

# DECAY OF PRECEDENTS IN STATE SUPREME COURTS<sup>†</sup>

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*This Article investigates the decay of precedents in state supreme courts—the speed at which judicial opinions lose precedential force as measured by the rates of subsequent citation. Prior literature has documented the existence of this effect, but to date researchers have not systematically investigated the phenomenon. This Article performs that analysis by examining three unique databases, each consisting of more than a hundred thousand relevant citations. We find that the frequency of citation drops off by a roughly constant ratio with each passing year—a pattern that fits an exponential curve with remarkable precision. The large scale and extended time period of our study suggest that this pattern must result from underlying forces unrelated to circumstances of time or place. The main takeaway is the extraordinary persistence of exponential decay across all of the data. Citations age at different rates across different cuts of the data, but in every case the deterioration of precedents displays an exponential pattern.*

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*In addition to documenting the exponential pattern of precedential decay, we explore the determinants of that process across case types. We find that opinions with dissents tend to cite older opinions and longer decisions tend to be cited more often and faster. As compared to constitutional law cases, criminal law opinions tend to cite more recent precedents, while trust and estate opinions tend to cite older precedents. We offer some conjectures about possible reasons for the observed differences in decay rates.*

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#### INTRODUCTION

Judicial opinions serve many purposes. They purport to explain to the litigants and lawyers the reasons why the court did what it did. Opinions issued by lower court judges provide the parties with an explanation for the decision rendered, set the framework for appeal, and inform the appellate courts about the basis of the decision they are asked to review. Opinions rendered by panels of appellate judges can reflect subtle tradeoffs and accommodations designed to attract support from other judges. If written with erudition and panache, judicial opinions can serve as part of a file prepared in hopes of the author's elevation to a higher court.

Perhaps the most important function of judicial opinions, however—especially opinions of appellate tribunals—is to provide guidance to lawyers and their clients about standards for acceptable behavior and to establish rules to be followed by courts in later cases. These guidance functions are summarized in the idea of precedent: a precedent is an action taken at one point in time that provides a standard to guide actions at later points in time. Inherent in the idea of precedent is the attribute of durability: precedents would not be precedents if their value dissipated with the execution of the judgment. For this reason, among others, judicial opinions are made available to the public and embodied

in media such as books and—more recently—electronic repositories of information.

Although they are durable, precedents are not immortal. Over time, they lose their capacity to influence action; eventually they cease to be of anything other than historical interest. While a given judicial decision could, in theory, be relied on in other cases at any time, as a practical matter, all precedents die. Some evanesce almost immediately: as we will report in this Article, a surprisingly high percentage (ten percent in our sample) of published judicial opinions are never cited even once. Some live for a long time. *Marbury v. Madison* is still cited in constitutional law decisions more than two hundred years after its birth. But even the longest-lived precedents will not last forever. This quality of judicial decisions—the fading of precedential force—is important for jurisprudence. If judicial decisions did not lose potency over time, the law would become unmanageable because of the volume of pronouncements that would need to be considered in each case. More importantly, if old rules persisted without weakening, the law itself would become ossified and lose its ability to adapt to new situations and changing values and beliefs.

Surprisingly, although the *fact* of precedential fading is accepted by everyone, the *determinants* of the process are not thoroughly studied. How fast do precedents fade? Does fading occur at different rates in different courts, or at different points in time? Do precedents fade at different rates in different areas of law? Do judges discount past decisions at different rates depending on the characteristics of the judge? Does precedential fading follow a consistent pattern? If so, is the pattern linear, in that the same amount of fading occurs every year? Is the fading pattern exponential, in that the amount of fading increases by a fixed percentage every year? Or is the pattern something odder, such as a sinusoidal pattern in which rates of fading go up and down? Below, within this Introduction, we outline our methodology, discuss the prior literature, and summarize our results.

#### A. *Methodological Considerations*

The impact of precedents can be studied in a variety of ways. One possibility is to examine the law at a given time and attempt to assess, substantively, where and when the rules appeared that influenced the application of the law at that time. This effort can have a payoff, in that, say, one might conclude from such a study that the Supreme Court's criminal procedure cases of the 1960s and 1970s had a major and continuing impact on the law. The precedents of those years could be compared with Supreme Court decisions on criminal procedure matters at other points in time, and their relative impact could be assessed.

Through that method, it could be possible to estimate periods of greater and lesser impact on this body of law. This approach has the virtue of allowing sensitive qualitative judgments. The method, however, is also highly subjective, in that different people could have different assessments of the substantive impact of a precedent.

An alternative, and the one we employ in this Article, is to use citations as a proxy. The advantage of citations as a measure of precedential force is that they can be observed and counted. As Richard Posner observed, citation studies enable “rigorous, quantitative analysis of elusive but important social phenomena such as reputation, influence, prestige, celebrity, the diffusion of knowledge, the rise and decline of schools of thought, *stare decisis* (that is, the basing of judicial decision on previous decisions—precedents), the quality of scholarly output . . . and the productivity of scholars, judges, courts, and law schools.”<sup>1</sup> The fact that a case is cited points to two elements of precedential force: first, the citation, unless negative, is an indication that the citing court believes that the case stands for a valid proposition of law; second, the citation signals to the bench and bar that the judge or tribunal has considered the cited case to be useful as a guide to decision. Accordingly, in general, the more frequently a case is cited, relative to other cases that might have been cited, the more precedential force is attributable to that case.

Like other measures of precedential force, citations are inexact proxies. John Henry Merryman observed long ago that the practice of citation, including judicial citations, “is often an uncritical unreflective process carried out without conviction or understanding about the purpose of citation, the nature of authority or the function of precedent.”<sup>2</sup> Judges may not give much thought to the citations that festoon their opinions. They may include references to enhance the appearance of authority. They may indulge in citations to mask the fact that they are imposing their own policy preferences on the law.<sup>3</sup> Many judges, moreover, utilize law clerks to draft opinions, reducing the reliability of a citation as an indicator of precedential force. Despite these shortcomings, citations, in our judgment, are a reasonably reliable and objective means to ascertain the impact of prior cases on current law.

If one looks for general features of law, rather than information on a particular court, an excellent source of information is the decisions of

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1. Richard A. Posner, *An Economic Analysis of the Use of Citations in the Law*, 2 AM. L. & ECON. REV. 381, 382–83 (2000).

2. John Henry Merryman, *The Authority of Authority: What the California Supreme Court Cited in 1950*, 6 STAN. L. REV. 613, 613 (1954).

3. See Frank B. Cross et al., *Citations in the U.S. Supreme Court: An Empirical Study of Their Use and Significance*, 2010 U. ILL. L. REV. 489, 492 (2010).

state supreme courts.<sup>4</sup> A study of decisions by these courts has several advantages over a study of a single court. Because these are courts of last resort, their decisions represent definitive adjudications of the law of the state in which the court sits. Decisions of state supreme courts are more likely to have a continuing impact than decisions of lower courts, thus allowing the analysis of opinions with long tails over time. Because these are high courts, the opinions they render are readily available on legal databases. Additionally, it is possible to identify demographic features of state supreme court judges that might help in understanding citation patterns. Finally, because there are a substantial number of such courts (every state has at least one court of last resort, and Texas and Oklahoma have two divided between civil and criminal matters), studying decisions of a substantial number of tribunals tends to smooth out idiosyncratic features and provide a more comprehensive overview of the general pattern.

### B. *Prior Literature and Our Contribution*

Our study contributes to a body of literature analyzing patterns of citations in a variety of contexts,<sup>5</sup> including legal opinions.<sup>6</sup> As might

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4. For general studies of state supreme courts, see, e.g., Stephen Daniels, *A Tangled Tale: Studying State Supreme Courts*, 22 LAW & SOC'Y REV. 833 (1988); Robert A. Kagan et al., *The Business of State Supreme Courts, 1870–1970*, 30 STAN. L. REV. 121 (1977); Robert A. Kagan et al., *The Evolution of State Supreme Courts*, 76 MICH. L. REV. 961 (1978).

5. Many prior studies use measures of citation to assess the impact of research in various fields of inquiry. See Michael C. Lovell, *The Production of Economic Literature: An Interpretation*, 11 J. ECON. LITERATURE 27 (1973); George J. Stigler & Claire Friedland, *The Citation Practices of Doctorates in Economics*, 83 J. POL. ECON. 477 (1975). The study of citations to legal scholarship, in particular, has been spearheaded by Fred Shapiro, who, ironically, has contributed to his own measured impact by the influence of this research. See Fred R. Shapiro & Michelle Pearse, *The Most-Cited Law Review Articles of All Time*, 110 MICH. L. REV. 1483 (2012); Fred R. Shapiro, *The Most-Cited Law Review Articles Revisited*, 71 CHI.-KENT. L. REV. 751 (1995); Fred R. Shapiro, *The Most-Cited Law Review Articles*, 73 CALIF. L. REV. 1540 (1985); see also Lee Petherbridge & David L. Schwartz, *An Empirical Assessment of the Supreme Court's Use of Legal Scholarship*, 106 NW. U. L. REV. 995 (2012); Lee Petherbridge & David L. Schwartz, *The End of an Epithet – An Exploration of the Use of Legal Scholarship in Intellectual Property Decisions*, 50 HOUS. L. REV. 523 (2012); David L. Schwartz & Lee Petherbridge, *The Use of Legal Scholarship by the Federal Courts of Appeals: An Empirical Study*, 96 CORNELL L. REV. 1345 (2010); David L. Schwartz & Lee Petherbridge, *Legal Scholarship and the United States Court of Appeals for the Federal Circuit: An Empirical Study of a National Circuit*, 26 BERKELEY TECH. L.J. 1561 (2011); Louis J. Sirico & Jeffrey B. Margulies, *The Citing of Law Reviews by the Supreme Court: An Empirical Study*, 34 UCLA L. REV. 131 (1986).

6. See William M. Landes & Richard A. Posner, *Legal Precedent: A Theoretical and Empirical Analysis*, 19 J. L. & ECON. 249 (1976); Posner, *supra* note 1. Also using citations by and to state supreme court decisions, see Elliott Ash & W. Bentley

be expected, given legal scholarship's longstanding focus on federal courts, these studies have looked most extensively at citations to and by federal courts and federal judges, both the United States Supreme Court<sup>7</sup> and the federal courts of appeals. These studies have attempted to tease out the impact (or lack of impact) of individual federal judges,<sup>8</sup> the importance of individual cases,<sup>9</sup> and the network patterns of influence that courts establish to other courts.<sup>10</sup> A smaller but robust body of literature examines citations to and by state supreme courts. John Henry Merryman's early studies of the California Supreme Court helped to establish state court citations as a field of study.<sup>11</sup> Numerous papers have followed Merryman in analyzing citation practices in individual state supreme courts.<sup>12</sup> Lawrence M. Friedman and co-authors' study of

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MacLeod, *Intrinsic Motivation in Public Service: Theory and Evidence From State Supreme Courts*, 58 J. L. & ECON. 863 (2015); Elliott Ash & W. Bentley MacLeod, *Reducing Partisanship in Judicial Elections Can Improve Judge Quality: Evidence From U.S. State Supreme Courts*, 201 J. PUB. ECON. 1 (2021); Elliott Ash & W. Bentley MacLeod, *Mandatory Retirement Reforms for Judges Improved Performance on U.S. State Supreme Courts*, 16 AM. ECON. J.: ECON. POL'Y (forthcoming 2024).

7. See Cross et al., *supra* note 3.

8. See Stephen J. Choi & G. Mitu Gulati, *Choosing the Next Supreme Court Justice: An Empirical Ranking of Judge Performance*, 78 S. CAL. L. REV. 23 (2004); Christopher C. McCurdy & Ryan P. Thompson, *The Power of Posner: A Study of Prestige and Influence in the Federal Judiciary*, 48 IDAHO L. REV. 49 (2011); William M. Landes et al., *Judicial Influence: A Citation Analysis of Federal Courts of Appeals Judges*, 27 J. LEGAL STUD. 271 (1998); Robert Anderson IV, *Distinguishing Judges: An Empirical Ranking of Judicial Quality in the United States Court of Appeals*, 76 MO. L. REV. 315 (2011); David Klein & Darby Morrisroe, *The Prestige and Influence of Individual Judges on the U.S. Courts of Appeals*, 28 J. LEGAL STUD. 371 (1999); Montgomery N. Kosma, *Measuring the Influence of Supreme Court Justices*, 27 J. LEGAL STUD. 333 (1998); Frank B. Cross, *Determinants of Citations to Supreme Court Opinions (and the Remarkable Influence of Justice Scalia)*, 18 SUP. CT. ECON. REV. 177 (2010).

9. See Frank B. Cross & James F. Spriggs II, *The Most Important (and Best) Supreme Court Opinions and Justices*, 60 EMORY L.J. 407 (2010).

10. See Ian Carmichael et al., *Examining the Evolution of Legal Precedent Through Citation Network Analysis*, 96 N.C. L. REV. 227 (2017).

11. See Merryman, *supra* note 2; John Henry Merryman, *Toward a Theory of Citations: An Empirical Study of the Citation Practice of the California Supreme Court in 1950, 1960, and 1970*, 50 S. CAL. L. REV. 381 (1977).

12. See Rachael K. Hinkle & Michael J. Nelson, *The Transmission of Legal Precedent Among State Supreme Courts in the Twenty-First Century*, 16 STATE POL. & POL'Y Q. 391 (2016); Joseph A. Custer, *Citation Practices of the Kansas Supreme Court and Kansas Court of Appeals*, 7 KAN. J.L. & PUB. POL'Y 126 (1997); A. Michael Beard, *Citation to Authorities by the Arkansas Appellate Courts, 1950–2000*, 25 U. ARK. LITTLE ROCK L. REV. 301 (2003); Mary Anne Bobinski, *Citation Sources and the New York Court of Appeals*, 34 BUFF. L. REV. 965 (1985); Dragomir Cosanici & Chris Evin Long, *Recent Citation Practices of the Indiana Supreme Court and the Indiana Court of Appeals*, 24 LEGAL REF. SERV. Q. 103 (2009); Richard G. Kopf, *Do Judges Read the Review: A Citation-Counting Study of the Nebraska Law Review and the Nebraska Supreme Court, 1972–1996*, 76 NEB. L. REV. 708 (1997); James Leonard, *An Analysis of Citations to Authority in Ohio Appellate Decisions Published in 1990*, 86 LAW LIB.



a sample of a century of state supreme court citations is exemplary of this literature.<sup>13</sup>

All studies of judicial citations recognize, implicitly or explicitly, that the force of precedent deteriorates over time. Surprisingly few studies, however, have focused on the features of these decay patterns. Ryan C. Black and James F. Spriggs examine the depreciation of citations to United States Supreme Court cases by the United States Supreme Court and the federal courts of appeals.<sup>14</sup> These authors find that precedents depreciate about eighty-one percent and eighty-five percent between their first and twentieth years of age at the Supreme Court and courts of appeals, respectively. They find, further, that the rate of depreciation is nonlinear: citations to newer cases, although starting at a higher baseline, depreciate more rapidly than citations to older cases.<sup>15</sup> The Supreme Court precedents in their study generally become dormant within thirty years of publication.<sup>16</sup>

William M. Landes and Judge Posner's 1976 study found that for a sample of federal court of appeals cases from 1974 to 1975, the rate of citation of Supreme Court opinions fell by half after 18.5 years and the rate of citation for other court opinions fell by half after 8.8 years; in a sample of Supreme Court decisions from 1974, these figures were 23 and 5.4 years, respectively.<sup>17</sup> Landes and Posner followed up with a study published in 1980 examining state court and federal court of

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J. 129 (1994); Richard A. Mann, *The North Carolina Supreme Court 1977: A Statistical Analysis*, 15 WAKE FOREST L. REV. 39 (1979); William H. Manz, *The Citation Practices of the New York Court of Appeals, 1850–1993*, 43 BUFF. L. REV. 121 (1995); William H. Manz, *The Citation Practices of the New York Court of Appeals: A Millennium Update*, 49 BUFF. L. REV. 1273 (2001).

13. See Lawrence M. Friedman et al., *State Supreme Courts: A Century of Style and Citation*, 33 STAN. L. REV. 773 (1980). Other valuable studies include: Gregory A. Caldeira, *The Transmission of Legal Precedent: A Study of State Supreme Courts*, 79 AM. POL. SCI. REV. 178 (1985), Gregory A. Caldeira, *Legal Precedent: Structures of Communication Between State Supreme Courts*, 10 SOC. NETWORKS 29 (1988), and Peter Harris, *Ecology and Culture in the Communication of Precedent Among State Supreme Courts, 1870–1970*, 19 LAW & SOC'Y REV. 449 (1985). Scholars in other countries have also examined citation practices in courts of sub-national sovereign entities. See also Dietrich Fausten et al., *A Century of Citation Practice on the Supreme Court of Victoria*, 31 MELB. U. L. REV. 733 (2007) (examining citations in decisions of the Supreme Court of Victoria, Australia at ten-year intervals between 1905 and 2005).

14. See Ryan C. Black & James F. Spriggs, *The Citation and Depreciation of U.S. Supreme Court Precedent*, 10 J. EMPIRICAL LEGAL STUD. 325 (2013).

15. See, e.g., *id.* at 343 (finding that Supreme Court precedent evidence shows that precedent depreciates quite quickly, and generally becomes all but dormant within thirty years of publication).

16. See *id.* at 343–44 (showing the steep depreciation curve for Supreme Court precedent).

17. Landes & Posner, *supra* note 6, at 256.

appeals diversity jurisdiction cases decided in 1980; they find, consistently with other studies, that these cases received significantly fewer citations as they aged.<sup>18</sup>

The 1954 Merryman study of California Supreme Court decisions, similarly, noted a “marked” tendency to cite recent decisions: “[a]pproximately one-half the California decisions cited in 1950 were published in the preceding ten-year period.”<sup>19</sup> Merryman’s subsequent study of California Supreme Court opinions observes that the probability that any decision of that court would be cited by a later decision of the same court fell by half approximately every seven years.<sup>20</sup> Fritz Snyder’s study of 1994 Montana Supreme Court decisions found 60.4% of self-citations were to cases decided within the previous seven years, 73.5% to cases decided within the previous ten years, and 92.3% to cases decided within the previous twenty years.<sup>21</sup>

This Article extends on the foregoing literature by reporting on the most comprehensive examination of patterns of decay of precedent in fifty state supreme courts (“SSCs”), including three separate data sets and almost half a million citations.<sup>22</sup> The use of these multiple data sets provides confirmation and reliability to our results and allows us to study aspects of the topic not addressed in prior work.

### C. Summary of Results

Our findings include the following. Remarkably, the frequency of citation in our data drops off by a roughly constant ratio with each passing year. The large scale of our data and the extended time period covered by the data suggest that this pattern must be the result of underlying forces unrelated to particular circumstances of time or place. Although all our data reveal this general pattern, we find significant differences in rates across different segments. For example, precedents in the areas of property law and trusts and estates age more slowly than decisions in other areas; decisions on matters of criminal law, death

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18. See William M. Landes & Richard A. Posner, *Legal Change, Judicial Behavior, and the Diversity Jurisdiction*, 9 J. LEGAL STUD. 367, 378 (1980).

19. See Merryman, *supra* note 2, at 655.

20. See Merryman, *supra* note 11, at 395.

21. See Fritz Snyder, *The Citation Practices of the Montana Supreme Court*, 57 MONT. L. REV. 453, 466 (1996).

22. We include fifty SSCs in this paper. The highest courts in Alaska and Hawaii are excluded but the highest criminal courts and civil courts of Texas and Oklahoma are all included. We exclude Hawaii and Alaska because in our previous paper we studied the impact of physical distance on citations and excluded these two distant courts. See Yun-chien Chang & Geoffrey P. Miller, *Regional Common Law*, 45 J. LEGAL PROF. 151, 156 (2021).



penalty, and family law age more rapidly. The forward-looking data on precedential decay show that ten percent of the SSC cases were never cited, and, if an SSC case was cited at all, it was cited rather quickly. If an SSC case is not cited before its seventh birthday, it is likely to be forgotten forever.

Turning to our results on judge- and panel-level data, our findings are largely negative, although not less interesting for that reason: neither the demographic characteristics of judges (ethnicity, age, gender), nor their status as elected or appointed, nor their political affiliations, had significance for the propensity of their opinions to be cited in future or past cases. Our research design does not enable us to do causal inference. Nonetheless, by observing correlational patterns from both the backward- and forward-looking perspectives, we hope to find plausible candidate factors that affect the life and death of precedents.

The rest of the Article is structured as follows. Part I describes our data sets. Part II analyzes citations to prior opinions that appeared in opinions by SSCs in 2003 and 2019. Part III turns to our forward-looking data set, which examines citations by any court at any time (up to the date of our study) to state supreme court opinions issued in 2003. We then conclude.

## I.

### THE DATA

Our study examines three data sets of state supreme court decisions, each of them compiled from the Westlaw legal database, supplemented with data hand-compiled from other sources, such as judges' ideologies (see Appendix A). We use three data sets in the expectation that by taking different "slices" of American law, we will obtain a more representative picture than would be available if we looked at only one set of data.<sup>23</sup> Two of these data sets look backward from a particular point in time: the 102,555 citations made by state supreme courts in 2019 and the 114,777 citations made by state supreme courts in 2003. The 2019 data set contains all citations in substantive, reported cases made by the state supreme courts in the contiguous states (excluding Alaska and Hawaii),<sup>24</sup> whereas the 2003 data set contains all citations in substantive (both reported and unreported) cases made by the state

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23. This strategy follows that of Landes and Posner's seminal paper, which studied citations from three separate samples (two from the United States Courts of Appeals and one from the United States Supreme Court). Landes & Posner, *supra* note 6, at 252.

24. For consistency with the original data and other papers we have done, in this Article we include only citations to or by the forty-eight contiguous states, in addition to all federal courts. That is, citations to or by the Hawaii Supreme Court and Alaska

supreme courts in forty-eight states.<sup>25</sup> The 2019 data set represents a modern slice of the case law. It is also a snapshot of the fully computerized and web-connected era. By contrast, the 2003 data set, which is from prior research by one of the co-authors,<sup>26</sup> provides a picture of citation pattern when the internet was in its puberty. We use these two backward-looking data sets, the timeline of which are sixteen years apart, to demonstrate that the decay pattern we identify is likely stable.

These data provide valuable information about the backward-looking precedential decay, but their explanatory power is limited by the lack of information about the universe of opinions from which the citations are drawn. The third data set also starts from state supreme opinions issued in 2003 but looks forward in time by harvesting 259,627 citations to these opinions by U.S. federal and state courts through September 30, 2018, when we began to collect data for this research. This third data set allows us to study citations drawn from a known population of prior opinions rather than inferring from an unknown population as in the other data sets.<sup>27</sup>

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Supreme Court are excluded. Citations by or to Washington, D.C. courts are excluded. Citations by or to non-federal and non-state courts are excluded.

25. Kim Hurley, a Westlaw representative, indicated in email correspondence that all reported state supreme court opinions in 2003 and 2018 are covered but that Westlaw does not have full coverage of unreported cases which we included in our 2003 data. This potential gap is unlikely to bias our results, as unreported cases tend to cite fewer cases than reported cases, and there is no clear reason that unreported cases would tend to have different patterns of citations in terms of case ages. In any event, the 2019 data are more recent and exclude unreported cases entirely.

26. See Theodore Eisenberg & Geoffrey Miller, *Reversal, Dissent, and Variability in State Supreme Courts: The Centrality of Jurisdictional Source*, 89 B.U. L. REV. 1451 (2009).

27. The 2003 backward-looking data set and the forward-looking data set both draw on data from a study of 7,519 state supreme court cases decided with written opinions in 2003 compiled by Eisenberg & Miller for the purpose of examining patterns of reversal and dissent in state supreme courts. See *id.* at 1465. Thousands of non-substantive decisions (a one-lined decision that states the appeal is dismissed, for instance) are not included in the original study. Among the 7,519 substantive decisions made by state supreme courts, 7,228 were made by the highest courts in the forty-eight states other than Hawaii and Alaska. 6,912 of the 7,228 cases cited to one or more prior cases. 6,501 of the 7,228 cases have been cited once or more times. Note that in the forward-looking data set, we are able to include only 7,197 unique citations (rather than 7,228) because some SSC substantive decisions were published in the same page of a reporter, so they share exactly the same citations. These very short cases are unlikely to bias our results. Finally, note that in Eisenberg & Miller, *id.*, at 1465, it is noted that the data base contains 7055 decisions, less than the number of cases reported here. One of us (Chang) acquired the data set, after Prof. Eisenberg prematurely and abruptly passed away, from Prof. Eisenberg's colleague Prof. Michael Heise, who was entrusted with the laptop left by Prof. Eisenberg. Despite Chang's best efforts, it is unclear how Prof. Eisenberg came up with the number (7,055) from the data set.

## II.

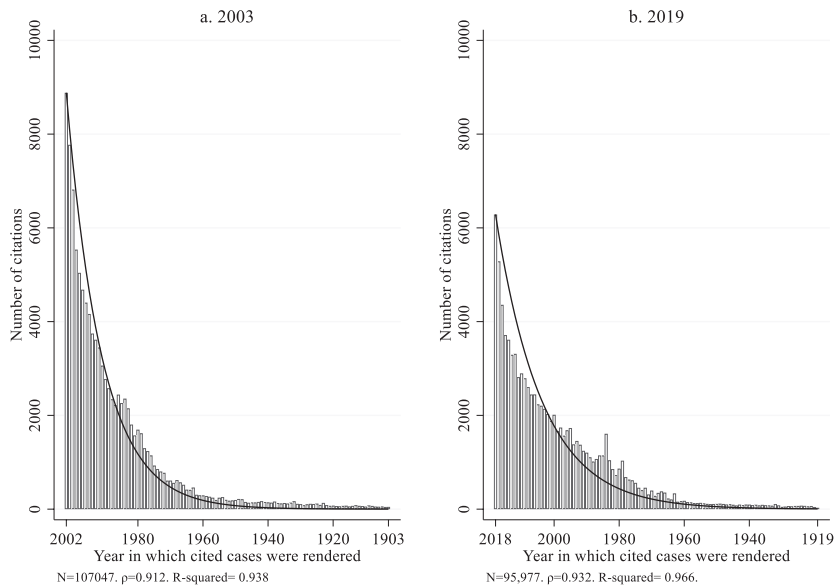
## PRECEDENTIAL DECAY: ANALYSIS OF BACKWARD-LOOKING DATA

SSC judges have to pick cases to cite. Older cases may be more authoritative but less relevant, while recent cases may address similar issues in similar social conditions but have not stood the test of time. Part A presents the overall patterns; Part B assesses which variables correlate with the age of the cited cases.

A. *The Overall Pattern*

Figure 1a presents the aggregate rates of citation between 1903 and 2002 for the 2003 data. Figure 1b presents the pattern for citations between 1919 and 2018 for the 2019 data. In each case we examine the decay pattern of citations extending back 100 years.

**Figure 1.**  
**Citations By 2003 and 2019 SSC Decisions**



Notes: Plot a: Citations made by state supreme court opinions in forty-eight states in 2003, excluding cited cases rendered in 2003 ( $N = 3,335$ ) or before 1902 ( $N = 1,370$ ), together with the best-fitting exponential curve. Plot b: Citations made by state supreme courts opinions in forty-eight states in 2019, excluding cited cases rendered in 2019 ( $N = 6,933$ ) or before 1918 ( $N = 2,232$ ), together with the best-fitting exponential curve.

A remarkable feature of these figures is the extraordinary smoothness of the decay pattern. One might expect that variations in social,

economic, or technological conditions, or in the makeup of the judiciaries, would lend discontinuities to the data, or at least would deform the shape of the curve at various points in time. For the most part, however, this was not the case. Whatever drives precedential decay in the state supreme courts, it does not appear to be a consequence of changing social or economic conditions.

Equally remarkable in both figures is the apparently exponential pattern of precedential decay which they reveal. We study this apparent pattern by fitting an exponential function<sup>28</sup> to the data that minimizes the residual sum of squares:

$$N_t = N_1 * \rho^{(t-1)} + \varepsilon \quad (1)$$

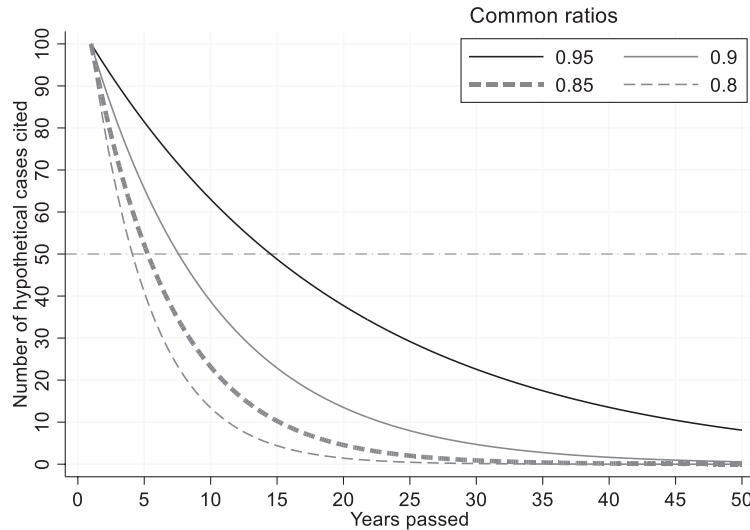
This function, if without the error term, will produce a geometric sequence. The values of the fitted function are graphed in the solid lines in the figures. Take Figure 1b as an example.  $N_t$  is the number of citations in any given year  $t$ . Year  $t$  equals one if the year is 2018; two if the year is 2017, and so on back in time.  $\rho$  is the variable to estimate in our exponential regression. We set our exponential regression (1) this way, both because it fits the data well and also because readers who are less familiar with an exponential regression and more familiar with geometric progressions can think of  $\rho$  as a common ratio. So understood, the term  $\rho$  represents the constant factor by which each term of the sequence increases or decreases relative to the preceding term.

The term  $\rho$  is a number between zero and one. ( $\rho$  greater than 1 would bring geometric growth rather than decay.) The larger the  $\rho$  within this range, the slower the rate of decay; the smaller the  $\rho$ , the greater the rate of decay. A  $\rho$  of .5 indicates that the starting value will be reduced by half within one year, a  $\rho$  of .71 indicates that the starting value will be reduced by approximately half within two years, a  $\rho$  of .79 indicates that the starting value will be reduced by approximately half within three years, and so on. As shown in Figure 2, a small (say, 0.05) difference in  $\rho$  will quickly affect the number of citations to older cases. We can use the  $\rho$  so calculated to provide insight into hypotheses about the data.

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28. We use the nl (non-linear) function in the statistical software package Stata.

**Figure 2.**  
**Decay Speed with Different Common Ratios**



Notes: This figure shows the decay of precedents under four common ratios (0.95, 0.9, 0.85, and 0.8). All four start with the hypothetical one-hundred citations to cases rendered in the previous year (year passed = 1).

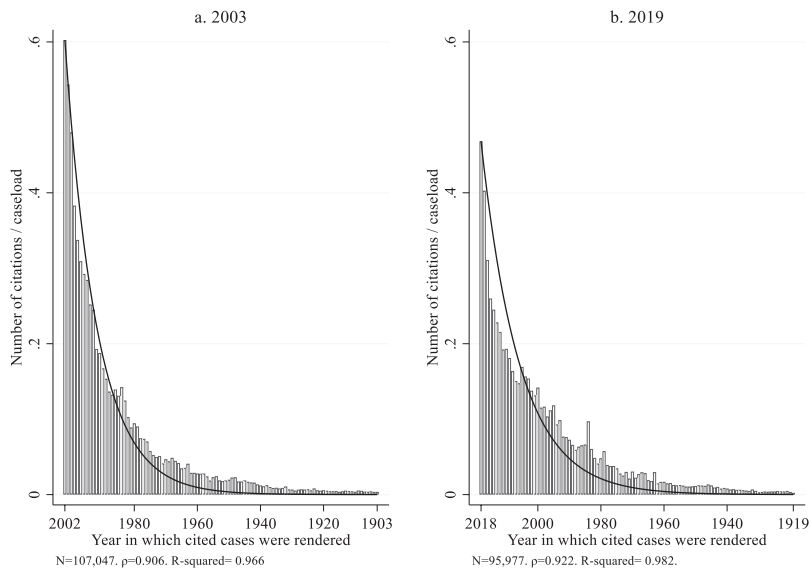
It is apparent from casual inspection that the curves shown on Figure 1 are close approximations of the actual data. We use the following strategy to gain greater precision. The conventional metric is the  $R^2$  (coefficient of determination, which ranges from 0 to 1, with 1 indicating perfect fit, and shows the proportion of variance in the dependent variable that can be explained by the independent variables), but the use of this measure (or its adjusted version) is challenged in non-linear models such as the one we study. We address this issue by taking the number of citations by  $\log_{10}$  and then calculating the  $R^2$  of the univariable ordinary least square (OLS) regression model (see equation 2). The  $R^2$  for the two models are 0.938 for the 2003 data and 0.966 for the 2019 data, indicating an extremely high level of fit between model and data.<sup>29</sup>

$$\text{Log}_{10}N_t = \alpha + \beta(t - 1) + \varepsilon \quad (2)$$

29. Careful readers may observe that the fitted line in the left plot of Figure 1 (the 2003 data) appears to be a better fit than the one in the right plot (the 2019 data), and yet the  $R^2$  is lower in the former. This may be due to our specification of setting the initial value of the curve at the number of citations in the first year, rather than trying to identify the most fitted curve. This again is due to our preference to present the results in a way that approximates the concept of a common ratio. In Figure A.4, which uses the data in Figure 4 but draws plots after transforming the number of citations in  $\log_{10}$  and shows fitted line per equation (2), it should be easy to eyeball that the plots with higher  $R^2$  do have a more fitted line, even though the counterpart plots in Figure 4 do not have a more fitted line.

An obvious objection to the data presented above is that it does not control for the available stock of precedent produced in any given year. If the precedents available for citation are increasing at an exponential rate, then the pattern of citations might not indicate a judicial preference for citing newer cases, but rather a simple random draw from the population. We investigate this possibility by controlling for the stock of precedent. Somewhat to our surprise, we discovered that the volume of opinions in state supreme courts has not increased in any consistent way over time.<sup>30</sup> Figure 3 displays the results of this analysis, displaying the number of citations divided by the number of total opinions in the year of the cited case across time. The pattern of exponential decay is unaffected by the adjustment. The  $R^2$  goodness-of-fit measures for these adjusted measures are even a bit higher than for the unadjusted data: .966 for the 2003 data and .982 for the 2019 data.

**Figure 3.**  
**Citations by 2003 and 2019 SSC Decisions, Scaled**



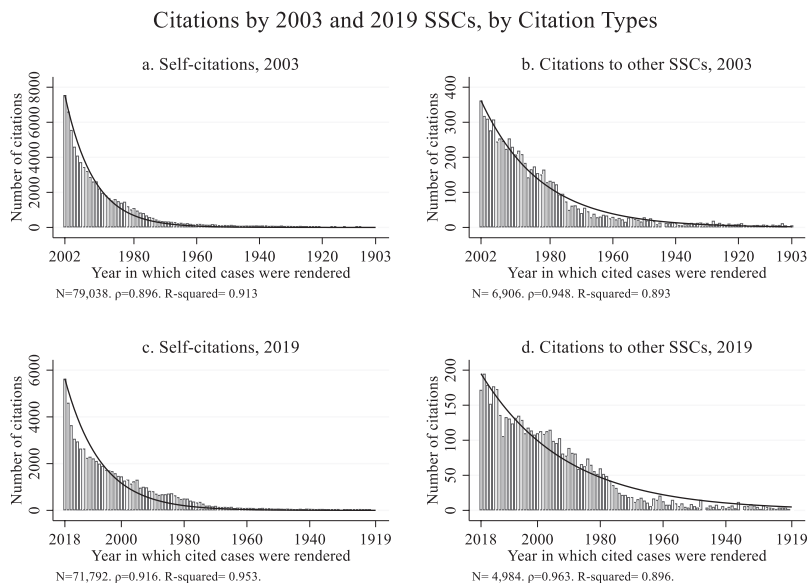
Notes: Plot a: Number of citations in a year is the numerator, whereas the number of total reported cases in the same year is the denominator. The Y-axis can be thought of as the “impact factor” of cases rendered in a given year for the 2003 SSCs.  $Y = 0.5$  would mean that an SSC case in a given year is on average cited 0.5 times in 2003. Plot b uses the same formula as Plot a.

30. See the statistical appendix Figure A.3 for the changes in volume of state supreme court decisions over the years.



Does the same pattern recur when these aggregate data are sliced in different ways? One possible distinction is that between self-citations (the citing court cites to opinions of courts in the citing court's state) and out-citations (the citing court cites to opinions issued by other courts). One might hypothesize that the pattern for out-citations would be more irregular than the pattern for self-citations, in that the citing court would rather quickly fix on a store of important decisions rendered by the courts of other states and maintain them in its citation base while forgetting about the others. The data do not support this hypothesis: the same general decay pattern is manifest in both cases. Figure 4a and Figure 4b distinguish between self- and out-citations for citations by state supreme courts in 2003; Figure 4c and Figure 4d make the same distinction for citations made by state supreme courts in 2019. As in the aggregate data, the  $R^2$  (reported under each plot) indicates a high level of fit between data and model.

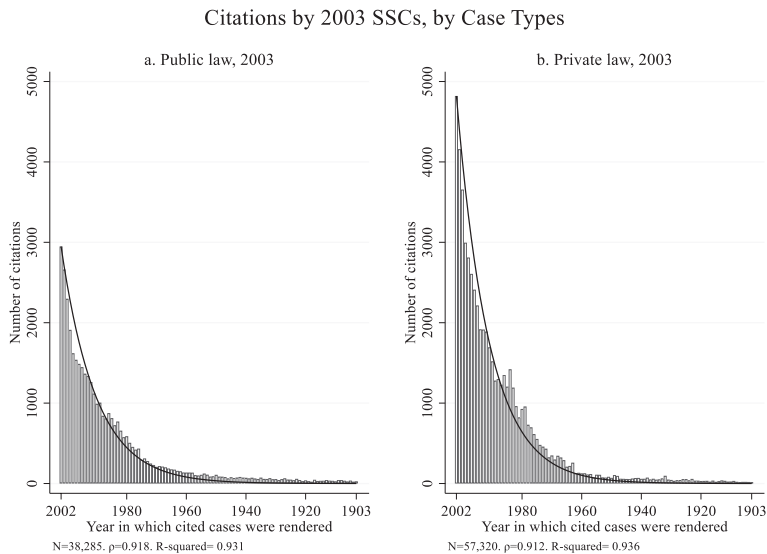
**Figure 4.**  
**Citations by 2003 and 2019 SSC Decisions, by Citation Types**



Notes: All four plots include only citations to a state supreme court case; state lower court cases and federal cases are excluded. In plots a and b, cited cases rendered in 2003 or before 1902 are also excluded. In plots c and d, cited cases rendered in 2019 or before 1918 are also excluded. Self-citations are citations to cases made by the same court. "Citations to other SSCs" are citations to cases made by other state supreme courts. R-squared is calculated by transforming the data into the log10 scale and calculating for the linear fitted line.

Perhaps different types of cases generate exponential decay patterns concealed beneath the apparently smooth surface of the aggregate data. For example, constitutional law or other public law decisions may have greater ramifications than decisions in the private law field, thus generating discontinuities or deformations of citation patterns in private law cases. Two of our data sets utilize 2003 state supreme court decisions which were coded as to case type. We divided these 2003 opinions into “public law” and “private law.” The categorization is arbitrary at the edges, since nearly all opinions have both public and private implications, but we believe it has sufficient cogency to generate information pertinent to the hypothesis. Included in “public law” were cases involving administrative law, tax law, capital punishment, constitutional law, and criminal law; cases involving issues of contracts, property, torts, trust and estate, family law, insurance law, debt collection, corporate law, and civil procedure were coded as “private.” The data do not support the hypothesis of a substantial variation in the decay pattern across the public law/private law divide. Figure 5 displays the pattern for cites by the 2003 opinions, grouped according to the public or private characteristic of the 2003 opinion. Once again, the  $R^2$  (reported under each plot) indicates a high level of fit between the data and the identified pattern.

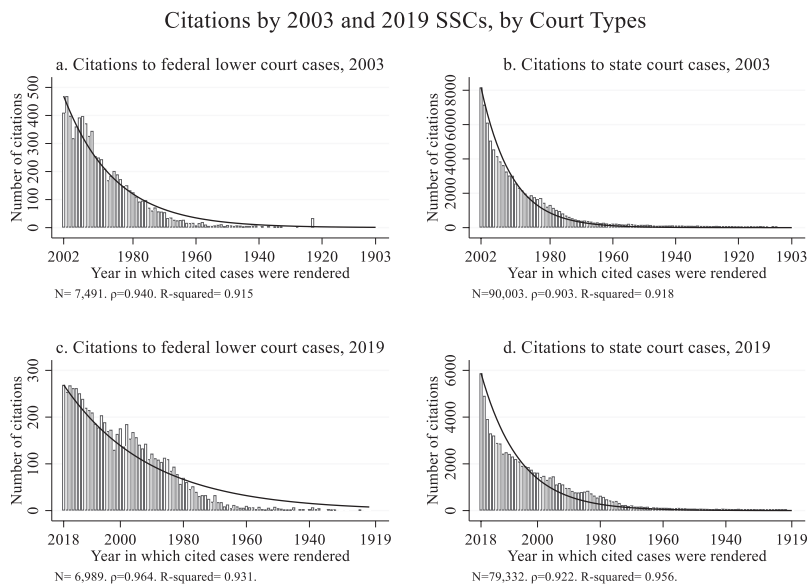
**Figure 5.**  
**Citations by 2003 SSC Decisions, by Case Types**



Notes: See definitions of public law and private law in the text above. Cited cases rendered in 2003 or before 1902 are also excluded. R-squared is calculated by transforming the data into the log10 scale and calculating for the linear fitted line.

What about the difference between citations to federal court and state decisions? Perhaps, given the supremacy of federal law, federal court citations would display more linearity in decay. The decay patterns for cites to state courts and federal lower courts are displayed in Figure 6. While the pattern for federal cases is not as pronounced, the general feature of exponential decay carries over to both types of citations (the pattern for U.S. Supreme Court decisions displays a similar decay pattern, but with considerably more variation, a feature we plan to address in future work).

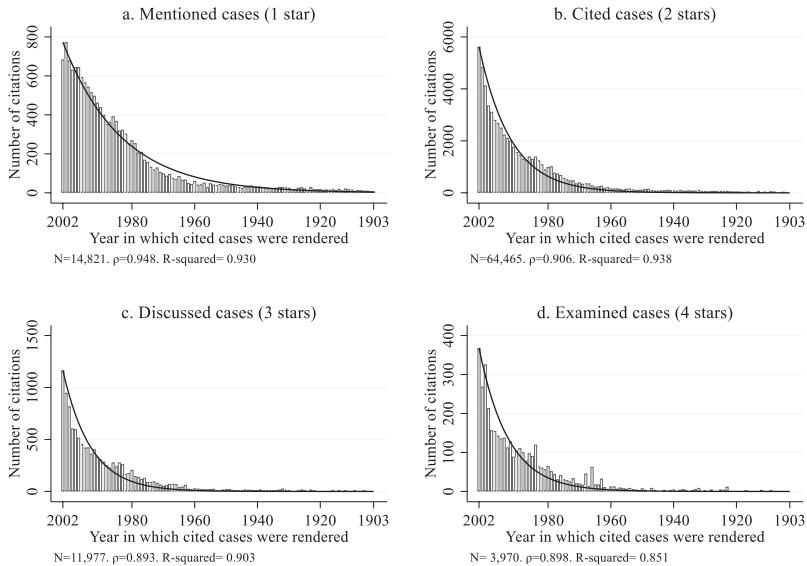
**Figure 6.**  
**Citations by 2003 and 2019 SSC Decisions, by Court Types**



Notes: In plots a and b, cited cases rendered in 2003 or before 1902 are ALSO excluded. In plots c and d, cited cases rendered in 2019 or before 1918 are also excluded. R-squared is calculated by transforming the data into the  $\log_{10}$  scale and calculating for the linear fitted line. Plots a and c only include citations to federal district courts and federal circuit courts, omitted the federal supreme court.

We can also evaluate the pattern across different depths of treatment, as defined by the coders who prepare the database. Westlaw reported four levels of depth of treatment for each cited case, ranked by the number of stars assigned: “mentioned” (one star), “cited” (two stars), “discussed” (three stars) and “examined” (four stars). The results are reported in the following figure. As in other results, the data display a notable exponential pattern, with remarkably high  $R^2$  statistics:

**Figure 7.**  
**Citations by 2003 SSC Decisions, by Depth of Treatment**



Overall, no matter how the data are sliced and diced, the pattern remains constant, although it is more pronounced in some cases than others. The pattern is intriguing because precedential decay does not necessarily have to follow this pattern. One might imagine that the process would proceed linearly rather than exponentially, so that a roughly fixed number of precedents would drop out each year, or perhaps decay would occur in bursts followed by periods of stability. A challenge for theory is to provide a plausible mechanism for the remarkable regularity of the observed patterns across multiple data sets of state supreme court citations.

### B. When Do SSC Judges Cite Older Cases?

The consistent pattern of exponential decay of state supreme court precedents does not imply that *rates* of decay will be the same across the data (though our data suggest that the rates were consistent no matter how the data are cut). One can imagine a variety of hypotheses about the judges who sit on the citing courts. Perhaps female or minority judges will cite more recent cases, on the theory that these judges will display more progressive attitudes towards possibilities of legal evolution. Perhaps Republican or ideologically conservative judges or older judges will cite older cases, on the same theory: they

may prefer a slower path of evolution of the law. One might conjecture that judges with longer tenures on the bench will cite older cases, given their presumably greater familiarity with the overall body of caselaw or affection for cases they know from the past. Perhaps opinions written by chief judges will cite older precedents as a way of emphasizing continuity on the courts they head. Perhaps elected judges will prefer to cite newer cases because they wish to establish themselves as influential jurists. Perhaps judges with more prestigious legal educations will cite newer cases, on the theory that they have an inclination gained in law school to rely on policy rather than doctrine. We have low confidence in any of these conjectures; one can imagine scenarios where their opposite would be the case. However, the hypotheses do suggest the value of examining the data to assess the likelihood of their being true.

We are also interested in how, if at all, characteristics of the citing cases correlate with the age of citations. Perhaps courts operating with mandatory appellate jurisdiction will cite to more recent cases, simply because they decide a larger number of cases every year and therefore have a greater stock of recent precedent to draw from. The presence of a dissenting opinion may trigger citations to older cases, since the judges will tend to reach further back in order to establish that their view of the case is better grounded in existing law. Cases decided *per curiam* or with an unsigned memorandum opinion may tend to cite older cases, on the theory that the summary treatment signals that the issues presented have long been decided. Perhaps opinions that reverse the case from which appeal is taken will also tend to cite older cases, on the theory that the judge writing the opinion for the appellate court will feel a need to provide additional justification for the opinion when the work of a colleague on the lower court is being rejected. Perhaps the subject matter of the case before the citing court makes a difference: for example, the court might cite to older precedents in a constitutional law case than in a commercial dispute. Again, we view these as conjectures that raise interesting questions about the data rather than as propositions in whose validity we place a great deal of confidence.

We can also assess the impact of *cited* cases. We might imagine, in this regard, that citations to opinions by other state supreme courts will tend to be older, on the theory that the citing court is using these citations to stand for theories about whose pertinence does not depend on how recently they were decided. We may infer the opposite about citations to lower courts of other states, based on the idea that these opinions have low precedential force and are likely to be cited only when highly pertinent to the facts of the case before the citing court. We might surmise, for the same reason, that citations to federal district courts will

tend to be more recent; the same might hold for citations to federal circuit courts, although in that case the preference for recency might be offset by the greater importance of federal appellate decisions. We may infer that citations to opinions of the United States Supreme Court will tend to be older because that court decides only a small number of cases every year and its precedents cannot be overruled other than by another decision of the same court. Citations to non-Article III courts, such as bankruptcy courts, may be recent because of the low precedential value of these decisions and because bankruptcies can impact ongoing litigation in significant ways.

Finally, we can assess the correlation of age with Westlaw's evaluative factors. Here, we imagine that citations accompanied by quotations are likely to be more recent, the quotation serving the function, in part, of introducing a newer idea or principle of law that cannot simply be described in a short form of words. Citations considered to reflect greater depth of treatment may also tend to be to newer cases, on the theory that older cases are likely to be better understood already and therefore not require extended analysis. As in the case of other variables, we introduce these as interesting questions to ask for research purposes, without holding a high degree of confidence in their proving to be confirmed in the data.

We study the foregoing questions by regressing possible explanatory variables on the natural log of the age of the cited case, using the 2003 data in ordinary least squares fixed-effects models. We cannot utilize the 2019 data in regressions because the demographic information regarding SSC judges in 2019 was not collected. We report five regression results. The baseline regression includes only the citing case characteristics and the citing state fixed effects. The other four models include additional variables on judge characteristics—two focusing on the personal characteristics of the judge who wrote the principal opinion; the other two using the average personal characteristics of all the judges who participated in the case. Our preferred specifications are models (2) and (4), as they include mostly pre-treatment variables regarding the nature of the citing case and the nature of the assigned judge or panel. It is debatable whether, under the studied context, the variables on the existence of dissenting opinions and case outcomes are pre- or post-treatment. Given that our research design does not enable us to make causal claims, and the main objective is description and prediction, we include these variables in all models but note that the principal opinions could be drafted when the outcome is already known and whether and which judge would dissent is also already known, qualifying it as a pre-treatment variable.



Models (3) and (5) include variables related to the cited cases and the way they were cited—including, e.g., a dummy variable on whether the cited cases were quoted by the citing cases, as well as a set of three dummy variables that measure the effect of the cited cases’ being cited, discussed, or examined, as compared to being mentioned, by the citing cases (Figure 7). We do not include these variables in the baseline and expanded models in columns (1), (2), and (4) due to endogeneity concerns—that is, the dependent variable, citation ages, may affect the independent variables (quotation and treatment statuses). Alternatively, citation ages may be determined at the same time as the cited case characteristics—for instance, the judge who penned the majority opinion may decide to cite an old case first and find that only a federal circuit court decision is available. Or the judge may determine first to cite an out-of-state SSC case and find that only a recent case is citable. These cited case characteristics are thus not “pre-treatment” and may be “bad controls.”<sup>31</sup> We report models (3) and (5) as some readers may, from a model-fitting perspective, disagree with our concern.

**Table 1.**  
**OLS Results on Citation Age (2003 Backward-Looking Data)**

	Dependent variable: natural log of citation age				
	(1)	(2)	(3)	(4)	(5)
	Baseline	Principal, expanded	Principal, cited cases	Panel, expanded	Panel, cited cases
<b>CITING CASE CHARACTERISTICS</b>					
CFscore /		-0.002	0.011	2.157	0.586
Average CFscore		(0.015)	(0.017)	(2.472)	(2.649)
Republican judges /		0.002	-0.007	-0.135	-0.203
% of Republican judges		(0.038)	(0.045)	(0.146)	(0.175)
Female judges /		-0.002	-0.001	-0.069	-0.117
% of female judges		(0.028)	(0.030)	(0.118)	(0.191)
White judges /		<b>0.075*</b>	0.057	-0.256	-0.011
% of White judges		(0.029)	(0.035)	(0.270)	(0.363)

31. See generally JOSHUA D. ANGRIST & JÖRN-STEFFEN PISCHKE, *MOSTLY HARMLESS ECONOMETRICS: AN EMPIRICIST’S COMPANION* (2009).

Judge age >=60 /	<b>0.055*</b>	0.031	0.019	0.017	
Average age	(0.027)	(0.027)	(0.014)	(0.021)	
Tenure >=7 years /	0.023	0.034	<b>-0.029+</b>	<b>-0.036+</b>	
Average tenure	(0.022)	(0.026)	(0.017)	(0.021)	
Judge was elected /	0.082	0.101	-0.924	-1.171	
% of elected judges	(0.054)	(0.064)	(0.993)	(0.866)	
Judge graduated from "Top 14"	0.021	0.001	-0.154	0.100	
law school / % of such judges	(0.039)	(0.041)	(0.902)	(0.544)	
Judge graduated from "not top 100 law school" / % of such judges	0.030	0.014	0.320	<b>1.473***</b>	
Chief justice	(0.027)	(0.032)	(0.984)	(0.307)	
Mandatory jurisdiction	-0.010 (0.028)	-0.020 (0.026)			
	-0.026 (0.023)	-0.013 (0.024)	-0.031 (0.030)	-0.017 (0.027)	-0.039 (0.033)
With dissenting opinions	<b>0.078***</b> (0.018)	<b>0.069**</b> (0.022)	0.045 (0.027)	<b>0.068**</b> (0.021)	<b>0.041+</b> (0.025)
En banc, per curiam, or memorandum decision	<b>-0.077*</b> (0.029)	<b>0.055*</b> (0.024)	0.022 (0.018)	<b>0.044+</b> (0.024)	0.003 (0.024)
<u>Outcomes</u> (baseline = reverse)					
Other results	0.052 (0.032)	0.045 (0.038)	0.070 (0.043)	0.025 (0.039)	0.044 (0.042)
Affirmed (in part)	-0.010 (0.020)	0.003 (0.020)	0.008 (0.022)	-0.003 (0.021)	0.006 (0.021)
<u>Case types (baseline = Constitution)</u>					
Contract	<b>-0.199*</b> (0.085)	<b>-0.186+</b> (0.102)	-0.024 (0.128)	<b>-0.195+</b> (0.098)	-0.034 (0.122)
Property	0.061 (0.052)	0.079 (0.060)	<b>0.268***</b> (0.071)	0.076 (0.063)	<b>0.266***</b> (0.072)
Torts	<b>-0.165***</b> (0.043)	<b>-0.149**</b> (0.050)	-0.034 (0.064)	<b>-0.164**</b> (0.051)	-0.047 (0.064)
Trust & estate	<b>0.186*</b> (0.072)	<b>0.226*</b> (0.090)	<b>0.415***</b> (0.101)	<b>0.220*</b> (0.092)	<b>0.407***</b> (0.103)
Family	<b>-0.254***</b> (0.054)	<b>-0.255***</b> (0.060)	<b>-0.138*</b> (0.065)	<b>-0.268***</b> (0.060)	<b>-0.149*</b> (0.065)

Insurance	<b>-0.255***</b> (0.049)	<b>-0.224***</b> (0.060)	-0.115 (0.069)	<b>-0.225***</b> (0.058)	<b>-0.116+</b> (0.067)
Debt collection	-0.005 (0.061)	-0.010 (0.076)	0.167 (0.100)	-0.017 (0.077)	0.156 (0.096)
Corporate	-0.137 (0.082)	<b>-0.280**</b> (0.098)	-0.048 (0.112)	<b>-0.242*</b> (0.102)	-0.017 (0.119)
Civil procedure	<b>-0.169***</b> (0.036)	<b>-0.137**</b> (0.043)	-0.058 (0.059)	<b>-0.147**</b> (0.044)	-0.068 (0.058)
Administrative & tax	-0.099 (0.067)	-0.070 (0.075)	0.003 (0.083)	-0.080 (0.074)	-0.003 (0.080)
Employment	<b>-0.287***</b> (0.050)	<b>-0.278***</b> (0.064)	-0.117 (0.076)	<b>-0.284***</b> (0.065)	-0.125 (0.076)
Death penalty	<b>-0.324***</b> (0.047)	<b>-0.321***</b> (0.051)	<b>-0.361***</b> (0.067)	<b>-0.334***</b> (0.051)	<b>-0.378***</b> (0.067)
Criminal	<b>-0.276***</b> (0.039)	<b>-0.251***</b> (0.047)	<b>-0.245***</b> (0.057)	<b>-0.261***</b> (0.047)	<b>-0.254***</b> (0.055)
Other case types	<b>-0.231***</b> (0.040)	<b>-0.236***</b> (0.045)	<b>-0.173**</b> (0.052)	<b>-0.230***</b> (0.047)	<b>-0.172**</b> (0.052)

#### CITED CASE CHARACTERISTICS

Court type (baseline = own state cases)

Other SSCs		<b>0.229*</b> (0.086)	<b>0.237**</b> (0.082)
Lower courts in other states		<b>-0.156*</b> (0.071)	<b>-0.147*</b> (0.068)
Federal district courts		<b>-0.179+</b> (0.089)	<b>-0.173*</b> (0.085)
Federal circuit court		0.016 (0.064)	0.020 (0.062)
SCOTUS		<b>0.369**</b> (0.134)	<b>0.387**</b> (0.129)
Other federal courts (non-Article 3 courts)		<b>-0.282*</b> (0.134)	<b>-0.279*</b> (0.128)
Quoted		0.043 (0.030)	0.042 (0.030)

Depth of treatment (baseline=Mentioned)

Cited		<b>-0.300***</b> (0.019)	<b>-0.295***</b> (0.019)
Discussed		<b>-0.404***</b> (0.029)	<b>-0.397***</b> (0.029)

Examined			<b>-0.484***</b> (0.043)		<b>-0.479***</b> (0.043)
Constant	<b>2.467***</b> (0.043)	<b>2.185***</b> (0.085)	<b>2.109***</b> (0.099)	<b>2.657*</b> (1.131)	1.678 (1.737)
Citing state fixed effects	Yes	Yes	Yes	Yes	Yes
Cited state fixed effects and Citing–cited state interactions	No	No	Yes	No	Yes
$R^2$	0.032	0.032	0.135	0.033	0.135
Observations	97,767	72,552	55,735	74,432	57,086

*Notes:* Robust standard errors in parentheses, clustered by citing state. Columns (1) presents the baseline model. Columns (2)–(3) report OLS regressions under which judge characteristics are based on the judge who wrote the principal opinion for the majority (or plurality). Columns (4)–(5) report OLS regressions under which judge characteristics are based on the average characteristics of judges who participated in the case. Models (2)–(3) are different from models (4)–(5) only regarding 9 dimensions of judge characteristics: CFscore (ideological score), Republican, female, white, age, tenure, selection method, law school graduation, and chief judgeship. Their definitions are provided in the statistical appendix. All other variables are specified in the same way. We classify judges into three types based on whether their law school alma mater is “top 14,” “top 100 but not top 14,” and “not top 100.” The second one is the baseline in the regressions. In columns (2)–(3), the dummy variable indicates whether the judge who wrote the principal opinion graduated from a law school that is not ranked as top 100. In columns (4)–(5), the continuous variable records the percent of judges participating in the case who graduated from a law school that is not ranked as top 100. “Panel average” regressions have more observations than “principal judge” regressions because a case will not be included if any feature or demographic characteristics of the principal judge is missing. When calculating panel average, we ignore judges on a panel with missing information (that is, as if they did not participate). Column (1) has more observations than the others because of missing judge characteristics. Column (1) lost 13,985 observations because the result of the cases was missing. This table only includes citations to cases rendered between 1903 and 2002. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

One noteworthy feature of Table 1, which reports the regression results, is the variables found not to be statistically significant. Almost none of the personal characteristics of the principal opinion author or of the panel had a significant impact on citation age: female judges were not distinguishable from male judges, nor older judges from younger judges, Republican judges from Democratic judges, conservative judges from liberal judges, minority judges from other judges, elected judges from appointed judges, judges with long tenures on the court from judges more recently arrived.<sup>32</sup> No judge-specific variable was consistently statistically significant. These results—that the personal

32. While the SSCs we studied do not assign cases to each judge in a strictly randomized fashion, we find that these SSCs do not appear to assign cases based on the judge characteristics we studied. See Yun-chien Chang & Geoffrey P. Miller, *Do Judges Matter?*, 179 J. INSTITUTIONAL & THEORETICAL ECON. 224, 236 (2023).

characteristics of the judge and the panel have no impact on the age of cited cases—are consistent with our prior study, which finds that personal characteristics of judges have no correlation with a wide variety of judicial tasks.<sup>33</sup>

The results on case type demonstrate interesting evidence that courts in cases involving trusts and estates tend to cite to older precedent and courts in family law, death penalty, and criminal law cases tend to cite newer precedent—all as compared to citation patterns in constitutional law cases. These data may suggest that the pace of change in the law differs across these areas: the law moves slowly in trust and estates law, resulting in citation to older cases, but moves quickly in family law, death penalty, and criminal law, resulting in citation to newer cases.

As for cited case characteristics,<sup>34</sup> our regressions report evidence that citations to opinions of other state supreme courts tend to be older, a result consistent with the hypothesis that these citations are often used to illustrate a longstanding principle of law. There is evidence that citations to opinions by lower courts of other states tend to be more recent, a result consistent with the idea that because these precedents are very weak, they will tend to be cited only when they are immediately pertinent to the case before the citing court and so recent that the principles of law they express have not yet been incorporated into opinions by higher courts.

Perhaps because of similar considerations, citations to federal district courts also tend to be more recent. The pattern is different for the United States Supreme Court, where we find strong evidence that citations tend to be older—as predicted by the hypothesis that the relative paucity of opinions of this court, coupled with their resistance to being overruled, sends citing courts backward in time to find appropriate authority.

We find evidence that citations to non-Article III courts tend to be more recent, a sign, perhaps, of the weakness of the precedential value of these opinions coupled with the fact that the cited opinions may in some cases be factually linked to the case then pending before the citing court. As for the variables based on evaluations by Westlaw coders, the regressions reveal a strong association between depth of treatment and recency: compared to a baseline of “mentioned,” citations coded as “cited,” “discussed,” or “examined” were significantly more likely to be to recent cases, a result consistent with

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33. *See id.* at 224.

34. Again, the results should be interpreted cautiously due to the potential endogeneity problem.

our hypothesis that courts would tend to spend more time discussing recent cases whose impact had not yet been fully incorporated into background law.

### III.

#### PRECEDENTIAL DECAY: ANALYSIS OF FORWARD-LOOKING DATA

The previous part describes citation patterns with a backward-looking angle. This is also how judges make citation decisions. We can also switch perspectives and observe the citation patterns from a forward-looking angle. Given a pool of decisions rendered in a given year, how would the number of citations to those cases decrease in future years?

We address this question by turning to our forward-looking data set, which examines citations by any court at any time (up to the date of our study) to state supreme court opinions issued in 2003. Our use of 2003 state supreme court cases as a baseline also allows us to leverage on the extensive additional data on those cases available in that data set.

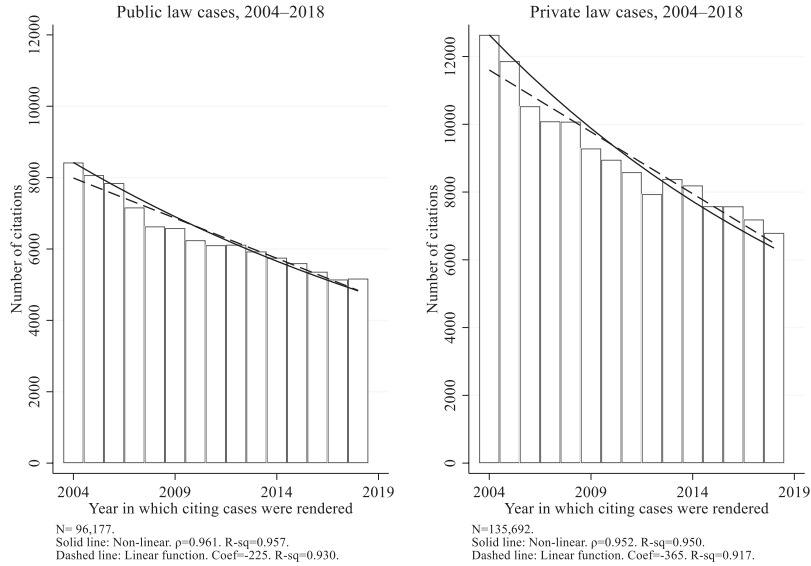
Section A provides a visual demonstration that the decay pattern is exponential when we look forward to later decisions, just as it is when we look backward from decisions to earlier cases. Section B performs a statistical analysis to determine what kinds of cases are to be cited more frequently and faster than other cases.

#### A. *The Overall Pattern*

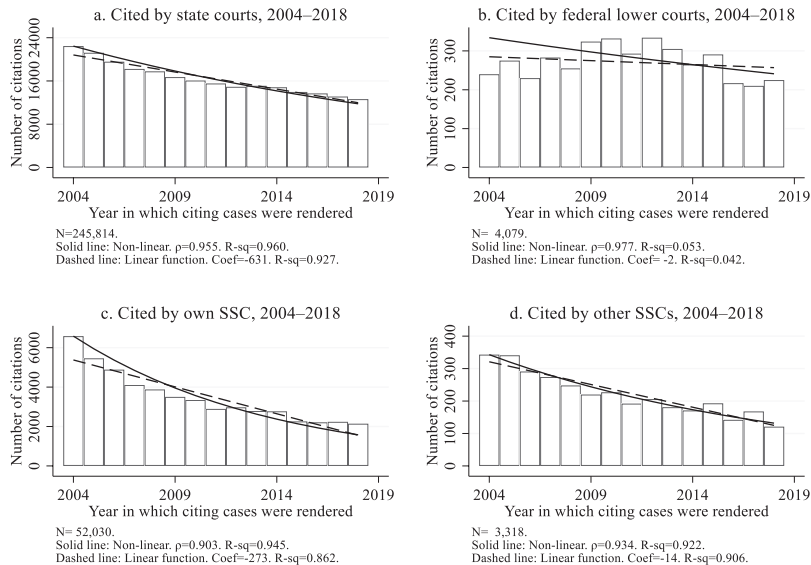
Figure 8 and Figure 9 divide the number of citations to 2003 SSC cases by case type and court type. Recall that we calculate the  $R^2$  for the non-linear line by taking the number of citations by  $\log_{10}$ , then fitting a linear line to the logged numbers, and finally running a univariate regression against the logged number of citations on the number of years since 2003. Judged by the  $R^2$  reported under each sub-plot, the number of citations to 2003 SSC cases from 2004 to 2018 approximate a geometric progression, although the fit for citations by lower federal courts is not as close as for other slices of the data.



**Figure 8.**  
Citations to 2003 SSC Decisions, by Types of Cited Cases

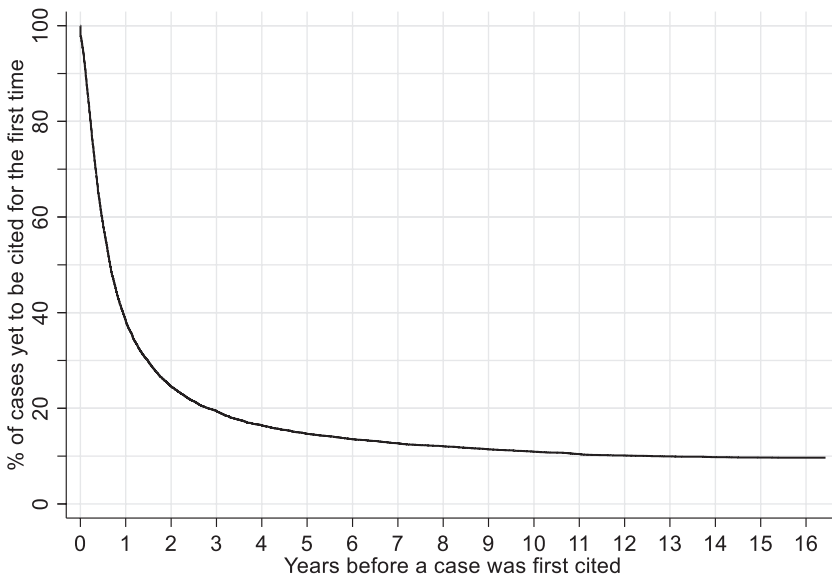


**Figure 9.**  
Citations to 2003 SSC Decisions, by Citing Court Types



In addition, 696 of the 7,197 SSC (10%) cases rendered in 2003 have never been cited during the ensuing fifteen years. Figure 10 shows when the first cites to the remaining 90% of the cases happened during their life span. As the Y-axis shows the percentage of cases yet to be cited for the first time, it means that, for example, by their first anniversary, 60% of the 2003 SSC cases have been cited at least once; at the end of the second and third year, 75% and 80% have been cited at least once respectively. If a 2003 SSC case has not been cited even once within the first seven years, it is highly unlikely that it will ever be cited. An unreported graph shows that, on the unrealistic but convenient assumption that no 2003 SSC cases were ever cited again after Sept. 28, 2018 (our cutoff date for data), approximately 75%, 55%, and 25% of the 2003 SSC cases were still cited three, ten and fifteen years, respectively, after being rendered.

**Figure 10.**  
**Kaplan Meier Curve for First Citation to 2003 SSC Cases**



N=7,197. Information cutoff: Sep. 28, 2018. Time is measured by days but shown in years.

*B. When Would SSC Decisions Be Cited Faster and More Often?*

Given the findings that SSC judges are inclined to cite more recent cases, and thus the probability of getting cited decreases over time, we investigate which characteristics generate more and faster citations. An investigation of the same variables as in Table 1 generates the results set forth in Table 2 and Table 3. We also include a variable for page length of the cited case (in natural log), on the theory that the length of an opinion may signal its importance and/or complexity and thus may correlate with faster and more frequent citation. Table 2 runs negative binomial models that take account of the total number of citations in each case's first 5,385 days of life.<sup>35</sup> We choose 5,385 days so that even a 2003 SSC case rendered in the last day of the year (December 31, 2003) has 5,385 days before the research cutoff date (September 28, 2018). Models (2) and (4) in Table 2 include an additional variable: the number of citations in the first 365 days (in natural log), on the conjecture that cases that were cited more in the first year of life have an edge.

While negative binomial models look into the volume of cites over the fifteen years, recurrent event models<sup>36</sup> in Table 3 show how *fast* a 2003 SSC would be cited time and again.<sup>37</sup> All models include the number of pages (log-transformed) as the main independent variable. Models (2) and (4) in Table 3 include an additional variable: number of days to the first cite (log-transformed), on the conjecture that a quicker first cite is likely to trigger a quicker follow-up cite.

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35. A negative binomial model is a count model that is appropriate to assess the relationship between the dependent and independent variables when the former is a count—here, the number of citations. A negative binomial model only takes into consideration the number of citations but not how fast or slow the citations occur.

36. A recurrent event model is an extension of a survival model, only that a survival model takes into consideration (or fits) when only one event (here, citation) occurs to each observed unit. A recurrent event model allows multiple events to take place.

37. As compared to a standard survival model (say, the Cox proportional hazard model), which only takes the first citation event into account, a recurrent event model accounts for all citation events. As compared to a negative binomial model, which only tallies the number of citations, a recurrent event model accounts for the days needed to get another citation. For two 2003 SSC cases, if one was cited twice in 2015, whereas the other was cited twice in 2004, under a negative binomial model, the two cases are treated the same (as cited twice). By contrast, under a recurrent event model, the two SSC cases differ because it takes the former case a much longer time to get two citations. As the dependent variable in our recurrent event models is days, a positive coefficient means it took more days to get a citation.

**Table 2.**  
**Negative Binomial Regression Results**

	(1)	(2)	(3)	(4)
Negative binomial model				
Dependent variable: total number of citations in the following fifteen years				
	Principal judge	Principal judge	Panel average	Panel average
Pages (ln)	<b>0.780***</b> (0.034)	<b>0.722***</b> (0.037)	<b>0.783***</b> (0.036)	<b>0.719***</b> (0.041)
Number of citations in the first 365 days (ln)		<b>0.381***</b> (0.045)		<b>0.393***</b> (0.049)
With dissents	<b>-0.163**</b> (0.054)	<b>-0.161**</b> (0.054)	<b>-0.150*</b> (0.061)	<b>-0.156**</b> (0.057)
CFscore /	0.024 (0.028)	0.010 (0.029)	-0.090 (0.280)	-0.184 (0.270)
Average CFscore				
Republican judges /	0.053 (0.105)	0.087 (0.112)	0.164 (0.411)	0.193 (0.364)
% of Republican judges				
Female judges /	-0.004 (0.052)	0.012 (0.049)	-0.420 (0.288)	-0.333 (0.300)
% of female judges				
White judges /	0.004 (0.097)	-0.012 (0.096)	0.951 (0.937)	0.231 (0.677)
% of White judges				
Judge age >=60 /	-0.041 (0.038)	0.010 (0.039)	-0.036 (0.028)	-0.043+ (0.026)
Average age				
Tenure >=7 years /	0.010 (0.043)	-0.013 (0.045)	0.049 (0.041)	0.051 (0.042)
Average tenure				
Judge was elected /	0.035 (0.083)	0.007 (0.083)	<b>-0.825+</b> (0.501)	-0.867 (0.600)
% of elected judges				
Judge graduated from "Top 14" law school / % of such judges	-0.003 (0.055)	0.002 (0.053)	-1.513 (1.761)	-1.842 (1.643)
Judge graduated from "not top 100 law school" / % of such judges	-0.027 (0.061)	-0.016 (0.055)	-2.984 (3.056)	-3.164 (3.443)
Chief justice	-0.044 (0.058)	-0.054 (0.053)		
Mandatory jurisdiction	-0.101 (0.072)	-0.102 (0.074)	-0.110 (0.072)	-0.104 (0.074)
En banc, per curiam, memorandum	0.103 (0.075)	0.064 (0.095)	<b>0.133*</b> (0.068)	0.102 (0.094)

Outcomes (baseline = reverse)

Other results	<b>-0.151<sup>+</sup></b> (0.083)	-0.125 (0.081)	<b>-0.158<sup>+</sup></b> (0.085)	-0.133 (0.082)
Affirmed (in part)	-0.063 (0.048)	-0.039 (0.043)	-0.061 (0.048)	-0.039 (0.041)

Case types(baseline= Constitution)

Contract	<b>0.213<sup>+</sup></b> (0.128)	<b>0.284<sup>*</sup></b> (0.128)	<b>0.241<sup>+</sup></b> (0.131)	<b>0.302<sup>*</sup></b> (0.125)
Property	0.148 (0.128)	<b>0.193<sup>+</sup></b> (0.115)	0.220 (0.135)	<b>0.236<sup>*</sup></b> (0.112)
Torts	<b>0.373<sup>**</sup></b> (0.120)	<b>0.380<sup>***</sup></b> (0.101)	<b>0.362<sup>**</sup></b> (0.116)	<b>0.374<sup>***</sup></b> (0.099)
Trust & estate	-0.022 (0.134)	0.022 (0.120)	-0.030 (0.132)	0.016 (0.116)
Family	<b>0.592<sup>***</sup></b> (0.114)	<b>0.597<sup>***</sup></b> (0.108)	<b>0.607<sup>***</sup></b> (0.115)	<b>0.611<sup>***</sup></b> (0.108)
Insurance	<b>0.373<sup>*</sup></b> (0.162)	<b>0.343<sup>*</sup></b> (0.140)	<b>0.343<sup>*</sup></b> (0.152)	<b>0.314<sup>*</sup></b> (0.128)
Debt collection	0.029 (0.146)	0.047 (0.149)	0.057 (0.160)	0.055 (0.153)
Corporate	0.023 (0.116)	0.094 (0.116)	-0.003 (0.125)	0.056 (0.127)
Civil procedure	<b>0.374<sup>***</sup></b> (0.110)	<b>0.396<sup>***</sup></b> (0.094)	<b>0.389<sup>***</sup></b> (0.111)	<b>0.413<sup>***</sup></b> (0.097)
Administrative & tax	<b>0.278<sup>*</sup></b> (0.125)	<b>0.280<sup>*</sup></b> (0.120)	<b>0.283<sup>*</sup></b> (0.123)	<b>0.287<sup>*</sup></b> (0.121)
Employment	-0.110 (0.116)	-0.084 (0.098)	-0.074 (0.118)	-0.053 (0.101)
Death penalty	<b>0.399<sup>**</sup></b> (0.123)	<b>0.390<sup>**</sup></b> (0.128)	<b>0.425<sup>***</sup></b> (0.126)	<b>0.421<sup>***</sup></b> (0.127)
Criminal	<b>0.653<sup>***</sup></b> (0.100)	<b>0.612<sup>***</sup></b> (0.089)	<b>0.685<sup>***</sup></b> (0.104)	<b>0.639<sup>***</sup></b> (0.092)
Others	0.047 (0.210)	-0.042 (0.150)	0.114 (0.210)	0.037 (0.155)

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Cited state fixed effects	Yes	Yes	Yes	Yes
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Observations	4,233	4,233	4,324	4,324
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*Notes:* Coefficients, not hazard ratios, are reported for each variable. “Principal judge” is the judge who authored the majority opinion. The definitions of variables are provided in the statistical appendix. “Panel average” regressions have more observations than “principal judge” regressions because a case will not be included if any feature or demographic characteristics of the principal judge is missing. When calculating the panel average, we ignore judges on a panel with missing information (that is, as if they did not participate). The number of cases/observations in the regression reduces from 7,197 to 4,000+ because, first, in most en banc, per curiam, and memorandum opinions, who penned the opinion and who participated in the case are unknown, and second, we do not have information about all guest judges and a number of permanent judges. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 3.**  
**Recurrent Event Regression Results**

	(1)	(2)	(3)	(4)
	Recurrent event model			
	Dependent variable: days to each of the next citation			
	Principal judge	Principal judge	Panel average	Panel average
Pages (ln)	<b>-0.018***</b> (0.002)	<b>-0.020***</b> (0.003)	<b>-0.017***</b> (0.002)	<b>-0.020***</b> (0.003)
Number of days to the first cite (ln)		<b>-0.004*</b> (0.002)		<b>-0.005**</b> (0.002)
With dissenting opinions	<b>0.004+</b> (0.003)	<b>0.005+</b> (0.003)	<b>0.004+</b> (0.003)	<b>0.005+</b> (0.003)
CFscore /	-0.002 (0.002)	-0.002 (0.002)	-0.010 (0.018)	-0.006 (0.018)
Average CFscore				
Republican judges /	-0.004 (0.004)	-0.004 (0.004)	-0.010 (0.019)	-0.009 (0.020)
% of Republican judges				
Female judges /	-0.000 (0.002)	-0.000 (0.002)	0.010 (0.012)	0.010 (0.012)
% of female judges				
White judges /	0.003 (0.003)	0.002 (0.003)	-0.003 (0.015)	-0.008 (0.016)
% of White judges				
Judge age >=60 /	0.003 (0.002)	0.003 (0.002)	0.001 (0.001)	0.001 (0.001)
Average age				
Tenure >=7 years /	-0.000 (0.002)	-0.001 (0.002)	0.001 (0.001)	0.000 (0.001)
Average tenure				
Judge was elected /	0.002 (0.003)	0.001 (0.003)	0.009 (0.021)	0.011 (0.021)
% of elected judges				
Judge graduated from "Top 14" law school / % of such judges	0.002 (0.004)	0.001 (0.004)	0.038 (0.054)	0.040 (0.058)
Judge graduated from "not top 100 law school" / % of such judges	-0.002 (0.003)	-0.003 (0.003)	0.035 (0.111)	0.050 (0.126)
Chief justice	-0.003 (0.002)	-0.003 (0.002)		
Mandatory jurisdiction	0.002 (0.002)	0.003 (0.002)	0.003 (0.002)	0.003+ (0.002)
En banc, per curiam, memorandum	0.002 (0.004)	0.001 (0.004)	0.006 (0.006)	0.004 (0.006)



Outcomes (baseline = reverse)

Other results	-0.003 (0.002)	-0.003 (0.002)	-0.004 (0.002)	-0.004 (0.002)
Affirmed (in part)	-0.000 (0.002)	0.000 (0.002)	-0.000 (0.002)	0.000 (0.002)

Case types(baseline= Constitution)

Contract	0.004 (0.006)	0.005 (0.007)	0.004 (0.006)	0.005 (0.006)
Property	<b>-0.006<sup>+</sup></b> (0.004)	-0.005 (0.004)	<b>-0.006<sup>+</sup></b> (0.003)	-0.005 (0.004)
Torts	-0.002 (0.005)	-0.002 (0.005)	0.001 (0.005)	0.001 (0.005)
Trust & estate	0.000 (0.009)	0.002 (0.009)	0.000 (0.008)	0.003 (0.008)
Family	-0.003 (0.005)	-0.003 (0.005)	-0.003 (0.005)	-0.003 (0.005)
Insurance	0.004 (0.007)	0.003 (0.007)	0.004 (0.007)	0.004 (0.007)
Debt collection	<b>-0.012<sup>**</sup></b> (0.004)	<b>-0.010<sup>*</sup></b> (0.004)	<b>-0.012<sup>**</sup></b> (0.004)	<b>-0.010<sup>*</sup></b> (0.004)
Corporate	-0.001 (0.007)	-0.001 (0.007)	-0.002 (0.007)	-0.003 (0.007)
Civil procedure	-0.006 (0.004)	-0.005 (0.004)	-0.006 (0.004)	-0.005 (0.004)
Administrative & tax	0.002 (0.005)	0.002 (0.005)	0.002 (0.005)	0.002 (0.005)
Employment	0.003 (0.005)	0.005 (0.005)	0.003 (0.005)	0.005 (0.005)
Death penalty	0.003 (0.004)	0.004 (0.004)	0.003 (0.004)	0.004 (0.004)
Criminal	<b>-0.008<sup>*</sup></b> (0.003)	<b>-0.008<sup>*</sup></b> (0.003)	<b>-0.008<sup>*</sup></b> (0.003)	<b>-0.008<sup>*</sup></b> (0.003)
Others	0.002 (0.008)	0.003 (0.008)	0.001 (0.008)	0.002 (0.008)

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Cited state fixed effects	Yes	Yes	Yes	Yes
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Observations	177,116	177,116	187,491	187,491
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*Notes:* Coefficients, not hazard ratios, are reported for each variable. “Principal judge” is the judge who authored the majority opinion. The definitions of variables are provided in the statistical appendix. “Panel average” regressions have more observations than “principal judge” regressions because a case will not be included if any feature or demographic characteristics of the principal judge is missing. When calculating panel average, we ignore judges on a panel with missing information (that is, as if they did not participate). We have tried parametric recurrent event models (Weibull distribution) and non-parametric recurrent event models with shared frailty on cited cases. None of the models converge in twenty-four hours. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Interestingly, a new variable studied in these regressions – page length – turns out to be highly significant in all specifications of the model. As would be predicted, the regressions indicate that longer opinions receive a higher volume of subsequent citations and are cited more rapidly than opinions with fewer pages.<sup>38</sup> Page length is a proxy for the substantive importance of a case and its complexity. It is reasonable to hypothesize that these longer cases are considered by later courts as having higher precedential values. Moreover, as expected, cases that have been cited more in their first year of life will garner more cites over the fifteen-year period. It is somewhat surprising, however, that cases that are quicker to receive their first cites tend to be slower to be cited again than cases that are slow to receive their first cites.

In general, the results of these regressions track the results of the regressions on the backward-looking 2003 data; most importantly, this data set, like the previous one, reflects no impact of judge-specific or panel-specific characteristics on the frequency or speed of cited opinions. But there were some differences. Certain variables found to be significant in the backward-looking data show up as insignificant in these regressions. For example, trust and estates law, significant in the backward-looking data, is not a significant variable here. We can speculate that the differences between the data sets may be due to the different time periods involved: the backward-looking data set includes citations to cases prior to 2003 and includes one hundred years of data while the forward-looking data set includes citations by cases after 2003 and includes only fifteen years of data. It is possible, for example, that changes in observed citation patterns in trust and estate law cases may be due to their long-standing underlying jurisprudence, which may have become less dynamic in the years since.

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38. It may be concerning that the number of pages in a case is itself a product of the judge and case characteristics included in the regressions. In unreported regressions, which are the same as those in Table 2 except that the page variable is omitted, the column (1) result is qualitatively the same, whereas under the revised column (2) model, “not top 100 law school” becomes significant at the 0.05 level (negative coefficient) and “With dissenting opinions” becomes significant at the 0.05 level (positive coefficient). The changes in the latter are not entirely surprising because if we run a regression of the same set of variables in the unreported models against the number of pages, the only two variables that are statistically significant are the dissent variable and the law school variable. The take-away message is that judges who graduated from better law schools tend to write longer opinions, and cases with dissents tend to produce longer opinions. Longer opinions tend to be cited later on, partly due to the plausible facts that hard cases with dissents are more likely to be cited and that judges with better legal education are more likely to write longer opinions.

A consistent pattern across the regressions using forward-looking and backward-looking data is found in citations to criminal law cases. In Table 1, criminal law is highly statistically significant with a negative coefficient in the backward-looking data, suggesting that, as compared to constitutional law cases, criminal law cases are inclined to cite more recent cases. Criminal law is statistically significant with a positive coefficient in the negative binomial model (Table 2) and is statistically significant with a negative coefficient in the recurrent event model (Table 3), suggesting that, as compared to constitutional law cases, criminal law cases receive more citations and get cited more quickly, consistently with what is found above—criminal law cases cite more recent precedents.

### CONCLUSION

This Article provides a comprehensive analysis of decay patterns of citations in state supreme court opinions, drawing on three different data bases: citations to a hundred years of prior cases made by state supreme courts in 2003, citations to a hundred years of prior cases made by state supreme courts in 2019, and citations made by later cases to state supreme court opinions issued in 2003. The main takeaway is the extraordinary persistence of exponential decay across all of the data. Citations age at different rates across different cuts of the data, but in every case the deterioration of precedents displays an exponential pattern. In some cases, the pattern is so strong that the best-fitting exponential curve, when fitted to the data, explains well over ninety percent of the observed variation. Our study probes more deeply to assess the rates of deterioration of precedent.

Multiple regression analysis of two data sets—the backward-looking 2003 data and the forward-looking 2003 data—reveals that characteristics of judges, panels, and mandatory jurisdictions had little or no impact on citation patterns. Opinion length—studied in the forward-looking 2003 data—turned out to have a strongly positive association with durability: longer opinions tended to be cited more rapidly and more often over time. Criminal law cases displayed a consistent pattern across the forward-looking and backward-looking regressions, but the pattern for other case types was mixed. A challenge for future research is to evaluate whether the exponential decay observed in our data is present in other courts and to devise a plausible and testable theory for why citation patterns seem to display such a pronounced quality of exponential decay.

## APPENDIX

The variables used in the regression models reported in Table 1 and Table 2 are defined in the following ways. Regressions using “principal judge” include a dummy variable indicating whether the judge who wrote the majority or plurality opinion has a certain feature or demographic characteristics. Regressions using “panel average” include continuous variables that capture the average values (for instance, for ideological score) or the percentage of judges participating in the case with a certain feature or demographic characteristics (for example, graduating from a top 14 law school).

- 1) **CFscore**: CFscore measures the ideology of each state supreme court judge. Theoretically, a common-space CFscore ranges from +2 (most conservative) to -2 (most liberal).<sup>39</sup> The original source contains judges whose CFscore is greater than 2, though. From the Journal of Law, Economics, and Organization (JLEO) website, we downloaded the data set compiled by Adam Bonica and Michael J. Woodruff<sup>40</sup> on the common-space CFscore of SSC judges who served between 1979 and 2012. We matched this data set to ours. Sixteen justices have missing CFscores in the Bonica and Woodruff data set; their cases are thus excluded from the regression using principal judge dummy variables.
- 2) **Republican judge**: Identification of judges as Republican, Democrat, independent, or unknown is based on our own sources, including whether the judge ran for office as a member of a political party, the political party of the governor who nominated the judge, press accounts, or reviews of the judge’s political campaign contributions. For eighty-one (24%) of the judges, we were unable to identify a party affiliation through any of these methods. They are coded as unknown originally, and they are coded as 0 in the Republican judge dummy variable.
- 3) **Female judge** = 1 if a voting judge is female.
- 4) **White judge** = 1 if a voting judge is Caucasian.
- 5) **Judge age** = 1 if the principal judge is sixty years old or older. Panel average regressions use average age, not the percentage of judges over the threshold.

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39. See Adam Bonica & Maya Sen, *The Politics of Selecting the Bench From the Bar: The Legal Profession and Partisan Incentives to Introduce Ideology Into Judicial Selection*, 60 J. L. & ECON. 559, 571 (2017); Adam Bonica, *Mapping the Ideological Marketplace*, 58 AM. J. POL. SCI. 367, 369 (2014).

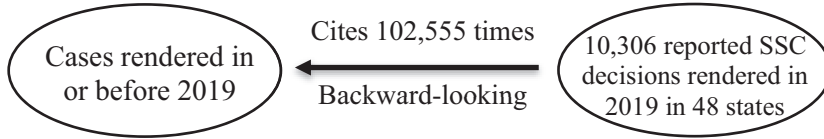
40. See Adam Bonica & Michael J. Woodruff, *A Common-Space Measure of State Supreme Court Ideology*, 31 J. L. ECON. & ORG. 472, 476 (2015).

- 6) **Tenure** = 1 if the principal judge has served in a state supreme court as of Jan. 1, 2003, for seven years or longer. Panel average regressions use average tenure length, not the percentage of judges over the threshold.
- 7) **Judge was elected** = 1 if the principal judge who, at their first appointment to the state supreme court, was selected by election.
- 8) **Judge graduated from top 14 law school** = 1 if the principal judge received her/his JD degree from a top 14 law school.
- 9) **Judge graduated from “not top 100 law school”** = 1 if the principal judge received her/his JD degree from a non-top 100 law school.
- 10) **Chief Justice** = 1 if the principal judge was the chief justice of the court when writing the principal opinion. This is not taken into account in the panel average regression.
- 11) **Mandatory jurisdiction** = 1 if a case is subject to mandatory jurisdiction and = 0 if it is subject to discretionary jurisdiction.
- 12) **With dissenting opinion** = 1 if any judge wrote a dissenting opinion; = 0 if all judges wrote or joined a principal opinion or concurring opinion.
- 13) **En banc, per curiam, memorandum** = 1 if the case is decided en banc, per curiam, or by a memorandum opinion; = 0 if otherwise.
- 14) **Outcomes**: Case outcomes are categorized into reversal, affirmation (in whole or in part), and other results.
- 15) **Case types**: JD-student coders’ subjective classification of the nature of the lawsuits. This variable is from the “case categories” used in Eisenberg & Miller’s article.<sup>41</sup> The model also includes fourteen dummy variables to account for the following fifteen case types: contract, property, torts, trust and estate, family law, insurance law, debt collection, corporate law, civil procedure, administrative law and tax, employment law, constitutional law, death penalty, criminal law, and other types.
- 16) **Quoted** = 1 if Westlaw shows that a cited case was quoted.
- 17) **Depth of treatment**: The one to four stars treatment was coded by Westlaw.
- 18) **Court type**: Our own classification following standard practice.
- 19) **State fixed effects**: A dummy variable for each of the forty-eight states.

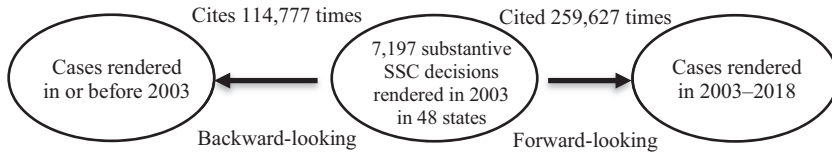
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41. See Eisenberg & Miller, *supra* note 26.

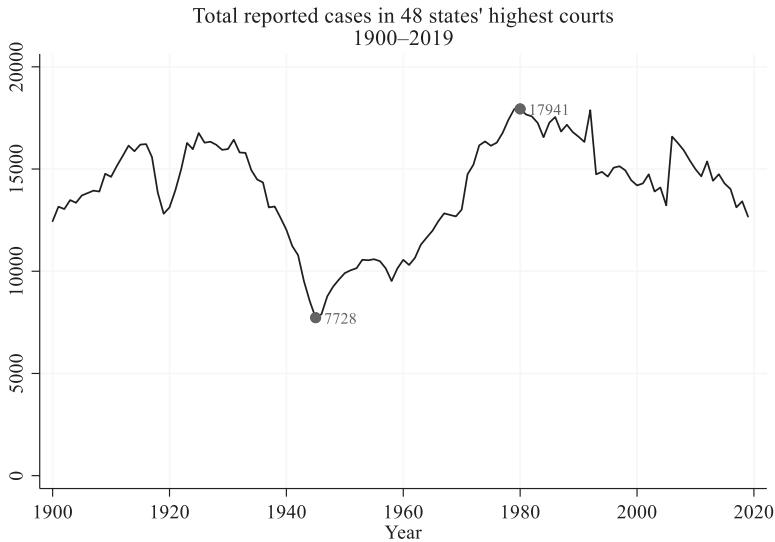
**Figure A.1.**  
**Data Structure for 2019 Backward-Looking Data**



**Figure A.2.**  
**Data Structure for 2003 Backward- and Forward-Looking Data**



**Figure A.3.**  
**Number of Reported Cases by Forty-Eight State Supreme Courts in 1900–2019**



Sources: Westlaw.

Notes: Only reported cases are included. Cases rendered by the supreme courts in Hawaii and Alaska are excluded. The two supreme courts in Texas and Oklahoma are both included.

**Figure A.4.**  
**Alternative to Figure 4, Number of Citations in Log<sub>10</sub>**

Citations by 2003 and 2019 SSCs, by Citation Types

