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

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## **Abstract**

The existing literature establishes that there exists inefficiency in energy consumption in Pakistan. In particular, with regard to electricity consumption, the problem of moral hazard is prevalent in the public sector. In this study, 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. Alternatively, with the introduction of punishments, they reduce moral hazard with respect to electricity consumption. 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.

**JEL Classification: H83, D12, D00, D03, D04**

**Key Words: Moral Hazard, Monitoring, Punishment, Electricity Consumption, Public Sector**

## **1. Introduction**

Moral hazard refers to a situation where economic agents maximize their benefits in an inefficient way. Alternatively, in situations of moral hazard, economic agents are able to avoid the costs associated with their conduct.<sup>1</sup> Moral hazard usually occurs due to asymmetric information which involves both ‘hidden actions’ and ‘hidden information’ (Arrow, 1985). For instance, workers’ shirking which is costly for the employers to monitor and carelessness in precautions taken by the insured are the examples of hidden actions. Likewise, superior information of experts related to

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<sup>1</sup> Formally, according to Kotowitz (1989), moral hazard is defined as actions of economic agents in maximizing their own utility to the detriment of others, in situations where they do not bear the full consequences or, equivalently, do not enjoy the full benefits of their actions due to uncertainty and incomplete or restricted contracts which prevent the assignment of full damages (benefits) to the agent responsible.

services such as those of the physicians, lawyers, masons, managers, politicians etc. are the examples of hidden information. The issue with moral hazard is that the agents' actions and the consequences of those actions cannot be separated. A feasible solution would be to either make agents liable for the outcomes of their actions or deter them from the actions which involve moral hazard.

To our knowledge, there is no path-breaking study which discusses the issue of moral hazards from the context of monitoring, detection or the associated punishment mechanism. However, relatedly, there are studies which analyze the impact of monitoring or punishment in circumstances of the other social dilemmas. For instance, one such dilemma is the contribution to public good which agents try to evade in the absence of monitoring or punishment. In this type of literature, the framework of public good games is used in order to observe the behavior of individuals with regard to their contribution for the provision of non-excludable public goods.<sup>2</sup> The experimental evidence in this regard shows that, on average, the participants in public good games contribute between 40% and 60% of their endowment (Camerer, 2003). However, in repeated games, the contribution declines due to the problem of free-riding. Alternatively, free-riding results in the break of cooperation in case of public goods (Ostrom, 2000; and Fischbacher et al., 2001). Thus, in order to avoid free-riding or control the disruption of cooperation, there should be some type of social sanctioning.<sup>3</sup> Social sanctioning can discipline the defectors which results in higher contributions to public goods. According to Fehr and Gächter, (2002), if agents in a public good game are provided with the power to sanction others; then the level of cooperation would increase. In sharp contrast, Nikiforakis (2008) shows that punishment enhances cooperation; however, peer punishment in a decentralized framework declines due to the fear of counter punishment. In addition to the game-theoretic literature, there are also studies which discuss moral hazards in different situations. For example, Stevens and Thevaranjan (2010) assert that the issue of moral hazards can be resolved in the principal-agent model if the agents are

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<sup>2</sup> For instance, according to Olson (1965), in case of public goods, one has to choose contribution for the provision of those goods where free-riding is preferable.

<sup>3</sup> See, for instance, Fehr and Gächter (2000); Fehr and Gächter (2002); Kritikos and Bolle (2004); Gintis et al., (2005); Fowler, (2005); Henrich, et al., (2006); Rockenbach and Milinski, (2006); and Sigmund, (2007); Casari and Luini, (2009); Faillo et al. (2013); Bortolotti et al. (2015) for details.

sensitized morally.<sup>4</sup> Likewise, Itoh (2004) proclaim that the presence of other-regarding preferences is of central concern in resolving the issue of moral hazards. We also have some other suggestions for minimizing moral hazards like peer pressure in team work (Corgnet et al., 2015); the recommendation of deductible in insurance (Raaij, 2016); prudential regulations in financial sector (Hellmann et al., 2000) etc.

In general, the concept of moral hazard comes from the insurance industry which provides a way to transfer risk to somebody else.<sup>5</sup> Here, we define moral hazard in a different context; i.e. we define it in terms of the misuse of electricity consumption in public sector. In Pakistan, there is inefficiency with regard to the consumption of electricity in public sector (Khan et al., 2016).<sup>6</sup> In this study, we discuss this type of inefficiency from the context of monitoring and the associated punishment mechanism. We conjecture that the introduction of punishment would have beneficial effects in reducing such inefficiency. For our analysis, we focus on a public sector university, i.e. Quaid-i-Azam University (QAU), Islamabad, which is a typical public sector organization of Pakistan. In most of the public sector universities in Pakistan, the employees and students are not charged for the electricity that they consume during the working hours and studies, respectively.<sup>7</sup> This is justified by the fact that universities fees in public sector are subsidized in Pakistan. Likewise, in hostels of the public sector universities, the consumption of electricity is exclusively made by the resident students. In case of hostels, students are charged in lump sum for their hostel rents, utilities, and other services. Alternatively, they are not charged an extra amount for the over-

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<sup>4</sup> In particular, they show that adding moral sensitivity increases the descriptive, prescriptive, and pedagogical usefulness of the principal-agent model.

<sup>5</sup> For example, an insurance company will pay up if you damage a rental car. However, the concept has wider applications in other fields of economics. See, for instance, Nyman (1999) in case of health economics.

<sup>6</sup> For instance, according to Khan et al. (2016), in hostels of public sector universities, the monthly consumption of electricity per student is 46.2 units as compared to 19.58 units in private hostels and an average of 20.5 units in households.

<sup>7</sup> In Pakistan, in most of the public sector universities, the consumption of electricity can be decomposed into three entities. First is the electricity that is used in the common places like class rooms, libraries, laboratories, street lights etc. Second category is the consumption of electricity, made specifically by the employees in offices etc. Finally, there is also another category which is made exclusively by the students in their hostels. In the first two categories, the consumption is mainly paid by the universities as the university fees in the public sector are subsidized. Thus, the consumption of electricity is like a public good. In other words, the employees and students may free ride on public sector. Similarly, in the third case, there may be a probability of moral hazard with regard to the electricity consumption.

consumption of the electricity that they might make. Due to these factors, there exists the problem of moral hazards in hostels of the public sector universities as far as the consumption of electricity is concerned. Khan et al. (2016) find that students in the public sector hostels misuse electricity by free riding on the non-consumers of public sector.

Students in the hostels of QAU are allowed to use lights, fans and irons in their rooms. Other electric appliances such as heater, water heating rods, air conditioners etc. are not allowed. However, in the presence of organizational inefficiency with respect to monitoring, it is very difficult to restrain students from using such non-allowed appliances. In order to regulate students in this regard, we have to raise the intrinsic and extrinsic costs of misuse of the electricity.<sup>8</sup> In this study, we focus on the extrinsic costs by introducing monitoring with a specified punishment mechanism in a field experiment. We use “keeping lights switched on in a locked room” as a proxy for the misuse of electricity. The experiment comprises six treatments with varying levels of punishments. In the Baseline Treatment (BT), we conduct survey of all boys’ hostels for three consecutive days. During the survey, we count the number of locked rooms with inside lights switched on. In the second treatment, named as Soft Notice Treatment (SNT), we display an appeal on the notice boards of all boys’ hostel which suggests judicious use of electricity in the hostels. After two days of the appeal, we conduct the survey again by counting the number of locked rooms with their inside lights switched on. We repeat this process for four more treatments by introducing different levels of punishments. For instance, in the third treatment, named as Harsh Notice Treatment (HNT), we introduce harsh words in the appeal. Likewise, in the fourth treatment, named as Warning Notice Treatment (WNT), we warn the students of an associated fine with the misuse of electricity. In addition, during this treatment, the notice of warning was delivered to rooms instead of displaying it on the notice boards. Finally, in the fifth and sixth treatments, i.e. Fine of Five hundred rupees Treatment (FFT) and Fine of One thousands rupees Treatment (FOT), respectively, we introduce monetary punishment. As stated earlier, we conduct the survey for three consecutive days in all of the treatments in order to count the number of locked rooms with their inside lights switched on. We find that the introduction of monitoring with punishment make the students significantly careful about the misuse of electricity. In other words, the number of locked rooms with their inside lights switched on significantly declines with the introduction of

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<sup>8</sup> For instance, for raising the intrinsic costs, we have to morally train the students. Likewise, for extrinsic costs, we have to provide efficient monitoring and punishment mechanism.

punishment. The rest of the paper is organized in five sections. Section 2 provides a review of literature. Section 3 describes the trends in the energy crisis of Pakistan and, in addition, it briefs us about the earlier findings in this regard. In section 4, we provide the experimental procedure, and make a discussion of the treatments and hypotheses of the study. Section 5 discusses the results of our analysis while section 6 concludes the paper.

## **2. Review of Literature**

There is considerable literature which highlights the implications of punishments for economic behavior. As is mentioned earlier, most of the existing studies are undertaken in the context of public good games.<sup>9</sup> However, besides controlled experiments, there are studies which test the impact of punishment in an environment of natural experiments. For instance, Elbla (2012) explore the role of punishment in reforming the behavior of students in schools. In particular, the study finds that both the verbal and corporal punishment have negative impact on students' behavior and personality in Khartoum, Sudan. In a similar way, Bar-Ilan and Sacerdote (2004) investigate the impact of punishment on deterring people from the violation of laws.<sup>10</sup> Traffic signals in Israel and San Francisco are used as testing beds for the experiment. The data on cars passed through the red lights was collected by the installed cameras.<sup>11</sup> The behavior of drivers was observed before and after the increase in fine. The results show that increase in fine sharply decreases the violation of crossing the red lights. On average, the criminally convicted individuals cross red lights more than the non-convicted ones; however, in terms of elasticity, the response of both towards fine is almost similar. Also, youngsters and people with old cars have higher elasticity with respect to fine as compared to older individuals and people having new cars, respectively. In terms of ethnicity, the minority groups in Israel show lower response towards the increase in fine.

Likewise, there are studies which focus on the level of optimal punishment in deterring some crimes. Nikiforakis and Normann (2008), in this regard, provide a comparative static analysis

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<sup>9</sup> See, for example, Fehr and Fischbacher (2004) and Nikiforakis (2008).

<sup>10</sup> They examine the impact of punishment on deterrence across different personal characteristics such as age, criminal record, driving record and income.

<sup>11</sup> The experimenter chooses red light signals at 8 intersections point of San Francisco and 73 intersections points of Israel.

of punishment in a public good game.<sup>12</sup> In particular, they focus on both the effectiveness of punishment and the amount by which the punishment can lessens the receivers' income. In each treatment of the experiment, the individuals were initially endowed with fixed amount of money and the participants have to decide simultaneously how much to contribute for a public good.<sup>13</sup> The results indicate that contributions increase monotonically with the increase in punishment. In particular, higher levels of punishment ensure full cooperation which results in enhancing welfare. However, the effectiveness of punishment below a threshold level cannot save the deterioration of cooperation for the provision of public good.

To our knowledge, there are no studies which directly examine the impact of punishment on behavior in the context of misuse of electricity. However, we do find studies which are related to this aspect. For instance, Takeuchi and Mizobuchi (2012) examine whether the behavior regarding the misuse of electricity can be reformed through incentives. The study is based on the residents of Matsuyama, a city of Japan. In order to see the impact of incentives on the reduction of electricity consumption and, thereby, the reduction in Carbon Dioxide (CO<sub>2</sub>), the behavior of 53 households was tested through the effect of monetary reward on the electricity consumption.<sup>14</sup> The results find that 34% of the households successfully reduce their consumption of electricity with an average reduction rate of around 4.8%. However, there were some households which did not respond to the economic incentives showing that, for some people, economic reward should be sufficiently high in order to incentivize them in this regard. The results also show that as the economic reward increases, the reduction of electricity consumption also increases.

In this study, we focus on the implication of punishment as deterrence for the misuse of electricity. Our sample includes hostels of the Quaid-i-Azam University (QAU), Islamabad. We observe the behavior of students towards electricity consumption while we introduce different types and levels of monetary and non-monetary punishments. Punishments raise extrinsic costs of the agents for misusing electricity. However, imposing punishments in certain situations may be costly, both in terms of resources spent on it and the retaliation associated with it. This study is

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<sup>12</sup> Through experiment, they examine the usefulness of four different levels of punishment in terms of contribution to a usual public good. The experiment comprises a repetitive linear public good game with two or more players.

<sup>13</sup> The participants were not allowed to communicate with each other.

<sup>14</sup> The field experiment lasted 12 weeks from November 2010 to January 2011.

different from the available studies in the sense that actual punishment notices are delivered to students after they were found of misusing the electricity.

### **3. Trends and Earlier Findings of the Energy Crisis in Pakistan**

Electricity is one of the key energy sources and plays an important role in the economic activities of an economy. Almost all of the industrial as well as agricultural development is mainly based on the availability of electricity (Alter and Syed, 2011). Pakistan is facing severe electricity shortfall since 2005.<sup>15</sup> In particular, the existing production is not meeting the current demand of electricity. The overall demand of electricity grew with 23.5 percent between 1980 and 2011 (Kessides, 2013). The shortfall in May 2012 has been estimated at 6,000 Mega Watt (MW) (Ebrahim, 2012; The Express Tribune, 2011; National Electric Power Regulatory Authority (NEPRA), 2011a, 2011b). It slightly declined to 4,250 in June, 2013 with demand standing at 16,400 MW and generation standing at 12,150; however, the gap is still alarming (Government of Pakistan, 2015). The predictions for the near future demonstrate that the gap between the demand and supply is likely to increase to 8,000 MW by 2017 and 13,000 MW by 2020 (Shahbaz, 2011).

The electricity crisis can be analyzed from two perspectives, i.e. the supply side or the demand side. 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. As is stated earlier, Pakistan is characterized by the lower production capacity. Likewise, there are huge distributional losses in Pakistan. For instance, Pakistan, on average, trashes 20 to 25 percent of output of the electricity through the technical and non-technical losses. This wastage is significantly higher as compared to an average of 4 to 12 percent for developed countries (National Transmission and Dispatch Company Limited (NTDCL), 2011; 2014; NEPRA, 2014). 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. This evidence is supplemented by the fact that Pakistan is far behind from both the developed and many developing countries in terms of efficiency. For instance, for each dollar of GDP, Pakistan is consuming 15 percent more energy than India, and 25 percent more energy than the Philippines (Friends of Democratic Pakistan (FDP), 2010). In addition, according to FDP (2010), the energy

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<sup>15</sup> Although, the gap between demand and supply of electricity is growing for the last 30 years, the severity surfaced since 2005.



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. The potential saving due to the efficient use of energy in Pakistan is estimated at 18 percent which is equal to 11.16 Million Tons of Oil Equivalents (MTOE), resulting in 51% reduction in the net imports of oil (FDP, 2010).<sup>16</sup> All of these trends imply that we have the potential of saving electricity through the demand side measures; however, so far, we have not been able to do so.

Given these trends, there has been 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.<sup>17</sup> 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.

#### **4. Experimental Procedures, Treatments and Hypotheses**

In this section, we provide the experimental procedure. Besides, we describe the details of all of the treatments. Also, we state the theoretical framework and the corresponding hypotheses of our analysis.

##### ***4.1. Experimental Procedure***

The experiment is conducted in boys' hostels of QAU. There are nine hostels and two annexes for the residence of students in QAU. Male students occupy six hostels; and the rest of the hostels are for female students. Based on convenience, the experiment is conducted in male hostels only.<sup>18</sup> Table 1 shows brief details of all boys' hostels in QAU. As is visible, the six boys' hostels are accommodating 1424 students. The experiment continued from October 27, 2015 to December 04, 2015. We conducted survey in all boys' hostels for three consecutive days in each week. As stated earlier, our purpose was to count the number of locked rooms with inside lights switched on.

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<sup>16</sup> For instance, according to FDP (2010), the potential of energy saving just in the one fiscal year of 2008 was estimated at 6.1 MTOE which corresponds to 15.4% of the total energy consumed in the country.

<sup>17</sup> See, for instance Jamil and Ahmad (2010), Ashraf et al. (2013), Shahbaz and Feridun (2012) etc.

<sup>18</sup> Future research can certainly replicate the study for female hostels.

Keeping this purpose in view, the survey was mostly conducted at night from 7:00 PM to 9:00 PM. In this way, we could identify the resident students who misuse electricity.

**Table 1: Description of the Boys Hostel of QAU**

Hostel No.	Allocation of Students	Number of Rooms	Number of Seats	Number of Seats per Room
3	M.PHIL/PHD	102	204	Bi-Seaters
4	M.PHIL/PHD	102	204	Bi-Seaters
6	MSc(1 <sup>st</sup> and 2 <sup>nd</sup> )	90	360	Four-Seaters
7	BS(1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup> )	52	208	Four-Seaters
8	MSc(3 <sup>rd</sup> and upper)	112	224	Bi-Seaters
9	BS(5 <sup>th</sup> and upper)	112	224	Bi-Seaters
<b>Total</b>		570	1424	

**Source:** QAU Prospectus 2015-2016.

**Note:** M.Sc. and M.Phil. are 4 semesters programs while BS and PhD are 8 semesters programs.

#### ***4.2. Experimental Treatments***

The experiment comprises six treatments. The details of each treatment are summarized in table 2. In the Baseline Treatment (BT), we conduct survey of all boys' hostels and count the number of locked rooms with inside lights switched on. In this treatment, there is no associated punishment. After the collection of data in BT, we arranged a meeting with the administration of hostels in order to ask for permission for displaying appeal on notice boards. After the approval of provost, the notice was prepared and displayed on all of the notice boards of boys' hostels with the support of hostel administration. After the display of notice on notice boards in SNT, all of the rooms were surveyed in the same way as in the BT treatment. Again, the survey was conducted for three consecutive days, i.e. Friday, Saturday, and Sunday. The HNT is similar to the SNT, except the wording of the notices. Alternatively, this time the notice incorporated harsh words instead of soft request. Again, after the formal approval of hostel administration, the harsh notice was displayed on all of the notice boards of hostels. The notice advised the students to keep lights of the rooms switched off in their absence. The notice also warned the students of the issuance of warning letter in case of any non-compliance. After the display of notice, again, the survey was conducted for consecutive three days. WNT is similar to HNT, except the mode of the delivery of notices. In WNT, the notices were given to resident students in their rooms. The wording of the notice is similar to that of the HNT. In FFT, again, the notice was displayed with the warning of fine of 500

rupees. Alternatively, each room was fined by 500 rupees in case of non-compliance. The per student decomposition implies that, in bi-seater room, a student was fined by 250 rupees while, in four-seater room, each of the resident was fined by 125 rupees. FOT is similar to FFT, except the amounts of fine. In FOT, the fine was raised to 1000 rupees per room in case of non-compliance. Even, in this case, the fine on room implied equal distribution among the resident students. Like, the previous treatments, in WNT, FFT, and FOT, the survey was conducted for three consecutive days. In the survey, we noted down the number of locked rooms with their inside lights switched on for each treatment.

**Table 2. Details of Treatments**

<b>Treatments</b>	<b>Date of Notice</b>	<b>Date of Survey</b>	<b>Relevant Wording in the Notice<sup>19</sup></b>
<b>Baseline Treatment (BT)</b>	No Notice	October 28 November 2 and 3, 2015	No Notice
<b>Soft Notice Treatment (SNT)</b>	November 5, 2015	November 6, 7, 8, 2015	All the residents of the boys' hostels are advised to switch-off the lights, fans etc. as they leave their respective rooms.
<b>Harsh Notice Treatment (HNT)</b>	November 11, 2015	November 13, 14, 15, 2015	All the residents of the boys' hostels are strictly advised to switch-off lights and other electrical appliances etc., as they leave their respective rooms. In case of non-compliance, warning notices will be issued to all resident students of a room.
<b>Warning Notice Treatment (WNT)</b>	November 18, 2015	November 20, 21, 22, 2015	It has been observed that, in spite of repeated notices issued by the office, the students do not switch off the lights of their rooms in their absence. It is sheer negligence and wastage of energy resources. Students are, therefore, finally warned to switch off all the lights and other electric appliances while leaving the room. In case of non-compliance, heavy fine will be imposed on the violators.
<b>Fine of Five hundred rupees Treatment (FFT)</b>	November 26, 2015	November 27, 28, 29, 2015	In exercise of the powers vested in Provost under the clause 17(a) of QAU Hostel Regulations, 1996, the residents of the room are therefore fined Rs.500/- collectively (i.e. Rs.125/-each in four seater room and Rs.250/-each in bi-seater room). The students are therefore, directed to deposit the above mentioned fine into the authorized university account under intimation to this office by December 07, 2015. Failing to comply with instructions or refusing to receive the notification would be considered as another act of indiscipline or cognizable offence under the law.
<b>Fine of One thousand rupees Treatment (FOT)</b>	December 2, 2015	December 4, 5, 6, 2015	In exercise of the powers vested in Provost under clause 17(a) of QAU Hostel Regulations, 1996, the residents of the room are therefore fined Rs.1000/- collectively. All the residents of the room are, therefore, directed to deposit the above mentioned fine collectively into the authorized university account under intimation to this office by December 10, 2015. Failing to comply with instruction or refusing to receive the notification would be considered as another act of indiscipline or cognizable offence under the law.

#### ***4.3. Theoretical Framework and Hypotheses***

As we discussed above, Quaid-i-Azam University charges each student fixed amount of fee per semester for hostel. The fee includes room rent, furniture, utilities, and other related services. On average, the amount of fee remains the same for each student during the entire period of study. As

<sup>19</sup> See detailed wording in Appendix

the students are not charged separately for utilities, therefore, at the end of each month, the university pays all bills of the utilities. Alternatively, the students usually remain unaware about the exact amount of units of electricity that they consume each month. If we take electricity as a consumer good for the student; then equilibrium implies that marginal benefit from consumption must be equal to the marginal cost. The consumption of electricity is beneficial for a student when he remains in his room; however, once he leaves his room, then the marginal benefits become zero for him.<sup>20</sup> In comparison, the marginal cost of electricity is independent of the consumption as far as an individual student is concerned.<sup>21</sup> In other words, we can say that the price of each additional unit of electricity is zero for each student. This discrepancy between the marginal benefit and marginal cost leaves no incentive for the students to conserve electricity. Accordingly, we might expect that the students will not be careful about switching off lights of the rooms in their absence. Thus, the probability of leaving the lights switched on in locked rooms increases with the misperception of students regarding the payment mechanism of electricity by the university.<sup>22</sup> In order to motivate students for switching off lights in their absence, we have to enhance the marginal cost of switched on lights in locked rooms. Alternatively, if the students are made liable for the cost of leaving lights switched on in locked rooms, we can reduce the misuse in electricity consumption. This is the focus of this paper where we want to see the impact in the notice treatments.

In SNT, HNT and WNT, if the students don't read notice boards; then the behavior of students across the BT and these treatments might not be different. Also, even after reading the notices, the effect might not be different across these treatments if the students have weaker level of guilt feeling. In contrast, in FFT and FOT, the behavior of students might be different as compared to BT because the students are monetarily punished for leaving lights switched on in

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<sup>20</sup> For instance, he will need light for study, fans for cooling etc. when he is inside the room.

<sup>21</sup> The reason is that the charges of electricity don't depend on the amount of consumed units of electricity. Rather it is fixed and collected in bulk at the time of fee submission at start of the semester.

<sup>22</sup> The students fail to realize that the government funds universities for meeting their expenditure. This funding, in turn, is financed by the taxes which are either directly or indirectly paid by almost all of the citizens of Pakistan. Thus, the students who misuse electricity in the university hostels also pay taxes to government in the form of sales tax, mobile phone taxes etc. So, the cost of misusing electricity is to some extent paid by the students. As on average people are not much rational to perceive the complexities of all this process as is shown from the results of centipede game where player do not play equilibrium per backward induction. Hence, higher misperception implies higher misuse of electricity.

locked rooms. This is due to the fact that the marginal cost of misuse increases while the marginal benefit, which is zero, remains the same. Therefore, majority of students are likely to abstain from leaving lights switched on in locked rooms in the fine treatments. Based on the above discussion, the hypotheses of the study are given below:

**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.

Also, it is established in the literature that some people consider fine like a price, hence it is likely that the students remain careless even after monetary punishment (Gneezy and Rustichini, 2000; Siang, 2012). For instance, according to Gneezy and Rustichini (2000), when parents are fined for picking up kids late from a day care center; the parents further delayed the arrival time instead of coming on time. Likewise, Siang (2012) shows that imposing fine on employees does not improve the attendance rate as employees consider fine like a price for their late coming. Based on this discussion the third hypothesis of the study is:

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

## **5. Experimental Findings**

In this section, we discuss the findings of our analysis. We divide this section into three subsections. In subsection 5.1, we provide an overview of the overall findings across all the treatments. In addition, it tells us about the decomposition of findings across the degree levels of the consumers. In subsection 5.2, we discuss comparative analysis of the impact of each treatment on the behavior of misusers of electricity. Finally, in subsection 5.3, we want to see the overall impact of experiment on the overall consumption of electricity.

### ***5.1. Overview of Findings across Treatments***

Table 3 shows an overview of the overall findings across all treatments. As is evident from the table, there is a continuous reduction in the percentage of locked rooms with inside lights switched

on with the introduction of notices and the associated punishment. The impact of soft and harsh notices is small; however, still, it is significant in both cases as compared to the BT ( $p < 0.05$  and  $p < 0.01$  in both cases, respectively).<sup>23</sup> This finding is contrary to hypothesis 1 where we claim that the behavior of students towards switching off lights in locked rooms is likely to be the same across BL, SNT and HNT. In other words, some individuals require just a reminder for reforming their behavior which the soft and harsh notices in SNT and HNT, respectively offer to them. Likewise, the comparison of SNT and HNT implies that both are almost similar in impact ( $p = 0.33$ ). This, in other words, suggest that individuals who are insensitive to notices behave in the same way in case of both the soft and harsh notices. It also shows the carelessness on part of the students towards notices displayed on notice boards.<sup>24</sup> Alternatively, for such students warning matters which may incentivize them to conserve electricity due to the increase in the marginal cost associated with that warning. This fact is shown by the comparison of HNT and WNT. As we can see from table 3, there is significant reduction in the percentage of locked rooms with the inside lights switched on in WNT as compared to HNT ( $p < 0.01$ ). The introduction of monetary punishment is, further, more effective as compared to warning. For instance, the percentage of locked rooms with inside lights switched on declines to 29.53% in FFT and 29.47% in FOT as compared to 42.32% in WNT ( $p < 0.01$  in both cases). This finding is in line with hypothesis 2 which claim that monetary punishment is more effective. This also confirms that punishment decreases the issue of moral hazard or increases cooperation in the presence of free riding which is already established in the literature by Polinsky and Shavell (1984); Ilan and Sacerdote (2004); Visser et al. (2006); and Nikiforakis and Normann (2008). Moreover, it is pertinent to mention that the comparison between FFT and FOT provides some support to the conjecture that fine is a price which is predicted by Gneezy and Rustichini (2000).

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<sup>23</sup> This p-value is the corresponding value of z-statistic of unequal variances while using the number of locked rooms with inside lights switched on as observation.

<sup>24</sup> It is possible that they might not have studied the displayed notices.

**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.
<b>BT</b>	368	253	68.75%
<b>SNT</b>	637	412	61.77%
<b>HNT</b>	713	422	59.19%
<b>WNT</b>	638	270	42.32%
<b>FFT</b>	762	225	29.53%
<b>FOT</b>	638	188	29.47%
<b>Total</b>	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

Most of these descriptive results are confirmed by the simple regression analysis which is shown in table 4. As is evident from columns 1 to 5 in table 4, all the dummies for all the treated rounds except SNT and HNT are significant in reducing the number of locked rooms with inside lights switched on. Column 6 confirms this finding further once we incorporate the dummies for all of the treated rounds in the same regression. Columns 7 and 8 show an important finding that monetary punishment is more effective as compared to non-monetary punishment.<sup>25</sup> Alternatively, inner guilt and warning associated with SNT, HNT and WNT, respectively are less effective as compared to monetary fines associated with FFT and FOT.

The overall findings can be decomposed across different units, i.e. hostels, of the survey. Alternatively, in this way, we can analyze the behavior of students while controlling for the type of degrees for which they are enrolled in the university. As we have shown earlier that MPhil./Ph.D. students reside in hostels 3 and 4; MSc. Students reside in hostels 6 and 8; BS

<sup>25</sup> In columns 7 and 8 we incorporated collective dummies for notices and fines.



students reside in hostels 7 and 9, therefore, we merge the data of these hostels by the level of degrees in which the resident students are enrolled. The details of this composition are shown in table A1 in the Appendix A. It is evident from the table that, for each level of students, the misuse of electricity declines with each successive treatment. In other words, in each hostel, the introduction of notices and fines has beneficial effects on the misuse of electricity. Thus, our results are robust to the different levels of educations.<sup>26</sup>

**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
<b>Constant</b>	60.43***	60.31***	60.74***	56.53***	51.47***	60.43***	56.53***	60.43***	31.46***
<b>DSNT</b>	-0.25					-0.25*			
<b>DHNT</b>		1.30				1.17			
<b>DWNT</b>			-16.82***			-16.52***			
<b>DFFT</b>				-25.30***		-29.20***			
<b>DFOT</b>					-21.6***	-30.57***			
<b>DNotices</b>								-5.20	
<b>DFines</b>							-25.99***	-29.89***	16.30**
<b>N</b>	36	54	72	90	108	108	108	108	30
<b>R<sup>2</sup></b>	0.0001	0.0021	0.25	0.36	0.21	0.59	0.47	0.49	0.04
<b>F</b>	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

<sup>26</sup> In terms of impact, the MSc students are slightly superior to the MPhil/PhD and BS students. For instance, in a sequential sense, the percentage of locked rooms with inside lights switched on is 23.53% for MSc students which is lower as compared to 30.10% for PhD students and 26.76% for BS students.

## 5.2. Behavioral Impact of Notices and Fines

In this section, we analyze the behavioral impact of notices and fines. In particular, we are interested in analyzing the behavior of those students whose rooms were locked with inside lights switched on in a particular treatment. For instance, we want to see whether the display of notices, warnings or fines in the next treatment plays any role in reforming their behavior. In order to test this, we follow a sequential approach, i.e. we want to see the impact on behavior in the next treatment. We capture such behavior through the following formula:<sup>27</sup>

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

The results of this behavioral impact are shown in table 5. As is evident from the table, there were 165 rooms which were locked in both the BT and SNT with their inside lights switched on in BT; however, with the introduction of notices during SNT, the residents of 57 rooms switched off their lights. This implies that 34.55% of the violators reformed their behavior with the display of notice in SNT. Likewise, the harsh notice during HNT resulted in the reformation of behavior of 35.06% of the violator students during SNT. This improvement in behavior is increasing with the severity of punishment. For instance, warning, rupees 500 fine and rupees 1000 fine ended up with the behavioral improvement of 47.16%, 58.95%, and 68.63% of the students, respectively. It is also shown by P-value of Z-statistic for cross-treatment comparison in table 5. In particular, like the overall results, the monetary punishment is an effective tool in reforming the behavior of habitual violators of rules. This is also confirmed by the simple regression in column 9 of the table 4 in which the dummy for fines is significant in reforming the behavior of violators. Again, the decomposition of students by the level of their degrees shows similar pattern. For instance, table A2 in the Appendix A shows that the introduction of notices and fines reform the behavior of violators in similar fashion across all three levels of education in hostels.

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<sup>27</sup> BI, CT and PT refer to Behavioral Impact, Current Treatment and Previous Treatment, respectively.

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

<b>Treatments</b>	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)
<b>Impact of SNT</b>	165	57	34.55%	---
<b>Impact of HNT</b>	251	88	35.06%	0.9124
<b>Impact of WNT</b>	229	108	47.16%	0.0071
<b>Impact of FFT</b>	190	112	58.95%	0.0160
<b>Impact of FOT</b>	51	35	68.63%	0.2077

### ***5.3. Impact of the Experiment on the Conservation of Electricity***

In this section, we examine the probable impact of the whole experiment on the conservation of electricity. For this purpose, we take the electricity bills of all hostels from the office of Project Director (PD) of QAU. We compare the consumed units of electricity for months right after the experiment with the corresponding months in the previous years. For instance, we compare the consumed units of electricity for the months of December, 2014, January, 2015 and February, 2015 with those of the same months in 2015-2016. This comparison is shown in table 6 which shows that except for the month of December, the consumption declines significantly in all of the remaining months. The overall impact shows that, with the experiment, the electricity consumption declines by 23040 KWh during these three months. This, in other words, suggests that if we establish an efficient monitoring system with appropriate punishment mechanism, we can achieve efficiency in terms of energy conservation. Likewise, the comparison between different levels of students demonstrates that for all levels except MSc students the consumption of electricity declines after the experiment.<sup>28</sup> It is pertinent to mention that, during the experiment, the hotels' administration installed 24 electric gasser of 1000 KW. Hence, the real impact might be underestimated due to this factor.

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<sup>28</sup> See table A3 in the Appendix A for the details.

**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
<b>Total</b>	386480	363440	-23040

## 6. Conclusion

This study is motivated by the previous literature that emphasizes the role of punishment in situations, involving moral hazards. Additional motivation is given by the findings with regard to the recent energy crisis in Pakistan. Inefficiency in energy consumption is considered as one of the major factors responsible for this crisis. In this study, we examine how monitoring and the associated punishment mechanism resolve moral hazards as far as the electricity consumption in public sector is concerned? We use the framework of a field experiment which comprises six treatments. The experiment is conducted in boys' hostels of Quaid-i-Azam University (QAU), Islamabad. 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.

Based on our indicator of misuse, i.e. the number of locked rooms with inside lights switched on, our analysis shows three important findings. First, people are responsive to both monetary and non-monetary punishments. For instance, with the introduction of punishments, we observe declining trends in the ratio of locked rooms with inside lights switched on. In particular, the trend in this change gets steeper over the severity of both the non-monetary and monetary punishments. When individuals are informed about their misuse of electricity in soft tone; they show a meager response in terms of change in their behavior. In contrast, when they are informed in harsh tone; their response enhances as compared to that of the soft tone. Likewise, the response level multiply once individuals are made liable to monetary punishment. Second, the individuals who are habitual violators of rules show reformation in their behavior with the severity of

punishments. In our case, we define habitual violators of rules as those who regularly keep lights switched on in their locked rooms. This finding negates the objection which people might make that the positive response towards monetary and non-monetary punishment may be due to new residents. Instead, our findings reveal that even those who are habitual violators show response to both the monetary and nonmonetary punishment. Again, the response to the monetary punishment is higher than that of the nonmonetary punishment. 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. This is shown by the reduction in overall consumption of electricity after the experiment. This finding negates the doubts about the possible retaliation in terms of misusing the other non-visible electric appliances such as iron-rod etc.

The study suggests that once individuals are informed about the external effects of their actions of moral hazard; they reform their behavior. Alternatively, if a monitoring system with the associated punishment mechanism is introduced; we can have beneficial effects in terms of resolving the moral hazard in energy consumption. However, future research in this strand is certainly needed in order to have clear policy guidelines in this regard. For instance, this experiment is undertaken only in boys' hostels. The same experiment with the same number of treatments can be done in female hostels for having a gender-based comparison. Likewise, the experiment is focused on students. Future research can examine the behavior of employees in a public sector institution.

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## Appendix A

**Table A1: Part I: Overview of Findings by Different Levels of Education**

Treatments	MPhil/PhD	M.SC	BS
BT	72.81%	66.67%	61.11%
SNT	65.37%	62.34%	58.56%
HNT	60.51%	55.19%	63.33%
WNT	41.49%	43.62%	47.13%
FFT	30.23%	23.99%	36.67%
FOT	30.10%	23.53%	26.76%

**Table A1: Part II: Inferential Comparison of Treatments by Different Levels of Education  
(Corresponding P-Values for Each Treatment)**

BT	---	-----	-----
Impact of SNT	0.0949	0.4413	0.4593
Impact of HNT	0.2340	0.1118	0.5028
Impact of WNT	0.0000	0.0098	0.0054
Impact of FFT	0.0060	0.0000	0.0477
Impact of FOT	0.9124	0.6672	0.0588

**Table A2: Part I: Impact of Each Treatment on Reforming the Behavior of Violators by Different Levels of Education**

Treatments	MPhil/PhD	M.SC	BS
Impact of SNT	34.21%	33.96%	36.11%
Impact of HNT	33.62%	39.76%	30.91%
Impact of WNT	48.51%	43.48%	49.15%
Impact of FFT	59.49%	60.94%	55.32%
Impact of FOT	51.00%	69.23%	68.42%

**Table A2: Part II: Inferential Comparison of Treatments in Terms of Reformation by Different Levels of Education  
(Corresponding P-Values for Each Treatment)**

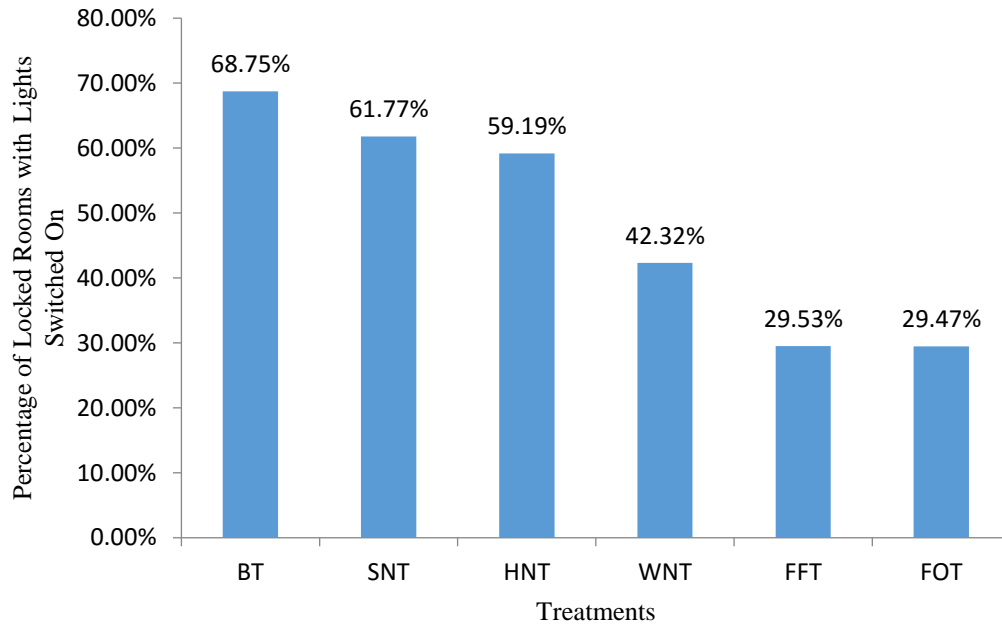
Treatments	MPhil/PhD	M.SC	BS
Impact of SNT	--	-	-
Impact of HNT	0.93624	0.4965	0.6030
Impact of WNT	0.0271	0.64552	0.0477
Impact of FFT	0.14156	0.04444	0.5287
Impact of FOT	0.2757	0.57548	0.2187

**Table A3: Comparison of the Consumed Electricity before and after the Experiment by the Level of Degrees (in KiloWatt-hour(KWh))**

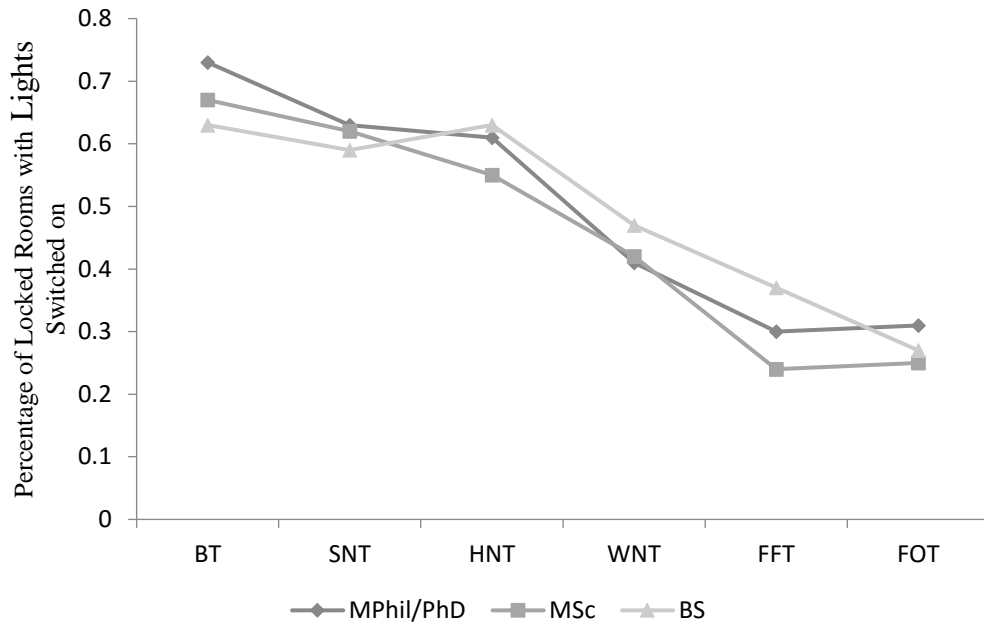
Months	MPhil/PhD Students		MSc Students		BS Students	
	2014-2015	2015-2016	2014-2015	2015-2016	2014-2015	2015-2016
<b>December</b>	19520	21000	17240	22480	15520	18720
<b>January</b>	51600	48240	42120	50240	43600	25040
<b>February</b>	66280	64000	68600	58440	62000	55280
<b>Total</b>	137400	133240	127960	131160	121120	99040
<b>Net Difference</b>	-4160		3200		-22080	

Note: The Net Difference is total units consumed in 2015 subtracted from those in 2014.

**Figure A1: Overview of Findings across Treatments**



**Figure A2: Decomposition of Students by the Level of Degrees**



**Figure A3: The Impact of Each Treatment in Reforming the Behavior of Violators**

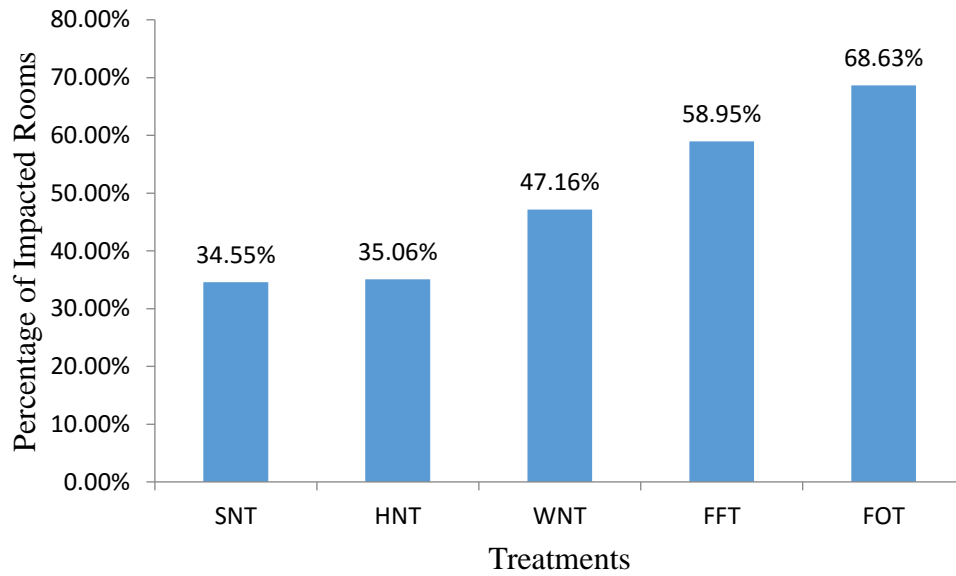
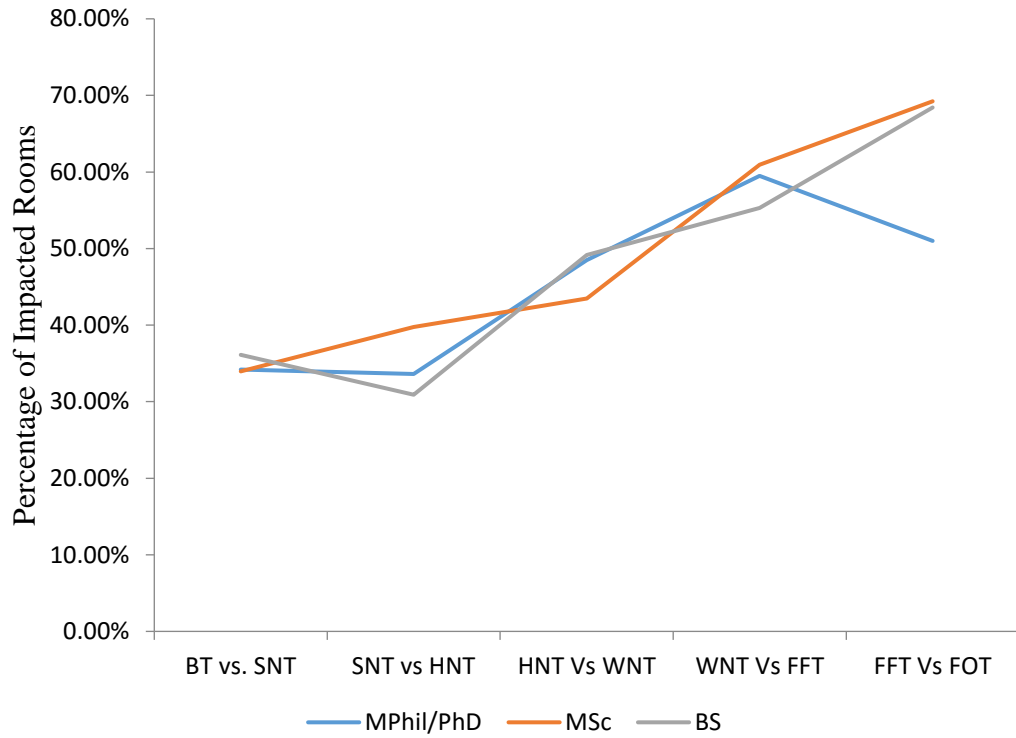


Figure A4: The Impact of Each Treatment in Reforming the Behavior of Violators by the Level of Degrees



## **Appendix B**

In this appendix we provide the copies of the notices that we used for different treatments.

### **B1 Copy of the Notice for SNT**

#### **Notice for the Economical use of Electricity in Hostels**

It has been observed that some of the boarders do not switch-off lights/ other electrical appliances while leaving their rooms. As we all know the current critical situation of a wider gap between supply and demand of electricity culminating into ever-worst situation of load-shedding, hence we utterly need to adopt a habit of judicious use of electricity.

Therefore, all the residents of the boys hostels are advised to ensure switch-off the bulbs, fans etc. as and when they leave their respective rooms.

Senior Warden  
(Boys hostels)

### **B2: Copy of the Notice for HNT**

#### **Second Notice for the Economical use of Electricity in Hostels**

It has been observed that in spite of the first notice dated 06/11/2105 for the economical use of electricity in hostels, most of the boarders do not switch-off lights/ other electrical appliances while leaving rooms locked. The current situation of wider gap between the supply and demand of electricity at national level is known to all. Hence, we need to adopt a habit of judicious use of electricity in hostels.

Thus, all the residents of the boy's hostels are strictly advised to ensure switch-off lights/ other electrical appliances etc., as and when they leave their respective rooms locked. In case of non-compliance warning notice will be issued to all dwelling students of a room.

Senior Warden  
(Boys Hostels)

**B3:Copy of the Notice for WNT**

QUAID-I-AZAM UNIVERSITY  
(Office of the resident Warden)

No.QAU/BH/2015-

Dated:-----

Subject: **Warning**

It has been observed that in spite of repeated notices issued by this office, you do not switch off the lights of your room while leaving it. It is sheer negligence and wastage of energy resources. You are, therefore, finally warned to switch off all the lights & electric appliances while leaving the room. Failing to comply with the instructions, heavy fine will be imposed on you.

Resident Warden  
Unit A/B/C

Room No----- Hostel No-----

Copy:-

Provost/ Senior Warden for information please.

**B4: Copy of the Letter FFT**

**QUAID-I-AZAM UNIVERSITY**  
(Office of the Provost)

No.QAU/P(BH)/2015-1916

Dated:- 25.11.2015

**Fine Notice**

With reference to this office Warning letter No.QAU/BH/2015-1875 dated 17.11.2015 regarding misusing of lights and other electric appliances, it has been once again noted during physical checking. That you did not follow the instructions of this office and also noted that lights of your room were still switched on while the room was locked

In exercise of the powers vested in Provost under clause: 17(a) of QAU, Hostel Regulation, 1996 the allottees of the room are therefore fined Rs.500/- collectively (i.e. Rs.125/-each in four seater room and Rs.250/-each in bi-seater room) The student (s) is/are therefore, directed to deposit the above mentioned fine into the authorized university account under intimation to this office by 07.12.2015. Failing to comply with instruction or refusing to receive the notification would be considered as another act of indiscipline/cognizable offence under the law.

Senior Warden

Room No.\_\_\_\_\_ Hostel No\_\_\_\_\_

Name of the allottees

1. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_
2. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_
3. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_
4. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_

**Distribution:**

- Chairperson Concerned Department
- Provost (Boys Hostels)
- Controller of Examinations
- Treasurer
- Resident Warden with the direction to facilitate delivery of above notification to the concerned student at the earliest. In case of non-compliance please report back.



**B5: Copy of the Letter for FOT**

**QUAID-I-AZAM UNIVERSITY**

(Office of the Provost)

No.QAU/P(BH)/2015-

Dated:- 02.12.2015

**Fine Notice**

With reference to this office Warning letter No.QAU/BH/2015-1875 dated 17.11.2015 and subsequent fine of Rs.500/- collectively vide notification No.QAU/P(BH)/2015-1916 dated 25.11.2015 regarding the misuse of lights and other electric appliances, it has been found that you once again did not follow the instructions of this office and left the lights of your room switched on while the room was locked. The date of the survey of your room is dd/mm/yy at xy pm

In exercise of the powers vested in Provost under clause: 17(a) of QAU, Hostel Regulation, 1996 the allottees of the room no ---xy---are therefore fined Rs.500/- each.

All the allottee of the room is therefore, directed to deposit the above mentioned fine into the authorized university account under intimation to this office by 10.12.2015. Failing to comply with instruction or refusing to receive the notification would be considered as another act of indiscipline/cognizable offence under the law.

Senior Warden

Room No. \_\_\_\_\_ Hostel No \_\_\_\_\_

Name of the allottees:

1. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_
2. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_
3. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_
4. Name \_\_\_\_\_ Deptt. \_\_\_ Sem. \_\_\_

**Distribution:**

- Chairperson Concerned Department
- Provost (Boys Hostels)
- Controller of Examinations
- Treasurer
- Resident Warden with the direction to facilitate delivery of above notification to the concerned student at the earliest. In case of non-compliance please report back.