

Punishment or Reward? The Choice of Nudging Policy in Minor Violations of Law — Insights from Illegal Parking Problem

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Abstract. In today's society, minor violations of laws present significant economic and social consequences, including the loss of social cohesion and trusts within the society. Traditional punitive measures are often ineffective, as fines may be regarded as the price of committing these violations. This study explores the effectiveness of reward-based system compared to punitive measures under the context of minor traffic violations. Through an online survey, this paper compares the difference in the response of the public towards punitive measures, long term reward system and short-term reward system. The results suggest that integrating reward-based measures, could be more effective in reducing minor violation of laws compared with punitive measures.

Keywords: minor legal violations, reward-based system, punitive measures, illegal parking, compliance incentives

1. Introduction

Minor violations of the law, such as running a red light and vandalism, are prevalent issues with far-reaching consequences. Each of these issues carries unnecessary costs which creates boarder societal impacts and consequences, such as erosion of trust and social cohesion, which leads to a fragmented community where residents feel less secure and less likely to interact and support each other. However, negligible economic impact is also a major problem to consider.

Existing measures to tackle minor violations of law usually only involves slight punishments. But this sometimes fails to regulate individuals properly, as they may reckon it as worth of paying—crossing red light to avoid being late for school (and possibly detention) is a good deal; it may even have the opposite effect, as people feel justified when they have paid penalty for their violations [1].

Due to the ineffectiveness of punishment in the control of minor violations of laws, many studies on more effective ways to reduce people's motivation of violating the law have been published. Among these studies, reward systems, which promotes compliance with the law through rewarding

the law-abiding behaviour, thus achieving the same purpose as the punishment mechanism to reduce minor violations of laws, have been proposed frequently and proved effective [2].

The optimal method to decrease rate of minor offences could be determined through a field experiment. In this experiment, participants are divided into three groups: one is subjected to punitive measure, second is subjected to reward-based measure and the last group is not given any treatments. A survey will be answered by candidates to access their initial attitude and response towards illegal parking. This practical is repeated multiple times which allows us to generate an accurate result.

2. Literature review

2.1. Research background

Traffic violations such as speeding, illegal parking, and running red lights continue to pose significant risks to public safety and urban mobility. Traditionally, these issues have been addressed through punitive measures including fines and penalties. However, evidence suggests that such punitive approaches might inadvertently normalize non-compliant behavior rather than deter it [1]. This has led researchers and policymakers to explore alternative measures, such as reward-based systems, which may effectively encourage compliance through positive reinforcement. Studies such as those by [2] and Shulman et al. have highlighted the potential for rewards to either complement or replace punitive measures to enhance road safety. Moreover, the effectiveness of these systems varies significantly across different cultural and geographic contexts, necessitating a diverse approach to understanding and implementing these systems globally [3].

2.2. Methodology development reference

To investigate the impact of punishments and rewards on driving behavior, particularly in regions like China where limited research exists, a comprehensive methodological approach is essential. Survey methods, often used in behavioral studies, can provide insights into drivers' attitudes and compliance levels [2]. Sampling strategies should aim for diversity and adequate representation to ensure generalizability of the findings. For instance, using a range of demographic variables can help understand different influences on behavior. Analysis techniques such as factor analysis and logistic regression can be instrumental in dissecting the attitudinal and demographic factors affecting driving behavior [2]. Additionally, incorporating technological tools like in-car systems for real-time feedback can offer empirical data on the immediate effects of reward systems on driver behavior [4].

2.3. Synthesis of current knowledge and future directions

The debate between the use of punishment versus reward in traffic law enforcement invites a broader examination of behavioral economics and psychology. While fines are traditionally seen as deterrents, they are often factored in by drivers as acceptable risks or costs [1]. Conversely, reward systems, including non-monetary incentives such as certificates or public recognition, have shown promising results in not only altering driver behaviors but also in fostering a more positive public attitude towards traffic compliance [5]. This suggests a paradigm shift might be beneficial, where rewards could potentially decrease daily traffic violations more effectively than traditional fines. However, as [4] suggest, further exploration into different combinations of fines and rewards could enhance our understanding of their relative efficacies.

Future research should focus on longitudinal studies and diverse geographical settings to provide a more comprehensive analysis of how different cultures respond to such systems. Also, more innovative sampling and data collection methods, such as the use of telematics in vehicles, could provide more accurate and less biased data on actual driving behaviors rather than relying on self-reported or documented offenses, which may miss nuances or underreported violations.

In conclusion, the shift towards integrating reward systems in traffic law enforcement appears promising, especially when compared to traditional punitive measures. Continued research and tailored approaches considering cultural and regional nuances will be crucial in formulating effective traffic law enforcement strategies globally.

3. Method

3.1. Participants and design

Participants were 577 Chinese, recruited from the general population and aged 18 or more, to ensure that they can (potentially) have a driving license and hence some real-life experience in parking a car. They were all friends or relatives of the researchers (opportunity sampling). According to whose acquaintance the participants were, they were randomly assigned to one of the groups: Group b) punitive measure (N=219); Group c) rewards, participants have been keeping the good record for 1.5 months (N=109); Group d) rewards, participants have been keeping the good record for 6 months (N=249). The reason for not having group a) is to minimize the possibility that the participants could guess which treatment they were in, and demonstrate behaviors in line with their guess.

3.2. Procedure

Participants were told that the survey would only take 2 minutes to answer. The intention was to reduce their feeling of boredom or frustration, especially as this was an online survey. They accessed the survey through QR code being shared in WeChat groups. Other than the QR code, they could only see texts saying, “questionnaire x (b, c or d)”. No information about the specific content of the survey was revealed. Each of the questionnaire contained two scenarios (and thus two questions), the first one was a control which is exactly the same for every single participant, the second one was slightly altered across groups. Participants were offered a thank-you message for completing the survey and were encouraged to share their reflections on the questionnaire and offer any suggestions.

3.3. Condition 1 – punitive treatment

Participants were asked to answer two closed-ended multiple choice questions. The first question measures one's habit in illegal parking. It contains a relatively detailed scenario: “Assuming you have 6 points left on your driver's license due to multiple violations of traffic regulations. Today, you are driving to the busy city center for work, and anxiously searching for a parking spot. There is an empty space on the roadside, but the sign says no parking, and you know that under the laws of this country, violations will result in a fine of 200 yuan.” The question is: “will you choose to park here or keep finding a parking spot?”. The choices were deliberately designed in this way (avoid mentioning “illegally park here”), to prevent a possible emphasis on “illegal”, which people may not perceive in real-life scenarios.

The second question measures the effectiveness of punitive behavior. In this scenario, a 3-point deduction was added to the previous 200-yuan fine, making it more costly for parking illegally. Other conditions of the scenario as well as the question itself remained the same.

3.4. Condition 2 – reward-based treatment (5.5)

Participants were also asked to answer two closed-ended multiple choice questions. The first question and scenario were the same as those in condition 1. The second scenario introduced rewards on keeping a good habit (not to park illegally): “Now the government has introduced new reward schemes: if you persist in not violating parking regulations for three months, you will receive a Junior Medal (which can be affixed to the front windshield) and an additional 0.5 points on your driver's license; if you can persist in not parking illegally for six months, you will receive a senior medal and an additional 2 points, and so on. Assume that you have not violated this law for 5.5 months.” We then ask people their willingness to park at that spot.

3.5. Condition 3 - reward-based treatment (1.5)

The scenarios and questions for condition 3 were the same as those in condition 2, apart from the assumption: in condition 3, instead of 5.5 months, participants were asked to assume that they had been keeping a good record for 1.5 months. This was to compare the effectiveness of reward system at different stages.

Table 1. Experimental results under different treatments

variable	N	mean	se	min	max
Treatment 1	27	0.259	0.447	0	1
Treatment 2	22	0.455	0.510	0	1
Treatment 3	64	0.375	0.488	0	1

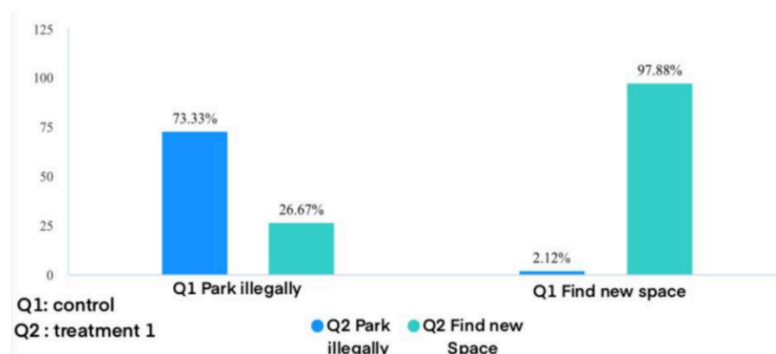


Figure 1. Treatment 1 (punitive measures)

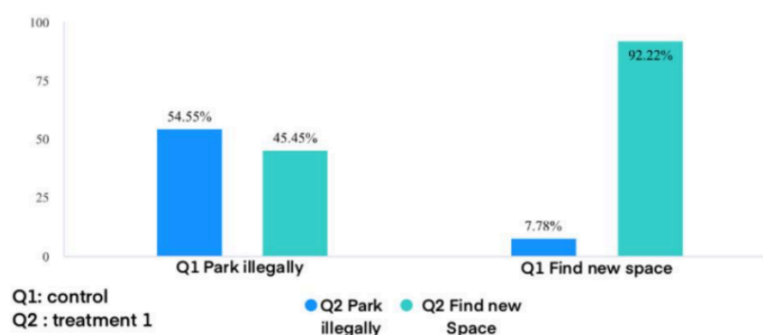


Figure 2. Treatment 2 (reward-based treatment A)

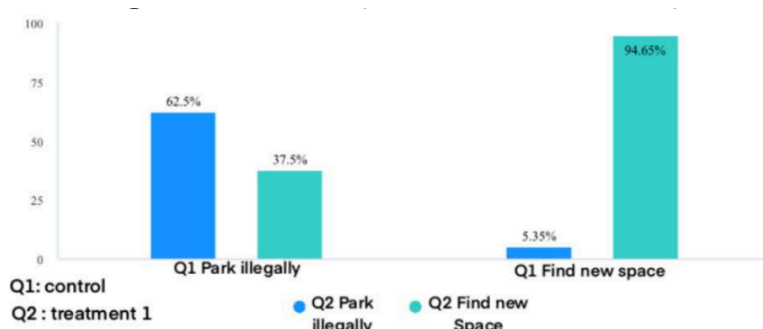


Figure 3. Treatment 3 (reward-based treatment B)

Experiment A provides data generated from the results of the experiment (online survey) where participants were exposed to different scenarios regarding parking choices,

The Y axis determines the number of individuals that responded, and the result is being categorised into four different behaviour response on the X axis.

The first bar (both illegal) represents people who chose to park illegally for both control and treatments. The second bar (control illegal/ treatment legal) represents people who choose to park illegally under the context of control but opted for legal parking (find a new parking space) when treatments is being applied. The third bar (control legal/ treatment illegal) indicates individuals who choose legal parking but switched to illegal parking when treatments is being applied. And finally, the last bar (both legal) indicates individuals who choose legal parking for both contexts.

According to the results, both figures 2 and 3 are reward-based measures, however figure 2 is 7.95% higher than figure 3, and this happens due to the idea that figure 2 provides immediate positive feedback, encouraging more desired behaviour, whereas figure 3 provides less immediate feedback.

In conclusion, this surgery demonstrates the idea that reward-based measure is more effective than punitive measures in terms of reducing rate of illegal parking. In particular, the data generated from figure 2 is 18.78% more effective than the figure 1 (punitive measure). The significant increase in the compliance with reward-based treatments suggests that positive reinforcement strategies could be considered in urban parking managements.

However, there are several potential biases and consideration for a fair test. For instance, we cannot ensure the behavioural consistency, since we cannot monitor whether participants' reported behaviours match their actor behaviour in real life.

Table 2. Test results determining the most effective method

T-test 1A (including outliers)		
	Punishment	Reward (5.5)
Mean	0.259259259	0.45454545
Variance	0.199430199	0.25974026
Observations	27	22
Pooled Variance	0.226377248	
Hypothesized Mean Difference	0	
df	47	
t Stat	-1.429059591	
P(T<=t) one-tail	0.079800078	
t Critical one-tail	1.677926722	
P(T<=t) two-tail	0.159600155	
t Critical two-tail	2.011740514	
T-test 1B (excluding outliers)		
	Punishment	Reward (5.5)
Mean	0.24	0.470588235
Variance	0.19	0.264705882
Observations	25	17
Pooled Variance	0.219882353	T-test 1B (excluding outliers)
Hypothesized Mean Difference	0	
df	40	
t Stat	-1.564270221	
P(T<=t) one-tail	0.062816048	
t Critical one-tail	1.683851013	
P(T<=t) two-tail	0.125632096	
t Critical two-tail	2.02107539	
T-test 2A (including outliers)		
	Punishment	Reward (1.5)
Mean	0.25925926	0.375
Variance	0.1994302	0.23809524

Table 2 (continued)

Observations	27	64
Pooled Variance	0.22679983	
Hypothesized Mean Difference	0	
df	89	
t Stat	-1.059049	
P(T<=t) one-tail	0.14622164	
t Critical one-tail	1.66215533	
P(T<=t) two-tail	0.29244328	
t Critical two-tail	1.9869787	
T-test 2B (excluding outliers)		
	Punishment	Reward (1.5)
Mean	0.24	0.395833333
Variance	0.19	0.244237589
Observations	25	48
Pooled Variance	0.225903756	
Hypothesized Mean Difference	0	
df	71	
t Stat	-1.329314762	
P(T<=t) one-tail	0.093999912	
t Critical one-tail	1.666599658	
P(T<=t) two-tail	0.187999823	
t Critical two-tail	1.993943368	
T-test 3A (including outliers)		
	Punishment	Reward (5.5) &reward (1.5)
Mean	0.25925926	0.395348837
Variance	0.1994302	0.241860465
Observations	27	86
Pooled Variance	0.23192184	
Hypothesized Mean Difference	0	
df	111	
t Stat	-1.2809905	
P(T<=t) one-tail	0.10143345	
t Critical one-tail	1.65869727	
P(T<=t) two-tail	0.2028669	
t Critical two-tail	1.98156676	
T-test 3B (excluding outliers)		
	Punishment	Reward (5.5) &reward (1.5)
Mean	0.24	0.421875
Variance	0.19	0.247767857

Table 2 (continued)

Observations	25	64
Pooled Variance	0.231831897	
Hypothesized Mean Difference	0	
df	87	
t Stat	-1.601590191	
P(T<=t) one-tail	0.056435618	
t Critical one-tail	1.662557349	
P(T<=t) two-tail	0.112871236	
t Critical two-tail	1.987608282	

According to T-test 1, the $P(T \leq t)$ one-tail is less than 0.1 which means it is 90% significant. This indicates that there is a difference between punishment and reward (5.5). On the opposite hand, the $P(T \leq t)$ one-tail is over 0.1 for both T-test 2A. This suggests the difference between punishment and reward (1.5) is not significant. Similarly, T-test 3A suggests the difference between punishment and reward (5.5) & reward (1.5) is also not significant. Which may mean the effect of reward (5.5) have been counteracted by reward (1.5). Therefore, having longer history of not violating the law decreases the chance of committing minor offences.

However, after excluding the outliers (people who didn't do the survey properly) the $P(T \leq t)$ one-tail of all T-tests has changed less than 0.1 which means it is 90% significant. This indicates that there is a significant difference between punishment and both rewards. Which means having longer history of not violating the law may not impact the chance of committing minor offences.

4. Discussion

Participants who were given additional points on their driving license and badges for not parking illegally, intended as analogue of rewards, behaved better than those given extra punishments when asked to choose between parking illegally or find a new place. This difference was seen when comparing their choices using a series of t-tests, which showed that rewards significantly increase the 'good behaviors'.

The mechanism under this result maybe as such: loss aversion, suggesting that people tend to be more motivated to avoid losses than to obtain gains, might instead also increase their tendency to be detracted from the task itself. People have cognitive constraints. Loss aversion shifts individuals' focuses to the loss (the result itself) thus not enabling them to think about their choices more rationally. Hence, the quality of information processing should be greater under reward than punishment, making them choose the correct option (park legally) more frequently.

However, three factors may weaken the internal validity of this result. First, the question setting may be vague for people to interpret. It said, 'you are driving to the busy city center for work', intending to stress that parking illegally at this point can save time. But some of the participants had asked specific questions on the intensity of 'business' and what is the 'work' exactly. This suggests that participants may have their own and distinct interpretations of the necessity of illegal parking in this scenario, and their choices may thus only reflect these interpretations instead of the effectiveness of punishment or reward mechanisms. Second, according to data we have collected, there were a small number of people who did not answer the questions seriously. They only took less than 15 seconds to complete the whole survey, indicating that under normal reading speed of

Mandarin, they did not finish reading the two question settings. It is more likely that they chose random answers. Thus, to reduce the likelihood that results are being affected by these outliers, we remove them from our dataset and remarried t-tests. Third, as the participants were informed that they were to take part in an investigation (although we did not tell them content of the research), they were aware that their choices would be examined by researchers. They may be afraid of 'standing out' from the crowd, so may instead deliberately choose the 'not parking here' option to conform to social norms and be more socially acceptable. But since we did not ask participants to reveal any of their personal information (name, age, gender, etc.), it is less likely for social desirability effect to take part.

Moreover, the nature of the sample makes it less able to be generalized. First, instead of monitoring people's behavior in a real-life setting, we distribute online questionnaires and let people indicate their thoughts in mcqs. As people are well-aware that they would not bear the costs of parking illegally in this online questionnaire, this is different to them making a choice in real-life. Thus, the result may lack external validity. Second, as we distributed the questionnaires in social media groups, it is inevitable that most of the individuals answering one questionnaire come from the same city or province. For example, more than half of the individuals completing question b) come from Sichuan province. Therefore, our result may fail to be applied to the whole population in China.

Lastly, although we aim to investigate means to regulate minor violations of law, we only did research on one issue: illegal parking. Other issues in the same field, like crossing red lights or speeding, and issues in other fields are not being touched in this paper. Thus, our conclusion cannot be a general one that applies to all issues, and social planners seeking insights to design policies may only find this paper effective in tackling illegal car parking.

5. Conclusion

The topic of reducing the motivation for minor violations of the law is crucial as it addresses a fundamental aspect of maintaining social order and public safety. By understanding and implementing effective measures—both reward-based and punitive—we can influence behaviour and encourage adherence to laws. Reward-based measures, such as incentives for compliance, tap into positive reinforcement, making lawful behaviour more appealing. Conversely, punitive measures deter misconduct through the fear of consequences. Analysing the effectiveness of these approaches helps us identify the most efficient strategies for promoting law-abiding behaviour, thereby contributing to a more orderly and safe society. In this paper, we investigate the effectiveness of reward-based measures versus punitive measures in reducing minor law violations, such as illegal parking. We used survey data from 577 Chinese participants who were exposed to different scenarios regarding illegal parking. We conducted a field experiment with participants divided into three groups: one subjected to punitive measures, one to reward-based measures with a short-term record of compliance, and another to reward-based measures with a long-term record of compliance. We then analysed the results using t-tests to compare the effectiveness of the different measures. The main result of our study is that reward-based measures were more effective than punitive measures in reducing the rate of illegal parking. Specifically, participants in the reward-based group with a 5.5-month compliance record showed an 18.78% higher effectiveness in reducing illegal parking compared to the punitive group. However, the effect was less significant for the short-term reward-based group. This suggests that positive reinforcement strategies, particularly with a longer history of compliance, could be more effective in urban parking management.

These findings necessitate further exploration into several critical areas: How might the effectiveness of reward-based measures vary across different cultural or socioeconomic contexts? Would combining punitive and reward-based measures produce better results than either approach alone? What is the long-term sustainability of reward-based measures in maintaining compliance with minor laws? We leave these questions to future research.

Acknowledgement

XianZhong Tang, Jifei Chen, Ziyu Zhang and Qiyan Zhu contributed equally to this work and should be considered co-first authors.

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