatment effects across groups, conditional on being "generally home during the day". Standard errors clustered at the household in parantheses. *,**,*** indicates significance at 0.10, 0.05, and 0.01.*

Table A.6: Central Air Conditioning

	% of HHs	All events	DA events	TM events
Price*1[No Central AC]	55%	-0.090**	-0.085*	-0.089*
		(0.042)	(0.048)	(0.052)
Price*1[Yes Central AC]	42%	0.033	-0.053	0.142**
		(0.049)	(0.063)	(0.056)
Price*1[Missing]	4%	-0.078	-0.071	-0.081
		(0.143)	(0.132)	(0.190)
IHD+P*1[No Central AC]	61%	-0.178***	-0.220***	-0.110
		(0.055)	(0.058)	(0.072)
IHD+P*1[Yes Central AC]	35%	-0.081	-0.092	-0.062
		(0.071)	(0.080)	(0.077)
IHD+P*1[Missing]	4%	-0.049	-0.170	0.123
		(0.445)	(0.420)	(0.297)
P-Value (P*Yes CAC = PIHD*Yes CAC)		0.151	0.680	0.018**
P-Value (P*No CAC = PIHD*No CAC)		0.154	0.039**	0.792
HH FEs		Yes	Yes	Yes
Hour-by-day FEs		Yes	Yes	Yes
Number of hhs		230	230	215
R-Square		0.583	0.583	0.583

*Notes: Treatment effects by presence of central air conditioning. P-Value reports probability of equal treatment effects across groups, conditional on the indicated observable. Standard errors clustered by household in parantheses. *,**,*** indicates significance at 0.10, 0.05, and 0.01.*