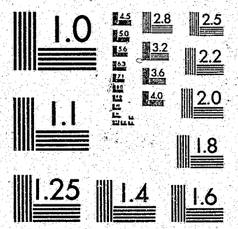

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Estimating the Economic Model of Crime: The Baltimore Case*

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Estimating the Economic Model of Crime: The Baltimore Case

Ann Dryden Witte (1980) has recently argued in this journal that new support is found for the deterrent hypothesis (or the "economic model of crime") when individual data are employed to estimate the determinants of rearrest rates. Her principal findings are that (1) increases in the certainty and severity of punishment tend to reduce participation in crime (measured by number of arrests or convictions per month free) and (2) higher legal wages have an extremely weak deterrent effect on crime.

Early evidence in support of the hypothesis that the certainty and severity of punishment deter crime has been seriously challenged by a recent panel established by the National Academy of Sciences. In their summary of the panel's report, Blumstein et. al. (1978) report that although most available evidence reveals a negative association between aggregate crime rates and punishment, "Any conclusion that these negative associations reflect a deterrent effect...is limited principally by the inability to eliminate other factors that could account for the observed relationships, even in the absence of a deterrent effect."[1] In a careful evaluation of virtually all of the published econometric tests of the deterrence hypothesis, statisticians Brier and Fienberg (1980) conclude that the aggregate crime and imprisonment data used empirically to examine the conventional model of crime are "so untrustworthy as to render any serious analysis meaningless."[2]

Witte avoids the criticism of previous attempts to estimate the economic model of crime by utilizing a rich, carefully constructed

micro-data set of released prisoners in North Carolina. In addition she is able to provide a more intuitive specification of the supply of crime by including direct measures of legitimate opportunities, which are obscured in aggregate data sets. The results she obtains, however, should be interpreted with caution.

Witte provides two possible measures of participation in crime: total arrests per month free and total convictions per month free. Both are biased measures of actual time allocated to crime. Both could conceivably capture elements of selectivity among alleged criminal offenders who may differ in their distributions of success in crime (or in endowments of attributes associated with the ability to avoid detection or to defy demonstration of guilt). To the extent that individual data are employed, and self-reported measures of crime are unavailable, some measure of official reported participation in crime is the best one could hope for.

Between arrests and convictions, however, arrests is to be preferred as the measure of participation in crime. The plea bargaining process typically results in a combining of a number of charges, thus making numbers of convictions a downwardly biased measure of crime participation. Many of those who get convicted, once, for numerous crimes will go to prison, and be out of the relevant universe by which to measure participation in crime. Similarly, those who do get convicted many times and who remain free, undoubtedly have committed less serious acts than those who have few convictions but who go to jail. Dividing by months free does not eliminate this problem, and as in the case of arrests, there is no one-to-one

relationship between number of crimes committed and number of convictions. To complicate matters, convictions measure the effectiveness of the police and the courts and this may make the interpretation of results using this proxy for participation in crime extremely difficult. This, of course, is the more serious flaw of the conviction variable as a measure of participation in crime. A strong inverse relationship between post-prison convictions and the probability of imprisonment may arise because of a positive relationship between prior criminal record of the accused and the ability of prosecutors to secure a conviction.[3] This relationship undoubtedly arises because judges and juries <u>believe</u> that those previously caught and proven guilty (or who plead guilty) are indeed guilty when they appear again before the court. Since more previous arrests translate into lower prior conviction probabilities, and more previous convictions result in lower prior imprisonment probabilities, the observed inverse relationship between post-prison conviction and prior punishment probabilities may be but an artifact of this sort of criminal history effect.

Admittedly the arrest variable could be contaminated with the same bias. The ideal way to correct for such bias is to estimate separate equations for the criminal justice production function and the offense supply function. This effort would require data on the inputs by the police and courts for <u>each case</u>. Short of the ideal, though, the arrest variable should be chosen as the measure of participation in crime because it corresponds with the entry level of the official criminal justice system and is thereby somewhat less contaminated than the conviction variable, which is confounded by

the behavior of police, prosecutors, judges, juries and defense counsel.[4]

Witte presents two equations where the dependent variable is total arrests per month free. They are reproduced below where P(C/A) is her measure of the certainty of conviction, P(J/C) the certainty of imprisonment, EXLOS the severity of punishment, WAGEAR the wage rate, MSTAY--which the author nowhere defines explicitly in the article--, TPOWR initial wealth, MFJAR time to first job, AAR and AAR^2 age and age squared, AFA age at first arrests, ARRBS prior arrests, RACE, MS marital status, ALKY alcohol use, JUNKY drug use, SUPER parole supervision, MS married and RULE the number of in-prison violations:[5]

(1) ARRAT = .5177 − .1760 P(C/A) − .1376 P(J/C) − .0010 EXLOS
(4.370) (−2.650) (−1.422) (−3.222)

−.0196 WAGEAR − .0577 MSTAY − .0024 TPOWR
(−.991) (−1.380) (.513)

− .0086 MFJAR X^2 = 23.948
(−1.093)

(2) ARRAT = .5739 − .0643 P(C/A) − .0858 P(J/C)
(3.301) (−.998) (−.927)

− .0006 EXLOS − .0251 WAGEAR − .0254 MSTAY
(1.663) (−1.337) (−.648)

− .0004 TPOWR − .0088 MFJAR − .0104 AAR + .0000 AAR^2
(−.093) (−1.208) (−1.116) (.459)

+ .0024 AFA + .0160 ARABS − .0771 RACE − .0155 MS
(.679) (5.093) (−2.656) (−.496)

+ .0292 ALKY + .1182 JUNKY − .0801 SUPER + .0164 RULE
(.982) (1.991) (−2.469) (1.851)

X^2 = 88.361

The first equation reveals a strong deterrent effect of the certainty and severity of punishment and an insignificant effect of

wages. When other variables capturing background characteristics and prison and criminal experiences are entered in the second equation, the statistical significance of wages increases while both the certainty and severity of punishment become insignificant. One could argue that on the basis of the higher chi-squared value, appropriately adjusted for degrees of freedom, the second equation should be preferred. The variables excluded in equation one include measures of tastes or preferences as well as indicators of previous criminal history that could both be correlated with the propensity to engage in crime and the included right hand side variables. In particular, one notes that ARRBS, prior arrests, is the denominator in the certainty of punishment variable, P(C/A). As previous criminal record rises, so does the measure of the probability of getting caught. But those who have been caught frequently in the past can expect to be rearrested more frequently because they have been labelled as criminals. So, omission of this variable may bias upward the coefficient of the certainty of punishment variable. Clearly, the conclusion that the certainty and severity of punishment strongly deters crime is reversed in the preferred equation. When other measures of tastes and criminal history are introduced, in addition, the effect of legitimate opportunities becomes statistically significant.

Accepting Witte's challenge to refute her findings with other micro-data sets, we present below estimates of arrest equations that reveal that returns to legitimate activity do indeed have a strong effect on crime rates and that the certainty and severity of punishment have minor, insignificant effects.

The Department of Labor sponsored an experiment in Baltimore between 1971 and 1974 wherein 432 high-risk male offenders were divided into groups that received weekly stipends of up to $60.00 a week for 13 weeks, assistance in finding a job, neither or both. To minimize work disincentives, stipends were continued (but reduced) when employment was found until a sum of $780 had been received. The sample is drawn from the Baltimore LIFE (Living Insurance for Ex-prisoners) experiment.[6]

The sample consists of males released from Maryland's state prisons to the Baltimore Metropolitan Area who had low financial resources, were repeat offenders, had no known history of alcohol or narcotic abuses and who had not been on work release for more than three months. The average age is twenty-four. Thirty-seven percent of the exoffenders were under 21 years. Only 10% were over 35. On the average, 4.387 years were served in prison for the current offense. Eighty-one percent had served five years or less. The range of time served was 2 to 21 years. About 87% of the sample is black, most had been raised in families with male heads (x_i = 67.8%) and had jobs arranged when they were released from prison (x_i = 57.9%). Most had held principally secondary labor market jobs or were previously unemployed (x_i = 52.5%), and all had extensive criminal records. The average number of previous arrests was 8 with 30% having 10 or more. The total number of arrests ranged to 40. Similarly, on the average the exoffenders had been convicted 4 times with a range of 25 previous convictions.

Experience, denoted by the longest job held, discounted by time

since longest job held, averaged 17.5 months. It was calculated on the basis of the following formula:

Y = experience in months

X = length of time on longest job in months

Z = months since longest job

$Y = X \cdot \exp(-.004167(Z))$

The discount rate is approximately 5% per year.

Ten percent had had less than 2 months discounted experience, 30% less than 6 months and about 50% less than a year. A group of 10% had had from 43 to 59 months of discounted experience.

The average school grade completed was the ninth grade, although 60% had completed less than 8 years of school.

Using the Baltimore LIFE data a stylized variant of the economic model of crime is estimated. These results are presented below.

$$\ln(\text{Arrest}/(1-\text{Arrest})) = 2.529 - .015^{**}\text{WAGE} \quad (3.352)\ (-5.943)$$

$$-.291^{*}\text{Treatment} - .058\ \text{Education} \quad (-1.377)\ (-1.078)$$

$$-.001\ \text{Experience} + .513^{*}\text{Black} - .035^{*}\text{Age} \quad (-.107)\ (1.599)\ (-1.622)$$

$$-.054\ \text{Time Served} + .087\ \text{Paroled} \quad (-.915)\ (.321)$$

$$-.239\ \text{Job Arranged} - .136\ \text{Convictions/Arrests} \quad (-1.025)\ (-.597)$$

$x^2 = 70.352^{**}$

* Significant at 10% level
** Significant at 1% level

The dependent variable is the probability that the offender was ever rearrested in one year following release from prison. The measures of the independent variables are subject to similar criticisms as those leveled against Witte's measures. The certainty of punishment is calculated to be the ratio of previous convictions to previous arrests. The severity of punishment is the time served for the last offense. Wage is the average weekly wage income for the entire year--averaging about $59.00. This measure to some extent takes account of varying hours worked, as well as varying wage rates on different jobs. It is superior to Witte's as a proxy for the returns to legitimate activity but more explicitly exposes the simultaneity of work-crime decisions implied by Witte's variable MJOB, months until first job. Elsewhere the author has obtained instrumental variable estimates of a linear model of post-prison rearrest, wages, hours worked and days in jail (Myers, 1980). The coefficients of the wage variable in the rearrest equation are found to be larger in absolute value, while the certainty and severity of punishment coefficients remain essentially the same. So, it can be suggested, that the results of Table 1 may underestimate the relative effectiveness of legitimate opportunities. It is easy to see that there is no significant effect of increasing certainty or severity of punishment on crime whereas returns to legitimate activity significantly reduces the probability of recidivism.[7]

Clearly these results are supportive of a general economic model of crime, but not necessarily that economic model that Witte ascribes to Becker and Ehrlich. Yet both Becker and Ehrlich recognize the possible deterrent effectiveness of improved legitimate activities,

with Ehrlich noting the likely positive relationship between certainty of punishment and crime when offenders are risk lovers.

Further evidence of the effect of legitimate opportunities on crime is found in an examination of monthly post-prison "survival" probabilities, detailed in Table 1. Here the dependent variable is defined as the probability that an individual was not rearrested in month t, given that up until that point he was not rearrested. This conditional probability denotes in essence the survival rate. The independent variables are the same as those in the annual rearrest equation, except that average weekly wages for the year are replaced with average weekly wages in month t. In every month, save the first, the average weekly wage is positively related to post-prison success and significant at the 1% level. In the first month the level of significance drops to 10%, but the effect is still positive.

However, virtually no evidence is found for the contention that increased certainty or severity of punishment increases the post-prison survival rate. In none of the twelve monthly equations is the estimated coefficient for the severity of punishment significantly different from zero. And, only in the sixth month is the certainty of punishment statistically significant. Then it has the traditional positive sign.

It is valid to note that other variables in the model frequently fail the significance test too. However, no other variable manages to enter the monthly survival equations with as consistently low significance levels as do the certainty and severity of punishment variables. Moreover, on the basis of the high chi-squared values in

all but the first two months, we reject the hypothesis that collectively the estimated coefficients should be zero.

In sum then, both on the basis of these results and on the preferred equation of Witte, Witte's claim of strong support for the deterrent effectiveness of punishment argument is weakened.

Increasingly the evidence from criminological research points to the conclusion that "nothing works" to reduce crime, particularly recidivism, except for incarceration, which reduces it by incapacitating the offender. This may be a faulty view. Economists appear well suited to investigate and devise innovative labor market strategies that can be expected to have significant impacts on crime reduction. At least in the context of general economic models of criminal behavior it has been shown that improving legitimate opportunities should work. Even Witte (1976) has demonstrated in other published works that programs such as work release do work. Thus, Witte's present results are not conclusive enough to warrant the premature judgment that the efficacy of traditional criminal justice strategies exceeds that of labor market solutions to the crime problems.

TABLE 1

Maximum Likelihood Estimates of Coefficients in Logistic Model of Monthly Survival Probabilities
(t-statistics in parentheses)

Independent Variable	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Constant	4.849	1.826	2.906	2.619	2.555	1.480	1.041	0.431	-0.421	-1.398	-1.702	-2.541
	(2.012)	(1.356)	(2.640)	(2.608)	(1.796)	(1.801)	(1.289)	(0.551)	(-0.562)	(-1.924)	(2.259)	(-3.350)
Treatment Group	1.297	0.576	0.358	-0.009	-0.071	0.256	0.255	0.250	0.024	0.184	0.194	0.250
	(1.572)	(1.482)	(1.163)	(-0.032)	(-0.280)	(1.144)	(1.151)	(1.153)	(0.116)	(0.887)	(0.933)	(1.214)
Nonwhite	-.100	-0.085	-0.353	-0.361	-0.561	-0.508	-0.509	-0.680	-0.350	-0.210	-0.444	-0.410
	(-.092)	(-0.150)	(-0.688)	(-0.784)	(-1.325)	(-1.370)	(-1.431)	(-1.954)	(-1.077)	(-0.662)	(-1.3898)	(-1.300)
Paroled	-.207	0.010	0.137	0.752	0.506	0.291	0.388	0.297	0.044	0.091	-0.049	0.024
	(-.262)	(0.022)	(0.368)	(2.272)	(-1.675)	(1.040)	(1.410)	(1.101)	(0.167)	(0.351)	(-0.187)	(0.091)
Job Arranged	.684	0.533	-0.264	-0.388	-0.147	-0.148	-0.178	-0.102	0.362	0.301	0.284	0.332
	(.855)	(1.272)	(-0.769)	(-1.267)	(-0.532)	(-0.586)	(-0.726)	(-0.428)	(1.579)	(1.343)	(1.242)	(1.452)
Experience	.026	0.004	0.008	0.013	0.022	0.015	0.011	0.014	0.009	0.0000004	0.009	0.005
	(.893)	(0.026)	(0.700)	(1.119)	(2.110)	(1.695)	(1.304)	(1.608)	(1.121)	(0.998)	(1.082)	(0.626)
Convictions/Arrests	-.197	0.234	0.133	-0.028	0.204	0.817	0.449	0.368	-0.077	0.060	-0.204	-0.116
	(-.155)	(0.344)	(0.237)	(-0.055)	(0.450)	(1.983)	(1.126)	(0.943)	(-0.204)	(0.162)	(-0.553)	(-0.315)
Age	-.786	-0.016	-0.040	-0.029	-0.036	-0.031	-0.018	0.0004	0.012	0.033	0.030	0.043
	(-1.356)	(-0.414)	(-1.326)	(-0.977)	(-1.364)	(-1.314)	(-0.792)	(0.019)	(0.569)	(1.710)	(1.382)	(2.023)
Time Served	.146	0.002	0.022	-0.046	-0.025	-0.032	-0.023	-0.032	-0.006	0.010	0.071	0.060
	(.663)	(0.022)	(0.304)	(-0.700)	(-0.421)	(-0.577)	(-0.429)	(-0.596)	(-0.106)	(0.204)	(1.288)	(1.082)
Education	-.089	0.004	-0.082	-0.122	-0.121	-0.077	-0.066	-0.040	-0.003	0.004	0.042	0.082
	(-.518)	(0.046)	(-1.074)	(-1.712)	(-1.898)	(-1.334)	(-1.183)	(-0.745)	(-0.057)	(0.085)	(0.786)	(1.582)

TABLE 1--continued

Independent Variable	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Average Weekly Wage in in Month t	.012 (1.282)	0.010 (2.444)	0.016 (4.519)	0.019 (5.927)	0.013 (5.170)	0.010 (4.814)	0.011 (5.584)	0.011 (5.577)	0.010 (5.707)	0.010 (5.848)	0.009 (5.337)	0.007 (4.337)
[Mean Weekly Wage in Month t]	[$49.75]	[$57.09]	[$60.19]	[$65.70]	[$63.71]	[$63.34]	[$62.24]	[$61.24]	[$59.00]	[$60.08]	[$58.56]	[$51.26]
Mean Survival Rate	97.92%	92.59%	87.73%	83.33%	78.94%	72.22%	68.75%	65.71%	60.19%	55.32%	51.62%	46.76%
X^2	9.515	13.388	29.848	61.946	49.716	40.784	50.284	51.734	52.822	53.914	58.224	50.524

Footnotes

1. Blumstein, et. al. (1978) p. 6.

2. Brier and Fienberg (1980) p. 151.

3. In his classic account of the determinants of recidivism Glaser (1969, p. 27) relates, "All the evidence tends to support the conclusion that the extent of an offender's prior criminal record will indicate the probability of his adding to it."

4. This principle was stated long ago by Thorsten Sellin (1931, p. 335): "...the value of a crime rate for index purposes decreases as the distance from the crime itself in terms of procedure increases."

5. Equation (1) corresponds to Regression 1 of Table II and Equation (2) corresponds to Regression 3 of Table II in Witte (1980).

6. For an earlier anlaysis of this data set see Mallar and Thornton (1976).

7. It is not so surprising that wages have a minor effect on recidivism after the fourth month. Most of the rearrests occurred shortly after release. Anyone who makes it through eight or nine months without getting rearrested--and then is unaffected by better wages--probably wasn't deterred in the first place but managed not to get caught while all along engaging in crime. Alternatively, we would speculate that some ex-prisoners, parolees and those with extensive criminal histories in particular, who manage not to get caught for many months are regarded with greater suspicion by law enforcement authorities, and are thereby more likely to be rearrested independently of the individual disincentive effect of better wages. This could be true in the case of parolees because as the parole expiration date approaches and formal supervision

ends the unique opportunity for law enforcement officials to monitor parolee activities ceases. This could be true in the case of exoffenders with extensive criminal histories because who would believe that someone with 20 previous arrests could manage to stay out of crime for 9 months? Such an alleged criminal may manage to get rearrested even if he did not engage in crime. These illustrative interpretations are partially reinforced by the positive coefficients estimated for the variables convictions/arrests and paroled in months 9 and 11.

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