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Article *in* Journal of Criminal Justice · September 2008

DOI: 10.1016/j.jcrimjus.2008.07.008

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Journal of Criminal Justice

The deterrent effect of executions: A meta-analysis thirty years after Ehrlich

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ARTICLE INFO

ABSTRACT

In 1975, Ehrlich published a seminal paper in *American Economic Review* which argued that executions prevent murders in America. Subsequent empirical studies varied in their methodology and the time-period/region/country covered, and therefore it is difficult to draw a clear conclusion about the deterrent effect of executions. This article applies a meta-analysis to combine the results from refereed studies in order to summarize objectively the findings. The overall results of the meta-analysis supported the deterrent effect of executions, but the evidence for a deterrent effect depended on the type of study carried out (time-series and panel data versus cross-sectional data and the effects of publicity).

Introduction

In 1975, Ehrlich (1975) published a seminal paper in *American Economic Review*, using econometric analyses, that radically changed the nature of research on the deterrent effect of the death penalty, and which stimulated econometric research into the issue. At this point in time, the United States remains the only Western industrialized country where capital punishment is still in force. Arguments for and against capital punishment are made on many grounds, one of which centers around whether it is a deterrent or not. Erhlich argued that his results indicated that executions deter murderers.

Although there have been several reviews and critiques of the research into the deterrent effect of executions (e.g., Cameron, 1994; Yang, 1998), as well as briefer reviews in the introductions to the many research studies, and detailed critiques of the methodologies involved (e.g., Donohue & Wolfers, 2005), it is still unclear whether there is any consistency in the results and the conclusions. Meta-analysis (Rosenthal, 1991), a statistical analysis that combines information from several studies, is a useful procedure for ascertaining consistency in a set of research studies and was employed in this study.

Ehrlich's research

The current interest of economists in criminal behavior began with Becker's (1968) rational choice analysis of both the individual's criminal behavior and society's response to crime. Ehrlich (1973, 1975) extended Becker's model and subjected it to elaborate empirical tests, one part of which was to explore whether executions have a deterrent effect on murder when individuals, including criminals, respond to the incentives and penalties embodied in the justice system.

Ehrlich was the first to employ a multiple regression analysis for estimating the deterrent effect of executions, with the advantage over previous research of embracing simultaneously several independent variables that affect the behavior of murder. To explain the murder rate, Ehrlich (1975) used the probability of arrest, the conditional probability of conviction, the conditional probability of execution, the per capita expenditures on police, and other socioeconomic and demographic variables, together with a time variable. Using national data for the United States compiled by the FBI for the period of 1933 to 1969, along with a log-linear form of the regression equation of the murder rate, Ehrlich found that the elasticity of the execution rate was negative and statistically significant. The empirical result suggested that one execution might prevent seven or eight murders a year during the period he studied.

Ehrlich's conclusion provoked a storm of controversy, which intensified because, in a constitutional challenge to the death penalty then pending in the United States Supreme Court (*Fowler v. North Carolina*, 1974), the Solicitor General presented Ehrlich's findings to the Court, and in his amicus brief, cited them as important empirical support that executions deter murderers (Baldus & Cole, 1975).

Ehrlich's empirical study was criticized extensively on a number of grounds (e.g., Layson, 1985), such as: (1) the FBI data used to measure murder and the probabilities of punishment were highly suspect, especially during the 1930s; (2) the results were sensitive to the inclusion of additional explanatory variables and the choice of functional form; (3) the results were unstable over the 1960s; and (4) since the conclusion was based on a correlational analysis, the actual causality might run in the opposite direction.

For example, both Bowers and Pierce (1975) and Passell and Taylor (1977) attempted to replicate Ehrlich's results and discovered that the strength of the deterrent effect of executions was dependent upon the choice of a logarithmic form for the model under estimation. These investigators also found that the deterrent effect was not significant

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doi:10.1016/j.jcrimjus.2008.07.008

Table 1
Time series studies

	Period	Control variables	Number of coefficients	Average effect size[e]	Researcher's conclusion	State
Canada						
Avio (1979)[a]	1926–1960	Yes	33	−0.083	No effect	
Avio (1988)[a]	1926–1960	Yes	12	−0.183	Deterrent	
Layson (1983)[a]	1927–1977	Yes	11	−0.415	Deterrent	
Lester (1993)[a]	1926–1958	No	6	+0.115	Mixed[f]	
England and Wales						
Wolpin (1978)[a]	1929–1968	Yes	7	−0.404	Deterrent	
Japan						
Merriman (1988)[a]	1957–1982	Yes	3	−0.321	Deterrent	
United States						
Ehrlich (1975)[a]	1935–1969	Yes	15	−0.462	Deterrent	
Bowers & Pierce (1975)[a]	1933–1969	Yes	142	−0.011	No effect	
Yunker (1976, 1977)[a]	1933–1972	Yes	5	−0.404	Deterrent	
Sesnowitz & McKee (1977)[a]	1960–1972	Yes	1	−0.877	No effect	
Fox (1977)[a]	1960–1972	Yes	1	+0.341	No effect	
Passell & Taylor (1977)[a]	1935–1969	Yes	8	−0.055	No effect	
Bechdolt (1977)[a]	1933–1974	Yes	4	−0.233	No effect	
Kleck (1979)[c]	1947–1973	Yes	4	+0.044	No effect	
Hoenack & Weiler (1980)[c]	1935–1969	Yes	4	−0.219	Mixed	
Cantor & Cohen (1980)[a]	1936–1975	Yes	20	−0.446	Deterrent	
Layson (1985)[a]	1935–1977	Yes	15	−0.508	Deterrent	
Layson (1986)[a]	1934–1984	Yes	9	−0.684	Deterrent	
Cover & Thistle (1988)[a]	1936–1977	Yes	18	−0.193	Mixed	
Chressanthis (1989)[a]	1965–1985	Yes	1	−0.350	Deterrent	
Fox & Radelet (1990)[a]	1936–1977	Yes	4	−0.242	No effect	
Peterson & Bailey (1991)[c]	1976–1987	Yes	25	+0.058	No effect	
Marvell & Moody (1999)[a]	1930–1995	Yes	4	+0.064	No effect	
Yunker (2001)[a]	1930–1997	Yes	4	−0.135	Deterrent	
Dezhbakhsh & Shepherd (2006)[a]	1960–2000	Yes	10	−0.635	Deterrent	
Individual states						
Bailey (1978a)[c]	1910–1962	Yes	12	+0.025	No effect	NC
Bailey (1979a)[c]	1910–1962	Yes	12	+0.035	No effect	CA
Bailey (1979b)[a]	1910–1962	Yes	12	−0.041	No effect	OH
Bailey (1979c)[a]	1918–1962	Yes	4	+0.033	No effect	OR
Bailey (1984)[d]	1890–1970	Yes	25	+0.057	Brutalization	DC
Bailey (1998)[c]	1989–1991	Yes	64	−0.003	Brutalization	OK
Decker & Kohfeld (1984)[b, c]	1933–1980	Yes	7	−0.218	No effect	IL
Decker & Kohfeld (1986)[a, b]	1930–1984	Yes	4	+0.160	No effect	FL
Decker & Kohfeld (1987)[b, c]	1933–1980	Yes	4	−0.032	No effect	MO
Decker & Kohfeld (1988)[b, c]	1932–1986	Yes	3	+0.056	No effect	TX
Decker & Kohfeld (1990)[a]	1931–1980	Yes	10	−0.140	No effect	CA, GA, NC, NY, TX
Sorensen, Wrinkle, Brewer, & Marquart (1999)[a]	1984–1997	Yes	2	+0.022	No effect	TX
Inadequate data:						
Bailey (1979–1980)[d]	1910–1967	Yes	--	−0.250	Mixed	39 states
Bailey (1978b)[d]	1910–1962	Yes	--	−0.333	No effect	UT
Bowers & Pierce (1980)[d]	1907–1964	No	--	+0.462	Brutilization	NY
Cities						
Bailey (1983a)[a] Chicago	1915–1921	Yes	166	+0.065	Brutalization	
Month-to-month changes						
Inadequate data:						
Cloninger & Marchesini (2001)[d]	1996–1997	No	4	−0.123	Deterrent[g]	
Monthly data						
Bailey & Peterson (1989)[c]	1940–1986	Yes	14	−0.062	No effect	
Bailey (1990)[c]	1976–1987	Yes	9	−0.082	No effect	
Daily						
Grogger (1990)[a]	1960–1963	No	235	−0.009	No effect	CA

[a] Effect sizes calculated from t-values.
[b] Effect sizes calculated from correlation coefficients.
[c] Effect sizes calculated from b/s.e.
[d] Effect size based on comparing the numbers of positive and negative regression coefficients (or other statistic) using an X^2 test and converting this to a Pearson r.
[e] Calculated by the present authors using an unweighted average of all of the individual effect sizes within each article.
[f] Unpublished data were used to calculate the effect size.
[g] Cloninger and Marchesini (2001) examined each of twenty-four months separately, and did not perform overall statistical tests on any of their four tables of results. For the present meta-analysis, the four tables of data were reduced to four X^2 tests, the X^2 values converted to Pearson correlations, and these were averaged.

when data from the 1960s were excluded from the regression analysis. During this period, there was a sudden rapid increase of crime of all types, including murder, while both the average length of prison terms and the probability of execution declined.[1]

Further challenges to the deterrence hypothesis came from economists with a welfare economics perspective and from those using more advanced econometric techniques. These econometric issues (including data problems such as measurement error and nonstationarity, specification problems, the influence of prior beliefs, and the application of more advanced econometric techniques) have been reviewed by Yang (1998) and are omitted here.

The present article undertakes a meta-analysis of the studies investigating the deterrent effect of executions on murder in order to see whether such a quantitative analysis can detect reliable effects; whether deterrent or brutalization.

Meta-analysis

In evaluating the deterrent effect of executions, it is important to note that there exist several problems involved in the empirical research that make it very difficult to reach a consensus in drawing conclusions. These problems arise from the decisions made by researchers about the following issues:

1. Measurement of the dependent and the primary independent variables

The measurement of executions[2] may be in terms of absolute number, number per murder, or number per capita of the population, while the murder or homicide rate can be obtained either from FBI crime statistics or the National Institutes of Health mortality statistics, respectively.

2. The nature and domain of the data set

The data set can be time-series or cross-sectional, or a combination of both (that is, panel data). In addition, the data set can be obtained from various countries (such as Canada, the United Kingdom, or the United States) and from different time periods. One further possibility is the choice between studying the nation as a whole or different regions separately (such as a particular state or city).

3. The estimation techniques

The ordinary least squares (i.e., multiple regression) was clearly the favorite choice early on, while maximum likelihood estimation (e.g., the logit model) was sparingly used. More recently, simulation techniques have been applied to generate samples, for example, as in bootstrapping. The selection of an estimation technique may vary according to the size and the nature of the data set and whether a single equation or a system of equations is employed for the estimation.

4. Data mining

Data mining consists of (a) transforming the scores for some variables (such as using logarithmic or square root transformations), (b) eliminating outliers or not, and (c) using the basic values of the variables or first (and second) order differences to deal with nonstationarity problems. There may be bias introduced from the use of multivariate techniques and the way in which the results are presented. Different journals and editors have different requirements for how the results are reported, and there is no standardized set of statistics that must be presented in a scholarly paper. The present meta-analysis used the results as presented and the transformational formulae and procedures provided by Rosenthal (1991).

5. Other measurement and specification errors

Other measurement errors refers to (a) errors made in the choice of variables used as proxies for such variables as the risk of punishment (e.g., when the number of offenses is used in both the measure of the crime rate and the risk of capture), and (b) econometric errors, such as simultaneous equation bias, the identification problem, the influence of prior beliefs, and the issue of nonstationarity.

Previous reviews of the research on the deterrent effect of capital punishment on murder have selected some of the available studies and endeavoured to draw a conclusion. It is never clear whether all of the available studies have been reviewed, nor on what basis the authors drew their overall conclusion.

One way to resolve some of this confusion is to conduct a meta-analysis, a statistical analysis that combines information from several studies. The 104 studies included in the present meta-analysis represent a collection of individual, subjective value calls about the methodology, design, data collection, estimation technique, etc. A standard review of the studies can easily lead to confusion and the lack of a clear conclusion. Meta-analysis provides an objective method that can be used to overcome the subjectivity of the individual studies and of the reviewer of the set of studies.

The idea is to define a common parameter called the standard effect size, reduce the results of each study to this standard effect size, and then average the standard effect sizes from all of the studies. This article presents such a meta-analysis of the studies on the deterrent effect of executions on homicide, showing how the sample of studies

Table 2
Cross-sectional studies

	Period	Number of states	Number of coefficients	Control variables	Effect size	Researcher's conclusion
Bailey (1974, 1975)[b]	1967/1968	27	8	No	−0.192	Deterrent
Passell (1975)[a]	1950/1960	41/44	16	Yes	+0.136	No effect
Bailey (1976)[d]	1930–1967	32–38	38	No	+0.278	Brutalization
Ehrlich (1977)[c]	1940/1950	43/44	52	Yes	−0.460	Deterrent
Bechdolt (1977)[a]	1970	?	6	Yes	+0.212	Brutalization
Bailey (1977)[b]	1920–1960	?	9	Yes	−0.033	No effect
Bailey (1980b)[c]	1956–1960	31	32	Yes	+0.006	No effect
Leamer (1982)[c]	1950	35	2	Yes	−0.185	Deterrent
Leamer (1983)[c]	1950	44	1	Yes	−0.273	Mixed[f]
McAleer & Veall (1989)[c]	1950	44	10	Yes	−0.440	No conclusion
Veall (1992)[c]	1950	44	7	Yes	−0.403	No conclusion
Boyes & McPheters (1977)[a]	1960	47	3	Yes	+0.172	No effect
Cloninger (1977, 1987)[a]	1960	48	4	Yes	−0.297	Deterrent
Yunker (2001)[a]	1997	51	4	Yes	−0.166	Deterrent
Yang & Lester (1988)[b]	1955–1959	41	5	Yes	+0.060	Deterrent
Brumm & Cloninger (1996)[a]	1985	59 cities	1	Yes	−0.343	Deterrent
Inadequate data:						
Black & Orsagh (1978)[e]	1950/1960	43/47	12	Yes	+1.000	No effect
Bailey (1980a)[e]	1910–1962	48	93	Yes	−0.239	Deterrent
Peterson & Bailey (1988)[e]	1973–1984	?	147	Yes	+0.156	No effect
Changes						
Forst (1977)[c]	1970–1960	32	10	Yes	+0.227	No effect
Bailey (1983b)[b]	1950–1960	32	4	Yes	+0.076	No effect

[a] Effect sizes calculated from t-values.
[b] Effect sizes calculated from correlation coefficients.
[c] Effect sizes calculated from b/s.e.
[d] Effect size based on p-values.
[e] Effect size based on comparing the numbers of positive and negative regression coefficients (or other statistic) using an X^2 test and converting this to a Pearson r.
[f] Leamer reported number of murders deterred and the standard error rather than a regression coefficient. The same data were reported by McManus (1985).

was chosen and how the calculations were carried out, presenting the results for each study in the sample, and discussing the results.

Method

Sampling and measurement

The meta-analysis was carried out using the following procedures.

1. Only studies published in peer-reviewed journals were included. No studies appearing in books or presented as conference papers, but which never appeared in peer-reviewed journals, were included. Peer-reviewed reports have been judged to be adequate by the reviewers of the journals and thus have passed at least one judgment of methodological adequacy.
2. Studies published after Ehrlich's (1975) paper in *American Economic Review* were identified by searching ECONLIT, PSYCLIT, SOCIOLIT and Criminal Justice Abstracts. The bibliographies of relevant articles were also searched for empirical studies.
3. The many results in each study were reduced to one overall effect size. For example, whether a study reported thirty-three regression coefficients (e.g., Avio, 1979) or three (e.g., Lester, 1993), a single average effect size was calculated for the study. The number of analyses carried out on one data set is often determined by the page allotment permitted by the journal or editor and sometimes by the extent of data mining engaged in by the researcher. Both weighted (based on the number of analyses) and unweighted means, however, are presented in Table 6.
4. The Pearson correlation coefficient rather than Cohen's (1977) d was chosen as the measure of effect size.[3] This choice was made because of the greater familiarity of researchers with the meaning of Pearson correlation coefficients (their size and range of possible values).
5. Effect sizes were calculated using the formulae provided by Rosenthal (1991, pp. 15-25) for converting X^2, t, F, z, and p values into effect sizes.
6. A few studies simply compared homicide or murder rates in states with and without a death penalty without any correlational or regression analyses while others compared mandatory and discretionary death penalty statutes (e.g., Bailey & Lott, 1977). These studies were omitted from the meta-analysis. Only studies on executions *per se* were included.
7. It should be noted that, in the tables, a minus sign indicates a deterrent effect and a plus sign a brutalization effect.

The results of the meta-analysis are presented in sufficient detail in the tables so that other researchers can make alternative decisions and conduct alternative analyses if desired.

The studies identified

According to the procedures laid out above, a total of 104 studies were identified for the meta-analysis. Only 95 of these studies had adequate data, that is, they provided estimates of t-values, correlation coefficients, regression coefficients together with standard errors, X^2 statistics, or p-values which could be used to calculate effect sizes as defined in item #5 above.

One study (Stack, 1987) was excluded from the meta-analysis because only two regression coefficients were reported with no t-test or standard error reported, thereby not permitting an estimate of the effect size.

A further nine studies were included in the tables, but listed under inadequate data because they reported a large number of regression coefficients with no standard error or test of statistical significance. For these studies, the numbers of positive and negative regression

Table 3
Panel data

	Regions	Period	Observations	Controls	Number of tests	Effect size	Researcher's conclusion
Chi-square analyses							
Lester (1979a)[c]		1930-1965	1,646	No	1	-0.940	Deterrent[e]
Cloninger (1992)[a]		1983-1988	254	No	4	-0.188	Deterrent
Lester (2000)[c]		1977-1992	720	No	1	+0.074	No effect
Wasserman (1981)[c]		1930-1965	1,715	No	1	-0.111	No effect
Regression analyses							
Albert (1999)[a]	States	1982-1994	663	Yes	10	-0.024	No effect
Ehrlich & Liu (1999)[a]	States	1940/1950	87	Yes	23	-0.346	Deterrent
Katz, Levitt, & Shustorovich (2003)[b]	States	1950-1990	1,844	Yes	18	-0.016	No effect
Dezhbakhsh, Rubin, & Shepherd (2003)[a]	Counties	1977-1996	3,054	Yes	6	-0.162	Deterrent
Mocan & Gittings (2003)[b]	States	1977-1997	750	Yes	9	-0.066	Deterrent
Liu (2004)[a]	States	1940, 1950	56/67	Yes	8	-0.453	Deterrent
Shepherd (2004)[a]	States	1977-1999	13,059	Yes	86	-0.028	Deterrent
Zimmerman (2004)[a]	States	1978-1997	1,000	Yes	6	-0.054	Deterrent
Donohue & Wolfers (2005)[a] re-analyses:							
Katz et al. (2003)			2,954	Yes	16	+0.006	No effect
Dezhbakhsh & Shepherd (2006)			1,968/2,009	Yes	5	-0.069	No effect
Mocan & Gittings (2003)			679/986	Yes	10	-0.153	No effect
Shepherd (2005)[a]	Counties	1977-1996	Various	Yes	162	+0.021	Brutalization
Zimmerman (2006)[a]	States	1978-2000	1,148	Yes	11	-0.285	Mixed
Dezhbakhsh & Shepherd (2006)[a]	States	1960-2000	1,638	Yes	16	-0.147	Deterrent
Ekelund, Jackson, Ressler, & Tollison (2006)[a]	States	1995-2000	255	Yes	9	+0.135	Mixed
Fagan, Zimring, & Geller (2006)[b]	States	1976-2002	1,377	Yes	10	+0.001	No effect
	TX counties	1976-2002	6,858	Yes	10	+0.004	No effect
Inadequate data:							
Peterson & Bailey (1988)[d]	States	1973-1984	?	Yes	6	0.000	No effect

[a] Effect sizes calculated from t-values.
[b] Effect sizes calculated from b/s.e.
[c] Effect size based on X^2 statistic.
[d] Effect size based on comparing the numbers of positive and negative regression coefficients (or other statistic) using an X^2 test and converting this to a Pearson r.
[e] Lester (1979b) found that the deterrent effect switched to a brutalization effect at high rates of execution, but he did not perform any statistical tests of this trend.

Table 4
Single executions

	Region	Time period	Controls	Number of coefficients	Effect size	Researcher's conclusion
Lester (1980)[b]	U.S.	Month/ fourteen days	No	2	-0.021	No effect
Cochran, Chamlin, & Seth (1994)[a]	OK	Week	No	27	+0.116	Brutalization
Cochran & Chamlin (2000)[a]	CA	Next week	No	21	-0.002	Mixed
Thomson (1997)[b]	Three cities, AZ	Nine months	No	22	+0.351	Brutalization
Thomson (1999)[b]	Los Angeles, CA	Month/eight months	No	21	+0.010	Mixed

[a] Effect sizes calculated from t-values.
[b] Effect size based on X^2 statistic.

coefficients were compared using an X^2 test and the resulting X^2 converted to a Pearson r using the formula reported in item #5 above.[4]

Five types of empirical studies for testing the deterrence hypothesis can be identified: (1) time-series studies on a nation or region as a whole, (2) cross-sectional studies over a set of regions in one year, (3) panel data covering a set of regions and several years, (4) the impact of a single execution, and (5) the impact of execution publicity from a series of executions. Each category will be reviewed in a separate section.[5]

Tables 1–5 present studies included in each category identified by the authors' names, publication date, period covered, region studied, the use of control variables (classified as yes versus no), number of coefficients reported in the study, average effect size calculated by the present authors, and the investigators' conclusion. The average effect size (see Table 6) was calculated in two ways: (1) a simple arithmetic mean of each effect size and (2) a weighted mean, weighting each effect size by the number of coefficients upon which it was based.

For the cross-sectional studies, the number of regions was noted; for panel data, the total number of observations; and for single executions and publicity, the region studied. The number of coefficients reported by each investigator varied depending on the specification of the estimation model and the particular data sets chosen for study.

Results

The following sections describe the features of the results of the meta-analysis that were associated with each of the five categories of studies.

Time-series studies:

This category led among the five with forty-one studies with adequate data, covering four nations. As indicated in Table 1, there were four studies on Canada, one on England and Wales, one on Japan, and thirty-five on the United States.

Twenty-eight of the effects sizes were negative, indicating a deterrent effect, and thirteen were positive, indicating a brutalization effect, a statistically significant difference. The mean unweighted effect size was -0.155, significantly different from zero, indicating an

Table 5
Publicity

	Place	Years	Number of coefficients	Controls	Effect size	Researcher's conclusion
Newspaper publicity						
King (1978)[a, c]	South Carolina	1950–1963 (20 months)	1	No	+0.107	No effect
Stack (1990)[a]	South Carolina	1950–1963 (168 months)	9	No	-0.127	Deterrent
Stack (1993)[a]	Georgia	1950–1965 (192 months)	2	No	+0.052	No effect
Stack (1998)[d]	California	1946–1955 (120 months)	1	No	-0.192	Deterrent
Bailey & Peterson (1989)[c]	United States	1940–1986 (564 months)	32	Yes	-0.039	No effect
Phillips (1980)[b]	England	1858–1921 (19 weeks)	2	No	-0.578	Deterrent
Bailey (1998)[c]	Oklahoma	1989–1991 (156 weeks)	60	Yes	+0.073	Brutalization
Television publicity						
Bailey (1990)[c]	United States	1976–1987 (144 months)	9	Yes	+0.075	No effect
Peterson & Bailey (1991)[c]	United States	1976–1987 (144 months)	23	Yes	+0.080	No effect
Publicity: day of execution						
Television publicity						
Phillips & Hensley (1984)[a]	United States	1973–1979 (25,556 days)	26	Yes	-0.012	Deterrent
Inadequate data						
Stack (1995)[d]	United States	1977–1984	20	No	-0.200	Deterrent

[a] Effect sizes calculated from t-values.
[b] Effect size based on p-values.
[c] Effect sizes calculated from b/s.e.
[d] Effect size based on comparing the numbers of positive and negative regression coefficients (or other statistic) using an X^2 test and converting this to a Pearson r.
[e] The effect size was based on a t-test calculated by the present authors on the data provided in King's article.

Table 6
Summary of meta-analysis

	n	Negative coefficients	Positive coefficients	Unweighted mean	Weighted mean
Adequate data					
Table 1 Time series studies	41	28[a]	13	-0.155[b] (se=0.039)	-1.267[b] (se=0.491)
Table 2 Cross-sectional studies	18	10	8	-0.090 (se=0.058)	-1.010 (se=1.520)
Table 3 Panel data	21	15[a]	6	-0.133[b] (se=0.051)	-0.987 (se=0.477)
Table 4 Single executions	5	2	3	+0.091 (se=0.069)	+2.200 (se=1.510)
Table 5 Publicity	10	5	5	-0.056 (se=0.066)	+0.306 (se=0.542)
Combined	95	60[a]	35	-0.115[b] (se=0.025)	-0.809[b] (se=0.387)
Including inadequate data					
Table 1 Time series studies	45	31[a]	14	-0.147[b] (se=0.039)	-1.125[b] (se=0.479)
Table 2 Cross-sectional studies	21	12	9	-0.034 (se=0.073)	-0.260 (se=2.120)
Table 3 Panel data	22[c]	15[a]	6	-0.127[b] (se=0.049)	-0.943 (se=0.457)
Table 4 Single executions	5	2	3	+0.091 (se=0.069)	+2.200 (se=1.510)
Table 5 Publicity	11	6	5	-0.069 (se=0.061)	-0.086 (se=0.627)
Combined	104[c]	66[a]	37	-0.102[b] (se=0.026)	-0.680 (se=0.501)

[a] Negative versus positive coefficients significant at the 5 percent level or better.
[b] Significantly different from zero at the 5 percent level or better.
[c] One coefficient was zero.

overall deterrent effect. The results from the weighted mean and when studies with inadequate data were included showed a similar deterrent effect.

Cross-sectional studies

Table 2 summarizes the results of eighteen studies with adequate data using a cross-sectional methodology. Ten effect sizes indicated a deterrent effect and eight a brutalization effect. The mean effect size did not differ significantly from zero. Thus, overall, these studies did not support either a deterrent or a brutalization effect of executions. The results using weighted means and including studies with inadequate data supported the same conclusion.

Panel-data studies

Table 3 summarizes twenty-one panel-data studies with adequate data. Fifteen effect sizes indicated a deterrent effect and six a brutalization effect, a significant difference in favor of a deterrent effect. The mean effect size was -0.133, significantly different from zero. The results using weighted means and including studies with inadequate data supported the same deterrent effect.

Single execution studies

Table 4 summarizes five studies which examined the impact of a single execution on the murder rate. One covered the United States as a whole, two covered individual states, and the other two covered cities. Two of the resulting effect sizes were negative (indicating a deterrent effect) and three were positive. Overall, there was neither support for a deterrent nor for a brutalization effect.

Publicity studies

Ten studies examined the impact of newspaper or television publicity of executions, using months, weeks, or days as the unit of time (see Table 5). Five studies had a negative effect size, while five had a positive effect size, indicating no overall effect from the publicity surrounding executions on the murder rate.

Summary of the overall estimation results

The results of the meta-analysis are summarized in Table 6. The table consists of two parts, one for the studies with adequate data, the other including those studies with inadequate data. For each part, the number of effect sizes and the number which were negative and positive are presented. In addition, both an unweighted average effect size (together the standard error) and the average effect size weighted by the number of coefficients reported in the study (together with the standard error) are presented. Finally, all of the studies from the five different methodologies were combined to provide an overall picture.

For the ninety-five studies with adequate data, sixty indicated an overall deterrent effect while only thirty-five indicated a brutalization effect, a statistically significant difference ($X^2=6.58$, df = 1, two-tailed $p<.02$). A simple unweighted mean for all of the Pearson correlation coefficients was -0.115 (standard error = .025), a statistically significant deterrent effect ($t=4.60$, df = 94, two-tailed $p<.001$). Weighting the coefficients by the number of estimates in each study and including studies with inadequate data also indicated a statistically significant deterrent effect.

Discipline and era

An attempt was made to examine whether economic studies differed from studies in other disciplines in their results.[5] Since the discipline of the authors of research is not always self-evident and since coauthors might differ in discipline, the studies were categorized as appearing in an economics journal versus all others. The point-biserial correlation between discipline and effect size was -0.25 ($n=19$, $p>.05$) for the time series studies (in Table 1) and -0.43 ($n=17$, $p>.05$) for the panel data studies (in Table 3).

To examine the impact of the era, the effect size for the time series studies were correlated with the beginning year of the time series and the end year.[7] The correlations were not significantly different from zero (0.04 and -0.04, respectively).

Discussion

Ever since Ehrlich published his work on the deterrent effect of executions, which was based on economic theory and econometric analyses, researchers have attempted similar analyses to support or refute his conclusions. The research has intensified and become more in-depth over the years. In the past, conclusions from reviews of the empirical studies of time-series, cross-sectional, and panel-data analyses using data from countries and individual regions have not been such that reviewers could draw a clear conclusion about the deterrent effect of executions. The debate over the deterrence hypothesis has a long history and involves scholars from several disciplines, each of which has its own methodology, perspectives, assumptions, and beliefs about human behavior. Due to these differences, it is not surprising that similar and even identical data sets can lead to different and contrary conclusions.

Against this background, a possible solution is to apply a meta-analysis to the studies, a statistical technique that combines information from all of the studies in order to summarize the results of research on the deterrence hypothesis using a numerical score. The present article has undertaken this task by reviewing 104 refereed studies on the deterrence hypothesis stimulated by Ehrlich's (1975) seminal paper and conducting a meta-analysis of the studies.

The presence of a deterrent effect in this meta-analysis depended upon the type of study. The statistically significant deterrent effect was found most clearly for the time-series studies and for the panel studies. In contrast, the cross-sectional studies, the studies of the effect of single executions, and the studies of newspaper and television publicity gave mixed results, and deterrent or brutalization effects failed to reach statistical significance.

It is intriguing to ask why the methodologies incorporating the dimension of time (time-series and panel data) gave evidence for a deterrent effect, while the cross-sectional (ecological studies over regions) did not. This difference in the results of time-series and cross-sectional studies is found in other areas (such as the socioeconomic predictors of aggregate suicide rates) (see Lester & Yang, 1995). Perhaps individuals are more likely to make decisions based on past conditions in their own community rather than by comparing their conditions with that of others in different ecological areas. The reasons for these differences in the outcome of the meta-analysis, however, are far from clear. It is hoped that the present meta-analysis will stimulate thought and research on this issue.

The implications of this review of the evidence concerning the existence of a deterrent effect from executions should be considered with some caution because executions result in the death of individuals. Besides the fundamental ethical argument for the value of human life, there are other considerations in employing capital punishment.

For example, the application of the death penalty to murderers may be affected by race (African American murderers who murder White victims may be at greater risk of being sentenced to death and executed), sex (male murderers are at higher risk of being sentenced to death and executed than are women), and social class (poor defendants may be at greater risk of being sentenced to death and executed than defendants who can afford to pay more competent defense lawyers) (Lester, 1998).

In addition, any decrease in the murder rate after executions theoretically may be caused by the motives of normative validation and victim mobilization rather than deterrence itself. Moreover, the possibility of executing innocent people is unavoidable. A recent newspaper article reported the release of twenty-one people from death row in the three-year period 1999-2001 based on the results of DNA testing (Masters, 2001). Legislation has been considered in Congress to provide funding for DNA testing and for the provision of more competent lawyers in capital murder cases.

Even if executions are shown to deter potential murderers, alternative strategies to reduce the murder rate may be more effective and more ethically acceptable, depending on one's theory of the etiology of murder (such as stricter gun control, elimination of poverty, legalization of drugs, etc.).[8] Such considerations may weigh more heavily in decisions to retain or abolish the death penalty than econometric analyses of the deterrent effect of the death penalty.

Notes

1. See also critiques by Baldus and Cole (1975) and Beyleveld (1982).

2. Only studies of executions were included in the meta-analysis—not studies of the presence or absence of a death penalty statute.

3. Conversion from r to d and vice versa is easily accomplished.

4. These studies were reported in the tables of results separately so that readers can ascertain for themselves whether their exclusion would have biased the results.

5. For the purpose of the meta-analysis, the individual studies were not evaluated for the adequacy of their methodology, because to make such an evaluation brings in a subjective factor (for different reviewers would make different decisions about this issue), and the goal of the present meta-analysis was to avoid subjectivity. For the same reason, the strengths and weaknesses of the five categories of studies (listed in Tables 1–5) were not evaluated. As noted, however, all the studies appeared in peer-reviewed journals.

6. This analysis was requested by an anonymous reviewer.

7. This analysis was requested by an anonymous reviewer.

8. See Cloninger and Marchesini (2006) for a similar argument.

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