Social norms and water conservation in three utilities

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City of WaterSmart

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Gallons of water used in the last two months

[illegible]

[illegible]

Matt Bloom
123 Main Street
Everytown, USA

[illegible]

[illegible]

[illegible]

[illegible]

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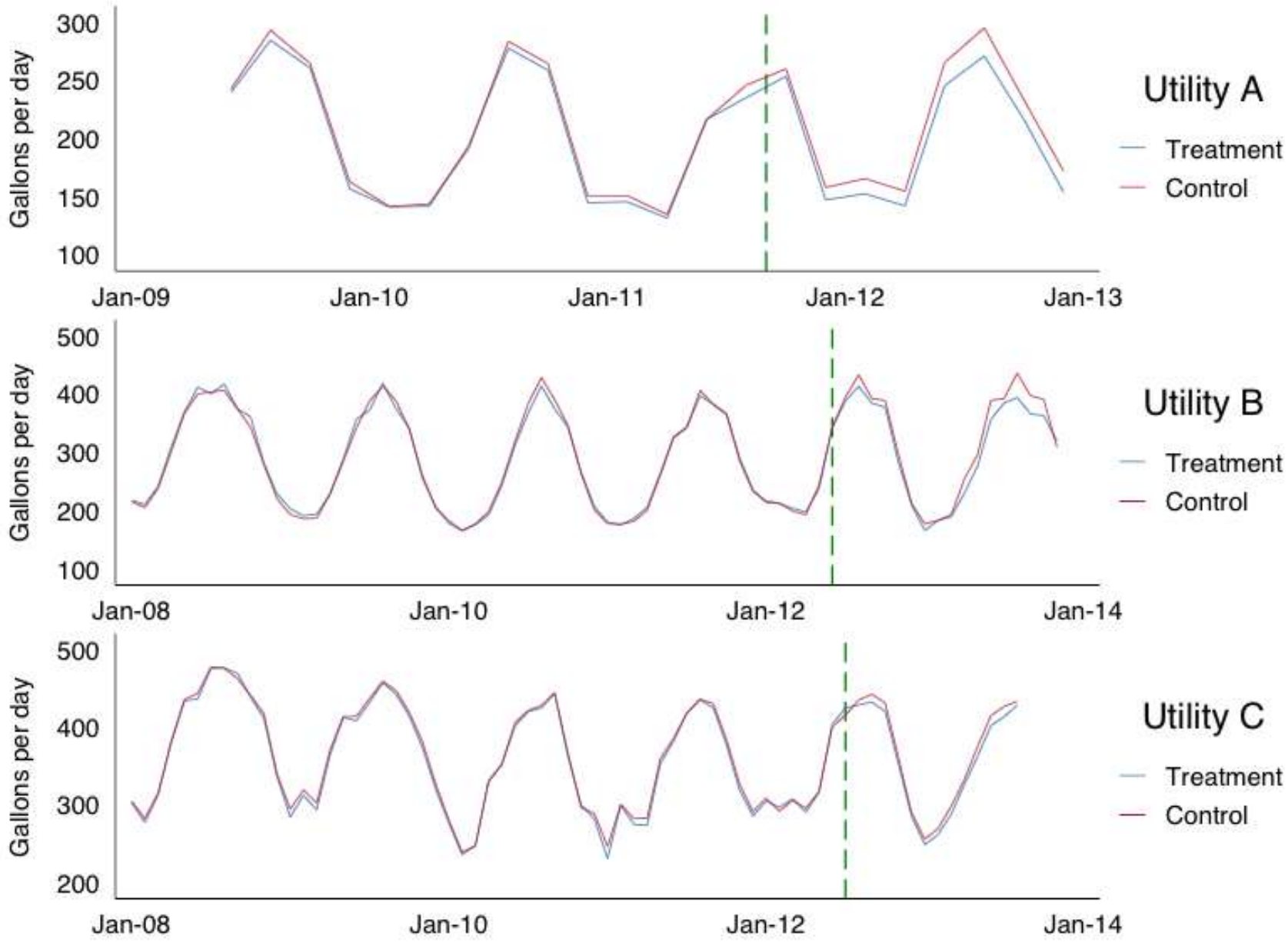
Table 1: Summary Statistics By Pilot

Pilot	Water Use	Temp (F)	Rain (in)	Income	HOuse Value	Ideology Index
Utility A	204	70	2.1	60,056	360,332	68
Utility B	291	67	1.6	99,522	720,944	57
Utility C	360	72	0.8	123,240	973,335	34

Table 3: Sample Sizes

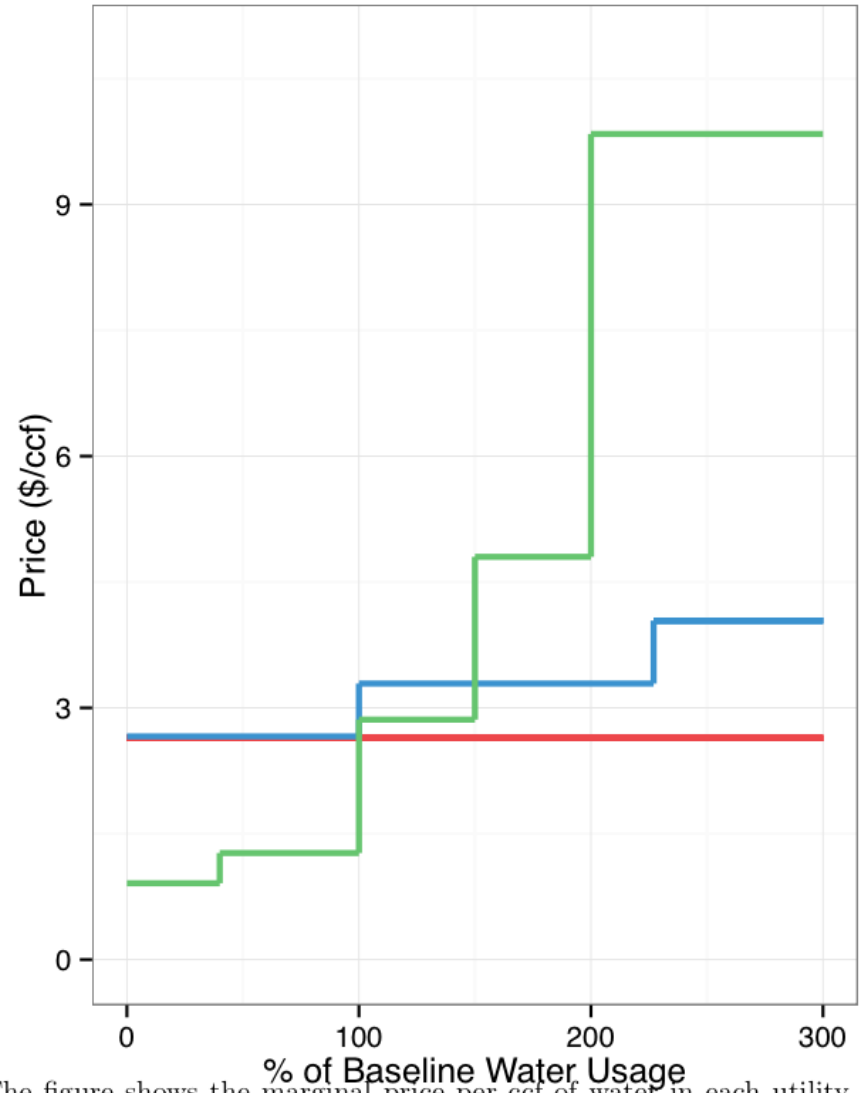
Pilot	Start Date	End Date	N: Obs	N: Post-Treat	HHs	Treated HHs
Utility A	2011-09-20	2013-01-01	43,598	15,041	2,233	992
Utility B	2012-06-28	on going	98,929	23,849	3,092	1,545
Utility C	2012-07-26	2013-08-23	671,279	121,209	11,307	1,180


Gallons per day
300
250
200
150
100
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Utility A
Treatment
Control
Gallons per day
500
400
300
200
100
Jan-08
Jan-10
Jan-12
Jan-14
Utility B
Treatment
Control
Gallons per day
500
400
300
200
Jan-08
Jan-10
Jan-12
Jan-14
Utility C
Treatment
Control

Treatment effect: Results

- Average treatment effects (95% CI):
  - Utility A: -10.6 gpd (-4.39 to -16.89 gpd)
  - Utility B: -16.0 gpd (-7.51 to -24.58 gpd)
  - Utility C: -4.66 gpd (+2.10 to -11.42 gpd)
- Assuming a program cost of $10 per household per year (print): $**2.61 per kgal** saved (Utility A) and $**1.73 per kgal** saved (Utility B).
- Savings equivalent to raising the first tier marginal price by **14%** and **15%** in Utilities A and B (ε=-0.38)

(from Utility C's rate sheet)



Tier	Rate/ccf
Low Volume	$ 0.91
Base Rate	$ 1.27
Inefficient	$ 2.86
Excessive	$ 4.80
Wasteful	$ 9.84

Notes: The figure shows the marginal price per ccf of water in each utility. Utility B and Utility C have increasing block rate structures where the marginal price depends on the level of consumption. The baseline level of consumption in Utility B is 172 gallons per day, in Utility C it is an allocation determined at the household level, and in Utility A there is only one tier.

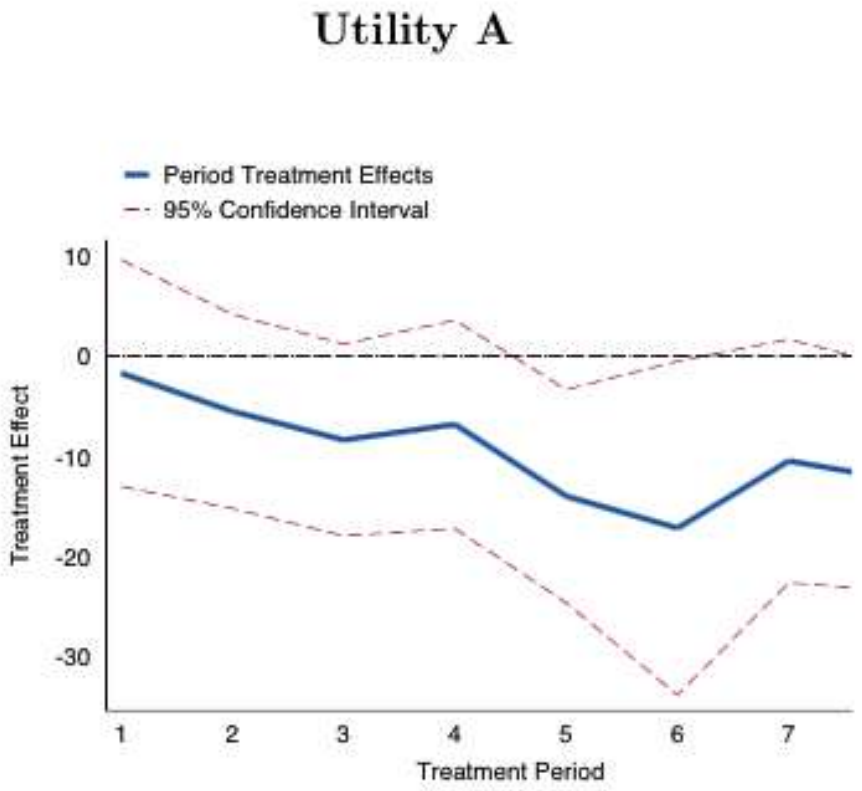
Lowest (baseline) water users

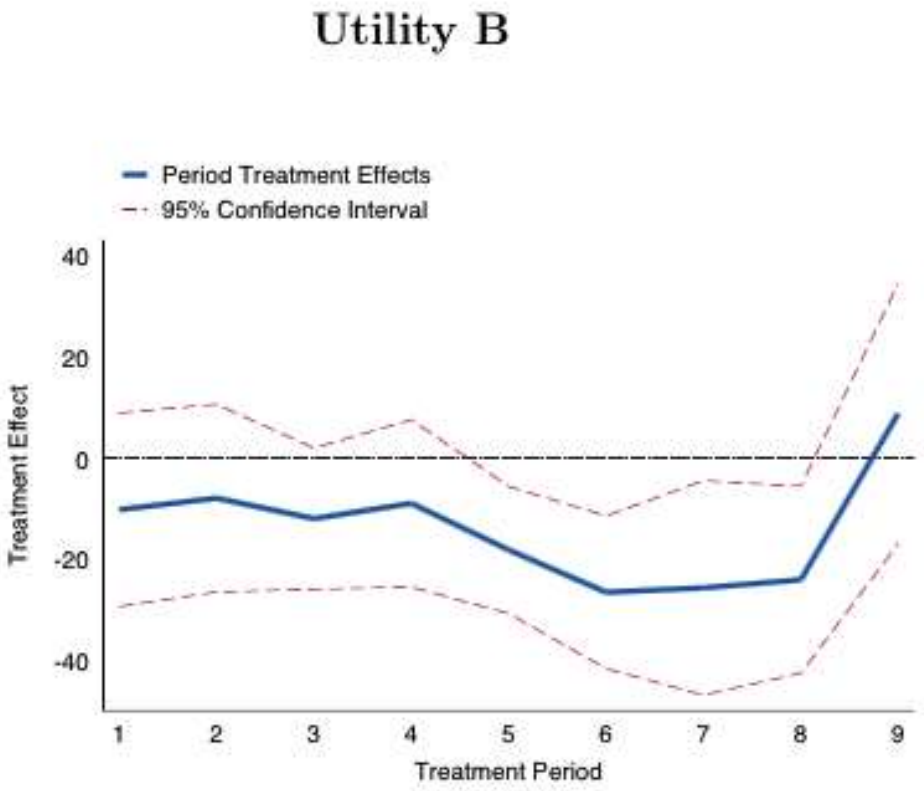
Highest (baseline) water users

Table 6: Heterogeneity: Baseline Water Use

	(1) Utility A	(2) Utility B	(3) Utility C
TE*Decile 1	-3.6155	5.6861	-7.6531
	(4.5038)	(4.2270)	(6.8840)
TE*Decile 2	-6.6872	-1.2045	-4.7360
	(5.3827)	(5.9139)	(7.6407)
TE*Decile 3	0.6467	-1.9949	20.2478***
	(5.3415)	(5.2862)	(7.2882)
TE*Decile 4	1.5023	1.8951	11.6678*
	(5.6364)	(8.5271)	(6.7423)
TE*Decile 5	2.1691	-7.0904	-9.5308
	(6.4989)	(8.2262)	(8.8396)
TE*Decile 6	-0.1273	-23.0569**	-25.0424***
	(8.7114)	(10.3158)	(8.7448)
TE*Decile 7	1.3495	-13.8441	-4.2213
	(8.5070)	(12.4949)	(9.6514)
TE*Decile 8	-19.2800**	-32.0168**	-10.7997
	(8.4271)	(14.4709)	(10.8069)
TE*Decile 9	-27.9715***	-14.6713	-12.6979
	(9.8854)	(15.3997)	(12.9851)
TE*Decile 10	-54.8718**	-77.9422***	-2.6685
	(21.7649)	(26.8523)	(18.7422)
Household FEs	Yes	Yes	Yes
Year-Period FEs	Yes	Yes	Yes
Weather Controls	Yes	Yes	Yes
Adjusted R^2	0.185	0.185	0.205
Households	1,889	3,091	2,379
Observations	38,099	85,217	148,517

Durability (while receiving HWRs)





Existing conservation programs

Existing conservation programs

	Utility A	Utility B	Utility C
Rebates			
Toilets	X	X	X
Clothes Washer	X	X	X
Lawn Conversion	X	X	X
Sprinklers			X
Irrigation Controller		X	X
Technical Advice			
Home Water Audits	X	X	
Community Classes	X		

Participation before and after treatment

(a) Utility A

Pre-treatment (over ~32 months)

	Treatment	N_T	Control	N_C	Treatment-Control	p-value
Any Program	0.125	1,023	0.133	928	-0.00742	0.625
Any Rebate	0.0997	1,023	0.0970	928	0.00272	0.840
Home Survey	0.0254	1,023	0.0356	928	-0.0101	0.191
Clothes Washer	0.0420	1,023	0.0474	928	-0.00538	0.566

Post-treatment (over 14 months)

	Treatment	N_T	Control	N_C	Treatment-Control	p-value
Any Program	0.0967	1,013	0.0147	882	0.0820	0.000
Any Rebate	0.0158	1,013	0.0102	882	0.00559	0.288
Home Survey	0.0809	1,013	0.00454	882	0.0764	0.000
Clothes Washer	0.00691	1,013	0.00794	882	-0.00103	0.795

(b) Utility B

	Pre-treatment					
	Treatment	N_T	Control	N_C	Treatment-Control	p-value
Any Program	0.27	1,604	0.26	1,605	0.0083	0.595
Any Rebate	0.26	1,604	0.25	1,605	0.0083	0.593
Toilet	0.037	1,604	0.042	1,605	-0.0050	0.473
Clothes Washer	0.13	1,604	0.12	1,605	0.0082	0.480

	Post-treatment					
	Treatment	N_T	Control	N_C	Treatment-Control	p-value
Any Program	0.055	1,501	0.028	1,512	0.028	0.000
Any Rebate	0.049	1,501	0.028	1,512	0.022	0.002
Toilet	0.0100	1,501	0.0053	1,512	0.0047	0.138
Clothes Washer	0.024	1,501	0.021	1,512	0.0035	0.517

Interaction with existing programs

- Households receiving HWR **8 percentage points** in Utility A to participate in any program, **7%** more likely in Utility B (*random effects logit*).
- In Utility A, more likely to participate in home survey/water audit and a toilet rebate. In Utility B more likely to participate in a rebate.

Effect on water usage of HWR + participation

- Participation in programs reduces water consumption (i.e. ~25 gpd for toilet rebate, ~35 gpd for water audit); HWR treatment effect declines slightly.
- Suggestive evidence that HWRs:
  - Attract more water-efficient households to request water audit (*bad news*)
  - Attract less water-efficient households to redeem high-efficiency toilet rebate (*good news*)

Thank you

- WaterSmart: Peter Yolles, Ora Chaiken, Chad Haynes, Will Holleran, and Doug Flanzer
- For helpful comments and advice: Michael Hanemann, Kerry Smith, Hendrik Wolff, Marc Jeuland, and Mark Long

Table 4: Balance of Observables Across Treatment

(a) Utility A

	Control	N_C	Treatment	N_T	Difference	p-value
Baseline Water	204.9	897	200.6	992	4.31	0.510
Assess Value	344,367	1,165	358,597	941	-14,229	0.006
Ideology Index	68.3	880	68.0	712	0.32	0.450
Occupants	2.55	1,241	2.61	992	-0.061	0.231
Lot Size	8,505	1,133	8,188	903	317	0.673
Year Built	1984.7	1,237	1983.9	992	0.76	0.279
Single Family Home	0.63	1,241	0.68	992	-0.059	0.004

(b) Utility B

	Control	N_C	Treatment	N_T	Difference	p-value
Baseline Water	279.5	1,547	278.8	1,545	0.72	0.928
Assess Value	714,723	1,508	713,211	1,502	1,511	0.923
Ideology Index	57.1	979	57.6	978	-0.53	0.488
Occupants	2.93	1,547	3.01	1,545	-0.082	0.065
Lot Size	8,703	1,546	8,177	1,542	526	0.110
Year Built	1951.7	1,547	1951.0	1,545	0.72	0.481
Single Family Home	0.98	1,547	0.97	1,545	0.0084	0.132

(c) Utility C

	Control	N_C	Treatment	N_T	Difference	p-value
Baseline Water	343.8	10,127	355.4	1,180	-11.6	0.040
Assess Value	967,899	8,794	965,938	1,061	1,961	0.920
Ideology Index	34.4	7,795	34.3	945	0.16	0.646
Occupants	3.99	10,127	3.88	1,180	0.10	0.000
Lot Size	5,462	8,622	5,432	1,041	30	0.756
Year Built	1990.7	10,121	1991.0	1,180	-0.33	0.349
Single Family Home	0.87	10,127	0.89	1,180	-0.025	0.017