

Online supplement to

Environmental Externalities and Free-Riding in the
Household

S.1 Supplemental figures and tables

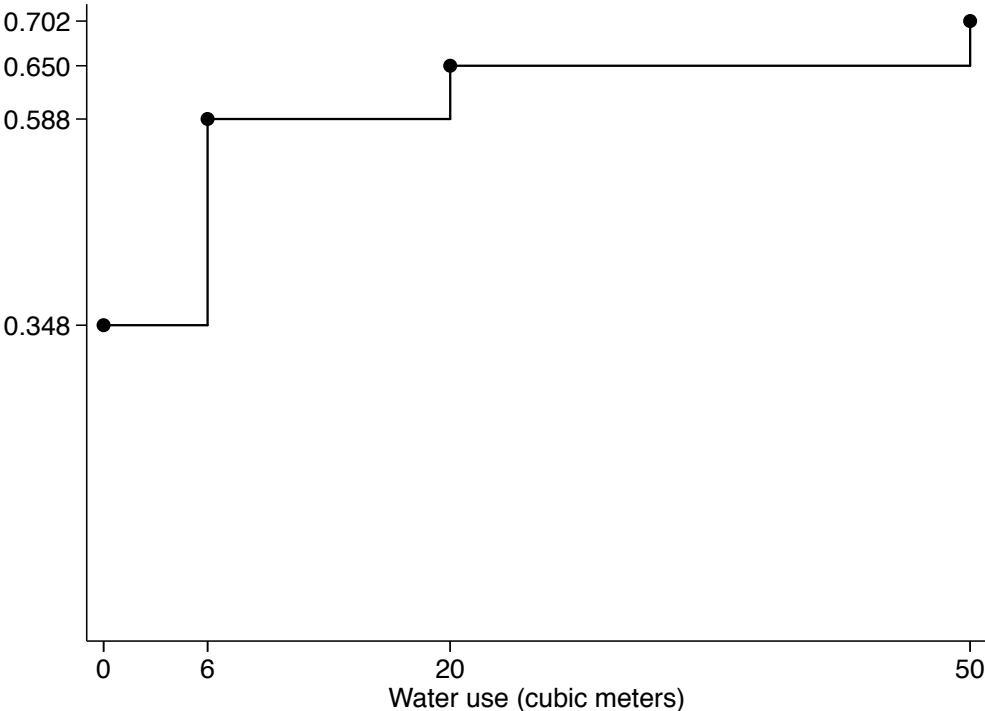


Figure S.1: 2015 tariff schedule

Notes: Increasing block tariff for residential piped water in Livingstone. The price is shown in 2015 USD per cubic meter and is increasing in cumulative consumption over the course of the month.

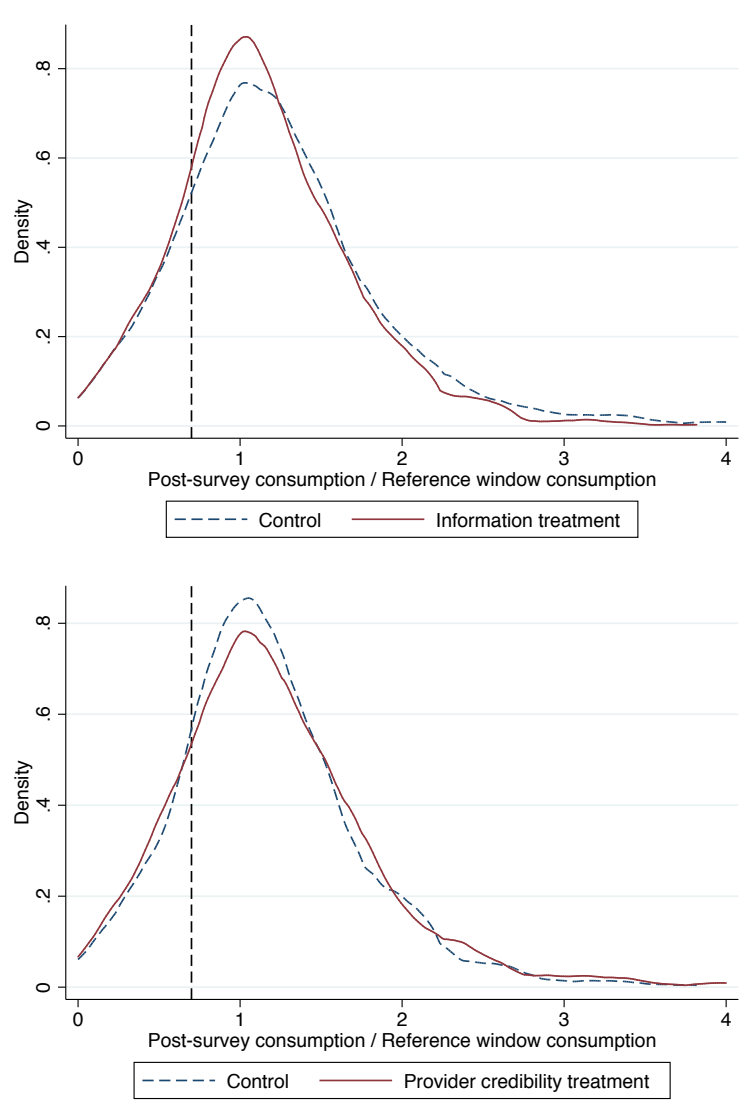


Figure S.2: Consumption, relative to incentive reference months

Notes: Density plots of post-survey monthly consumption relative to the average monthly consumption in the reference months used to determine incentive treatment eligibility. The top figure compares households with and without price information. The bottom figure compares households with and without the provider credibility treatment. Note that the incentive treatment is excluded from these plots. The dashed vertical line shows the 70 percent threshold for lottery eligibility.

Table S.1: Balance: Information treatment

	No info (1)	Info treatment (2)	P-val (2)=(3) (3)
Quantity consumed	18.927 (12.255)	18.531 (11.037)	0.584
Any payment	0.772 (0.159)	0.765 (0.168)	0.500
Missing meter reading	0.100 (0.165)	0.108 (0.163)	0.439
Total monthly bill	91.720 (68.509)	89.689 (64.163)	0.625
Household size	5.832 (2.375)	5.888 (2.209)	0.697
HH has maid	0.165 (0.371)	0.157 (0.364)	0.748
Owns home	0.491 (0.501)	0.508 (0.500)	0.584
Rooms in home	3.485 (1.249)	3.560 (1.388)	0.386
English fluency	0.778 (0.416)	0.767 (0.423)	0.666
Either underestimated price	0.557 (0.498)	0.653 (0.476)	0.005
Blame SWSC for high bill	0.428 (0.496)	0.427 (0.495)	0.976
Both know bill quantity	0.108 (0.311)	0.128 (0.334)	0.342
Both know bill charge	0.671 (0.471)	0.694 (0.461)	0.427
W: Effective bill payer	0.317 (0.466)	0.309 (0.462)	0.779
W: Bigger user	0.766 (0.424)	0.833 (0.373)	0.007
Share sent to spouse by husband	0.702 (0.273)	0.694 (0.257)	0.660
Share sent to spouse by wife	0.526 (0.263)	0.513 (0.260)	0.458
H: Share NGO	0.320 (0.251)	0.303 (0.241)	0.260
W: Share NGO	0.285 (0.224)	0.272 (0.220)	0.349
H: SDB score	20.033 (2.579)	19.951 (2.782)	0.639
W: SDB score	19.623 (2.904)	19.957 (2.917)	0.072
Households	334	948	

Notes: Column 1 shows means for the sample that did not receive the information treatment, and column 2 for the survey sample that did receive the information treatment. Column 3 reports the p-value for a test of equal means between columns 1 and 2.

Table S.2: Balance: Provider credibility treatment

	No credibility (1)	Credibility treatment (2)	P-val (2)=(3) (3)
Quantity consumed	18.884 (11.830)	18.379 (10.870)	0.426
Any payment	0.768 (0.166)	0.766 (0.166)	0.822
Missing meter reading	0.098 (0.157)	0.114 (0.170)	0.096
Total monthly bill	91.859 (67.023)	88.547 (63.510)	0.364
Household size	5.740 (2.185)	6.009 (2.314)	0.032
HH has maid	0.159 (0.366)	0.159 (0.366)	0.994
Owns home	0.491 (0.500)	0.517 (0.500)	0.370
Rooms in home	3.519 (1.362)	3.562 (1.345)	0.564
English fluency	0.782 (0.413)	0.757 (0.429)	0.296
Either underestimated price	0.595 (0.491)	0.660 (0.474)	0.031
Blame SWSC for high bill	0.427 (0.495)	0.428 (0.495)	0.949
Both know bill quantity	0.121 (0.326)	0.124 (0.330)	0.834
Both know bill charge	0.668 (0.471)	0.709 (0.455)	0.114
W: Effective bill payer	0.329 (0.470)	0.293 (0.455)	0.161
W: Bigger user	0.802 (0.399)	0.830 (0.376)	0.200
Share sent to spouse by husband	0.698 (0.259)	0.694 (0.264)	0.792
Share sent to spouse by wife	0.520 (0.267)	0.514 (0.254)	0.671
H: Share NGO	0.313 (0.254)	0.302 (0.231)	0.440
W: Share NGO	0.279 (0.226)	0.272 (0.217)	0.568
H: SDB score	19.947 (2.867)	19.998 (2.585)	0.738
W: SDB score	19.760 (2.988)	19.981 (2.839)	0.176
Households	647	635	

Notes: Column 1 shows means for the sample that did not receive the provider credibility treatment, and column 2 for the sample that did receive the credibility treatment. Column 3 reports the p-value for a test of equal means between columns 1 and 2.

Table S.3: Heterogeneous effects of price information and provider credibility treatments

	log (quantity) (1)	log (quantity) (2)
Info treatment	-0.043 [0.050]	
Info x Underestimated price	0.037 [0.061]	
Provider credibility treatment		0.011 [0.033]
Provider credibility x Distrust billing		0.042 [0.048]
HH FE	x	x
Zone-Month-Year FE	x	x
Observations (HH)	1,282	1,282
Observations (HH-months)	26,246	26,246

Notes: Regressions include the post-survey indicator interacted with the heterogeneity variables. The incentive treatment indicator is excluded (treatments are pooled). Underestimated price equals one if either spouse underestimated the marginal price of water. Distrust billing equals one if both spouses blame a high water bill on the provider. Standard errors are clustered at the household level. Price beliefs are imputed for 257 households.

Table S.4: Principal components: Intrahousehold survey measures

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5
Both say decide income use together	-0.031	0.440	-0.461	-0.065	-0.178
Both say decide extra money use together	0.008	0.405	-0.486	-0.132	-0.197
Both say they never disagree	0.328	0.067	0.009	0.204	-0.001
Both say they make plans together	-0.144	0.257	-0.260	-0.117	0.461
Both say it is easy to stick to plans	0.166	0.242	0.063	0.304	0.077
Both say they never deviate	0.424	-0.050	-0.047	0.224	0.364
Both say other never deviates	0.426	0.029	-0.162	0.132	0.373
Both say they know if spouse deviates	0.158	0.345	0.436	-0.412	0.028
Both say they can keep spouse from deviating	0.127	0.428	0.409	-0.328	0.139
Both say they do things for other	-0.387	0.242	0.164	0.425	0.209
Both say other does things for them	-0.391	0.290	0.177	0.384	0.130
Both say they never hide income	0.317	0.181	0.010	0.232	-0.129
Both say it is very difficult to hide income	0.193	0.180	0.189	0.322	-0.585
Eigenvalue	2.480	1.580	1.292	1.125	1.046

Notes: Factor loadings for principal component analysis of survey measures of intrahousehold decision-making.

Table S.5: Robustness check: Other outcomes

	Any pay (1)	Missing quantity (2)
Couple incentive	-0.006 [0.019]	-0.006 [0.010]
Husband incentive	0.017 [0.017]	-0.007 [0.009]
Wife incentive	0.018 [0.017]	-0.001 [0.008]
Price info	0.011 [0.016]	0.003 [0.008]
SWSC credibility	0.005 [0.011]	-0.007 [0.006]
Surveyed	-0.046** [0.022]	0.034*** [0.012]
HH FE	x	x
Zone-Month-Year FE	x	x
Observations (HH)	1,282	1,282
Observations (HH-months)	27,664	29,845

Notes: In column 1 the outcome is the probability that a household made any payment during the month. In column 2 the outcome is the probability that $\log(\text{quantity})$ is missing from the billing records, conditional on the household having received a prior non-missing meter reading.

S.2 Scripts

S.2.1 Price incentive treatment

[Private – to be read to husband/wife before they are brought back together]

Thank you for answering these questions. Before I go to check with my colleague, I have good news: We are running a program that gives prizes to people who cut down their water bill.

We will run a raffle, which has a K. 300 cash prize, and you will be entered into the raffle if your household reduces your water use by 30% next month. Since we are now in [current month]'s billing cycle, we will not consider this month's water use, but use [next month's] water use instead. This shows up on the [next month + 1's] bill.

If your water use in [next month] is below X cubic meters, then you will be entered for the draw. You can check the actual [next month] usage on the bill in [next month + 1] to see if it is X or lower. *[Point out where to locate the water quantity on the bill.]*

The lottery winner will be picked on the 15th of [next month + 2].

If you make the required reduction, you will have a 1 in 20 chance of winning the prize. In other words, for every 20 people who qualify for the raffle based on their bills in [next month + 1], we will draw one winner.

If you are the winner, we will call you on the number you gave us previously to convey the good news.

You will be requested to come to our office in Mosi-oa-Tunya House to collect the prize money, and you will also be compensated K.20 for your transportation.

We will continue to run a raffle every month at least until the end of the year and maybe longer, so if you also reduce water use to X in the months after [next month], you will be entered into that month's raffle too, so if you don't win in one month, you could still win the next month as long as the usage on your bill for that month is less than X cubic meters. You could even be a winner in multiple months!

How do we figure out how much you have to cut back to qualify for the raffle? We look at how much your household used in this year's March and April bills. In these bills (March and April) your average use was for Y cubic meters. So you need to cut your household usage by Y-X cubic meters in order to achieve X cubic meters or lower and qualify to our draw. For every household in this program, the target water usage is based on their own past usage during those two months.

[If only the husband/only the wife is receiving the treatment]: Not all individuals or all households are getting the opportunity to try for the raffle. In particular, you have been selected, so I am only informing you of this, and not your husband/wife.

My colleague is not informing your husband/wife about this either, because for your household, only you have been selected to participate. It is entirely up to you if you want to inform him/her or not.

If you would like to check whether your household cut back usage enough to qualify for the raffle, you may call 096-934-3167 after the 15th of [next month + 2]. You will not be charged any airtime to call this number.

When you call, the line will be cut immediately and you will automatically be called back from a different number. When you pick up the phone, you will hear a recorded message that tells you if you qualified for the raffle or not. The message is linked to the number you gave us, so please use the same sim card when you call.

You can also call that number after the 15th of each month following [next month + 2] to see if you qualified for that month's raffle.

You can also use that number to check if the raffle program is still going on.

If you win, we will ensure that we are speaking only with you when we call to inform you. Nobody else will know that you have won, unless you share the news.

[If both are receiving the treatment]: Not all individuals or all households are getting the opportunity to try for the raffle. In particular, your household has been selected. Just as I am informing you of this raffle, my colleague in the other room is informing your spouse about it as well.

If your household wins, we will inform both of you, and we would appreciate it if you both came to collect the prize. If you would like to check whether your household cut back usage enough to qualify for the raffle, you may call 096-934-3167 after the 15th of [next month + 2]. You will not be charged any airtime to call this number.

When you call, the line will be cut immediately and you will automatically be called back from a different number. When you pick up the phone, you will hear a recorded message that tells you if you qualified for the raffle or not. The message is linked to the number you gave us, so please use the same sim card when you call.

You can also call that number after the 15th of each month following [next month + 2] to see if you qualified for that month's raffle. You can also use that number to check if the raffle program is still going on.

If you win, we will ensure that we are speaking with you or your spouse when we call to inform you. Nobody else, other than your spouse, will know that you have won, unless you share the news.

[For everyone]: Only people in some of the households we are surveying are eligible for this raffle, so others that you speak to may not have been given this opportunity. The raffle is sponsored by our research project, not SWSC – they will not be aware if you are eligible

or not, or if you won or not.

S.2.2 Provider credibility treatment

We have collected this information purely for research and will not share any details with SWSC. However, we want to provide you with a little bit of extra information about how SWSC calculates your bill. SWSC tries to ensure that bills are accurate by reading your meter monthly and using the amount of water consumption shown on your meter to calculate your bill. That is, the amount that you are charged is based on the amount of water you use. The meter readings taken this month measure your usage since the time when last month's reading was taken. Once SWSC has collected all the readings for this month, this is used to calculate the bill that will be given to you next month. For example, when you received your water bill in March you were charged for the water your household used between the 21st of January and the 20th of February, roughly speaking. When you received your water bill in April, you were charged for the water your household used between the 21st of February and the 20th of March, and so on. If there are some months that they cannot get a meter reading, then you are charged an estimate based on your previous consumption, and they try to get meter readings again as soon as possible. Then the next time they read your meter, they adjust your bill for any over- or under- charges from the months when they were not able to do the reading. SWSC is taking measures to make sure that bills are fair and based on actual water usage. They are committed to honest billing practices.