Crime and rationality: An empirical study of murdered police officers

Leon Taylor

Instructor
Marshall University
Lewis Business College
Department of Finance and Economics
Huntington, West Virginia USA

The rate at which police officers were murdered rose over the 1960s, although the expected penalties were also growing more severe. During that period, a subjective index indicates, arrest suspects may have been growing more prone to commit crimes for impulsive or political reasons rather than out of rational behavior. [*JEL K42*]

1 Introduction

Murders in which no rational gain is immediately evident pose an important issue for policymakers. The killing of police officers may discourage police presence in areas perceived as dangerous, many of them poor neighborhoods; killings in schools may hinder learning. Such murders also pose an intriguing puzzle for the economic theory of crime. Murders committed in public — or against public symbols such as police officers and politicians — carry a high risk of conviction and of long imprisonment or of execution. Why, then, do they occur?

This paper examines the question through an analysis of a subset of murders for which data are relatively abundant — the killing of police officers.

Killers of officers are much more likely to be arrested and sentenced to life imprisonment or execution than are other murderers. From 1986 through 1995, of 967 suspects in the deaths of law enforcement officers in line of duty in the United States, 80 percent were arrested and charged; 12 percent were "justifiably killed," reported the FBI; and 6 percent killed themselves. There were 11 fugitives and 18 pending cases. Of those charged for whom the FBI knew the final outcome, 70 percent were convicted of murder; 9 percent, of a lesser charge related to murder; 6 percent, of a charge not related to murder; and 1 percent died in custody. Nine percent were acquitted, or their charges were dismissed. Of 539 convicts, the courts sentenced 21 percent to death; 46 percent, to life imprisonment; and 32 percent, to prison terms of 2 to 396 years.[6]. In addition, police officers pose less lucrative targets for robbery than do most victims of murder-for-profit.

The distinctive feature of the police officer as an object of murder is his representation of law and order. The killers of police officers may gain direct utility from striking out against this symbol.

The point of this study is to test alternative models of police killings. Perhaps the killer acts impulsively; perhaps he takes into account the likelihood of life imprisonment or execution but nonetheless favors the utility from the murder; or perhaps the murders occur not because of criminal motives but because guns are widely available or because officers are poorly trained to manage volatile encounters. The study seeks to determine which of the three models might best account for police killings in the United States in the latter half of the 20th century.

2 Model

The model treats the killing as an economic decision under uncertainty, and it follows a standard analysis of uncertainty [1]. The criminal may be in one of three behavioral states i: (1) premeditation, in which he has weighed the benefits and costs of murdering an officer; (2) impulsiveness, in which he has not weighed the benefits and costs; and (3) externally directed, in which he has no opportunity to kill an officer, either because he has no lethal weapon or because the officer has averted any deadly encounter. The probability of state i is P_i, where $P_1 + P_2 + P_3 = 1$.

In states 1 and 2, the criminal may resort to one of two actions, denoted as a: Kill the officer ($a = 1$) or don't kill him ($a = 0$). In state 3, he can choose only not to kill the officer. When choosing his action, the criminal knows which state he is in.

In states 1 or 2, the criminal chooses a probability that he will kill the officer, β, to maximize his expectation of utility U. This is a positive monotonic function of his rebelliousness R against law and order as well as of his expected longevity of life outside incarceration, F: $U = U(R,F)$. In the event of the criminal's death, $U = 0$.

The utility function estimated takes a Klein-Rubin form [2]:

$$U = \gamma_1(a)\ln(R - R_0) + \gamma_2(a)\ln(F - F_0)$$

where $R_0 > 0$ and $F_0 > 0$ are the minimal levels of R and F necessary to the survival of the full-fledged criminal personality. The criminal does not choose levels of R and F; these are given by institutions. Rather, in state 1, he chooses whether to let himself enjoy utility from R and F. The parameters $\gamma_j(a)$ are thus functions of his chosen action:

$$\begin{aligned}
\gamma_1(1) &> 0, \gamma_1(0) = 0; \\
\gamma_2(1) &= 0, \gamma_2(0) > 0; \\
\gamma_1(a) &= \gamma_2(a) = 0 \text{ if criminal dies.}
\end{aligned}$$

Through his premeditated choice between killing or not killing the officer, his utility function in state 1 will change: γ_1 and γ_2 cannot both remain positive. The analysis thus treats his decision as one that will reshape his personality.

To satisfy data constraints, the analysis assumes that the criminal in state 1 believes that, if he kills an officer, then he will be caught and sentenced either to life imprisonment or to execution. In either case, $F = F_0$. The criminal also believes that, if he does not try to kill the officer, then he will not be sentenced either to life imprisonment or to execution.

In premeditation, the criminal chooses β to maximize expected utility:

$$\beta\gamma_1(1)\ln(R-R_0)+(1-\beta)\gamma_2(0)\ln(F-F_0).$$

where $\gamma_1+\gamma_2=1$. Thus

$$\begin{aligned} \gamma_1(1)\ln(R-R_0) &> \gamma_2(2)\ln(F-F_0)\Rightarrow\beta=1, \\ \gamma_1(1)\ln(R-R_0) &< \gamma_2(0)\ln(F-F_0)\Rightarrow\beta=0, \\ \gamma_1(1)\ln(R-R_0) &= \gamma_2(0)\ln(F-F_0)\Rightarrow 0\leq\beta\leq 1. \end{aligned} \tag{1}$$

In state 2, the impulsive criminal expects that killing the officer will yield utility $U(R,F)$ such that $\gamma_j > 0,\ j = 1,2$. He takes no account of consequential execution or life imprisonment.

In state 3, the criminal must accept utility $U = \gamma_2(0)\ln(F-F_0)$.

3 Estimating the models

3.1 Estimating arguments in U(R,F)

R may be a function of several interacting factors. The criminal may view the killing of a police officer as either a symbolic act of rejection or as retaliation; and his predisposition to make such emotional decisions may depend in part on his age.

Rejection is distinct from retaliation. An act of rejection is a demonstration that the criminal does not belong to the group that the opponent represents to him. It implies no subsequent acts. An act of retaliation, on the other hand, demonstrates the consequences to an opponent if he persists in some policy.

The murder of an officer may symbolize, for the criminal, rejection of either the rules of society or of those who visibly enforce them. The criminal believes himself to be acting on behalf of some group to which he claims membership. His killing of an officer may be an exaggerated consequence of group beliefs that he shares. Rejection of enforcers may be evident in a rise in the crime rate in the group, c. Rejection of the rules themselves may be evident in a low rate of voter participation, $1-v$. Especially before 1964, v also reflects exclusion of

African-Americans through Southern literacy tests, so that the impact of v on the probability of police murder may partly reflect the identification of the criminal with African-Americans excluded from voting.

Rather than as rejection, the criminal might instead view the murder of an officer as retaliation, either for harsh treatment of a group to which he claims membership or for harsh treatment of suspects in general (such as shootings by police officers or avertable deaths in detention). Retaliation is indexed with s.[1]

Finally, the share of youths in the population arrested, y, reflects the predisposition of the criminal to make emotional decisions. From 1988 through 1997, the average age of a suspect arrested for the murder of an officer was 28.

In sum,

$$R = (1-v)^{\alpha_1} c^{\alpha_2} y^{\alpha_3} s^{\alpha_4}.$$

F may be computed as the life expectancy of the criminal at his age of arrest, minus the expected length of incarceration.

3.2 Estimating the probability of State 3

P_3 depends negatively upon the availability of guns in the population, G. From 1988 through 1997, of 688 officers killed in line of duty, 92 percent were killed with firearms. Indeed, 72 percent were killed with handguns. The .38 caliber and the 9 millimeter alone accounted for 43 percent of the handgun deaths [6].

P_3 also depends positively upon government investment in the police, N. It seems likely that the preparation of the officers for potentially deadly encounters influenced their chances for survival. From 1988 through 1997, 62 officers killed in line of duty (9 percent) were killed with their own weapons. More than half of the officers killed by gunshot wounds were within 5 feet of the attacker. Almost half of the fatal wounds were to the head, more than 100 occurring despite the use of body armor [6].

A hill-shaped probability distribution for P_3 seems appropriate. An increase in the number of guns per capita seems likely to decrease P_3 by the most when weapons reach younger residents and less likely to decrease P_3 by much when virtually the entire population already owns guns. An increase in police training and support seems likely to increase P_3 by the most when it reaches officers who

[1] In principle, one may distinguish between group retaliation — a sense that officers are most harsh toward suspects who belong to a particular group — and general retaliation. In practice, the data available for this study do not permit the distinction.

only occasionally have encounters with the potential for violence; that is, they would be completely unprepared for the encounters had they received no training. The study will estimate P_3 as normally distributed:

$$\begin{aligned} P_3 &= P\{Y_1 \geq Y\} = \int_{-\infty}^{Y_1} \frac{1}{\sqrt{2\pi}} \exp\left\{\frac{-h^2}{2}\right\} dh, \\ Y_1 &= c_1 - c_2 G + c_3 N, \end{aligned}$$

where h is a transformation of Y with a normal distribution, a mean of zero, and a variance of one.

The study presumes that when $Y_1 > Y$, then the officer will put himself out of range of death at the hands of the subject whom he is arresting. P_3 is thus the probability that the subject arrested will have no chance to kill the officer.

The study estimates a separable function for Y_1 since the marginal impact of guns on the probability of deadly encounters would not seem to depend greatly on police preparation. The converse would also seem to hold.

3.3 Estimating the general model

P_k is the probability that the criminal kills the officer in an arrest; $P_{a=1}$ is the probability that the criminal decides to kill the officer. Then, bearing in mind that the criminal will certainly decide to kill the officer in state 2,

$$P_k = P_1 P_{a=1} + (1 - P_1 - P_3). \tag{2}$$

Equation (1) gives the condition for the criminal to choose $a = 1$. Values of F and R vary from year to year t, so that the value of the criminal's utility may be treated as a random variable. The probability that the utility value in a given year exceeds the threshold value required for a decision to kill may be assumed to follow a normal distribution. Extremely small or large values of F_t, which reflects the median age of criminals in year t, are about equally less likely than medium values, suggesting a hill-shaped distribution. This reasoning leads to the cumulative function

$$\begin{aligned} P_{a=1} &= P\{Y_{2t} \leq Y_0\} = \int_{-\infty}^{Y_0} \frac{1}{\sqrt{2\pi}\sigma} \exp\left\{\frac{-(Y_{2t} - \overline{Y_{2t}})^2}{2\sigma^2}\right\} dY_{2t}, \qquad (3) \\ Y_{2t} &= (1 - \gamma_1) \ln(F_t - F_0) - \gamma_1 \ln(R_t - R_0), \end{aligned}$$

where $\overline{Y_{2t}}$ is the mean of Y_{2t} and σ its standard deviation ([3]). A probit model of 3 will yield estimates of γ_1 and of $P\{Y_{2t} \leq 0\} = F_Y(0)$. Using these estimates in a rewriting of (2),

$$P_k + P_3 - 1 = P_1(F_Y(0) - 1), \quad (4)$$

enables estimation of P_1 as the coefficient in a regression.

4 Data

All data derive from time series in [4] and are annual series for 1945 through 1970. This period is an historical evolution from a time of relative national unity (the post-WWII era) to one of divisiveness (the 1960s), so it seems appropriate to a study of violent actions in which social cohesion may play an important role. Table 1 describes the series, and Appendix A has details.

Variable	**Description**
P_k	(number of officers killed by felons) / (number of arrests)
N	(spending by all governments on police protection) / (number of arrests)
G	(number of homicides by firearms) / (total number of homicides)
c	(number of arrests) / (resident population)
P_f	(number of executions for murder) / (number of officers killed)
v	percentage of eligible adults voting in most recent Presidential election
y	(number of persons arrested under age of 24) / (total number of arrests)
t	(number of homicides through intervention of police) / (all homicides)
s	(number of nonwhites arrested) / (total number of arrests)

5 Estimations

5.1 Estimating P_k

The risk of death to a police officer diminished historically but remained high relative to the risk in other occupations. The risk of murder to the police officer in the course of arrest fell sharply from 12.7 in 100,000 arrests in 1946 to 1.37 in 100,000 arrests in 1960, then rose slightly but steadily to 2.33 in 100,000 arrests in 1970.[2]

[2]The low probability in 1960 may owe partly to the inclusion of data for Alaska and Hawaii for the first time that year.

Total police expenditures per arrest followed a similar pattern. Real spending per arrest fell steeply from $1610 in 1945 to $530 in 1965 and then rose to $620 in 1969. These figures do not express the direct costs of arrest; they include spending on other police services and on the maintenance of police buildings. They indicate the value of general investment in capital that the officer may deploy in an arrest.

Although both the level of investment and the risk of death for an officer were much lower in 1970 than in the late 1940s, the risk of death by remote weapons rose. The share of all police murders that occurred through firearms or explosives rose steadily from .54 in 1945 to .67 in 1970.

One may loosely infer that, although police work remained dangerous in 1970, it was much less violent than in the late 1940s.

5.2 Estimating R and F

The tables below give the results for a log-linear estimation of *R*. The rate of arrest is elastic with respect to the share of the arrested who are youths (*YouthsArrested*) or who are nonwhite (*NonWhiteArrests*). Both coefficients are positive as expected. The share of all homicides that occur through the intervention of police (*MurdersWithCops*) relates negatively to the rate of arrest. The interventions may signal danger to potential criminals and thus induce them to try harder to avoid either committing crimes or getting arrested.

The rate of arrest also relates negatively to the share of adults who don't vote in Presidential elections (*NotVoting*). The relationship remains negative after inclusion, among independent variables, of the rate of unemployment, which correlates negatively with the rate of nonvoting and positively with the rate of arrest. One can speculate that the negative link between the arrest rate and the nonvoting rate reflects the impact of apathy on voting and on crime.

Regression Statistics	
Dependent variable	*Arrest rate*
Adjusted R Square	0.949925
Standard Error	0.151121
F	119.562
Observations	26

Variables	**Coefficients**	**t Stat**	**Lower 95%**	**Upper 95%**
Intercept	-7.80301	-5.15274	-10.95225	-4.65376
NotVoting	-2.88439	-6.21009	-3.85031	-1.91847
YouthsArrested	1.05250	6.95303	0.73771	1.36730
MurdersWithCops	-1.07245	-4.15875	-1.60874	-0.53616
NonWhiteArrests	1.57864	2.68389	0.35543	2.80185

In general, the index of rebelliousness fell slightly over late 1940s and then rose steadily to 1970.

The implied penalty of killing an officer followed a similar pattern. It fell through the late 1940s and early 1950s, then rose. The penalty depends partly on how much longer the killer might have expected to live, had he not risked life imprisonment or execution by killing an officer. The expectation of additional years of life for an arrest suspect, minus the expected length of imprisonment, fell from 36.5 years in 33.4 years in 1952, then rose to 42 years in 1970.

These trends raise the possibility that, since the likelihood of a police death per arrest fell over the 1950s and rose over the 1960s, the impulse to kill due to rebelliousness may have grown more important, relative to the penalty of lost freedom, during the Sixties. A more precise conclusion may hinge upon the estimation of P_3.

6 Appendix A: Data

P_k. Data sources: Series H987-989 in [4]. The number of officers killed by felons is available in [4] only for 1961 through 1970. For 1945 through 1960, the study estimates the number of officers killed by felons. It multiplies the total number of law enforcement officers killed in line of duty by a factor based on a linear regression. This regresses, on the year, the share of officers killed by felons, for years 1961 through 1970, excluding 1968. The equation is *FelonShare* = - 23.2 + 0.0121 *Year*, R^2 (adjusted) = .441. T-statistics are (-2.63, 2.70) on the intercept and coefficient, respectively. The F statistic (7.31) suggests that the regression provides a more valuable estimate of the share of officers killed by felons than the mean of shares for 1961-1970.

The regression excludes 1968 because the share of officers killed by felons that year was onetime and unusually low. The share in 1968 was .52, compared to a mean of .61 for 1961-70. The drop was evidently due as much to an unusually large number of officers killed in accidents as to an unusually small number of officers killed by felons. From 1967 to 1968, the number of officers killed in accidents rose, from 47 to 59; the number of officers killed by felons dropped, from 76 to 64.

Most murders of officers do not occur during arrests. Of 61 officers killed in situations involving felons in 1998, 22 (36 percent) died during arrests or while serving arrest warrants [7]. Focusing a study of police murders on arrests, however, allows clearly for two possibilities: The killer may have acted on impulse; or he may have acted after pre-meditation. The second-largest source of police murders, investigation of disturbance calls, seems more likely to involve impulsive killings. To study the link between criminal behavior and rationality, a focus on arrests seems appropriate.

v. Data source: Series Y27 in [4].

s. The share of all homicides that occurred through the intervention of police. It is computed from Series H977 and H971 in [4]. Estimates for 1945 through 1948 are computed from a linear regression of *s* on the year for 1949-1970, with an adjustment in the intercept such that the percentage change from 1948 to 1949 equals the mean annual percentage change from 1949 through 1970.

The original regression was $s = 1.0933 - .0054\,Year$, t-statistics (7.8, -7.6) on the intercept and coefficient, respectively; adjusted $R^2 = .73$. The mean annual percentage change from 1949 through 1970 was -1.9138 percent. To constrain the change from 1948 to 1949 to equal this change, I subtracted .006224 from the intercept.

F. This variable is the suspect's expectation of years of freedom remaining in his life if he is now arrested. It measures the penalty to the suspect of killing the officer and consequently suffering life imprisonment or execution.

Here's how I computed the variable. Let the suspect's age be s. Let his life expectancy at that age be $L(s)$. Let the expected length of his prison term, in the event of an arrest at time t, be $P(t)$. Let the share, in all arrests, of those of suspects of age s be $A(s)$. Then

$$F(t) = \sum_{s=10}^{70} A(s,t)[L(s,t) - P(t)].$$

Details follow.

s, A(s,t) and *L(s,t).* Historical data are available for persons arrested in age brackets. For a given age bracket, I estimated the mean age for those arrested; I assumed that those arrested varied between ages 10 and 70. I then estimated the life expectancy for a male of that age of a given racial group by interpolating linearly between the reported life expectancies for the age just above *s* and the age just below *s*.

Data are available for life expectancy at birth as well as at ages 20, 40, 60 and 70 in Series B116 through B125 in [4].

The life expectancy at age *s* in time *t* is defined here as the average number of years that those of that age would continue to live if they were subject to the same death rates, for particular age brackets, as prevailed at time *t*. Current death rates — rather than of either actual future death rates or projected future death rates — seem most appropriate in computing the arrest suspect's expectation of the length of his remaining life. I have drawn upon current life tables computed for a hypothetical cohort of a stationary population that is supported by 100,000 annual births. The computations assume no migration [5]. The current life tables compute the "average number of years" in the life expectancy at age *s* in this way: Estimate the total number of years remaining to those in the hypothetical cohort who would survive to the *s*th birthday; and divide this number of years by the number of survivors.

Annual life expectancy data are available, for given ages, back to 1955. Estimates are also available for the periods 1949-51 and 1939-41. To estimate annual data for 1945 through 1954, I regressed the natural log of life expectancy on the natural log of the year. I then calibrated the regression estimates to those available for 1949-51 and 1939-41 by resetting the intercept.

I computed two series of life expectancy: White and nonwhite. "White" includes those reported as Mexican, Cuban and Puerto Rican. *L(s)* is the weighted average of these two series for a given mean age *s*, where the weights are the share of that racial group in all arrests.

I distinguished between racial groups because both life expectancy and shares of arrest differ significantly between the groups. I used life expectancy figures for males since these differ significantly from those for women, who are rarely suspects in murders of officers. From 1988 through 1997, of 950 suspects in murders of officers, 886 (93 percent) were male [6].

P(t): Expected duration of imprisonment. This annual series is calculated as the annual probability of imprisonment times the long-run length of the prison term actually served.

Length of prison term. This was estimated by regressing the number of prisoners released in year *t* upon the current value and lags of the number of prisoners received into prison from the courts. I used the lags as estimates of effective prison terms. The average prison term is a weighted average of the lags, where the coefficient values provide the weights. To determine the number of lags to use, I added longer lags to the regression until adjusted R-squared exceeded .9. The data come from Series H1135, 1138 and 1144 of [4].

I estimated the length of the prison term for two time periods. For 1945-1957, prison terms appear relatively short for inmates of state and federal penitentiaries:

Regression statistics	
Dependent variable:	*Prisoners released*
Adjusted R Square	0.92
Standard Error	2640.79
Period	1945-1957
Observations	13

Model		
Variable	*Coefficients*	*t Stat*
Intercept	3061.88	0.46
Received in current year	0.26	1.01
Received in prior year	0.74	3.21

The estimated average length of the prison term for this period is $.26*1+.74*2=1.74$.

For 1958-1970, prison terms appear significantly longer:

Regression statistics	
Dependent variable:	*Prisoners released*
Adjusted R Square	0.91
Standard Error	2200.26
Period	1958-1970
Observations	13

Model		
Variable	*Coefficients*	*t Stat*
Intercept	-100185.81	-4.13
Received in current year	0.83	3.68
Received in prior year	0.38	1.98
Received two years before	0.09	0.44
Received three years before	-0.01	-0.03
Received four years before	0.22	1.11
Received five years before	0.83	3.93

The estimated length of the prison sentence is 3.42. I set to zero the relative weight on prisoners received three years before; its impact on current prisoners released is relatively insignificant. Thus the estimated length is $(.83*1+.38*2+.09*4+.22*5+.83*6)/(.83+.38+.09+.22+.83)=3.42$.

Probability of imprisonment. This is calculated as the share, of all criminal cases that disposed of the defendant, that ended in a conviction of imprisonment. There is no need to calculate a probability of arrest, since the data concern only suspects on the point of arrest. Data: Series H1100 and 1108 of [4].

G. Homicides by firearms and explosives as a share of all homicides: Index of gun supply among criminals. Data: Series H975 and H971 of [4].

N. Real spending by all governments on police protection, per arrest, deflated by the GNP implicit price deflator. Data for 1951, 1947 and 1945 are linearly interpolated. Data: Series H1013, E1 and H999 of [4].

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