Getting off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment

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GETTING OFF DEATH ROW: COMMUTED SENTENCES AND THE DETERRENT EFFECT OF CAPITAL PUNISHMENT*

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ABSTRACT

This paper merges a state-level panel data set that includes crime and deterrence measures and state characteristics with information on all death sentences handed out in the United States between 1977 and 1997. Because the exact month and year of each execution and removal from death row can be identified, they are matched with state-level criminal activity in the relevant time frame. Controlling for a variety of state characteristics, the paper investigates the impact of the execution rate, commutation and removal rates, homicide arrest rate, sentencing rate, imprisonment rate, and prison death rate on the rate of homicide. The results show that each additional execution decreases homicides by about five, and each additional commutation increases homicides by the same amount, while an additional removal from death row generates one additional murder. Executions, commutations, and removals have no impact on robberies, burglaries, assaults, or motor-vehicle thefts.

> I have inquired for most of my adult life about studies that might show that the death penalty is a deterrent, and I have not seen any research that would substantiate that point. [FORMER U.S. ATTORNEY GENERAL JANET RENO at a Justice Department press briefing, January 20, 2000]

I. INTRODUCTION

EMPIRICAL studies of the economics of crime have established credible evidence regarding the impact of sanctions on criminal activity. In particular, it has been demonstrated that increased arrests and police have deterrent

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effects on crime.[1] The analysis of the determinants of homicide is especially important because it poses an interesting test for economic theory. According to the standard economic model of crime, a rational offender would respond to perceived costs and benefits of committing crime. Murder is an important case to test this behavioral hypothesis because murder may be considered a crime that can be committed without regard to costs or benefits of the action. However, empirical tests reveal that even murder responds to costs of crime.[2] Capital punishment is particularly significant in this context, because it represents a very high cost for committing murder (loss of life). Thus, the presence of capital punishment in a state or the frequency with which it is used should unequivocally deter homicide. Yet it has been a difficult empirical task to identify the impact of capital punishment on homicide simply because there is not much variation in the execution rates in a cross section of states or over time to estimate its impact on homicide with precision.

The statement of former U.S. Attorney General Janet Reno cited above highlights the mixed scientific evidence on the deterrent effect of the death penalty. Isaac Ehrlich found a significant deterrent effect of capital punishment on murder rates using aggregate time-series and cross-sectional data.[3] Ehrlich's findings were challenged by subsequent work on the grounds of the identification of the murder supply equation, the functional form of the equations estimated, the sample period investigated, and the choice of variables.[4] Ehrlich and others responded to these criticisms.[5] Nevertheless, the

[1] Hope Corman & H. Naci Mocan, A Time-Series Analysis of Crime, Deterrence, and Drug Abuse in New York City, 90 Am. Econ. Rev. 584 (2000); Steven D. Levitt, Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime, 87 Am. Econ. Rev. 270 (1997); Jeffrey Grogger, Certainty vs. Severity of Punishment, 29 Econ. Inquiry 297 (1991).

[2] For example, an increase in murder arrests decreases murders in New York City. Corman & Mocan, *supra* note 1; Hope Corman & Naci Mocan, Carrots, Sticks and Broken Windows (Working Paper No. 9061, Nat'l Bur. Econ. Res., July 2002).

[3] Isaac Ehrlich, The Deterrent Effect of Capital Punishment: A Question of Life and Death, 65 Am. Econ. Rev. 397 (1975); and Isaac Ehrlich, Capital Punishment and Deterrence: Some Further Thoughts and Additional Evidence, 85 J. Pol. Econ. 741 (1977).

[4] Edward E. Leamer, Let's Take the Con Out of Econometrics, 73 Am. Econ. Rev. 31 (1983); Stephen A. Hoenack & William C. Weiler, A Structural Model of Murder Behavior and the Criminal Justice System, 70 Am. Econ. Rev. 327 (1980); Peter Passell & John B. Taylor, The Deterrent Effect of Capital Punishment: Another View, 67 Am. Econ. Rev. 445 (1977); William J. Bowers & Glenn L. Pierce, The Illusion of Deterrence in Isaac Ehrlich's Research on Capital Punishment, 85 Yale L. J. 187 (1975).

[5] Isaac Ehrlich & Zhiqiang Liu, Sensitivity Analyses of the Deterrence Hypothesis: Let's Keep the Econ in Econometrics, 42 J. Law & Econ. 455 (1999); Isaac Ehrlich & George D. Brower, On the Issue of Causality in the Economic Model of Crime and Law Enforcement: Some Theoretical Considerations and Experimental Evidence, 77 Am. Econ. Rev. 99 (1987); Isaac Ehrlich, The Deterrent Effect of Capital Punishment: Reply, 67 Am. Econ. Rev. 452 (1977).

issue of whether the death penalty deters murder is still debated in the media,[6] as well as in academia.[7]

Because of the ethical, moral, and religious aspects of capital punishment, executing death row inmates generates repercussions, even from outside the United States. For example, Pope John Paul II appealed to then-governor George W. Bush to stop an execution scheduled for January 2000. Recently, state lawmakers have been reacting to the sentiment that there is arbitrariness and possibly a racial bias in the implementation of the death penalty by proposing legislation to either abolish it or institute a moratorium.[8] Similarly, a bill was recently introduced in the U.S. Congress to abolish the death penalty under federal law.[9]

In this paper, we investigate whether the death penalty is a deterrent for homicide. An inherent difficulty in uncovering an impact of deterrence on crime is to find appropriate data sets to overcome the issue of simultaneity between criminal activity and deterrence measures. Low-frequency time-series data or cross-sectional data are not satisfactory to address the issue.[10] We use a state-level panel data set that contains information on homicide and other crimes, deterrence variables, and relevant capital punishment measures, along with a number of state characteristics.

An innovation of this paper is the use of a Department of Justice data set that is new to the literature. This data set contains detailed information on the entire history of 6,143 death sentences between 1977 and 1997 in the United States. For example, the reason and exact month of removal from death row are identified for each prisoner. This information is valuable as it

[6] Recent examples are Gallup Poll: Americans and the Death Penalty, on CNN Live Today (June 27, 2001); Former New York governor Mario Cuomo and Oklahoma governor Frank Keating on Meet the Press (NBC, June 10, 2001); Death Penalty as a Deterrent, on The O'Reilly Factor (Fox News Network, June 11, 2001).

[7] Hashem Dezhbakhsh, Paul H. Rubin, & Joanna M. Shepherd, Does Capital Punishment Have a Deterrent Effect? New Evidence from Postmoratorium Panel Data, 5 Am. Law & Econ. Rev. 344 (2003); Jon Sorensen *et al.*, Capital Punishment and Deterrence: Examining the Effect of Executions on Murder in Texas, 45 Crime & Delinq. 481 (1999); Samuel Cameron, A Review of the Econometric Evidence on the Effects of Capital Punishment, 23 J. Socio-Econ. 197 (1994); James Peery Cover & Paul D. Thistle, Time Series, Homicide, and the Deterrent Effect of Capital Punishment, 54 S. Econ. J. 615 (1988); Walter S. McManus, Estimates of the Deterrent Effect of Capital Punishment: The Importance of the Researcher's Prior Beliefs, 93 J. Pol. Econ. 417 (1985); Sam G. McFarland, Is Capital Punishment a Short-Term Deterrent to Homicide? A Study of the Effects of Four Recent American Executions, 74 J. Crim. L. & Criminology 1014 (1983); Stephen Layson, Homicide and Deterrence: Another View of the Canadian Time-Series Evidence, 16 Can. J. Econ. 52 (1983); Brian Forst, Capital Punishment and Deterrence: Conflicting Evidence? 74 J. Crim. L. & Criminology 927 (1983).

[8] Legislators in at least 21 states have recently proposed legislation to modify their current capital punishment laws. Illinois governor George H. Ryan imposed a moratorium in 2000 and issued a blanket commutation in January 2003 for all prisoners awaiting execution.

[9] Federal Death Penalty Abolition Act of 2001, S. 191, 107th Cong., 1st Sess. (January 25, 2001) (introduced by Senator Russell Feingold, D-Wis.).

[10] Corman & Mocan, *supra* note 1; Levitt, *supra* note 1.

allows us to link executions to criminal activity in the proper time frame. More specifically, previous studies linked the crime rate in a given year to the number of executions in the same year. However, if an execution takes place toward the end of a year, it cannot considerably affect crime rates in that same year (as the crimes for that year have been committed since January). Rather, such an execution is expected to affect the crime rate of the following year. This issue is potentially significant because 47 percent of all executions, 53 percent of all removals from death row for reasons other than executions and other deaths, and 51 percent of all commutations (reductions in sentence) between 1977 and 1997 took place between the months of July and December.

Another innovation of this paper is the investigation of the impact on homicide of removals from death row. A removal from death row takes place if the capital sentence is declared unconstitutional by the state court or the U.S. Supreme Court, the conviction is affirmed but the sentence is overturned by the appellate court, the conviction and sentence are overturned by the appellate court, or the sentence of the prisoner is commuted.[11] In this paper, we investigate the impact of removals, and the impact of commutations (a subset of removals), on homicide. Both of these represent a decrease in the expected cost of committing the crime and should have a positive effect on the homicide rate. The impact of commutations and removals from death row on homicide or other crimes has not been investigated before.

We find statistically significant relationships between homicide and executions, commutations, and removals. Specifically, each additional execution or commutation reduces or increases homicides by about five, while an additional removal from death row generates about one additional murder.

Section II gives the background on the death penalty in the United States. Sections III and IV describe the methodology and the data, respectively. Section V presents the results. Section VI consists of the extensions, and Section VII is the conclusion.

II. Recent History of Capital Punishment and the Data Set

In the late 1960s, 40 U.S. states had laws authorizing use of the death penalty. However, strong pressure by those opposed to capital punishment resulted in few executions. For example, there were 145 executions between 1960 and 1962. In 1963 and 1964, there were 21 and 15 executions, respectively. Between 1965 and 1967, there were a total of 10 executions, and nobody was executed between 1968 and 1972. All executions were halted and hundreds of inmates had their death sentences lifted by a Supreme Court

[11] The cases in which an inmate is deceased or executed on death row are not considered removals from death row for the purposes of this paper. Thirty-five cases in which the removal is "for other reasons" were not included in the analysis.

decision in 1972.[12] The Supreme Court struck down federal and state laws that had allowed wide discretion resulting in arbitrary and capricious application of the death penalty. Three of the Supreme Court justices voiced concerns that included an appearance of racial bias against black defendants. Furthermore, laws that imposed a mandatory death penalty and those that allowed no judicial or jury discretion beyond the determination of guilt were declared unconstitutional in 1976.[13] Starting in the mid-1970s, many states reacted by adopting new legislation to address the concerns of the Supreme Court, and these new state laws were later upheld by the Supreme Court.[14] New state statutes created two-stage trials for capital cases, where guilt/innocence and the sentence were determined in two different stages. The first post-*Gregg* execution took place in 1977 in Utah, and the number of executions has since continued to rise. Currently, only 12 states and the District of Columbia do not have capital punishment, although a number of states are considering abolishing the death penalty.[15]

Figure 1 displays the murder rate in the United States per 100,000 people between 1977 and 1997, along with the number of executions during the same time period. Following the first post-*Gregg* execution in 1977, the number of executions increased to an average of about 20 per year around the mid-1980s. After remaining stable until the early 1990s, the number of executions started rising in 1993, reaching 74 executions in 1997. The homicide rate was 8.8 murders per 100,000 people in 1977. It reached 10.2 in 1980, and then started declining continuously until 1984. When the number of executions was relatively stable in late 1980s, the murder rate rose again, reaching 9.8 murders per 100,000 people in 1991. It began declining after 1991 and went down to 6.8 in 1997.

III. Empirical Methodology

To investigate the impact of capital punishment and other forms of deterrence on homicide, we estimate regressions of the following form:

$$\text{MURDER}_{it} = \mathbf{DETER}_{it-1}\beta + \mathbf{X}_{it}\Omega + \mu_i + \psi_{it} + \eta_{it} + \varepsilon_{it}, \qquad (1)$$

where MURDER_{it} is the homicide rate in state i and year t and **DETER** stands for the vector of deterrence variables. Following Ehrlich and the subsequent literature,[16] **DETER** consists of the subjective probabilities that

[12] Furman v. Georgia, 408 U.S. 153 (1972).

[13] Woodson v. North Carolina, 428 U.S. 280 (1976); Roberts v. Louisiana, 428 U.S. 325 (1976).

[14] For example, Gregg v. Georgia, 428 U.S. 153 (1976); Jurek v. Texas, 428 U.S. 262 (1976); and Proffitt v. Florida, 428 U.S. 242 (1976).

[15] The 12 states are Alaska, Hawaii, Iowa, Maine, Massachusetts, Michigan, Minnesota, North Dakota, Rhode Island, Vermont, West Virginia, and Wisconsin.

[16] Ehrlich, The Deterrent Effect, *supra* note 3.

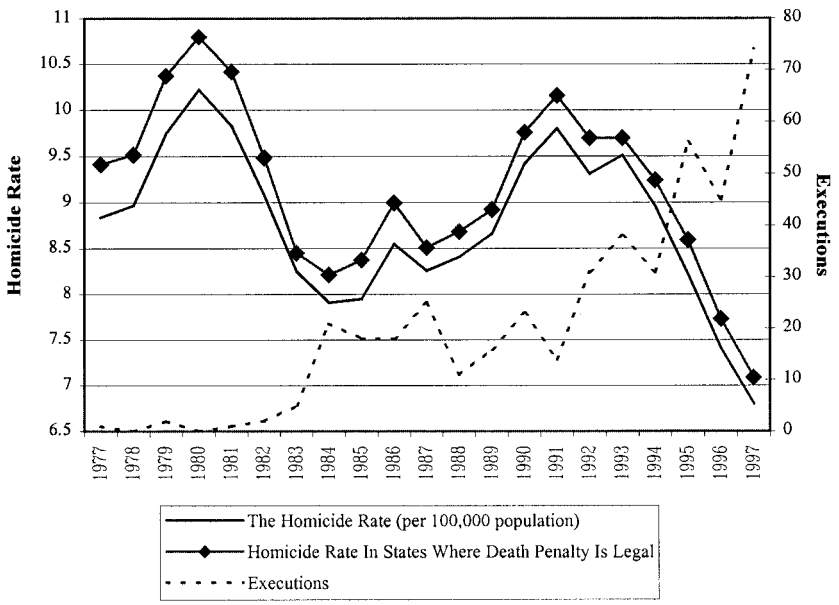

FIGURE 1.—Executions and the homicide rate in the United States

potential offenders are apprehended, convicted, and executed. The first one of these probabilities is measured by the murder arrest rate (the proportion of murders cleared by an arrest). The second probability is calculated as the ratio of death sentences in year t divided by murder arrests in year $t - 2$.[17] Following Steven Levitt and Lawrence Katz, Levitt, and Ellen Shustorovich, incapacitation is calculated as the number of prisoners per violent crime.[18] Following the results of Katz, Levitt, and Shustorovich,[19] we also included the prison death rate, a measure of prison conditions, as another deterrence measure. The fifth variable in **DETER** pertains to the probability of execution given conviction. Following Hashem Dezhbakhsh, Paul Rubin, and Joanna

[17] The same measure is used by Dezhbakhsh, Rubin, & Shepherd, *supra* note 7. In our inmate-level data set, the annual average duration between a murder arrest and the day the inmate is sentenced is about 1.3 years. Using sentences in year t to arrests in year $t - 1$ gave identical results. To be comparable to Dezhbakhsh, Rubin, & Shepherd, we reports results with arrests lagged 2 periods.

[18] Steven D. Levitt, Juvenile Crime and Punishment, 106 J. Pol. Econ. 1156 (1998); Lawrence Katz, Steven D. Levitt, & Ellen Shustorovich, Prison Conditions, Capital Punishment, and Deterrence, 5 Am. L. & Econ. Rev. 318 (2003). As Levitt notes, the number of individuals in custody as a fraction of the population may correspond more closely to the theoretical notion of incapacitation. Thus, as an alternative measure we also employ the number of prisoners per population.

[19] *Supra* note 18.

Shepherd,[20] we calculate the risk of execution as the number of executions in year t to death sentences in year $t - 6$.[21, 22] The data set also contains information on death row inmates whose sentences are commuted. An increase in this type of clemency implies a decrease in the probability of execution, which economic theory predicts should have a positive impact on murder rates. We use the number of commutations divided by death sentences 6 years ago as an (inverse) deterrence measure. As an alternative measure of inverse deterrence, we use a more comprehensive measure of removals from death row that includes all removals other than executions and other deaths on death row. Such removals include inmates who received a commuted sentence, those who are removed from death row because the capital sentence is declared unconstitutional by the state court or the U.S. Supreme Court, those for whom the conviction is affirmed but the sentence is overturned by an appellate court, or those for whom the conviction and sentence are overturned by an appellate court.[23]

The vector $\boldsymbol{X}$ contains state characteristics that may be correlated with criminal activity. It includes information on the unemployment rate, real per capita income, the proportion of the state population in the age groups 20–34, 35–44, 45–54, and 55 years and over, the proportion of the state population in urban areas, the proportion that is black, the infant mortality rate, and the legal drinking age in the state.[24] The variable μ_i represents unobserved state-specific characteristics that affect the murder rate, and η_t represents year effects. To control for the impact of the 1995 Oklahoma City bombing, we included a dummy variable that takes the value of one in Oklahoma in 1995 and zero elsewhere. The models also include state-specific time trends represented by ψ_{it}.

[20] *Supra* note 7.

[21] In an earlier version, we calculated this probability as the number of executions per death row inmates in the same year. Although this is a measure of a flow over a stock, we obtained very similar results.

[22] Dezhbakhsh, Rubin, and Shepherd, *supra* note 8, perform their analysis at the county level. Another difference between their paper and ours is that we employ a larger number of deterrence variables.

[23] Following Katz, Levitt, & Shustorovich, *supra* note 18; Corman & Mocan, *supra* note 1; Levitt, *supra* note 18, deterrence variables are lagged once to minimize the impact of simultaneity between the murder rate and deterrence measures. Because the number of homicides appears in the numerator of the independent variable and in the denominator of the homicide arrest rate and prisoners per violent crime, measurement error in homicides generates biased estimates. Unlike other types of crimes, measurement error in the homicide variable is unlikely to be consequential. Nevertheless, lagging the deterrence measures also helps to minimize this potential bias as well (Levitt, *supra* note 17).

[24] Theoretical and empirical justification for the inclusion of these variables can be found in Levitt, *supra* note 18; and John R. Lott, Jr., & David B. Mustard, Crime, Deterrence, and Right-to-Carry Concealed Handguns, 26 J. Legal Stud. 1 (1997).

IV. Data

We use data from *Capital Punishment in the United States, 1973–1998*, which was compiled by the Department of Commerce and the Bureau of Census and published by the Bureau of Justice Statistics of the U.S. Department of Justice. The data set contains information on the exact month and year of the prisoner's sentencing and the month and year when the prisoner was removed from death row. These data provide information on the history of 6,143 death sentences between 1977 and 1997 in the United States. The data set allows us to analyze, for the first time in this literature, the impact of commutations and total removals from death row on the homicide rate. An increase in the number of commutations handed to death row inmates implies a decrease in the risk of execution. Thus, an increase in the commutation rate is expected to be positively related to murders. The same is true for total removals from death row.[25]

Second, as mentioned earlier, an advantage of our data set is the availability of the date of each execution and removal. This information enables us to create execution, commutation, and removal measures that are more consistent with theory. More specifically, if executions, commutations, or removals from death row send signals to potential criminals, then the timing of the signal is important. For example, an execution that took place in January 1980 could have had an impact on the homicide rate for the full year. However, if the execution took place in December 1980, it would had have a trivial impact on the 1980 homicide rate. Instead, the impact of this December execution on murder will be felt in 1981. The distribution of executions is relatively uniform over the year. An investigation of the 432 executions that took place between 1977 and 1997 shows that approximately 8 percent took place in each month. Given this, we prorated the executions, commutations, and removals on the basis of the month in which they occurred. As above, an execution that took place in January 1980 is expected to have affected the state homicide rate for the entire 12 months in 1980. Therefore, we count this execution as a full execution in 1980. By contrast, if an execution took place in November 1980, it is assumed that its deterrent impact on homicide was felt during the subsequent 12-month period. Thus, this November execution counts as 2/12 of an execution for 1980 and 10/12 of an execution for 1981. The same algorithms are applied for commutations and removals. As a second measure, we created the following algorithm: if an execution took place within the first three quarters of a year, we attributed that execution to the same year. If the execution took place in the last quarter of a year (October–December), we attributed that execution to the following year under

[25] A commuted sentence does not mean that the inmate is released from prison. Rather, the sentence is typically converted to life in prison.

the assumption that the relative impact on murders would be felt in the following year. The same was done for removals and commutations.

Table 1 presents the descriptive statistics of the data. The top part of the table presents information on the homicide rate, homicide arrests, the two measures of the execution, commutation, and removal rates, as well as sentencing, custody, and prison death rates. The lower part of the table summarizes the data that capture state characteristics. These are legal drinking age in the state, state unemployment rate, real per capita income, infant mortality rate in the state, percentage of population living in urbanized areas, percentage black, age distribution of state population, and a dichotomous variable to indicate whether the governor is a Republican. The bombing of the federal building in Oklahoma City in 1995 is controlled for with the dummy variable Oklahoma City 1995, although its omission from the models has no impact on the empirical results. The sources of these data are described in the Appendix. Table 1 also displays the standard deviations of the variables after removing state fixed effects, time effects, and state-specific time trends. The variation goes down significantly for some variables such as Urbanization, Percent Black, and the age distribution variables, but substantial variation remains for most others.

V. Results

Table 2 presents a number of different specifications. Column 1 contains the specification in which the homicide rate is explained by the probability of arrest (number of murder arrests divided by number of murders), sentencing rate (number of death sentences divided by number of murder arrests made 2 years prior), custody rate (number of prisoners per violent crime), risk of execution (number of executions divided by number of death sentences 6 years prior), and various state characteristics.

The model used in column 1 and all other specifications estimated in the paper include state fixed effects to control for state-specific characteristics that are not captured by the control variables, as well as time dummies and state-specific trends. The state-specific characteristics consider within-state changes and eliminate the impact of time-invariant omitted factors that are correlated with deterrence variables across states. The time dummies control for the unobserved time-varying determinants of homicide that affect all states in the same fashion, and state-specific time trends capture the factors that affect the time-series behavior of homicide that can differ from state to state.

Deterrence variables are lagged once, and the models are estimated with weighted least squares, where the weight is the state's share of the U.S. population. Robust standard errors are reported in parentheses. As is well known, serial correlation in errors results in biased standard errors. It is shown that in aggregate panel data analysis, one solution is to estimate standard

TABLE 1

DESCRIPTIVE STATISTICS OF THE DATA

Variable	Description	Mean (Standard Deviation)[a]	Standard Deviation[b]
Homicide Rate	Number of homicides divided by population, multiplied by 1,000	.070 (.038)	(.010)
Homicide Arrest Rate	Number of homicide arrests divided by number of reported homicides	.876 (.312)	(.219)
Execution Rate	Prorated count of number of executions in the previous and current year divided by number of persons sentenced to death 6 years before	.085 (.276)	(.192)
Execution Rate-2	Number of executions in the first three quarters of the current year and the last quarter of the previous year divided by number of persons sentenced to death 6 years before	.089 (.31)	(.23)
Commutation Rate	Prorated count of the number of commutations in the previous and current year divided by number of persons sentenced to death 6 years before	.019 (.115)	(.104)
Commutation Rate-2	Number of commutations in the first three quarters of the current year and the last quarter of the previous year divided by number of persons sentenced to death 6 years before	.019 (.131)	(.119)
Removal Rate	Prorated count of number of removals from death row (other than executions, deaths from other causes, or reasons unknown) in the previous and current year divided by number of persons sentenced to death 5 years before	.332 (.596)	(.481)
Removal Rate-2	Number of removals from death row (other than executions, deaths from other causes, or reasons unknown) in the first three quarters of the current year and the last quarter of the previous year divided by number of persons sentenced to death 5 years before	.332 (.673)	(.569)
Sentencing Rate	Number of persons sentenced to death divided by number of homicide arrests 2 years before	.017 (.031)	(.024)
Prisoners per Population	Number of persons in custody of state correctional authorities divided by adult population, multiplied by 1,000	2.755 (1.539)	(.274)
Prisoners per Violent Crime	Number of persons in custody of state correctional authorities divided by total number of violent crimes	.518 (.288)	(.086)

Prison Death Rate	Number of prison deaths other than executions divided by number of state prisoners, multiplied by 1,000	2.457	
		(1.872)	(1.589)
Percent Black	Percentage of the state population that is black	9.388	
		(9.464)	(1.193)
Republican Governor	Dummy variable (=1) if the governor is Republican in that year	.409	
		(.492)	(.351)
Unemployment Rate	State unemployment rate	6.398	
		(2.084)	(1.033)
Per Capita Income	Real per capita income in 1982–84 dollars divided by 1,000	13.438	
		(2.322)	(.354)
Infant Mortality Rate	Number of deaths of children under 1 year of age per 1,000 live births	10.076	
		(2.516)	(.885)
Urbanization	Percentage of the state population residing in urbanized areas	67.781	
		(14.467)	(.138)
Drinking Age 18	Dummy variable (=1) if the state's legal drinking age for wines and spirits is 18 for at least half the calendar year	.084	
		(.277)	(.151)
Drinking Age 19	Dummy variable (=1) if the state's legal drinking age for wines and spirits is 19 for at least half the calendar year	.110	
		(.312)	(.194)
Drinking Age 20	Dummy variable (=1) if the state's legal drinking age for wines and spirits is 20 for at least half the calendar year	.050	
		(.219)	(.175)
Percent Aged 20–34	Percentage of state population aged 20–34	24.675	
		(2.406)	(.459)
Percent Aged 35–44	Percentage of state population aged 35–44	13.866	
		(2.184)	(.233)
Percent Aged 45–54	Percentage of state population aged 45–54	10.319	
		(1.199)	(.142)
Percent Aged 55+	Percentage of state population aged 55 or older	20.292	
		(2.977)	(.297)
Oklahoma City 1995	Dummy variable (=1) for Oklahoma in 1995	.001	
		(.031)	(.028)

NOTE.—We have 1,050 observations, except for Homicide Arrest Rate, for which we have 1,047 observations, and Prison Death Rate, for which we have 1,049 observations. The number of observations for the execution rate and commutation rate variables is 750 because of the 6-year lag of the denominator. Similarly, there are 800 observations for the removal rate variables because of the 5-year lag of the denominator.

[a] Raw data.

[b] After removal of state and time effects and state-specific time trends.

TABLE 2

DETERMINANTS OF THE HOMICIDE RATE

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Execution Rate (−1)	−.006*	. . .	. . .	−.0063*	−.0063*	−.0472^{+}	−.0484^{+}
	(.0027)			(.0028)	(.003)	(.026)	(.0283)
	[.0035]			[.0034]	[.0029]	[.0257]	[.027]
Commutation Rate (−1)	. . .	.0069*	. . .	.0073**	. . .	.1076**	. . .
		(.0028)		(.0027)		(.0308)	
		[.0032]		[.003]		[.0314]	
Removal Rate (−1)	. . .	. . .	.0017*	. . .	.0018*	. . .	.0198*
			(.0007)		(.0008)		(.0081)
			[.0007]		[.0007]		[.0082]
Homicide Arrest Rate (−1)	−.0043^{+}	−.0046^{+}	−.0043	−.0045^{+}	−.0042	−.0433	−.0349
	(.0024)	(.0025)	(.0028)	(.0025)	(.0028)	(.0295)	(.0321)
	[.0034]	[.0034]	[.0037]	[.0034]	[.0038]	[.033]	[.0368]
Sentencing Rate (−1)	.0034	.00002	.0131	−.0002	.017	−.0856	.3546
	(.0211)	(.0189)	(.0254)	(.0196)	(.0258)	(.3332)	(.3644)
	[.0237]	[.0214]	[.0272]	[.0221]	[.0276]	[.401]	[.3793]
Prisoners per Violent Crime (−1)	−.0354**	−.0364**	−.0384**	−.0357**	−.0383**	−.3465**	−.3819**
	(.0069)	(.0069)	(.007)	(.0069)	(.007)	(.0793)	(.0798)
	[.009]	[.0096]	[.0084]	[.0092]	[.008]	[.0898]	[.0904]
Prison Death Rate (−1)	−.0003	−.0003	−.0002	−.0003	−.0003	−.0001	−.0013
	(.0006)	(.0006)	(.0005)	(.0006)	(.0006)	(.0066)	(.0063)
	[.0005]	[.0005]	[.0005]	[.0005]	[.0005]	[.0058]	[.0058]
Percent Black	−.0001	−.0002	−.000010	−.0001	−.00002	−.002	−.0011
	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)	(.0032)	(.0033)
	[.0005]	[.0005]	[.0004]	[.0005]	[.0004]	[.0045]	[.0043]
Republican Governor	−.0019	−.0019	−.0011	−.002	−.001	−.0207	−.0084
	(.0013)	(.0014)	(.0013)	(.0014)	(.0013)	(.0143)	(.0139)
	[.0022]	[.0022]	[.002]	[.0022]	[.002]	[.0197]	[.0185]
Unemployment Rate	−.0008	−.0009	−.0011	−.0009	−.001	−.003	−.0064
	(.0007)	(.0007)	(.0007)	(.0007)	(.0007)	(.0077)	(.0075)
	[.0012]	[.0012]	[.0012]	[.0011]	[.0012]	[.0106]	[.0115]
Per Capita Income	−.0014	−.0014	−.0011	−.0014	−.0012	−.0212	−.0196
	(.0022)	(.0022)	(.0021)	(.0022)	(.0022)	(.0266)	(.0261)
	[.0022]	[.0022]	[.0022]	[.0022]	[.0022]	[.0257]	[.0275]
Infant Mortality Rate	.0022**	.0019*	.0023**	.0021*	.0023**	.0218*	.0256*
	(.0009)	(.0009)	(.0009)	(.0009)	(.0009)	(.0104)	(.0106)
	[.0012]	[.0011]	[.001]	[.0012]	[.001]	[.0107]	[.0111]
Urbanization	−.0406**	−.0398**	−.0399**	−.0398**	−.043**	−.3671**	−.4364**
	(.0105)	(.0104)	(.0091)	(.0104)	(.0094)	(.123)	(.1205)
	[.0157]	[.0155]	[.0138]	[.0156]	[.0139]	[.1556]	[.1529]
Drinking Age 18	−.0125^{+}	−.0125^{+}	−.0088	−.012^{+}	−.0091	−.1106	−.0784
	(.0067)	(.0067)	(.0065)	(.0068)	(.0067)	(.0723)	(.0702)
	[.0063]	[.0068]	[.0076]	[.0063]	[.0073]	[.0673]	[.0612]
Drinking Age 19	−.0099**	−.0096*	−.0057^{+}	−.0099**	−.0058^{+}	−.0701^{+}	−.0397
	(.0038)	(.0038)	(.0034)	(.0038)	(.0034)	(.0379)	(.035)
	[.0052]	[.0053]	[.0042]	[.0051]	[.0041]	[.0458]	[.0412]
Drinking Age 20	.0003	.0004	.0016	.0006	.0019	.0049	.0136
	(.0024)	(.0024)	(.0022)	(.0024)	(.0022)	(.0276)	(.0262)
	[.0021]	[.0022]	[.0023]	[.0021]	[.0022]	[.0254]	[.0257]

TABLE 2 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Percent Aged 20–34	.0061**	.0063**	.0063**	.0062**	.0063**	.0987**	.102**
	(.0021)	(.0021)	(.0019)	(.0021)	(.0019)	(.0252)	(.0237)
	[.0036]	[.0035]	[.003]	[.0036]	[.003]	[.0405]	[.0375]
Percent Aged 35–44	.0019	.0022	.0003	.0024	.0005	.0195	.0099
	(.0036)	(.0035)	(.0035)	(.0036)	(.0036)	(.0415)	(.0437)
	[.0056]	[.0055]	[.0053]	[.0055]	[.0054]	[.0676]	[.0727]
Percent Aged 45–54	.0118*	.0125**	.0124**	.0125*	.0134**	.0265	.0252
	(.0049)	(.0048)	(.0048)	(.0049)	(.0048)	(.0703)	(.0687)
	[.006]	[.006]	[.0062]	[.006]	[.0061]	[.0712]	[.0802]
Percent Aged 55+	−.0146**	−.0147**	−.0127**	−.0154**	−.0134**	−.1262**	−.1082**
	(.004)	(.0039)	(.0038)	(.004)	(.0038)	(.0363)	(.0366)
	[.0046]	[.0047]	[.0038]	[.0048]	[.0037]	[.0453]	[.04]
Oklahoma City 1995	.0512**	.0525**	.0519**	.0515**	.0513**	.5267**	.519**
	(.005)	(.0047)	(.0045)	(.0049)	(.0046)	(.0573)	(.0522)
	[.0027]	[.0026]	[.0027]	[.0027]	[.0029]	[.0272]	[.0282]
N	680	693	695	679	691	679	691
R^2	.955	.956	.956	.956	.956	.965	.965

NOTE.—All models include state fixed effects, time dummies, and state-specific trends. In columns 6 and 7, the dependent variable is in logarithms. Robust standard errors are in parentheses. Robust and clustered standard errors are in brackets.

+ Statistical significance between 10 and 5 percent.

* Statistical significance between 5 and 1 percent.

** Statistical significance at the 1 percent level or better.

errors with cluster adjustment to the level of aggregation.[26] The values in square brackets report robust standard errors that were obtained from models estimated with weighted least squares, as before, that also account for clustering of errors at the state level.

Columns 2 and 3 of Table 2 report the results of the models with commutation and removal rates, respectively. Column 4 includes execution and commutation rates jointly, and column 5 displays the results of the model that contains execution and removal rates jointly. The execution, commutation, and removal rates are all prorated measures. Using the alternative second measure did not alter the results. Similarly, measuring the custody rate as prisoners per population produced very similar results.[27]

In all specifications, the coefficient of the execution rate is negative and statistically significant, indicating that an increase in the risk of execution lowers the homicide rate. Because the annual average time between sentencing and removal from death row is about 5 years, the removal rate is deflated by the number of death sentences 5 years prior. As depicted in Table 2, the commutation rate and the removal rate from death row have positive and statistically significant effects on the homicide rate. The custody rate

[26] Marianne Bertrand, Esther Duflo, & Sendhil Mullainathan, How Much Should We Trust Differences-in-Differences Estimates? (Working Paper No. 8841, Nat'l Bur. Econ. Res., March 2002).

[27] These results are available on request.

(prisoners per violent crime) has a negative effect on the homicide rate. The same is true for the homicide arrest rate, although the coefficient is not statistically significant in all specifications. The prison death rate and the sentencing rates are not significantly different from zero.

To investigate the sensitivity of the estimated standard errors to an alternative way of controlling for the potential serial correlation in errors, we estimated the models by incorporating a first-order autogressive structure in the errors within each state. The results remained the same. We also deflated the number of death sentences by the once-lagged murder arrest rate to arrive at the sentencing rate, which did not alter the results.

The magnitude of the impact of an execution is surprisingly similar to that reported by Ehrlich.[28] Using the average of the coefficients estimated, we found that each additional execution or commutation results in a reduction or increase of about five murders The impact of total removals is smaller: each removal from death row other than execution and death yields about one additional homicide.[29] Columns 6 and 7 of Table 2 display the results of the models by employing the logarithms of the murder rate. They are consistent with the ones in which the homicide rate is in levels.

In Table 3, we report the results of the models in which the deterrence variables enter with two lags to allow richer dynamics. Put differently, the homicide rate in year t is affected by the execution, commutation, or removal rates, arrest rate, sentencing rate, custody rate, and prison death rate in years $t - 1$ and $t - 2$. As before, the models include state fixed effects, time dummies, and state trends. The results are consistent with those in Table 2. With very few exceptions, the individual coefficients of deterrence variables have expected signs: the coefficients of executions, homicide arrests, custody, and prison deaths are negative, and those of commutations and other removals are positive. Table 3 also reports the sum of the lags for the deterrence variables along with a test for statistical significance of the sums. The sums of execution lags, arrest rate, and custody lags are negative and significantly different from zero.

To investigate whether the presence of the death penalty has a direct impact on the homicide rate, we added a dichotomous variable to the models that takes the value of one if capital punishment is legal in the state and zero otherwise. The existence of the death penalty in a state is unlikely to be an exogenous event; rather, it may be influenced by the murder rate. To avoid this simultaneity, we lagged the value of the dummy variable. The result is

[28] Ehrlich, The Deterrent Effect, *supra* note 3.

[29] The impact of a 1-unit increase in the number of executions, commutations, and removals is calculated as β(Pop)/Sent/1,000, where β is the estimated coefficient of the deterrence variable (execution rate, commutation rate, or removal rate), Pop is the mean of the population used in the estimation sample, and Sent is the mean of the number of death sentences, which is the denominator of the deterrence variables. We divide by 1,000 because the homicide rate is scaled by 1,000.

presented in column 1 of Table 4. There is sufficient variation of the dummy variable that measures the legality of the death penalty in a state because seven states legalized the death penalty between 1977 and 1997 (Kansas, New Hampshire, New Jersey, New Mexico, New York, Oregon, and South Dakota), and Massachusetts and Rhode Island abolished it during the same time period. The variable Death Penalty Legal is negative and significantly different from zero, which indicates that the presence of the death penalty has a negative impact on the murder rate. In column 2, we report the result in which the lagged value of Death Penalty Legal is interacted with the lagged execution and commutation variables, and in column 3 it is interacted with the lagged execution and removal variables. The coefficients of the execution variable are negative, those of the commutation and removal rates are positive, and they all are significant.[30] The coefficient of Death Penalty Legal suggests that the presence of the death penalty reduces the number of murders by 64.

As an alternative specification, it may be reasonable to assume that the presence of capital punishment in a state is a function of past homicide rates in the state. More specifically, consider the following formulation for the existence of capital punishment:

$$\begin{aligned} L_t = {} & \alpha \mathrm{MURDER}_{t-1} + \alpha\lambda \mathrm{MURDER}_{t-2} \\ & + \alpha\lambda^2 \mathrm{MURDER}_{t-3} + \alpha\lambda^3 \mathrm{MURDER}_{t-4} + \ldots, \end{aligned} \tag{2}$$

where L_t represents the death penalty indicator in the state in year t, MURDER stands for the homicide rate in the state, and λ is less than one in absolute value. Equation (2) portrays the existence of capital punishment in year t as a function of past homicide rates in the state, where homicide rates in the more distant past have smaller effects. Our main equation of interest, equation (1), can be expressed more compactly as

$$\mathrm{MURDER}_t = \beta \mathrm{DETER}_{t-1} + \gamma L_{t-1}, \tag{3}$$

where state subscripts and other determinants of homicide are suppressed for ease of exposition. Substituting (3) into (2) gives

$$\begin{aligned} L_t = {} & \alpha\beta \mathrm{DETER}_{t-2} + \alpha\gamma L_{t-2} + \alpha\beta\lambda \mathrm{DETER}_{t-3} \\ & + \alpha\gamma\lambda L_{t-3} + \alpha\beta\lambda^2 \mathrm{DETER}_{t-4} + \alpha\gamma\lambda^2 L_{t-4} + \ldots, \end{aligned} \tag{4}$$

and it is straightforward to show that equation (4) can be rewritten as

$$L_t = \alpha\beta \mathrm{DETER}_{t-2} + \lambda L_{t-1} + \alpha\gamma L_{t-2}. \tag{5}$$

[30] The coefficient of the execution rate is not considerably different from those obtained in earlier specifications. When we estimated the models using the second measures of the execution, commutation, and removal rates, the coefficient of the execution rate became somewhat smaller in absolute value.

TABLE 3

MODELS WITH MULTIPLE LAGS

Variable	(1)	(2)
Execution Rate (−1)	−.0063*	−.0051^{+}
	(.0028)	(.0028)
	[.0033]	[.0028]
Execution Rate (−2)	−.0048	−.0021
	(.0037)	(.003)
	[.0042]	[.0038]
Commutation Rate (−1)	.0062^{+}	. . .
	(.0033)	
	[.0035]	
Commutation Rate (−2)	.0007	. . .
	(.0034)	
	[.0039]	
Removal Rate (−1)	. . .	.0008
		(.0007)
		[.0008]
Removal Rate (−2)	. . .	.0006
		(.0007)
		[.0007]
Homicide Arrest Rate (−1)	−.0053*	−.0051^{+}
	(.0024)	(.0026)
	[.0033]	[.0036]
Homicide Arrest Rate (−2)	−.002	−.0016
	(.0022)	(.0023)
	[.0025]	[.0026]
Sentencing Rate (−1)	.0086	.0255
	(.0219)	(.0277)
	[.0265]	[.0292]
Sentencing Rate (−2)	−.0004	−.0105
	(.0166)	(.0174)
	[.0203]	[.0202]
Prisoners per Violent Crime (−1)	−.0304**	−.0331**
	(.0083)	(.0085)
	[.0098]	[.0095]
Prisoners per Violent Crime (−2)	−.0039	−.0043
	(.0084)	(.0082)
	[.0095]	[.0098]
Prison Death Rate (−1)	−.0008	−.0009
	(.0007)	(.0006)
	[.0006]	[.0006]
Prison Death Rate (−2)	−.0004	−.0008
	(.0006)	(.0006)
	[.0007]	[.0007]
Sum of Execution Rate = 0:		
Coefficient	−.0110*	−.0072^{+}
F-statistic	4.79	2.82
P-value	.029	.94
Sum of Commutation Rate = 0:		
Coefficient	.0069	. . .
F-statistic	2.26	. . .
P-value	.1338	. . .
Sum of Removal Rate = 0:		
Coefficient	. . .	.0014
F-statistic	. . .	1.66
P-value	. . .	.198

TABLE 3 (*Continued*)

Variable	(1)	(2)
Sum of Homicide Arrest Rate = 0:		
Coefficient	−.0073*	−.0067*
F-statistic	4.93	3.93
P-value	.027	.048
Sum of Sentencing Rate = 0:		
Coefficient	.0083	.0150
F-statistic	.07	.17
P-value	.790	.678
Sum of Prisoners per Violent Crime = 0:		
Coefficient	−.0343**	−.0374**
F-statistic	18.75	23.35
P-value	.000	.000
Sum of Prison Death Rate = 0:		
Coefficient	−.0012	−.0016[+]
F-statistic	1.90	3.62
P-value	.1684	.058
N	625	639
R^2	.957	.959

NOTE.— All models include state fixed effects, time dummies, and state-specific trends. Robust standard errors are in parentheses. Robust and clustered standard errors are in brackets.

[+] Statistical significance between 10 and 5 percent.

* Statistical significance between 5 and 1 percent.

** Statistical significance at the 1 percent level or better.

Equation (5) suggests that the presence of capital punishment, although endogenous, can be instrumented with twice-lagged deterrence variables and two lags of capital punishment law. The results of the instrumental-variables estimation are presented in columns 4 and 5 of Table 4 with commutation and removal rates, respectively. Again, the coefficient of the death penalty indicator (Death Penalty Legal) is negative and statistically significant. The coefficients in Table 4 suggest that an additional execution generates a reduction in homicide by five, an additional commutation increases homicides by four to five, and an additional removal brings about one additional murder. The coefficients of other deterrence variables are also consistent with those reported in previous tables. Estimating these models with the second measures of execution, commutation, and removal rates or using the number of prisoners per population as the measure of incapacitation did not change the conclusions.[31]

VI. EXTENSIONS

We estimated the models with the addition of quadratic state-specific time trends. This specification puts heavy demands on the data. Nevertheless, we

[31] The coefficient of the execution rate became somewhat smaller in absolute value, such that an additional execution implied a reduction of four murders.

TABLE 4

IMPACT OF LEGALIZED DEATH PENALTY

Variable	(1)	(2)	(3)	(4)	(5)
Death Penalty Legal (−1)	−.0154**	−.0138+	−.0119+	. . .	. . .
	(.0055)	(.0077)	(.0071)		
	[.0061]	[.0061]	[.0056]		
Death Penalty Legal (−1) × Execution Rate (−1)	. . .	−.0067*	−.0068*	. . .	. . .
		(.0028)	(.003)		
		[.0036]	[.0029]		
Death Penalty Legal (−1) × Commutation Rate (−1)	. . .	.0068*	. . .	. . .	. . .
		(.0028)			
		[.0029]			
Death Penalty Legal (−1) × Removal Rate (−1)	. . .	. . .	.002**	. . .	. . .
			(.0008)		
			[.0008]		
Death Penalty Legal	. . .	. . .	. . .	−.0312**	−.0210*
				(.0102)	(.0093)
				[.0098]	[.0107]
Death Penalty Legal × Execution Rate (−1)	. . .	. . .	. . .	−.0070*	−.0062*
				(.003)	(.0029)
				[.0034]	[.0027]
Death Penalty Legal × Commutation Rate (−1)	. . .	. . .	. . .	.0046	. . .
				(.0035)	
				[.0037]	
Death Penalty Legal × Removal Rate (−1)	. . .	. . .	. . .	. . .	.0008
					(.0007)
					[.0008]
Homicide Arrest Rate (−1)	−.0008	−.0035	−.0032	−.0036	−.0037
	(.0027)	(.0024)	(.0027)	(.0023)	(.0025)
	[.0033]	[.0027]	[.003]	[.0025]	[.0027]
Sentencing Rate (−1)	−.0026	.0001	.0167	.0058	.0184
	(.0198)	(.0193)	(.0259)	(.0202)	(.0274)
	[.0218]	[.0219]	[.0278]	[.0235]	[.0279]
Prisoners per Violent Crime (−1)	−.0402**	−.0367**	−.0392**	−.0372**	−.0400**
	(.0061)	(.0069)	(.007)	(.0069)	(.007)
	[.0087]	[.0094]	[.0082]	[.0105]	[.0096]
Prison Death Rate (−1)	.0001	−.0004	−.0003	−.0005	−.0006
	(.0003)	(.0005)	(.0005)	(.0005)	(.0005)
	[.0003]	[.0005]	[.0005]	[.0006]	[.0006]
Percent Black	−.0001	−.0001	−.000007	−.0001	.00005
	(.0004)	(.0003)	(.0003)	(.0003)	(.0003)
	[.0004]	[.0005]	[.0004]	[.0005]	[.0005]
Republican Governor	−.0014	−.0015	−.0006	−.00004	−.0001
	(.0011)	(.0014)	(.0014)	(.0015)	(.0014)
	[.0016]	[.0019]	[.0017]	[.0021]	[.0017]
Unemployment Rate	−.001+	−.0009	−.0011	−.0005	−.0009
	(.0006)	(.0007)	(.0007)	(.0009)	(.0008)
	[.0009]	[.0012]	[.0012]	[.0014]	[.0013]
Per Capita Income	.0035+	−.0014	−.0012	−.0008	−.0021
	(.002)	(.0022)	(.0021)	(.0024)	(.0022)
	[.0027]	[.0026]	[.0024]	[.003]	[.0026]
Infant Mortality Rate	.0022**	.002*	.0021*	.0015+	.0012
	(.0007)	(.0009)	(.0009)	(.0009)	(.0009)
	[.0009]	[.0011]	[.001]	[.0012]	[.0011]

TABLE 4 (*Continued*)

Variable	(1)	(2)	(3)	(4)	(5)
Urbanization	−.0187*	−.0361**	−.0396**	−.0291**	−.0382**
	(.0078)	(.0092)	(.0084)	(.0095)	(.0092)
	[.012]	[.0124]	[.0111]	[.013]	[.0107]
Drinking Age 18	−.0095*	−.0118+	−.009	−.0151	−.009
	(.0047)	(.0068)	(.0066)	(.0096)	(.0071)
	[.0066]	[.0063]	[.0074]	[.0096]	[.007]
Drinking Age 19	−.0077*	−.009*	−.0052	−.0077+	−.0025
	(.0033)	(.0037)	(.0034)	(.004)	(.0034)
	[.0048]	[.0048]	[.004]	[.0044]	[.0046]
Drinking Age 20	.0006	.0019	.0029	.0009	.0039
	(.0023)	(.0026)	(.0023)	(.0025)	(.0024)
	[.0026]	[.0024]	[.0025]	[.0021]	[.0028]
Percent Aged 20–34	.0012	.005*	.0052**	.0055*	.0048*
	(.0014)	(.0021)	(.0019)	(.0024)	(.0022)
	[.002]	[.0032]	[.0026]	[.0036]	[.0031]
Percent Aged 35–44	−.0024	.0022	.0006	.0013	−.0008
	(.0025)	(.0035)	(.0035)	(.004)	(.0038)
	[.0035]	[.005]	[.0049]	[.0054]	[.0048]
Percent Aged 45–54	−.0017	.0146**	.0152**	.0157**	.0158**
	(.0033)	(.005)	(.005)	(.0058)	(.0055)
	[.0045]	[.006]	[.0065]	[.0071]	[.0072]
Percent Aged 55+	−.0031	−.0147**	−.0131**	−.0128**	−.0126**
	(.0029)	(.004)	(.0039)	(.0044)	(.004)
	[.0037]	[.0046]	[.0037]	[.0057]	[.0042]
Oklahoma City 1995	.0497**	.0518**	.0517**	.050**	.0512**
	(.0048)	(.005)	(.0046)	(.0045)	(.0045)
	[.0025]	[.003]	[.0033]	[.0026]	[.0024]
N	877	679	690	628	642
R^2	.950	.957	.957	.961	.960

NOTE.—All models include state fixed effects, time dummies, and state-specific trends. Robust standard errors are in parentheses. Robust and clustered standard errors are in brackets.

+ Statistical significance between 10 and 5 percent.

* Statistical significance between 5 and 1 percent.

** Statistical significance at the 1 percent level or better.

obtained very similar results, although the precision of the estimated coefficient of the execution rate was less in models with the commutation variable, and the precision of the removal rate was less in models with that measure.

Katz, Levitt, and Shustorovich estimated separate models that included region-year and state-decade interactions.[32] As explained in their paper, inclusion of region-year interactions allows the parameters of the model to be identified through differences across states within a particular region and year. For this exercise we classified the states into four regions: northeast, midwest, south, and west. Inclusion of state-decade interactions implies that we exploit the variation within a state around that state's mean value in a particular decade. Our data start in 1977, but because we lose 6–7 years owing to lagging the variables, we split the sample into two periods in 1992.[33] These results, which are not reported in the interest of space, were consistent with those obtained earlier.

[32] *Supra* note 18.

[33] Splitting the sample in 1990 or 1991 did not significantly alter the results.

TABLE 5

IMPACT OF CAPITAL PUNISHMENT ON OTHER CRIMES

Variable	Robbery	Burglary	Rape	Motor Vehicle Theft
Execution Rate (−1)	−.0203	.0926	−.0028	.0442
	(.076)	(.2031)	(.0086)	(.195)
	[.0708]	[.1753]	[.0136]	[.2192]
Commutation Rate (−1)	.0482	−.2535	−.011	−.4948
	(.1045)	(.3144)	(.0193)	(.3394)
	[.1362]	[.3207]	[.0231]	[.3641]
Own Arrest Rate (−1)	.0911	−7.5594**	−.0745**	.2721
	(.3233)	(1.9888)	(.0266)	(1.0989)
	[.5215]	[2.7384]	[.0239]	[1.4148]
Sentencing Rate (−1)	−.3575	−.452	−.0248	1.2558
	(.4181)	(1.536)	(.0745)	(1.604)
	[.4035]	[1.3391]	[.0831]	[1.5769]
Prisoners per Violent Crime (−1)	−.5448**	−3.1351**	−.0721**	−2.2591**
	(.1817)	(.9166)	(.0253)	(.5761)
	[.2704]	[1.1079]	[.0319]	[.638]
Prison Death Rate (−1)	−.0194	−.1061**	−.0018	−.0476
	(.0176)	(.0393)	(.0014)	(.0328)
	[.0142]	[.0617]	[.0018]	[.0462]
Percent Black	−.0073	.0412	.0026*	−.0439*
	(.0085)	(.029)	(.0012)	(.0218)
	[.0129]	[.0425]	[.0015]	[.0302]
Republican Governor	.0285	.5803**	.0112**	−.0864
	(.041)	(.1311)	(.0041)	(.0929)
	[.0782]	[.2172]	[.006]	[.1121]
Unemployment Rate	.0208	.3162**	−.0019	.0118
	(.0219)	(.0584)	(.0024)	(.0519)
	[.0306]	[.07]	[.0029]	[.0642]
Per Capita Income	−.0598	−.4508*	.0161*	−.2551^{+}
	(.0764)	(.2113)	(.0079)	(.1534)
	[.1188]	[.3953]	[.0119]	[.3234]
Infant Mortality Rate	.0674**	.0437	.0058^{+}	.0757
	(.0251)	(.0835)	(.0035)	(.0635)
	[.0446]	[.1262]	[.0055]	[.0999]
Urbanization	−1.0832**	−2.3392**	−.0529	−1.5992^{+}
	(.3295)	(.8723)	(.0404)	(.905)
	[.6737]	[1.5563]	[.0734]	[1.7168]
Drinking Age 18	−.3305*	−1.0393	.0337*	−.0047
	(.139)	(.6865)	(.0168)	(.3284)
	[.1823]	[.9818]	[.0273]	[.5576]
Drinking Age 19	−.422**	−1.6693**	.0295**	−.5874*
	(.1154)	(.3338)	(.0082)	(.2587)
	[.14]	[.6456]	[.0131]	[.3338]
Drinking Age 20	−.0192	−.2955	.0194*	−.0264
	(.0661)	(.2428)	(.0077)	(.1766)
	[.0707]	[.2979]	[.011]	[.2147]
Percent Aged 20–34	.2384**	.4842**	−.0236**	1.3742**
	(.0637)	(.1686)	(.0066)	(.1493)
	[.1207]	[.3065]	[.0099]	[.261]
Percent Aged 35–44	−.2006^{+}	−1.3889**	.0225^{+}	−.0834
	(.1036)	(.3175)	(.0122)	(.2821)
	[.1407]	[.3503]	[.0221]	[.5456]
Percent Aged 45–54	.37**	−.2769	.0242	−.6439^{+}
	(.1411)	(.4505)	(.0176)	(.3528)
	[.2469]	[.7137]	[.0296]	[.6606]
Percent Aged 55+	−.5583**	.5069^{+}	−.0039	−1.657**
	(.1167)	(.2759)	(.0098)	(.2727)
	[.1628]	[.3616]	[.0176]	[.5323]

TABLE 5 (*Continued*)

Variable	Robbery	Burglary	Rape	Motor Vehicle Theft
Oklahoma City 1995	−.0335	.2914	−.0168[+]	−.0285
	(.0770)	(.24)	(.0094)	(.2094)
	[.0698]	[.2024]	[.0078]	[.1431]
R^2	.972	.972	.958	.960

NOTE.—All models include state fixed effects, time dummies, and state-specific trends. Robust standard errors are in parentheses. Robust and clustered standard errors are in brackets. $N = 679$.

[+] Statistical significance between 10 and 5 percent.

* Statistical significance between 5 and 1 percent.

** Statistical significance at the 1 percent level or better.

To investigate how removals from death row, commutations, executions, and other deterrence variables affect crimes other than homicide, we investigated their impact on robberies, burglaries, rapes, and motor vehicle thefts. To the extent that capital punishment is a murder-specific deterrent, they are not expected to have significant effect on these crimes. On the other hand, executions may affect crimes such as robbery, burglary, and rape if the offender is aware of the possibility that an offense may result in a homicide. Alternatively, an execution may have a negative impact on all crimes if it provides a signal to potential offenders regarding the attitude of the criminal justice system overall. Along the same lines, a commutation or a removal from death row may be taken as a signal for a more lenient criminal justice environment and therefore may promote criminal activity.

Table 5 presents the results for robbery, burglary, rape, and motor vehicle theft. For each model, crime-specific arrests are included. An increase in the custody rate, measured by the number of prisoners per violent crime, reduces all four crime rates reported in the table. Prison death rate is negatively related to burglaries. Increases in burglary arrests and rape arrests reduce these crimes. There is no evidence that noncapital crimes are influenced by the execution or commutations rates. The results did not change when we used the number of prisoners per population as the measure of custody or when we used removal rates.[34]

VII. Conclusion and Discussion

The investigation of whether the death penalty deters homicide is important from an academic as well as a public policy point of view. The effectiveness of capital punishment as a crime control device and its appropriateness in a modern democratic society have both been hotly debated in the United States. This paper uses a data set that consists of the entire history of 6,143 death sentences between 1977 and 1997 in the United States to investigate the

[34] The coefficient of the removal rate in the rape equation was positive and significant at the 4 percent level.

impact of capital punishment on homicide. We merge this data set with state panels that include crime and deterrence measures as well as state characteristics. Our data set allows us to analyze not only the impact of executions but also, for the first time in the literature, the impact of both commutations and total removals from death row on criminal activity. Because we can identify the exact month and year of each execution and removal, we match them with criminal activity in the relevant time frame. Controlling for a variety of state characteristics, we investigate the impact of the execution, commutation, and removal rates, homicide arrest rate, sentencing rate, imprisonment rate, and prison death rate on the rate of homicide. The models are estimated in a number of different forms, controlling for state fixed effects, common time trends, and state-specific time trends. We find a significant relationship among the execution, removal, and commutation rates and the rate of homicide. Each additional execution decreases homicides by about five, and each additional commutation increases homicides by the same amount, while one additional removal from death row generates one additional homicide. These results are robust to model specifications and measurement of the variables. Executions, commutations, and removals have no impact on robberies, burglaries, assaults, or motor vehicle thefts.

Although these results demonstrate the existence of the deterrent effect of capital punishment, it should be noted that there remain a number of significant issues surrounding the imposition of the death penalty. For example, although the Supreme Court of the United States remains unconvinced that there exists racial discrimination in the imposition of the death penalty, recent research points to the possibility of such discrimination.[35] Along the same lines, there is evidence indicating that there is discrimination regarding who gets executed and whose sentence gets commuted once the death penalty is received.[36] Given these concerns, a stand for or against capital punishment should be taken with caution.

DATA APPENDIX

Crimes and Arrests

Crimes: U.S. Department of Justice, Bureau of Justice Statistics, *Crime in the United States* (various years). Available at http://www.ojp.usdoj.gov/bjs/datast.htm.

[35] David C. Baldus *et al*., Racial Discrimination and the Death Penalty in the Post-*Furman* Era: An Empirical and Legal Overview, with Recent Findings from Philadelphia, 83 Cornell L. Rev. 1638 (1998); Jeffrey J. Pokorak, Probing the Capital Prosecutor's Perspective: Race of the Discretionary Actors, 83 Cornell L. Rev. 1811 (1998); Gary Kleck, Racial Discrimination in Criminal Sentencing: A Critical Evaluation of the Evidence with Additional Evidence on the Death Penalty, 46 Am. Soc. Rev. 783 (1981).

[36] Laura Argys & Naci Mocan, Who Shall Live and Who Shall Die? An Analysis of Prisoners on Death Row in the United States (Working Paper No. 9507, Nat'l Bur. Econ. Res., February 2003).

Arrests: U.S. Department of Justice, Federal Bureau of Investigation, "Uniform Crime Reporting Program Data: County-Level Arrest and Offenses Data, 1977–1997" (computer file). Ann Arbor, Mich.: Inter-university Consortium for Political and Social Research (distributor), 1998. Available at http://www.icpsr.umich.edu/NACJD. Missing state-level arrest values were filled in by directly contacting the local Uniform Crime Report state agencies. The year 1988 was a transitional year for Florida, and arrest values are not available. Kansas was unable to produce data for 1995 and 1996. The values for neither Florida nor Kansas were imputed.

Capital Punishment Data

U.S. Department of Justice, Bureau of Justice Statistics, "Capital Punishment in the United States, 1973–1998" (computer file). Compiled by the U.S. Department of Commerce, Bureau of the Census; edited by ICPSR. Ann Arbor, Mich.: Inter-university Consortium for Political and Social Research (producer and distributor), 2000. Available at http://www.icpsr.umich.edu/NACJD.

Prison Population and Prison Deaths

Prison Population: U.S. Department of Justice, Bureau of Justice Statistics, "Prisoners in Custody of State or Federal Correctional Authorities" (electronic file). National Prisoner Statistics Data Series (NPS-1), version August 1, 2000. Available at http://www.ojp.usdoj.gov/bjs/data/corpop05.wk1.

Prison Deaths: *Sourcebook of Criminal Justice Statistics.* For the year 1985, values were obtained from the Bureau of Justice Statistics Web site, which compiles the same data: U.S. Department of Justice, Bureau of Justice Statistics, "Deaths among Sentenced Prisoners under State or Federal Jurisdiction" (electronic file). National Prisoner Statistics Data Series (NPS-1), version June 19, 2000. Available at http://www.ojp.usdoj.gov/bjs/data/corpop32.wk1. Alaska did not report prison deaths in 1994, and we did not impute a value.

Other State Data

Total State Population and Age Representation: U.S. Department of Commerce, Bureau of the Census, Population Division, Statistical Information Staff (electronic files; Internet Release Dates: August 1995; March 9, 2000). Available at http://eire.census.gov/popest/estimates.php.

Ethnic Population Representation: U.S. Department of Commerce, Bureau of the Census, *Current Population Survey* (various years).

Income per Capita: U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis, Regional Economic Information System, "State Annual Summary Tables" (SA1-3, SA51-52) (electronic file), 1969–99. Available at http://www.bea.gov/bea/regional/reis. The data are given nominally and were converted to 1982–84 dollars using the Consumer Price Index.

Unemployment Rate: U.S. Deparment of Labor, Bureau of Labor Statistics, "Local Area Unemployment Statistics" (electronic file). Available at http://www.bls.gov/lau/home.html. The 1977 data for all states and for the years 1978 and 1979 for California were completed using U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States* (various years).

Urbanization: U.S. Department of Commerce, Bureau of the Census, "Urban and Rural Population: 1900 to 1990" (electronic files). Available at http://www.census.gov/population/censusdata/urpop0090.txt. The files provided percent urbanization data for all states for 1970, 1980, and 1990. Values were linearly

interpolated for the 1970s and 1980s. The same change in urbanization for the 1980s was used to calculate the urbanization numbers for the 1990s.

Infant Mortality Rate: National Center for Health Statistics, *Vital Statistics of the United States* (various years).

Governor Data: Congressional Quarterly, Inc., *Gubernatorial Elections, 1787–1997* (1998).

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