Moral Hazard, Monitoring and Punishment: Evidence from a Field Experiment

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Introduction

- Inefficiency in Energy Consumption in Pakistan--Moral Hazard in Public Sector with regard to Energy Consumption.

- We define Moral Hazard in terms of the misuse of electricity consumption in public sector.

- We observe this aspect by focusing on the behavior of consumers once they are held liable to monitoring with the associated punishment mechanism

- By providing evidence from a field experiment, we make three conclusions. First, individuals respond to both the monetary and non-monetary punishments.

- Second, the habitual violators of rules reform their behavior after they are made accountable for their actions.

- Third, if appropriate monitoring systems along with the associated punishment mechanism are introduced, we can have beneficial effects in terms of resolving the energy crisis on the aggregate level.

Trends and Earlier Findings of the Energy Crisis in Pakistan

- Severe Energy Crisis in Pakistan since 2005--23.5 percent growth in demand between 1980 and 2011—Short fall of almost 8000MW in 2017 and it is projected to be 13,000MW by 2020.

- The supply side incorporates the production capacity as well as the issues related with the distribution and transmission of electricity from grid to the end users---Pakistan, on average, trashes 20 to 25 percent of output of the electricity through the technical and non-technical losses.

- On the demand side, the inefficient use of electricity is of concern for Pakistan---According to Ullah et al. (2014), 52% of the increase in energy intensity since 1972 is caused by the inefficiency in the use of energy--for each dollar of GDP, Pakistan is consuming 15 percent more energy than India, and 25 percent more energy than the Philippines—consumption per unit of GDP for Pakistan is five times higher than the average of the developed countries; and it is two times higher than the world average.

- Commendable research conducted on energy issues in Pakistan. However, most of the studies have been conducted in the context of changes in energy prices and its relation to economic growth, inflation and other macroeconomic indicators. To our knowledge, there is only one study, i.e. Khan et al. (2016), on the micro perspective of energy crisis in Pakistan which shows that the consumption of electricity in public sector is inefficient. In this study, we augment on this side by highlighting the importance of monitoring and punishment mechanism in relieving that inefficiency.

Experimental Procedures, Treatments and Hypotheses

- We conduct the experiment with Six Treatments in the Boys' hostels of Quaid-i-Azam University Islamabad---from October 27, 2015 to December 04, 2015.

- We conducted survey in all boys' hostels for three consecutive days in each week from 7:00 PM to 9:00 --Our purpose was to count the number of locked rooms with inside lights switched on.

- BT(Baseline Treatment)(No Notice and No Monetary Punishment)—SNT (Soft Notice Treatment)(Soft Notice and No Monetary Punishment)—HNT(Harsh Notice Treatment (Harsh Notice and No Monetary Punishment-- WNT(Warning Notice Treatment (Warning Notice and No Monetary Punishment)--FFT(Fine of Five Hundred Rupees Treatment)(Monetary Punishment)--FOT(Fine of One Thousand Rupees Treatment)(Monetary Punishment)

- **H1**: The behavior of students towards switching off lights in locked rooms is likely to be the same across BL and SNT, HNT and WNT.

- **H2**: The behavior of students towards switching off lights in locked rooms is likely to be different across BL and FFT, FOT.

- **H3**: The behavior of students across FFT and FOT might not be different.

Experiment Results—Overview of Findings Across Treatments

Table 3: Part I: Overview of Findings across Treatments

Treatments	Total Number of Locked Rooms in all the three Rounds	Total Number of Locked Rooms with Inside Lights Switched on in all the three Rounds	The Percentage Of Locked Rooms with Lights Switched On.
BT	368	253	68.75%
SNT	637	412	61.77%
HNT	713	422	59.19%
WNT	638	270	42.32%
FFT	762	225	29.53%
FOT	638	188	29.47%
Total	3756	1770	47.12%

Table 3: Part II: Inferential Comparison of Treatments

Treatments	P-Value	Treatments	P-Value
BT vs SNT	0.026	SNT vs FOT	0.000
BT vs HNT	0.002	HNT vs WNT	0.000
BT vs WNT	0.000	HNT vs FFT	0.000
BT vs FFT	0.000	HNT vs FOT	0.000
BT vs FOT	0.000	WNT vs FFT	0.000
SNT vs HNT	0.332	WNT vs FOT	0.000
SNT vs WNT	0.000	FFT vs FOT	0.984
SNT vs FFT	0.000		

Note: The survey was conducted for three consecutive days. Therefore, the number of rooms here implies that it is out of the total of 1710=570*3

Experiment Results—Overview of Findings Across Treatments
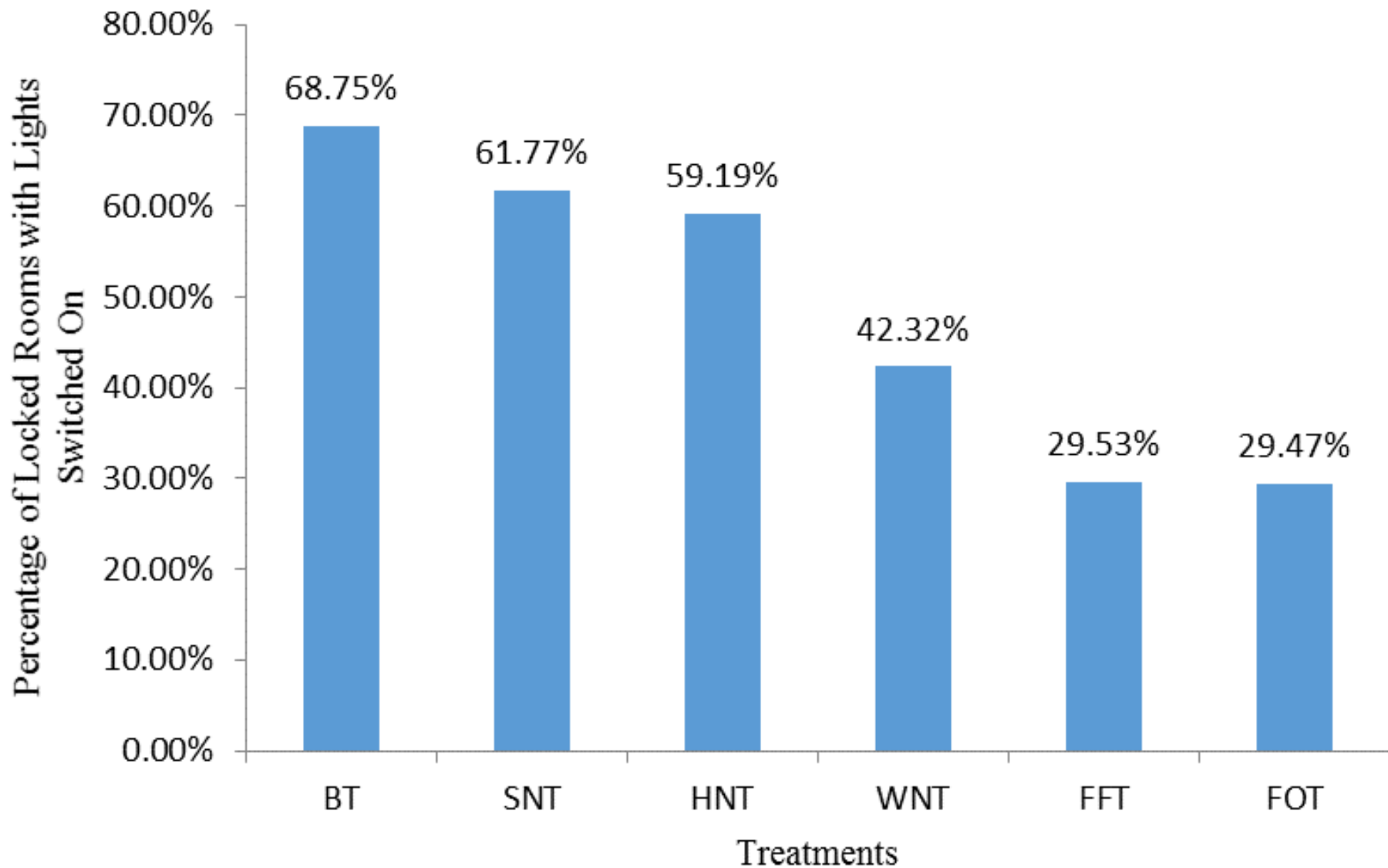
Experiment Results—Simple Regression Results

Table 4: Simple Regression Results

	Dependent Variables								
	Percentage of Locked Rooms with Inside Light Switched On								Impacted Rooms
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Constant	60.43***	60.31***	60.74***	56.53***	51.47***	60.43***	56.53***	60.43***	31.46***
DSNT	-0.25					-0.25*			
DHNT		1.30				1.17			
DWNT			-16.82***			-16.52***			
DFFT				-25.30***		-29.20***			
DFOT					-21.6***	-30.57***			
DNotices								-5.20	
DFines							-25.99***	-29.89***	16.30**
N	36	54	72	90	108	108	108	108	30
R^2	0.0001	0.0021	0.25	0.36	0.21	0.59	0.47	0.49	0.04
F	0.00	0.11	23.88***	49.99***	27.38***	29.10***	95.85***	49.55***	4.69**

Note: 1. ***=p<0.01, ** = p<=0.05 and *=p<0.01

2. D with each Treatment denotes dummy for that Treatment. Likewise, DNotices and DFines are dummies for all types of notices and fines, respectively

# Experiment Results—Behavioral Impact of Notice and Fines

Table 5: The Impact of Each Treatment on Reforming the Behavior of Violators

$$BI = \frac{\text{Overlapped Locked rooms in CT and PT but with lights switched off in CT and Switched on in PT}}{\text{Overlapped Locked Rooms in CT and PT but with lights switched on in PT}} * 100$$

Treatments	Number of Overlapped Locked Rooms with Lights Switched on in Previous Treatment	Number of Overlapped Locked rooms with Lights Switched off in Current Treatment	Percentage of Overlapped Locked rooms with Lights Switched off in Current Treatment	Statistical Significance on the basis of Z-statistic (P-value<0.05)
Impact of SNT	165	57	34.55%	---
Impact of HNT	251	88	35.06%	0.9124
Impact of WNT	229	108	47.16%	0.0071
Impact of FFT	190	112	58.95%	0.0160
Impact of FOT	51	35	68.63%	0.2077

Experiment Results—Behavioral Impact of Notice and Fines
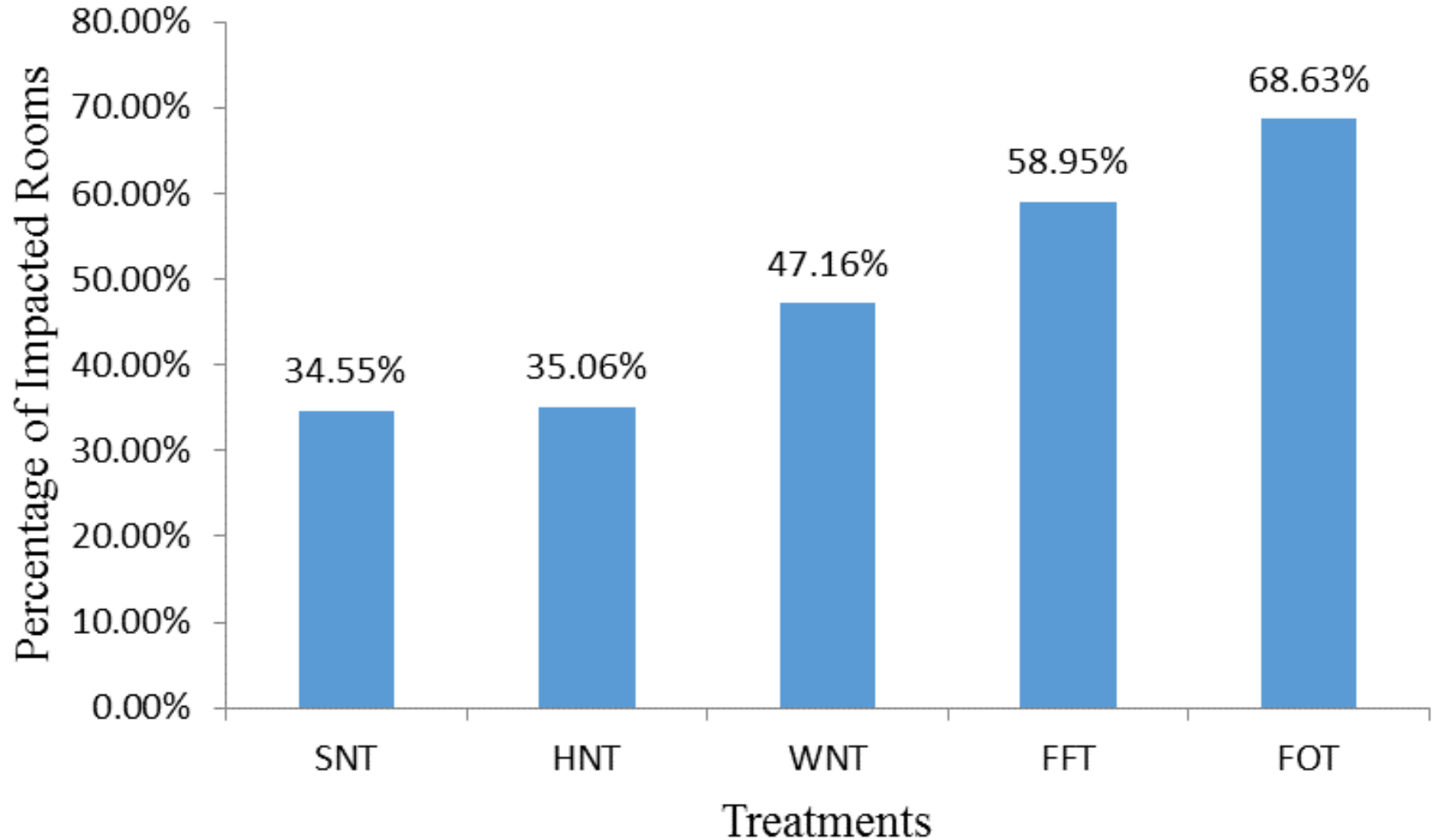
Experiment Results—Impact of the Experiment on the Conservation of Electricity

Table 6: Comparison of the Consumed Electricity before and after the Experiment (in KiloWatt-hour(KWh))

Months	Before Experiment (2014-2015) (consumed units in KWh)	After Experiment (2015-2016) (consumed units in KWh)	Difference between 2014-2015 and 2015-2016 (consumed units in KWh)
December	52280	62200	9920
January	137320	123520	-13800
February	196880	177720	-19160
Total	386480	363440	-23040

Conclusion

- Motivation from the previous literature that emphasizes the role of punishment in situations, involving moral hazards.

- We focus on three aspects. First, we want to see how monetary and non-monetary punishments incentivize individuals to abandon the misuse of electricity? Second, we focus on the behavior of violators of rules, i.e. misusers of electricity. For instance, we want to see how their behavior towards misuse changes with the severity of monetary and non-monetary punishments. Third, we are also interested in the overall impact of the experiment on the overall conservation of electricity.

- We make three conclusions. First, people are responsive to both monetary and non-monetary punishments. Second, the individuals who are habitual violators of rules show reformation in their behavior with the severity of punishments. Third, with regard to the overall impact of the experiment, our finding shows that people start conserving electricity once they are made liable to monetary and non-monetary punishments.

- Future research, can also examine the issue of moral hazard by observing the use of electricity in the rooms, for heating and cooking purposes, which is not allowed in most of the hostels; however, this requires physical inspection of each room. The limitation of our study is that hostel administration does not allow such permission to a student. Hence, we used "locked room with lights switched on" as a proxy for the moral hazard of using electricity for heating and cooking purpose. We assume that this proxy though capture the issues of moral hazard but is not its perfect substitute.