DONALD WITTMAN

PUNISHMENT AS RETRIBUTION*

ABSTRACT. The article is concerned with punishment as retribution. A number of reasonable assumptions concerning the punishment of criminals as well as the punishment of innocent individuals are made. These assumptions are consistent and from them a comprehensive 'justice map' is drawn. Several implications concerning justice are derived and there is an analysis as to where slack in the pursuit of justice is most likely to occur. It is then shown that all of the assumptions and consequently all the results can be derived from a simple utility maximization model. Throughout the paper, behavior consistent with the concept of retribution is presented and there is some comparison to other theories of punishment. More generally, the article can be seen as a building of a social welfare function. In contrast to other work on social welfare functions which begin with just methods of aggregating preferences, this article begins with just preferences.

This article develops the concept of retribution. Retribution is concerned with the notion of deserved and undeserved punishments and rewards. When an individual does something good, it is 'just' that we reward him (i.e., rewards are due); and when he does something bad, it is 'just' that we punish him. Phrases such as 'he got what was coming to him', 'he deserves to be punished' and 'he is paying his debt to society' are examples of belief in retribution.[1]

One objective of this paper is to show that retribution explains a considerable amount of behavior with respect to the punishment of the guilty as well as of the innocent. Although in some cases, similar behavior could be predicted by applying other approaches to punishment, in many cases the behavior can only be explained by retribution. A second objective of the paper is to present a particular social welfare function. Like many positive (i.e., predictive) theories, the theory of retribution presented here can also be seen as being normative (i.e., prescriptive). Thus the theory tells how a person who believes in retribution should act, suggests what qualities a system of retribution would have and derives the moral implications and interrelationships from the philosophy of retribution.

The article is organized along the following lines: In Sections I and II a number of reasonable assumptions concerning the punishment of

Theory and Decision 4 (1974) 209–237.

criminals as well as the punishment of innocent individuals are made. These assumptions are consistent and from them a comprehensive 'justice map' is drawn. Several implications concerning justice are derived and there is an analysis as to where slack in the pursuit of justice is most likely to occur. In Section III most of the assumptions, and consequently most of the results, of the first two sections are derived from a simple utility maximization model, and in Sections IV and V the utility model is used to derive further results concerning different crimes and different punishments.

Throughout the paper, behavior consistent with the concept of retribution is presented and there is some comparison to other theories of punishment.

I. PUNISHMENT OF CRIMINALS

Let that punishment which fits the crime be denoted by P_F^0 (Note: letting the punishment fit the crime need not mean an eye for an eye.) The superscript in P_F^0 will be explained on p. 211. The greater (lesser) the punishment is than P_F^0, the less the justice. Thus if the just sentence (P_F^0) for a crime is 10 years in prison, it is more unjust to let a person stay 20 years in prison than 15.

In mathematical symbols:

(1) P is the punishment for a crime

(2) P_F^0 is the punishment which *fits* the crime

(3) J = Justice; $J(P)$ is a maximum at $P = P_F^0$

This can be seen in Figure 1.

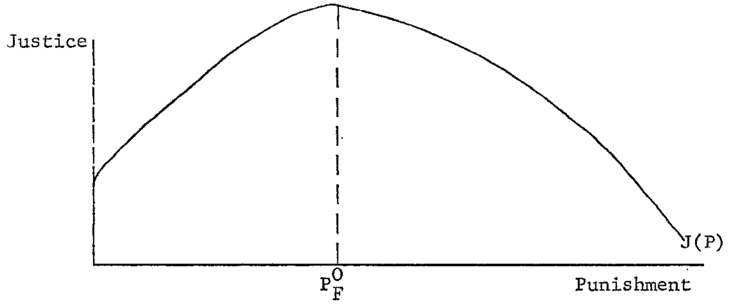

Fig. 1. $P_F{}^0$ is the punishment which fits the crime; as $|P_F{}^0 - P|$ increases, justice decreases. Justice $= J(P)$. $J(P)$ is at a maximum at $P = P_F{}^0$.

It should be noted that 'the punishment which fits the crime' is treated as a given. Although the article mentions several methods of determining this point, I make no serious attempt to derive it and leave the 'correct' derivation to others; instead, the punishment that fits the crime is discovered by either asking the decision-makers involved which is the correct punishment or by observing their behavior (revealed preference). This is the same approach used in all of economics as well as in theories of deterrence. For example, economists do not ask why a person prefers artichokes to asparagus nor do they tell him why he should – i.e., the utility function is treated as given. Similarly, the sophisticated model of deterrence gives lighter penalties to less severe crimes, the severity of the penalties being determined by the *disutility* of the crimes and by the probabilities of the criminals being convicted.[2] As a final example, Gary Becker's article on the economics of crime and punishment assumes a cardinal social utility function.[3] While some might argue that the more interesting question is what determines the utility function, and others might criticize these approaches for involving considerable difficulty in measurement, few would say that these approaches have not been useful. In the theory of retribution, the punishment which fits the crime is treated as given, and thereby the scholarly debate over the correct punishment is avoided; this is no more serious than the analogous omission when punishment is viewed as deterrence or as a means of maximizing social utility.

(4) Let $J_X(P)$ be the justice when X known criminals are not punished.
$J_0(P)$ then means that all the known criminals are punished and is a different function from $J_{10}(P)$ where 10 known criminals are not punished.

It is very plausible to believe that the maximum justice that can be achieved is greater, the fewer the known criminals not punished.
In mathematical symbols:

(5) Let $J_X(P)$ be at a maximum at P_F^X.
(6) $J_X(P_F^X) > J_Y(P_F^Y)$ for all $X < Y$.

If a number of people are known to have committed a crime, but only a few are actually punished, our concept of a just punishment may change. It can be argued that the proper punishment is then less than if all the known criminals were punished. E.g., an appeal for clemency is often made and sometimes granted on the grounds that when so many others get off scot-free, it is unfair to single out one person for such a strong punishment. This can be seen in the Calley court-martial. While the issue is quite complex, it appears that many feel that he is a scapegoat and it is unfair to punish him so severely when many others go free.[4] On the other hand, if all the others who committed 'war crimes' were punished, Calley's punishment would not be seen as being too severe. Similarly, the proscription against cruel and unusual punishment suggests that even the punishment which fits the crime is not acceptable if it is unusual. For example, capital punishment may be the punishment which fits the crime of murder, but the recent Supreme Court decision declared this punishment unconstitutional because it is so unusual.

For ease of exposition, I will assume that the maximal justice is at P_F^0 whatever the number of known criminals punished. With a few exceptions, similar results would be obtained if it were assumed that the fewer the criminals punished the less (more) severe the optimal punishment.

In mathematical symbols:

(7) For all X, let $P_F^X = P_F^0$.

6 and 7 can be combined to form Assumption I,

(8) Assumption I (optimal punishment):
$$P_F^X = P_F^0 \quad \text{and} \quad J_X(P_F^0) > J_Y(P_F^0) \quad \text{for all} \quad X < Y.$$

If there is no punishment, then justice is the same whether all or none of the criminals are punished.[5]

In mathematical symbols:

(9) Assumption II (zero punishment):
$$J_X(0) = J_Y(0) \quad \text{for all} \quad X, Y.$$

It is reasonable to believe that for almost any crime, there exists a punishment so severe that the society is more just, the fewer criminals it punishes, e.g., the criminal who has stolen a loaf of bread does not *deserve* to be put to death even if this is a good deterrent (there may be some crimes that are so heinous that even the most diabolical punishment is not severe enough).[6]

In mathematical symbols:

(10) Assumption III (severe punishment):

There exists a severe punishment S such that

$$J_X(S) < J_Y(S) \quad \text{for all} \quad X < Y.$$

Three assumptions about three sets of points have been made. The first assumption was about the peaks of the justice functions – the fewer the known criminals punished, the lower the peak; the second assumption concerned zero punishment (a point to the left of the peaks) – whatever the number of criminals punished with 0 punishment, justice is the same; the third assumption concerned extremely severe punishments (a point to the right of the peaks) – the fewer criminals given extreme punishment, the greater the justice.

I will now make the assumption that the functions connecting the three points are linear.

(11) Assumption IV (linearity):

$$J_X(P) = J_X(0) + \left[\frac{J_X(P_F^X) - J_X(0)}{P_F^X}\right] P \quad \text{for} \quad 0 \leqslant P \leqslant P_F^0.$$

$$J_X(P) = J_X(P_F^X) - \left[\frac{J_X(P_F^X) - J_X(S)}{S - P_F^X}\right] [P - P_F^X]$$

$$\text{for} \quad P_F^0 \leqslant P \leqslant S.$$

The mapping of these four assumptions can be seen in Figure 2.

The standard methodological procedure suggests that the realism of the assumptions is irrelevant and that the assumptions need not be testable except indirectly – the only concern being whether they give insight. Thus the acceptance of the four assumptions presented here relies mainly on whether they generate interesting results. However, these assumptions are also capable of being tested and in addition the assumption of linearity is very robust (i.e., considerable departures from the assumption of linearity will leave the model intact). With regard to the second point, any set of justice functions which are monotonically increasing and whose differences are monotonically increasing until P_F^0 have properties which are consistent with the results presented here. The main reason for not using this assumption instead of linearity is that monotonicity requirements involve a different approach which loses considerable elegance gained by assuming some of the conclusions of the linearity approach. Like many logical systems, this one can be approached from many directions.

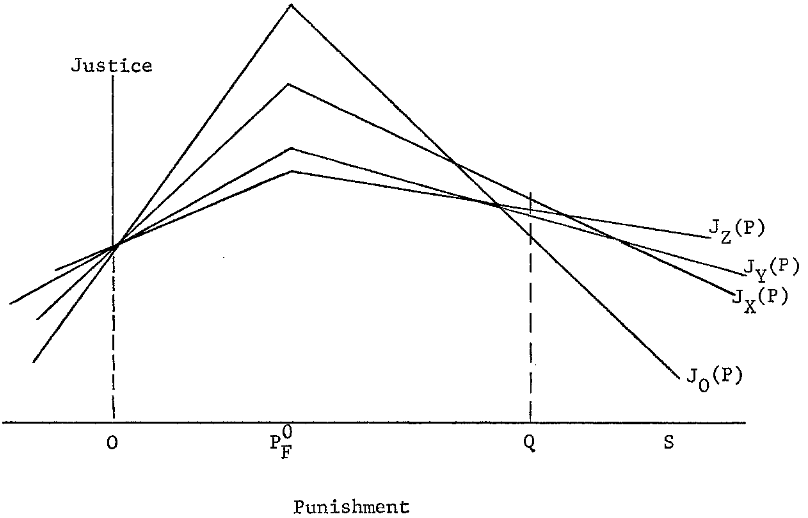

Fig. 2. Punishment: $0 < X < Y < Z$. $J_X(P)$ is the justice when all except X criminals are punished with severity P.

AI.	at $P = 0$, $J_X(0) = J_Y(0)$ for all X, Y
AII.	at $P = P_F{}^0$, $J_X(P)$ is at a max, $J_X(P_F{}^0) > J_Y(P_F{}^0)$ for all $X < Y$
AIII.	at $P = S$, $J_X(S) < J_Y(S)$ for all $X < Y$
	at Q, $J_X(Q) > J_Z(Q) > J_Y(Q)$ although $X < Y < Z$.

(Note: In Sections III, IV and V it is suggested that this result cannot take place, as the utility approach restricts $J_X(P)$, $J_Y(P)$ and $J_Z(P)$ to intersecting at one point.)

It is relatively easy to test whether assumptions I, II and III accord with a person's notion of justice. The assumptions only involve ordinality and all that needs to be done is to ask the person which situation is the most just (or observe his behavior). Linearity (IV) is a cardinal relationship and whether a person's justice function is linear or not can be determined in the same way that cardinal utility functions are determined: by von Neuman-Morgenstern lotteries, as justice is one element of a utility function.[7]

In order to best understand the interrelationships and implications of these four assumptions, it is useful to know the context in which legal decisions and moral judgments are made. Rarely, if ever, does one person have control over all the variables that are necessary to achieve the best possible situation. Punishment is no exception. Legislators, policemen, prosecutors and judges all participate in the legal process. Legislators can impose maximum and minimum sentences, but rarely do they have any control over who is convicted; policemen have some control over who is prosecuted, but they have no control over the severity of the punishment; judges sometimes have control over the severity of the punishment but rarely over who is prosecuted, and other times they have control over who is not convicted but little control over the severity of the punishment. Even if the government is seen as a unit, there may be lags in some areas of the legal system when there is a shift in moral values. And certainly, the individual who is making moral judgments concerning particular actions of the legal system must make these judgments in the context of the other decisions that have been made. As a result people are constantly forced to make 'second best' decisions.

A considerable part of the analysis in this paper is concerned with these 'second best' solutions. In some cases, the solutions are both obvious and straightforward. For example, if the punishment is less than P_F^0, the more criminals punished, the more just the system, while in other cases the second best strategy is not at all obvious. For example, if the punishment is greater than P_F^0, maximizing the number of criminals being punished is not the second best solution; and if the second best solution is to let X criminals go unpunished, letting Y instead of Z ($X < Y < Z$) criminals go unpunished may result in a decrease in justice (see Figure 2).[8]

Justice is only one element in a utility function and if the opportunity costs are too great, the optimal or second best solution may not be discovered or enforced (if it is known). Part of the following analysis will show the conditions under which this 'slack' in the pursuit of justice is most likely to arise.[9]

The four assumptions yield a number of interesting relationships:

A. If the punishment is less than the optimal (P_F^0), the smaller the punishment the less the difference in justice between punishing many and a few of the known criminals.

(12) If $0 < P < P_F^0$, as $P \to 0$, $J_X(P) - J_Y(P) \to 0$ for all X, Y.

Proof:

$$(13) \quad J_X(P) - J_Y(P) = J_X(0) + \left[\frac{J_X(P_F^0) - J_X(0)}{P_F^0}\right] P - J_Y(0) - \left[\frac{J_Y(P_F^0) - J_Y(0)}{P_F^0}\right] P$$

$$(14) \quad = \left[\frac{J_X(P_F^0) - J_Y(P_F^0)}{P_F^0}\right] P, \quad \text{as} \quad J_Y(0) = J_X(0)$$

by Assumption II. Since the expression in the brackets is a constant, as $P \to 0$ so does 14.

This series of proofs can readily be seen by looking at Figure 2.

For any particular crime, the less P is than P_F^0, the more likely slack will develop in the government's prosecution of criminals. As P approaches 0, the government may not bother to prosecute the known offenders, as there is little increase in justice when more criminals are punished.

There are, of course, other explanations: for example, the government may not be interested in prosecuting the crime in the first place. The usefulness of the theory of retribution is that there is no need to rely on these ad hoc explanations.

B. If the punishment is less than or equal to P_F^0, then the more known criminals punished, the greater the justice.

(15) If $0 < P \leqslant P_F^0$, $J_X(P) > J_Y(P)$ for $X < Y$.

Proof:

$$(16) \quad J_X(P) - J_Y(P) = \left[\frac{J_X(P_F^0) - J_Y(P_F^0)}{P_F^0}\right] P \quad \text{by} \quad (14).$$

$J_X(P_F^0)$ is greater than $J_Y(P_F^0)$ by assumption and both P and P_F^0 are greater than 0. Therefore the whole expression is greater than 0.

It is interesting to compare this result with other approaches to punishment. Before doing so a word of caution must be made. There are considerable problems in comparing retribution to other theories of punishment since they are concerned with different variables. E.g., retribution is concerned with punishment in its relationship to crimes that have already been committed; while deterrence is only concerned with punishment insofar as it reduces future crimes.

Both Gary Becker (1968) and Gordon Tullock (1971) treat crime as an ordinary economic commodity; the main difference is that the criminal does not always pay for his purchase. If the criminal were always caught, the optimal punishment would be a fine equal to the marginal cost of the crime – the harm to the victim plus the cost of apprehending the criminal. In this way, if the criminal did purchase his crime and the fine were paid to the victim, both he and the victim would be better off. The easiest way to understand what transpires when the criminal is not always caught is to assume a linear utility function and zero cost of conviction. If the probability of being caught is 50%, then the optimal price is twice the cost to the victim. In this way the purchase of the crime by the criminal will leave society indifferent. When the punishments for other crimes are given, an exogenous increase in the punishment (fine) reduces the optimal probability of being convicted. Otherwise the expected price (probability of being convicted times the fine) would be greater than the marginal cost to the victim and optimality conditions demand that price equal marginal cost. This is in contrast to punishment as retribution where any increase in punishment below P_F^0 has no effect on the optimal number of criminals being convicted – which is all of them; and if slack in retribution takes place, more criminals will be punished as the punishment increases towards P_F^0.

Two reasons for the different results may give insight into the two approaches. Retribution sees crime as a moral sin, while in the economic model, committing a crime is not necessarily bad. In fact, as shown above, if the punishment (fine) is exogenously increased, society will try to encourage more crime by decreasing the probability of capture as this increases total social income. The second reason for the different results is that like most economic models, minimizing social loss of income ignores questions of income distribution. Thus implementation of the theory may result in an *a posteriori* income distribution which is very unfair, as the convicted criminals have to pay for the purchase of crime by those who remain free. In contrast, retribution is concerned with the distribution of punishment and does not allow one man to be burdened with the sins of others.[10]

C. If the punishment is greater than P_F^0, the greater the punishment, the greater the justice of punishing a few of the known criminals minus the justice of punishing many of them.

$$\text{(17)} \qquad \text{If } P > P_F^0 \quad [J_Y(P) - J_X(P)] \uparrow \quad \text{as} \quad P \uparrow, Y > X.$$

Proof:

$$\text{(18)} \qquad J_Y(P) - J_X(P) = J_Y(P_F^0) - \left[\frac{J_Y(P_F^0) - J_Y(S)}{S - P_F^0}\right][P - P_F^0] - J_X(P_F^0) + \left[\frac{J_X(P_F^0) - J_X(S)}{S - P_F^0}\right][P - P_F^0]$$

(19)

$$= \underbrace{\left\{J_Y(P_F^0) - J_X(P_F^0) + P_F^0\left[\frac{J_Y(P_F^0) - J_Y(S) - J_X(P_F^0) + J_X(S)}{S - P_F^0}\right]\right\}}_{K} + P\underbrace{\left[\frac{J_X(P_F^0) - J_Y(P_F^0) + J_Y(S) - J_X(S)}{S - P_F^0}\right]}_{C}.$$

K is a constant. C is a constant greater than 0 as $J_X(P_F^0) > > J_Y(P_F^0)$ by optimal punishment assumption and $J_Y(S) > > J_X(S)$ by severity assumption. Therefore as $P \uparrow$, so does $[J_Y(P) - J_X(P)]$.

COROLLARY. *For any particular crime, as the punishment increases beyond P_F^0, the optimal number of criminals not punished increases.*

This is in contrast to any punishment less than P_F^0, where it is always more just to punish more criminals. Thus if the punishment is felt to be too severe, fewer criminals will actually be convicted. There is evidence to support this view. For example, when Virginia increased the penalty for drunken driving to a mandatory one-year loss of the person's driver's license, juries became less likely to convict. This is because in our society the loss of a driver's license is a severe punishment (*Virginia Law Review*, 1967). In the reverse direction, in California the reduction from a felony to a misdemeanor for possession of marijuana seems to have resulted in more convictions. Evidently, marijuana users did not 'deserve' a felony punishment.

D. The fewer known criminals punished, the less effect a change in punishment will have on justice.

$$(20) \qquad \left|\frac{\Delta J_X(P)}{\Delta P}\right| > \left|\frac{\Delta J_Y(P)}{\Delta P}\right| \quad \text{for} \quad X < Y.$$

Proof:

$$(21) \qquad \text{For } 0 < P < P_F^0, \quad \left|\frac{\Delta J_X(P)}{\Delta P}\right| = \left|\frac{J_X(P_F^0) - J_X(0)}{P_F^0}\right| = \frac{J_X(P_F^0) - J_X(0)}{P_F^0};$$

$$\text{as } X\uparrow, \quad J_X(P_F^0)\downarrow, \quad \therefore \left|\frac{\Delta J_X(P)}{\Delta P}\right|\downarrow.$$

The proof is similar for $P \geqslant P_F^0$.

The fewer criminals punished, the more likely that there will be slack in the system, i.e., the more likely that the government will not choose the optimal P_F^0. This is because the fewer criminals that are punished, the less change in justice any change in the severity of punishment will have. The government need not be so careful, as the consequences are so slight. This may account for the fact that societies which punish few criminals often have greater extremes in punishment than societies which punish more criminals. E.g., in Russia 'economic speculation' can result in death but few speculators are punished (this would also be predicted by the economic theory of punishment). If the punishment for speculation were reduced, there would be little increase in justice. On the other hand, if the number of criminals punished were increased, any change in punishment would have a large effect on justice, and therefore the country would be more careful in deciding the severity of the crime.

Obviously much of this can be explained in terms of different cultural attitudes towards speculation, but it is not necessary to resort to the ad hoc explanation of cultural differences. Furthermore, slack in retribution suggests that societies which punish few of their criminals would have punishments which greatly differ (either more or less severe) from the average punishment for that crime, while countries which punish many of their criminals would have punishments which only slightly differ from the average for that crime.

E. By a natural extension of the lines to the left (Figure 2) of zero punishment, it is clear that if we reward known criminals, the fewer criminals we reward, the more just the system.

(22) For $P < 0, \quad J_X(P) < J_Y(P), \quad X < Y.$

Proof:

(23) $$J_X(P) - J_Y(P) = \left[\frac{J_X(P_F^0) - J_Y(P_F^0)}{P_F^0}\right] P \quad \text{by 16},$$

for $X < Y$, the term in brackets is >0. If $P < 0$, then the whole expression is <0 and therefore $J_Y(P) > J_X(P)$.

One method of rewarding a criminal is to give him 'psychic' income, e.g., the notoriety given Dillinger and Billy the Kid. A society with many criminal heroes would be less just than one with few of them.

F. As P increases beyond P_F^0, the maximum justice that can be achieved ($J^{\max}(P)$) decreases at a decreasing (or constant) rate. I.e., if P is only slightly greater than P_F^0, when P increases, the decrease in justice is very great; but if P is much larger than P_F^0, when P increases the decrease in justice is only slight.

(24) Let $J^{\max}(P)$ be the optimal justice than can be obtained at P.

(25) For $P' > P > P_F^0$, $J^{\max}(P) > J^{\max}(P')$, and
$$J^{\max}(P) - J^{\max}(P + \Delta) \geqslant J^{\max}(P') - J^{\max}(P' + \Delta).$$

Proof. For $P > P_F^0$, the greater the P, the greater the optimal number of criminals not punished (by corollary to C); and the greater the number of criminals not punished, the less steep the slope (by D).[11]

It is reasonable to believe that if the punishment is P_F^0, then the reduction in justice when X instead of $X+1$ known criminals are punished is not greater than the reduction in justice when Y ($Y > X$) instead of $Y+1$ known criminals are punished. In the extreme case, the difference in justice between punishing every known criminal and every known criminal except one cannot be less than the difference in justice between punishing one known criminal and punishing none. See Figure 3. This follows from the earlier argument that the optimal punishment may decrease when fewer criminals are punished. Thus when twice as many criminals are punished at P_F^0, justice not only increases because the number of criminals punished is doubled, but also because the punishment (P_F^0) itself is more just as more criminals are punished.

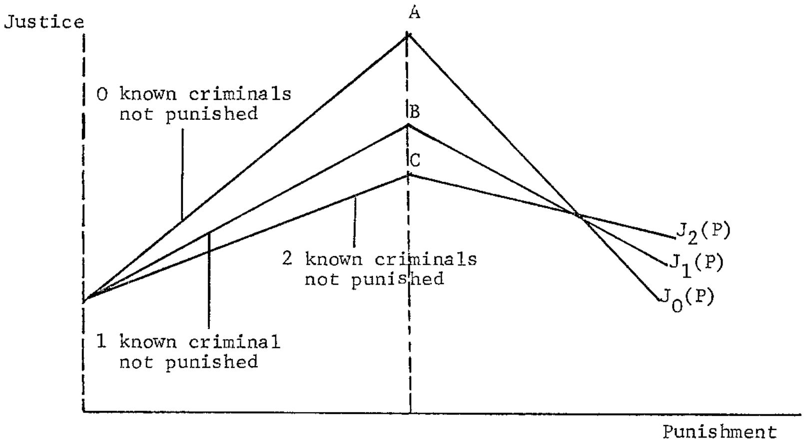

Fig. 3. $A-B$ is not less than $B-C$.

(26) Assumption V:

If $P = P_F^0$ and $X < Y$, then $J_Y(P_F^0) - J_{Y+1}(P_F^0) \leqslant$
$\leqslant J_X(P_F^0) - J_{X+1}(P_F^0)$.

If $P = P_F^0$, the fewer the known criminals caught, the less the change in justice when one more (or less) criminal is not punished.

II. PUNISHING THE INNOCENT

The approach outlined above can be extended to the question of the injustice of punishing an innocent person. If innocent individuals are punished, then the greater the punishment and/or the more people punished, the less the justice (see Figure 4).

(27) Let the injustice of punishing an innocent person be $I = I_X(P)$, where X is the number of innocent people punished and P is the severity of the punishment.

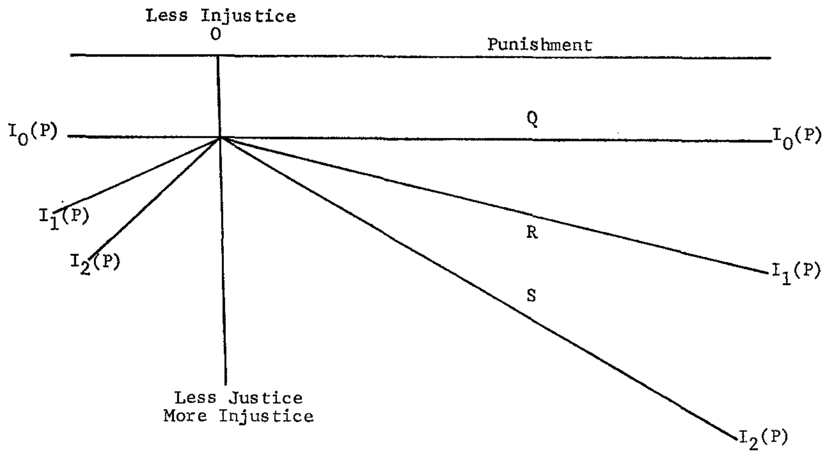

Fig. 4. The greater the P, and/or the greater the number of innocents being punished, the more the injustice. By Assumption VII, $S-R \geqslant R-Q$. There is also injustice in rewarding a person who does not deserve it ($P<O$).

The greater the injustice the larger the I. I is treated here as being positive. The larger (more positive) injustice, the less the justice.

(28) Assumption VI:
$I_X(P)$ is an increasing function of X and a positive linear function of P for $P>0$, with $I_X(0)=I_Y(0)$ for all $X=Y$.

Once again, the assumption of linearity is not critical. For example, any family of functions $I_X(P)=b(X)f(P)$, where $f(0)=0$, $b(X)\geqslant 0$, and where both of these expression have positive first derivatives, b has a non-negative second derivative and f has a non-positive second derivative, will yield the same results.

G. The smaller the punishment, the less the difference in justice between punishing a few and many innocent individuals.

(29) $I_X(P)-I_Y(P)\to 0$ as $P\to 0$, for all X, Y.

This result and the notion of slack may explain why governments appear to care little about punishing the innocent when the punishment is small: when there is little difference in justice between punishing a few and many innocent individuals, the government need not be so diligent.

Some examples may be the right to a public defender and to trial by jury, which are not granted for minor crimes.

It is reasonable to believe that the difference in justice between Y innocent people being punished and $Y+1$ innocent people being punished is not less than the difference in justice between X innocent people being punished and $X+1$ innocent individuals being punished ($X<Y$). I.e., the injustice done to the tenth innocent person is as great as the injustice done to the first individual, for he does not suffer any less.[12]

(30) Assumption VII

$$[I_{X+1}(P)-I_X(P)] \leqslant [I_{Y+1}(P)-I_Y(P)], \quad \text{for} \quad X<Y.$$

If assumptions I–VII hold, and if at $P=P_F^0$, it is more just to let X more criminals go free than to punish Y more innocent individuals, then for all punishments it is more just for KX ($K>1$) more criminals to go free than for KY more innocents to be punished.

(31) THEOREM I: *If assumptions* I–VII *hold and* $I_{Z+Y}(P_F^0)-$ $-I_Z(P_F^0)>J_W(P_F^0)-J_{W+X}(P_F^0)$, *then* $I_{Z+KY}(P)-I_Z(P)>$ $>J_W(P)-J_{W+KX}(P)$. *For all* $K>1, P>0$. *Z, W being the initial number of innocents being punished, and the initial number of guilty going free, respectively.*

Proof. The difference between punishing all the known criminals except W and all except $W+X$ (viz., $J_W(P)-J_{W+X}(P)$) is at a maximum at P_F^0. (Refer to Figure 5.) When punishment increases beyond this point, $[J_W(P)-J_{W+X}(P)]$ decreases. On the other hand, the difference between punishing $Z+Y$ innocent and Z innocent increases as P increases. Therefore if it is better to let X more criminals go free than punish Y more innocent individuals: when the punishment is P_F^0

$$(\text{i.e.,} -I_Z(P_F^0)+J_{W+X}(P_F^0)>-I_{Z+Y}(P_F^0)+J_W(P_F^0)),$$

then it is better to let X more criminals go free than punish Y more innocent when the punishment is greater than P_F^0. For punishments less than P_F^0, the difference in justice between punishing all the criminals except W and all the criminals except $W+X$ is

$$\frac{J_W(P_F^0)-J_{W+X}(P_F^0)}{P_F^0}\,P$$

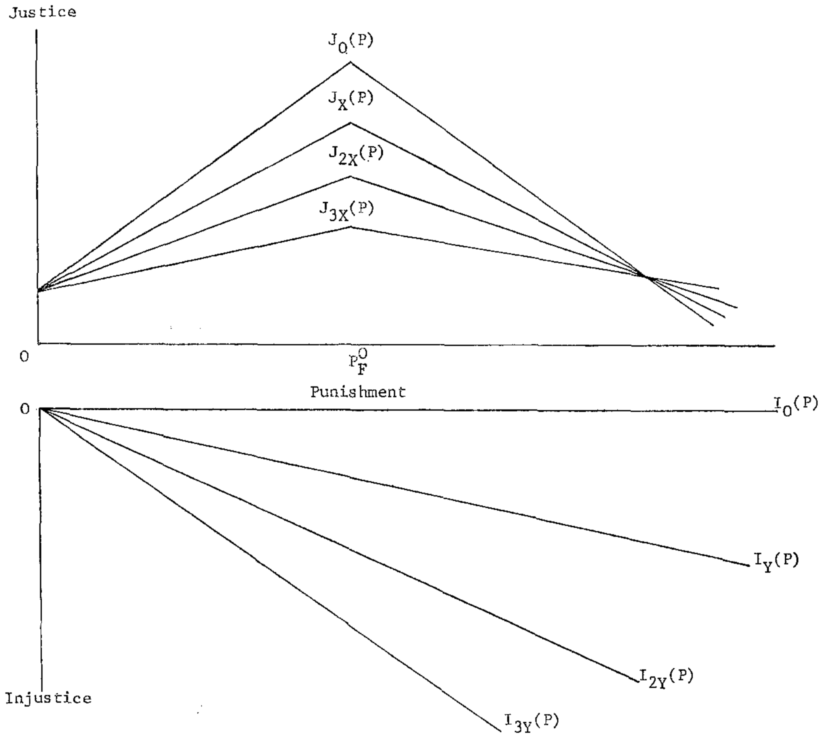

Fig. 5.

and the difference in injustice between punishing $X+Y$ innocent and Y innocent is

$$\frac{I_{Z+Y}(P_F^0)-I_Z(P_F^0)}{P_F^0}P.$$

Therefore if it is more unjust to punish Y more innocent individuals than to let X more criminals go free when P is P_F^0, the same holds for $P<P_F^0$.

As noted above, when $P=P_F^0$, the additional injustice of punishing $K+1$ instead of K innocent individuals is at least as great as punishing K instead of $K-1$ innocent individuals, while the reduction in justice of not punishing $J+1$ instead of J known criminals is no more than the reduction in justice of not punishing J instead of $J-1$ known criminals. Therefore when $P=P_F^0$, if it is more just to let X more criminals go free than punish Y more innocent, it must be more just to let $2X$ more criminals go free than punish $2Y$ more innocent. The rest of the proof proceeds as before.

This proof suggests that if the proper judicial procedures are chosen when the punishment fits the crime, the safeguards built into the system to protect the innocent should not be weakened no matter what the punishment and no matter how many criminals go free (as long as the alternative, punishing more criminals, must be accompanied by a proportional increase in the number of innocent people being punished).

The choice between letting X more criminals go free or punishing Y more innocent individuals has just been analyzed. The opposite perspective can also be used. Society may have a choice of punishing X criminals and Y innocent people, or $2X$ criminals and $2Y$ innocent people, e.g., in a mass demonstration in a public place where not everyone present has committed an illegal act, the police have a choice of arresting no one (in this case neither the guilty nor the innocent will be punished), of arresting a few (in this case there is a chance of some innocent as well as some guilty being punished) and of arresting everyone present (in this case there is a chance of many innocent as well as many guilty being punished).

I will now show that the most just decision is either to arrest all or none of those present but never just a few.[13] These results hold under slightly more restrictive conditions than have held previously. Assume that Assumption VII holds with equality.[14]

$$(32) \qquad I_{X+1}(P) - I_X(P) = I_{Y+1}(P) - I_Y(P).$$

If the number of innocents punished is doubled, so is the injustice. In contrast, Assumption V states that the increase in justice when $2X$ instead of X criminals are punished is greater than the increase in justice when X instead of 0 criminals are punished. Thus if the increase in justice of punishing X criminals is greater than the decrease in justice of punishing Y innocent, then the increase in justice of punishing $2X$ criminals is greater than the decrease in justice of punishing $2Y$ innocents. So if it pays to punish a few criminals with the concomitant risk of punishing a few innocent individuals, then it pays to punish all the criminals with a proportional increase in the number of innocents being punished.

But even if it does not pay to punish a few criminals, it may pay to punish them all. This is because the justice of punishing more criminals grows faster than the injustice of punishing more innocent individuals,

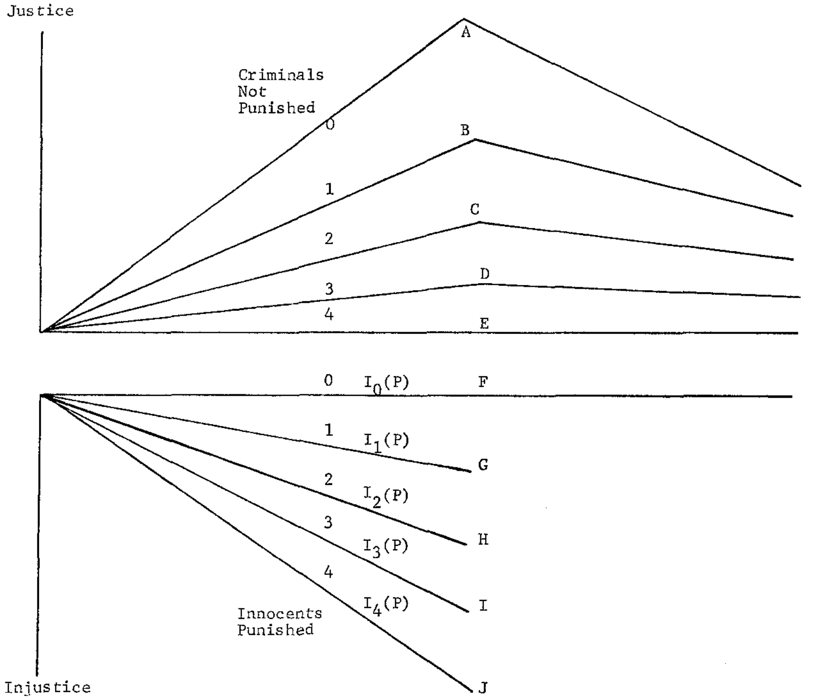

Fig. 6. In this example there are four criminals. If for every criminal punished, one innocent is punished, then eight people will be punished because this is the most just solution. $A-E>J-F$ even though $D-E<G-F$.

e.g., in Figure 6 there are four criminals. If for every criminal punished one innocent is punished, the increase in justice of punishing one criminal instead of $0(D-E)$ is less than the increase in injustice of punishing one instead of 0 innocent individuals $(G-F)$. As more criminals are caught, the increase in justice increases rapidly while the increase in injustice of punishing more innocents remains the same. Consequently it is more just to punish all four criminals and to punish four innocent people than to punish no one (i.e., $A-E>J-F$).

III. UTILITY FUNCTION

In the previous two sections, the axiomatic approach isolated the key variables and gave considerable insight into the concept of retribution.

In this section I show that the assumptions made can be derived from a simple utility function; and consequently the analysis of punishment as retribution need not involve any assumptions that are not ordinarily made in decision-theory. This should make the concept of retribution more acceptable, as it ultimately relies on fewer assumptions than were made earlier (with the previous assumptions now being implications), and because the assumptions that are made are typical of those made in economics. Furthermore, the fact that the utility approach produces virtually the same results means that the analysis in the first two sections can be applied to other areas besides punishment.

It is assumed that the utility function is of the following form:

(33) $U(P, X, Y) = (N - X)\, J^*(P^0_{F_i} - P) + XJ^*(P^0_{F_i} - 0) + YI(P - 0) = J_X(P) + I_Y(P)$. For notational convenience when Y is fixed or assumed to equal 0, $U(P, X, Y) = U(P, X)$. Where N is the number of criminals; $P^0_{F_i}$ is the punishment which fits the crime i; $J^*(P^0_{F_i} - P)$ is the justice function.

$$\frac{\Delta J^*}{\Delta\, |P^0_{F_i} - P|} < 0, \qquad \frac{\Delta^2 J^*}{\Delta\, |P^0_{F_i} - P|^2} \geqslant 0,$$

X is the number of criminals not punished;
Y is the number of innocents punished;
$I(0 - P)$ is the injustice function, $I(0) = 0$, and

$$\frac{\Delta I}{\Delta\, |0 - P|} < 0, \qquad \frac{\Delta^2 I}{\Delta\, |0 - P|^2} \geqslant 0.$$ [15]

Here injustice is negative utility. As the injustice becomes greater, I becomes more negative.
Note that $(N - X)J^*(P^0_{F_i} - P^0_{F_i}) + XJ^*(P^0_{F_i} - 0) = (N - X)J^*(0) + XJ^*(P^0_{F_i}) = J_X(P_{F_i}) \neq J_X(0)$.

In other words, there is an optimal punishment and the farther away the punishment is from the optimal, the less the justice. The utility function is the weighted sum of the justice at P and the justice at 0.

Using the language of decision theory, for each case (innocent or guilty), there is a different target and a different loss function. The utility function is a weighted sum of the loss functions. Other schemes are also consistent with the results:

for example, $U(P, X) = J^*([N-X]\,|P^0_{F_i} - P| + X|P^0_{F_i} - 0|)$.

Simpler schemes such as $U(P, X, Y) = [N-X]\,J^*(P^0_{F_i} - P) + X \times J^*(P^0_{F_i} - 0) + YWJ^*(P-0)$, where $J^*(0) = 0$, are also possible. W is greater than 1 and means an incorrect punishment is weighted more heavily when the person is innocent. For this formula, all the results except possibly D, F, K hold whatever the sign of the second derivative of J^* with respect to P.

It is easy to see that this utility function satisfies all the previous assumptions except linearity (in some cases the former inequalities ($\leqslant$) hold with strict equality).

(34) At $P = P^0_{F_i}$, $$\frac{\partial U(P, X)}{\partial X} = -J^*(0) + J^*(P^0_{F_i}) < 0,$$

because J^* decreases as $|P^0_{F_i} - 0|$ increases. Assumption I.

(35) At $P = 0$, $U(P, X) = [N - X + X]\,J^*(P^0_{F_i} - 0)$,
and therefore $U(0, X)$ is independent of X. Assumption II.

Let S be a value of P such that $S - P^0_{F_i} > P^0_{F_i} - 0$. Then

(36) $$\frac{\partial U(P, X)}{\partial X} = -J^*(P^0_{F_i} - S) + J^*(P^0_{F_i} - 0) > 0.$$

Assumption III.

(37) $U(P^0_F, X) = (N - X)\,J^*(0) + XJ^*(P^0_F)$,
$$\frac{\partial^2 U(P^0_F, X)}{\partial X^2} = 0.$$ Assumption V.

Assumption VII also holds with strict equality.

In the following sections, the utility function is used to derive further implications. Section IV will be concerned with different crimes and Section V with different punishments.

IV. DIFFERENT CRIMES

The conclusions reached above are not independent of the nature of the crime. For each crime there is a different punishment deemed appropriate.

In general, the greater the disutility to the victims, the more severe the punishment necessary to fit the crime.[16] Some of the issues can be brought out in a discussion of two distinct crimes. It is easiest to compare the following situation: A society where the criminals are robbers and a

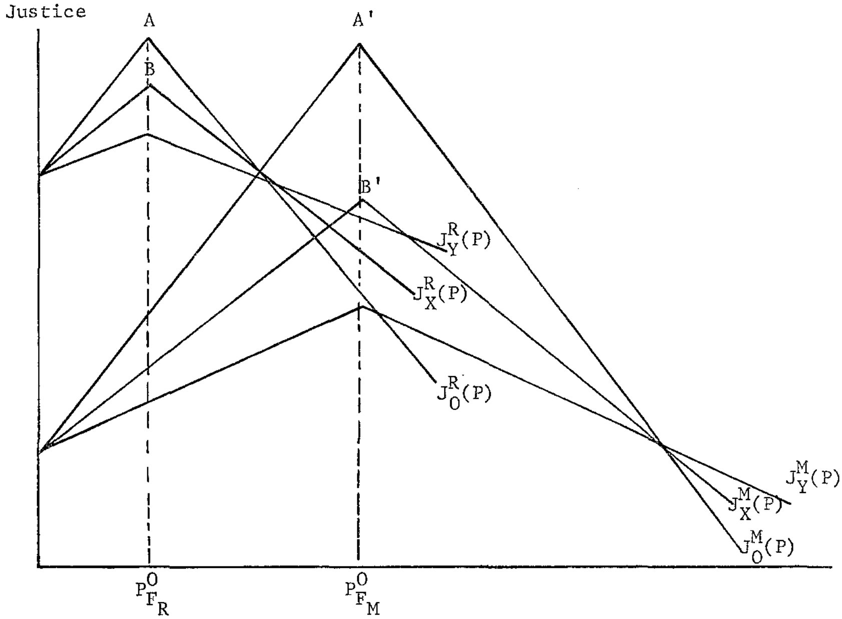

Fig. 7. Different crimes.
$J_X{}^M(P)$ Justice in the society with murder.
$J_X{}^R(P)$ Justice in the society with robbery.
$J_X{}^R(P) > J_X{}^M(P)$ for $P < P_{F_R}{}^0$.
$J_X{}^R(P_{F_R}{}^0) - J_Y{}^R(P_{F_R}{}^0) < J_X{}^M(P_{F_M}{}^0) - J_Y{}^M(P_{F_M}{}^0)$ for $X < Y$, i.e., $A' - B' > A - B$.
$J_Y{}^R(P) - J_X{}^R(P) > J_Y{}^M(P) - J_X{}^M(P)$ for $P > P_{F_M}{}^0$ and $Y > X$.
$J_Y{}^R(P) - J_X{}^R(P) < J_Y{}^M(P) - J_X{}^M(P)$ for $P < P_{F_R}{}^0$ and $Y > X$.
$\partial J_X{}^M/\partial P \leqslant \partial J_X{}^R/\partial P$ for $P < P_{F_R}{}^0$ and $P > P_{F_M}{}^0$.
Notice that with the utility approach there are only two points of intersection.

society where the criminals are murderers – in each there are n criminals. Both societies have the same scale of retribution. It will be useful to refer to Figure 7.

Using the utility function presented in Section III, the following relationships become apparent:

H. For any given punishment less than the punishment which fits the crime of robbery, there is less justice in the society whose criminals are murderers; on the other hand it is possible that for a given punishment greater than the punishment which fits the crime of murder there is greater justice in the society whose criminals are robbers. Without loss of generality, assume that there are no innocent individuals punished.

(38) Then let $U^M(P, X) = J_X^M(P) = [N - X]J^*(P_{F_M}^0 - P) + XJ^*(P_{F_M}^0 - 0)$ be the justice function for the society whose criminals are murderers,

(39) and let $U^R(P, X) = J_X^R(P) = [N - X] \quad J^*(P_{F_R}^0 - P) + X \times J^*(P_{F_R}^0 - 0)$ be the justice function for the society whose criminals are robbers.

(40) $J_X^R(P) > J_X^M(P)$ for $P < P_{F_R}^0$.

Proof.

(41) For $P < P_{F_R}^0$,

$$J_X^M(P) = [N - X]\, J^*(P_{F_M}^0 - P) + XJ^*(P_{F_M}^0 - 0) < < [N - X]\, J^*(P_{F_R}^0 - P) + XJ^*(P_{F_R}^0 - 0).$$

Because J^* decreases as the term within the parenthesis increases and $P_{F_R}^0$ is closer to P and 0 than $P_{F_M}^0$ is to P and 0.

I. If the punishment fits the crime, then there is a greater decrease in justice if X known murderers are not punished than if X known robbers are not punished:

(42) $J_X^R(P_{F_R}^0) - J_Y^R(P_{F_R}^0) < J_X^M(P_{F_M}^0) - J_Y^M(P_{F_M}^0), \quad X < Y.$

Proof.

(43)
$$\begin{aligned} &J_X^R(P_{F_R}^0) - J_Y^R(P_{F_R}^0) = [N - X]\, J^*(P_{F_R}^0 - P_{F_R}^0) + \\ &+ XJ^*(P_{F_R}^0 - 0) - [N - Y]J^*(P_{F_R}^0 - P_{F_R}^0) - YJ^*(P_{F_R}^0 - 0) = \\ &= [Y - X]\, J^*(0) + [X - Y]J^*(P_{F_R} - 0) < \\ &< [Y - X]\, J^*(0) + [X - Y]\, J^*(P_{FM}^0 - 0) = \\ &= J_X^M(P_{F_M}^0) - J_Y^M(P_{F_M}^0), \end{aligned}$$

because $[X - Y] < 0$ and $J^*(P_{F_M}^0 - 0) < J^*(P_{F_R}^0 - 0)$, by assumption.

When the punishment fits the crime, the less severe the crime, the more likely slack will develop for the difference in justice in punishing one more (or less) criminal is smaller. This probably explains why governments do not care about prosecuting all the known criminals of petty crimes – the decrease in justice is very slight. These results coincide with the facts as well as with punishment as deterrence and with the economic approach to punishment.

J. For any given punishment greater than $P^0_{F_M}$, punishing one less criminal results in a lesser decrease (or greater increase) in justice for the society whose criminals are robbers than for the society whose criminals are murderers:

$$J^R_X(P) - J^R_Y(P) < J^M_X(P) - J^M_Y(P), \quad \text{for} \quad P > P^0_{FM} \text{ and } \quad Y > X. \tag{44}$$

Proof.

$$J^R_X(P) - J^R_Y(P) = [Y - X]\, J^*(P^0_{F_R} - P) + [X - Y] \times \times J^*(P^0_{F_R} - 0) < [Y - X] \times \times J^*(P^0_{F_M} - P) + [X - Y]\, J^*(P^0_{F_M} - 0) = J^M_X(P) - J^M_Y(P). \tag{45}$$

$$[Y - X]\, J^*(P^0_{F_R} - P) < [Y - X]\, J^*(P^0_{F_M} - P); \text{ as } \quad J^*(P^0_{F_R} - P) < J^*(P^0_{F_M} - P) \quad \text{for} \quad P > P^0_{F_M} \text{ and } \quad X < Y, \tag{46}$$

$$[X - Y]\, J^*(P^0_{F_R} - 0) < [X - Y]\, J^*(P^0_{F_M} - 0) \Leftrightarrow J^*(P^0_{F_R} - 0) > J^*(P^0_{F_M} - 0); \tag{47}$$

the latter inequality holds by assumption.

K. For any given punishment less than $P^0_{F_R}$, the decrease in justice of punishing one less criminal is not more for the society whose criminals are murderers than for the society whose criminals are robbers:

$$J^R_X(P) - J^R_Y(P) > J^M_X(P) - J^M_Y(P) \quad \text{for} \quad P \leqslant P^0_{F_R} \text{ and } \quad Y > X. \tag{48}$$

Proof.

$$J^R_X(P) - J^R_Y(P) = [Y - X]\, J^*(P^0_{F_R} - P) + [X - Y] \times \times J^*(P^0_{F_R} - 0) = [Y - X]\, [J^*(P^0_{F_R} - P) - J^*(P^0_{F_R} - 0)] \tag{49}$$

(50) $\geqslant [Y - X]\,[J^*(P^0_{F_M} - P) - J^*(P^0_{F_M} - 0)]$.

By assumption that second derivative $\geqslant 0$

(51) $= J^M_X(P) - J^M_Y(P)$

V. DIFFERENT PUNISHMENTS

So far the analysis has been in terms of a choice between a punishment P and no punishment. In this section, I will analyze the effect of a choice between two punishments – P_1 and P_2. It is obvious (see Figure 8) that all the proofs that held for P and 0 hold for P_1 and P_2 with only a slight modification.

L. The closer P_1 (or P_2) is to P^0_F, the greater the justice and the less the decrease (or greater the increase) in justice when one less criminal is punished at $P_2(P_1)$.

$$\frac{\partial\,[[N - X]\,J^*(P^0_F - P_1) + XJ^*(P^0_F - P_2)]}{\partial\,|P^0_F - P_i|} < 0, \quad i = 1 \text{ or } 2. \tag{52}$$

and

$$\frac{\partial^2\,[[N - X]\,J^*(P^0_F - P_1) + XJ^*(P^0_F - P_2)]}{\partial\,|P^0_F - P_2|\,\partial X} < 0 \tag{53}$$

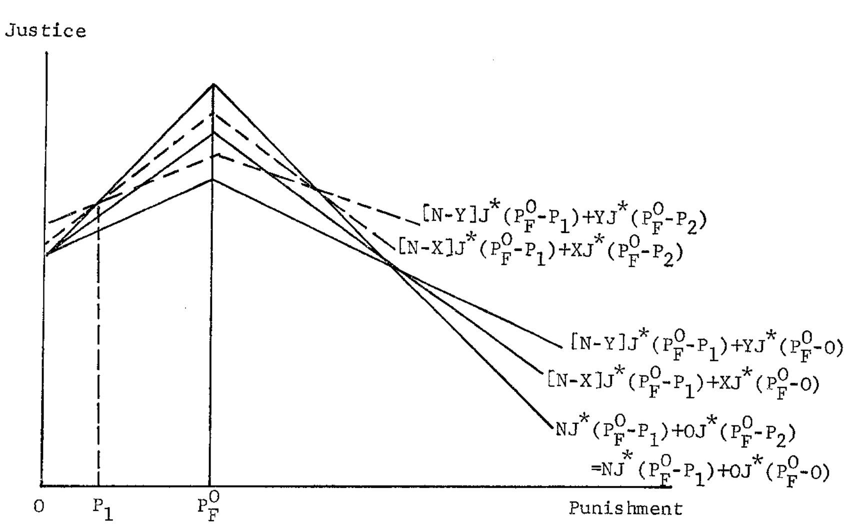

Fig. 8. Different punishments.

and

$$(54) \qquad \frac{\partial^2 [[N-X]\,J^*(P_F^0 - P_1) + XJ^*(P_F^0 - P_2)]}{\partial\,|P_F^0 - P_1|\,\partial(N-X)} < 0.$$

The proof is obvious.

The utility approach is also capable of handling more than two levels of punishments without difficulty.

VI. FINES

Just like the optimality results in economics, the economic theory of punishment equates marginal benefits to the criminal with marginal costs to the victim in order to achieve an optimal outcome. It should not be surprising then that this approach suggests that the rich and poor pay the same fine, for economics ignores income distribution when discussing efficiency. Most people believe that the rich should pay a higher fine. This is probably because they hold either the retributionist or the deterrent view. A bigger fine is needed to deter the rich than the poor; and in order to equate the punishment to the crime, a bigger fine is needed for the rich.

VII. CONCLUSION

This article has explored the concept of retribution, as distinct from deterrence, rehabilitation and other rationales for punishment. While the concept may appear to be quaint to some, the article has shown that retribution predicts a considerable amount of behavior. Furthermore, as can be seen in the following three examples, retribution explains certain cases of failure by other approaches to punishment. (1) There are some crimes, like being a litterbug, which are hard to detect and thus there is a very small probability of being punished. In these situations, maximizing deterrence or minimizing social loss of income would suggest that the fines be extremely high, yet it is unlikely that anyone has been fined as much as one thousand dollars for throwing a beer can along the highway. The reason is that it would be unjust to punish a person so severely for such a minor crime. (2) Although armed robbery is a more serious crime than burglary, the probability of being apprehended and convicted for robbery is much greater as the victim is a witness. Minimizing social loss of income would probably indicate a greater punishment for burglary, yet this is not the case, for then the punishment would not fit the crime.[17] (3) The proscription against punishing the innocent is not terribly strong in those approaches which maximize deterrence or minimize social loss of income. Punishing the first-born child of the criminal may be an extremely good deterrent, and mistakenly fining an innocent person involves little social loss of income. In an attempt to partially overcome this problem, John Harris (1970) incorporated into the economic model a loss of utility when an innocent person is punished. This means that it is unjust to punish an innocent person (one who does not deserve punishment), but that it is not unjust to punish a criminal (a person who deserves it). This is one element in the concept of retribution and once we allow one moral externality to be incorporated into a social utility function, there is little reason not to incorporate the others.[18] These examples should also show that retribution cannot be said to be a more cruel or inhumane approach to punishment than deterrence.

Under certain circumstances, the other approaches to punishment may be seen as special cases of retribution, as they lead to identical results. If the costs of detection are low, there is an egalitarian income distribution, and the fine which fits the crime is equal to the harm done to the victims, then the fine which fits the crime is the optimal (i.e., efficient price) fine in the economic model and in both cases all the criminals will be prosecuted.

The concept of retribution was shown to incorporate a number of ideas. E.g., if the punishment is greater than the punishment which fits the crime, the greater the punishment the fewer the optimal number of criminals punished; and when fewer of the known criminals are punished, the less the optimal punishment.

Three points made in the article are worthy of major emphasis. First, as more criminals are punished (i.e., the better our police detection system) the more sensitive justice is to the nature of the punishment. In other words, a call for improved technology rightly should be accompanied by careful consideration of the penalty structure. Secondly, when punishments are more or less 'appropriate' and when society accepts that it is more just to let X criminals go free than to punish Y innocent men, this concern with the 'rights of the accused' is proper and just whatever the level of punishment. And third, if it is more just to let ten criminals go free than punish one innocent person, it is more just to let 20 criminals go free than punish two innocent people.

This work can be seen not only as being concerned with punishment but also as a building of a social welfare function. When people realized that there was no one truth or philosophy that they could appeal to, they became interested in just methods of aggregating diverse beliefs. The rise in the belief in democracy is an example, but the work of Kenneth Arrow (1963) and others has been a severe blow to those who believe that we can find a just method of aggregating individual differences. So maybe it is time for the pendulum to swing back: Not to start off with a just method of aggregating preferences, but to start off with just preferences.

Outside of the concepts connected with Pareto optimality, economic theory has provided few moral precepts. The implications concerning justice and deserved punishment and rewards that can be derived from the utility function presented here hopefully will give greater texture than the sterile statement that marginal benefits should outweigh marginal costs.

Department of Economics,
University of California, Santa Cruz

NOTES

* I would like to thank David Kaun and Richard Posner for their comments.

[1] Retribution should not be confused with revenge: For philosophical justifications of retribution see Armstrong (1961), Mabbot (1939), Lewis (1949), and Mundle (1954). There are other elements to justice besides retribution.

[2] A naive approach to deterrence would suggest that the maximal punishment should be given in order to deter a crime. Unfortunately this would encourage criminals to upgrade their crime as there would be little additional cost. E.g., if robbery were punishable by death, this would encourage robbers to become murderers.

[3] A narrow interpretation of Becker's approach would see the cost of crime as purely an economic cost. In this case, the utility functions would not have to be known. However, this would lead to some unreasonable conclusions; e.g., there would be little cost to murdering non-productive members of society.

[4] Lt. William Calley was found guilty of premedicated murder in killing 22 Vietnamese civilians in the hamlet of My Lai and sentenced for life at hard labor. A poll reported in *Newsweek* (April 12, 1971, p. 28) found that approximately 80 % of the people disapproved and found the sentence to be too harsh; of these 71 % disapproved of the verdict because others were responsible for similar crimes and only 20 % because they thought it was not a crime.

[5] If a criminal is brought to trial and found innocent, there is a slight punishment as he has had the cost of a trial.

[6] The following assumption may be substituted: There exists a punishment S' such that $J_X(S') - J_Y(S') < J_X(P_F{}^0) - J_Y(P_F{}^0)$ for all $X < Y$. This alternative assumption involves a cardinal relationship.
[7] In the absence of more detailed information, linearity is a reasonable assumption to start with as can be witnessed by seeing all the other theories that assume it. Linearity is a simple relationship and can approximate more complex ones.
[8] The optimality conditions in economics are only a reasonable guide if the conditions hold elsewhere in the economy. Economists have not developed good theories of the 'second best'. See Lancaster and Lipsey (1956).
[9] The concept of slack is developed by Cyert and March (1963). However, there is no need to subscribe to the behavioral theory of the firm in order to accept the notion of slack. All it means is that the utility function involves more than one goal, and consequently the main goal is not necessarily achieved.
[10] For a discussion of the conflict between equity and efficiency in law enforcement, see Thurow (1970).
[11] Under certain regularity conditions on the change in slope from one justice function to the next, the envelope will be a negative hyperbola and $J_X(P)$ will be a single-peaked function of X for any given P.
[12] The assumption that the decrease in justice of punishing the tenth innocent individual is not less than the decrease in justice of punishing the first innocent individual is a stronger assumption than is necessary for this and the following proofs. It is possible that the reverse is true. But as long as $I_{Y+1}(P) - I_Y(P) \geqslant Q[I_Y(P) - I_{Y-1}(P)]$ and $J_X(P_F{}^0) - J_{X+1}(P_{F_0}) \leqslant Q[J_{X-1}(P_F{}^0) - J_X(P_F{}^0)]$ for $0 < Q \leqslant 1$, the proof still holds.
[13] A few would be arrested if they were clearly identified as having committed the illegal acts (e.g., the leaders). In such a case, the probability of arresting an innocent person is unlikely.
[14] Again the assumption is more restrictive than need be.
[15] If $\Delta^2 J^*/(\Delta |P_{F_i}{}^0 - P|^2) < 0$, then all the proofs hold except D, K and Theorem 1.
[16] The punishment which fits the crime may be defined as the sum of all the utilities from the crime including the criminal's. The latter are the mitigating circumstances; e.g., the thief was starving when she stole an apple.
[17] Minimizing social loss of income would also suggest that those crimes which cause the same amount of harm but have different probabilities of the criminal being convicted should have different punishments. E.g., people who commit murder before television cameras should be punished less severely than those who do not. In general this is not the case. (An additional punishment for hit and run driving may be the exception.) The fact that punishment for murder is either a long jail sentence or death suggests that retribution is the prime explanation. Murder has a low recidivism rate and therefore it is not necessary to keep murderers in jail; long sentences or death does not appear to be a deterrent to potential murders and a long prison sentence or death is not rehabilitative. These and the other examples suggest that punishment as a means of minimizing the loss of social income may be more normative than positive.
[18] A grand social utility function incorporating both economics and retribution would lose the clear insights of both approaches.

BIBLIOGRAPHY

Aristoteles, *The Nicomachean Ethics* (transl. by David Rose), London 1959.
Armstrong, K. G., 'The Retributivist Hits Back', *Mind* **70** (1961) 471–490.

Arrow, K., *Social Choice and Individual Values*, New York, Second Edition, 1963.
Becker, G., 'Crime and Punishment: An Economic Approach', *Journal of Political Economy* **76** (1968) 169–217.
Cyert, R. and March, J., *A Behavioral Theory of the Firm*, Englewood Cliffs 1963.
Harris, J. R., 'On the Economics of Law and Order', *Journal of Political Economy* **78** (1970) 165–174.
Hart, H. L. A., *Punishment and Responsibility*, Oxford 1968.
Landes, W., 'An Economic Analysis of the Courts', *Journal of Law and Economics* (1971) 61–107.
Lewis, C. S., 'The Humanitarian Theory of Punishment', *Twentieth Century* (1949).
Lipsey, R. G. and Lancaster, K., 'The General Theory of the Second Best', *Review of Economic Studies* **24** (1956) 11–32.
Mabbott, J. D., 'Punishment', *Mind* **49** (1939) 152–167.
Mundle, C. W. K., 'Punishment and Desert', *Philosophical Quarterly* **4** (1954) 216–228.
Posner, R. A., 'An Economic Approach to Procedure', *Journal of Legal Studies* **2** (1973).
Stigler, G. J., 'The Optimum Enforcement of Laws', *Journal of Political Economy* **78** (1970) 526–536.
Thurow, L., 'Equity vs. Efficiency in Law Enforcement', *Public Policy* (1970) 451–462.
Tullock, G., *The Logic of the Law*, New York 1971.
Virginia Law Review **53** (1967). 'Jury Sentencing in Virginia', 968–974.
Wittman, D., 'Two Views of Procedure', *Journal of Legal Studies* **3** (1974).