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Attitudes of Iranians toward the Becker Proposition

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Abstract

This paper evaluates attitudes of Iranians toward crossing red traffic lights and their sensitivity to fines. Economic theory of crime under expected utility predicts that because of the possibility of severe punishments, risk adverse individuals would not cross red lights. This is implied by the *Becker proposition*. However, among 262 individuals surveyed, more than half of the sample has previous records of conviction with respect to traffic laws. The result indicates that the effect of introducing a new fine on pedestrians is about twice the effect of increasing the existing fine on drivers by 150%. The elasticity of crossing red lights with respect to fine hike is -0.25. Regression analysis shows that previous record of breaking traffic laws, being single and crossing red lights by cars are significant explanatory variables for decision to do jaywalking.

Keywords: Becker Proposition, Crossing Red Traffic Lights, Jaywalking, Expected Utility.

JEL Classification: D81, K42.

1. Introduction

A celebrated proposition from Becker (1968) states that the most efficient way to deter crime is to impose the severest possible penalty with the lowest possible probability. This is called the Becker proposition by Dhami and Al-Nowaihi (2006). In other words, to economize on costs of enforcement such as policing and trial costs, we should impose the severest punishment with the lowest probability of detection and conviction.

Becker is dominantly known for applying standard toolkits of economics to new areas. Becker (1968) is the application of the

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standard model of decision making into criminology. This approach is in sharp contrast with other crime theories asserting that crime is the result of economic stress, political legitimacy and family disorganization.

Lea (2006) states that the theory of rational decision making is a characteristic of an economic approach to any problem. This means individuals will do the best they can. According to Lea (2006), on the contrary, most psychologists believe that humans faced with real economic problems will not in fact do their best.

Nevertheless, looking at crime through a cost-benefit framework is not a dismal activity as the most important incentive of criminals is more and easier lucrative economic benefits. Moreover, crime is a major activity with estimates indicating that it constitutes up to one-fifth of global gross domestic product (Glenny, 2008). On the other hand, because of lack of reliable data and difficulties in estimating crime costs, empirical analysis of crime is difficult. For example, criminals' opportunity cost is correlated with unemployment that, in turn, depends on other factors. Thus, there is not even a consensus on the existence of positive correlation between crime and some determinant variables.

As stated by Dhami and Al-Nowaihi (2013) if the Becker proposition holds, then its central insight should apply to all human behavior that involves taking some action that with some probability leads to severely costly outcomes. The work of Bar-Ilan and Sacerdote (2004) shows how red lights running decreases in response to higher fines. Dhami and Al-Nowaihi (2013) consider this evidence against the Becker proposition.

If the Becker proposition holds, given the severe self-inflicted punishments of running red lights, there should be no change in behavior when one varies the external factors like the monetary punishments or probability of an accident. Hence, a designed survey asked whether people would cross red lights as drivers and pedestrians if in a rush. The question is repeated when there is an increase in fine for crossing red lights by cars or introducing a new fine for jaywalking.

The elasticity of violation with respect to 150% increase in fine is -0.25. This is consistent with the elasticity of conviction found in the

literature. Introducing a fine on pedestrians decreased jaywalking by 64%. People's attitude towards jaywalking is best explained by their previous record of breaking traffic laws and if they would cross red lights by cars. It seems single people are crossing more red lights as pedestrians as compared to drivers. As compared to other people, single people are more sensitive to the imposition of a new fine on pedestrians. These findings indicate that the Becker proposition does not hold.

The plan of the paper is as follows. Section 2 investigates crossing red traffic lights as a crime under expected utility framework. Section 3 describes the survey design and data. Section 4 reports the results. Some remarks are made in conclusion.

2. The Model

Considering running red traffic lights as a crime, the benefit is supposed to be the amount of money an individual could lose as a result of being late. While this benefit can vary across individuals, it should be a positive amount. Hence, the benefit of crossing red lights is $b = y_1 - y_0 \geq 0$, where y_1 denotes income from crossing the red light, and y_0 is the income from not crossing the red light.

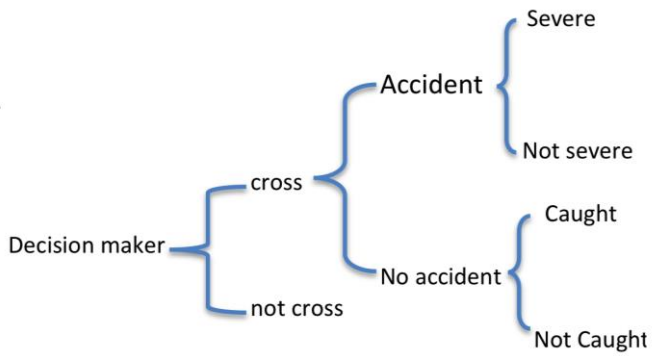

Figure 1: The Decision Tree

A decision maker is supposed to face a decision tree depicted in Figure 1. If the individual crosses the red light, with some probability $p_1 \in [0,1]$ she would have an accident, and with probability $1 - p_1$ she would not. In case of no accident, the

individual is caught with probability $0 \leq p_2 \leq 1$. If caught, the individual is asked to pay a monetary fine denoted by F_p that refers to public fine. In the crime literature, it is common to assume that the punishment is a function of probability of detection. Hence, it is assumed that F_p is a hyperbolic function given by $F_p = \frac{c}{p}$, where c is a constant (Dhami and Al-Nowaihi, 2013). In case of an accident, the individual will face a serious injury with probability p_3 ,$0 \leq p_3 \leq 1$, and she will not with probability $1 - p_3$. In case of an accident, the punishment and the loss of utility are coming from two different sources. One is the self-inflicted punishment that includes injuries, higher insurance premium and car repair costs. The self-inflicted punishment is donated by F_q. The other is the public policy punishment (F_p).

If the individual does not face a serious injury the outcome is $y_1 - F_p - F_q$, and if she does, the outcome is $y_1 - F_p - F_q - s$ where s refers to the loss of utility from the serious injury. Given the enforcement parameters p and F_p, individuals decide whether to cross the red light or not. Under expected utility, if the individual does not cross the red light, her payoff from no-crime (U_{NC}) condition is given by $EU_{NC} = u\,(y_0)$. On the other hand, her expected utility from crossing the red light is given by

$$EU_c = (1-p_1)\{(1-p_2)u(y_1) + p_2\,u(y_1 - F_p)\} + p_1\{p_3\,u(y_1 - F_p - F_q - s) + (1-p_3)\,u(y_1 - F_p - F_q)\} \quad (1)$$

The individual does not cross the red light if the no-crime condition (NCC) given by $EU_c \leq EU_{NC}$ is satisfied. NCC is clearly satisfied for $p_2 = 1$. The NCC continues to hold as p_2 declines from 1, if and only if

$$\frac{d}{dp_2}[(1-p_1)(1-p_2)u(y_1) + (1-p_1)p_2\,u(y_1 - F_p)] \geq 0$$

$$\Leftrightarrow\ -(1-p_1)u(y_1) + (1-p_1)\,u(y_1 - F_p) - (1-p_1)p_2F_p'\,u'(y_1 - F_p) \geq 0 \quad (2)$$

Dividing both side of the above equation by $(1-p_1)$, we get the same equation that Dhami & Al-Nowaihi (2006) used to prove the Becker proposition under expected utility;

$$u'(y_1 - F_p) \geq \frac{u(y_1) - u(y_1 - F_p)}{-p_2 F_p'} \tag{3}$$

They have proved that by the assumptions of hyperbolic punishment function and concave utility function, the NCC will hold for all $p_2 \in (0,1]$ when there are severe punishments. Thus, the expected utility predicts that individuals with concave utility functions (risk adverse individuals) will not cross red lights in the presence of severe punishments.

3. Data Collection Procedure and Its Description

Participants were asked whether they would cross red lights while driving in a rush, and if yes, what if the fine increases up to 150%. The same question was repeated as if they were pedestrians. However, since there is no fine on jaywalking, in this case it was a matter of introducing a fine rather than increasing it.

The sample is made of three distinct groups of people. Group one consists of Iranians who are living abroad. This group was chosen to make a comparison with the result of Bar-Ilan and Sacrdote (2004) indicating that foreigners' sensitivity towards fine hike is less as compared to residents of the particular place. This is because foreigners do not see themselves as part of the society. Group two consists of Iranians residing in Iran. To compare the attitude of Iranians with other nationalities, group three involves only Indian subjects.

Participants were found through two methods. In the first method, responses were collected through free online survey software (Survey monkeys). The link of the survey was sent either directly to my friends and acquaintances or it was shared on Facebook. In the second method, the questionnaire was distributed where a group of people could be found: i.e. insurance offices, banks, companies, and so on. Only group two data was gathered by this method.

3.1 Complete Information of Aggregate Data

Table 1 indicates the description of collected variables for the whole sample. The sample consists of 262 individuals with complete information on ten variables.

Table 1: Definitions of Variables and Summary Statistics of Aggregate Data

Variables	Description	Values	Mean
Age	Age	18-64	30.874
Gender	Dummy	Female = 0, Male = 1	0.6297
Mart	Marital status	Single = 1, Other = 0	0.6641
Country	Country of birth	Iran = 1, India = 0	0.8396
Education	Years in full time education	8-24	16.3454
Record	Previous records with respect to traffic laws	Yes = 1, No = 0	0.5670
D.C.R	Crossing red lights while driving	Yes = 1, No = 0	0.2366
If D.C.R	Crossing red lights while driving after the fine increase	Yes = 1, No = 0	0.1526
W.C.R	Crossing red lights while walking	Yes = 1, No = 0	0.6870
If W.C.R	Crossing red lights while walking after imposing a fine	Yes = 1, No = 0	0.2519

One of the prominent features of this data is that it consists of well-educated subjects with average age of 31 years old. The sample has 165 male respondents. 62% of males have a previous conviction with respect to traffic laws. Among 97 females, only 46% of them have a previous record. Hence, as compared to females, males break more traffic laws.

66% of respondents are single. As compared to others, singles declared to cross fewer red lights by cars and have less previous records with respect to traffic laws. However, single people declared to do more jaywalking than the rest. Interestingly, the result after the fine hike shows the exact opposite; as compared to other people, single subjects declared to cross more red lights as drivers but less so as pedestrians. It seems single people are more sensitive to the new fine imposition as compared to the fine hike.

While 57% of the sample declared that they have previous records of breaking traffic laws, only 24% said that they would cross red lights if in a rush. The elasticity of violation with respect to the fine hike is -0.25. This is consistent with Bar-Ilan and Sacerdote (2004) results indicating that the elasticity of violation with respect to the fine hike is around -0.33 to -0.26. Approximately, 69% of the sample said that they would cross red lights as pedestrians. The figure reduced to 25% after imposing £30 sized fine in group one and three and 200,000 Rials in group two.

If we assume that the probability of an accident is equal in the case of driving and walking, then the question is how these educated individuals could have more importance for their cars than themselves? Moreover, the punishment in the case of driving contains self-imposed injury, costs of car repair, increased insurance premium, receiving a fine and feeling of guilt in case of fatal accidents. However, in the case of walking, the punishment is just of a self-imposed nature. While this evidence shows the positive effect of monetary punishment, it may also indicate that people believe that they have more control over themselves than their cars.

I used McNemar tests to check the significance of change in behavior after the fine increase. According to Conover (1999), when the data consists of observations on *n* independent bivariate random variables and the measurement scale for each variable is nominal with two categories (yes and no), it's possible to use McNemar test to get informed about significance of change. In the McNemar test, the data is summarized in a 2*2 contingency table. The null hypothesis is that there is no significant difference between responses before and after the fine hike.

$$\begin{cases} H_0: P_{01} = P_{10} \\ H_1: P_{01} \neq P_{10} \end{cases} \textit{The test statistics is } T = \frac{(y_{01} - y_{10})^2}{y_{01} + y_{10}} \sim \chi^2_{(1)}$$

After		T=17.7894	
		No	Yes
Before	Yes	190	6
	No	32	34

Since $\chi^2_{(1)} = 3.84$ at 0.05 significance level and T is greater than 3.84, the null hypothesis is rejected. This means that there is a significant difference between responses to crossing red lights before and after the fine hike. For the case of pedestrians, the McNemar test is applied to check the significance of change before and after the introduction of a new fine.

After		T=116.0333	
		No	Yes
Before	Yes	81	1
	No	119	61

Since the test statistic is 116.0333, the null hypothesis is strongly rejected. This implies that the effect of imposing a new fine on pedestrians' behavior is statistically significant.

3.2 Complete Information of Group One

This group consists of 100 young Iranians who are living abroad. Because of sample selection, the average years of full time education is 17.5 years. Table 2 shows descriptive statistics of this group.

Table 2: Summary Statistics of Group One

Variables	Mean	Standard deviation	Min	Max
Age	26.55	3.6608	21	40
Gender	0.61	0.4902	0	1
Mart	0.85	0.3588	0	1
Education	17.56	2.2141	8	24
Record	0.38	0.4878	0	1
D.C.R	0.16	0.3684	0	1
If D.D.R	0.14	0.3487	0	1
W.C.R	0.79	0.4093	0	1
If W.C.R	0.24	0.4292	0	1

The prominent feature of this group is that 79% of well-educated people declared that they would cross red lights while walking. The figure falls to 24% after the imposition of £30 sized fine. Only 16% of this group would cross red lights while driving, and the elasticity of

violation with respect to the fine hike is -0.08. Thus, it seems monetary fines have already had high deterrence for this young educated group.

3.3 Complete Information of Group Two

Group two includes 120 Iranians residing in Iran. For this group, there were 6 extra questions designed to consider the effect of increase in probability of an accident happening on jaywalking. The considered probabilities range from 1/1,000,000 to 1/10. Moreover, for this group, I was able to get information about their monthly incomes. Three level of income was defined; the first level is approximately equal to the poverty line indicated by below ten million Rials (approximately equivalent to £610 at the time of this study, 2010), the second level is between ten and thirty million Rials and the last one are above thirty million Rials. Table 3 demonstrates their responses.

Table 3: Summary Statistic of Group Two

Variables	Values	Means	Standard devastation	Min	Max
Age	18-64	35.95	9.8402	18	64
Gender	0 or 1	0.64	0.4815	0	1
mart	0 or 1	0.42	0.4964	0	1
Education	12-19	15.15	2.1341	12	19
Income	Below 10m to upper 30m	15923617	6757712	10,000,000	30,000,000
Record	0 or 1	0.85	0.3585	0	1
D.C.R	0 or 1	0.29	0.4564	0	1
If D.C.R	0 or 1	0.15	0.3665	0	1
W.C.R.A	0 or 1	0.65	0.4789	0	1
If W.C.R.A	0 or 1	0.25	0.4348	0	1
W.C.R.B	0 or 1	0.59	0.4935	0	1
If W.C.R.B	0 or 1	0.25	0.4348	0	1
W.C.R.C	0 or 1	0.51	0.5018	0	1

Table 3: Summary Statistic of Group Two

Variables	Values	Means	Standard devastation	Min	Max
If W.C.R.C	0 or 1	0.20	0.4078	0	1
W.C.R.D	0 or 1	0.37	0.4861	0	1
If W.C.R.D	0 or 1	0.15	0.3665	0	1
W.C.R.A.E	0 or 1	0.24	0.4298	0	1
If W.C.R.E	0 or 1	0.11	0.3223	0	1
W.C.R.A.F	0 or 1	0.14	0.3501	0	1
If W.C.R.F	0 or 1	0.07	0.2644	0	1

W.C.R.A denotes crossing red traffic lights while walking when the probability of an accident is 1/1,000,000. This is a dummy and equals to 1 if yes and 0 otherwise. Again If W.C.R.A refers to the same variable after the introduction of the fine. In the same manner, W.C.R.B to W.C.R.F denote crossing red traffic lights while walking when the probability of an accident is 1/100,000 and decreases to 1/10 by a factor of 10.

Similar to group one, this group has an average age of 36 years old. Interestingly, 85% of this group declared to have previous records of breaking traffic laws. However, quite similar to other groups, only 29% of the group declared that they would cross red lights while driving. This figure declines to 16% after the fine hike. Hence, the elasticity of crossing red lights with respect to the fine increase is -0.30. Since the same elasticity is equal to -0.08 for Iranians living abroad, our finding is consistent with the result of Bar-Ilan and Sacrdote (2004) indicating less sensitivity of foreigners to an increase in fine.

Figure 2 illustrates average responses to the questions of jaywalking with different probabilities of an accident before and after the introduction of the fine. The horizontal axes show different probabilities of an accident happening, while the vertical axes shows the percentage of people who would cross red lights. The blue line (upper one) shows the sample behavior before the introduction of the

fine and the red line indicates their responses after introducing the fine. Intuitively, the deterrence effect of monetary punishment is less than the increase in the probability of an accident happening.

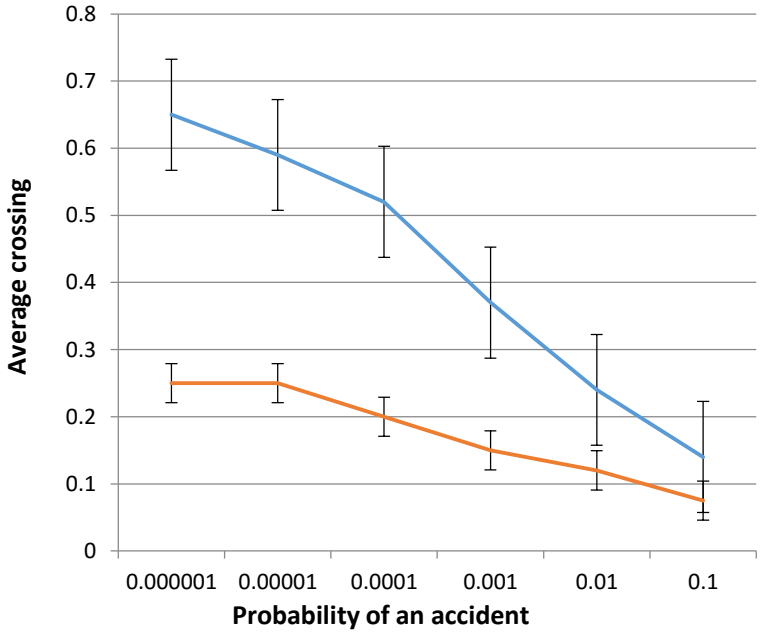

Figure 2: Responses to Increase in the Probability of an Accident Happening

3.4 Complete Information of Group Three

We got only 42 subjects for the last group who are all Indians. Table 4 summarizes their responses.

Table 4: Summary Statistic of Group Three

Variables	Mean	Standard devastation	Min	Max
Age	26.64	5.7586	20	55
Gender	0.64	0.4849	0	0
Mart	0.90	0.2971	0	0
Education	16.83	2.2837	10	24
Record	0.21	0.4152	0	0
D.C.R	0.35	0.4849	0	0
If D.D.R	0.16	0.3771	0	0
W.C.R	0.54	0.5037	0	0
If W.C.R	0.19	0.3974	0	0

As mentioned earlier, because of the selection procedure, the average age of this group is approximately 27 years. 36% of this group said they would cross red lights by cars. The figure decreases to 16% after raising the existing fine by 150%. Hence, the elasticity of violation with respect to the fine hike is -0.37. This shows the highest absolute elasticity. For pedestrians, the effect of introducing the £30 sized fine is shown by 65% reduction in the numbers of jaywalking.

4. Regression Analysis

Logit regressions are used to estimate the probability of jaywalking based on a few factors that influence the decision to cross red lights. These explanatory variables are Age, Gender, Mart, Education, Income, Country, Record and D.C.R collected in x_i. Let y_i denotes the decision under study for individual i, where y_i = 1 if the individual declares to cross red lights and y_i = 0 otherwise.

p_i= Pr [y_i= 1|x_i] = F (x_i' β)

The Logit model assumes F (x_i' β) has the logistic distribution given by:

$$F\ (x_i'\ \beta) = \frac{\exp(x_i'\ \beta)}{1+\exp(x_i'\ \beta)}$$

The result of this model using aggregate data is given in Table 5.

Table 5: Estimates of the Logit Model with the Data in Table 1

Variables	Coefficients	Standard error	Z	$p > \|Z\|$	Odds ratio
D.C.R	1.0341	0.4119	2.65	0.008	2.8154
Record	1.0027	0.3348	2.99	0.003	2.7256
Education	0.1967	0.0629	3.13	0.002	1.2173
Country	0.8603	1.3722	-2.97	0.003	2.3640
Mart	0.6977	0.3530	1.98	0.048	2.0092
Gender	0.0348	0.3051	0.11	0.909	1.0354
Age	-0.0086	0.0189	-0.46	0.649	0.9914
Constant	-4.0703	0.3905	2.09	0.037	0.0170

Note: Number of obs= 261, Log likelihood = -142.47197, LR chi2(7) = 39.95, Prob > chi2 = 0.0000

Intuitively, D.C.R is the most important explanatory variable that would affect the decision to do jaywalking. The same people who would cross red lights while driving are more likely to do so as pedestrians. If we increase D.C.R by one unit, the odds ratio of jaywalking will be multiplied by 2.8154.

We can also expect people with previous records of conviction to do more jaywalking. Such people cross red lights approximately three times more than the ones who do not have a previous record. This is consistent with the work of Bar-Ilan and Sacerdote (2004) indicating that criminals cross more red lights than those without a record.

The positive coefficient of Mart indicates that single people run more red lights as compared to other people. The odds ratio indicates that running red lights by single pedestrians is almost twice as likely as running red lights by others. Finally, as compared to Indians, Iranians are more likely to cross red lights as pedestrians.

Contrary to the common belief that educated people will commit less crime and have greater respect for the rule of law, this sample shows the opposite. Although the odds ratio for Education is close to 1, the positive significant coefficient indicates that people with more years of education would do more jaywalking.

Negative coefficients lead to an odds ratio of less than one. For example, the negative coefficient of Age leads to the odds ratio of 0.9914. This means that a one unit increase in Age leads to the event being less likely to occur. However, because of the selection procedure, Age was an insignificant explanatory variable. We have a young sample with 75% of subjects in the range of 19-34 years old. It is worth mentioning that if we rule out the insignificant variables the odds ratios will not change significantly as in the logit regression the insignificant variables are not counted.

As discussed in Cameron and Trivedi (2010) assessing the fit of the model enables researchers to measure how effectively the model can describe the outcome variable. One approach to evaluate the fit of the model is measuring the percentage of correctly classified observations by comparing fitted and actual values. As a result of applying this method, it seems 73.66 % of the values are correctly specified.

For robustness checks, the model was estimated for each group data. The results are similar with the aggregate data. More

specifically, the model with group one data has the highest odds ratio of 6.7949 for D.C.R. This means people who would run red lights by cars would do jaywalking approximately seven times more than others. Group two with the highest number of observations gives similar results to the ones obtained from the aggregate data. However, the income variable was an insignificant explanatory variable. The model with group three data also indicates that Record and D.C.R are the best explanatory variables with odds ratio of 2.0773 and 3.6854 respectively. Because of high level of education in all three groups, we have positive insignificant coefficients for education.

5. Conclusion

A conducted survey data is used to investigate Iranians' behavior towards traffic laws and their sensitivity to fines. 262 individuals were asked whether they would cross red lights by cars or as pedestrians while varying the associated fines. There is a considerable difference between responses to an increase in fine, and to the introduction of a new fine. The result shows that the effect of a new fine on pedestrians is approximately twice the effect of increasing fine up to 150% for drivers.

The analysis shows that males are just as sensitive to fines as females, whereas singles are more responsive than others. Educated people declared to do more jaywalking than others. Individuals with previous records of breaking traffic laws would cross more red lights as pedestrians, while their sensitivity to a new fine is approximately similar to those without such records.

In comparison with people who do not have previous records with respect to traffic laws, people with such a record would cross more red lights by cars. These people are more sensitive to the fine hike, which contradicts the result from Bar Ilan and Sacerdote (2004) indicating that criminals are just as sensitive as noncriminal to changes in fine.

In all three groups, we observe a substantial decrease in the numbers of declared jaywalking after the introduction of the fine. Since jaywalking has a severe self-inflicted punishment with low probability, the Becker proposition predicts no jaywalking. As the data shows, increase in monetary punishment changes behavior significantly. Thus, on the whole, the conducted survey contradicts the

Becker proposition. The elasticity of crossing red lights with respect to 150% increase in fine is -0.25, which fits in the range of found elasticities in the crime literature.

While the introduction of a new monetary fine on pedestrians decreased the violation by 64%, increasing the existent fine on drivers only dropped the infringement up to 37%. This can explain the trend of traffic laws. Traffic laws were initially focused on increasing associated penalties to economize on enforcement costs. However, as the effect of monetary punishments was declining, other kinds of punishments were implemented. The reason why the point system (when one's driving license is suspended for some period depending on the received points) has become popular relies on the efficiency brought by introducing new non-monetary fines.

Furthermore, sever monetary punishments result in public' perception that policies are designed with other objectives than deterrence. Moreover, having the severest monetary punishment is impossible as it depends on offenders' ability to pay. Hence, the maximum penalty should not be just the monetary one. People will be more sympathetic with policies targeting criminals' behavior rather than their wallets. Thus, policies on deterrence should be creative.

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