

Economic analysis of the Interrelationship between severity of penalty and deterministic of penalty

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Abstract: Regarding the interrelationship between the severity of penalty and the deterministic of penalty, the current academic circles generally believe that both of them have the utility to deterring crimes. Compared with the severity of penalty, the deterministic of penalty is more deterrent to potential crimes. There are two logical defects in this viewpoint: first, although the severity of penalty and the deterministic of penalty both have the utility to deterring crimes, but there is no discussion on whether there is a substitute relationship between them? And if there is a substitution relationship, what the substitution rule is? Second, it is believed that the deterministic of penalty has more utility to deter potential crimes. It is compared with the deterrent utility of the same amount of them on potential crimes, ignoring the huge difference cost of obtaining the same amount of them. This article uses the method of law and economics analysis to analyze and supplement these two logical defects.

Presentation of questions

At present, the general theory in academic circles holds that the deterministic of penalty is more deterrent to potential crimes than the severity of penalty. The severity of penalty refers to the extent of penalty for criminal acts; the deterministic of penalty refers to the probability of punishment for criminal acts. In expressing this view, the most widely quoted expression in academic circles is Beccaria's assertion in his classic book *On crime and penalty*: "The most powerful restraining force for crime is not the severity of penalty, but the deterministic of penalty."^[1] In order to reinforce this assertion, Beccaria further demonstrated in the book: "Even if the penalty is moderate, its deterministic is more impressive than the fear caused by the terrible penalty linked with a glimmer of hope of impunity. The reason is even the smallest consequences will always make people palpitated if once confirmed."^[2]

From this conclusion, we can infer two implicit conclusions: first, both the severity of penalty and the deterministic of penalty have the utility of deterring crimes; second, deterrent utility of the deterministic of penalty is always greater than the severity of penalty. In the economic sense, the second point means that there is a "corner solution" (as shown in Fig.1).

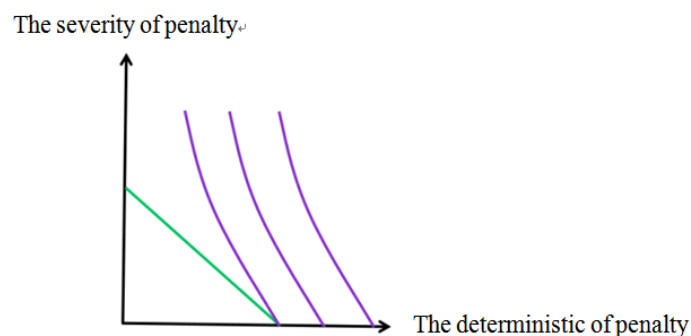


Fig. 1

When the country invests resources to pursue the deterrent utility of crime, based on rational motivation and calculation, it is bound to choose the scheme that can enhance the deterrent utility of crime more. In other words, when the deterrent utility is established, the country will choose the scheme with the lowest cost; or when the cost is fixed, the state will pursue the plan with the greatest deterrent utility. If the deterrent utility of the deterministic of penalty is always greater than the severity of penalty, then the country will choose to invest all resources into enhancing the deterministic of penalty in order to maximize the deterrent utility. As a result, the theoretical expected judicial practice path will present two remarkable phenomena: first, unless the new criminal acts are deterred by legislate in order to adapt to the needs of economic and social changes, it is no necessary to adjust the penalty range of the old criminal laws. Because the resources spent on adjusting the penalty range of the existing criminal law will have more deterrent utility if they are invested in enhancing the deterministic of penalty. Second, the legislative organs will become weaker and weaker, while the judicial organs will become stronger and stronger.

However, more than 250 years have passed since Beccaria's classic book *On crime and penalty* published, and the judicial practice of most countries in the world has not shown the above two obvious phenomena. Time has proved that the development path of judicial practice of most countries is not consistent with the expected path of this

theoretical expected. Looking at the development of criminal laws in most countries around the world, it is a common phenomenon to adjust the penalty range for various crimes. The scale of legislative organs in most countries is still growing and the legislative and amendment activities of criminal laws are very active. There is a contradiction between the theory and the actual. So, what is the problem in theory?

The theoretical reconstruction by the method of law and economics

At present, the academic circles generally believe that the severity of penalty and the deterministic of penalty have deterrent utility on potential crimes, and believe that the deterrent utility of the deterministic of penalty on potential crimes is greater than the severity of penalty. This view has two important flaws in logic: first, it is not perfect in theory to think that both of them have deterrent utility on potential crimes. It is necessary to further discuss whether there is a substitute relationship between them? And if there is a substitution relationship, what the substitution rule is? Second, it is believed that the deterrent utility of the deterministic of penalty on potential crimes is greater than the severity of penalty. It compares the deterrent utility of the same amount of them on potential crimes. It ignores the significant difference between the two costs. When there are significant cost differences and budget constraints, we cannot judge whether a thing is good or bad only by its own value, but also by the cost of obtaining it. Generally speaking, we should not only see whether this thing is good or not, but also whether it is expensive or not.

The construction of criminal deterrence utility function. Economic analysis adheres to the "individualism methodology" and does not believe that the collective has preferences and cannot make independent rational choices. However, when a country makes a choice, it is not the collective of the country that makes the choice. The decision makers behind it are individuals, individuals who have mastered the power. They make rational choices after understanding the needs of the country and synthesizing various situations. Therefore, the "rational hypothesis" is still applicable, and the individual decision makers who hold the power still have the basic characteristics of the "rational hypothesis" and conform to the basic assumptions of preferences. First, the completeness. At the same cost, when the deterrent utility of plan A is greater than plan B, he will choose plan A to obtain the maximum deterrent utility. Second, the transferability. When the deterrent utility of plan A is greater than plan B, and the deterrent utility of plan B is greater than plan C, he prefers plan A to plan C. Third, the unsaturation. If the difference between the two plans is only the amount, he always prefers the one which containing the larger number. From this we can construct deterrent utility function. U stands for utility, P stands for the deterministic of penalty, C stands for the severity of penalty.

$$U(P, C) = P^a C^b, (a > 0, b > 0)$$

The character of the indifference deterrent utility curve. The deterrent utility function is Cobb-Douglas utility function, and the preference represented by the function is a typical preference with good properties. Its properties satisfy monotonicity and strict convexity. The shape of the indifference curve is shown in Fig. 2.

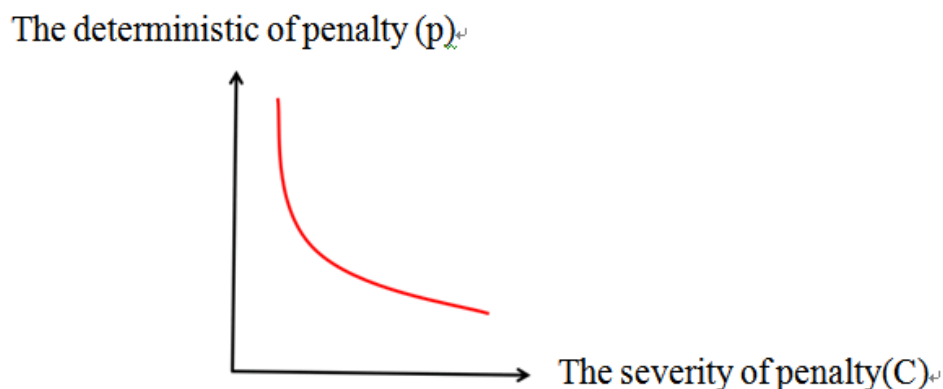


Fig.2

Monotonicity. Satisfying monotonicity means satisfying the assumption of unsaturation. Generally speaking, if the difference between two plans is only the number is different, he always prefers the plan with a larger number. For the indifference curve, satisfying monotonicity means that the slope of the indifference curve is negative, that is to say, when the number of the deterministic of penalty(P) is increased, the number of the severity of penalty(c) must be reduced to keep the utility level unchanged. If both can be increased at the same time, the utility level will inevitably increase. From this we can also learn that monotonicity means that the farther away the indifference curve is from the origin, the higher the utility level it represents.

Strict convexity. Strict convexity means that there is substitution between punishment probability (P) and punishment intensity (C), and marginal substitution rate decreases. Marginal substitution rate refers to the ratio of decision makers willing to replace the number of punishment intensity (C) with punishment probability (P) in order to keep the utility level unchanged. The mathematical expression of marginal substitution rate is $MRS = -\frac{Y}{X}$. Decreasing marginal substitution rate means that with the increase of punishment intensity (C), the indifference curve becomes flatter and flatter, which means that with the increase of punishment intensity (C), decision makers are more willing to replace a smaller number of probability (P) with a larger number of punishment intensity (C), because

probability becomes scarcer than severity. As shown in fig. 3, the X axis represents the punishment intensity, and the Y axis represents the punishment probability, IC represents the indifference deterrent utility Curve.

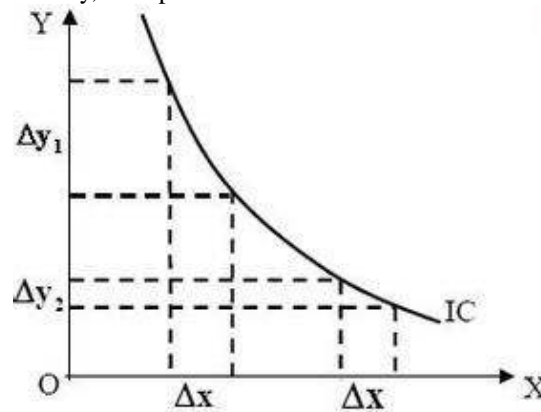


Fig. 3

It can be seen from the figure that when the quantity of the punishment probability is low, only Δy_2 quantities of the punishment probability can be replaced by ΔX ; When the quantities of the punishment probability is high, more quantities of the punishment probability (Δy_1) can be replaced by ΔX , $\Delta y_1 > \Delta y_2$. In other words, as the punishment probability becomes more and more, it becomes less and less scarce, and ΔY that ΔX can replace becomes more and more.

Indifference curve cluster. Each point on the indifference curve corresponds to a certain number of combinations of the corresponding punishment probability (P) and punishment intensity (C), and the deterrent utility obtained by the specific combination represented by any two points on the indifference curve is the same. As shown in fig. 4, point A on the indifference curve represents the combination of the punishment probability (P_A quantity) and the punishment intensity of (C_A quantity), point B on the indifference curve represents the combination of the punishment probability (P_B quantity) and the punishment intensity (C_B quantity), and point A, B can form the same deterrent utility, so they are all located on the same indifference curve.

The deterministic of penalty (p)

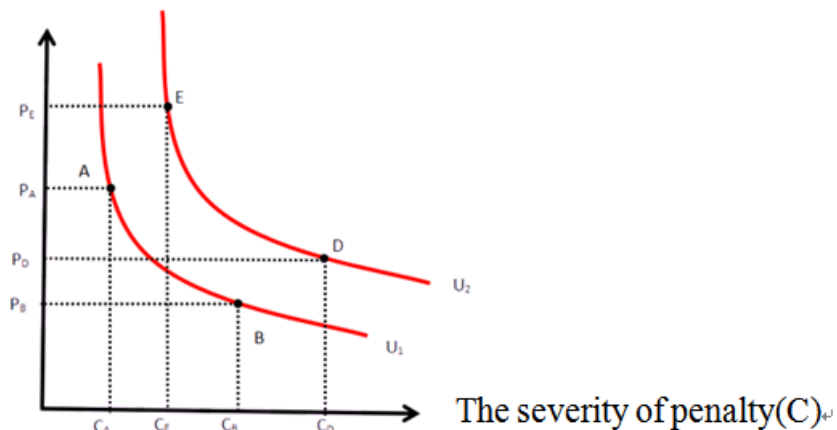


Fig. 4

The combination of different quantities of punishment probability (P) and punishment intensity (C) will have different degrees of deterrent utility. The more combinations of punishment probability (P) and punishment intensity (C), the greater the deterrent utility gets. As shown in fig. 5, point E represents the combination of P_E quantities of punishment probability and C_E quantities of the punishment intensity, $P_E > P_A$, $C_E > C_A$, so the deterrent utility of point E is greater than point A, and point E has a higher utility level. Similarly, point D represents the combination of P_D quantities of punishment probability and C_D quantities of punishment intensity, $P_D > P_B$, $C_D > C_B$, so the deterrent utility of point D is greater than point B, and point D has a higher utility level. Therefore, the indifference curve U_2 between the connection point E and the point D represents a higher deterrent utility, and the deterrent utility of U_2 is higher than U_1 . Since there are numerous combinations of different punishment probability (P) and punishment intensity (C), there are also numerous indifference curves of deterrence effectiveness of different grades.

The deterministic of penalty (p)

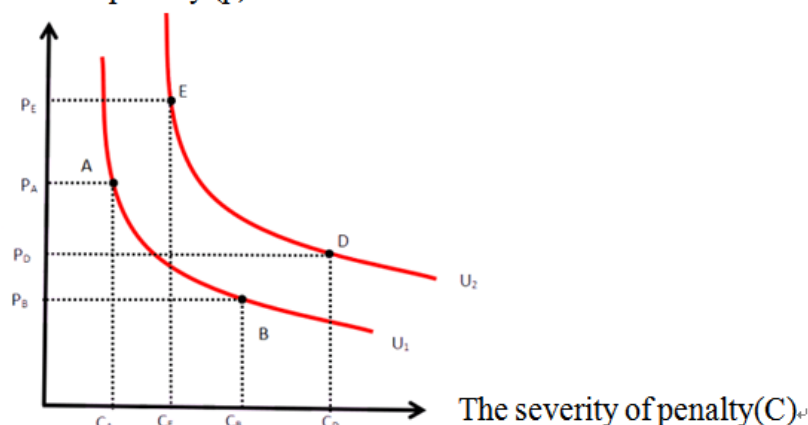


Fig. 5

Maximizing utility analysis under budget constraints

The high judicial cost and the low legislation cost. To enhance the probability of criminal punishment means that public security organs, public prosecution organs, courts and prison organs should conscientiously perform their duties and increase the probability of criminal punishment through measures such as increasing the detection rate of cases, examining and instituting public prosecution, conducting public and fair trials, and strictly enforcing criminal punishments. The investment spent in this series of processes is called judicial investment, and the unit cost to enhance the probability of punishment is called judicial cost. To increase the severity of punishment for crimes means that the legislature has to revise the punishment range of existing crimes through the provisions and procedures of the «Legislative Law». The input spent in this series of processes is called legislative input, and the unit cost to increase the severity of punishment is called legislative cost.

For an act suspected of committing a crime, the process of entering the criminal procedure is very complicated. It involves case registration, investigation, retain a lawyer or legal aid, examining and prosecuting, initiating public prosecution, the first instance judgment, appeal or protest, the second instance judgment, and in some cases need checking procedures. This complicated of criminal procedure process runs down costs quite high, which means that the judicial cost is very high. The legislative procedure is much simpler than the criminal procedure. Legislative procedures are generally carried out according to the following steps: proposing a draft law-deliberation this draft law-vote by ballot-pass the law. The relatively simple legislative process also means that the legislative cost is relatively low. Not only that, legislation or amendment laws is to enhance the severity of punishment from a macro perspective for a long time, while justice is to carry out criminal proceedings for every criminal act from a micro perspective to enhance the probability of punishment. Therefore, the frequency of use of the two paths is completely different: the frequency of use of legislation or amendment laws is far lower than that of justice. The huge difference in the frequency of use has further widened the huge difference between the judicial cost and the legislative cost.

Budget constraint. An obvious fact is that no matter which country, the social resources that can be invested in legislation or judicature are obviously limited, and the judiciary cannot pursue the probability of punishment without restriction, because there are restrictions on the funds. The legislature cannot legislate or amend laws arbitrarily, one of the reasons is that there are financial constraints.

Equilibrium analysis. At present, the academic circles generally holds that the deterrent utility of the probability of punishment on crime is higher than that of the severity of punishment on crime, and this assertion has also been proved by behavioral science research. However, the above research conclusion seems to ignore an important issue emphasized earlier-cost difference: the cost of increasing probability of punishment is very high, far higher than the cost of increasing intensity of punishment, and the budget invested by the state is extremely limited. This budget constraints and huge difference costs makes the above viewpoint no longer correct and applicable, just as Newton's law of motion is no longer correct at high speeds. Perhaps the deterrent utility of increasing probability of punishment on crime is indeed higher than that of increasing intensity of punishment, but the cost of increasing probability of punishment is also much higher than that of increasing intensity of punishment. In the case of budget constraints, it is a fallacy to emphasize that increasing probability of punishment is more effective in deterring crime.

The state has budgetary constraints on its investment in deterring crimes, and the unit price for pursuing the deterrent utility of probability of punishment is much higher than that for severity of punishment, so how can the budget be invested in both of them are reasonable? According to the "equal marginal law", it is a scientific method to compare the deterrent utility of the two on the last unit of currency. That is, to solve the utility maximization under budget constraints, the "equal marginal law" needs to be satisfied. According to the "equal marginal law", the maximize deterrent utility will obtained while the last unit of currency gets the equal marginal deterrent utility between the probability of punishment and the severity of punishment. If the marginal utility of the last unit of currency spent on any

choice is not equal, then the decision maker can choose to spend resources on the choice that can bring higher marginal utility, which will increase the total utility-until “the law of diminishing marginal utility” makes the marginal utility of the last unit of currency spent on the choice fall to be equal to that of the other choice, at which time the total utility is the largest (as shown in fig. 6).

The deterministic of penalty (p)₀

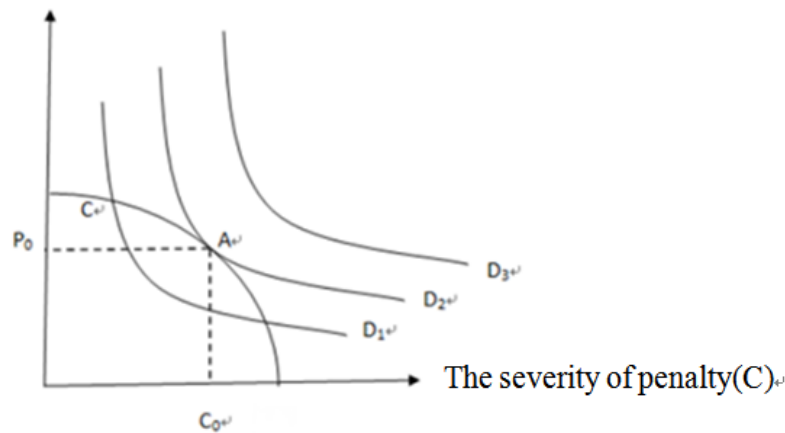


Fig. 6

The vertical axis represents the probability of punishment(P), the horizontal axis represents the severity of punishment(C), D_1 、 D_2 and D_3 represent three deterrent utility curves with different effectiveness levels, and the deterrent utility levels is $D_3 > D_2 > D_1$. The line C represents the budget constraint, intersects D_1 at two points, tangents D_2 at point A, point A represents the combination of the probability of punishment of P_0 quantity and the severity of punishment of C_0 quantity. Deterrence utility is $D_2 > D_1$. According to rational hypothesis, the maximize deterrence utility under budget constraint can be achieved by selecting point A. At this time, the marginal deterrent utility can be equal for the last unit of currency between the probability of penalty and the severity of penalty.

Conclusion

Regarding the interrelationship between the probability of penalty and the severity of penalty, the current academic circles generally believe that both of them have deterrent utility on potential crimes, and that the deterrent utility of the probability of penalty on potential crimes is greater than the severity of penalty. There are two logical defects in this statement: first, there is no discussion on whether there is a substitute relationship between them? And if there is a substitution relationship, what the substitution rule is? Second, it is believed that the deterrent utility of the probability of penalty on potential crimes is greater than the severity of penalty. It is compared with the deterrent utility of the same amount of the probability of penalty and the severity of penalty on potential crimes, ignoring the significant difference between the two costs. In this paper, by constructing the deterrent utility function of crime, analyzing the character of the indifference curve of deterrent utility and analyzing the problem of utility maximization under budget constraint, the problem of substitution relationship between the probability of penalty and the severity of penalty - conform to “the law of diminishing marginal substitution rate”, and the method of maximizing the deterrent utility of crime under budget constraint- conform to “the equal marginal law”.

References

[1] Beccaria, translated by Feng Huang, 《On crime and penalty》, Peking University Press, 2008, p. 62. (In Chinese)

[2] Beccaria, translated by Feng Huang, 《On crime and penalty》, Peking University Press, 2008, p. 62. (In Chinese)