ELSEVIER

Economics Letters 55 (1997) 97–102

economics letters

On criminals' risk attitudes

William S. Neilson[a,*], Harold Winter[b]

[a]Department of Economics, Texas A&M University, College Station, TX 77843-4228, USA
[b]Department of Economics, Ohio University, Athens, OH 45701, USA

Received 30 September 1996; accepted 19 November 1996

Abstract

If criminals are expected utility maximizers and more sensitive to changes in the certainty than the severity of punishment, they must be risk preferrers. We show that risk aversion is not ruled out if the expected utility hypothesis is weakened. © 1997 Elsevier Science S.A.

Keywords: Risk aversion; Punishment; Nonexpected utility; State-dependent preferences

JEL classification: D81; K42

1. Introduction

Economic studies have used many methods to ascertain whether or not individuals are risk averse. Experimental studies address risk attitudes directly, asking whether subjects would rather play a lottery or have its expected value for sure. Empirical studies use financial data to estimate coefficients of absolute or relative risk aversion. When it comes to ascertaining criminals' risk attitudes, though, the process is less direct. Empirical studies, such as those of Grogger (1991) and Block, Gerety (1995) establish that criminals are more sensitive to changes in the certainty, p, than the severity, f, of punishment. Becker (1968) demonstrates that if offenders are expected utility maximizers, this pattern of sensitivity implies that they must be risk preferrers. This would make criminals different from the rest of the population, because the other types of analysis have established that law-abiding citizens tend to be risk averse.[1]

There is no direct evidence about the risk attitudes of criminals. Instead, their risk preference is inferred from the combination of the sensitivity pattern and the expected utility hypothesis. The goal of this paper is to simultaneously account for criminals being risk averse and yet still more sensitive to

*Corresponding author. Tel.: (409) 845-9952; e-mail: wsn@econ4.tamu.edu

[1]Experimental evidence does show that people tend to be risk preferring over losses. When someone considers committing a crime, though, they face a gamble with a positive payoff (getting away with it) and a negative payoff (being caught and convicted). The evidence suggests that people are risk averse when some payoffs are gains and some are losses.

PII S0165-1765(97)00042-6

the certainty, as opposed to the severity, of punishment. We do this in two ways: we augment the expected utility model to include state-dependent utility, and we relax the assumption that criminals are expected utility maximizers. In particular, we demonstrate that if criminals have state-dependent preferences, or if they are rank-dependent expected utility maximizers,[2] it is possible for them to be risk averse but still be more sensitive to changes in the certainty, as opposed to the severity, of punishment.

2. Expected utility

We begin with Becker's (Becker, 1968) model of an expected utility maximizing criminal. The criminal commits an illegal act which makes his total wealth y. He is caught and punished with probability p, and the punishment is comprised of a fine $f \leq y$. His expected utility is given by the expression

$$EU = pU(y-f) + (1-p)U(y), \tag{1}$$

where the criminal's von Neumann–Morgenstern utility function is U. Becker also observes the empirical regularity that criminals respond more to a change in p than to a change in f. He goes on to show that within the context of the expected utility model, this implies that the criminal must be risk preferring.

To establish this, note that the elasticity of expected utility with respect to the probability of punishment is

$$\eta_p^{EU} \equiv \frac{\partial EU}{\partial p} \cdot \frac{p}{EU} = [U(y) - U(y-f)] \frac{p}{EU}$$

and that the elasticity of expected utility with respect to the fine is

$$\eta_f^{EU} \equiv -\frac{\partial EU}{\partial f} \cdot \frac{f}{EU} = pU'(y-f) \frac{f}{EU}.$$

Note that $\eta_p > \eta_f$ if

$$\frac{U(y) - U(y-f)}{f} > U'(y-f) \tag{2}$$

which *cannot* hold if U is risk averse, that is, if $U'' < 0$. This is shown in Fig. 1. The left hand side of expression (2) is the slope of the chord connecting the two points on the utility function, and the right hand side is the slope of the line tangent to the utility function at $y-f$. Expression (2) holds if the chord is steeper than the tangent. Fig. 1 clearly shows, though, that when the utility function is concave, the tangent is steeper than the chord.

Becker's analysis, then, proves that a risk averse expected utility maximizing criminal cannot respond more to changes in the certainty of punishment than to changes in the severity of punishment.

[2]For a construction and overview of the rank-dependent expected utility model, see Quiggin (1993).

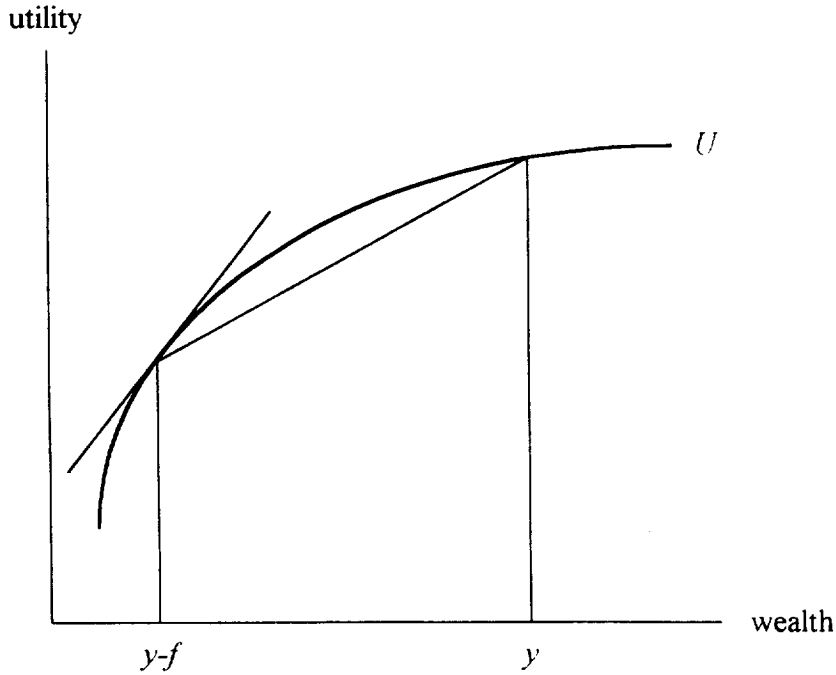

Fig. 1. Certainty vs. severity for state-independent expected utility.

The next two sections show that if the expected utility assumption is replaced, some risk averse criminals are more sensitive to changes in the certainty of punishment.

3. State-dependent utility

In this section we demonstrate that if the expected utility model is augmented by allowing preferences to be state-dependent, a criminal can be risk averse *and* be more sensitive to changes in certainty than changes in severity. A criminal's utility function might be state-dependent for a variety of reasons. A utility function measures the utility the individual receives from different wealth levels. If a criminal is caught and punished, it might adversely affect his ability to enjoy consumption of his wealth. For example, incarceration impedes the ability to consume, and it also adversely affects income and the ability to find employment after prison.[3] Even without a prison sentence, the fact that a person has a criminal record can affect the payoffs from criminal and other activities. For example, having been convicted of one crime increases the punishment from future crimes. For these and other reasons, the criminal's utility function might be state-dependent.

Let U_c denote the criminal's (state-dependent) utility function if he is punished, and let U_n denote the utility function if he is not caught. The two utility functions are related by $U_c(x)<U_n(x)$ for all x.

[3]For example, see Lott (1992) and Waldfogel (1994) for empirical evidence of the adverse effect of conviction on income and employment.

This is consistent with the idea that criminals are less able to enjoy consumption of their wealth if they are caught. With state-dependent utility, expression (1) becomes

$$SDEU = pU_c(y-f) + (1-p)U_n(y). \tag{3}$$

Redefining the elasticities to fit the state-dependent expected utility framework, we find that $\eta_p^{SDEU} > \eta_f^{SDEU}$ if

$$\frac{U_n(y) - U_c(y-f)}{f} > U_c'(y-f). \tag{4}$$

Fig. 2 shows that this inequality can hold even if the individual is risk averse, that is, if $U_c'' < 0$ and $U_n'' < 0$. The left hand side of expression (4) is the slope of the line connecting the point on U_c at wealth level $y-f$ to the point on U_n at wealth level y. The right hand side of (4) is the slope of the tangent to U_c at wealth level $y-f$. As shown in Fig. 2, both curves are concave, but the chord is steeper than the tangent. Consequently, if utility is state-dependent, it is possible for criminals to be risk averse and be more sensitive to changes in the certainty than to changes in the severity of punishment. The reason is that an increase in the probability of punishment raises the likelihood that the criminal faces the bad state, while an increase in the fine leaves unchanged the probability of facing the bad state, and merely reduces the payoff in the bad state. If the bad state is "sufficiently bad," the criminal is better off with the larger fine.

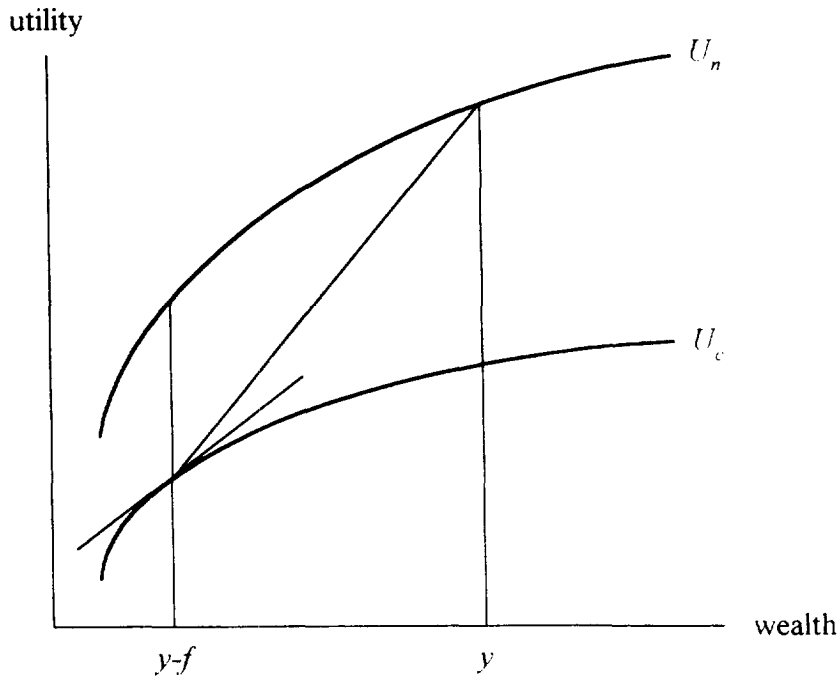

Fig. 2. Certainty vs. severity for state-dependent expected utility.

4. Rank-dependent expected utility

In this section we demonstrate that if a criminal's preferences violate the expected utility model, it is possible for him to be risk averse and be more sensitive to changes in certainty than changes in severity. We do this using one well-known generalization of the expected utility model, the rank-dependent expected utility (*RDEU*) model. The *RDEU* model differs from the expected utility model in that probabilities are transformed before expectations are taken. In Becker's setting in which a criminal is punished the amount f with probability p, the *RDEU* model transforms the punishment probability by the function g, with $g(0)=0$, $g(1)=1$, and $g'(p)>0$. The counterpart of Eq. (1) is

$$RDEU = g(p)U(y-f) + (1-g(p))U(y). \tag{5}$$

The only difference between (5) and (1) is that in (5) the transformed probability $g(p)$ is used in place of the true probability p.

Because both payoffs and probabilities are transformed in the *RDEU* model, definitions of risk aversion must govern both types of transformation. The standard expected utility notion of risk aversion says that the worse of two payoffs figures more prominently into the decision than the better payoff. In the expected utility model, this takes the form of a concave utility function, so that the good outcome generates less than a proportional amount of utility. In the *RDEU* model, there are two ways to make the worse payoff figure more prominently into the decision. One is by using a concave utility function. The other is to give the worse payoff a higher probability weight, by setting $g(p)>p$ for $0<p<1$. In Eq. (5) this means that the criminal overweights the event that he is punished, and underweights the event that he is not. An *RDEU* maximizer is risk averse if U is concave and $g(p)\geq p$.

The elasticity of the preference function *RDEU* with respect to the probability of punishment is

$$\eta_p^{RDEU} \equiv -\frac{\partial RDEU}{\partial p}\cdot\frac{p}{RDEU} = g'(p)[U(y)-U(y-f)]\frac{p}{RDEU}$$

and the elasticity of the preference function *RDEU* with respect to the fine is

$$\eta_f^{RDEU} \equiv -\frac{\partial RDEU}{\partial f}\cdot\frac{f}{RDEU} = g(p)U'(y-f)\frac{f}{RDEU}.$$

Note that $\eta_p^{RDEU} > \eta_f^{RDEU}$ if

$$g'(p)\frac{p}{g(p)} > U'(y-f)\frac{f}{U(y)-U(y-f)}. \tag{6}$$

The left hand side of expression (6) is the elasticity of the probability transformation function. The right hand side of (6) is the ratio of the slope of the tangent in Fig. 1 to the slope of the chord. If the individual is risk averse, that is, if U is concave, the right hand side of (6) is always greater than one. In the expected utility case, $g(p)=p$, so the left hand side of (6) is equal to one, and (6) cannot hold if the individual is risk averse. For an *RDEU* maximizing individual, though, it is possible to choose a function g with $g(p)\geq p$ for which (6) holds.

The interpretation of (6) is straightforward. The left hand side is the elasticity of the probability

transformation function. The right hand side is similar to the elasticity of the utility function. The criminal is more sensitive to changes in the certainty of punishment than changes in the fine if the probability transformation function is more elastic than the utility function. In other words, the criminal is more sensitive to changes in the certainty of punishment than changes in the fine if his preference function is more sensitive to changes in probabilities than changes in payoffs.

5. Conclusion

This paper establishes that if the expected utility model is generalized in a manner consistent with the uncertainty literature, then unlike in the case of expected utility, risk aversion can no longer be ruled out by the empirical finding that criminals respond more to changes in the certainty of punishment than to changes in the severity of punishment. We have shown that if criminals' preferences are state-dependent or criminals are rank-dependent expected utility maximizers, it is possible for offenders to be both risk averse and more sensitive to changes in the certainty of punishment. These demonstrations are meant to be illustrative. While there is evidence that individuals have state-dependent preferences in other settings, or that individuals' choices are consistent with the rank-dependent expected utility model in experimental settings, there is no compelling reason to believe that criminals' preferences are best described by one of these two models. Nor is there any reason to believe that criminals' preferences are best described by the expected utility model. There may be other models of choice under uncertainty which better suit the preferences of criminals.

Acknowledgments

W.S. Neilson is grateful to the Private Enterprise Research Center at Texas A&M for financial support.

References

Becker, G.S., 1968. Crime and Punishment: An Economic Approach. Journal of Political Economy 76(2), 169–217.

Block, M.K., Gerety V.E., 1995. Some Experimental Evidence on Differences Between Student and Prisoner Reactions to Monetary Penalties and Risk. Journal of Legal Studies, 24, 123–138.

Grogger, J., 1991. Certainty vs. Severity of Punishment. Economic Inquiry 29(2), 297–309.

Lott, J.R., 1992. Do We Punish High Income Criminals Too Heavily. Economic Inquiry, 30, 583–608.

Quiggin, J., 1993. Generalized Expected Utility Theory: The Rank-Dependent Model. Kluwer Academic Publishers, Boston.

Waldfogel, J., 1994. Does Conviction Have a Persistent Effect on Income and Employment? International Review of Law and Economics, 14, 103–119.