

Reassessing the Cost of the Death Penalty Using Quasi-Experimental Methods: Evidence from Maryland

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Extant research on the cost of the death penalty consistently finds that pursuit of a death sentence adds costs to case processing. However, these studies have important limitations in either the sampling frame or in their failure to include adequate statistical controls. This research draws upon a rich dataset of capital-eligible cases in Maryland to estimate the additional cost of filing a death notice. Multivariate models are used to control for selection into capital case processing and for competing explanations of cost. We find that filing a death notice is associated with an additional one million dollars in costs. (JEL K00, K1, K4)

1. Introduction

The modern death penalty era began in 1976, in the wake of the U.S. Supreme Court's decision in *Gregg v. Georgia* in which the Court outlined the scope of capital punishment statutes that are consistent with the Eighth

The authors wish to thank Aaron Sundquist and Askar Darmenov for their important contributions to this paper and Raymond Paternoster for providing and interpreting the data used here. We also wish to thank Steve Raphael and Geno Smolensky for very helpful comments on early drafts. This research was supported by a grant from The Abell Foundation. Views expressed here are the authors'. They do not reflect the official position or policies of the Abell Foundation, nor the Urban Institute, its trustee, or funders.

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American Law and Economics Review

doi:10.1093/aler/ahp023

Advance Access publication December 15, 2009

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Amendment's prohibition on cruel and unusual punishment. Since 1976, there have been more than 1100 executions in the United States with thirty-three states and the federal government each having executed at least one prisoner. Despite recent moratoriums on capital punishment in New Jersey, Illinois and several other states, more prisoners were executed in the United States in 2007 than in any year between 1976 and 1994 and, in 2008, the Supreme Court denied an appellant's petition to revisit the constitutionality of the death penalty.¹ By reasserting the constitutionality of current execution practices, the Supreme Court has returned the debate over the future of the death penalty to state-level policymakers. Naturally, cost is not the only consideration in the policy-making process, especially when legislating an issue that has historically been dictated by normative considerations. However, in a time of fiscal contraction, in a number of states, cost may become a key in deciding the future of the death penalty.

Prior research has examined both the costs of administering a death penalty regime and the deterrent effect of executions. Of these two strands of research, the deterrence studies have been far more rigorous. However, despite the sophistication of deterrence research, this body of work has generated more controversy than consensus and Donohue and Wolfers (2006) offer compelling evidence that data limitations will prevent any definitive conclusions.² While solutions to the identification problems endemic to deterrence studies remain elusive, given adequate data, advances in the study of the costs of capital punishment are far more accessible.

Prior research on the cost of capital punishment unambiguously finds that capital cases are more expensive to process than non-capital cases. However, as we will argue, most of these studies either rely on data that are too limited to generate causal inferences about the impact of capital punishment on costs or make the wrong comparison. From an econometric perspective, prior research has been limited by small sample sizes, unobserved heterogeneity (many factors related to the cost of a death regime are not observed), selection bias (cases are included in samples because of ex post case outcomes rather than ex ante attributes), and truncated observation periods.

1. See *Baze v. Rees*.

2. Wolfers and Donohue (2006, p. 794) note, "Our estimates suggest not just 'reasonable doubt' about whether there is any deterrent effect of the death penalty, but profound uncertainty. We are confident that the effects are not large, but we remain unsure even of whether they are positive or negative."

Two criticisms of prior studies deserve special attention. The most common design in the extant literature is one in which cases are identified based on ex post case outcomes, specifically comparing cases resulting in a death sentence to a sentence of life without parole (LWOP). Legislators are particularly interested in this question, since they would likely consider replacing the death penalty with LWOP. However, this design is temporally confounded. Conceptually, the identification mechanism must be an ex ante choice only because of the presence of the death penalty as a sentencing option. In practice the only such choice is the prosecutor's decision to pursue the death penalty for each eligible case. A comparison of death sentence cases with an LWOP establishes a false dichotomy since juries are generally not constrained by those two possible sentences. In addition, because the differential costs of capital prosecution begin prior to sentencing, prior research has confounded the comparison, counting costs prior to the assignment of the treatment. Finally, since the jury's sentence is the result of a stochastic process that is not directly controlled by public policy, such a comparison has little policy relevance and generally does not capture the true costs of the changes that state policymakers are contemplating.

The other main criticism of the extant literature is that these studies lack controls for competing explanations of cost. Nearly all of the prior research on death penalty costs has ignored the threat of selection bias,³ though cases selected for capital prosecution are likely not selected at random. If cases selected for capital prosecution would have tended to be more costly to prosecute even in the absence of a death notice, then the resulting cost estimates will be biased upwards. Given the national trend toward more select prosecution of capital eligible cases, it seems reasonable to assume that heterogeneity in case attributes is related to the decision to pursue a capital prosecution, and thus, at minimum, statistical tests for heterogeneity in attributes are warranted.

In this paper, we test whether capitally prosecuted cases resulted in additional costs to Maryland taxpayers drawing upon a large sample of capital-eligible cases in Maryland from 1978 to 1999. We estimate the total cost

3. Theoretically, with sufficient data describing the attributes of the case that independently predict the case outcome and the cost, a randomized design could be approximated to identify a comparison of life without parole and death sentences. In practice, it appears unlikely to be achieved.

of processing each case by constructing a complete case event history from administrative data and conducting semi-structured interviews with court personnel to determine resource inputs. We employ multivariate methods commonly used in quasi-experiments of observational data to measure outcomes (the lifetime cost of the case) as a function of treatment (the state's decision to seek a capital sentence). The model is identified by the prosecutor's decision to file a death notice that formally announces state's intention to seek a death sentence. Because the state's decision to seek a capital sentence may be related to the cost of the case, we use propensity scores to balance capitally prosecuted, and non-capitally prosecuted cases along a large number of case characteristics.

The paper is laid out as follows. We begin with a very brief review of prior literature. Next, we provide a description of the adjudication process for capital eligible cases in Maryland. We then provide the reader with a description of the data as well as a detailed review of how cost estimates were composed. Finally, we discuss our methods and results and we end with a brief discussion of the policy implications of this research.

2. Prior Research

Fourteen studies have estimated the costs of capital punishment, including one study of the federal death penalty and 13 state- or county-level studies (Table 1). Each study concludes that the presence of capital punishment results in additional costs. However, there is substantial variation in the cost estimates. Among the five studies that compare the cost of a death sentence with the cost of a capital-eligible case in which no death notice is filed, the average (additional) cost per case is \$650,000, but the estimates range from about \$100,000 to more than \$1.7 million.⁴

The studies vary widely in their scope and rigor. The generalizability of the cost estimates is limited by a variety of statistical and identification problems including unobserved heterogeneity (because of limitations in data

4. Throughout the paper, we refer to the death penalty regime as encompassing those cases that met statutory requirements that allow a prosecutor to seek the death sentence. Cases in which the death sentence was sought by the prosecutor are referred to as "death notice" cases and cases in which the death sentence was not sought as "no-death notice cases." All dollar amounts have been converted into 2007 dollars.

Table 1. Results of Published Studies Reporting the Costs Associated with Processing Capital Cases

	Study attributes		Cost of capital-eligible cases			Added cost – Capital case	
	Type of study	Stages	Annual	Capital case	Death sentence	Death notice	Death sentence
New Jersey (2007)	Cost to state	OPD DOC	\$1.59 M	–	–	–	–
Cook, North Carolina (2009)	Bottom up	T, P, A, PC				\$13.5 M/annually	
Washington (2007)	Mixed	T, A, FH	–	–	\$198,263 (A, FH)	\$480,204 (T)	\$103,679
Forsberg, New Jersey (2005)	Top down	T, PC, A DOC	–	–	\$4,460,000	–	–
Tennessee (2004)	Mixed	T, PC, A	–	\$74,072 (T, A)	\$25,857 (PC only)	–	–
Baicker, 2004 (NH)	Econometric	–			\$2,200,000		
Connecticut (2003)	Top down	T, P	–	–	\$428,206	–	\$200,170
Kansas (2003)	Bottom up	T, A	–	–	\$1,352,230	–	\$946,561
Federal (1998)	Top down	T	–	\$277,446	–	\$206,502	–
Erickson, L.A. County (1993)	Bottom up	T	–	–	–	–	\$1,721,871
Cook et al., North Carolina (1993)	Bottom up	T, PC, A, DOC	\$5.74 M	–	–	–	\$309,937
Maryland (1985)	Top down	T, P	–	\$96,187	–	\$67,650*	–
Garey, California, (1985)	Bottom up, Single case	T, P, A, PC, SC	–	–	\$1,156,182	–	\$388,286
NY State (1982)	Mixed	T, P, A, CPR	–	\$3,927,895	–	\$2.6 M**	–

Source: Urban Institute review of extant studies of the costs of the death penalty. All costs are in 2007 dollars. T, Trial; P, Penalty phase; A, Appellate; PC, Post-Conviction; FH, Federal Habeas; CP, Certiorari Petition Review; SC, Supreme Court; OPD, Office of the Public Defender; DOC, Department of Correction. *As compared with guilty pleas. **Only compared trial cost of capital case with DOC cost for life-sentenced inmate for 40 years. <http://www.samhsa.gov/oas/nhsda/2k2nsduh/2k2tabs.pdf>.

for at least some aspects of case processing), selection effects (cases are selected into the sample as a result of the case's outcome rather than any ex ante case attribute), and a reliance on unadjusted differences in means rather than multivariate analysis. Of the 14 prior studies of the cost of the death penalty, only four studies (Tennessee, 2004; Kansas Legislative Division of Post Audit, 2003; Cook et al., 1993, 2009) compared capital eligible cases in which a death notice was sought with cases in which it was not sought. The remainder of studies utilized comparisons, which are either contaminated or otherwise not of optimal policy relevance. Several studies (Tennessee, 2004; Goodpaster, 2002; Garey, 1985; New York, 1982) compared cases receiving a death sentence with cases receiving a sentence of life in prison without the possibility of parole. Maryland (1985) compared death sentence cases with a control group in which the defendant pled guilty to murder charges which is a temporally confounded comparison. Finally, three studies estimate costs for death sentence cases, but did not estimate costs for cases in which the death sentence was not sought (Forsberg, 2005; New Jersey, 2007; Connecticut, 2003), thus providing a fairly comprehensive estimate of the cost of capital punishment but without a relevant comparison.

Prior research has also suffered from severe data limitations that resulted in an incomplete analysis of case processing. New York (1982) counted only litigation costs, ignoring a number of important costs over the lifetime of a case, including the cost of seating a jury and the cost of incarceration. Two studies were limited to budget data from the office of the public defender and/or the Department of Corrections (Connecticut, 2003; New Jersey, 2007). Several others did not measure costs associated with the post-conviction phase of the adjudication process (Capital Losses, 1982; Maryland, 1985; Connecticut, 2003). Only three studies quantified the cost of selecting and compensating jurors (Cook et al., 1993; Tennessee, 2004; Goodpaster, 2002). Tennessee (2004) was unable to collect defense attorney costs for life without parole cases. Finally, only Cook et al. (1993) attempted to control for case attributes (indigence of defendant and the number of additional felony charges) that were hypothesized to independently predict case costs, finding that the two variables conditioned on were significant and resulted in a smaller estimate of the cost of capital punishment. In the most recent study, Cook (2009, in this issue) addresses the problem of potential selection into death cases by trimming cases from the sample that do not proceed at least to trial, thus removing the weakest cases from the sample. To

date, no study has accounted for a large number of alternative explanations for the observed cost differential and, to date, no research has adjusted the sample for the possibility that case attributes may predict whether a death sentence was sought in the first place.⁵

3. Processing Capital-Eligible Cases in Maryland

Death penalty cases in Maryland proceed through a labyrinthine process. In Maryland, a defendant is eligible for the death penalty if he or she is convicted of first-degree murder,⁶ is over the age of 18 years, and is not mentally retarded. If a homicide is capital-eligible, the decision to seek a capital conviction is ultimately at the discretion of the State's Attorney. In general, regardless of whether the death penalty is sought, case processing can be divided into six phases: (1) pre-trial, (2) trial, (3) sentencing, (4) post-conviction, (5) state appeals, and (6) federal appeals. The process is detailed in Figure 1.

Differences in costs between death notice and no-death notice cases accrue for several reasons—namely because death notice cases may have more court events, because more resources and/or more expensive resources may be required for some or all of the court events, and because such cases may take longer to process. In the next section, we briefly describe the major processing events that may differ between death notice and no-death notice cases in Maryland in pre-trial, voir dire, sentencing, appeals, and post-conviction review.

In the pre-trial phase, the prosecutor decides whether to seek a death sentence by filing a death notice, in which the state formally notifies defense counsel of its decision to seek a capital sentence.⁷ If the state files a death

5. We also note one econometric study to estimate the costs of the death penalty. Baicker (2004) used aggregate data to conduct an econometric study of the cost of capital cases by examining changes in county budgeting across time and place. Baicker estimated that each death penalty conviction is associated with an increase in county-level judicial and corrections expenditures of more than \$2.2 million, and may lead to a shifting of resources away from policing.

6. There are circumstances where a defendant accused of second-degree murder may be death eligible, but these cases are unusual.

7. A notice to seek a sentence of life without parole (LWOP) must also be filed at least 30 days prior to trial. In the pre-trial phase, capital-eligible cases may be subject to

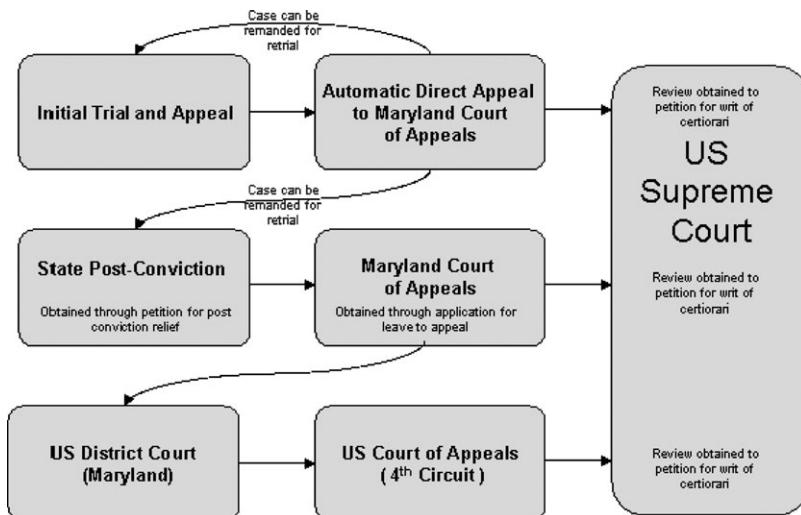


Figure 1. Death penalty case processing in Maryland.

notice, additional procedures are required in processing the case.⁸ Once a death notice is filed, external guidelines determine to a large extent how resources are allocated. For example, American Bar Association (ABA) guidelines require that indigent defendants are represented by two attorneys in capital trials (American Bar Association, 2003, p. 28). Likewise, there are several procedural differences for death notice cases at trial. In cases receiving a death notice, voir dire (jury selection) includes a process of “death qualification”—no juror may serve on a death penalty trial unless he or she is willing to impose the death penalty—which adds time and complexity to voir dire in death penalty cases.

Next, death notice cases proceed through a bifurcated trial. The first stage of the trial—the guilt/innocence phase—is identical in structure for both death notice and no-death notice cases (although the resources

strategic negotiations as the prosecution debates whether to file a death notice and the defense attempts to dissuade the state’s attorney from doing so. While this negotiation undoubtedly occurs, we cannot observe this type of strategic behavior in the data. Hence, costs accrued prior to the filing of a death notice are not included in this research.

8. These additional requirements are often referred to by attorneys as “super-due process,” whereby a defendant who is facing a capital sentence is afforded every benefit of the doubt throughout the legal process.

dedicated to the process may differ). If a guilty verdict is issued in a death notice case, the penalty phase commences in which the same jury will determine the sentence. In the penalty phase, the jury must unanimously find that the aggravating circumstances of the murder outweigh any mitigating circumstances in a second ‘penalty’ phase of the trial.⁹ There is no penalty phase analog for no-death notice trials, as, in these trials, the judge will pronounce sentence.

Once a defendant has been sentenced, the case generally progresses through multiple stages of post-sentencing case review. Defendants in cases with a sentence other than death can first appeal to the Maryland Court of Special Appeals. If the conviction is upheld by the Court of Special Appeals, the defendant may then appeal to the Maryland Court of Appeals, though the Court of Appeals may choose not to review his or his case. Cases receiving a death sentence appeal directly to the Court of Appeals,¹⁰ thus avoiding one stage of processing. A defendant sentenced to death is granted an automatic appeal regardless of whether a notice of appeal is filed, considerably raising the certainty of incurring costs in this stage of adjudication.

After an appeal, post-conviction review procedure allows a defendant to raise specific challenges in court that may not have been heard on appeal.¹¹ Most often, those challenges involve issues that fall outside the trial record, including the effectiveness of counsel or withholding of evidence by the state. The defendant may also raise claims based on new case law or on claims that the defendant unknowingly waived fundamental rights. Because the nature of these claims often involves reopening parts of the case, the defendant may seek to prove that prior counsel failed to present exculpatory evidence. Thus, preparation for post-conviction review can result in significant costs, particularly if effectiveness of counsel is at issue and a new defense team is required. All defendants have a statutory right to counsel on

9. In weighing aggravating and mitigating circumstances, jurors are instructed to use a standard of “preponderance of the evidence,” rather than a standard of “beyond a reasonable doubt.” Maryland law identifies ten aggravating circumstances, including murders while in custody, murder for hire, multiple victims, and murder in combination with another serious felony such as rape or kidnapping. Mitigating circumstances include crimes committed under duress, diminished capacity, and, importantly, any other fact that the court or jury deem to be a mitigating factor.

10. Maryland Rules 8-301.

11. Maryland Uniform Post Conviction Procedure Act.

their first petition.¹² Generally, in subsequent post-conviction reviews for death sentence cases, counsel is also provided by the state while counsel is rarely provided for additional post-conviction reviews for cases with other sentences. Before 1995, a capital or non-capital defendant had the right to file a second post-conviction petition in Maryland. Under current law, however, a second post-conviction petition can only be filed if reopening the case is determined to be in the “interest of justice.” In practice, defendants in death sentence cases often proceed through multiple post-sentencing reviews.

Once an appeal for post-conviction relief is denied, the defendant is allowed to file for a writ of habeas corpus in the United States District Court for the District of Maryland. The review is available only after it has been shown that the defendant has exhausted all possible processes of appeal within the State Court. However, the scope of habeas review is limited: habeas may only be raised on claims that are federal or constitutional in nature. Thus, Federal Habeas Corpus Review is much more likely for death cases. Defendants who have received a death sentence have a right to counsel during this review whereas other defendants have no such right.

4. Data

Data used in this analysis are developed from several sources. The foundation for the analysis is data collected by University of Maryland researchers in their study of racial disparities in the application of the death penalty (Paternoster, Brame, Bacon, and Ditchfield, 2004). Paternoster et al. identified 6000 first- and second-degree murders committed in Maryland from August 1978 until September 1999. From this sample, they identified 1311 cases that were eligible to be prosecuted as capital cases under state guidelines. The data they collected include substantial information about case attributes for each of the 1311 cases. Eighty-four observations were multiple records of the same event (usually retrials for the same homicide). These trials were recoded into a single defendant-level file, yielding an initial subsample of 1227 cases.

In order to construct the dependent variable, a complete event history was required, with an estimate of a unit price and quantity for each event. Price

12. Section 645A (A) of Article 27, Chapter 258 of the Acts of 1995.

data were generally observable from publicly available data. We identified two sources of quantity data. Case event histories were constructed from an official records administrative database: the Maryland Judiciary Case Search (MDJCS) Database containing data on court events in Maryland state courts and the Public Access to Court Electronic Records (PACER) database containing detailed information on court events in U.S. District Court and the U.S. Court of Appeals. Of the 1227 cases in Paternoster et al., we identified complete court dockets in MDJCS and PACER for 538 cases.¹³ Next, all cases in which the prosecutor declined to prosecute or which resulted in an initial not guilty verdict were excluded, yielding a final analytical sample of 1136 from which we analyze a subsample of 509 cases for which sufficient administrative data are available.¹⁴ These data describe the number and type of events for each case.

Finally, an initial estimate of preparation time for each death notice¹⁵ and no-death notice case at each stage of processing was developed in collaboration with a panel of defense and prosecution counsel with experience trying both capital and non-capital cases. These estimates were subsequently sent to one or more counsel in the State's Attorney's Offices and the Offices of the Public Defender, respectively, in each of Maryland's twenty-three counties for verification. In total, sixteen defense estimates were sent to fifteen

13. A case was deemed incomplete if any phases or crucial events, such as a sentencing date, were unobservable. Dockets were labeled as missing if no data were available in the MDJCS database.

14. From the Paternoster dataset of 1227 observations, key identifiers—case number, name, date of birth, year of case, and trying county—were used as search criteria to locate electronic case dockets in the MDJCS database. We observed additional variables in MDJCS that were not available in Paternoster including key dates such as arraignment, trial days, hearings, motions, petitions, and appeals. To verify the accuracy of the MDJCS database, we conducted site visits to courthouses in Baltimore County, Baltimore City, Prince George's County, and Anne Arundel County and compared data from MDJCS with data observed in the in-house databases. In all instances, the availability and the scope of records from both sources were found to be identical. Thus, we searched MDJCS for all 1227 records in the Paternoster data. Many records, especially for cases with no activity after 1990, were missing in the MDJCS database. We could identify no other means of efficiently collecting these records.

15. For our purposes, we defined a death-notice case as a case in which a death notice was filed and not withdrawn. In some cases, a death notice was initially filed but dropped before the trial began. While the initial filing of the death notice may result in higher attorney costs, we were unable to observe when the decision was made not to pursue a death sentence and thus we consider all such cases as no-death notice cases.

Table 2. Time Spent Preparing Cases in the Pre-trial and Trial Phases.

Item	Death notice	No death notice
<i>Pretrial Phase</i>		
Percentage of time on a case (before death notice is filed)	50	15
Percentage of time on a case (after death notice is filed)	30	15
Percentage of time on a case (90 days prior to trial)	50	25
Percentage of time on a case (45 days prior to trial)	75	50
Percentage of time on a case (30 days prior to trial)	100	100
Number of attorneys assigned	2	1
Attorney time to prepare for each hearing day (hours)	12	6
Paralegal time to prepare for each hearing day (hours)	2	1
<i>Guilt/Innocence Phase</i>		
Attorney time to prepare for each day of voir dire (days)	3	3
Average number of days of voir dire in a "typical" case	20	2
Attorney time to prepare for each trial day (hours)	60	60
Paralegal time to prepare for each trial day (hours)	5	5
Attorney time to prepare for each hearing day (hours)	12	6
Paralegal time to prepare for each hearing day (hours)	2	1
<i>Penalty Phase</i>		
Attorney time to prepare for each trial day (hours)	60	
Paralegal time to prepare for each trial day (hours)	5	
Attorney time to prepare for each hearing day (hours)	12	
Paralegal time to prepare for each hearing day (hours)	2	
Percentage of time on a case (during phase)	100	
<i>Post-Conviction</i>		
Hours/week	40	40
Percentage of time on a case	15	10
Percentage of time on a case (two weeks prior)	40	40
Percentage of time on a case (during the hearing)	100	100
Attorney time to prepare for each hearing day (hours)	8	8
Paralegal time to prepare for each hearing day (hours)	1	1
<i>Appellate</i>		
Attorney time to prepare an appeal (hours)	600	300

Source: Staff Attorneys from the Office of the Public Defender and the State's Attorney's Office.

counties and thirty-seven prosecution estimates were sent to twenty-three counties. From these interviews, we developed estimates of the time allotted to each stage of case processing (Table 2) that were applied to court events observed in each of the 509 cases in our database.

5. Construction of the Dependant Variable

This research counts the opportunity cost of the death penalty, which is defined as the value of resources in their next best use. Resources take the

form of capital (such as the value of court space) and labor costs (salary and wages). We estimate the value of each resource (the price) in terms of the price per unit (such as one hour of attorney time) and count the value of all resources paid for by Maryland taxpayers in the processing of a capital eligible case. We estimate costs for each defendant's case and for each stage of case processing.¹⁶ The remainder of this section describes how price and quantity estimates are combined to construct the dependant variable.

5.1. Pre-Trial/Trial/Penalty Phase

5.1.1. Defense Cost. The Office of the Public Defender (OPD) is the state agency responsible for the provision of legal representation to indigent defendants in the State of Maryland. The responsibility of establishing and funding county-level Offices of the Public Defender rests, not on the individual counties but under the Executive branch of the Government of the State of Maryland. Position salaries are determined at the state level. In assigning value to attorney time, we derive estimates of the hourly wage of OPD staff, taking into account salaries, fringe benefits, and days of paid leave. Staff salaries for county-level OPD offices were drawn from the Maryland Department of Budget and Management's (DBM) State Salary Plan (Ostrom, 2005). The annual salary for OPD staff was computed as the mean of the minimum and maximum salary listed for each position. The District Public Defender's salary is approximately \$93,672.00, with \$72,157.50 for each Assistant Public Defender and \$40,516.00 for each paralegal. Following convention, fringe benefits are assumed equivalent to 30% of annual salary for all positions.¹⁷ To estimate the hourly wage rate, an estimate of the average number of workdays in a given year was generated. Estimates

16. Because we are comparing trial costs of capital cases and non-capital cases, we dropped from our comparison group cases that were acquitted. Given that these cases could not possibly receive the same cost inputs as the treatment group, including them would have deflated the cost of the comparison group and artificially raised the differential cost of death penalty as compared to cases that did not receive the death penalty. We note that Cook (2009) uses a similar approach to trim weak cases that are disproportionately no-death notice cases and thus contribute to selection bias.

17. Fringe benefits represent a direct cost to the employer (in this case, the State of Maryland) and include Social Security, Health Insurance, Pension Retirement, Deferred Compensation Match, Workers Compensation, and Unemployment Insurance. The estimate of 30% is close to the Department of Budget and Management's (DBM) FY 2007 estimate of a fringe rate of 33% for the typical state employee in the state personnel management system.

of additional annual days of leave were developed from the annual leave policies outlined by the Maryland DBM. Accounting for 43.5 days of leave and 104 weekend days, we estimate that there are 217.5 workdays in an average year. Put differently, this estimate is equivalent to a 43.5-week year or a 1740-hour year, assuming an eight-hour workday.¹⁸ Thus the hourly wage rate is given as the sum of each position's annual salary and benefits divided by 1740 annual hours.

5.2. Time Spent on Capital Eligible Cases

Attorney time associated with an individual case could not be estimated directly as there were no time logs available for either the prosecution or defense. Other studies (Cook et al., 1993; Washington, 2007) have dealt with this problem by using survey data or interviews with attorneys to estimate, on average, the amount of time dedicated to a case. We developed a survey for attorneys with experience in capital cases to estimate time spent on capital eligible cases. Time categories were developed to match with administrative data where we observe both event data (number of hearings and number of trial days) and duration data (length of a phase). The survey queried attorneys with experience trying capital cases regarding time spent on a case in each of these stages of processing. These estimates account for the mean amount of time an attorney spends each day working on a capital eligible case, as well as additional time associated with specific court events. Survey respondents estimated that the number of attorneys dedicated to cases in which a death notice is filed is twice (two) the number assigned to a no-death notice case (one). Thus, for many court events, about twice as much time is spent in preparation. Respondents, however, report that the amount of time taken for voir dire preparation and a day of trial is identical in death notice and no-death notice cases.¹⁹

18. Interviews with attorneys involved in death cases suggest that their work often spans more than 40 hours per week especially around trials, attorneys are not eligible for overtime pay and, as such, a 40-hour work week is assumed in all cost analyses.

19. One critical difference between cases that receive a death notice and cases that do not receive a death notice occurs in the period before a death notice is filed. Survey respondents report that the prosecution must spend additional time with these cases to determine whether a death sentence will be sought, and the defense works intensely to prevent the death notice filing. In capital-eligible cases in which the death notice is not sought, we are unable to observe the amount of additional time spent by defense counsel

5.2.1. Prosecution Cost. The State's Attorney's Office (SAO) is responsible for prosecuting violations of Maryland State law within the geographical boundaries of its respective county. Unlike the OPD, policies dictating SAO salaries differ slightly for each county. We estimate the hourly wage of SAO staff using a process that is identical to the estimation strategy for OPD staff. However, because these salaries do not fall under the State Salary Plan, SAO wages were estimated from the Anne Arundel County Class and Compensation Plan. Again, we compute salaries as the mean of the minimum and maximum salary for each position and assume fringe benefits equivalent to 30% of annual salary. We estimate SAO hourly wages at \$102 for a State's Attorney, \$58 for an Assistant State's Attorney, and \$31 for a paralegal.

As noted above, with the exception of differences in the appeals process, survey respondents reported, on average, that there were no substantial differences between the defense and prosecution in the amount of time dedicated to a death notice case in the pre-trial and trial phases. Thus, the same estimates are used for prosecutors as for the defense. Within each type of case—death notice and no death notice—differences in cost between the prosecution and defense are because of differences in the wage rather than intensity of preparation.

5.2.2. Expert Witnesses and Specialists. Most studies conclude that the cost of expert testimony is a significant part of the overall cost to the death penalty. Because we were unable to observe the cost of expert witnesses directly, we estimate this cost based upon a federal study of the death penalty (1998). This study estimates the percentage of overall cost, which can be attributed to reimbursements to experts, which includes forensic science experts, experts in interpretation or authentication, mitigation specialists, jury consultants, psychologists, and psychiatrists. Overall, 19% of payments for representation went to services for experts and investigators for capital cases. In non-capital death-eligible cases, 16.2% of total costs were spent on experts. We apply these estimates to the cost of attorney fees for the guilt and penalty phases.²⁰

to fight a death notice filing and the prosecution to prepare a death notice filing. Thus, in this area we likely underestimate the costs of the death penalty.

20. It is likely that experts will also be called on in the post-conviction stage of a case. We assume that the sum of all expert time will follow the estimate in the federal

5.2.3. Courtroom, Judge, and Jury Costs. The opportunity cost of the court room is the value of the space in its next best use as proxied by the rental price of that space for another purpose. The rental value of one courtroom day is estimated using the prevailing market rental rates for an average square footage of Circuit Court space appropriate for trying a murder case.²¹ To calculate courtroom usage, we assume one day of court usage per trial day, one day of court usage per hearing day, and one day of court usage per full day of voir dire. For trial days, we assumed that the jury room and the court room were used. For hearing days, we assumed that the courtroom was used. For days of voir dire we assumed that the jury pool room and courtroom were used. To calculate per day costs of the judge and Circuit Court judicial staff, we follow the same general approach as was used to estimate fully loaded attorney wages.²² We calculate cost of judges for trial

study. So, for example, if there was inadequate expert assistance in the pre-trial phase, there will be more in the post-conviction stage, but the sum will be the same as if the initial expert assistance had been fully adequate.

21. To calculate the square footage of relevant courthouse facilities, we solicited estimates of the size of court space from the Administrative Office of the Courts, the Department of Public Works and/or the Department of General Services in five counties in our sample. Specifically, we requested the square footage of a typical courtroom, jury room, judge's chamber, and jury pool room. Of the five counties surveyed, only Baltimore City and Prince George's County did not process our request. Taking the average square footage of each facility, we estimated 1534.3 square feet for a typical courtroom, 341.3 for a jury room, 541.7 for a judge's chamber, and 4458.7 for a jury pool room. To assign value to courthouse facilities, we used a seven-year average (in 2007 dollars) of market rates for class B office rental space in suburban Maryland. Applying the rental rate of \$27.09 per square foot to the average area of the four relevant Circuit Court facilities, we calculate the annual rental value for each facility. Assuming that court is in session 240 days a year, we estimate the following daily rental values for each facility: \$173.19 for a courtroom, \$38.53 for a jury room, \$61.14 for a judge's chamber, and \$503.27 for a jury pool room.

22. We assume fringe benefits are 30% of annual salary, judges receive 43.5 days of annual leave, and judges work a 1740-hour year. We use the annual salary of \$134,352 for a Circuit Court Judge provided by the Maryland Judiciary to compute the salary-benefits total for that position. Salary estimates for other Circuit Court staff—court clerk, law clerk, court reporter, and bailiff (deputy sheriff)—are again computed from the Anne Arundel County Class and Compensation Plan. We estimated hourly wage rates for Circuit Court staff at \$100.38 for a Circuit Court Judge, \$22.75 for a Court Clerk, \$32.15 for a Court Law Clerk, \$39.17 for a Court Reporter, and \$34.78 for a Deputy Sheriff serving as Court Bailiff.

days as well as hearing days in the guilt and penalty phase and assumed eight-hour workdays. Each trial day and hearing day was given one full day of judge time.

Jury costs were estimated as the opportunity cost of an average juror's time as proxied by the foregone income of an average juror. In economic analyses, the value of one hour of an adult's time is generally assumed to be equal to an hour of wages. Using state-level data from the Bureau of Labor Statistics, we calculated the average hourly earnings of a Maryland citizen of 18 years or older. This rate reflects employed as well as unemployed persons and averages to approximately \$12.59 per hour. This hourly rate was then applied to the process of jury selection. From the survey we estimate that the average length of voir dire for a capital case is five days and two days for a non-capital case. From semi-structured interviews, we estimated the number of individuals who interact with the court system in the process of jury selection.²³ We assume selected jurors (14) are present for all trial days, assuming eight-hour trial days.

5.2.4. Retrials and Pleas. In the event of a retrial of either the entire guilt phase or the sentencing (penalty) phase, we apply the same methods used for calculating the original trial costs. In the event of a plea, we also apply the same estimates used for calculating original trial costs. That is, we increase the amount of time an attorney spends on a case the same way we would as a case approaches trial. We assume that an attorney treats a case as though it will go to trial until the moment of a plea. For trials in which the actual timeline did not allow for our estimation timeline (i.e. the phase was less than 90 days or the death notice filing date occurred within 90 days of the

23. For capital cases, semi-structured interviews with judges and attorneys report that 800 individuals fill out the juror-selection survey and estimate an hour of time per individual. We estimate that 175 potential jurors appear for jury selection and each spends, on average, 2.5 days in the juror pooling process (we assume that each juror is not present for all the days of voir dire). Twelve jurors and at least two alternate jurors are selected from the pool of 175 prospective jurors. We assume an opportunity cost of eight hours per trial day. For non-capital cases, we assume that 120 individuals complete the juror-selection survey (one hour of time). We estimate sixty jurors appear for one day of jury pooling (we assume not all prospective jurors are present for all two days of voir dire).

trial), we used only the applicable time percentages to the actual number of days.²⁴

5.3. Penalty Phase Costs

The penalty phase is unique to cases in which the death penalty is sought. In this phase, mitigating circumstances are often presented, and a defendant may elect to be sentenced either by a jury or by a judge. In general, we follow the same process to estimate costs in this phase as in the trial phase. One difference between the trial and penalty phase is that we assume that attorneys spend 100% of their time working on the case during this phase (which we observe from case dockets to last an average of 13.8 working days). Thus, in order to avoid double counting, time associated with the penalty phase was calculated as the total number of hours in the phase minus trial and hearing day hours and preparation hours for trial days and hearing days. Any remaining hours were then assumed to also have been spent working on the case.

In the penalty phase, the defendant has the right to elect between sentencing by a jury and sentencing by a judge, and we were able to observe these events in our data. Where sentencing was pronounced by a judge, we calculated the cost the same way as the cost of the judges' time during the trial days. Jury costs were calculated using the same method as was used for the trial phase (although in the penalty phase the cost of voir dire was not included since generally the same jury that sat in the guilt phase will sit in the penalty phase).

5.3.1. Retrials and Pleas. There were thirteen instances in which an offender was remanded for a retrial of the penalty phase only. For these events, the average length of a phase was much longer, an average of 292 working days. In these cases, we calculated time devoted to a case using the same percentages as in the trial phase. There were only two cases in which a death notice was filed, a plea was made, and a penalty trial was still held. These were calculated the same as the typical penalty phase cases, using the plea as the start date of the phase.

24. For example, if a case had a pretrial phase of 50 days, we used the attorney time percentage 90 days out (50%) for 5 days, 45 days out (75%) for 15 days, and 30 days out (100%) for 30 days.

5.4. Case Review

Costs associated with state-level post-sentencing proceedings are separated into costs associated with petitions for post-conviction relief and costs associated with appeals (both to the Court of Appeals and the Court of Special Appeals in non-capital cases). In general, costs associated with adjudicating the post-conviction phase were estimated using the same process described above. Differences include: (1) in the post-conviction phase, private attorneys instead of public defenders are oftentimes used, and (2) attorney's time spent on appeals was based on the number of appeals, rather than the length of the phase. These differences are further described below.

We note that it is possible that for some cases in our sample, post-conviction events will continue to occur into the future. Rather than try to predict the cost of additional post-conviction events, we only summed total observable costs. However, it is important to note that while we cut off case enrollment into our sample in 1999, we were able to observe case events through early 2008, a period of nine years. Furthermore, early in our analysis we tested the difference in the incidences of court-events (specifically post-conviction events and number of appeals) for cases from 1990 to 1995 and those from 1995 to 1999. In this analysis, we found that there were no significant differences and most post-conviction events and appeals occurred within ten years of the initial trial. Therefore, while there will almost certainly be post-conviction events after 2008, we do not believe that these events will substantially affect the average cost of cases.

5.4.1. Post-Conviction Phase. In the post-conviction phase, we use the same estimates for specialists, courtroom costs, and judge costs as in the previous stage. Survey data indicated that attorney time on a case during the post-conviction phase differs from time during the trial or sentencing phase. Since this phase often spans many years, from the day that a petition is filed to the day a decision is handed down, attorneys estimate that they spent, on the average, 15% of their time on a case during this process. However, in the weeks before a hearing on the petition, the proportion of time spent on the case increases to 40%.

It is important to note that at this stage a sentence has already been handed down. Thus, treatment cases that did not receive a sentence of

death now use the same attorney time estimates as no-death notice cases. Furthermore, at this stage many petitions for post-conviction relief are not filed by attorneys but by the defendants themselves. Consequently, many petitions are withdrawn or dismissed and the costs associated with such petitions are the opportunity costs of the defendant, which we assume to be zero. Because we were unable to observe when a petition was filed by an attorney and when it was not, we made the following assumptions based on interviews:

- All death penalty cases are represented by an attorney;
- Cases in which a death sentence was handed down and subsequently revoked will continue to be represented by an attorney during the post-conviction process;
- Costs associated with petitions that do not make it to a hearing will be assumed at zero;
- All petitioners whose cases are heard have representation.

5.4.2. Appellate Phase. In the appellate phase, we use the same estimates for courtroom costs as the previous stages. However, attorney time associated with appeals was calculated as the average number of hours necessary to draft an appeal, rather than a percentage of attorney time dedicated to a case throughout a phase. This assumption was made after interviews with public defenders and prosecutors indicated that the majority of work was done filing the appeal, rather than in the time between when the appeal was filed and when a decision was handed down. Attorney hours associated with appeals was one of the few areas in which we were informed that there is, on the average, a difference in preparation time between the defense and prosecution. Because the defense has the burden of drafting the appeal and the prosecution responds, we were told that the prosecution devotes less time to this particular stage. We have estimated attorney time in the appeals phase to be 600 hours for the defense and 300 hours for the prosecution.

For the appellate stage, we assumed that all first appeals in non-capital cases go to the Court of Special Appeals and attribute one full day of judge time per appeal filed. For the second and subsequent appeals for non-capital cases, as well as all state-level appeals for capital cases, we used the hourly

rate of judges at the Maryland Court of Appeals level. Similarly, we assume one full day of judge time per decision handed down.²⁵

5.5. Federal Costs

Once an appeal for post conviction is denied, the defendant may file for habeas relief in the federal court. Costs associated with the federal level can be broken down into Federal Habeas Petitions and Federal Appeals. Information on costs associated with the federal stages was obtained from electronic dockets located on PACER, the federal judiciary's central location for court records for the U.S. District Court and the U.S. Court of Appeals. Docket information was obtained only for cases that had received a death sentence. At the U.S. District Court level, we observed the date of filing for petitions for habeas corpus, hearings, and the date decisions were handed down. At the Federal Appellate level, we observed the number of appeals filed and decided upon. Appeals that were withdrawn or dismissed did not factor into our cost analysis. While we were unable to collect docket data at the federal level for our control group (those with no death sentence), we estimated the probability of a case proceeding to each federal stage and the cost of adjudication of a non-capital case at the federal habeas and federal appeal level. We then distributed this expected cost amongst our no-death sentence group. The data we used to create these estimates are those reported by the Bureau of Justice Statistics (Scalia, 1997), which reports data on the rate of capital and non-capital petition filing on a state-by-state basis. Scalia also estimates the average length of time between a filed petition and a decision, differentiated by capital and non-capital cases; the percentage of petitioners who have representation rather than represent themselves; and the rate petitions are dismissed.

25. We estimated hourly wage rates as follows: \$106.13 for a Special Appeals Associate Judge, \$108.37 for a Special Appeals Chief Judge, \$27.52 for an Appeals courtroom clerk, \$128.77 for a Court of Appeals Chief Judge, and \$114.57 for a Court of Appeals Associate Judge. For the Court of Special Appeals, we assumed a three-judge panel composed of the chief judge and two associate judges. For the Court of Appeals, we assumed that all seven judges are involved in handing down a decision. In both instances, we accounted for the hourly time of one courtroom clerk. Assuming an eight-hour day, the labor cost of judicial staff of a day in the Court of Special Appeals is \$2,785.25 and \$6,749.85 for a day in the Court of Appeals.

5.6. Cost of Prison

Prison is a substantial component of the cost of processing a murder case. Many defendants in the sample were in prison when data were collected for this study. Thus, we estimate an observed prison cost component (time spent in prison) and a forecasted component (expected time until release or death). We forecast an expected date of exit from prison for each inmate as a function of individual attributes. Based on the expected total time served (including healthcare costs), we estimate the total cost of incarceration for each defendant in the sample.

To forecast expected time served, an expected age of death was generated for each defendant. Existing data, such as the Bureau of Justice Statistics' Death in Custody Reporting, are insufficient to estimate counterfactual ages of death for our sample as our average observation would be an outlier in those data.²⁶ To construct an expected age of death, we use data on age-specific mortality rates and life expectancy that are available for the general population, estimated separately by race and gender. Life expectancy in prison was modeled in three stages. First, life expectancy was linked to mortality rates for the general population via a bivariate Ordinary Least Squares (OLS) regression of life expectancy on mortality rates. Next, using linear transformations of in-prison race, gender, and age-specific mortality rates to mortality rates in the general population (calculated in Arias, 2006), we estimated in-prison mortality rates for each age, by race and gender. Finally, in-prison life expectancy was estimated by regressing life expectancy for the general population on in-prison mortality rates.²⁷ After generating an expected date of death for each defendant in the sample, we compare this date with an expected date of release and chose the earlier of the two.²⁸ Expected release date is calculated by multiplying each case's sentence by

26. The majority of prisoners in state and federal prisons do not die in custody and, instead are released prior to death. As a result, mean ages of death in custody do not reflect an unbiased sample of ages of death among the prison population. Second, individuals in our sample—all convicted murderers—serve longer sentences than the average prisoner, compounding the likelihood that their death will occur while in custody.

27. The model was specified as a log-log relationship between prison life expectancy and national life expectancy and was estimated separately for each gender and race for age group, for ages 17–65. The fitted values from this regression were exponentiated to yield and expected age of death for each individual in our sample.

28. In order to estimate an expected length of time served in prison, we generate an expected length of sentence served. Sentence (in years) available in the dataset used by

54%, the average length of sentence served for a violent crime in Maryland (Durose et al., 1999) and an estimated year of release was created. Finally, the difference between entry and exit years estimates the number of years during which prison costs accrue. For inmates on death row, an expected age of exit from death row was calculated by taking the product of the weighted average of time to execution for those in the sample who were executed and the probability of execution, conditional on a death sentence. Upon leaving death row, inmates with additional time to be served were assumed to accrue normal prison costs until their forecasted date of death or release.

Annual costs for the Maryland House of Correction–Jessup Region were used to estimate non-death row incarceration costs. Other data from the Maryland Department of Public Safety and Correctional Services detail costs for Maryland's death row. All costs were converted into 2007 constant dollars and the observed change in cost from 1978 to 2007 was used to estimate the real prison-specific inflation rate (2.1%), the rate at which prison costs outpaced inflation. Prison costs prior to 2007 were deflated at a rate of 2.1%. Future costs were inflated at a rate of 2.1% to account for expected real prison-specific inflation (which we assume will proceed to grow at a fixed rate). Finally, an additional discount rate of 5% was applied to all costs that will be incurred in the future.

The increasing cost of health care for aging offenders is a significant cost associated with life without parole (Goodpaster, 2002). Increases in the cost of healthcare are driven by two factors: real growth in healthcare costs over time and individual-level increases in costs associated with aging. Per capita health expenditure by age group was not readily available for Maryland, and thus age-specific prison healthcare costs calculated by a study of the healthcare costs death-eligible cases in Indiana were applied here (Goodpaster, 2002). A comparison between Indiana and Maryland suggests similar per capita annual healthcare costs (Stephan, 2007). Healthcare costs estimated by Goodpaster (2002) were transformed into 2007 constant dollars, and past expenditures were calculated by deflating these costs by the estimated real rate of increase in healthcare costs. This rate (2.3%) was calculated as the average of the historical average excess cost growth for Medicare and

Paternoster et al. (2004) was multiplied by 54%, the average length of sentence served for a violent crime in Maryland and an estimated year of release was created.

Medicaid as given by the Congressional Budget Office (Orszag, 2008). Future costs were projected by first inflating costs for the real rate of increase in healthcare costs and then by deflating this cost by a 5% discount rate to account for the time value of money. In order to avoid double counting healthcare costs and prison costs, the estimated percentage of prison costs attributable to healthcare costs was subtracted from the total prison costs (estimated at 12% based on the national average; Stephan, 2007). Finally, lifetime healthcare costs were estimated for each inmate based on their age of entry into prison and their expected age upon exit.²⁹

5.7. Costs of the Office of the Public Defender, Capital Defense Division

As a statewide office established in 1988, the Capital Defense Division coordinates the delivery of legal defense services, arranges for experts, and advises counsel in the defense of capital cases. We observed total expenditures (in 2007 dollars) over a period of five years and subtract out technical and special fees to avoid double counting the cost of specialists and expert witnesses. We take the inflation-adjusted, five-year annual average of Division expenditures, \$563,575, and apply it to the years in the sample for which the Division operated (1988–1999), adding an additional \$6.2 million to cases in our sample. We account for these cases continuing into 2000 and beyond by estimating the percentage of old cases (41%) continuing from 1999 to 2000 and discount by 41% for each subsequent year beyond 1999, and thus estimate an additional \$0.95 million. The total estimated cost of the Capital Defense Division accrued to cases in our sample is \$7.15 million.³⁰

29. The process of subtracting out average healthcare costs and then adding in age-inflated healthcare costs does induce a degree of measurement error. As a sensitivity analysis, we reran our final models using only the original Maryland prison cost (without accounting for the individual age-related increase in healthcare costs over the life-course). These two methods did not result in any appreciable difference in the outcome.

30. This approach does not double-count costs as the Capital Defense Division “is generally administrative in nature and rarely litigates death penalty cases” (Department of Legislative Services, 2004, 4). Thus, the activities of this unit should not appear in other categories of cost.

6. Methods

Our initial database contained all 1136 death-eligible murder cases in Maryland prosecuted between 1978 and 1999 that resulted in a guilty verdict.³¹ We observe and correct for two potential sources of bias. First, case records were either missing or incomplete for 627 of the 1136 cases, yielding a sample of 509. Second, cases are not randomly assigned to receive a death notice, and thus we use propensity scores to adjust the sample to account for the presence of non-random selection into capital prosecution (see below). After trimming the sample to exclude treatment observations with no comparable comparison observation and comparison observations with no comparable treatment observation, we are left with a final analytic sample of $n = 457$.³²

6.1. Missing Data

Cases were not missing at random, and thus failure to control for the characteristics of missing cases has the potential to bias estimates of the outcome. We followed the literature on non-response bias in surveys and used sampling weights to adjust for potential bias because of missing data. Weights were generated using the following logistic regression model:

$$p_i = \exp(X\lambda) / (1 + \exp(X\lambda)). \quad (1)$$

In Equation (1), p_i is an indicator variable for whether or not case i had complete case data and X is a matrix of covariates theoretically linked to the probability for which the data are missing. As the generation of sampling weights is largely atheoretic, all variables that were either empirically or theoretically related to case missingness were included in the model (see Table 3). The explanatory power of the model (Pseudo $R^2 = 0.44$) was high, and an area-under-the-curve (AOC) statistic of 0.838 indicates that the model discerns between missing and non-missing cases with a reasonably high degree of accuracy. In order to verify that the selection weights

31. Cases in which the state subsequently declined to prosecute or in which the jury returned a not guilty verdict were excluded from the dataset as differences in cost that are driven by the lack of culpability of the defendant would spuriously attribute cost differences to the filing of a death notice.

32. Given that the conditional independence assumption holds, the average treatment effect is defined only in the region of common support (see Rosenbaum and Rubin, 1983).

Table 3. Independent Variables Used in the Regression Models to Generate Weights to Account for Missing Values**Defendant Characteristics**

Age of defendant, defendant race is white, defendant has a prior felony charge, defendant has a history of alcohol abuse, defendant has a troubled job history

Victim characteristics

Victim race is white, victim is unable to defend oneself, victim is elderly or frail

Offense characteristics

Multiple victims, defendant was a stranger to any victim, victim was executed, victim made to beg for life, victim took a long time to die, victim was killed in own home, defendant persisted even when victim's death was certain, defendant attempted to evade capture, defendant confessed to the crime, evidence against defendant was circumstantial

Statutory Aggravators

- A1. Victim was a law enforcement officer
- A2. Defendant committed murder while in a correctional institution
- A3. Defendant committed murder while trying to escape custody
- A4. Victim was murdered in the course of an abduction
- A5. Victim was a child abductee
- A6. Defendant murdered pursuant to agreement for remuneration
- A7. Defendant employed another who killed for remuneration
- A8. Defendant committed murder while under life sentence
- A9. Same incident produced multiple murder victims
- A10. Defendant committed murder in the commission of another offense

County Dummies (reference category = all other counties)

Anne Arundel, Baltimore City, Baltimore County, Harford, Montgomery, Prince Georges, Other

Year of case

Source: Urban Institute analysis. <http://www.samhsa.gov/oas/nhsda/2k2nsduh/2k2tabs.pdf>.

successfully reweighted the sample, independent samples *t*-tests compared the unweighted and weighted means for each predictor in the model. This analysis returned no significant differences across all twenty-four variables, indicating that bias caused by incomplete case records is successfully removed by model (2), conditional upon the observables in *X*.

Next, the data were weighted so that the sample would approximate the population of death cases in Maryland. In order to generate sampling weights for each case, model (2) was run separately for treatment cases and comparison cases generating a predicted p_i the probability that the case contained complete records. For each of the 1136 cases, we generated a base weight, $w_i = 1/p_i$, where p_i is the probability that case *i* is complete (non-missing) in the dataset. Thus, complete cases with a high probability

of having missing data receive greater weight in the analysis, reweighting the sample of 509 complete cases to resemble the original sample of 1136.³³

6.2. Selection into Death Notice

Prior research on the cost of capital eligible cases does not account for the possibility that case attributes—rather than the filing of a death notice—may have caused the higher costs that were observed in the capitally prosecuted sample. In observational studies, un-modeled factors that are related to both selection into treatment (the filing of a death notice) and outcomes (cost) have the potential to bias point estimates on the treatment parameter in final outcome models (Heckman, 1977, 1990; Greene, 1981; Berk, 1983; Rosenbaum and Rubin, 1983). It is reasonable to presume that the aggravating circumstances of cases that lead to the filing of a death notice may have prompted prosecutors to devote substantially greater resources to the prosecution of these cases, even if capital punishment had not been an option. A substantial body of research (Greene, 1981; Heckman, 1977, 1990; Rosenbaum and Rubin, 1983) suggests that covariates alone are insufficient to attain an unbiased estimate of the treatment parameter when individuals are not randomly selected into treatment, thus necessitating an alternate approach.

Propensity score models have been proposed as a viable solution to modeling selection bias arising under this scenario (Rosenbaum and Rubin, 1983; Heckman, Ichimura, and Todd, 1998; Dehejia and Wahba, 1998; Caliendo and Kopeinig, 2005). Under certain conditions, propensity score analysis can approximate a randomized controlled trial and generate unbiased estimates of the treatment effect. Here, the propensity score is the conditional probability of a death notice filing and can be written as $\text{Pr}(T_i = 1 | X_i)$, where $T_i = 1$ if the case is capitally prosecuted and 0 if it is not. X_i is a vector of covariates theoretically associated with the probability of capital prosecution.³⁴

33. In order to ensure that no single case contributed undue influence to subsequent models weights were winsorized at a value of four and normalized so the sum of the weights was equal to the sample size of the complete cases.

34. The use of selection models is not without statistical cost. Propensity scores—whether used in matching, stratification, or weighting—result in increased standard errors and, as such, are relatively inefficient estimators.

In selecting variables for inclusion in a propensity score model, it has been noted that the inclusion of extraneous variables that are unrelated to the outcome of interest decreases precision of the resulting estimates and increases the support problem (Augurzky and Schmidt, 2000; Bryson, Dorsett, and Purdon, 2002). We follow Rubin and Thomas (1996) and exclude all variables that are unrelated to case outcomes but retain other available predictors to minimize the probability of omitted variable bias. Next, we began with a parsimonious model containing several theoretically important predictors of selection (the filing of a death notice) and add predictors one by one, retaining all predictors that were significant or improved classification error (Heckman, Ichimura, Smith, and Todd, 1998; Caliendo and Koepenig, 2005). This process yields a propensity core model with fifteen predictors and a pseudo R^2 of 0.28. The first column of Table 4 contains results from the selection model used to construct the propensity score, including the defendant's age, the race of the victim, the year of the case, attributes of the crime, and a series of county dummies.

As the average treatment effect is defined only in the region of common support (Bryson, Dorsett, and Purdon, 2002), prior to defining an analytic sample, all observations with a propensity score smaller than the minimum and larger than the maximum in the other group were deleted from the dataset. This resulted in the exclusion of six cases from the death notice group and 46 cases from the no-death notice group, yielding a final sample of $n = 457$. In order to assess the quality of our propensity score model, we follow Sianesi (2004) and compare the pseudo R^2 of the propensity score model prior to and after using inverse probability of treatment weights. After weighting, the Pseudo R^2 of the propensity score model is just 0.03 and a likelihood ratio test fails to reject that coefficients in the propensity score model are jointly equal to zero, indicating that the model achieves covariate balance between the treatment and comparison cases. The results from this diagnostic test are represented in column 2 of Table 4. In addition, independent samples t -tests confirm that no differences remain among variables in the weighted versus unweighted sample.

6.3. Outcome Models

The general model for the analysis is

$$\text{COST}_i = \beta_0 + \beta_1 \times \text{DN}_i + \beta_3 \times \text{PS}_1 + \varepsilon_i, \quad (2)$$

Table 4. Selection Model

	(1)	(2)
Age of defendant	0.04** (0.02)	0.01 (0.04)
Race of victim (1 if white)	0.48* (0.28)	-0.25 (0.75)
Victim executed	0.93*** (0.33)	0.59 (0.90)
Victim killed in own home	0.42 (0.26)	0.30 (0.61)
Victim elderly or frail	0.94* (0.51)	1.92 (1.22)
Victim unable to defend himself	0.82*** (0.29)	0.85 (0.64)
Circumstantial evidence	0.52 (0.57)	0.55 (1.08)
Multiple murder victims	0.68** (0.27)	0.47 (0.66)
County		
Anne Arundel	-1.20** (0.57)	-1.2 (2.09)
Baltimore City	-1.57*** (0.48)	-1.58 (1.98)
Baltimore County	1.01** (0.43)	0.75 (1.40)
Harford	-0.23 (0.81)	0.12 (2.08)
Montgomery	-1.02* (0.58)	-0.83 (1.77)
Prince George	-0.71 (0.46)	-0.85 (1.52)
Year of case	-0.06*** (0.02)	-0.06 (0.06)
<i>R</i> ²	0.28	0.03
<i>N</i>	509	457

Each column reports coefficients from a logistic regression of selection into receiving a death notice. Column 1 presents results from the selection model, including sampling weights and with robust standard errors. As a diagnostic tool, the model is then rerun, reweighted using the generated predicted values. A likelihood ratio test fails to reject that coefficients in the propensity score model are jointly equal to zero, indicating that propensity weights appropriately balance the sample. Results from this diagnostic are presented in column 2.

where COST_i is the total cost of processing case i , DN_i is an indicator variable equal to 1 if the case had a death notice filed and 0 if not and PS is the propensity score, the estimated probability that the case receives a death notice. In models with only DN_i , β_0 is the average cost of a capital-eligible case in which the death penalty was not sought. All outcome

models are specified using the missing case weights described in the previous section.

7. Results

Table 5 presents descriptive statistics for all variables used in the analysis, including attributes of victims and defendants and the attributes of the case. Overall, the average age of defendants is 25.6. Less than one-quarter of defendants were white as were 40% of victims. Almost all (92%) defendants had a prior felony charge. Fifty-eight percent of defendants report prior alcohol abuse and 42% report job problems. The crimes under investigation were horrendous: there were multiple victims in 21% of cases, victims were murdered “execution-style” in 12% of cases and, in 27% of cases the victims were murdered in their own home.

There are some differences in defendant attributes across the two cohorts. Those for whom a death notice was filed are significantly less likely to have a prior felony (though 90% do), significantly more likely to have a history of alcohol problems and a troubled job history. The death notice cohort was significantly more likely to have a white victim, to have murdered a victim who was unable to defend himself or herself, and to have an elderly victim. The death notice cohort was significantly more likely to have murdered a stranger, to have murdered the victim in their own home, to have also sexually assaulted the victim, and to persist when the victim’s death was certain. Some significant differences exist in terms of statutory aggravators, although many aggravators are relatively rare in both populations. More death notice cases were filed earlier in the study period (with a mean year of filing of 1989 in the death notice cohort and 1992 in the no-death notice cohort). Overall, cases in Baltimore City were significantly less likely to have a death notice filed (Baltimore County accounts for 44% of no-death notice cases, but only 7% of death notice cases). The converse is true in Baltimore City, which accounts for only 9% of no-death notice cases but 34% of death notice cases.

Of the 457 cases in the sample, we observed 336 cases that made it to a trial (the remainder were pleas), 84 cases that completed a penalty phase, and 283 cases in which at least one appeal was filed. At the post-conviction stage, the majority of cases (326) did not receive a hearing. Of the remaining cases,

Table 5. Descriptive Statistics

	Death notice not filed (n = 379)		Death notice filed (n = 78)		Entire sample (n = 457)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
<i>Defendant characteristics</i>						
Age	25.3	6.41	27.1**	6.83	25.6	6.51
race is white	0.19	0.40	0.29*	0.46	0.21	0.41
has a prior felony charge	0.90	0.39	0.96**	0.19	0.92	0.28
has a history of alcohol abuse	0.56	0.50	0.69**	0.46	0.58	0.49
has a troubled job history	0.39	0.49	0.54**	0.50	0.42	0.49
<i>Victim characteristics</i>						
race is white	0.35	0.48	0.60***	0.50	0.39	0.49
is unable to defend oneself	0.10	0.30	0.24***	0.43	0.13	0.33
is elderly or frail	0.02	0.15	0.08*	0.27	0.03	0.18
<i>Offense characteristics</i>						
Multiple victims	0.20	0.40	0.26	0.44	0.21	0.40
D was a stranger to any V	0.36	0.48	0.59***	0.50	0.40	0.49
V was sexually assaulted	0.07	0.25	0.19***	0.40	0.09	0.29
V was executed	0.12	0.23	0.14	0.35	0.12	0.33
V made to beg for life	0.07	0.25	0.14*	0.35	0.08	0.27
V took a long time to die	0.08	0.27	0.13	0.34	0.09	0.28
V was killed in own home	0.25	0.43	0.37**	0.49	0.27	0.44
D persisted even when V's death was certain	0.14	0.34	0.23*	0.42	0.15	0.36
D attempted to evade capture	0.11	0.31	0.18	0.39	0.12	0.33
D confessed to the crime	0.13	0.34	0.22	0.42	0.15	0.36
Evidence against D was circumstantial	0.04	0.20	0.06	0.25	0.04	0.20

Statutory Aggravators

A1. V was a law enforcement officer	0.00	0.05	0.08**	0.27	0.02	0.12
A2. D committed murder while in a correctional institution	0.04	0.20	0.00***	0.00	0.03	0.18
A3. D committed murder while trying to escape custody	0.01	0.10	0.05	0.22	0.02	0.13
A4. V was murdered in the course of an abduction	0.11	0.31	0.19*	0.40	0.12	0.33
A5. V was a child abductee	0.05	0.22	0.04	0.19	0.05	0.21
A6. D murdered pursuant to agreement for renumeration	0.03	0.16	0.06	0.25	0.03	0.18
A7. D employed another who killed for renumeration	0.02	0.25	0.06	0.025	0.03	0.17
A8. D committed murder while under life sentence	0.01	0.07	0.00	0.00	0.00	0.07
A9. Same incident produced multiple murder victims	0.19	0.39	0.16	0.44	0.20	0.40
A10. D committed murder in the commission of another offense	0.66	0.47	0.86***	0.35	0.69	0.46

County Dummies

County = Anne Arundel	0.08	0.27	0.01	0.22	0.07	0.26
County = Baltimore City	0.30	0.46	0.08***	0.27	0.26	0.44
County = Baltimore County	0.11	0.31	0.41***	0.50	0.16	0.37
County = Harford	0.01	0.11	0.03	0.16	0.02	0.12
County = Montgomery	0.09	0.29	0.08	0.27	0.09	0.29
County = Prince Georges	0.37	0.48	0.31	0.46	0.36	0.48
County = Other	0.03	0.18	0.05	0.22	0.04	0.18
Year of case	1991	5.14	1988	5.71	1991	5.32

D, defendant; V, victim. Significance levels are based on independent samples *t*-tests comparing group means in cases in which a death notice was filed versus cases in which a death notice was not filed. All analyses are conducted using sampling weights.

Significance testing: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Time Elapsed for Key Events in Working Days

Variable	No death (<i>n</i> = 379)	Death notice (<i>n</i> = 78)
Guilt phase		
Length of phase	240	250
Hearing days	1.7	3.82***
Trial days	3.18	6.94***
Penalty phase		
Length of phase	—	97.4
Number of trial days	—	3.06
Number of hearing days	—	0.7
Post-conviction phase		
Length of phase	387.3	346.3**
Number of hearing days	1.4	1.76
Appellate phase		
Number of appeals	0.74	1.19***

Source: Urban Institute. Significance-levels results from independent samples *t*-tests comparing group means between cases in which a death notice was filed versus cases in which a death notice was not filed. All analyses are conducted using sampling weights.

Significance testing: **p* < 0.10, ***p* < 0.05, ****p* < 0.01.

149 completed an initial post-conviction review (15 of which had received a death sentence), and thirty-four completed multiple post-conviction reviews (three of which had received a death sentence). Past this stage, only one non-capital case was assumed to have had a Federal Habeas review while fourteen death sentence cases filed a petition of habeas corpus. At the federal appellate level, we observed ten appeals.

Table 6 presents event data for each phase of a capital eligible case, on an individual defendant level. Days refer to working days (Monday–Friday) and the length of phase does not include trial days. Death sentence cases have a higher average number of trial days, hearing days, and overall length of phase at every stage of the trial except for post-conviction. The length of phase for the penalty trial includes retrials of the penalty phase, which can be longer than a year from when the retrial is remanded until the actual onset of the trial.

Table 7 displays regression coefficients from four OLS models in which the dependent variable is the total cost of case processing. In each model the coefficient on the additional cost associated with the filing of a death notice is reported. We first specify model (1) in Table 7 that contains only the main effect—the dummy variable for the filing of a death notice. In model (2) we add the propensity score estimates generated in stage 2 of the analysis. In

Table 7. Total Cost of Case Processing

	(1)	(2)	(3)	(4)
Death notice filed = 1	\$1,114*** (\$193)	\$1,009*** (\$178)	\$1,001*** (\$177)	1,008*** (\$176)
Propensity score	–	\$541 (\$357)	\$2,440*** (\$812)	–\$330 (\$2,180)
Propensity score ²	–	–	–\$3,165** (\$1,556)	\$8,095 (\$9,237)
Propensity score ³				–1.1 × 10 ⁷ (\$9,272)
Controls included?	No	No	No	No
R ²	0.24	0.25	0.27	0.27
N	457	457	457	457

Each column reports selected coefficients from an OLS regression of the total cost of case processing. The coefficient on a death notice filed is the cost associated with a death notice case, above the cost of a capital-eligible case in which a death notice is notified. The intercept parameter is the cost of a capital-eligible case in which a death notice is not filed. Coefficients are reported in thousands of dollars. All models are run using sampling weights winsorized at a value of four and, in all models, robust standard errors are reported. Significance testing: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

effect, these propensity scores account for the underlying differences in the propensity of cases to have a death notice. Models (3) and (4) add a squared propensity score and a cubic propensity score, respectively.

In model (1), the coefficient on the intercept parameter is \$1.1 million (not reported in the table). This coefficient can be interpreted as the cost of an average case that did not receive a death notice. Thus, the average death-eligible case in Maryland has total costs (including prison) of \$1.1 million. In the base model, the death notice parameter is \$1,114,000, indicating that a death notice case is approximately \$1.11 million more expensive than a case in which a death notice is not filed. All death notice parameter estimates were statistically significant at $p < 0.01$ and the base model explained approximately 24% of the variation in the cost. Overall, without accounting for the effect of adding the propensity score to the model, an average death notice case costs \$2.2 million. Model (2) adds the propensity score to model (1). The propensity score parameter is not significant at conventional levels. As the propensity score captures each case's probability of receiving a death notice, the effect of adding the propensity score to the outcome model is to reduce the estimated cost of a capital case by approximately 9%, to \$1,009,000. The results change very little with the cubic and quadratic propensity score terms.

Table 8. Total Cost of Case Processing, Logged Dependent Variable

	(1)	(2)	(3)
Death notice filed = 1	0.63*** (0.09)	0.62*** (0.09)	0.62*** (0.09)
Propensity score	0.36* (0.21)	2.24*** (0.57)	1.64 (1.27)
Propensity score ²		-3.16*** (0.90)	-0.74 (4.67)
Propensity score ³			-2.36 (4.49)
Controls included?	No	No	No
R ²	0.13	0.16	0.16
N	457	457	457

Each column reports selected coefficients from an OLS regression on the logged total cost of case processing. The coefficient on a death notice filed represents the percentage increase in cost associated with a death notice case. All models are run using sampling weights winsorized at a value of 4 and in all models, robust standard errors are reported.

Significance testing: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

While this model specification allows for a direct comparison with outcomes in the previous literature, there is also reason to believe that the effect of a death notice filing on total case cost is not additive but instead varies proportionally. To account for this, we specify a final model in which we take the log of the total cost, again including only iterations of the propensity score and the death notice indicator as controls. The results of this analysis are included in Table 8. Overall, the filing of a death notice is associated with a 63% increase in the cost of the case, when controlling for selection.

The costs described above can be further parsed to show the additional cost at each stage of case processing. Table 9 presents the average cost for each cost component, as well as the total cost, for the sample of cases with and without a death filing notice, adjusting for sampling weights.

In addition, differences can be reported adjusting for selection using a multivariate framework (Table 10). The model specification from model (2) in Table 7 was used to predict cost across each stage of case processing. Except for the guilt phase, accounting for selection lowers the cost-differential between death and no-death notice cases. However, similar to the final cost models, these differences are small. Cases receiving a death notice are approximately \$517,000 more costly during the trial phase, \$147,000 more costly during the penalty phase, and \$201,000 more costly during the

Table 9. Cost of Case Processing by Stage, with Sampling Weights

		(1) Guilt trial	(2) Penalty trial	(3) Post-conviction	(4) Appellate	(5) Other (State-level)	(6) Federal habeas	(7) Federal Appellate	(8) Prisons	(9) Total cost
Death notice filed = 1	Mean	659,646	163,725	47,475	260,935	4,251	25,715	0	769,041	1,930,397
N = 78	SD	340,184	336,706	88,540	344,880	8,939	105,815	0	554,444	912,934
Death notice filed = 0	Mean	160,663	–	42,720	43,113	1,488	0	0	628,295	876,280
N = 379	SD	96,109	–	75,431	46,168	3,207	0	0	342,589	379,093
Difference		498,983***	163,725***	4,755	217,821***	2,762***	25,715***	0	140,746***	1,054,116***

Significance testing: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10. Cost of Case Processing by Stage, Adjusting for Selection

	(1) Guilt trial	(2) Penalty trial	(3) Post-conviction	(4) Appellate	(5) Other (State-level)	(6) Federal habeas	(7) Federal Appellate	(8) Prisons
Death notice filed = 1	517*** (23)	147*** (5)	0.41 (11)	201*** (17)	2*** (0.6)	23 (5)	– –	118 (79)
R ²	0.55	0.24	0.02	0.29	0.06	0.07		0.03
N	457	457	457	457	457	457	457	457

Each column reports selected coefficients from an OLS regression of the total cost of case processing. All models contain the same control variables as in model (2) in Table 7. The coefficient on a death notice filed is the marginal cost of a death notice filing. Coefficients are reported in thousands of dollars. In all models, robust standard errors are reported. Significance testing: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

appellate phase than a capital eligible case where no death notice was filed.³⁵ These differences are significant at $p < 0.001$.

7.1. Robustness

In order to determine how sensitive our results were to several assumptions made in the analysis, we recalculate the dependent variable under a variety of alternative assumptions. First, we vary the discount rate used to calculate the value of future prison costs incurred, using alternative discount rates ranging from 0% to 10%. Under any reasonable scenario, the coefficient values are virtually unaffected. Likewise, we test the assumption that defendants sentenced to a term in prison serve 54% of their sentence and propose an alternate estimate of 80%. Using the 80% estimate the difference in prison costs between the treatment and comparison group was 16% lower than it was when the 54% estimate was used. However, the overall cost parameter is just 1% lower, reflecting the fact that prison costs are a fairly small portion of the costs of a typical capital case.³⁶ Thus, our estimate is highly robust to this assumption. Finally, in accordance with semi-structured interviews with attorneys and court staff, we had assumed that, due to the presence of “super due process,” attorneys spent considerably more time working on cases that received a death notice than those that did not. Even under the extraordinarily conservative assumption that attorneys spent no more time on death notice cases than no-death notice cases, we find that our initial estimate is reduced by only 40%, resulting in an additional cost of \$650,000 per death notice case. The result is highly significant. This would appear to represent a lower bound on the added cost of capital prosecution.

35. The estimates are for all death notice cases and include cases that did not progress to that stage of case processing. Thus, the average cost of only those cases that made it to the penalty phase and the appellate would be higher.

36. The reason that this assumption has such a negligible impact on the final result is that only a fraction of cases resulted in a sentence in which that assumption was necessary. The only time we assumed that an individual served 54% of their sentence was when an individual was sentenced to a number or range of years in prison, rather than for life. As many individuals within this study were sentenced to life without parole, life, or life plus additional years, this assumption was often not applicable. This assumption was applied to 20% of the control (no-death notice) group and 6% of the treatment (death-notice) group. While changing this assumption did increase the average prison cost of the control group, it only had a minor impact on the overall differential. Thus, our estimate is highly robust to this assumption.

7.2. Total Cost of the Death Penalty to Maryland Taxpayers

The estimated cost of a capital prosecution can be summed across all cases to estimate the total cost of the death penalty to the citizens of Maryland between 1978 and 1999. To estimate the total cost of the death penalty, we multiply our preferred estimate from Table 7 (column 2, which accounts for differences in case attributes between death notice and no-death notice cases) by the 162 cases with a death notice filed during this period. In total, these cases cost Maryland taxpayers \$163 million more than would have been expended in the absence of capital prosecutions, with a 95% confidence interval of \$161–166 million. In addition, the Capital Defense Division cost \$7.2 million, resulting in a total cost of capital punishment to the citizens of Maryland in excess of \$170 million, with a 95% confidence interval of \$169–173 million.³⁷

7.3. Limitations

This study has several limitations. First, the study relies heavily on the accuracy of information on the amount of time spent on an average case reported to us by prosecutors, judges, and public defenders. Data were collected post-hoc and respondents were asked to provide information on an “average” or “typical” case, potentially introducing recall bias. Second, although multivariate models explained a high proportion of variation in the cost of case processing, we cannot rule out the possibility that the coefficient on the treatment dummy is biased because of the presence of one or more omitted variables. Of particular concern is the fact that because of both information and statistical constraints, we were unable to account for case clustering among prosecutors, defense attorneys and judges, all of which might reasonably be related to the cost of a case. Third, prison costs estimated for each individual in the study sample rely on an estimated counterfactual age of death that is not sensitive to whether or not a defendant was

37. An additional assumption that is often contentious in any study that seeks to predict future spending is the choice of a discount rate. In general, higher discount rates produce smaller estimates of future costs. In this case, we were able to test our use of a 5% discount rate. The models in Tables 5 and 6 were rerun twice, once using a discount rate equal to the rate of prison inflation (2.1%), and a second time with a discount rate set to zero. In each case, the parameter estimate on death notice decreased by approximately 3% and the parameter estimate on death sentence increased by approximately 3%, indicating that results are highly robust to the choice of discount rate.

under sentence of death. If living under sentence of death itself impacts life expectancy then prison costs may be subject to either upward or downward bias, depending on whether those on death row live longer or shorter lives. Fourth, though this study captures the costs associated with a large number of case events, there are additional costs associated with capital cases that cannot be estimated. Any stage of processing beyond federal appeals, such as costs associated with the commutation process or litigation around competency to be executed, could not be observed and were not included here. In addition, it is possible that there were additional costs associated with no-death notice cases in which defense counsel preemptively fought a death notice filing and, as a result, the prosecution ultimately relented and did not file a death notice.

Fifth, a critical assumption in the study centers on the issue of a death notice “sticking.” In more than 100 cases, a death notice was filed but by the time the case reached trial, the death penalty was no longer being sought. No data were available to determine when the decision not to proceed with the death notice occurred. Depending upon when the prosecutor withdrew the death notice, substantial additional resources may have been consumed by both the defense and prosecutor in the initial pre-trial phase, addressing this death notice. However, since it was impossible to empirically observe those additional expenses, we are forced to ignore these potential additional costs. By doing so, we may underestimate the incremental cost of a death notice during this period.

Finally, it was beyond the scope of our paper to address possible systematic effects of eliminating the death penalty. For example, the literature has considered the possible impact of the elimination of the death penalty regime on plea-bargaining and deterrence. Given the lack of consensus on the effect of deterrence, as well as evidence that the death penalty may not induce plea-bargaining (Kuziemko, 2006), it is difficult to quantify the size or direction of these hypothetical costs. Rather, in the interest of coherency, we only analyzed observable costs of case processing.

8. Discussion and Conclusion

Extant literature on the costs of capital punishment unambiguously finds that capital cases are more expensive to prosecute from beginning to end

than non-capital cases. However, past research has used top-down estimates of costs on a limited subset of cases and cost domains. Moreover, to date, no study has accounted for the possibility that many other variables related to the cost of case processing or the process of selecting cases for death penalty prosecution explain the cost differential. In this research, we estimate the costs for 457 capital-eligible cases that resulted in a guilty verdict in Maryland from 1978 to 1999, nearly half of the cases prosecuted during this time period, and approximately 75% of the cases prosecuted after 1989. Using propensity scores, we are able to control for competing explanations of cost. We find a strong, positive association between the filing of a death notice and the cost of processing the case. On average, a death notice adds about \$1,000,000 in costs over the duration of a case. This estimate is considerably higher than the cost obtained in Washington State's 2007 study, which estimated an added cost of a death notice to be just under \$500,000. However, it is considerably less than the estimate derived by the New York State Defenders Association's 1985 study, which concluded that a death notice added \$2.6 million in costs. The considerable degree of heterogeneity is explained both by differences in criminal procedure between states and by variation in the methods employed by researchers.

Selection into capital prosecution—that is, the choice by the prosecutor to seek the death penalty—is found to have a statistically insignificant though potentially empirically relevant impact on findings. Including a selection variable in the model reduces the estimate of the differential cost of a death notice by 9%. We note that the literature on the cost of the death penalty is not unique in the social policy cost literature in its omission of modeling that would allow for causal inference. While causal models are commonly used to estimate benefits, they are rarely used in the study of costs. In this case, we estimate that selection bias leads to a small overestimate of the cost of the death penalty. That the magnitude of the selection bias is small supports the notion that the majority of the cost of a capital prosecution is not because of the characteristics of such cases, but instead may be attributed to the structure of super-due process. In other states, however, where case attributes contribute more to the decision about seeking a death notice, modeling selection may be critical. This finding suggests that there is promise in this approach and future studies could obtain more precision by incorporating causal modeling into cost estimation.

From a policy perspective, given that public resources are scarce, resources consumed in the processing of death penalty cases have an opportunity cost that should be considered. To exempt these costs from a discussion of their next best use yields inefficient policymaking. Unlike other costs in the criminal justice system that are relatively fixed in the short-term, such as prison costs or police administrative costs, at least some of the costs associated with the death penalty would be relatively easy to reallocate. For instance, much of the additional costs in the post-conviction stage are wages paid to private attorneys. Since these wages are far below market wages for experienced attorneys, ending the death penalty would create a more efficient allocation of their production. Other expenditures, such as the cost of the Capital Defense Division and the cost of maintaining death row, occur only because of the existence of a death regime, and the resources dedicated to those activities would likely be relatively easy to reallocate.

It is also worth noting that the cost of a death penalty regime is highly dependent upon a host of state-specific variables—the rate at which death notice cases result in death sentences, the degree to which death notice cases are granted “super due process,” the cost of various case inputs, and the depth of the appeals process. Above all, the relative cost of the death penalty is highly dependent upon the rate at which defendants sentenced to death are actually executed. In these cases, all of the costs associated with a death notice are absorbed without the accrual of the chief fiscal benefit of capital punishment—the savings from no longer needing to pay for the defendant to remain in prison for the remainder of his or her natural life. The cost of these cases is further exacerbated by the fact that these defendants are typically housed on death row during the appeals process. Thus, the state’s ability to select cases for capital prosecution that will withstand judicial scrutiny is a critical input into the cost function. For this reason, it is important that overly broad conclusions are not drawn from this research. While this paper’s findings are unambiguous in Maryland, its chief contribution to the policy debate may ultimately be more in its application of quasi-experimental methods to isolating the costs of a death penalty regime than in its conclusions.

References

- American Bar Association. 2003. Guidelines for the Appointment and Performance of Defense Counsel in Death Penalty Cases.

- Arias, Elizabeth. 2006. "United States Life Tables, 2003," National Vital Statistical Report 54/14. http://www.cdc.gov/nchs/data/nvsr/nvsr54/nvsr54_14.pdf (accessed December 20, 2007).
- Augurzky, Boris, and Christoph Schmidt. 2000. "The Propensity Score: A Means to an End," Working Paper, University of Heidelberg.
- Baicker, Katherine. 2004. "The Budgetary Repercussions of Capital Convictions," *4 Advances in Economic Analysis & Policy* 1–26.
- Berk, Richard A. 1983. "An Introduction to Sample Selection Bias in Sociological Data," *48 American Sociological Review* 386–98.
- Bryson, Alex, Richard Dorsett, and Susan Purdon. 2002. The Use of Propensity Score Matching in the Evaluation of Labour Market Policies. Working Paper No. 4, Department for Work and Pensions, United Kingdom.
- Caliendo, Marco, and Sabine Kopeinig. 2005. Some Practical Guidance for the Implementation of Propensity Score Matching, IZA Discussion Paper No. 1588.
- Cook, Philip. 2009. "Potential Savings from Abolition of the Death Penalty in North Carolina," *American Law and Economic Review* 10.1093/aler/ahp022.
- Cook, Philip, Donna Slawson, and Lori Gries. 1993. *The Costs of Processing Murder Cases in North Carolina*. Durham, NC: Terry Sandford Institute of Public Policy, Duke University 1–114.
- Dehejia, Rajeev, and Sadek Wahba. 1998. Propensity Score Matching Methods for Non-experimental Causal Studies. NBER Working Paper 6829.
- Department of Legislative Services, Maryland General Assembly. 2004. Fiscal and Policy Note, House Bill 521. http://house.state.md.us/2004rs/fnotes/bil_0001/hb0521.doc (accessed December 5, 2009).
- Donohue, John J., and Justin Wolfers. 2006. "Uses and Abuses of Empirical Evidence in the Death Penalty Debate," *58 Stanford Law Review* 791–846.
- Durose, Matthew, David Levin, and Patrick Langan. 1999. "Felony Sentences in State Court," Bureau of Justice Statistics NCJ-190103. <http://www.ojp.usdoj.gov/bjs/pub/pdf/fssc98.pdf> (accessed December 5, 2009).
- Forsberg, Mary. 2005. "Money For Nothing? The Financial Costs of New Jersey's Death Penalty," Trenton, NJ: New Jersey Policy Perspective.
- Furman, v. Georgia*. 1972. 408 U.S. 238.
- Garey, Margot. 1985. "The Cost of Taking a Life: Dollars and Sense of the Death Penalty," *18 University of California, Davis, Law Review* 1221–73.
- Goodpaster, Mark. 2002. "Cost Comparison between a Death Penalty Case and a Case Where the Charge and Conviction is Life Without Parole," The Application of Indiana's Capital Sentencing Law: Findings of the Indiana Criminal Law Study Commission. http://www.in.gov/cji/special-initiatives/law_book.pdf (accessed December 20, 2007).
- Governor's Commission on the Death Penalty. 1993. An Analysis of Capital Punishment in Maryland: 1978–1993.
- Greene, William H. 1981. "Sample Selection Bias as a Specification Error: A Comment," *49 Econometrica* 795–8.

- Gregg v. Georgia.* 1976. 428 U.S. 153.
- Heckman, James J. 1977. Sample Selection Bias as a Specification Error. NBER Working Papers 0177.
- Heckman, James J. 1990. "Varieties of Selection Bias," 80 *American Economic Review* 313–18.
- Heckman, James, Hidehiko Ichimura, and Petra Todd. 1998. "Matching as an Econometric Evaluation Estimator," 65 *The Review of Economic Studies*, 261–94.
- Kansas Legislative Division of Post Audit. 2003. *Costs Incurred for Death Penalty Cases: A K-GOAL Audit of the Department of Corrections.* 04-03.
- Kuziemko, Ilyana. 2006. "Does the Threat of the Death Penalty Affect Plea-Bargaining in Murder Cases? Evidence from New York's 1995 Reinstatement of Capital Punishment," 6 *American Law and Economics Review* 116–42.
- Maryland Court of Appeals, Committee Designated to Develop Rules Regarding Public Access to Court Records. *Maryland Access Rule.* <http://mdcourts.gov/access/ro-accesstocrecords.pdf>. (accessed December 5, 2009).
- Maryland House Appropriations Committee. 1985. Committee to Study the Death Penalty in Maryland Final Report: The Cost and Hours Associated with Processing a Sample of First Degree Murder Cases for Which the Death Penalty was Sought in Maryland Between July 1979 and March 1984, Annapolis, MD, USA.
- Maryland Judiciary Case Search. Maryland Rules 16-1001 through 16-1011. <http://casesearch.courts.state.md.us/inquiry/inquiry-index.jsp> (accessed December 5, 2009).
- Maryland Judiciary Offers Internet Case Search of Court Records. 2006. *Court Information Office.* <http://www.courts.state.md.us/press/2006/pr03-07-06.html> (accessed December 5, 2009).
- New Jersey Death Penalty Study Commission. 2007. New Jersey Death Penalty Study Commission Report.
- New York State Defenders Association. 1982. *Capital Losses: The Price of the Death Penalty in New York State.* Albany, NY: New York State Defenders Association.
- Office of the Public Defender, State of Maryland. 2006. Fiscal Year 2006 Annual Report. <http://www.opd.state.md.us/Index%20Assets/Annual%20Report%202006.pdf>. <http://www.ola.state.md.us/Reports/Fiscal%20Compliance/OPD07.pdf> (accessed December 5, 2009).
- Orszag, Peter. 2008. *CBO Testimony before the committee on the Budget of the United States Senate: Growth in Health Care Costs.* Congressional Budget Office.
- Ostrom, Brian J., Matthew Kleiman, and Christopher Ryan. 2005. Maryland Attorney and Staff Workload Assessment, 2005. National Center for State Courts. http://www.ncsconline.org/WC/Publications/Res_WorkLd_MDAatty&StaffWkLdAs05Pub.pdf (accessed December 5, 2009).
- Paternoster, Raymond, Robert Brame, Sarah Bacon, and Andrew Ditchfield. 2004. "Justice by Geography and Race: The Administration of the Death Penalty in

- Maryland, 1978–1999,” 4 *University of Maryland Law Journal of Race, Religion, Gender and Class* 1–97.
- Rosenbaum, Paul, and Donald B. Rubin. 1983. “The Central Role of the Propensity Score in Observational Studies for Causal Effects,” 70 *Biometrika* 41–55.
- Rubin, Donald B., and Neal Thomas. 1996. “Matching Using Estimated Propensity Scores: Relating Theory to Practice,” 52 *Biometrics* 249–64.
- Scalia, John. 1997. Prisoner Petitions in the Federal Courts, 1980–1996. Bureau of Justice Statistics NCJ-164615.
- Sianesi, B. 2004. “An Evaluation of the Active Labour Market Programmes in Sweden,” 86 *The Review of Economics and Statistics* 133–55.
- State of Connecticut Commission on the Death Penalty. 2003. Study Pursuant to the Public Act No. 01-151 of the Imposition of the Death Penalty in Connecticut.
- State of Tennessee Comptroller of the Treasury. 2004. Tennessee’s Death Penalty: Costs and Consequences.
- Stephan, James. 2007. “State Prison Expenditures, 2001,” Special Report. Bureau of Justice Statistics.
- Washington State Bar Association. 2007. Final Report of the Death Penalty Subcommittee of the Committee on Public Defense.
- Wolfers, Justin, and John J. Donohue. 2006. “Uses and Abuses of Empirical Evidence in the Death Penalty Debate,” 58 *Stanford Law Review* 791–846.