WALTER C. RECKLESS MEMORIAL LECTURE

Death and Deterrence Redux: Science, Law and Causal Reasoning on Capital Punishment

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"Things are seldom what they seem . . . Skim-milk masquerades as cream . . ."
Gilbert and Sullivan

I. THE CURRENT CONTROVERSY

Long before the U.S. Supreme Court restored capital punishment in 1976, proponents of the death penalty claimed that executions save lives by deterring would-be murderers from lethal violence. The more recent ascension of deterrence as a rationale for capital punishment in the 1970s coincided with a series of landmark Supreme Court cases that first abolished and then reinstated the death penalty (a list of cases is available), and with the publication of a series of articles that claimed a scientific basis for the assertion that potential murderers can be deterred from homicide by the threat of execution. The originator of these claims was economist Isaac Ehrlich, who (inspired by the theoretical work of the University of Chicago's Gary Becker[1]) developed a theoretical model that explained crime as a process of rational choice between illegal and legal behavior; the choices were shaped by how law enforcement reacted to illegal activities.[2] Such rationality, Ehrlich argued, would influence would-be offenders to avoid punishment and forego crime.

Ehrlich published a highly influential article in 1975 that tested this model in the case of murder and capital punishment. It was a technical piece using

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[1] *See generally* Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 J. POL. ECON. 169 (1968) [hereinafter Becker, *Crime and Punishment*]; GARY S. BECKER, THE ECONOMIC APPROACH TO HUMAN BEHAVIOR (1976) [hereinafter BECKER, ECONOMIC APPROACH].

[2] Isaac Ehrlich, *The Deterrent Effect of Capital Punishment: A Question of Life and Death*, 65 AM. ECON. REV. 397 (1975); Isaac Ehrlich, *Capital Punishment and Deterrence: Some Further Thoughts and Additional Evidence*, 85 J. POL. ECON. 741 (1977).

econometric methods, but its influence went way beyond the economics profession. Ehrlich's work was cited in *Gregg v. Georgia*,[3] the landmark U.S. Supreme Court decision restoring capital punishment. No matter how carefully Ehrlich qualified his conclusions, his article had the popular and political appeal of a headline, a sound bite and a bumper sticker all rolled into one: "One execution saves eight innocent lives." Ehrlich's work was cited favorably in *Gregg*, and it was later cited in an amicus brief filed by the U.S. Solicitor General in *Fowler v. North Carolina*.[4] Even though Ehrlich's findings were disputed in academic journals such as the *Yale Law Journal*,[5] the proponents of deterrence had gained the upper hand in how this research was interpreted and how its findings were applied.[6]

Ehrlich's work became the focal point for research on deterrence and the death penalty, launching an era of contentious arguments in the press and in professional journals.[7] Over the next two decades, economists and other social scientists attempted to replicate Ehrlich's results using different data, alternative statistical methods, and other twists that tried to address glaring errors in Ehrlich's techniques and data.[8] Yet the accumulated scientific evidence from these later

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[3] 428 U.S. 153 (1976).

[4] 428 U.S. 904 (1976).

[5] *See* Editors' Introduction, *Statistical Evidence on the Deterrent Effect of Capital Punishment*, 85 YALE L.J. 164 (1975); David C. Baldus & James W.L. Cole, *A Comparison of the Work of Thorsten Sellin and Isaac Ehrlich on the Deterrent Effect of Capital Punishment*, 85 YALE L.J. 170 (1975); William J. Bowers & Glenn L. Pierce, *The Illusion of Deterrence in Isaac Ehrlich's Research on Capital Punishment*, 85 YALE L.J. 187 (1975); Isaac Ehrlich, *Deterrence: Evidence and Inference*, 85 YALE L.J. 209 (1975).

[6] For critiques of Ehrlich's work, see Michael McAleer & Michael R. Veall, *How Fragile Are Fragile Inferences? A Re-Evaluation of the Deterrent Effect of Capital Punishment*, 71 REV. ECON. & STATISTICS 99 (1989); Edward E. Leamer, *Let's Take the Con out of Econometrics*, 73 AM. ECON. REV. 31 (1983); 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); Jeffrey Grogger, *The Deterrent Effect of Capital Punishment: An Analysis of Daily Homicide Counts*, 85 J. AM. STATISTICAL ASSOC. 295 (1990).

For support and extensions of Ehrlich's work, see Stephen A. Layson, *Homicide and Deterrence: A Reexamination of the United States Time-Series Evidence*, 52 S. ECON. J. 68 (1985) [hereinafter Layson, *Homicide and Deterrence*]; James P. Cover & Paul D. Thistle, *Time Series, Homicide, and the Deterrent Effect of Capital Punishment*, 54 S. ECON. J. 615 (1988); George A. Chressanthis, *Capital Punishment and the Deterrent Effect Revisited: Recent Time-Series Econometric Evidence*, 18 J. BEHAV. ECON. 81 (1989).

[7] For an excellent summary of the critique of Ehrlich's article, see John Lamperti, *Deter Murder? A Brief Look at the Evidence*, ¶ 17, *available at* http://www.math.dartmouth.edu/~lamperti/capitalpunishment.html (last visited Aug. 18, 2006).

[8] *See, e.g.*, Layson, *Homicide and Deterrence*, *supra* note 6, at 75, 80; Stephen Layson, *United States Time-Series Homicide Regressions with Adaptive Expectations*, 62 BULL. N.Y. ACAD. MED. 589 (1986).

studies also weighed heavily against the claim that executions deter murders.[9] Ehrlich's findings were challenged by many scholars as to the sample period and/or the variables he chose, and the murder supply equation and the functional form of the equations he estimated.[10] Also, under Ehrlich's methodology, the aggregation of data from all U.S. states led to his conclusion that "a decrease in the execution risk in one State combined with an increase in the murder in another State would, all other things being equal, suggest a deterrent effect that quite obviously would not exist."[11] Within three years of the publication of Ehrlich's study, an expert panel appointed by the National Academy of Sciences issued strong criticisms of his work.[12] Despite the weight of technical economic and other social science evidence condemning Ehrlich's work, each new study that followed supporting the deterrence conclusion found uncritical acceptance among proponents of the death penalty, while the critiques failed to get popular or political traction.

History is now repeating itself. In the past five years, a new wave of a dozen or more studies have appeared, reporting deterrent effects of capital punishment

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[9] For example, Peter Passell and John Taylor showed that Ehrlich's result relied heavily on movements from 1963 to 1969. They focused on Ehrlich's observed negative relation between executions and homicide rates, and analyzed the impact of a change in the time period chosen for the model or a change in the assumptions as to the model's functional form. Both changes showed that the broad aspects of the model were unchanged, but that the evidence suggesting a particular deterrent effect from executions had totally vanished. *See* Peter Passell & John B. Taylor, *The Deterrent Effect of Capital Punishment: Another View*, 67 AM. ECON. REV. 445, 450 (1977):

> First, we have shown that Ehrlich's model does not satisfy the statistical requirement of temporal homogeneity and that the results are sensitive to specification of the variables and transformation of the data. . . . Second, . . . it is not possible to infer from [Ehrlich's murder rate regression function] that a change in legal institutions . . . would reduce murder rates. . . . [I]t is prudent to neither to accept nor reject the hypothesis that capital punishment deters murder.

See also Bowers & Pierce, *supra* note 5, at 187; Richard M. McGahey, *Dr. Ehrlich's Magic Bullet: Economic Theory, Econometrics and the Death Penalty*, 26 CRIME & DELINQ. 485 (1980); Stephen A. Hoenack & William C. Weiler, *A Structural Model of Murder Behavior and the Criminal Justice System*, 70 AM. ECON. REV. 327 (1980); McAleer & Veall, *supra* note 6, at 99. *See generally* Grogger, *supra* note 6, at 295; *see also* William C. Bailey, *Deterrence, Brutalization, and the Death Penalty: Another Examination of Oklahoma's Return to Capital Punishment*, 36 CRIMINOLOGY 711 (1998); Jon Sorenson et al., *Capital Punishment and Deterrence: Examining the Effect of Executions on Murder in Texas*, 45 CRIME & DELINQ. 481 (1999).

[10] H. Naci Mocan & R. Kaj Gittings, *Getting Off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment*, 46 J. L. & ECON. 453 (2003).

[11] Craig J. Albert, *Challenging Deterrence: New Insights on Capital Punishment Derived from Panel Data*, 60 U. PITT. L. REV. 321, 356 (1999) (citing Gregg v. Georgia, 428 U.S. 153, 235 (1976) (Marshall, J., dissenting)). Later in the article, the author also adds, after analyzing the same data as Ehrlich's, "the data do not support any conclusion that executions deter homicides." *Id*. at 363.

[12] *See* Lawrence R. Klein et al., *The Deterrent Effect of Capital Punishment: An Assessment of the Estimates*, *in* DETERRENCE AND INCAPACITATION: ESTIMATING THE EFFECTS OF CRIMINAL SANCTIONS ON CRIME RATES 336, 336–60 (Alfred Blumstein et al. eds., 1978).

that go well beyond Ehrlich's findings. The new deterrence studies analyze data that spans the entire period since the resumption of executions in the U.S. following the 1973 decision in *Furman v. Georgia.*[13] The new studies go further, though, claiming that pardons, commutations, and exonerations cause murders to increase.[14] Some say that even murders of passion, among the most irrational of lethal acts, can be deterred.[15]

At least one study, by Professor Zhiqiang Liu, claims that executions not only deter murders, but they also increase the deterrent effects of other punishments.[16] Following this logic, the new deterrence research has been applied to justify punitive criminal justice policies in several areas: mandatory minimum sentences and "three strikes" laws, zero tolerance policies for school children and drug offenders, and mandatory transfer of adolescent offenders from the juvenile court to the criminal court. Thus, the deterrent effects of capital punishment are apparently indefinite and offer execution as a cure-all for everyday crime.[17]

Many of these studies have already appeared in leading academic journals, while others are working their way through the review process. These studies have been reported favorably and uncritically by leading newspapers (e.g., *Washington Post*, *Boston Globe*, *Wall Street Journal*), and they have been broadcast widely by pro-death penalty advocacy groups to state legislators.[18] Many were cited in major newspapers even before their papers underwent some major changes after comments and critiques of their peers, while newspapers of record, such as *The Washington Post*, quoted in their headlines findings that were later proven to be wrong.[19] Pro-death penalty advocacy groups including *Justice for All*, *The Criminal Justice Legal Foundation* and *American Voice*, are widely disseminating the results of the new studies as scientific evidence of the deterrent effects of capital punishment. State groups in California and North Carolina also are citing this evidence to oppose local moratorium efforts. As in the *Gregg* era, these studies have been cited without challenge in amicus briefs in recent capital cases

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[13] 408 U.S. 238 (1972).

[14] *See* Mocan & Gittings, *supra* note 10.

[15] Joanna M. Shepherd, *Murders of Passion, Execution Delays, and the Deterrence of Capital Punishment*, 33 J. LEGAL STUD. 283 (2004) [hereinafter Shepherd, *Murders of Passion*].

[16] Zhiqiang Liu, *Capital Punishment and the Deterrence Hypothesis: Some New Insights and Empirical Evidence*, 30 E. ECON. J. 237 (2004).

[17] *Id*.

[18] For example, Mocan's article received media coverage in *inter alia* Gene Koretz, *Equality? Not on Death Row*, BUSINESS WEEK, June 30, 2003, at 28; Jeff Jacoby, *Execution Saves Innocents*, BOSTON GLOBE, Sept. 28, 2003 at H11; Kieran Nicholson, *Study: Race, Gender of Governors Affect Death-Row Decisions*, DENVER POST, Dec. 19, 2002, at A17; Richard Morin, *Lame Ducks and the Death Penalty*, WASH. POST, Jan. 20, 2002, at B05; Richard Morin, *Murderous Pardons?*, WASH. POST, Dec. 15, 2002, at B05. *See also* Mocan & Gittings, *supra* note 10.

[19] George Lardner, *The Role of the Press in the Clemency Process*, 31 CAP. U. L. REV. 179 (2003) (pinpointing all the mistakes made in the Mocan's article and taken at face value by the Washington Post, without any due review by professional criminologists).

including *Schirro v. Summerlin.*[20] In April 2004, Professor Joanna Shepherd, co-author of some of these studies, summarized the new deterrence evidence in testimony before the federal House Judiciary Committee, claiming that there is sound scientific evidence that each execution deters between three and eighteen murders.[21]

Accordingly, the reach of the new deterrence research seems quite long, and its potential impact on criminal justice politics and policies extends well beyond the death penalty. This new deterrence research also benefits advocates of capital punishment by competing with death penalty opponents who cite high rates of errors in capital cases and wrongful convictions as arguments for state moratoria or abolition.[22] If these claims are true, the new evidence would not only fundamentally change the roiling discourse on capital punishment, it could have influence on both the politics and substance of criminal law and policy.

What are we to make of these claims? I answer this question in three ways. First, we will look at the evidence itself. What claims are made in the various studies, and what might we conclude about executions and deterrence scanning across the new body of evidence? What is the structure of the data and what does the data tell us, even before we look at the modeling process itself? What cautions should we place on the interpretation and application of this information?

Second, we ask how well these claims stand up to scientific scrutiny. Have these analyses asked too much of the data? What happens when the data are subject to alternatives in measurement and analysis? Do the studies pay sufficient attention to the conceptual details of deterrence, murder itself, and alternate explanations for the complex relationships that influence changes in murder rates over time? Here, we consider some serious omissions in the construction of this

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[20] Summerlin v. Stewart, 341 F.3d 1082 (9th Cir. 2003), *rev'd*, Schirro v. Summerlin, 542 U.S. 348 (2004).

[21] Joanna Shepherd has recently argued before Congress that recent research has created a "strong consensus among economists that capital punishment deters crime," going so far as to claim that "[t]he studies are unanimous." *Terrorist Penalties Enhancement Act of 2003*: *Hearing on H.R. 2934 Before the Subcomm. on Crime, Terrorism, and Homeland Security of the H. Comm. on the Judiciary*, 108th Cong. 23–28 (2004) (statement of Joanna M. Shepherd, Visiting Assistant Professor, Emory Law School) [hereinafter Shepard Statement]. This consensus was repeated in recent testimony by Professor Paul Rubin, co-author on several recent studies also reporting deterrent effects from executions. *An Examination of the Death Penalty in the United States: Hearing Before the Subcommittee on the Constitution, Civil Rights and Property Rights of the Senate Committee on the Judiciary*, 109th Cong. (2006) (statement of Paul H. Rubin, Samuel Candler Dobbs Professor of Economics and Law, Emory), *available at* http://judiciary.senate.gov/testimony.cfm?id=1745 &wit_id=4991 (last visited Mar. 10, 2006) [hereinafter Rubin Statement].

[22] *See, e.g.*, Lawrence C. Marshall, *The Innocence Revolution and the Death Penalty*, 1 OHIO ST. J. CRIM. L. 573 (2004); Robert Warden, *Illinois Death Penalty Reform: How it Happened, What it Promises*, 95 J. CRIM. L. & CRIMINOLOGY 381 (2005). *See generally* DAVID L. PROTESS & ROBERT WARDEN, A PROMISE OF JUSTICE (1998) (documenting the media reactions to the exonerations of the four death row inmates).

theoretical framework, both conceptually and in the details of some modeling decisions.

Third, can the causal modeling approach of these studies justify the claims they make?[23] In this section, we offer secondary analyses of data from one of the new deterrence studies, authored by Professors Naci Mocan and Kaj Gittings,[24] in an effort to replicate the findings.[25] Replication is one of the cornerstones of the scientific process,[26] and is essential to vetting the types of claims of causal inference that are deeply embedded in the new deterrence studies. In this spirit, the re-analyses in this article apply alternate measurement strategies and model forms to establish the robustness or fragility of these findings. Already, at least one re-analysis has shown that the estimates are unstable when re-analyzed under different measurement and analysis conditions.[27] The analysis in this article goes further by re-specifying these models using analytic strategies that account for the unique temporal dependence in murder rates. Based on the results, I draw conclusions about the status of this evidence and its utility both in law and policy.

Finally, we consider the tensions at the intersection of science and law that these episodes raise. Here, we examine the recurring phenomenon of what we might conveniently call a "rush to judgment" when science—whether behavioral or natural—dangles the promise of simple answers to urgent but very complex questions.

The essay shows that the new deterrence studies are fraught with numerous technical and conceptual errors: inappropriate methods of statistical analysis, failures to consider several relevant factors that drive murder rates such as drug epidemics, missing data on key variables in key states, the tyranny of a few outlier states and years, weak to non-existent tests of concurrent effects of incarceration, statistical confounding of murder rates with death sentences, failure to consider the

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[23] For discussion of the complexity of causal analysis in estimating the effects of social interventions with observational data, see Martin Rein & Christopher Winship, *The Dangers of 'Strong' Causal Reasoning in Social Policy*, 36 SOCIETY 38 (July/August 1999); Michael E. Sobel, *An Introduction to Causal Inference*, 24 SOC. METHODS & RES. 353 (1996); Richard A. Berk & David A. Freedman, *Statistical Assumptions as Empirical Commitments*, *in* PUNISHMENT AND SOCIAL CONTROL 235 (2d ed.) (Thomas G. Blomberg & Stanley Cohen eds., 2003); PAUL R. ROSENBAUM, OBSERVATIONAL STUDIES (1995).

[24] Mocan & Gittings, *supra* note 10, at 454.

[25] Another re-analysis of the Mocan and Gittings data also reported instability in these results. *See* John Donohue & Justin Wolfers, *Uses and Abuses of Empirical Evidence in the Death Penalty Debate*, 58 STAN. L. REV. 791 (2005) [hereinafter Donohue & Wolfers, *Uses and Abuses*](reviewing the main studies cited by Sunstein and Vermeule and finding the empirical support for the claim that the death penalty deters . . . to be unstable and too unreliable to inform either law or policy).

[26] Lee Epstein & Gary King, *The Rules of Inference*, 69 U. CHI. L. REV. 1 (2002) [hereinafter Epstein & King, *The Rules of Inference*]. For examples of how data sharing and independent replication can advance the scientific process, see Lee Epstein & Gary King, *Building an Infrastructure for Empirical Research in the Law*, 53 J. LEGAL EDUC. 311 (2003).

[27] Donohue & Wolfers, *Uses and Abuses*, *supra* note 25, at 791.

general performance of the criminal justice system, artifactual results from truncated time frames, and the absence of any direct test of the components of contemporary theoretical constructions of deterrence. Social scientists have failed to replicate several of these studies, and in some cases have produced contradictory or unstable results with the same data, suggesting that the original findings are unreliable and perhaps inaccurate. The central mistake in this enterprise is one of causal reasoning: the attempt to draw causal inferences from a flawed and limited set of observational data, and the failure to address important competing influences on murder. Murder is a complex and multiply-determined phenomenon, with cyclical patterns for over forty years of distinct periods of increase and decline that are not unlike epidemics of contagious diseases. There is no reliable, scientifically sound evidence that pits execution against a robust set of competing explanations to identify whether it can exert a deterrent effect that is uniquely and sufficiently powerful to overwhelm these consistent and recurring epidemic patterns. These flaws and omissions in a body of scientific evidence render it unreliable as a basis for law or policy that generate life-and-death decisions. To accept it uncritically invites errors that have the most severe human costs.

II. THE NEW DETERRENCE LITERATURE

Over a dozen new studies appeared since the mid-1990s, mainly in economics journals, with most claiming new evidence that executions have strong and powerful deterrent effects on homicide.[28] The studies have quickly found their way into the courts. Similar to the immediate citations of Ehrlich's work in *Gregg* and other cases, the new deterrence studies were cited in *Schirro v. Summerlin*[29] in an amicus brief in a *certiorari* petition to the United States Court of Appeals for the Ninth Circuit.[30] The studies gained attention in Congress,[31] in the popular press,[32] among death penalty advocates,[33] and now, among legal scholars.[34]

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[28] For a compilation of recent studies, along with abstracts, see CRIMINAL JUSTICE LEGAL FOUNDATION, ARTICLES ON DEATH PENALTY DETERRENCE, http://www.cjlf.org/deathpenalty/DPDeterrence.htm (last visited Nov. 11, 2005).

[29] 542 U.S. 348 (2004).

[30] Arguing that "[t]here is grave danger that the 'annually improvised' jurisprudence of capital punishment is killing innocent people through lost deterrence" and that "that a death penalty which is actually enforced saves innocent lives in large numbers." Brief of Amici Curiae Criminal Justice Legal Foundation at 23–24, Schirro v. Summerlin, 542 U.S. 348 (2004) (No. 03-526), *available at* http://www.cjlf.org/briefs/Summerlin.pdf.

[31] *See* Shepherd Statemetn, *supra* note 21; Rubin Statement, *supra* note 21.

[32] *See, e.g.*, Jacoby, *supra* note 18; *see also* John Hood, *A Deadly Moratorium?*, CAROLINA J. ON-LINE, (2004), http://www.carolinajournal.com/jhdailyjournal/display_ jhdailyjournal.html?id=1391. Studies such as Mocan & Gittings, *supra* note 10, were discussed in the *Washington Post* even before their publication in peer-reviewed journals. Several of the unreviewed papers received broad media coverage in, *inter alia*, BUSINESS WEEK, *supra* note 18; BOSTON GLOBE, *supra* note 18; DENVER POST, *supra* note 18; and WASH. POST, *supra* note 18. *See also* Hashem Dezhbakhsh et al., *Does Capital Punishment Have a Deterrent Effect? New Evidence from Postmoratorium Panel*

Professors Sunstein and Vermeule find the new deterrence evidence "powerful"[35] and "impressive,"[36] and they couple it with "many decades of reliable data about [capital punishment's] deterrent effects"[37] as the "foundation" of their argument that since "capital punishment powerfully deters killings,"[38] there is a moral imperative to aggressively prosecute capital crimes.

The studies use several designs that conceptualize capital punishment as a "treatment" that would deter homicides. The studies include classical panel designs that co-vary homicide rates and deterrence measures that incorporate executions, quasi-experiments testing the effects of moratoria, natural experiments comparing homicide rates in death penalty and non-death penalty states, nested (hierarchical) designs of counties within states that provide more fine-grained analyses of local homicide rates, and instrumental variables designs that attempt to disentangle spurious effects due to factors other than deterrence. The estimation techniques vary from standard Ordinary Least Squares models to complex equilibrium models with simultaneous equations, to negative binomial estimators of homicides. Several have used a relatively new dataset on death sentences and executions to operationalize and measure deterrence. The data are produced by the U.S. Department of Justice,[39] and are updated and revised annually. They include

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Data, 5 AM. L. & ECON. REV. 344 (2003), was discussed uncritically in, Jerry Seper, *Garza Executed for Drug Killings: Murderer Makes Deathbed Apology*, WASH. TIMES, June 20, 2001, at A3; Paul H. Rubin, *Study: Death Penalty Deters Scores of Killings*, ATLANTA J. CONST., Mar. 14, 2002, at 22A, which led to Professor Shepherd's testimony before the U.S. House of Representatives, *supra* note 31. None of these papers sought opinions from criminologists who might have raised questions about the reliability of many of the new deterrence studies. *See, e.g.*, George Lardner, *supra* note 19 (pinpointing mistakes made in Mocan & Gittings, *supra* note 10).

[33] *See, e.g.*, CRIMINAL JUSTICE LEGAL FOUNDATION, *supra* note 28.

[34] Cass R. Sunstein & Adrian Vermeule, *Is the Death Penalty Morally Required? Acts, Omissions, and Life-Life Tradeoffs*, 58 STAN. L. REV. 703 (2005). *See also* Richard Posner, *The Economics of Capital Punishment*, http://www.becker-posner-blog.com/archives/2005/12/the_economics_o.html (last visited Dec. 18, 2005); Gary Becker, *More on the Economics of Capital Punishment*, http://www.becker-posner-blog.com/archives/2005/12/more_on_the_eco.html (last visited Dec. 18, 2005).

But see Carol S. Steiker, *No, Capital Punishment Is Not Morally Required: Deterrence, Deontology, and the Death Penalty*, 58 STAN. L. REV. 703 (2005) (responding to claim of the "moral requirement" of Sunstein and Vermeule by stating that "…executions constitute a distinctive moral wrong (purposeful as opposed to non-purposeful killing), and a distinctive kind of injustice (unjustified punishment)" and concluding that … "acceptance of 'threshold' deontology in no way requires a commitment to capital punishment even if …deterrence is proven").

[35] Sunstein & Vermeule, *supra* note 34, at 745.

[36] *Id*. at 713.

[37] *Id*. at 751.

[38] *Id*. at 738.

[39] BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, CAPITAL PUNISHMENT IN THE UNITED STATES, 1973–2002, http://webapp.icpsr.umich.edu/cocoon/ICPSR-DAS/03958.xml). See THOMAS P. BONCZAR & TRACY L SNELL, CAPITAL PUNISHMENT (2002), *at*

all death sentences and their dispositions following the resumption of capital punishment following *Furman*. The conclusions these studies derive are wedded to the methods and sources that are used to compile these data. The studies have appeared both in peer-reviewed journals, primarily in economics, and in law reviews; a few have been published online as working papers.

The studies are listed in Appendix A. Their claims are strong, far stronger than results produced in most social policy experiments on education, welfare, or crime control. A detailed analysis of the methods and results of these studies is not the purpose here; instead, here is a representative sampling of the results and claims made by these authors.

> • Mocan & Gittings: "[A]n 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."[40]
> • Dezhbakhsh et al.: "Our results suggest that capital punishment has a strong deterrent effect; each execution results, on average, in eighteen fewer murders—with a margin of error of plus or minus ten."[41]
> • Shepherd (Murders of Passion): "[E]ach execution results in, on average, three fewer murders….[C]apital punishment deters murders previously believed to be undeterrable: crimes of passion and murders by intimates….[L]onger waits on death row before execution lessen the deterrence. . . . [O]ne less murder is committed for every 2.75-year reduction in death row waits. Thus, recent legislation to shorten the wait should strengthen capital punishment's deterrent effect."[42]
> • Dezhbakhsh & Shepherd: "Our results indicate that capital punishment has a deterrent effect, and the moratorium and executions deter murders in distinct ways. This evidence is corroborated by both the before-and-after comparisons and regression analysis."[43]
> • Cloninger and Marchesini: As a result of the unofficial moratorium on executions during most of 1996 and early 1997, the citizens of Texas experienced a net 90 additional innocent lives lost to homicide.[44]
> • Liu: From the econometric standpoint, the structure of the murder supply function depends on the status of the death penalty, which is in

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www.ojp.usdoj.gov/bjs/pub/pdf/cp02.pdf for illustrations of the components of the dataset and trends and patterns over time.

[40] Mocan & Gittings, *supra* note 10, at 469.

[41] Dezhbakhsh et al., *supra* note 32.

[42] Shepherd, *Murders of Passion*, *supra* note 15.

[43] Hashem Dezhbakhsh & Joanna M. Shepherd, *The Deterrent Effect of Capital Punishment: Evidence from a "Judicial Experiment,"* 44 ECON. INQUIRY 512, 517–26 (2006).

[44] Dale O. Cloninger & Roberto Marchesini, *Execution and Deterrence: A Quasi-Controlled Group Experiment*, 33 APPLIED ECON. 568, 575 (2001).

> itself endogenous. Liu goes on to claim that executions deter crimes other than murder, suggesting collateral benefits of capital punishment for public safety more broadly.[45]
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> • Shepherd (Deterrence Versus Brutalization): The impact of executions differs substantially among the states. Executions deter murders in six states, executions have no effect on murders in eight states, and executions increase murders in thirteen states. Additional empirical analyses indicate that there is a threshold effect that explains the differing impacts of capital punishment. On average, the states with deterrence execute many more people than do the states where executions increase crime or have no effect. To achieve deterrence, states must execute several people.[46]

Readers can easily see the appeal of these findings. Just as the Ehrlich findings were quickly embraced in popular and political culture, these new studies make strong claims that have similar appeal. It is not surprising that they have been quickly embraced and disseminated as a counterweight against the cultural and political narratives of innocence[47] and errors.[48]

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[45] Liu, *supra* note 16, at 238.

[46] Joanna M. Shepherd, *Deterrence Versus Brutalization: Capital Punishment's Differing Impacts Among States*, 104 MICH. L. REV. 203, 205 (2005) [hereinafter Shepherd, *Deterrence Versus Brutalization*].

[47] *See, e.g.*, BARRY SCHECK ET AL., ACTUAL INNOCENCE: FIVE DAYS TO EXECUTION, AND OTHER DISPATCHES FROM THE WRONGLY CONVICTED (2000) (citing numerous exonerations from death row as evidence of the risks of wrongfully executing an innocent person); *see also* Samuel R. Gross et al., *Exonerations in the United States, 1989 Through 2003*, 95 J. CRIM. L. & CRIMINOLOGY 523 (2005); RICHARD C. DIETER, DEATH PENALTY INFORMATION CENTER, INNOCENCE AND THE CRISIS IN THE AMERICAN DEATH PENALTY (2004), *available at* http://www.deathpenaltyinfo.org/article.php?scid=45&did=1149#ExSum (last visited Aug. 18, 2006) (showing that the number of innocence cases increased by more than fifty percent in an eight year period, from thirty-two in 1989–1996 to forty-nine in 1997–2004); STAFF OF S. COMM. ON THE JUDICIARY, SUBCOMM. ON CIVIL AND CONSTITUTIONAL RIGHTS, 103D CONG., INNOCENCE AND THE DEATH PENALTY: ASSESSING THE DANGER OF MISTAKEN EXECUTIONS (OCT. 21, 1993); Joshua Herman, Comment, *Death Denies Due Process: Evaluating Due Process Challenges to the Federal Death Penalty Act*, 53 DEPAUL L. REV. 1777 (2004); Joseph L. Hoffmann, *Protecting the Innocent: The Massachusetts Governor's Council Report*, 95 J. CRIM. L. & CRIMINOLOGY 561 (2005); Evan J. Mandery, *Innocence as a Death Penalty Issue*, 40 CRIM. L. BULL. 78 (2004); Evan J. Mandery, *Massachusetts and the Changing Debate on the Death Penalty*, 40 CRIM. L. BULL. 518 (2004); Michael L. Radelet, William S. Lofquist & Hugo A. Bedau, *Prisoners Released from Death Rows Since 1970 Because of Doubts About Their Guilt*, 13 T. M. COOLEY L. REV. 907 (1996); Rob Warden, *Illinois Death Penalty Reform: How it Happened, What it Promises*, 95 J. CRIM L. & CRIMINOLOGY 381 (2005); Laurie A. Whitt et al., *Executing the Innocent: The Next Step in the Marshall Hypotheses*, 26 N.Y.U. REV. L. & SOC. CHANGE 309 (2001–2002); Laurie A. Whitt et al., *Innocence Matters: How Innocence Recasts the Death Penalty Debate*, 38 CRIM. L. BULL. 670 (2002). Newspaper accounts also show that growing support for moratoria on executions is animated by fears of wrongful executions. *See* Ken Armstrong & Steve Mills, *O'Connor Questions Fairness of Death Penalty Justice Rethinking Laws She Shaped*, CHIC. TRIB., July 4, 2001, at 1; Helen Dewar, *Support Grows for Execution Safeguards: Exonerations Spur Bills*

III. SOCIAL SCIENCE REASONING

These strong claims of powerful deterrent effects are not without contradictions and serious limitations. When the elements of this scientific enterprise are decomposed and evaluated, we can identify a series of recurring challenges in their conceptualization, model specification, measurement, and causal reasoning. The totality and cumulative weight of these challenges yields strong reasonable doubts about the reliability of these claims. There are errors both of commission and omission in this oeuvre of research, as I discuss below. In addition, some simple empirical exercises reveal problems in the sensitivity of the results to alternate measurement and model specification assumptions, producing different results whose instability and fragility undermine the strong claims of death penalty proponents.

A. *The Structure of the Data*

The findings of a negative correlation between executions and murder seem to be structured into the data in a way that weakens generalizations or predictions. Indeed, executions in most states in most years since *Gregg* are very rare. According to the Death Penalty Information Center, there have been 1045 executions since 1976; more than one in three (366) have been in Texas.[49] A simple average of executions per state per year would be deceptive, since state laws were enacted in different years, but even a simple estimate—there are thirty-eight death penalty states, each with a valid law in effect for an average of twenty years since *Gregg*—suggests that on average, there is fewer than one execution per

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in Congress, WASH. POST, June 16, 2000, at A1; Sara Rimer, *Support for a Moratorium in Executions Gets Stronger*, N.Y. Times, Oct 31, 2000, at A18; Jodi Wilgoren, *Citing Issue of Fairness, Governor Clears Out Death Row in Illinois*, N.Y. TIMES, Jan 12, 2003, at A1. In addition to Illinois, popular and political concerns over innocence have generated creation of an innocence commission in North Carolina. *See* Phoebe Zerwick, *Innocence Commission: N.C. Creates First In Nation To Backstop Court*s, WINSTON-SALEM JOURNAL, Aug. 20, 2006, at A1.

[48] James S. Liebman et al., *Capital Attrition: Error Rates in Capital Cases, 1973–1995*, 78 TEX. L. REV. 1839 (2000) (showing that 68% of all death sentences since *Furman v. Georgia* were reversed either on direct appeal, state direct appeal, or federal habeas review; most (82%) of those reversed were re-sentenced to non-capital punishments, 7% were exonerated, and the remainder were re-sentenced to death). *See, e.g.*, David Broder, *Broken Justice*, WASH. POST, June 18, 2000, at B7; *see also* Jonathan Alter, *The Death Penalty on Trial: Special Report: DNA and Other Evidence Freed 87 People from Death Row; Now Ricky McGinn is Roiling Campaign 2000. Why America's Rethinking Capital Punishment*, NEWSWEEK, June 12, 2000, at 24, 26–34 (noting changes in political rhetoric concerning the death penalty); Alan Berlow, *The Broken Machinery of Death*, AM. PROSPECT, July 30, 2001, at 16; David Gergen, *Death by Incompetence*, U.S. NEWS & WORLD REP., June 26, 2000, at 76; James Liebman, *The Condemned, and the Mistakes*, N.Y. TIMES, July 12, 2000, at A20; *Murder One*, THE ECONOMIST, June 17, 2000, at 33.

[49] DEATH PENALTY INFORMATION CENTER, *available at* http://www.deathpenaltyinfo.org/article.php? scid=8&did=146 (last updated Sept. 1, 2006).

year per state. In states other than Texas, the median state-year average is far lower.

In Mocan and Gittings,[50] for example, executions between 1976 and 1997 range from 0 to 18, with 859 of the 1000 over the 21 years (86%) equal to 0. As a result, the median is also 0. There are 78 values (8%) equal to 1. There are but 11 values (1%) larger than 5, ranging from 7 to 18 executions. Obviously, the distribution is highly skewed, and the mean is dominated by a few extreme values. Most states in most years execute no one. Accordingly, the low number of events in most states suggests that there is hardly enough signal to reach a disparate and heterogeneous population of would-be murderers.[51]

The problems of both low base rates and the hegemony of Texas in the new deterrence studies have been illustrated by Professor Richard Berk, who re-analyzed data from Mocan and Gittings to show some simple trends and empirical facts in the data.[52] Berk constructed a simple deterrence measure, lagging executions one year behind homicides, to show several underlying trends in these data. First, a deterrent effect—that is, a negative slope in the murder rate relative to the execution rate—occurs when the number of executions within a state over a single year is five or more. Figure 1, from Professor Berk's analysis, illustrates this point. But even at this extreme tail of the distribution, the confidence intervals are so large as to render a claim of prediction meaningless.

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[50] Mocan & Gittings, *supra* note 10, at 458 fig.1.

[51] Richard Berk, *New Claims About Executions and General Deterrence: Déjà Vu All Over Again?*, 2 J. EMPIRICAL LEGAL STUD. 303 (2005) [hereinafter Berk, *New Claims*]. Not only are executions clustered in Texas, but most states in most years have no executions, a statistical burden that none of the new deterrence studies competently address. To address this problem statistically, one must first estimate a model that explains which states have any executions, and then a second model to show the factors that predict the frequency of its use. Such models are called "hurdle" regressions. *See, e.g.*, Christopher J. W. Zorn, *An Analytic and Empirical Examination of Zero-Inflated and Hurdle Poisson Specifications*, 26 SOC. METHODS & RES. 368 (1998); *see also* Yin Bin Cheung, *Zero-Inflated Models for Regression Analysis of Count Data: A Study of Growth and Development*, 21 STAT. IN MED. 1461, 1462–67 (2002). Statistical methods that fail to account for this two part process will produce unreliable and inflated results.

[52] Berk, *New Claims*, *supra* note 51, at 304.

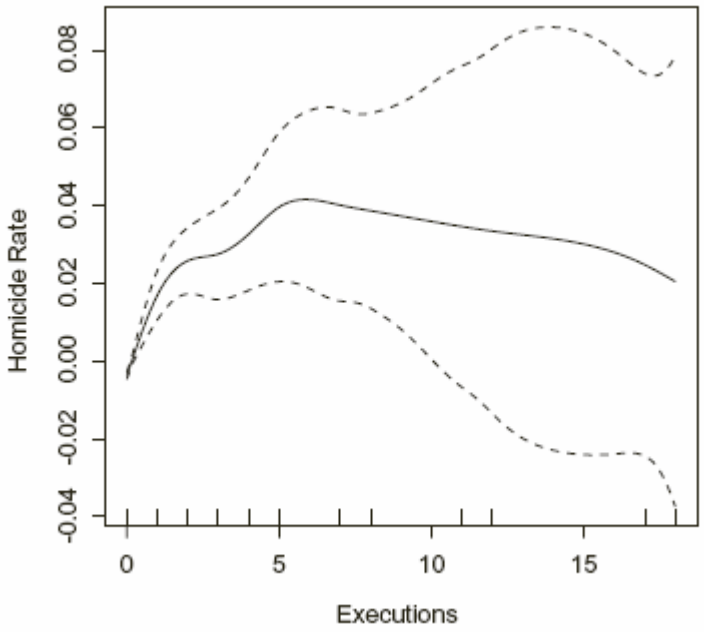

Figure 1. Homicide rate as a function of the number of executions lagged by one year, 1976–1997.[53]

Second, Professor Berk shows that after controlling both for the initial and average murder rate per state over the full twenty-one year study interval and state population size over time, the trends become unstable and unpredictable.[54] Third and most important, he shows that once Texas is removed from the analysis, all deterrent effects disappear.[55]

These extremes have undue "leverage" and "influence" on the data[56] Most of the model-fitting methods in these studies tend to weigh these skewed observations very heavily, giving them undue leverage in the regression coefficients in complex models. According to Professor Berk, claims of a deterrent effect reflect these extreme cases, not the mass of the data.[57] The leverage of these cases is transformed into influence when extreme values of a predictor—executions—are likely to be paired with extreme values of a response variable—homicides. By "influence" one means that the potential impact of leverage in a model's fit

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[53] *Id*. (reanalyzing data from Mocan & Gittings, *supra* note 10). Note: Solid line is smoothed fitted values. The dotted lines contain the approximate 95% confidence interval. The relationship between the homicide rate and the lagged number of executions is generally positive for up to five executions and uncertain thereafter.

[54] *Id.* at 319 fig.13.

[55] *Id.* at 321–24 figs.15–18.

[56] *Id.* at 305.

[57] *Id.* at 318.

becomes a reality, reinforcing the illusion of a statistical relationship which—in this case—actually is simply a product of one small set of observations. When he eliminates Texas, where these extremes are concentrated, Professor Berk shows that the relationship between execution and homicide disappears.[58]

Some analysts have tried to overcome these difficulties by disaggregating murders to the county level,[59] but the extreme cases still unduly influence the execution-homicide trends. No matter how deterrence is measured, the analyses remain captives of the structure of the data, and that structure ordains a particular result. If there is an effect of executions on homicides, it is the result of eleven extreme values, and from the influence of Texas. Generalizations from the eleven observations to the remaining ninety-nine percent would be unstable and inappropriate.

B. *Theory and Specifications*

The current set of deterrence tests typically takes the form of a regression model predicting murder rates. The predictors include measures of deterrence in the form of executions per death sentence, a lag function expresses assumptions about the delay from sentence to execution; and from execution to the deterrent effect on murder. At least one study includes "announcement effects" of executions by including newspaper reports of executions.[60] Controls are sometimes introduced to account for different assumptions about the production of the "supply" of offenders eligible for execution: murder arrests, population size and demography. Rarely are there measures that capture the punitiveness of the criminal justice system or its incapacitative effects. Some try to estimate the risks of detection by indexing the number of police. Few estimate the aggressiveness of law enforcement by looking at the general behavior of legal institutions toward crime generally. Socio-economic contexts associated with homicide appear via measures of the age distribution of the population, poverty and unemployment rates, and the extent of urbanization of the population. These structural factors have been identified as homicide risks over time and across different units of analysis including states, cities, and neighborhoods.[61] Most of the new deterrence

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[58] *Id.* at 322 fig.16. The confidence intervals in Figure 16 suggest that there may be a positive relationship between the homicide rate and the lagged number of executions when Texas is removed from the data set.

[59] Shepherd, *Deterrence Versus Brutalization*, *supra* note 46, at 223. One of the problems that Shepherd faced in this analysis was disaggregating death sentences and executions to the county level. Her solution was to apply the statewide measures for each year to each county within the state, creating an ecological fallacy that biases estimates of deterrence.

[60] *Id.* at 253.

[61] *See, e.g.*, Kenneth C. Land et al., *Structural Covariates of Homicides Rates: Are There Any Invariances Across Time and Social Space?* 95 AM. J. SOC. 922 (1990); Robert J. Sampson & Janet Lauritsen, *Violent Victimization and Offending: Individual-, Situational-, and Community-Level Risk Factors*, *in* UNDERSTANDING AND PREVENTING VIOLENCE: SOCIAL INFLUENCES 1, 48–63 (A. Reiss &

studies measure both murder and social structural risk at the state level, but others are based on a county-within-state analysis.[62]

The typical approach in the new deterrence studies involves estimation of regressions with different combinations of predictor variables, with sensitivity or robustness estimated from variation in the size of the regression coefficient for execution or the statutory presence of the death penalty in different configurations of predictors. Covariates associated with the production of homicides are included, but often are manipulated to form a sensitivity test for the specifications. However, these predictor sets often omit a range of other important factors that have stable and recurring effects on murder rates. These omissions in turn create specification errors that tend to inflate the significance of the deterrence factors. As we shall see below, some omissions are more important than others, but the cumulative effect of these omissions is a distortion and inflation of execution effects.

1. Deterrence, Incapacitation, and Life Without Parole

Perhaps the most important theoretical misspecification in the new deterrence studies is the omission of the incapacitative effects of imprisonment generally, and Life Without Parole (LWOP) sentences in particular. Of the thirty-eight states that currently have valid death penalty statutes, thirty-seven also have LWOP statutes. Only New Mexico does not. Of the twelve states without the death penalty, eleven have life without parole. Only Alaska does not.[63] Even if LWOP were available as a sentencing option in cases other than capital trials, incarceration of persons with lengthy histories of violent crimes for non-capital offenses would likely exert some prophylactic effect on murder, given the prevalence of felony murders such as robbery-homicides.[64] Accordingly, the omission of LWOP from research on legal interventions to reduce homicide is a potentially biasing omission.

But how much of an effect might LWOP have on homicide rates? Systematic data on the extent to which juries return LWOP sentences capital cases is difficult to obtain; when available, it often is only for periods beginning in 1990 or later.

J. A. Roth eds., 1994); Lauren J. Krivo & Ruth D. Peterson, *The Structural Context of Homicide: Accounting for Racial Differences in Process*, 65 AM. SOC. REV. 547 (2000).

[62] Shepherd, *Deterrence Versus Brutalization*, *supra* note 46.

[63] Julian H. Wright, Jr., *Life-Without-Parole: An Alternative to Death or Not Much of a Life at All?*, 43 VAND. L. REV. 529, 546 (1990); J. Mark Lane, *"Is There Life Without Parole?" A Capital Defendant's Right to a Meaningful Alternative Sentence*, 26 LOY. L.A. L. REV. 327 (1993); DEATH PENALTY INFORMATION CENTER, LIFE WITHOUT PAROLE (2000), *available at* http://www.deathpenaltyinfo.org/ article.php?did=555&scid=59 [hereinafter DPIC]; BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, STATE COURT ORGANIZATION (1998), *available at* http://www.ojp.usdoj.gov/bjs/pub/pdf/sco9807.pdf.

[64] Jeffrey Fagan et al., *Capital Punishment and Capital Murder: Market Share and the Deterrent Effects of the Death Penalty*, 84 TEX. L. REV 1803 (2006) [hereinafter Fagan et al., *Capital Punishment and Capital Murder*].

Information is available on when each state passed its LWOP statute or modified it to make it a sentencing alternative in capital cases,[65] so the effects at least of the availability of LWOP as a sentencing option could be modeled and estimated. None of the new deterrence studies do so.

Yet data from a small number of states shows ample evidence that LWOP is used far more often than are death sentences in capital cases and cannot be ignored in estimating reasons for the decline in homicide rates.[66] For example, data from the Pennsylvania Department of Corrections shows that there were 139 LWOP sentences in Pennsylvania in 1999, compared to 15 death sentences. [67] In 2000, there were 121 life sentences compared to 12 death sentences.[68] In California, there were 3163 inmates serving life without parole on February 29, 2004, compared to 635 on death row, and zero executions.[69] In South Carolina, 485 defendants have received LWOP sentences since 1996, compared to 27 executions.[70] One final illustration comes from Georgia. Georgia has sentenced 369 persons to death since passing its LWOP statute in 1993, while death sentences have declined from about ten per year to four during this time.[71] Georgia has executed 21 persons since passing its LWOP statute.[72] Overall, data from the National Judicial Reporting Program in 2002 shows that LWOP sentences were more than three times more frequent in murder cases than were death sentences, and nearly ten times more common than executions.[73]

Obviously, LWOP has incapacitative effects, as does execution, and the two are difficult to disentangle empirically. The 1978 National Research Council Panel

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[65] DPIC, *supra* note 63.

[66] *Id*.

[67] PA. DEP'T OF CORRECTIONS, ANNUAL STATISTICAL REPORT 18 (1999), *available at* http://www.cor.state.pa.us/stats/lib/stats/ASR1999.pdf.

[68] PA. DEP'T OF CORRECTIONS, ANNUAL STATISTICAL REPORT 19 (2000), *available at* http://www.cor.state.pa.us/stats/lib/stats/Annual%20Report%202000.pdf.

[69] CAL. DEP'T OF CORRECTIONS, FACTS AND FIGURES (Third Quarter 2004), *available at* http://www.corr.ca.gov/DivisionsBoards/AOAP/FactFiguresArchive/FactsFiguresArchive.html. Fewer than 100 of the LWOP sentences were "Three Strikes Convictions." *See* FRANKLIN ZIMRING ET AL., PUNISHMENT AND DEMOCRACY: THREE STRIKES AND YOU'RE OUT IN CALIFORNIA (2001).

[70] S.C. DEP'T OF CORRECTIONS, INMATE POPULATION STATISTICS AND TRENDS, SENTENCE LENGTH DISTRIBUTION FY-01-05 (2005), *available at* http://www.doc.sc.gov/PublicInformation/StatisticalReports/InmatePopulationStatsTrend/AsOfTrendSentenceLengthDistributionFY01-05.pdf. For sentence length distributions for 1996–2001, data are available from the author at http://www2.law.columbia.edu/fagan/researchdata/osjcl_deter/.

[71] Associated Press, *Georgia: Number of Death Penalty Cases Decline*, Dec. 28, 2003, *available at* http://www.democracyinaction.org.dia/organizations/ncadp/news.jsp?key=374&t=.

[72] GA. DEP'T OF CORRECTIONS, INMATE STATISTICAL PROFILE, *available at* http://www.dcor.state.ga.us/pdf/ lwop04-10.pdf (last visited Oct. 21, 2004).

[73] U.S. DEP'T. OF JUSTICE, BUREAU OF JUSTICE STATISTICS NATIONAL JUDICIAL REPORTING PROGRAM 2002, INTER-UNIVERSITY CONSORTIUM FOR POLITICAL SCIENCE AND SOCIAL RESEARCH, http://www.icpsr.com.

on Research on Deterrence and Incapacitation noted the complex relationship between the two and the difficulty of separating the effects of each.[74] Using a lengthy time series, Professors Katz, Levitt and Shustarovich compared deterrence (executions per 1000 prisoners) with incapacitation and conclude that the death rate among prisoners, which they view as a proxy for prison conditions, has a significant deterrent effect on violent crime rates, but they find no robust evidence of a deterrent effect of capital punishment.[75] And in one study that does compete incarceration and deterrence, Mocan and Gittings report larger regression coefficients for incarceration (-.0354) than executions (-.0063).[76] Mocan and Gittings call no attention to this very interesting finding that competes well with execution as an explanation for the decline in murders. Few other studies in the new deterrence literature report incarceration effects, and when they do, the effects either compete with or overwhelm execution effects.

To claim that executions deter homicides when there may be equally strong simultaneous effects from incarceration—whether incapacitative or deterrent—introduces an omitted variable bias that potentially inflates the effects of execution. Indeed, with the exceptions noted above, most of the new deterrence studies simply ignore incarceration or understate its effects.[77] Incarceration effects argue against the *marginal* deterrent effects of execution threats. Felony murder offenders should be deterred both by the threat of prison and the threat of execution. But when both are included in multivariate models, there seems to be no greater marginal threat from execution than from a generalized effect from incarceration. Indeed, one sensitivity test that was not conducted by Mocan and Gittings is a model that includes incarceration but not execution.

Parsing the deterrent effects of incarceration from its incapacitative effects is a task for another article. But for this essay, it is important to note that high incarceration rates across most states are exerting a significant downward pressure on homicide rates.[78] Moreover, these rates are highest for violent crimes.[79] This is

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[74] *See generally* Klein et al., *supra* note 12.

[75] Lawrence Katz et al., *Prison Conditions, Capital Punishment, and Deterrence*, 5 AM. L. & ECON. REV., 318, 327 (2003) [hereinafter Katz et al., *Prison Conditions*].

[76] Mocan & Gittings, *supra* note 10, at 464 tbl.2 col.1.

[77] For example, Shepherd's analysis of state-by-state "Deterrence Versus Brutalization" effects includes prison admissions in one of the estimating equations in her model of deterrence, but the effects are not reported. *See* Shepherd, *Deterrence Versus Brutalization*, *supra* note 46.

[78] Prison sentences and prison populations have been increasing dramatically since 1978. *See* Alfred Blumstein & Allen J. Beck, *Population Growth in U.S. Prisons, 1980–1996*, 26 CRIME & JUST. 17 (1999). The largest segment of the prison population is inmates convicted of violent crimes. *See* PAIGE M. HARRISON & ALLEN J. BECK, BUREAU OF JUSTICE STATISTICS, U. S. DEP'T OF JUSTICE, PRISONERS IN 2004 (2005), *available at* http://www.ojp.usdoj.gov/bjs/pub/pdf/p04.pdf. At year end in 2004, there were 2.1 million persons incarcerated in state prisons, including an estimated 624,900 prisoners serving time for a violent offense, and the nationwide incarceration rate in state prisons was 486 per 100,000 population. *See*, *e.g.*, MARK R. DUROSE & PATRICK A. LANGAN, BUREAU OF JUSTICE STATISTICS, U. S. DEP'T OF JUSTICE, FELONY SENTENCES IN STATE COURTS, 2002 (2005), *available at* http://www.ojp.usdoj.gov/bjs/pub/pdf/fssc02.pdf. In 2002, the average state prison sentence for a

important for two reasons. First, most capital-eligible homicides are felony murders: homicides committed in the course of other crimes, specifically robbery and rape.[80] No offense category has grown faster in the run-up of incarceration than violent crimes.[81] Removing a segment of serious offenders through incarceration inevitably will reduce the base rate of robbery and assault, and reduce the portion of such crimes that escalate to homicides. While Shepherd controls for the robbery rate in one of the new deterrence studies, she does not control for robbery incarcerations or any other incarceration category.[82] Second, the high rate of incarceration and the increasingly lengthy sentences imposed for violent offenses may leave little margin for additional deterrent effects from the threat of execution. Certainly, a robust test of deterrence, as well as a fully specified conceptual theory, would address the separate if not conditional effects of incarceration on murder rates. Unfortunately, the current crop of deterrence studies overlooks this question.

2. Policing and Deterrence

Deterrence theorists emphasize the importance of perceived punishment risk in dissuading would-be offenders from committing crimes. Such risks depend on the efficiency of the police in detecting wrongdoing and responding quickly and efficiently, or alternately, the risk of punishment after having been caught and prosecuted. Research both with offenders and general population samples suggests that (subjectively) perceived risk weighs heavily on the decisions of would-be offenders to engage in or avoid crime.[83] But only a small minority of the new deterrence studies include measures of risk of detection, especially as constructed through effective and efficient policing.

For example, Mocan and Gittings include "the subjective probabilities that potential offenders are apprehended, convicted, and executed" in their estimation models, but restrict their policing and conviction estimates to murders.[84] This is a fairly typical strategy in the few studies that do consider policing. Others focus on police expenditures,[85] or the number of police officers.[86] But with the exception of

violent offense was eighty-four months, a rate that excludes life sentences. The average time served was 5.4 years. *Id*.

[79] *See* Durose & Langan, *supra* note 78.

[80] *See* Fagan et al., *Capital Punishment and Capital Murder*, *supra* note 64.

[81] *See* Durose & Langan, *supra* note 78.

[82] Shepherd, *Deterrence Versus Brutalization*, *supra* note 46, at 225.

[83] Daniel S. Nagin, *Criminal Deterrence Research at the Outset of the Twenty-First Century*, 23 CRIME & JUST. 1 (1998).

[84] Mocan & Gittings, *supra* note 10, at 457–58.

[85] *See* Shepherd, *Murders of Passion*, *supra* note 15; Shepherd, *Deterrence Versus Brutalization*, *supra* note 46.

[86] *See, e.g.*, Dezhbakhsh et al., *supra* note 32.

Katz and his colleagues, there is little attention to the contributions of policing to reductions or variations in homicide rates.

This is an error not just in understanding how crime rates vary, but also it mis-specifies the theoretical pathway and mediating effects of how policing affects deterrence and homicide. The locus of deterrent effects may reside either in the threat of execution or in the threat of apprehension and punishment. A century of deterrence theory and research shows that punishment risk outweighs punishment costs in a general deterrence heuristic,[87] suggesting that the margin for deterrence from execution may be rather thin when compared to punishment risks that have a higher present-value to offenders. Clearance rates for murder are a simple metric for establishing these risks. Clearance rates usually are expressed as the percent of homicides that result in an arrest of a suspect leading to a prosecution. Although plea bargaining often reduces the conviction charge and punishment cost for the offense, homicide arrests are still quite likely to generate a sentence of some lengthy spell of incarceration, achieving either a deterrent or incapacitative effect, if not both. The question, then, is whether there is a marginal deterrent effect of execution.

The clearance rate for felonies that creates punishment risk also attenuates the supply of potential homicide offenders. The ability of local law enforcement to identify homicide offenders or high rate offenders generally will reduce their prevalence and in turn the risks of homicides, especially felony murders. Examining errors in capital sentences, Professor James Liebman and his colleagues showed that from 1976 to 1995 inefficient criminal justice systems seemed to overly rely on the death penalty to respond to homicides compared to jurisdictions with more efficient and effective policing regimes.[88] This signals that the death penalty was compensatory in these locales for poor policing. The court jurisdictions that used the death penalty more often were prone to higher rates of serious reversible error.[89]

Recent studies also show that the police have a prophylactic effect on crime.[90] This effect goes beyond simply the expenditure on policing or the number of police. Police efficiency and strategy exert strong influences on crime rates,

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[87] *Nagin*, *supra* note 83.

[88] JAMES S. LIEBMAN ET AL., A BROKEN SYSTEM, PART II: WHY THERE IS SO MUCH ERROR IN CAPITAL CASES, AND WHAT CAN BE DONE ABOUT IT (2002), *available at* http://www2.law.columbia.edu/brokensystem2/report.pdf [hereinafter LIEBMAN ET AL., A BROKEN SYSTEM, PART II].

[89] *Id*.

[90] *See, e.g.*, 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); Jonathan Klick & Alexander Tabarrok, *Using Terror Alert Levels to Estimate the Effect of Police on Crime*, 48 J. L. & ECON. 267 (2005); Steven D. Levitt, *Understanding Why Crime Fell 1990s: Four Factors that Explain Decline and Six that Do Not*, 18 J. ECON. PERSP. 163 (2004).

including gun-related crimes that carry a special risk of escalating to lethality. For example, Professor Jacqueline Cohen's analysis of aggressive police interdiction strategies in Pittsburgh showed strong reductions in gun crimes and gun injuries.[91]

Local police departments allocate and deploy their resources to reflect strategic analyses of crime problems and the tactics best suited to their control. These decisions, and policing effects generally, are not accurately captured through measures of police force size or police expenditures that are typically used in the new deterrence studies. In general, the inconsistent and atheoretical attention to policing as a competing source of deterrence or crime control is another form of omitted variable bias that weakens the claims of the new deterrence studies.

3. Co-Morbid Epidemics

Homicide was not the only epidemic social problem in the United States in the years following *Furman*. *Furman* was decided just as a five year epidemic of heroin use had begun to wane in the United States in the early 1970s,[92] an era when homicide rates also rose sharply across American cities.[93] The sharp rise in homicides was linked temporally and spatially to an epidemic of heroin use.[94] Over the next two decades, homicide rates rose and fell concurrently with other drug epidemics. Homicide rates spiked again from 1979 to 1981, concurrent with the emergence of street drug markets in major cities where powdered cocaine was openly sold.[95] Record homicide rates in American cities in the early 1990s coincided with the crack epidemic that lasted nearly a decade after 1986.[96]

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[91] Jacqueline Cohen & Jens Ludwig, *Policing Crime Guns*, *in* EVALUATING GUN POLICY: EFFECTS ON CRIME AND VIOLENCE 217 (Philip J. Cook & Jens Ludwig eds., 2003). *See generally* FAIRNESS AND EFFECTIVENESS IN POLICING: THE EVIDENCE (Wesley Skogan & Kathleen Frydl eds., 2004) (citing empirical evidence that specialized policing targeting specific crime problems is more effective than general reactive policing, and discounting evidence reporting that larger police forces are more effective at crime deterrence).

[92] *See* DAVID F. MUSTO, THE AMERICAN DISEASE: ORIGINS OF NARCOTIC CONTROL (3d ed. 1987). *See generally* David F. Musto, *Perception and Regulation of Drug Use: The Rise and Fall of the Tide*, 123 ANNALS INTERNAL MED. 468 (1995).

[93] *See* FRANKLIN ZIMRING & GORDON HAWKINS, CRIME IS NOT THE PROBLEM: LETHAL VIOLENCE IN AMERICA (1997); *see also* Alfred Blumstein & Richard Rosenfeld, *Explaining Recent Trends in U.S. Homicide Rates*, 88 J. CRIM. L. & CRIMINOLOGY 1175 (1998); Richard Rosenfeld, *Patterns in Adult Homicide: 1980–1995*, *in* THE CRIME DROP IN AMERICA 130 (Alfred Blumstein & Joel Wallman eds., 2000).

[94] *See* LEON G. HUNT & CARL D. CHAMBERS, THE HEROIN EPIDEMICS: A STUDY OF HEROIN USE IN THE UNITED STATES, 1965–1975, 73–113 (1976); James A. Inciardi, *Heroin Use and Street Crime*, 25 CRIME & DELINQ. 335 (1979); D.J. Egan & D.O. Robinson, *Models of a Heroin Epidemic*, 136 AM. J. PSYCHIATRY 1162 (1979); Michael Agar & H.S. Reisenger, *A Heroin Epidemic at the Intersection of Histories: The 1960s Epidemic Among African Americans in Baltimore*, 21 MED. ANTHROPOL. 115 (2002).

[95] *See, e.g.*, Bruce D. Johnson et al., *Drug Abuse in the Inner City: Impact on Hard Drug Users and the Community*, *in* DRUGS AND CRIME 9 **(**Michael Tonry & James Q. Wilson eds., 1990); TERRY WILLIAMS, THE COCAINE KIDS (1989); Audio Tape: Lloyd Johnston et al., National Trends in

The temporal and spatial dependence of murder and drugs is an epidemiological fact that deserves serious attention as a competing influence on the murder rate. One might see drug epidemics and murder as simply co-morbid problems that share common etiologies or that combine to weaken the resources needed to resist such social problems. Or, one might see them as causally related, in which case the rise and fall of one epidemic would predict concurrent or closely spaced changes in the other.[97] The latter view dominated criminological research through the 1990s. Through mechanisms that connect drug sales and gun violence, the crack epidemic exerted a strong push on murder rates and spread across American cities in a pattern similar to a contagious disease.[98]

The decline in homicides through the late 1990s and into the early part of this decade has been linked to the decline in the crack epidemics, specifically changes in street markets where drugs had been openly sold amidst much violence a decade earlier.[99] Drug sales declined in volume and moved indoors as demand shrunk and also as police focused on drug sales. Competition between sellers waned, reducing

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Drug Use and Related Factors Among American High School Students and Young Adults, 1975–86 (1987) (DHS ADM 87–1535); LYNN ZIMMER, OPERATION PRESSURE POINT: THE DISRUPTION OF STREET-LEVEL DRUG TRADE ON NEW YORK'S LOWER EAST SIDE (1987); Lynn Zimmer, *Proactive Policing Against Street-Level Drug Trafficking*, 9 AM. J. POLICE 43 (1990).

[96] Eric Baumer et al., *Poverty, Crack, and Crime: A Cross-City Analysis*, 31 J. RES. CRIME & DELINQ. 311 (1994); Eric Baumer et al., *The Influence of Crack Cocaine on Robbery, Burglary and Homicide Rates: A Cross-City Longitudinal Analysis*, 35 J. RES. CRIME & DELINQ. 316 (1998); Jeff Grogger & Michael Willis, *The Emergence of Crack Cocaine and the Rise in Urban Crime Rates*, 82 REV. ECON. & STAT. 519, 526 (2000); Roland G. Fryer et al., *Measuring the Impact of Crack Cocaine* 1–65 (Nat'l Bureau of Econ. Research, Working Paper No. 11318, 2005), *available at* http://papers.nber.org/papers/w11318.pdf (last visited Mar. 13, 2006).

[97] *See, e.g.*, Jan M. Chaiken & Marcia R. Chaiken, *Drugs and Predatory Crime*, *in* DRUGS AND CRIME 203 (Michael Tonry & James Q. Wilson eds., 1990); ROBERT J. MACCOUN & PETER REUTER, DRUG WAR HERESIES: LEARNING FROM OTHER VICES, TIMES AND PLACES (2003).

[98] *See* Alfred Blumstein, *Youth Violence, Guns, and the Illicit-Drug Industry*, 86 J. CRIM. L. & CRIMINOLOGY 10 (1995); Daniel Cork, *Examining Space-Time Interaction in City-Level Homicide Data: Crack Markets and the Diffusion of Guns Among Youth*, 15 J. QUANTITATIVE CRIMINOLOGY 379 (1999); *see also* Paul J. Goldstein et al., *Crack and Homicide in New York City, 1988: A Conceptually Based Event Analysis*, 16 CONTEMP. DRUG PROBS. 651 (1989) (showing that in 1988 in New York City, 85% of crack-related crimes were caused by the market culture associated with illicit crack sales, primarily territorial disputes between rival crack dealers); Roland G. Fryer et al., *supra* note 96. The Fryer crack index is specific to cocaine and specifically crack, and emphasizes homicide victimization and drug overdose deaths. However, since most drug-related violence, including homicide, is associated with drug trafficking, the index is of less utility in explaining long-term variation in drug market trends and their effects on homicides. *See* Jeffrey Fagan, *Intoxication and Aggression*, *in* DRUGS AND CRIME 241 (Michael Tonry & James Q. Wilson eds., 1990). *See generally* U.S. SENTENCING COMMISSION, *Chapter 5: Cocaine and Crime*, *in* REPORT ON COCAINE AND FEDERAL SENTENCING POLICY, *available a*t http://www.ussc.gov/crack/chap5.htm (last visited Mar. 22, 2006).

[99] *See, e.g.*, Richard Curtis, *The Improbable Transformation of Inner-City Neighborhoods: Crime, Violence, Drugs and Youth in the 1990s*, 88 J. CRIM. L. & CRIMINOLOGY 1233 (1998).

the incidence of disputes implicated in many murders during the height of the epidemic.[100]

None of the new deterrence studies consider the epidemics of drug use and related violence, especially murder. Perhaps the declines in drug markets were due to police efforts to deter drug selling through intensive drug enforcement and high volumes of drug arrests, or to sentencing laws that targeted drug sellers. But these direct or indirect effects of policing were also not given close attention. As in policing, the inattention to the effect of drug epidemics on violence is an omission that challenges, if not impeaches, the conclusions of the new deterrence studies of a singular effect of execution on homicide.

4. Are all Homicides Deterrable?

Most of the new deterrence studies regard homicide as a homogeneous criminal behavior. With one exception, these studies make no distinctions between homicides committed in varying contexts or with different motivations. The assumption is that all are equally deterrable. This logic is challenged in at least two different ways. First, several decades of empirical research on homicide that cut across the social sciences suggests that homicides are variably rational; some, such as crimes of jealousy or unplanned and highly contingent events, are simply poor candidates for deterrence. Second, the law makes these distinctions explicit in felony murder rules, and carves out a particular set of homicides—such as homicides committed in the course of other crimes—as eligible for capital punishment. The most accurate test of the underlying rationale for deterrence would be the sensitivity of these homicides to the threat of execution.

Only one among the new studies, by Professor Joanna Shepherd,[101] offers estimates of the deterrent effects of execution on specific categories of homicide.[102] Shepherd reports that executions deter all types of murder, including domestic or marital homicides, or other "crimes of passion" that so often are considered to be irrational and spontaneous acts that are beyond the rational reach of execution threats.[103]

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[100] *Id*. *See also* NAT'L INSTITUTE OF JUSTICE, 1998 ANNUAL REPORT ON COCAINE USE AMONG ARRESTEES, NCJ 175657, *available at* http://www.ncjrs.gov/pdffiles1/175657.txt (last visited Mar. 16, 2006).

[101] Shepherd, *Murders of Passion*, *supra* note 15.

[102] Information about the circumstances of events is provided by the Federal Bureau of Investigation in the Supplemental Homicide Reports, a data file of homicide records that includes information on victims, offenders (where known via arrest), and the circumstances of the homicide event. *See* BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, HOMICIDE TRENDS IN THE U.S., *available at* http://www.ojp.usdoj.gov/bjs/homicide/homtrnd.htm#contents (last visited Sept. 1, 2006); JAMES A. FOX, INTER-UNIVERSITY CONSORTIUM FOR POLITICAL SCIENCE AND SOCIAL RESEARCH, UNIFORM CRIME REPORTS [UNITED STATES]: SUPPLEMENTARY HOMICIDE REPORTS, 1976–2003 (2005), *available at* http://webapp.icpsr.umich.edu/cocoon/ICPSR-STUDY/04351.xml.

[103] Shepherd, *Murders of Passion*, *supra* note 15.

The high rate of murder-suicides in domestic homicides is one clue to the irrationality if not mental illness of this subset of murderers, limiting the prospects for deterrence.[104] The gradient of uncontrolled rage that precedes many domestic homicides also suggests the inelasticity of motivation and arousal among men who kill or nearly kill their intimate partners.[105] The steady decline over nearly 30 years in "domestic" or intimate partner homicides[106] suggests a secular trend that is insensitive to fluctuations in the number of executions since capital punishment was reinstated following *Gregg*.

The literature on homicide events shows that many homicide offenders are simply unresponsive to punishment threats.[107] Professor Jack Katz offers an analysis of homicide events and offenders that portrays some as "stone cold killers" while others simply take pleasure from killing, even as they remain indifferent to punishment threats or even death by retaliation in the moment of the homicide.[108] Using a social interactionist framework, several sociologists conclude that most homicide events are largely unplanned products of complicated social interactions—disputes that escalate from minor conflicts into threatening conflicts where the fear of injury or death motivates lethally violent responses to even minor provocations.[109] Deanna Wilkinson and I suggest that the presence of firearms

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[104] *See, e.g.*, Jacquelyn C. Campbell et al., *Risk Assessment for Intimate Partner Homicide*, *in* CLINICAL ASSESSMENT OF DANGEROUSNESS: EMPIRICAL CONTRIBUTIONS 136 (Georges-Franck Pinard & Linda Pagani eds., 2001); Lauren Bennett et al., *Risk Assessment Among Batterers Arrested for Domestic Assault: The Salience of Psychological Abuse*, 6 VIOLENCE AGAINST WOMEN 1190 (2000); Arlene N. Weisz et al., *Assessing the Risk of Severe Domestic Violence: The Importance of Survivors' Predictions*, 15 J. INTERPERSONAL VIOLENCE 75 (2000).

[105] *See* KENNETH POLK, WHEN MEN KILL: SCENARIOS OF MASCULINE VIOLENCE (1994); *see also* Jeffrey Fagan & Angela Browne, *Violence toward Spouses and Intimates: Physical Aggression between Men and Women in Intimate Relationships*, *in* 3 UNDERSTANDING AND PREVENTING VIOLENCE 115 (Albert J. Reiss, Jr., & Jeffrey A. Roth eds., 1994); Angela Browne et al., *Homicide Between Intimate Partners*, *in* HOMICIDE: A SOURCEBOOK OF SOCIAL RESEARCH 149 (M. Dwayne Smith & Margaret A. Zahn eds., 1999).

[106] *See, e.g.*, Laura Dugan et al., *Explaining the Decline in Intimate Partner Homicide: The Effects of Changing Domesticity, Women's Status, and Domestic Violence Resources*, 3 HOMICIDE STUD. 187 (1999) (attributing the two-decades-long decline in the intimate partner homicide rate in the United States as a function of three factors that reduce exposure to violent relationships: shifts in marriage, divorce, and other factors associated with declining domesticity; the improved economic status of women; and increases in the availability of domestic violence services).

[107] *See* JACK KATZ, SEDUCTIONS OF CRIME: THE MORAL AND SENSUAL ATTRACTIONS OF DOING EVIL (1988) [hereinafter KATZ, SEDUCTIONS OF CRIME] (describing "stone cold killers" who are insensitive to punishment threats, and whose homicides can only be described as the pursuit of domination and pleasure); *see also* NATHANIEL J. PALLONE & JAMES J. HENNESSY, TINDER-BOX CRIMINAL AGGRESSION: NEUROPSYCHOLOGY, DEMOGRAPHY, PHENOMENOLOGY (1996).

[108] KATZ, SEDUCTIONS OF CRIME, *supra* note 107.

[109] *See* Richard B. Felson & Henry J. Steadman, *Situational Factors in Disputes Leading to Criminal Violence*, 21 CRIMINOLOGY 59, 59–60 (1983); David F. Luckenbill, *Criminal Homicide as a Situated Transaction*, 25 SOC. PROBS. 176 (1977); Richard B. Felson, *Impression Management and the Escalation of Aggression and Violence*, 45 SOCIAL PSYCHOLOGY Q. 245 (1982); David F.

short circuits the decision stages where the perceived cost of not killing a possibly armed opponent is one's own death from the opponent's firearm.[110] There is no planning in these events; the emotional arousal in the moment trumps all restraint and compromises the type of reasoning and calculation necessary for deterrence.[111]

The use of total homicides has always been an aggregation error in the deterrence debate in the United States.[112] Under common law, only the top grade of murder was ever eligible for the death penalty. However, the traditional legal framework on the criteria that made criminal homicide potentially capital was far from clear until the U.S. Supreme Court imposed minimum constitutional standards for death eligibility in *Gregg v. Georgia* and its companion 1976 cases.[113] Shepherd's was one of the few projects to attempt to disaggregate homicides into separate categories to assess their deterability. However, she did not use legally relevant categories; her partitioning of the data was not indexed to statute, but to a set of categories descriptive of "different types of murders"[114] that were defined neither by statute nor, with the exception of "crimes of passion," by theory. More importantly, none of these categories were narrowed according to statutory criteria that bound the circumstances and conditions that qualify a murder as "capital."[115]

In fact, when one narrows the search for deterrence by focusing not on general homicide trends and rates, but on the subset of homicides that are eligible for the death penalty, any evidence of deterrence disappears. If execution risk is the core element in deterrence, these types of homicides should provide a more sensitive test than the overall homicide rate index for detecting a deterrent effect

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Luckenbill & Daniel P. Doyle, *Structural Position and Violence: Developing a Cultural Explanation*, 27 CRIMINOLOGY 422, 422–23 (1989); WILLIAM OLIVER, THE VIOLENT SOCIAL WORLD OF BLACK MEN 138–40 (1994).

[110] Deanna L. Wilkinson & Jeffrey Fagan, *A Theory of Violent Events*, *in* THE PROCESS AND STRUCTURE OF CRIME: CRIMINAL EVENTS AND CRIME ANALYSIS 169 (Robert F. Meier & Leslie Kennedy eds., 2001). *See also* DEANNA L. WILKINSON, GUNS, VIOLENCE, AND IDENTITY AMONG AFRICAN AMERICAN AND LATINO YOUTH (2004); Jeffrey Fagan & Deanna L. Wilkinson, *Guns, Youth Violence, and Social Identity in Inner Cities*, *in* YOUTH VIOLENCE 105 (Michael Tonry & M.H. Moore eds., 1998) [hereinafter Fagan & Wilkinson, *Guns, Youth Violence*].

[111] PALLONE & HENNESSY, *supra* note 107.

[112] *See* THORSTEN SELLIN, THE DEATH PENALTY: A REPORT FOR THE MODEL PENAL CODE PROJECT OF THE AMERICAN LAW INSTITUTE (1959). Sellin's classic studies of more than 50 years ago included particularly high risk categories of homicides, such as killings of police officers and prison guards.

[113] Gregg v. Georgia, 428 U.S. 153 (1976).

[114] Shepherd, *Murders of Passion*, *supra* note 15, at 292 (sorting murders into categories of victim-offender relationship including intimates, acquaintances, and strangers, crime-of-passion murders and murders committed during other felonies, and murders of African-American and white people).

[115] For the distinction between felony murder and capital murder, see 40A AM. JUR. 2D *Homicide* § 551 (2006).

from execution.[116] After all, felony murder carries strict liability, a consequence of the intent-based retributivism that guides most of the capital murder statutes in effect in 38 states today.[117]

However, when partitioned according to these legal categories, there seems to be no evidence of deterrence based on lagged executions. Analyses of homicide trends from 1976 to 2003 in death penalty states, using a variety of econometric models, show that there is no significant effect of executions on the rate of capital-eligible murders. [118] One deterrence story is that the threat of execution should affect the subset of homicides eligible for executions more than other homicides. Accordingly, the "market share" of homicides that are capital-eligible should decline as the overall homicide rate declines, while non-capital homicides should remain unaffected by the threat of execution. But, together with colleagues Franklin Zimring and Amanda Geller, I find just the opposite: the market share is rising, since capital-eligible homicides remain stable over time while the rate of other homicides declines. This also is true when we isolate county-level trends in Texas, the state that has carried out more than one third of all executions in the United States since *Gregg*.[119] This is the opposite of what would be predicted from economic theories of death penalty deterrence.

If capital eligible homicides are insensitive to deterrent threats, even as other homicides are declining, then the prospects for a more generalized pattern of deterrence of homicide are not good. As non-capital eligible homicides decrease in number, it would be logical that police and prosecutors would devote more attention to the smaller number of capital-eligible cases. Greater resources would be available for police investigations and clearance rates should improve. Prosecutors also would have more time and greater resources to devote to these cases, increasing the likelihood of lengthy prison sentences, if not capital sentences. Yet even this concentration of criminal justice resources on capital-eligible cases has not leveraged the rate of capital-eligible homicides.

C. *Measurement and Specification Errors*

Three types of measurement error undermine the claims of the new deterrence studies: large amounts of missing data on key indices of murder, over-inclusion of persons who are eligible for capital punishment in the estimates of deterrence, and arbitrary and artifactual temporal truncation in the panel designs. Each source of error independently leads to inflated estimates of deterrence.

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[116] *See, e.g.*, Franklin Zimring & Gordon Hawkins, *Deterrence and Marginal Groups*, 5 J. RES. CRIME & DELINQ. 100 (1968).

[117] Kevin Cole, *Killings During Crime: Toward a Discriminating Theory of Strict Liability*, 28 AM. CRIM. L. REV. 73 (1990).

[118] Fagan et al., *Capital Punishment and Capital Murder*, *supra* note 63.

[119] *Id*.

1. Missing Data

To measure both homicides and homicide arrests, most of the new deterrence studies rely on data published by the Federal Bureau of Investigation through its Uniform Crime Reporting (UCR) program.[120] However, the UCR data have large amounts of missing data from critical states. For example, data on homicide and robbery arrests in Florida are missing for many local police departments in 1988 and 1989 and again in 1997 through 2002.[121] A more recent analysis by Professors Michael Maltz and Harald Weiss of monthly data on crimes reported to the police shows that many years have only partial data: reports in fewer than the full twelve months of the calendar year.[122] For example, Florida reported homicides to the UCR system for no months in 1988, five months in 1989, and no more than two months in 1997 through 1999.[123] Yet Florida is one of the nation's most active death penalty states, with fifty-seven executions from *Gregg* through 2003, so the importance of its omission and the potential bias in estimating the deterrent effects of execution due to incomplete data is obvious. In general, non-reporting by police agencies is a recurring problem in the UCR program. For example, from 1992–1994, 3516 of the 18,413 (19%) agencies participating in the UCR system made no reports at all to the UCR program. [124] According to Professor Michael Maltz, the non-reporting agencies included the primary police agencies in three counties and cities with populations greater than 100,000, and also the primary agencies in 200 cities with populations greater than 10,000. By 1995, the percent of the U.S. population covered by agencies reporting crimes to the UCR system declined from nearly 100% in 1980 to less than 90%.[125] By 1997, the percent of the U.S.

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[120] FED. BUREAU OF INVESTIGATION, UNIFORM CRIME REPORTS DEP'T OF JUSTICE, UNIFORM CRIME REPORTS FOR THE UNITED STATES: CRIME IN THE UNITED STATES, 1973–2003, *available at* http://bjsdata.ojp.usdoj.gov/dataonline/ (last visited Aug. 18, 2006).

[121] *See, e.g.*, INTER-UNIVERSITY CONSORTIUM FOR POLITICAL SCIENCE AND SOCIAL RESEARCH, UNIFORM CRIME REPORTING PROGRAM DATA [UNITED STATES]: OFFENSES KNOWN AND CLEARANCES BY ARREST (1999) *available a*t http://www.icpsr.umich.edu/cgi-bin/bob/newark?study=3158&path=NACJD (last visited July 21, 2006). Data for each state and year are available at http://www.icpsr.umich.edu/NACJD/ucr.html (last visited July 21, 2006).

[122] MICHAEL D. MALTZ & HARALD E. WEISS, CREATING A UCR UTILITY: FINAL REPORT TO THE NATIONAL INSTITUTE OF JUSTICE (2006), *available at* http://www.ncjrs.gov/pdffiles1/nij/grants/215341.pdf.

[123] *Id*. Data for Florida and all other states from 1960–2002 are available in spreadsheets from http://sociology.osu.edu/people/mdm/UCR_Utility.zip.

[124] *See* MICHAEL MALTZ, BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, BRIDGING GAPS IN POLICE CRIME DATA (1999), *available at* http://www.ojp.usdoj.gov/bjs/pub/pdf/bgpcd.pdf, at 9 tbl.1 and accompanying text. The percent of the population covered by police agencies reporting arrests statistics declined from 95% in 1977 to 73% by 1997. *Id.* at fig.10.

[125] *Id*. at fig.3.

population covered by agencies reporting UCR arrest records had declined from 95% in 1977 to 73%.[126]

The new deterrence studies are generally silent on the patterns of missing data and offer no adjustments that might compensate the biases from excluding key states and years. When not silent, the adjustments for missing data are often puzzling, but more worrisome is their potential for introducing bias. In one study, Professor Shepherd takes heart in the fact that over 90% of the homicides are reported by the FBI, ignoring the weighting and distribution of the missing homicide statistics. Instead, she simply dropped those data points "so that the missing data do not bias my results."[127] Quite the contrary, simply leaving out these state-months raises doubts about the accuracy and absence of bias in her results. The 10% of the population that is not included in the UCR's crime reports is not normally distributed, nor is the 27% that is not included in the arrest statistics. The bias from ignoring the processes generating such large amounts of missing data is potentially quite large.

Even within states, the omission of these key agencies and years in places like Florida introduces a selection bias that is likely to distort both the regression coefficients and the standard errors. Professor Jon Sorenson showed an undercounting of 137 homicides in a two year span from 1996 to 1997 by Cloninger and Marchesini[128] in their analysis of the impacts on homicide of the short moratorium on executions in Texas in the mid-1990s.[129] Similarly, Mocan and Gittings use a substitution algorithm to replace cases where division by zero (in computing executions per lagged death sentence) with .99, a decision that increases the size of the deterrence coefficient by approximating a value of one rather than a value of zero.[130] In Section IV, I show that when I run the Mocan and Gittings regression models correcting this coding decision, the deterrence variable is no longer statistically significant.[131]

The new deterrence studies also fail to address the missing data problems or investigate alternate data sources that might fill in important gaps in annual homicide rates. One such data set is available from the mortality and morbidity

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[126] *Id.* at fig.10.

[127] Shepherd, *Murders of Passion*, *supra* note 15, at 304.

[128] Cloninger & Marchesini, *supra* note 44.

[129] Jon Sorensen et al., *Capital Punishment and Deterrence: Examining the Effect of Executions on Murder in Texas*, 45 CRIME & DELINQ. 481 (1999) (finding no evidence of deterrence resulting from capital punishment using Texas execution and murder rate data from 1984 through 1997); *see also* JON SORENSON & ROCKY LEANN PILGRIM, LETHAL INJECTION: CAPITAL PUNISHMENT IN TEXAS DURING THE MODERN ERA (2006) (re-analyzing claim that the moratorium resulted in an increase in homicides).

[130] Mocan & Gittings, *supra* note 10. *See also* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25.

[131] *See infra* Part IV.A., tbl.1; *see also* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25.

files of the National Center for Health Statistics (NCHS).[132] Information on all deaths classified as homicides by local coroners or medical examiners are compiled by NCHS and reported annually. The data are available for counties as well as states, and have been used in research on capital punishment to develop a metric of the use of the death penalty relative to local homicide rates.[133] The extent of the missing data bias is evident when we substitute a complete record of homicides in regression models estimating the deterrent effects of capital punishment. For example, when the complete NCHS homicide victimization data set is substituted for the incomplete FBI homicide data in the Mocan and Gittings data set, regression model results change dramatically and the magnitude of a putative deterrent effect is significantly reduced.[134]

2. Deterring Which Murders?

Most of the new deterrence studies use global measures of murder that include persons or types of murders that are ineligible for execution. For example, global measures of homicide offenses include murders committed by persons whose ages are below the threshold of eligibility for capital punishment in most death penalty states. Since *Gregg*, only eleven persons below the age of sixteen at the time of their crime were sentenced to death, and none were executed.[135] Moreover, the practice was barred by the 1988 U.S. Supreme Court decision in *Thompson v. Oklahoma*[136] exempting juveniles below the age of sixteen from capital punishment. Yet despite the exclusion (at first by socio-legal norm and later by law) of youths below the age of sixteen from capital punishment, the new deterrence studies include *all* homicides in their estimates. Yet between 1976 and 2003, 8312 of the 339,187 homicides since *Gregg* (where the offender's age is

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[132] State homicide and victimization data, including by race, are from the Vital Statistics of the United States or other data compilations generated by the Centers for Disease Control and Prevention National Center for Health Statistics. Data for 1973–1992 are from Vital Statistics of the United States, Mortality Detail Files, 1968–1992, Inter-University Consortium for Political Science and Social Research, Study No.7632, 6798. Data for 1993–1998 are from Centers for Disease Control and Prevention National Center for Health Statistics, Compressed Mortality File, 1989–98 CD-ROM Series 20, No 2C ASCII Version. Data after 1998 are from CDC Wonder, the Centers for Disease Control data extraction engine at http://wonder.cdc.gov. Through 1992, the relevant data sources list homicide victims by State of death. After 1993, the relevant data source lists homicide victims by state of residence. Data for 2001 excludes all victims from the events of September 11, 2001.

[133] John Blume & Theodore Eisenberg, *Judicial Politics, Death Penalty Appeals, and Case Selection: An Empirical Study*, 72 S. CAL. L. REV. 465 (1999); LIEBMAN ET AL., A BROKEN SYSTEM, PART II, *supra* note 88.

[134] *See infra* Part IV. & tbl.1.

[135] VICTOR STREIB, THE JUVENILE DEATH PENALTY TODAY: DEATH SENTENCES AND EXECUTIONS FOR JUVENILE CRIMES, JANUARY 1, 1973—FEBRUARY 28, 2005 (2005), *available at* http://www.law.onu.edu/faculty/streib/documents/juvdeath.pdf.

[136] 487 U.S. 815 (1988) (plurality opinion).

known) were committed by persons below the age of sixteen.[137] In Texas, where more than one in three executions in the U.S. have taken place of the homicides (of the 36,630 where information is available on the offender's age) during these years were committed by persons below the age of sixteen. During the years of the highest homicide rates in the United States, juveniles were the fastest growing group of homicide offenders from 1985 through 1993.[138]

The extent of potential bias depends on several factors. If the number of juvenile homicide offenders is small and stable over time, then this poses little threat. From 1976–2003, among homicides where the offender's age was known, a small subset of homicides (2.6%) were committed by persons under the age of sixteen.[139] But offender age is unknown in about one in three cases in this interval,[140] and there is no reliable way to estimate the age distribution of offenders in unknown cases. Yet, assuming that the age distribution of the unknown cases approximates the age distribution of the known cases, there may be no reason to suspect that the parameter estimates of deterrence are inflated due to the inclusion of murders by very young offenders in the homicide rate. Whatever noise these cases introduce into the econometric models is negligible and unlikely to be correlated with any of the predictors. But this is obvious neither empirically nor theoretically, especially since homicides by and of adolescents increased more rapidly than every other category of homicides for nearly a decade beginning in 1985.[141]

The instability over time in the number of homicides committed by persons below sixteen, and also instability over time in the number of cases where the offender age is unknown, create measurement problems that invalidate the invariance assumptions needed to ignore such trends. If these two parameters are fluctuating over time, and their correlation with other predictors is changing simultaneously, then we have to ask additional questions to assess whether these shifts are inconsequential in their effects on the estimates of the homicide rates. [142]

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[137] *See* INTER-UNIVERSITY CONSORTIUM FOR POLITICAL SCIENCE AND SOCIAL RESEARCH, UNIFORM CRIME REPORTING PROGRAM DATA [UNITED STATES]: SUPPLEMENTARY HOMICIDE REPORTS, 1976–2003, *available at* http://webapp.icpsr.umich.edu/cocoon/ICPSR-STUDY/04351.xml (last visited Dec. 15, 2005). The Supplementary Homicide Reports are filtered to exclude the deaths in New York associated with the attacks of September 11, 2001, but include those associated with the Oklahoma City bombing of April 19, 1995.

[138] Philip J. Cook & John H. Laub, *The Unprecedented Epidemic of Youth Violence*, *in* 24 CRIME AND JUSTICE: A REVIEW OF RESEARCH 27 (Michael Tonry & Mark H. Moore eds., 1998).

[139] Fagan et al., *Capital Punishment and Capital Murder*, *supra* note 64, at tbl.1.

[140] *Id*.

[141] Cook & Laub, *supra* note 138.

[142] For example, these correlates were changing simultaneously with the changes in homicide rates by adolescents. From 1985–1992, the percentage of homicides committed by firearm rose more quickly among adolescents than other population groups. So too did the demography of homicide: the concentration of perpetrators and victims among African Americans rose steadily throughout this period. *Id*. *See also* Lois A. Fingerhut et al., *Firearm and Nonfirearm Homicide Among Persons 15*

First, is the timing of the fluctuations related to the peaks and valleys in the homicide rate, and second, is the timing of these changes correlated with any of the control variables that also are predictors of homicide? For example, if the number of homicide offenders below sixteen rises during periods of intense drug activity and increases in the violence associated with drug markets, then the error terms in the homicide estimates and the predictors may be correlated, biasing the standard errors and distorting the significance of the estimates of the size of a putative deterrent effect of execution. At the least, the timing and magnitude of increases in the youth homicide rate and increases in the number of offenders whose ages are unknown should raise cautions in interpreting the magnitude of deterrent effects in the types of panel series econometrics that populate the new deterrence studies.

3. Early Cutoffs in Panel Designs

A third concern is the artifactual truncation of observations that excludes data points where execution and homicide show no relationship. What would happen if there were five to eight more years added to these panels, years when homicide rates were stable while executions were sharply declining? That is the case in the new deterrence studies, and the result is that the current estimates suffer from period effects that produce artifactual and elevated estimates of deterrence.

Many of the studies include data from 1977 through 1996[143], 1997[144], or 1999.[145] Only one panel study extended the observational window through 2000.[146] But the pattern of executions and homicides in the five years following these studies suggests that murder was insensitive to the levels of execution in this interval: executions declined nationwide from ninety-eight in 1999 to fifty-nine in 2004, but the murder rate remained nearly stable, varying between 5.5 and 5.6 per 100,000 population. Perhaps there were changes in the predictors of homicide in that period that helped stabilize the murder rate, such as shifts in demography, incarceration patterns, drug epidemics, or other factors such as the robbery rate that influences the crimes that typically lead to capital-eligible felony murders. But there is no reason to believe that homicide rates had become insensitive to the pace of change in these externalities. Nor did these factors decline at a rate greater than

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Through 19 Years of Age: Differences by Level of Urbanization, United States, 1979 Through 1989. 267 J. AM. MED. ASS'N 3048 (1992); Lois A. Fingerhut et al., *Firearm Homicide Among Black Teenage Males in Metropolitan Counties: Comparison of Death Rates in Two Periods, 1983 Through 1985 and 1987 Through 1989*, 267 J. AM. MED. ASS'N 3054 (1992).

[143] Shepherd, *Deterrence Versus Brutalization*, *supra* note 46.

[144] *See, e.g.*, Mocan & Gittings, *supra* note 10; Paul R. Zimmerman, *State Executions, Deterrence, and the Incidence of Murder*, 7 J. APPLIED ECON. 163 (2004); James A. Yunker, *A New Statistical Analysis of Capital Punishment Incorporating U.S. Postmoratorium Data*, 82 SOC. SCI. Q. 297 (2001).

[145] Shepherd, *Murders of Passion*, *supra* note 15.

[146] Zimmerman, *supra* note 144.

the 40% decline in executions. If homicides were sensitive to executions, we would expect an uptick in the homicide rate as executions declined. But this distinctive footprint of deterrence is not evident in the patterns of murder through 2004, which remained nearly flat across the nation since 1999.

The flat pattern of homicides and executions since 1999 is likely to influence both the regression coefficient for any of the measures of execution-based deterrence, as well as the standard errors of the estimates. Whatever the form of the model before 2000, it is now different. Throughout the late 1990s, as executions increased while homicides declined, there was nearly a linear relationship between execution and murder. But the addition of five more years with a different pattern of executions and homicides, where the relationship is no longer tightly defined, makes the earlier model at a minimum less accurate because the overall fit of the trend line is no longer comfortable. In other words, the shape of the curve is now different, and so too should be the functional form of the equation that predicts it.

4. Computation and Model Specification Errors

Other computational and model specification errors have been noted in two articles by Professors John Donohue and Justin Wolfers,[147] including conceptual and measurement errors in the selection of instrumental variables by Dezhbakhsh et al.[148] Instrumental variables should be correlated with the predictor—in this case, executions—but not with the dependent variable murders. This technique allows analysts to conduct quasi-experiments that simulate the conditions of true experiments. Dezhbakhsh and colleagues use instruments that are in all likelihood correlated with executions: prison admissions, Republican voters, and police payrolls. It is hard to imagine that the same social and political dynamics, including higher crime rates, that contribute to higher prison admissions do not also contribute to harsher criminal justice policies including the aggressive application of the death penalty. Indeed, Professor Liebman and his colleagues show that these measures—political dynamics, punitive criminal justice policies, high murder rates, and aggressive use of the death penalty—are correlated with errors in death sentences.[149]

When Donohue and Wolfers make minor adjustments to avoid the confounding of the instruments with the other design elements, the estimates of deterrence become very unstable and range so widely (from 429 lives saved per

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[147] Donohue & Wolfers, *Uses and Abuses*, *supra* note 25; John Donohue & Justin Wolfers, *The Death Penalty: No Evidence for Deterrence*, THE ECONOMIST'S VOICE 1 (2006), *available at* http://bpp.wharton.upenn.edu/jwolfers/Press/DeathPenalty(BEPress).pdf [hereinafter Donohue & Wolfers, *The Death Penalty*].

[148] Dezhbakhsh et al., *supra* note 32.

[149] LIEBMAN ET AL., A BROKEN SYSTEM, PART II, *supra* note 88.

execution to 86 lives lost) as to become meaningless.[150] They also show, as I do in Section IV of this article, that when computational errors by Mocan and Gittings are corrected, their estimates are no longer statistically significant. Overall, these types of computational errors lead to biased if not inaccurate estimates. The biases affect both the size of the regression coefficients and the standard errors. Both biases suggest that the published estimates are unacceptably sensitive to even minor modifications in measurement and, as we see below, estimation techniques. This is the opposite of robustness, and shows the risks of a utilitarian approach to vetting claims of deterrence.

D. *Estimation Techniques*

The new deterrence studies share a common econometric language and preferences for analytic strategies. All the studies use panel data examining murder rates over time within states or counties over a number of years. The general analytic form is a regression equation where the murder rate in each state and year in the time series (or panel) is the dependent variable, and the predictors are a linear combination of factors including the presence of a death penalty law in a given state, the predictability of execution given a death sentence in some previous era, state effects that account for differences between the states, and year effects that account for national time trends that affect the states. Most studies estimate models with states as the unit of analysis, while others include models where county murder rates are predicted from a combination of state- and county-level predictors.[151]

As discussed earlier, most designs include statistical controls or covariates that represent factors within states or counties that may affect both the homicide rate including demographic and socio-economic conditions, law enforcement indicia and political forces that may encourage use of the death penalty.[152] But these factors also influence the presence and use of the death penalty, introducing an analytic confound that can bias results and give misleading and inflated estimates of deterrence.[153] To avoid this, and to approximate an experiment where experiments are not possible, some studies use instrumental variables designs, where variables are included that might affect the use of the death penalty but not

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[150] Donohue & Wolfers, *The Death Penalty*, *supra* note 147, at 3.

[151] *See, e.g.*, Dezhbakhsh et al., *supra* note 32.

[152] The model form generally is expressed as:

$$\frac{Murders_{s,t}}{(Population_{s,t}/100{,}000)} = \beta_1 Death\ Penalty\ Law_{s,t} + \sum_s State\ Effects_s + \sum_t Time\ Effects_t + \lambda Controls_{s,t} + \varepsilon_{s,t}$$

See Donohue & Wolfers, *Uses and Abuses*, *supra* note 25, at 804.

[153] For a discussion of how this endogeneity problem affects estimates of deterrence, see Richard A. Berk, *Knowing When to Fold 'Em: An Essay on Evaluating the Impact of CEASEFIRE, COMPSTAT, and EXILE*, 4 CRIMINOLOGY & PUB. POL'Y 451 (2005).

necessarily murder.[154] These studies assume that this strategy can produce accurate and unbiased results, however, we saw earlier that measurement and model specification errors can produce misleading, if not inaccurate, results regardless of how sound the instruments may be.[155]

Put that aside for the moment, and consider the analytic strategy on its own terms. Two connected assumptions in this strategy may undermine the stability and accuracy of the claims of the new deterrence studies. First, the state-fixed effects strategy assumes that any variance that is not accounted for by the covariates remains stable over time. In other words, state- or county-level factors that might produce initial differences are assumed to be invariant. This is probably incorrect, especially for longer time periods: the assumption that the states or counties are invariant with respect to stability in these exogenous factors places a huge burden on the covariates to do all the work in accounting for meaningful change within the states over time. Accordingly, the assumption of stability is only as good as the selection of the covariates. Earlier, I discussed limitations and errors in these predictors and covariates that are likely to produce biased and inaccurate estimates. So, analytic strategies that rely on the assumptions of stability (or the absence of cross-sectional heteroskedacity) in the unmeasured variance in the predictors are quite risky and probably wrong.

Second, using fixed effects for years treats each year as a separate experimental period that is independent from the previous year's outcomes. The year-fixed effects may account for national trends over time, but it ignores the effects of time within states. In effect, this approach to understanding time in panel data ignores the fact that murder rates within states vary *through* time, and that murder rates within states or counties are serially correlated over time. This is the problem of autoregression, or serial correlation.[156] Autoregression is the

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[154] Instrumental variables or instruments are necessary when the predictors or independent variables are correlated with the error terms of the dependent variable. A valid instrument is a variable that would be correlated with the explanatory variable (in this case, executions or the presence of a death statute) and is uncorrelated with the error term of the dependent variable, or the murder rates. *See, e.g.*, Dezhbakhsh et al., *supra* note 32 (using several instruments including prison admissions, police payrolls, judicial expenditures, and the statewide Republican vote). Misspecification of instruments can produce misleading results by introducing factors that might be correlated not just with the execution rate, but also with the error term in the crime rate. Donohue and Wolfers point out that Republican voters are more likely to elect legislators who will pass tough-on-crime measures such as mandatory minimum sentences, which would also affect the murder rate. *See* Donohue & Wolfers, *The Death Penalty*, *supra* note 147, at 3. In classic experimental terms, this is an endogeneity problem, where the "treatment" condition (in this case, executions) is correlated with other predictors (Republican votes) of the dependent variables (murders). *See, e.g.*, PAUL ROSENBAUM, OBSERVATIONAL STUDIES (2d ed. 2002).

[155] *See* discussion *supra* Parts III.C.1–3.

[156] County murder rates are also spatially correlated. The murder rates in a particular county, may reflect processes that are taking place in the adjacent counties, such that they are simply picking up the effects of causal factors operating nearby but not necessarily within the county itself. *See* SPATIAL STATISTICS : METHODOLOGICAL ASPECTS AND APPLICATIONS (Marc Moore ed., 2001).

tendency of trends in longitudinal or time series data to be heavily influenced by the trends in preceding years.[157] In other words, the best predictor of what the murder rate will be next year is what it was last year. Statistically and conceptually, it is unlikely that effects of extremely rare events, such as executions, can impact trends that are so heavily influenced by their own history.[158] The problem is compounded when there are patterns of missing observations in time series models when the data evidence autoregressive structures.[159] The problem is compounded again when there is serial correlation in the treatment variable, as is the case when estimating the effects of the presence of a death penalty statute, which nearly always is constantly present from year to year once a valid statute passes and goes into effect.[160]

Many of the studies underplay the question of when and where executions take place and the differences between death penalty and non-death penalty states. Several of the studies include non-death penalty states as comparisons, but fail to address statistically the differences between the two groups of states. Simple contrasts between death penalty and non-death penalty states, even with covariates that characterize some of the differences, make strong identifying assumptions that in the absence of a treatment, the average murder rates for states in each group would have followed parallel paths over time. But if the murder rates are higher in death penalty states, then the antecedents of homicides are probably unbalanced in the two groups, and the estimates of treatment effects are biased. Simply controlling for state differences via state fixed effects, or inserting a variable for whether a valid death penalty statute was in effect in any year, raises a series of connected endogeneity problems that require an integration of econometrics with methods more familiar in the analysis of data in natural experiments.[161]

Most of the new deterrence studies use standard errors computed from simple Ordinary Least Squares (OLS) regressions, but without correcting for autoregression, the standard errors in the estimates of the effects of execution are

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[157] *See, e.g.*, WILLIAM GREENE, ECONOMETRIC ANALYSIS (5th ed. 2003).

[158] *See* Berk, *New Claims*, *supra* note 51; *see also* BADI H. BALTAGI, ECONOMETRIC ANALYSIS OF PANEL DATA (2001); Badi H. Baltagi & Qi Li, *Testing AR(1) Against MA(1) Disturbances in an Error Component Model*, 68 J. ECONOMETRICS 133 (1995); Robert C. Jung & A.R. Tremayne, *Testing for Serial Dependence in Time Series Models of Counts*, 24 J. TIME SERIES ANALYSIS 65 (2003).

[159] K.D.S. Yound & L.I. Pettit, *The Effect of Observations on Bayesian Choice of an Autoregressive Model*, 27 J. TIME SERIES ANALYSIS 41 (2006).

[160] *See* JEFFREY M. WOOLDRIDGE, ECONOMETRIC ANALYSIS OF CROSS SECTION AND PANEL DATA (2002); *see also* Marianne Bertrand et al., *How Much Should We Trust Differences-in-Differences Estimates?*, 119 Q. J. ECON. 249 (2004).

[161] *See, e.g.*, Alberto Abadie, *Semiparametric Difference-in-Differences Estimators*, 72 REV. ECON. STUD. 1 (2005). For classic examples of the use of natural experiments to detect the presence of deterrent effects of executions, see Hans Zeisel, *The Deterrent Effect of the Death Penalty: Facts v. Faiths*, 1976 SUP. CT. REV. 317 (1976). *See also* Thorsten Sellin, *Homicides in Retentionist and Abolitionist States*, *in* CAPITAL PUNISHMENT 135 (Thorsten Sellin ed., 1967); Thorsten Sellin, *Experiments with Abolition*, *in* CAPITAL PUNISHMENT 122 (Thorsten Sellin ed., 1967).

well understated.[162] In at least two studies in the new deterrence literature, when the standard errors are corrected for autoregression, the standard errors increase, and the execution variable is no longer statistically significant.[163] Such instability in the coefficients under different measurement and analytic conditions should be a serious warning sign to those who would uncritically embrace the new deterrence evidence. In section IV., I show that statistical modeling techniques that account for the strong year-to-year correlation of murder rates over time produces dramatic changes in the statistical significance and effect size of executions on murder rates.[164]

E. *Deterrence*

Death sentences are rare, as are executions. One reason is that capital punishment is limited by a jurisprudence that recognizes that "death is different" and should, therefore, be reserved for only the most heinous murders.[165] This jurisprudence leads to a necessary scarcity: most states have narrowly tailored capital punishment laws to constrain the number and types of homicides that are eligible for the death penalty.[166] This scarcity undermines the logic of deterrence: is it reasonable to expect that rare execution events will have salience across large heterogeneous pools of potential offenders?

This problem is not just a matter of social science, but also of law. The Supreme Court concluded in *Furman* that when only a tiny fraction of persons who

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[162] *See, e.g.*, Bertrand et al., *supra* note 160. In general, to produce accurate standard errors when there is serial correlation or autoregression in the outcome variables, we need to estimate standard errors that are robust to autocorrelation as well as heteroskedasticity, otherwise known as Heteroskedasticity and Autocorrelation-Consistent (HAC) standard errors, or Newey-West standard errors. *See* Whitney Newey & Kenneth D. West, *A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent-Covariance Matrix*, 55 ECONOMETRICA 703 (1987); *see also* WOOLDRIDGE, *supra* note 160.

[163] *See* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25, at 835 (reporting that when they correct Zimmerman's (2004) analysis for serial clustering or correlation, the confidence interval on his estimates widens to a range of twenty-three homicides caused by each execution to fifty-four homicides prevented by each execution); *see also infra* Part IV.

[164] *See infra* Part IV.B; *see also* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25, at 835.

[165] HUGO ADAM BEDEAU, DEATH IS DIFFERENT: STUDIES IN THE MORALITY, LAW, AND POLITICS OF CAPITAL PUNISHMENT 55–59 (1987); Jeffrey Abramson, *Death-is-Different Jurisprudence and the Role of the Capital Jury*, 2 OHIO ST. J. CRIM. L. 117 (2004).

[166] *But see* Jonathan Simon & Christina Spaulding, *Tokens of Our Esteem: Aggravating Factors in the Era of Deregulated Death Penalties*, *in* THE KILLING STATE: CAPITAL PUNISHMENT IN LAW, POLITICS, AND CULTURE 81 (Austin Sarat ed., 1999) (showing that state legislatures steadily expanded death penalty eligibility for two decades starting in the early 1980s by adding a wide range of aggravators). Scarcity has been eroded by a gradual expansion of the categories of murders that are subject to felony murder rules and classification as capital-eligible. Simon and Spaulding note that these elements of homicides provide a "currency through which states seek to recognize various concerns and valorize certain kinds of subjects and situations." *Id*.

commit murder are sentenced to death, capital punishment is unconstitutionally irrational because it serves no identifiable penal function.[167] Assuming rationality, for the moment, rare executions are unlikely to influence decision processes by motivating would-be killers to adjust to these punishment threats. A death penalty that is almost never used serves no deterrent function, because no would-be murderer can reasonably expect to be executed.[168] In his concurrence in *Furman*,[169] Justice White recognized that:

> [A] major goal of the criminal law—to deter others by punishing the convicted criminal—would not be substantially served where the penalty is so seldom invoked that it ceases to be the credible threat essential to influence the conduct of others. . . . [C]ommon sense and experience tell us that seldom-enforced laws become ineffective measures for controlling human conduct and that the death penalty, unless imposed with sufficient frequency, will make little contribution to deterring those crimes for which it may be exacted.[170]

The heart of the matter, then, is whether the criminal law can deter murder and if so, under what conditions. The contours of the modern deterrence argument in capital punishment were constructed by Professor Gary Becker in theoretical work that preceded and informed Ehrlich's 1975 empirical application to the death penalty.[171] Becker's framework was a decision heuristic informed by rational choice and information processing: "All human behavior can be viewed as involving participants who (1) maximize their utility (2) form a stable set of preferences and (3) accumulate an optimal amount of information and other inputs in a variety of markets."[172] In the decades following Ehrlich's publication, these theoretical propositions formed the core of discourse, theory and research on deterrence. Accordingly, the new deterrence studies are minor extensions of Becker's and Ehrlich's original theoretical formulations that lean heavily on price theory.[173]

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[167] 408 U.S. 238 (1972).

[168] *See, e.g.*, Paul Slovic et al., *Decision Processes, Rationality and Adjustment to Natural Hazards*, *in* PERCEPTION OF RISK 1 (Paul Slovic ed., 2000).

[169] 408 U.S. 238 (1972).

[170] *Id.* at 312 (White, J., concurring).

[171] Becker, *Crime and Punishment*, *supra* note 1.

[172] *Id*. *See also* BECKER, ECONOMIC APPROACH, *supra* note 1, at 14. Becker continues to advance price theory as a supplement to, if not a substitution for, the limitations of the new deterrence research, noting that "most people have a powerful fear of death" that ultimately will deter their homicidal behavior. *See* Gary S. Becker, *On the Economics of Capital Punishment*, 3 THE ECONOMIST'S VOICE 1166 (2006), *available at* http://www.bepress.com/ev/vol3/iss3/art4 (last visited April 16, 2006) [hereinafter Becker, *On the Economics of Capital Punishment*].

[173] When confronted with unstable and noisy data from the current studies, proponents of deterrence, such as Becker, lean on price theory, claiming that since most people have a strong fear of

Until recently, the crossfire between death penalty deterrence advocates and opponents focused not on the moving parts of deterrence theory, but on three methodological concerns: the econometrics to estimate deterrence, data and measurement concerns, and model specification problems such as those discussed earlier.[174] Despite advances in theorizing deterrence in the context of public enforcement of law, including the addition of constructs such as tastes for risk or imperfect knowledge,[175] empirical research on capital punishment has not been updated to test these propositions. In fact, there still have been *no* direct tests of deterrence among groups whose responses could be reasonably generalized to violent offenders. No studies have shown that murderers are aware of executions in their own state, much less in far-away states, and that they rationally decide to forego homicide and use less lethal forms of violence in the face of risk of execution.

No one doubts that the criminal law, as well as other types of legal sanctions, have deterrent effects, but the evidence suggests that such effects may be confined to risk groups atypical of homicide offenders.[176] Deterrence research in the last half century is equivocal on the robustness of deterrent effects, and quite modest when extending deterrence rationales to groups of high-rate or serious offenders.[177] Professor Daniel Nagin's detailed review shows that deterrent effects in the criminal law are conditioned on the social position of the person and the type of

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death, they will avoid murder. *See* Becker, *On the Economics of Capital Punishment*, *supra* note 172.

[174] For example, one of the primary critiques of Ehrlich's 1975 article was the leverage that was exerted on homicide trends by the final seven years of his time series (1963–1969), while ignoring contemporaneous trends in non-death penalty states. *See, e.g.*, Peter Passell & John B. Taylor, *The Deterrent Effect of Capital Punishment: Another View*, 67 AM. ECON. REV. 445 (1977); *see also* 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); Zeisel, *supra* note 161, at 317.

[175] *See* A. Mitchell Polinsky & Steven Shavell, *The Theory of Public Enforcement of Law*, *in* 1 HANDBOOK OF LAW AND ECONOMICS (forthcoming 2006); *see also* Owen Bar-Gill & Alon Harel, *Crime Rates and Expected Sanctions: The Economics of Deterrence Revisited*, 30 J. LEGAL STUD. 485 (2001).

[176] Nagin, *supra* note 83. *See, e.g.*, Jeff T. Casey & John T. Scholz, *Beyond Deterrence: Behavioral Decision Theory and Tax Compliance*, 25 LAW & SOC'Y REV. 821 (1991); Karly A. Kinsey et al., *Framing Justice: Taxpayer Evaluations of Personal Tax Burdens*, 25 LAW & SOC'Y REV. 845 (1991); Greg Pogarsky & Alexis R. Piquero, *Can Punishment Encourage Offending? Investigating the "Resetting" Effect*, 40 J. RES. CRIME & DELINQ. 95 (2003) (exploring the relevance of judgment and decision making research on gambler's fallacies in probabilistic reasoning for crime decision making); *see also* D.L. McArthur & J.F. Kraus, *The Specific Deterrence of Administrative* Per Se *Laws in Reducing Drunk Driving Recidivism*, 16 AM. J. PREVENTIVE MED. 68 (Supp. 1999); Donald S. Kenkel & Steven F. Koch, *Deterrence and Knowledge of the Law: The Case of Drunk Driving*, 33 APPLIED ECON. 845 (2001).

[177] *See* Nagin, *supra* note 83; *see also* Daniel S. Nagin & Greg Pogarsky, *Integrating Celerity, Impulsivity, and Extralegal Sanction Threats into a Model of General Deterrence: Theory and Evidence*, 39 CRIMINOLOGY 865 (2001).

crime. The evidence cannot be reliably extended to murderers, since the more persuasive deterrence experiments have been done using experimental paradigms with lower risk groups.[178] Obviously, in experimental paradigms, it is unrealistic to simulate the contexts where lethal aggression tends to occur. But one could doubt that extreme violence might be deterred: Nagin reports no evidence of valid tests for deterrence of injury aggression.

With these limitations in mind, what conditions are necessary to reliably extend deterrence theory to the case of murder and capital punishment? Professors Paul Robinson and John Darley identify three conceptual and practical prerequisites to deterrence that are necessary to establish a plausible link between punishment contingencies and behavioral outcomes: rationality, knowledge, and choice.[179] They characterize each as a conceptual hurdle that deterrence theory must overcome to attain empirical validity and conceptual legitimacy.

1. Rationality

The rationality test asks whether offenders, assuming they possess knowledge of the risks of detection and punishment, will apply their understanding to the decision to engage in homicide at the moment when they are making the choice. Studies that directly examine the reactions of individuals to punishment threats consistently show the limits of rationality, especially in the case of aggression or violence. For example, violence often is embedded in the contexts of the moment, where choices among alternatives are skewed by the demands of the situation. For murder, these contingencies include revenge, retaliation, fear of lethal attack, and nonnegotiable demands of peers or network cohorts.[180] Consequently, many situations that could end in lethal violence are highly volatile, where decisions are made under conditions of arousal, whether anger or fear.[181] Rationality may be

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[178] *See, e.g.*, Daniel Nagin & Raymond Paternoster, *Personal Capital and Social Control: The Deterrence Implications of Individual Differences in Criminal Offending*, 32 CRIMINOLOGY 581, 584 (1994) (reporting results of research with a sample of college students showing that "individuals who commit crimes place little weight on the future consequences of their actions").

[179] Paul H. Robinson & John M. Darley, *Does Criminal Law Deter? A Behavioral Science Investigation*, 24 OXFORD J. LEGAL STUD. 173 (2004) (reviewing evidence from criminology and other behavioral sciences and concluding that the deterrent effects of the criminal law are quite limited).

[180] *See, e.g.*, LEE ROSS & RICHARD NISBETT, THE PERSON AND THE SITUATION: PERSPECTIVES OF SOCIAL PSYCHOLOGY (1991). *See also* Luckenbill & Doyle, *supra* note 109; Andrew V. Papachristos, *Murder Markets: Network Contagion and the Social Order of Gang Homicide*, Abstract, *available at* http://ssrn.com/abstract=855304 (last visited May 15, 2006) [hereinafter Papachristos, *Murder Markets*].

[181] *See, e.g.*, PALLONE & HENNESSY, *supra* note 107; Fagan & Wilkinson, *Guns, Youth Violence*, *supra* note 110.

further impaired by cognitive, organic and neuropsychological factors that may occlude punishment risk from rational calculations.[182]

The underlying assumptions of rationality depend on clarity and objectivity among offenders in cognition, risk analysis, cost measuring, future orientation and premeditation.[183] Such attributes are unknown in research on murder and murderers, except perhaps among the very small percentage of murder-for-hire and premeditated killings.[184] Rather, murderers are more likely to discount punishment risks, and inflate the present value of whatever gains the crime may offer.[185] This amounts to economics minus the rationality assumptions.[186]

The limitations in unreconstructed rationality lead Professors Russell Korobkin and Thomas Ulen to recommend replacing the rationality assumption with a multi-disciplinary understanding of human behavior, drawing from such fields as cognitive psychology, sociology, and decision sciences.[187] Along the same lines, Professor Robert Cooter says that economic theories of deterrence need a theory of endogenous preferences that will integrate cognitive psychology to incorporate motives and values into the deterrence calculus.[188] These theories are unified in prospect theory, an alternate decision framework that describes how people actually make decisions.[189] Like rational choice theory, prospect theory assumes that decision makers will seek to maximize their outcomes, but in

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[182] *See, e.g.*, Adrian Raine et al., *Reduced Prefrontal and Increased Subcortical Brain Functioning Assessed Using Positron Emission Tomography in Predatory and Affective Murderers*, 16 BEHAV. SCI. & L. 319 (1998); Lisa M. Gatzke-Kopp et al., *Temporal Lobe Deficits in Murderers: EEG Findings Undetected by PET*, 13 J. NEUROPSYCHIATRY & CLINICAL NEUROSCI. 486 (2001); Dorothy Otnow Lewis et al., *Ethics Questions Raised by the Neuropsychiatric, Neuropsychological, Educational, Developmental, and Family Characteristics of 18 Juveniles Awaiting Execution in Texas*, 32 J. AM. ACAD. PSYCHIATRY & L. 408 (2004); Dorothy Otnow Lewis et al., *Neuropsychiatric, Psychoeducational, and Family Characteristics of 14 Juveniles Condemned to Death in the United States*, 145 AM. J. PSYCHIATRY 584 (1988); D. Michael Bitz & Jean Seipp Bitz, *Incompetence in the Brain Injured Individual***,** 12 ST. THOMAS L. REV. 205, 260 (1999).

[183] Jon Elster, *When Rationality Fails*, *in* THE LIMITS OF RATIONALITY 19 (Karen Schweers Cook & Margaret Levi eds., 1990).

[184] KATZ, SEDUCTIONS OF CRIME, *supra* note 107 (citing anecdotal evidence to build a theory of criminal motivation in killings).

[185] *See, e.g.*, PALLONE & HENNESEY, *supra* note 107; *see also* KATZ, SEDUCTIONS OF CRIME, *supra* note 107; POLK, *supra* note 105; ELIJAH ANDERSON, THE CODE OF THE STREET (1999) [hereinafter ANDERSON, CODE OF THE STREET].

[186] Christine Jolls, Cass R. Sunstein & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471 (1998).

[187] Russell Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 CAL. L. REV. 1051 (2000).

[188] Robert Cooter, *Treating Yourself Instrumentally: Internalization, Rationality and the Law*, *in* THE LAW AND ECONOMICS OF IRRATIONAL BEHAVIOR 95 (Franco Parisi & Vernon L. Smith eds., 2005).

[189] Chris Guthrie, *Prospect Theory, Risk Preference, and the Law*, 97 NW. U. L. REV. 1115, 1116–19 (2003).

unpredictable ways. The theory assumes that people will make risk-averse decisions when deciding among options that seem to be gains, but will make risk-seeking decisions when faced with losses.[190] Offenders will value losses more than gains of a similar magnitude, and they will overvalue certainty.[191] In other words, most people, perhaps including criminal offenders, are more likely to take risks to avoid losses than to accumulate gains.

This challenge to rationality and the movement toward disciplinary integration exposes the fault lines in assumptions of rationality among criminal offenders. As a group, offenders often are risk-seekers and prone to thrill seeking,[192] and their impulsivity tends to be significantly higher than non-offenders.[193] They value social rewards and status from crime over the social rewards of conventional roles and behaviors,[194] and they often are impaired cognitively from extensive careers of drug and alcohol abuse.[195] Future consequences are either ignored or postponed, giving way to an orientation to consider only present contingencies.[196] In one of the few studies with samples of criminal offenders, Professor Charles Dean and his research collaborators report that the stability of present orientation over a long developmental period explains long criminal careers.[197] These irrational orientations tend to co-exist in a cascade of organic and cognitive impairments to further weaken cognition and decision making.[198]

Under these conditions, when faced with uncertainty, decision makers are likely to systematically depart from the rational actor model.[199] Nevertheless,

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[190] *Id*. at 1116.

[191] Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decisions Under Risk*, 47 ECONOMETRICA 263 (1979) [hereinafter Kahneman & Tversky, *Prospect Theory*].

[192] Nagin & Paternoster, *supra* note 178.

[193] *But see* Cooter, *supra* note 188.

[194] Jeffrey Fagan & Deanna L. Wilkinson, *Social Contexts and Functions of Adolescent Violence*, *in* VIOLENCE IN AMERICAN SCHOOLS: A NEW PERSPECTIVE 55 (D.S. Elliott, B. Hamburg & K.R. Williams eds., 1998) [hereinafter Fagan & Wilkinson, *Social Contexts*]; Deanna L. Wilkinson & Jeffery Fagan, *The Role of Firearms in Violence "Scripts": The Dynamics of Gun Events Among Adolescent Males*, 59 LAW & CONTEMP. PROBS. 55 (1996) [hereinafter Wilkinson & Fagan, *Role of Firearms*].

[195] Chaiken & Chaiken, *supra* note 97.

[196] Nagin & Paternoster, *supra* note 178.

[197] Charles Dean, Robert Brame & Alex Piquero, *Criminal Propensities, Discrete Groups of Offenders, and Persistence in Crime*, 34 CRIMINOLOGY 547 (1996).

[198] *But see* Stephen J. Morse, *Brain Overclaim Syndrome and Criminal Responsibility: A Diagnostic Note*, 3 OHIO ST. J. CRIM. L. 397 (2006) (facetiously addressing the tendency among some social scientists and legal scholars to apply limited research from neuroscience to explain a wide range of antisocial and violent behaviors).

[199] Amos Tversky & Daniel Kahneman, *Rational Choice and the Framing of Decisions*, 59 J. BUS. S251, S251–54 (1986) [hereinafter Tversky & Kahneman, *Rational Choice*]. The failure of

rationality is a familiar comfort zone for the law.[200] But rationality as a descriptive term for cognition has given way in social science to the concept of "bounded rationality."[201] Professor Herbert Simon uses "bounded rationality" to describe the process of making decisions using decision making heuristics, limited time, and incomplete information. A rational choice would be one which maximizes utility, but Simon points out that in many cases the decision maker will aim to make only a satisfactory choice (Simon calls this "satisficing").[202]

These shortcomings in rationality remind us that even when facts are known, they may be neither recalled in a particular event nor mobilized accurately as part of a decision heuristic. The facts themselves may or may not be relevant to the situation,[203] and even if recalled, they may be interpreted incorrectly given the context. If a criminal offender is prone to discounting costs that create cognitive dissonance with the perceived benefits or their preferences, the facts that communicate those costs will be distorted if not ignored.[204]

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rationality under conditions of uncertainty suggests the need to distinguish between rationality and rational choice. The latter is the topic of later sections in this essay. *See* i*nfra* Part III.E.3–4.

[200] *See, e.g.*, Richard A. Posner, *The Economic Approach to Law*, 53 TEX. L. REV. 757, 761 (1973) ("The basis of an economic approach to law is the assumption that the people involved with the legal system act as rational maximizers of their satisfactions'"); *see also* Richard A. Posner, *Values and Consequences: An Introduction to Economic Analysis of Law*, *in* CHICAGO LECTURES IN LAW AND ECONOMICS 189, 191 (Eric A. Posner ed., 2000) ("Most economic analysis consists of tracing out the consequences of assuming that people are more or less rational in their social interactions"); Jeanne L. Schroeder, *Rationality in Law and Economics Scholarship*, 79 OR. L. REV. 147 (2000) (providing an alternate foundation for the basis of rationality in the law while critiquing Posner's model of rationality); Herbert Hovenkamp, *Rationality in Law & Economics*, 60 GEO. WASH. L. REV. 293 (1992); MELVIN ARON EISENBERG, THE NATURE OF THE COMMON LAW (1988) (setting forth the case for internal rationality in the common law).

[201] Herbert A. Simon, *Theories of Bounded Rationality*, *in* 2 MODELS OF BOUNDED RATIONALITY: BEHAVIORAL ECONOMICS AND BUSINESS ORGANIZATION 408 (1982).

[202] Herbert A. Simon, *Rational Choice and the Structure of the Environment*, *in* MODELS OF MAN: SOCIAL AND RATIONAL 261, 270–71 (1957). The difference between "satisficing" and optimizing can be understood by the following analogy: optimizing is searching for the sharpest needle in the haystack, and satisficing is searching for a needle that is sharp enough for sewing. *See* Melvin Aron Eisenberg, *The Limits of Cognition and the Limits of Contract*, 47 STAN. L. REV. 211, 214 (1995).

[203] *See* ROSS & NISBETT, *supra* note 180.

[204] *See, e.g.*, David Anderson, *The Deterrence Hypothesis and Picking Pockets at the Pickpocket's Hanging*, 4 AM. L. & ECON. REV. 295 (2002), *cited in* Robinson & Darley, *supra* note 179, at 176.

2. Knowledge

The second hurdle is knowledge: does the offender know and understand the implications of the law?[205] Does the offender know which actions are criminalized and at what schedule, or which actions will excuse one's crime or otherwise mitigate one's culpability?

There is little attention to this question in the new deterrence literature. For example, Professor Joanna Shepherd elaborates on the early deterrence theoretical framework, maintaining that executions deter all types of murder by allowing all would-be murderers to update their expectations of punishment risk, compensating for the uncertainty about whether the murder they are about to commit would be charged and prosecuted capitally.[206] Such uncertainty, she claims, has less to do with the motivations of murderers than with their capacity to internalize exogenous factors such as prosecutorial discretion, quality of defense counsel, and juror preferences. There are no assumptions in her study nor in the other studies in this oeuvre about where or how potential murderers acquire the information to do so.

Instead, the new deterrence studies seem to assume, incredibly, that murderers have perfect knowledge about the probability and magnitude of sanctions, and that their decisions about risk are neither discounted nor variable. One study, for example, includes measures of newspaper stories and other media reports of executions.[207] It is a causal story that assumes much about the reading habits and television viewing preferences of would-be murderers. Quite the opposite is probably true given literacy levels among most prison inmates. The new studies fail to show that murderers are aware of executions in their own state, much less in far-away states, and that they rationally decide to forego homicide and use less lethal forms of violence.

The rules—whether one faces execution for one type of murder versus another, or whether one faces execution at all given the circumstances producing a death—are too abstract and removed from the moment to be salient, even assuming that there is a small number of murderers or would-be murderers who have such knowledge. There is no evidence that information markets among would-be murderers are dense, efficient, or fueled by accurate information.[208] First, there is no evidence to suggest that there are networks among persons who commit murder. They may be embedded in social networks where violence is common—for example, in street gangs or drug selling networks—but homicide is

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[205] Robinson & Darley, *supra* note 179, at 176.

[206] Shepherd, *Murders of Passion*, *supra* note 15, at 292.

[207] Shepherd, *Deterrence Versus Brutalization*, *supra* note 46.

[208] *See, e.g.*, Cass R. Sunstein, *Group Judgments: Deliberations, Statistical Means, and Information Markets*, 80 N.Y.U. L. REV. 962 (2005) (showing that network connectedness and group deliberation are prerequisites for efficiency in information markets and in both individual and collective decisions).

far from a primary motivator of social cohesion in these groups.[209] Cass Sunstein also claims that in such markets, competition among group members may lead to gaming where some may withhold information or not disclose what they know. This has the unfortunate effect of propagating errors and corroding group cohesion.

While experience—whether direct or vicarious—may substitute for knowledge, these experiences may not be transferable to the specific situations that may lead to murder. Robinson and Darley suggest that offenders are unlikely to do the calculations necessary to decide correctly which rules apply in which situations.[210] Indirect or vicarious knowledge is prone to error as well, as it is fueled by gossip and misinformation about the rules of law and the probabilities of detection and punishment.

3. Choice and Preferences

Assuming knowledge and rationality, will an offender make a behavioral choice consistent with deterrence? Robinson and Darley refer to this as the *Perceived Net Cost Hurdle*.[211]

Decisions themselves—as a matter of human development and not just antisocial behavior—suggest that even in a "rational" estimation of costs and benefits, decision makers are more likely to use intuitive heuristics, shortcuts which may or may not result in wise decision making.[212] Professors Amos Tversky and Daniel Kahneman note that although heuristics sometimes work well, they can also lead to irrational decisions or decisions that may not maximize utility but instead maximize short-term preferences that are framed by situational contingencies and present circumstances.[213] "In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors."[214] The moving parts in biased decision making heuristics include two dimensions: fallacies and skewed adjustments.[215] Additionally, decisions are skewed by emotions. Preferences for utility, cognition and heuristics under conditions of arousal are all vulnerable to distortion under conditions of arousal or fear.

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[209] *See, e.g.*, Papachristos, *supra* note 180.

[210] Robinson & Darley, *supra* note 179, at 178.

[211] *Id*. at 182.

[212] RICHARD THALER, QUASI RATIONAL ECONOMICS (1991).

[213] Kahneman & Tversky, *Prospect Theory*, *supra* note 191, at 263–91; Daniel Kahneman, *Reference Points, Anchors, Norms, and Mixed Feelings*, 51 ORG. BEHAV. & HUM. DECISION PROCESSES 296 (1992).

[214] Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCI. 1124 (1974).

[215] *See* Korobkin & Ulen, *supra* note 187, at 1086; *see also* Pamela K. Lattimore et al., *The Influence of Probability on Risky Choice: A Parametric Estimation*, 17 J. ECON. BEHAV. & ORG. 377 (1992) (applying the prospect theory principle of nonlinear probability weighting to crime decision making).

a. Availability, Representativeness and the Base Rate Fallacy

Tversky and Kahneman suggest that rational decision makers would take into account general information about population characteristics, and especially information about the chance of a specific event occurring, but rarely do. The failure to consider relevant information to make a probability judgment is a logical fallacy known as the base rate fallacy. [216] The representativeness fallacy refers to the tendency of decision makers to ignore base rates and overestimate the correlation between what something is and what it appears to be. The availability heuristic, like the representativeness heuristic, can lead to irrational decision making in ignoring base rates.[217] The availability heuristic, on the other hand, refers to the tendency of decision makers to overestimate the relevance of significant or memorable incidents, and underestimate the base rates.[218]

b. Anchoring and Adjustment

In the estimating process, decision makers are likely to form an arbitrary "anchor" that serves as the starting point for estimation, and then adjust from this anchor but still remain too close to it.[219] Professors Russell Korobkin and Chris Guthrie conducted a series of experiments to show, among other things, how this irrational tendency to anchor and adjust can affect settlements in litigation.[220] In one experiment, subjects were assigned to two groups and were given almost identical scenarios, at the end of which they were asked whether they would settle with the defendant, or go to trial (with the prospect of winning more but the risk of losing everything). The only difference in the scenarios was the anchor—one group was given an extremely low settlement offer (the "low ball initial offer" group) and the other was given a reasonable settlement offer (the "reasonable

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[216] *See* Daniel Kahneman & Amos Tversky, *On the Psychology of Prediction*, 80 PSYCHOL. REV. 237 (1973); *see also* Maya Bar-Hillel**,** *The Base-Rate Fallacy in Probability Judgments*, 44 ACTA PSYCHOLOGICA 211 (1980); Matthew C. Schneider, *Deterrence and the Base Rate Fallacy: An Examination of Perceived Certainty*, 18 JUST. Q. 63 (2001).

[217] *See* Korobkin & Ulen, *supra* note 187, at 1087. For example, most people believe that there are more words that begin with the letter "k" than words in which "k" is the third letter. This is probably because it is easier to think of words beginning with "k"; i.e., such words are more readily available. However, there are actually two times as many words that have "k" in the third letter than in the first. Similarly, most people believe that homicides and car accidents kill more people in the United States than diabetes and stomach cancer, because the former events receive more media attention and are thus more available.

[218] *See, e.g.*, REID HASTIE & ROBYN M. DAWES, RATIONAL CHOICE IN AN UNCERTAIN WORLD: THE PSYCHOLOGY OF JUDGMENT AND DECISION MAKING, 112–13 (2001).

[219] Tversky & Kahneman, *Rational Choice*, *supra* note 199.

[220] Russell Korobkin & Chris Guthrie, *Psychological Barriers to Litigation Settlement: An Experimental Approach*, 93 MICH. L. REV. 107, 139–42 (1994).

initial offer" group)—but both groups were given an identical "final" settlement offer.[221]

Rational choice theory would predict that, given identical choices, the two groups would either accept the settlement offer or reject it and proceed to trial in the same proportions. However, the initial settlement offer had a strong effect on the option chosen by subjects in each group. Subjects who were made the reasonable initial offer were more likely to reject it than to accept it, whereas subjects who were made the low initial offer were more likely to accept it. This difference between the groups was statistically significant.[222] Thus, as Korobkin and Guthrie note, "When choosing between a concrete settlement offer and an uncertain trial result, our subjects faced cognitive biases that prevented at least some of them from acting in what decision theorists would consider a rational manner….Together, the results suggest that litigants—who are not always rational actors—may fail to reach settlement on some occasions when settlement makes good economic sense."[223]

c. Emotion

One's emotional state plays a role in decision making, and can influence a person to act in ways that are not maximally optimal (or rational).[224] Obviously, anger and other forms of arousal can skew judgment in several ways, changing both rationality and also reshaping the estimation of costs and benefits. Professor Anne Dailey argues that lawyers should focus more on the source of an individual's needs, feelings, and motives, which may be unconscious, irrational, or both.[225] One example of how emotions can lead to irrational decision making is illustrated by the finding that, in general, people are willing to pay more for an emotionally meaningful item than for an equally valuable but emotionally neutral item. Professor Russell Korobkin calls this the *endowment* effect.[226]

d. Weighing Net Costs

Assume that knowledge is internalized and a would-be murderer will put this information to work accurately and rationally. Theorists from Becker[227] to

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[221] *Id*.

[222] *Id.*

[223] *Id.* at 142.

[224] Anne C. Dailey, *The Hidden Economy of the Unconscious*, 74 CHI.-KENT L. REV. 1599, 1604–06 (2000).

[225] *Id*. at 1606–08.

[226] Russell Korobkin, *The Endowment Effect and Legal Analysis*, 97 NW. U. L. REV. 1227, 1228 (2003). This also is an example of risk aversion. *See also* Richard Birke, *Reconciling Loss Aversion and Guilty Pleas*, 1999 UTAH L. REV. 205, 212.

[227] Becker, *Crime and Punishment*, *supra* note 1.

Polinsky and Shavell[228] have posited a calculus of decision making where actors weigh costs and benefits prior to action (or inaction). The decision making is complex, of course, with different actors assigning different utilities and preferences to the components of cost and return. For example, postponing reward is an expression of preference, as is discounting past (sunk) costs or postponing present costs. Deterrence will take place, to put it simply, when punishment is a cost worth avoiding—that is, when the costs of punishment outweigh the perceived rewards of the act. Put another way, is the offender likely to choose compliance as the more beneficial option?

Beginning with Bentham, deterrence theorists have disaggregated costs into three dimensions: probability, severity, and delay. [229] While there is no debate on severity,[230] there is strong evidence that death is delayed punishment owing to due process and the numerous errors in capital sentences.[231] Probability also is low: no more than one homicide in four is capital-eligible,[232] few of these are selected for prosecution,[233] and the percentage of death row cases that proceed to execution for states other than Texas remains very low.[234] As mentioned earlier, scarcity

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[228] Polinsky & Shavell, *supra* note 175.

[229] JEREMY BENTHAM, AN INTRODUCTION TO THE PRINCIPLES OF MORALS AND LEGISLATION (1789). *See also* Robinson & Darley, *supra* note 179.

[230] Although there may be some debate on the severity of life imprisonment without the possibility of parole compared to execution, and the marginal deterrence of capital punishment relative to such life sentences is unknown. *See supra* Part III.B.1.

[231] *See* JAMES LIEBMAN ET AL., A BROKEN SYSTEM, PART I: ERROR RATES IN CAPITAL CASES, 1973–1995 (2000), *available at* http://www2.law.columbia.edu/instructionalservices/liebman/ [hereinafter LIEBMAN ET AL., A BROKEN SYSTEM, PART I] (citing the average time from sentence to execution of 9 years for death sentences imposed between 1973 and 1995, and an average of 7.6 years until death sentences are reversed and defendants are re-sentenced, exonerated, pardoned or their sentences commuted). *See also* Alex Kozinski & Sean Gallagher, *Death: The Ultimate Run-On Sentence*, 46 CASE W. RES. L. REV. 1, 2, n.10 (1995).

[232] *See* Fagan et al., *Capital Punishment and Capital Murder*, *supra* note 64.

[233] *See, e.g.*, Raymond Paternoster et al., *Justice by Geography and Race: The Administration of the Death Penalty in Maryland, 1978–99*, 4 MD. L.J. RACE, RELIGION, GENDER & CLASS 1 (2004) (examining 1311 death-eligible cases from 1978 to 1999 based on the Maryland statute, MD. CODE ANN., CRIM. LAW § 2-201 & 2-205m, which defines murder in the first degree as: (a) a deliberate, premeditated, and willful killing, (b) committed by lying in wait, (c) committed by poison, (d) committed in the perpetration of or an attempt to perpetrate arson, burglary, carjacking, escape from prison, kidnapping, mayhem, rape, robbery, sexual offense, sodomy, bomb-making, and (e) if they willfully, deliberately, and with premeditation intended the death of a law enforcement officer.) Although the Maryland study generated statistical information on which statutory aggravating factors were most often present among cases selected for capital prosecution: murders committed during other crimes, murders with multiple victims, murders committed while the perpetrator was in a correctional institution, contract killings, and murders committed while fleeing capture by police. *Id*.

[234] As a simple index for comparison, Texas courts have issued 776 death sentences since 1976 and executed 364 inmates, nearly half those sentenced. In Florida, Pennsylvania, and California, three states whose courts also issue high numbers of death sentences, the comparable number of death sentences and executions are: 60 of 235 (Florida), 13 of 652 (California), and 3 of 316 (Pennsylvania). *See* DEATH PENALTY INFORMATION CENTER, DEATH SENTENCING RATE BY STATE,

undermines the deterrent threat of death, and the marginal deterrence from this weak threat compared to the certainty and harshness of incarceration undermines this utilitarian argument for capital punishment.

The benefit side of the equation is more complex. Together with Professor Richard Freeman, I analyzed a series of empirical studies on the tradeoffs between legal work and illegal income-producing criminal activity for young men in inner cities.[235] When faced with sharply escalating incarceration risks throughout the late 1980s and 1990s, robbers and drug dealers consistently valued the economic returns of illegal work over either the foregone opportunities for legal income or the punishment costs that jail would exact. Similar tradeoffs were reported by burglars[236] and robbers[237] in ethnographic studies of their crime decision making. Other studies have shown that drug offenders will heavily value the combined reward of relief from withdrawal symptoms and the pleasure of addiction over the risk of detection and punishment.[238]

Scholars of homicide have long known that murder is the result of complex social interactions that increase the present value of benefits and push costs to the background.[239] Recent studies on violence *in situ* confirm the salience of reward, and introduce an element of risk that attaches when extreme violence is *not* used. In interviews with 125 young males ages sixteen to twenty-four who were involved in over 300 incidents of gun violence in New York City from 1995–1997, I collaborated with Professor Deanna Wilkinson to understand decision making within violent events where guns were used, and other events where guns were almost used but avoided at some point during a confrontation.[240] In these settings, lethal violence has both instrumental and intrinsic rewards that trumped what these young men perceived inaccurately as a distal risk of detection and punishment. In

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available at http://www.deathpenaltyinfo.org/article.php?scid=67&did=915 (last visited May 15, 2006); DEATH PENALTY INFORMATION CENTER, NUMBER OF DEATH EXECUTIONS BY STATE AND REGION SINCE 1976, *available at* http://www.deathpenaltyinfo.org/article.php?scid=8&did=186 (last visited May 15, 2006).

[235] Jeffrey Fagan & Richard B. Freeman, *Crime and Work*, *in* 25 CRIME AND JUSTICE: A REVIEW OF RESEARCH 225 (1999).

[236] RICHARD T. WRIGHT & SCOTT H. DECKER, BURGLARS ON THE JOB: STREETLIFE AND RESIDENTIAL BREAK-INS (1994).

[237] RICHARD T. WRIGHT & SCOTT H. DECKER, ARMED ROBBERS IN ACTION: STICKUPS AND STREET CULTURE (1997) [hereinafter WRIGHT & DECKER, ARMED ROBBERS IN ACTION]. Wright and Decker interviewed men whose criminal careers included repeated robberies. Robbers were committed to a street culture that emphasized the materials rewards and social status attendant to being a successful "stickup boy," while minimizing or heavily discounting punishment risk.

[238] JOHN KAPLAN, THE HARDEST DRUG: HEROIN AND PUBLIC POLICY (1983).

[239] *See, e.g.*, MARVIN E. WOLFGANG, PATTERNS IN CRIMINAL HOMICIDE (1958); KATZ, SEDUCTIONS OF CRIME, *supra* note 107; POLK, *supra* note 105; JAMES O'KANE, WICKED DEEDS: MURDER IN AMERICA (2005).

[240] Fagan & Wilkinson, *Guns, Youth Violence*, *supra* note 110. *See also* KATZ, SEDUCTIONS OF CRIME, *supra* note 107.

fact, there was greater fear of retaliation from victims' families or friends than from what was perceived as the remote possibility of police involvement. Extreme violence was an expected and valued behavior and, for some, thought to be necessary to ensure their survival.[241] Chance encounters with others in these neighborhoods were seen as potentially threatening or lethal—unknown others were widely thought to harbor hostile intentions and capacity to inflict harm. Extreme violence and toughness was the currency of respect, and respect had both strategic value and offered strong social reward. Violence was a public performance, designed to maintain a social identity that deters attack and reinforces a self-presentation of "toughness." Other acts of violence also were pathways to social status. For example, robbery not only generated material goods or cash and was helpful in sexual conquests, but it also established one's status in a social hierarchy where respect was a finite commodity.[242] Of course, the danger that a robbery could escalate into a homicide was always present. Violence also functions as social control in these contexts, redressing grievances or peremptorily ending them before they ever begin.

In a similar study, Andrew Papachristos interviewed gang members in the Austin and North Lawndale neighborhoods of Chicago.[243] Most had been involved either as witnesses or accomplices in murders committed in gang disputes. The risk of a death sentence was simply not a reality among gang members despite Illinois' high rate of death sentences prior to 2000. This is not to say that rationality is not part of their decisions about crime and violence: gang members often think rationally about crimes, especially drug dealing, but usually as a matter of business details such as packaging, marketing and selling drugs to maximize their returns. Their knowledge of law clearly passed the knowledge hurdle.[244]

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[241] WILKINSON, GUNS, VIOLENCE, AND IDENTITY, *supra* note 110 (illustrating the dynamics of violent events, including their "spark" or motivation, and their ending). In social interactions in this context, violence is an expected and valued behavior, shaped by a normative code. It is but one response in a toolkit of behaviors and responses to danger that evolves within these social worlds. Teenagers select from this toolkit according to their cognitive reading of a situation, with the level of danger and lethality their primary consideration. The presumption of hostile intent is both an accurate reading of potential danger and a reflection of socialization within this ecology. Cognitive appraisals occur within a setting of witnesses (bystanders) who judge and announce the actor's level of toughness under conditions of arousal, perhaps while high or drunk, very likely while armed, and with an adversary whose intentions are either hostile or unknown. *See also* Jeffrey Fagan, *Context and Culpability in Violent Events*, 6 VA. J. SOC. POL'Y & L. 507 (1999).

[242] *See* ANDERSON, CODE OF THE STREET, *supra* note 185; ELIJAH ANDERSON, STREETWISE: RACE, CLASS AND CHANGE IN AN URBAN COMMUNITY (1990).

[243] Andrew V. Papachristos, Gang Violence as Social Control (unpublished manuscript, on file with the University of Chicago, Department of Sociology). *See also* Papachristos, *Murder Markets*, *supra* note 180.

[244] *See* Papachristos, *Murder Markets*, *supra* note 180. In one organized drug location, Papachristos observed an intricate ten man selling system that used walkie-talkies, look-outs, and multiple "drive-through" locations. Moreover, the "leaders" of this operation had detailed knowledge of gun and narcotic laws. They made sure that the guns and dope were kept separately to ensure that,

But the perceptions of risk and benefit were different for interpersonal violence, including murder. Compared with drug selling, gang members do not necessarily act "rationally" or weigh the prospects of execution in the course of violence. Although most of these gang members had been in and out of jail quite often, very few know anyone on "death row" or who has been executed. Rather, the greatest risk in murder was retaliation by members of rival gangs, not retribution by the state. A much broader and more pressing "threat of violence" looms over the gang world. Even more so than in "street culture" more generally, the consequences of victimization is the chief concern and is to be avoided at all costs. *Self-protection* and *mutual protection* are often key determinants in carrying weapons and engaging in violence. Violence was often reactionary and retaliatory, serving as a deterrent against future victimization, a form of self-protection, or a mechanism of social control. State sanctions, and especially the death penalty, rarely entered into the means-ends calculus of gang members on the street. Quite the opposite was true: gang members see prison sentences as "worth it" in order to maintain face and self-respect to deter the possibility of victimization. Often, receiving a prison sentence for maintaining personal honor can, in fact, *increase* one's personal reputation.[245]

There are numerous other examples of perceived benefits eclipsing risk in homicide: murders by violent spouses aimed at dominating and controlling intimate partners, retaliation and reprisal, or even robbery-homicides. [246] In fact, punishment costs may be discounted even more in the modal category of capital-eligible crimes: felony murders—homicides committed in the course of other crimes, especially robbery. Robbery is not a crime that is committed casually, nor are robbers a random sample of the criminal population: most have prior arrest records and many have completed spells in prison.[247] In felony murders, especially robbery-homicides which are more than half the capital-eligible murders,[248] struggles for weapons or fear of identification may escalate the crime to a homicide. There is a weak prospect that a risk heuristic of punishment will enter into the volatile and unpredictable street dynamics of robbery interactions to

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in the possibility of an arrest, they would not get enhanced sentences for "criminal conspiracy cases" (in Cook County, the presence of weapons *and* drugs implies on on-going drug operation and carries stiffer penalties). In one instance, a gang leader made sure that any members carrying weapons near his drug operation were *juveniles* to ensure that the leaders could avoid gun charges if caught. *See also* Steven Levitt & Sudhir A. Venkatesh, *Growing Up in the Projects: The Economic Lives of a Cohort of Men Who Came of Age in Chicago Public Housing*, 91 AM. ECON. REV. 79 (2001).

[245] *Id*.

[246] KATZ, SEDUCTIONS OF CRIME, *supra* note 107.

[247] *See, e.g.*, WRIGHT & DECKER, ARMED ROBBERS IN ACTION, *supra* note 237. Most acknowledge the risk of punishment as intrinsic to their work, yet tend to either discount the cost of punishment or over-value the present benefits of the robbery, or both.

[248] Fagan et al., *Capital Punishment and Capital Murder*, *supra* note 64.

reduce the risk of lethality,[249] especially when a gun is present. Accordingly, the presence of a gun in a robbery further increases not just the risk of lethality but the decision by the robber to use it.[250] In other words, there is a strong risk of cognitive errors in situations of intense arousal, errors that are likely to overwhelm the evaluations of the benefits of crime and the risks and costs of punishments.[251]

4. Cumulative and Conditional Corrosion

In the Robinson-Darley framework, "[s]etting any one of the variables to zero means that there is no deterrent effect whatever."[252] Of course, none of these values reach zero in reality, except perhaps in the case of the mentally ill.[253] Nevertheless, the parts of this framework are neither exchangeable nor separate. Rather, they interact conditionally and multiplicatively to produce a robust deterrent effect, and weakness in any one domain will drag down the salience of the others. So, for example, prison may be worth avoiding if there is a positive benefit from compliance. If detached from conventional social worlds via joblessness or addiction, the exposure of violent offenders to the actuarial benefits of compliance declines, and their perception of detection risks—not inaccurately, from their perspective—declines with it.[254] The scarcity of execution, however salient executions may be, is unlikely to disturb their risk assessment. How deterrence works in this social system and in skewed information markets is uncharted territory. Having said that, there is a large body of social science evidence that in the case of murder, each of the three hurdles in this framework becomes far higher than in the case of less complex or serious crimes, and their reciprocal and multiple effects are likely to militate against deterrence. That is, the cumulative effect of these hurdles for deterring murder is considerable, and their height casts doubt on the streamlined version of deterrence argued in the new deterrence studies.

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[249] *Id*. *See also* Franklin Zimring, *Determinants of the Death Rate from Robbery: A Detroit Time Study*, 6 J. LEGAL STUD. 317 (1977); Franklin Zimring & James Zuehl, *Victim Injury and Death in Urban Robbery: A Chicago Study*, 15 J. LEGAL STUD. 1 (1986)[hereinafter Zimring & Zuehl, *Victim Injury and Death*]; Jack Katz, *The Motivation of the Persistent Robber*, *in* 14 CRIME AND JUSTICE: A REVIEW OF RESEARCH 277 (1991).

[250] Zimring & Zuehl, *Victim Injury and Death*, *supra* note 249; Fagan & Wilkinson, *Social Contexts*, *supra* note 194; Wilkinson & Fagan, *Role of Firearms*, *supra* note 194.

[251] *See*, *e.g.*, Daniel Kahneman & Amos Tversky, *Choice, Values, and Frames*, 39 AM. PSYCHOLOGIST 341 (1984).

[252] Robinson & Darley, *supra* note 179, at 196.

[253] *See, e.g.*, Bruce G. Link et al., *Psychotic Symptoms and Violent Behaviors: Probing the Components of "Threat/Control-Override" Symptoms*, 33 SOC. PSYCHIATRY & PSYCHIATRIC. EPIDEMIOLOGY S55 (Supp. 1998).

[254] Robinson and Darley tell a similar story. *See* Robinson & Darley, *supra* note 179, at 197.

IV. RE-ESTIMATING DETERRENCE

One of the highest hurdles of causal inference is the replication requirement.[255] In the conduct of social inquiry, it is commonplace if not imperative for investigators to subject their data to testing under alternate measurement and analytic conditions. Obtaining consistent evidence is a sign of reliability and robustness[256] of the central theoretical and empirical finding. Some of the researchers whose work is central to the claims of the "new deterrence" have followed these norms and made not only their data available for further testing and replication, but also their statistical programming that produced the results they reported. To assess the robustness and stability of the empirical deterrence claims, I chose one of these datasets, from Mocan and Gittings[257] (hereafter, MG), for statistical analyses with a set of alternate measurement and analytic specifications. The results are shown in Tables 1 and 2.

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[255] Epstein & King, *The Rules of Inference*, *supra* note 26.

[256] A finding is considered to be robust when it is insensitive to variation among the inputs and can be reproduced under a variety of sampling and measurement conditions.

[257] Mocan & Gittings, *supra* note 10.

Table 1. Original and Alternate Specifications for Analysis of Deterrent Effects of Execution from Mocan and Gittings Data[a]

					CI		
Model	***B***	***SE***	***p(t)***	***Exp B***	***Lower***	***Upper***	***N***
1. Original Specification	- .006	.003	.028	.994	-.011	-.001	680
2. Alternate Data Sources[1]	-.004	.001	.004	.996	-.007	-.001	682
3. Original Specification, Recoding[2]	.000	.000	.762	1.000	.000	.000	680
4. Original Specification without Texas	-.005	.003	.074	.995	-.010	.000	666
5. Original Specification without Texas, Recoding[2]	-.00002	.000	.639	1.000	-.0001	.0001	666
6. Alternate Data Sources[1], Recoding[2]	.000	.000	.340	1.000	.000	.000	682
7. Original Specification, Recoding 0=0	-.006	.004	.084	.994	-.014	.001	359
8. Alternate Data Sources[1], Recoding, 0=0	-.003	.001	.048	.997	-.006	.000	364
9. Alternate Data Sources, No Texas	-.003	.001	.021	.997	-.006	-.001	668
10. Original Specification without state-time trend	-.002	.003	.497	.998	-.008	.004	680
11. Original Specification, Alternate Deterrence Index[3]	-.001	.000	.065	.999	-.002	.000	879

[a] Source: Naci Mocan & Kai Gittings, *Getting Off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment*, 46 J.L. & ECON. 453 (2003).

[1] Homicides: NAT'L CTR. FOR HEALTH STATISTICS, MORBIDITY FILE; Death Sentences: BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, CAPPUN2003; Executions: DEATH PENALTY INFORMATION CENTER.

[2] Recoding years with zero death sentences to .01 instead of .99.

[3] Executions lagged one year and Death Sentences lagged two years.

Table 2. Growth Curve Models of Effects of Execution and Incarceration on Murder Rates, Using Mocan and Gittings Execution Index and Incarceration Data[a]

	Time		*Time and Time²*	
Effect	***B***	***p(t)***	***B***	***p(t)***
Execution	-.003	.826	-.007	.829
Custody	-.004	.797	.051	.088
Time * Execution	-.0003	.677	.0005	.916
Time * Custody	-.002	.016	-.010	.018
Time² * Execution			-.00003	.853
Time² * Custody			.0003	.030
Ratio of Custody to Execution Coefficients				
β (Custody) | β (Execution)	1.50		-6.99	
β (T*Custody) | β (T*Execution)	7.13		-19.72	
β (T²*Custody) | β(T² * Execution)			-10.37	
Model Fit				
-2LL	-3404		-3342	
AIC	-3398		-3336	
BIC	-3385		-3323	

[a] All models estimated with random intercepts and both fixed and random effects for time. Estimates are population-averaged with AR(1) covariance structure. Execution measure derived from H. Naci Mocan & R. Kaj Gittings, G*etting off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment*, 46 J.L. & ECON. 453, tbl.2, panel A (2003).

The replication is done in two steps. The first set of analyses accepts the functional form of the regressions that are reported by MG in their 2003 article, but substitutes alternate data sources and also makes a series of adjustments to handle missing data in ways that differ from MG's strategies. In the second set of analyses, reported in Table 2, I vary the functional form of the regression equation and adopt an analytic strategy that responds to concerns discussed earlier about the panel structure of the data and appropriate statistical tests to detect changes over time when observational data are heavily correlated from one year to the next.

A. *Sensitivity Tests*

The columns in Table 1 show the results of estimates for the deterrence measure reported by MG in Table 2. In the original MG analysis, the deterrence measure is computed as the ratio of executions in the past year to death sentences six years preceding. Table 1 shows only the regression results for that deterrence variable, using the original code and data generously provided by Professors Mocan and Gittings.[258] The columns include a standard set of statistics to characterize the results in each model. Of particular interest is the regression coefficient, the standard error, the probability or statistical significance of the estimate (p(*t*)), and the number of cases included in the analysis.[259]

The first step is a replication of the original MG analysis. Model 1 shows results identical to those reported by MG in several regression estimates in Table 2, row 1. Model 2 uses the original MG specification, but substitutes alternate data sources to measure homicides and executions. MG used homicide statistics obtained from the Uniform Crime Reports, a crime accounting system maintained by the Federal Bureau of Investigation, U.S. Department of Justice. There are well-known limitations in that system, including large amounts of missing data.[260] We use data from the Morbidity and Mortality Files of the National Center for Health Statistics. Homicide counts are generated from death certificates filed by each county's coroner or medical examiner. Cases are classified as homicides pursuant to a separate investigation and decision making process. More important, there is complete coverage in these records for all years in the time series (1976–1998). The second alternate measure is the count of executions in each state. MG used reports of executions obtained from the U.S. Justice Department in an archive that is updated each year based on death row cases. The current version of this dataset is publicly available as *Capital Punishment 2003*,[261] and is updated annually with new information supplied by the states. The alternate data source is

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[258] Mocan and Gittings include several other predictors simultaneously with the deterrence variable. So, these results show the estimated effects of the deterrence variable, controlled statistically for other variables including population characteristics and urbanization, incarceration rates, income and unemployment, infant mortality, other causes of removal from death row (commutations and pardons), prison death rates, the presence of a Republican governor in the state, and state minimum drinking age laws. They also include a dummy variable to account for the spike in homicides in Oklahoma City in 1995 from the bombing of the Murrah Federal Office Building.

[259] Readers familiar with regression analyses will be interested in the confidence intervals, which show the range in which the coefficient could vary, and the exponentiated coefficient, which describes the magnitude of the effects of the deterrence variable.

[260] *See* Maltz, *supra* note 124.

[261] BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, CAPITAL PUNISHMENT IN THE UNITED STATES, 1973–2003 (2004).

a count of executions generated by the Death Penalty Information Center,[262] a private not-for-profit organization that closely monitors capital punishment legislation and activity across the states and in the federal courts. With these alternate data, the results are again statistically significant, though the regression coefficient is smaller compared to Model 1.

Model 3 uses the original MG data, but applies an alternate computation to estimate deterrence for cases when the denominator in the original measure was zero. Recall that deterrence is measured as the number of executions in a given state divided by the number of death sentences six years earlier. For some observations, this required division by zero, which would produce an infinite result. For these observations, MG replaced the incomputable zero value with .99. The alternate measure was to replace the problem observation with .01, a value that is closer to the true value of zero in the denominator.[263] The result here is a dramatic change from Models 1 and 2. The coefficient is now close to 0 (it is rounded to .000 in the table), and deterrence is no longer statistically significant.

Model 4 repeats Model 1—a replication of the original MG analysis—but excludes Texas. The hegemony of Texas in the estimates of deterrence was discussed earlier, and its influence on the distributions suggests that specifications without Texas might show different results. The results here are mixed. The coefficient is in the same range as in Models 1 and 2, but it no longer is statistically significant ($p=.074$) at the conventional $p \leq .05$ threshold.[264] Model 5 repeats Model 4, excluding Texas while adopting the alternative coding procedures of Model 3. The results closely resemble the results in Model 3, and deterrence here is not statistically significant ($p=.639$). Model 6 repeats Model 2, but adopting the recoding conventions of Model 3; deterrence again is not statistically significant ($p=.340$).

Models 7 and 8 use a different strategy for addressing the problem of division-by-zero, this time by substituting a true zero for the zero value. The deterrence estimate in Model 7 is the same as in the original MG analysis, but it no longer is statistically significant, with ($p=.084$). In Model 8, using the alternate data sources, the coefficient is smaller but it once again is significant ($p=.048$).

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[262] DEATH PENALTY INFORMATION CENTER, EXECUTIONS IN THE UNITED STATES, 1976–2006 (2006), *available at* http://www.deathpenaltyinfo.org/article.php?did=414&scid=8.

[263] MG recode all state-years with 0 death sentences as having 0.99 death sentences. Thus for non-executing states, the probability of execution is 0.99. When there are zero executions, there is no difference whether one uses 0.99 or 0.01, because the ratio of executions to death sentences remains zero. However, they intended to drop those cases, based on their computer code, so there is no effect on their estimates when they substitute for zero. For the state-years when there are positive (greater than zero) executions, they assume that the denominator is 0.99, but it does influence their estimates because they dropped cases at a lag of six years, not seven. *See* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25. In the estimates in this article, both these errors are corrected, and several models are estimated with full data and a denominator of 0.01 for years when there are no executions.

[264] See Epstein & King, *The Rules of Inference*, *supra* note 26 for a discussion of this convention.

However, note the sample size is nearly halved: the decrease in the number of cases that are eliminated when true zeros replace the artifactual values of either .01 or .99 for the cases with division-by-zero. In Model 9, using alternate data sources but excluding Texas, the coefficient is half of the original estimate (Model 1), and it is significant (p=.021).

Model 10 omits one predictor from the MG models—a within-state time parameter that is meant to capture variance in the models that is attributable to state-specific time trends within each death penalty state.[265] The contribution of this time trend is not obvious, and possibly is redundant with the linear time trend for the aggregate panel, with state and year fixed effects in the original MG model. Without this time trend, the coefficient for deterrence in Model 10 is not significant (p=.497).

Finally, Model 11 replicates Model 1 but shortens the time lag for executions. Here, deterrence is computed as the number of executions in the previous year divided by the number of death sentences two years prior. This specification emphasizes the temporal proximity of punishment by assuming a shorter duration between death sentences and executions. MG assume that six years[266] temporal proximity brings the importance of the celerity of punishment to the forefront in estimating deterrent effects, since offenders may be less likely to discount punishments that are not postponed far into the future; in other words, celerity increases the present value of a deterrent threat. It also provides a better approximation of how offenders update their information, since they are unlikely to recall the frequency of death sentences in their state from six or seven years earlier. When we substitute this measure, the coefficient becomes very small (β=-.001) and is not statistically significant (p=.065).[267]

The sensitivity of these analyses to alternate specifications undermines the claims by MG of robust deterrence findings. The coefficient for deterrence varies from 0 to -.006 in the 10 alternate models, and only four of the 10 are statistically significant at the conventional threshold of p<.05. Note also that in Models 3 through 8 and again in Model 10, the upper bound on the confidence interval is zero or above. This suggests that it is possible that the regression coefficients may be zero or positive, suggesting either no deterrent effect, or a positive or "brutalization" effect of executions. The sensitivity of these analyses to wide

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[265] *See* Mocan & Gittings, *supra* note 10, at 461 (providing a more detailed explanation of this time trend).

[266] In some models, they intended to estimate a seven year lag, although close inspection of the MG programming code shows that they actually estimated a six year lag. Both time intervals are well shorter than the measured lag between sentence and execution, averaging approximately nine years for death sentences handed out from 1973–1995. *See* LIEBMAN ET AL., A BROKEN SYSTEM, PART II, *supra* note 88.

[267] We also increase the sample size in this model to 879 cases, since the shorter lag time means that fewer years are censored due to truncation from lagged denominator in the MG deterrence measure.

swings in the estimates of deterrence when alternate data sources are used and when coding errors are corrected weakens the case for deterrence and introduces uncertainty and fragility when the policy questions demand stability and consistency.

B. *A Different Accounting of Time*

The panel structure of the data in most of the deterrence studies lends itself to a class of statistical models that explicitly examine change over time and identify the effects of time-varying events that may alter trajectories of homicide. Earlier, I noted the advantages and appropriateness of such models for data with repeated measures over time, where the events in one year are highly correlated with the events in both the preceding and the following years. In this section, I use this functional form to re-estimate the effects of deterrence using the MG dataset.[268]

One class of models that is designed for these circumstances is hierarchical or mixed effects regressions. These regression models can identify the parameters that shape a trajectory or pattern or sequence of behaviors over time, and estimate the effects of interventions or treatments that might influence these patterns.[269] The models are "mixed" in the sense that some variables are considered fixed and others random. Variables are "fixed" when we assume that they are measured without error, or that they are constant across studies. So, for example, variables such as population, the number of executions or death sentences, or the incarcerated population are fixed effects. We assume that "random" variables have measurement error, and that models with random effects are making inferences or generalizations within some probability distribution.

In mixed effects growth curve modeling, time is usually modeled as both a fixed effect, to control for the effects of specific years in the time series, and a random effect, to estimate change over time in the dependent variable. Of particular interest in this class of models is the interaction of time with each of the fixed effects. This interaction allows the influence of a fixed effect to vary over

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[268] The models were estimated using the MIXED procedure in SPSS 13.0. The programming commands and the output are available at http://www2.law.columbia.edu/fagan/researchdata/osjcl_deter/. This package was selected because it offered options to specify an autoregressive covariance structure. *See supra* Part III.D. and notes 155–58. Other options to adjust regression estimates in analyses of panel data include the use of Newey-West standard errors. Since observations in panel data often are highly correlated over time, this temporal dependence results in serial correlation and thus downwardly biased standard errors. For an illustration using crime data, see Klick & Tabarrok, *supra* note 90. For the derivation of Newey-West standard errors, see Newey & West, *supra* note 162, at 703–08. *See also* Jeremy Smith & Michael McAleer, *Newey-West Covariance Matrix Estimates for Models with Generated Regressors*, 26 APPLIED ECON. 635 (1994).

[269] *See, e.g.*, ANTHONY BRYK & STEPHEN RAUDENBUSH, HIERARCHICAL LINEAR MODELS: APPLICATIONS AND DATA ANALYSIS METHODS (1992); JUDITH SINGER & JOHN B. WILLETT, APPLIED LONGITUDINAL DATA ANALYSIS: MODELING CHANGE AND EVENT OCCURRENCE (2003); Sophia Rabe-Hesketh et al., *Maximum Likelihood Estimates of Limited and Discrete Dependent Variables with Nested Random Effects*, 128 J. ECONOMETRICS 301 (2005).

time as the fixed effect itself changes. Accordingly, the interactions show whether and how the rate of change in the dependent variable over time is affected by the values of the predictor or independent variable at different points in time. Finally, because of "serial correlation," the estimates in Table 2 use an adjustment for autoregression.[270]

The general composite two-level model follows the form:

$$Y_{ij} = \gamma_{00} + \gamma_{10}\text{TIME} + \gamma_{01}\text{EXECUTION} + \gamma_{11}(\text{EXECUTION}* \text{ TIME}) + \gamma_{02}\text{CUSTODY} + \gamma_{21}(\text{CUSTODY} * \text{TIME})] + [\zeta_{01} + \zeta_{1i}\text{TIME} + \varepsilon_{ij}]$$

where EXECUTION is the deterrence measure in MG, and CUSTODY represents the incarceration parameter. The cross-level interactions of each predictor with TIME identify whether the effects of TIME differ by levels of the theoretical predictors—i.e., whether EXECUTION or DETERRENCE variables are, in fact, associated with a decrease in homicide rates. This is the critical test. The models are specified with the same time-varying covariates as in MG, Table 2. Estimates are population-averaged, and an autogressive (AR[1]) covariance structure is assumed.

Table 2 shows the results of models that apply mixed effects regressions to the MG data. The models included two expressions of time: a linear measure and a second order polynomial (time and time^2). The latter expression of time reflects the actual pattern of change in homicide rates over time during the study interval: rising through 1993 followed by a relatively steep decline through the end of the study period.[271] To illustrate the importance of such assumptions on how we assess deterrence, I compare the results of a model using only a linear measure of time with a model using this second order polynomial change. Although all the variables in the MG analysis were included in these models, Table 2 shows only the results for two predictors: deterrence (EXECUTION) and incarceration (CUSTODY). Incarceration is shown because it is an important counterfactual to the claim of deterrence.[272] Both the main effects for each predictor and the interactions of time with each predictor are shown. The models also include random intercepts, a technique that controls for differences between the states in their initial starting points at the outset of the time series in 1977.[273] As in Table 1, the regression estimate (coefficient) is shown together with the standard error and

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[270] Panel data often are troubled by correlated error terms over time in the relationships between the dependent variables and the predictors. To adjust for this problem, the models are estimated using AR(1) covariance structures. *See, e.g.*, GREENE, *supra* note 157; SINGER & WILLETT, *supra* note 269.

[271] *See, e.g.*, Richard Rosenfeld, *Patterns in Adult Homicide: 1980–1995*, *in* THE CRIME DROP IN AMERICA 130 (Alfred Blumstein & Joel Wallman eds., 2005).

[272] Katz et al., *Prison Conditions*, *supra* note 75.

[273] *See* SINGER & WILLETT, *supra* note 269 (discussing the use and interpretation of random intercepts).

the statistical significance (probability) for that parameter. To further assess the relative contributions of deterrence and incarceration to changes in homicide rates, Table 2 shows the ratio of the coefficients for the two measures, including the coefficients for their interactions with time.

The left half of Table 2 shows that when we estimate the effects of deterrence using a linear time parameter, deterrence is not statistically significant (p=.677) but incarceration is (p=.016). The ratio of the interactions of TIME * EXECUTION to TIME * CUSTODY is 7.13, suggesting a strong difference in the relative contributions of the two variables to homicide rates. The right half of Table 2 repeats this analysis but with a second order polynomial term to model the effects of the predictors over time. The non-linear term better reflects the actual distribution of homicide over time. The results are the same. The important parameter is the line for the interaction of $TIME^2$ * EXECUTION and $TIME^2$ * CUSTODY. The effects for deterrence are not statistically significant (p=.853), but the effects of incarceration are (p=.030). The ratio of incarceration to executions for this model is 10.37, again suggesting that the contributions of incarceration to declining homicide rates are far greater than the contributions of execution.

The story told by Table 2 is that an alternate functional form, one designed explicitly to account for serial correlation (autoregression) in homicide rates within states over time, produces estimates of deterrence that are not significant. We are unable to reproduce the estimates of deterrence once we correct for this centrally important feature in homicide trends and patterns. The regression coefficients in the model on the left side of Table 2 are similar in size and range to the estimates obtained using the fixed effects regression models in Table 1, but the standard errors are far higher and the results not statistically significant. There is greater range in the estimates of deterrence in the models using the polynomial term on the right side of Table 2. In this model, we find significant effects only for the custody variables while execution remains not significant.

C. *Instability and Robustness*

These analyses were designed neither to contradict the results shown by MG, nor were they intended as a critique of MG. Rather, these results illustrate the sensitivity and volatility of estimates of the deterrent effects of capital punishment on homicide.[274] The analyses do show the uncertainty and lack of robustness for this one study of the effects of capital punishment on murder. Simple adjustments in measurement, coding, and in the functional form of the regressions all introduce not consistency in the findings of deterrence, but consistency only in the volatility of the critical finding. Moreover, any effects on the murder rate are small, and

[274] Donohue and Wolfers have also shown the uncertainty of estimates of the deterrent effects of capital punishment in other studies in the new deterrence literature. *See* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25.

depending on the model specification and other plausible empirical decisions, also could appear to be a counter-deterrent. But I take no more faith in that finding than I do in deterrence, simply because of the poor conceptual specification of the factors that produce murders in this study and the others in the new deterrence literature, and the numerous limitations in measurement and method that were discussed earlier.

The limitations identified here are not likely to be an artifact of the decisions of MG: that many of the problems identified and addressed in these analyses are also plainly evident in other datasets used in the new deterrence literature.[275] The cyclical movements of homicide over the three decades since *Furman* and *Gregg* are simply too large to be influenced by small numbers of executions that are widely scattered across the states and so heavily concentrated in one state as to make executions in the others appear to be anomalies. Legal scholars and legislators makers should take note of this uncertainty before taking what amounts to a leap of faith rather than an extension of scientific fact.

V. CONCLUSION: A CAUTIONARY TALE

The new deterrence studies claim that each execution prevents anywhere from three to thirty two murders. This is hardly a new claim: about 30 years ago, similar claims about the death penalty were made just before executions resumed following the post-*Furman* moratorium. One thousand executions later, the claim has been revived by a small group of researchers touting advances in econometric techniques and new data sources that resolve technical problems in the earlier work. Endorsing these claims, Sunstein and Vermeule suggest that this evidence "morally" requires executions, a conclusion echoed by Becker and Posner. These arguments too are neither new nor correct.

The new deterrence literature fails to provide a stable foundation of scientific evidence on which to base law or policy. Nor can this evidence be used to calibrate the normative implications of new "facts" about lives saved or lost. As in the debate over Ehrlich's findings, simple but necessary changes in the functional form of regression equations, combined with measurement strategies that provide more complete and accurate data, produce different results that differ from the current crop of studies, results that are far more equivocal. Even more significant modifications to these studies, such as using research designs that more closely approximate quasi-experiments that account for murder trends in states with no executions, also produce different and equivocal results.[276] Conceptual errors and omissions in specifying the multiple influences on murder rates seriously bias the estimates of deterrence.

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[275] For example, Shepherd's decision to drop cases with missing data on homicide rates in high murder and high execution states such as Florida. *See* Shepherd, *Murders of Passion*, *supra* note 15, at 304.

[276] *See* Donohue & Wolfers, *Uses and Abuses*, *supra* note 25.

The wide range of results, and the sensitivity of findings to even the most minor tweaks, introduces *model uncertainty*. Each study in the new deterrence literature, both those that confirm and those that challenge the deterrence claims, uses a particular model of crime that embodies a choice of data, time period, control variables, and statistical specifications. Variation in these choices is part of a vigorous scientific vetting of a theoretical proposition. While model uncertainty is endemic to this process, the uncertainty here is so wide and so profound as to raise strong cautions on reaching any conclusion about deterrence, much less policy. At the end of the day, econometric "pyrotechnics"[277] may dazzle, but they are diversions that fail to advance the debate on capital punishment.

Sunstein and Vermeule embrace these findings, and use the evidence to animate their calls for a more vigorous use of the death penalty. Sunstein and Vermeule are willing to tolerate error in the estimates of deterrence, arguing that doubts about their robustness should not stand in the way of increasing the use of execution if executions can avoid harm.[278] The problem for them is that the fragility of the new deterrence evidence, a function of the fundamental empirical and theoretical errors in this body of work, raises concerns greater than simply just "doubt": the conclusions in this body of work are wrong, there is no reliable evidence of deterrence. The only scientifically and ethically acceptable conclusion from the complete body of existing social science literature on deterrence and the death penalty is that it impossible to tell whether deterrent effects are strong or weak, or whether they exist at all.[279]

Social science sets a high bar for causal inference, demanding caution until such claims can be replicated under a variety of experimental conditions. Several such replication efforts, facilitated by generous sharing of data and statistical programs, suggest that these claims of deterrence are volatile and inconsistent, sensitive to alternate ways to measure murder rates and decisions on how to account for anomalies such as missing information and years with no homicides.[280] Depending on commonplace methodological adjustments, regression models can just as easily show that executions increase murder or reduce murder.[281] In fact, this work fails the tests of rigorous replication and robustness analysis that are the hallmarks of good science. And the analyses here and elsewhere suggest that the prospect for replications that will produce a range of estimates that can confirm the core finding of deterrence are not forthcoming.

As a matter of social science, it is important to ask how this debate, in reality the second round in the debate over deterrence and the death penalty, arrived at

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[277] *Id*.

[278] Sunstein & Vermeule, *supra* note 34.

[279] Donohue & Wolfers, *The Death Penalty*, *supra* note 147.

[280] Donohue & Wolfers, *Uses and Abuses*, *supra* note 25.

[281] *Id*.

this point. Like the cold fusion scandal in the 1980s,[282] when bold scientific claims were greeted with widespread enthusiasm by the public that fueled a sharp mobilization of academic and political institutions, there was a quick and passionate embrace of the new deterrence claims by a small community of legal scholars and death penalty advocates. As the new evidence leeched into the mainstream media and eventually into political discourse and appellate arguments, the evidence was reified as scientifically rigorous. And as with the cold fusion episode, these claims seem to be unable to withstand scientific vetting.

There are several distinctions between cold fusion and the current deterrence debate. Cold fusion was the work of two scientists. The new deterrence is the work of several researchers, nearly all economists, using core elements of identical data sets on executions, death sentences, and murders, and submitting their papers to peer reviewed journals in economics and non-peer reviewed law reviews. One can only speculate about what happens between submission of an empirical article to a good journal and an editorial decision. But Walter McManus showed that it is not unreasonable to assume that a reviewer's priors influence her posteriors.[283] When McManus introduced the priors of researchers into a representative regression model of murders and executions, he showed that "significant conflicts remain over the estimated deterrent effect of an additional execution, even after the researchers have confronted the same data. The conflicting interpretations of the data evidence are serious."[284] Model uncertainty would be large in a condition

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[282] For a thorough account of the cold fusion episode, see Michele Landis Dauber, *The Big Muddy*, 57 STAN. L. REV. 1899 (2005). When Stanley Pons and Martin Fleischmann announced at a press conference in March 1989 that they had achieved cold fusion, their news was wildly embraced by the public and the media as a scientific breakthrough that promised to transform the nation's protracted and contentious debate over energy policy. (Cold fusion is defined by Wikipedia as "a sustained nuclear fusion in a beaker of water at room temperature that would produce vast quantities of energy at little cost and with few environmental risks." For a general description of cold fusion, see Cold Fusion on Wikipedia, *at* http://en.wikipedia.org/wiki/Cold_Fusion). But the scientific community greeted the news with skepticism and caution. The discovery came not through a process of vetting via scientific publication and replication, but instead was presented to the scientific community via the news media. Although they invited peer review and replication, they pre-empted scientific testing by claiming that other scientists had already "repeated his experiments with success". FRANK CLOSE, TOO HOT TO HANDLE: THE RACE FOR COLD FUSION 335 (1991). The claim that other scientists had vetted the Pons and Fleischmann finding was untrue. Although some scientists reached similar conclusions, others were skeptical and suspected several methodological flaws. It took some time, since these other researchers were starting from scratch, but eventually, physicists rejected the cold fusion claims as soon as mistakes were uncovered and published. According to John Huizenga, one physicist said of their research, "If you got a paper like that from an undergraduate, you would give it an F." JOHN HUIZENGA, COLD FUSION: THE SCIENTIFIC FIASCO OF THE CENTURY 24 (1992). Sadly, as evidence mounted that the results could not be replicated, Pons and Fleishmann refused to admit that there were problems in the initial research that undermined their claims.

[283] McManus, *supra* note 6.

[284] *Id*. at 423.

such as this.[285] The priors of the researchers, in other words, overwhelm the data, and the data simply are not strong enough to lead researchers to a consensus or convergent conclusion. It is not hard to see, given McManus' demonstration, how like-minded researchers would reach similar conclusions.

But understanding the priors of researchers can not explain how reviewers and journal editors would overlook the same flaws that are apparent to many others who have critiqued this body of work. One assumes that reviewers and editors have a wider distribution of priors, but whether the priors of reviewers and editors enter into peer review decisions is unknowable for the moment. I suspect a different dynamic: a set of papers about murder were reviewed as part of an interior conversation among economists who have little or no familiarity with the dynamics of murder, murderers, and criminal legal institutions. Other opinions seem to be unwelcome in this literature.[286] Editors and reviewers alike seem impervious to the kind of intellectual humility that would sustain a result at dissonance with the dominant paradigm of price theory. When discussing the study of deterrence as carried out by economists, Coase[287] notes in *Economics and Contiguous Disciplines* that:

> Punishment, for example, can be regarded as the price of crime. An economist will not debate whether increased punishment will reduce crime; he will merely try to answer the question, by how much? The economist's analysis may fail to touch some of the problems found in the other social systems. . . .[288]

Indeed, potentially the most disturbing concerns in this interlude reside not just in the willingness (or preference) of good journals to publish stylized econometrics over substantive social science theory. Rather, these decisions also are rooted in the striking absence of either critical commentary or substantive contributions by scholars from other disciplines since the initial publication of these articles over the past decade.[289] In fact, these other disciplines are marginalized or dismissed in the current debate. Nor do editors or reviewers

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[285] Leamer, *supra* note 6.

[286] Sorensen et al., *supra* note 129, at 569 (showing that Cloninger and Marchessi fail to cite one article on the deterrent effects of the death penalty authored by a sociologist). My own reading of these articles shows similar omissions in several articles. Shepherd breezily dismisses the contributions of sociologists to the empirical literature on the death penalty as insubstantial and perhaps ideologically motivated. *See* Shepherd, *Murders of Passion*, *supra* note 15; Shepherd, *Deterrence Versus Brutalization*, *supra* note 46.

[287] Ronald H. Coase, *Economics and Contiguous Disciplines*, 7 J. LEGAL STUD. 201 (1978).

[288] *Id*. at 210.

[289] In fact, concern with declining critical commentary has also been raised by others. For an empirical illustration of the problem in major economic journals, see, for example, Philip R.P. Coelho et al., *Decline in Critical Commentary, 1963–2004*, 2 ECON. J. WATCH 355 (2005), *available at* http://www.econjournalwatch.org/pdf/CoelhoetalEconomicsInPracticeAugust2005.pdf.

challenge this self-referential group with concerted attempts to test more rigorously for the immediate impact of a change in threatened punishment with more detailed crime data and a better causal theory. Unfortunately for anyone interested in the deterrent impact of harsher sentences, several of the built-in safeguards for self-correction within the social sciences have clearly failed in this instance. Whether the explanation resides in orthodox beliefs, lack of critical skepticism, or whatever else may be responsible, the failure to maintain scientific and intellectual rigor is particularly disturbing. Indeed, any study which is not adequately challenged by one's scholarly peers can only hinder rather than help the credibility of scholarly contributions to either side of the deterrence debate.

As a regulatory matter, embracing the new deterrence findings ignores risks of error that would have serious consequences. As a normative matter, the implications are dangerous. Research at Columbia Law School on reversals in capital sentences from 1973–1995 showed that the number of serious errors leading to reversal in capital sentences increased sharply with higher rates of death sentences per murder.[290] More than two death sentences in three during this time were reversed, and at resentencing, approximately five percent were exonerated.[291] Even the harshest critics of the Columbia studies acknowledge that the lower bound on error rates is four in ten.[292] Making more people eligible for execution increases the risks of horrific errors of wrongful conviction that are far more likely in states that execute "many people." The clamor to make policy if not law under these conditions of uncertainty is expensive and dangerous.

In this episode, a group of scholars combine some sophisticated empirical strategies to compare the use of the death penalty with a sample of state murder rates. They introduce a set of theoretically tangential controls, and reach a conclusion of deterrence that fails to replicate when more complete data are applied, when unsustainable coding decisions are corrected, and when the functional form is modified to account for the rigid structure of the data. The appeal of this simple story of deterrence is obvious. Sadly, though, "it is easier to muddy the waters than it is to calm them,"[293] especially in the midst of recent erosion in popular support for the death penalty that followed the moratorium on executions in Illinois,[294] the exoneration of the 100th person from death row,[295] and

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[290] *See* LIEBMAN ET AL., A BROKEN SYSTEM, PART II, *supra* note 88.

[291] LIEBMAN ET AL., A BROKEN SYSTEM, PART I, *supra* note 231.

[292] Joseph L. Hoffman, *Violence and the Truth*, 76 IND. L.J. 939, 946 (2001).

[293] Dauber, *supra* note 282.

[294] *See* Rob Warden, *Illinois Death Penalty Reform: How it Happened, What it Promises*, 95 J. CRIM. L. & CRIMINOLOGY 381, 406 (2005). *See generally* DAVID L. PROTESS & ROBERT WARDEN, A PROMISE OF JUSTICE (1998) (documenting the media reactions to the exonerations of the four death row inmates).

[295] Samuel R. Gross et al., *Exonerations in the United States, 1989 Through 2003*, 95 J. CRIM. L. & CRIMINOLOGY 523, 527 (2005).

the revelations of widespread reversals and errors in capital sentences.[296] Complexity and uncertainty, though, are what the data say. Until this research survives the rigors of replication and thorough testing of alternative hypotheses, this research provides no basis for decisions to take many more lives.

This cohort of studies and researchers, like Ehrlich before them, has created unjustified confidence in the minds of legislators, death penalty advocates, and a small group of legal scholars about the capacity of death sentences and executions to deter murder. They raise their concerns to a high moral ground, and brush off evidentiary doubts as unreasonable cautions that place potential beneficiaries at risk of severe harm. Although rebukes like this and others may put the brakes on the rush to once again embrace deterrence as the cure for murder, interludes such as this one also remind us to invoke the tough, neutral social science standards and commonsense causal reasoning before taking a path that can do far more harm than good.

APPENDIX A. PARTIAL LIST OF STUDIES PUBLISHED AFTER 1990 ON DETERRENT EFFECTS OF THE DEATH PENALTY

Harold J Brumm & Dale O. Cloninger, *Perceived Risk of Punishment and the Commission of Homicides: A Covariance Structure Analysis*, 31 J. ECON. BEHAV. & ORG. 1 (1996).

Dale O. Cloninger, *Capital Punishment and Deterrence: A Portfolio Approach*, 24 APP. ECON. 645 (1992)

Cloninger, Dale O.& Roberto Marchesini, *Execution and Deterrence: A Quasi-Controlled Group Experiment*, 35 APPLIED ECON.569 (2001).

Dale O. Cloninger & Roberto Marchesini, *Executions, Moratoriums, Commutations, and Deterrence: The Case of Illinois* (June 2005), *available at* http://econwpa.wustl.edu:8089/eps/le/papers/0507/0507002.pdf.

Hashem Dezhbakhsh et al., *Does Capital Punishment Have a Deterrent Effect? New Evidence from Postmoratorium Panel Data*, 5 AM. L. & ECON. REV. 344 (2003).

Hashem Dezhbakhsh & Joanna M. Shepherd, T*he Deterrent Effect of Capital Punishment: Evidence from a "Judicial Experiment,"* 44 ECON. INQUIRY 512 (2006)

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[296] *See* LIEBMAN ET AL., A BROKEN SYSTEM, PART I, *supra* note 231; LIEBMAN ET AL., A BROKEN SYSTEM, PART II, *supra* note 88.

Lawrence Katz et al., *Prison Conditions, Capital Punishment, and Deterrence*, 5 AM. L. & ECON. REV. 318 (2003).

Zhiqiang Liu, *Capital Punishment and the Deterrence Hypothesis: Some New Insights and Empirical Evidence*, 30 E. ECON. J. 237 (2004)

H. Naci Mocan & R. Kaj Gittings, *Getting Off Death Row: Commuted Sentences and the Deterrent Effect of Capital Punishment*, 46 J.L. & ECON. 453 (2003).

Joanna M. Shepherd, *Deterrence Versus Brutalization: Capital Punishment's Differing Impacts Among States*, 104 MICH. L. REV. 203 (2005).

Joanna M. Shepherd, *Murders of Passion, Execution Delays, and the Deterrence of Capital Punishment*, 33 J. LEGAL STUD. 283 (2004).

Jon Sorenson et al., *Capital Punishment and Deterrence: Examining the Effect of Executions on Murder in Texas*, 45 CRIME & DELINQ. 481 (1999).

Paul R. Zimmerman, *Estimates of the Deterrent Effect of Alternative Execution Methods in the United States: 1978–2000*, 65 AM. J. ECON. & SOC. 909 (2006).

Paul R. Zimmerman, *Executions, Deterrence, and the Incidence of Murder*, 7 J. APPLIED ECON. 163 (2004).

James A. Yunker, *A New Statistical Analysis of Capital Punishment Incorporating U.S. Postmoratorium Data*, 82 SOC. SCI. Q. 297 (2002).